ABB MEASUREMENT & ANALYTICS | OPERATING INSTRUCTION

EL3060

Continuous gas analyzers

Gas analyzers for use in hazardous areas

Measurement made easy

Contents

Preface

Content of this operating instruction

This operating instruction contains all the information necessary for the safe and compliant installation, start-up, operation, calibration, configuration and maintenance of the gas analyzer.

Further information

Analyzer data sheet

The version of the delivered gas analyzer is described in the "Analyzer data sheet" supplied with the gas analyzer.

DVD-ROM "Software tools and technical documentation"

The DVD-ROM "Software tools and technical documentation" with the following contents is included in the scope of supply of the gas analyzer:

- Software tools
- Operating instructions
- Data sheets
- Technical information
- Certificates

Internet

You will find information on ABB Analytical products and services on the Internet at "http://www.abb.com/analytical".

Service contact

If the information in this operating instruction does not cover a particular situation, ABB Service will be pleased to supply additional information as required.

Please contact your local service representative. For emergencies, please contact

ABB Service,
Telephone: +49-(0)180-5-222 580, Telefax: +49-(0)621-381 931 29031,
E-mail: automation.service@de.abb.com

Symbols and typefaces

CAUTION identifies safety information to be heeded during gas analyzer operation, in order to avoid risks to the user.

NOTE identifies specific information on the operation of the gas analyzer as well as on the use of this instruction.

1, ***2***, ***3***, …	Identifies reference numbers in figures.
`Display`	Identifies a display on the screen.
▲ ▶ ▼ ◀ **OK**	Identifies function keys.
p_e	Gauge pressure
p_{abs}	Absolute pressure
p_{amb}	Atmospheric pressure

Guideline for installation and commissioning

Basic steps

The following basic steps should be followed for the installation and commissioning of the gas analyzer:

1 Note the information on the intended application (see page 8).

2 Follow the safety information (see page 9).

3 Prepare for the installation, provide the requisite material (see page 17).

4 Unpack the gas analyzer (see page 32).

5 Check the seal integrity of the sample gas feed path (see page 34).

6 Install the gas analyzer (see page 35).

7 Connect the gas lines (see page 36).

8 Connect the electrical leads (see page 43).

9 Check the installation (see page 44).

10 Purge the sample gas feed path (see page 46).

11 Start up the gas analyzer (see page 47).

12 Configure the gas analyzer (see page 80).

Safety information

Intended use

Intended application of the gas analyzer

The gas analyzers of the EL3060 series are intended for the continuous quantitative determination of individual gas components in gas mixtures. Any other application is not compliant with the specified use. The specified use also includes taking note of this operating instruction.

The gas analyzer is suitable for measuring non-flammable and flammable gases under atmospheric conditions, which can occasionally form a potentially explosive atmosphere (Zone 1). The mixing ratio of these gases should be clearly below the lower explosive limit (LEL) or clearly above the upper explosive limit (UEL). Exceptions can be e.g. startup and shutdown conditions.

A special version of the gas analyzer is suitable for measuring non-flammable and flammable gases under positive pressure (see page 22) if special conditions are met.

The gas analyzer may not be used for measuring gases that attack the materials in contact with the sample medium (e.g. gases containing chlorine).

The EL3060-Uras26 analyzer unit may only be operated in conjunction with the EL3060-… control unit (see page 14).

Important safety note

According to EU Directive 2014/34/EU and the general requirements for equipment installed in explosive atmospheres stated in IEC 60079-0, the scope of the certification of our equipment is limited to atmospheric conditions, unless specified otherwise in our certificates.

Atmospheric conditions are defined as follows:

- Temperature range −20 to +60 °C
- Pressure range p_{abs} = 80 to 110 kPa (0.8 to 1.1 bar)
- Ambient air with normal oxygen content, typically 21 % vol.

If the **atmospheric conditions are not met**, the operator is obliged to ensure the safe operation of our equipment outside the atmospheric conditions by means of further measures (for example, assessment of the gas mixture) and / or supplementary protection devices.

Safety instructions

Requirements for safe operation

In order to operate in a safe and efficient manner the device should be properly handled and stored, correctly installed and set up, properly operated and correctly maintained.

Qualifications of the personnel

Only persons familiar with the installation, commissioning, operation and maintenance of comparable devices and certified as being capable of such work should work on the device.

Instructions and regulations to be observed

These include

- The contents of this operating instruction,
- The safety information affixed to the device,
- The applicable safety regulations for installing and operating electrical devices,
- The applicable safety regulations for working with gases, acids, condensates, etc.

National regulations

The regulations and norms, standards and directives cited in this operating instruction are applicable in the Federal Republic of Germany. The applicable national regulations should be followed when the device is used in other countries.

Device safety and safe operation

The device has been designed and tested in accordance with EN 61010 Part 1, "Safety requirements for electrical equipment for measurement, control, and laboratory use" and has been shipped ready for safe operation.

In order to maintain this condition and to assure safe operation, safety information in this operating instruction must be observed. Failure to do so can put persons at risk and can lead to device damage as well as damage to other systems and devices.

Comply with the safety regulations

The safety regulations for explosion protection must be complied with without fail before carrying out any work on the device.

Carrying out work with an explosion hazard is prohibited

Carrying out work on live parts, with the exception of intrinsically safe circuits, and with auxiliary equipment which represents a danger of ignition is prohibited if there is an explosion hazard.

Equipotential bonding connection

The local potential equalization must be connected before any other connections are made.

Risks of a disconnected protective lead

The device can be hazardous if the protective lead is interrupted inside or outside the device or if the protective lead is disconnected. Carrying out work on the potential equalization or the equipotential bonding connection is prohibited if there is an explosion hazard.

Risks involved when opening the covers

Current-bearing components can be exposed when the covers or parts are removed, even if this can be done without tools. Current can be present at some connection points.

Risks involved in working with an open device

The housing of the device must not be opened if the surrounding atmosphere is explosive. The relevant warning notice on the housing must be observed.

When connected to power, the housing of the device may only be opened if it has been ascertained in accordance with the applicable regulations that the surrounding atmosphere cannot become potentially explosive.

Before carrying out any work on an open device, all poles must be disconnected from all power sources. All work on a device that is open and connected to power should only be performed under the prescribed conditions by trained personnel who are familiar with the risks involved.

Danger from charged capacitors

The capacitors in the device require 10 minutes to discharge after all poles of the device have been disconnected from all power sources.

Replacing the battery

The battery may not be replaced in an explosive atmosphere.

Stopping the supply of sample gas

In the case of flammable and toxic sample gases, the supply of sample gas must be stopped and the sample gas feed path purged with nitrogen before the housing of the device is opened.

When safe operation can no longer be assured ...

If it is apparent that safe operation is no longer possible, the device should be taken out of operation and secured against unauthorized use.

The possibility of safe operation is excluded:

- If the device is visibly damaged,
- If the device no longer operates,
- After prolonged storage under adverse conditions,
- After severe transport stresses.

Information for the installation, maintenance and repair of electrical installations in hazardous areas

Installation to IEC/EN 60079-14 (VDE 0165 Part 1)

The electrical apparatus must be installed according to IEC/EN 60079-14 (VDE 0165 Part 1) "Electric Apparatuses for Potentially Explosive Gas Atmospheres" Part 14: Electrical equipment in hazardous areas".

Equipotential bonding

With respect to the equipotential bonding, the requirements of IEC/EN 60079-14 and DIN VDE 0100 Part 410 "Protection against electric shock" and part 540 "Earthing, PE conductors, equipotential bonding conductors" must be complied with.

Electrostatic charging

Electrostatic charging must be avoided. In this respect, the trade association regulations for the "Avoidance of ignition hazards due to electrostatic charges" (BGR 132) must be complied with.

Monitoring and testing

Electrical equipment in hazardous areas must be monitored for its correct condition. It must be checked by a qualified electrician as required, or at least every three years, unless it is permanently monitored by a responsible engineer.

Carrying out work on electrical installations

Electrical installations in hazardous areas must be disconnected from the power supply before any maintenance work is carried out on them. The isolation point must be provided with a suitable warning sign e.g. "Do not switch on - explosion hazard".

This does not apply to apparatus which may be opened under normal operating conditions, e.g. recording instruments, or for which it is expressly noted in the type examination certificate.

Carrying out work on intrinsically safe circuits

Work may also be carried out under voltage on intrinsically safe circuits in hazardous areas.

However, the electrical data of the relevant test equipment (inductance, capacitance, current value and voltage values) must be considered.

Particular attention is required when carrying out work on intrinsically safe circuits, which have been installed in conjunction with zone 0.

Explosion hazard

The explosion hazard must be eliminated before carrying out any repair work.

Qualified personnel

Repair work may only be carried out by qualified personnel.

Original spare parts

Only original spare parts may be used for the repair.

CAUTION
Repair works on the flameproof joints are not allowed!

Purge before commissioning

If repair work is carried out on components of an electrical equipment, on which the explosion protection depends, an expert must check and certify that the essential explosion protection characteristics of the apparatus correspond to the construction and design of the apparatus described in the certificate before it is returned to service.

Repair by the manufacturer

The repair can also be carried out by the manufacturer, e.g. locally by an employee of the ABB after sales service or at the manufacturer's works.

In this respect, an indication of the repairs carried out with a subsequent individual test is affixed to the type plate. A test by an expert is not required in this case.

Network and data security

Customer's responsibility

The gas analyzer is designed to be connected to and to communicate information and data via a network interface.

It is the customer's sole responsibility to provide and continuously ensure a secure connection between the gas analyzer and the customer’s network or any other network (as the case may be). The customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB Ltd and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Active services and open ports on the Ethernet interface

22/tcp	Used for software update only. No direct access to the device.
502/tcp	Used for Modbus/TCP. The device allows any Modbus client to connect, there is no access restriction to authorized clients only.
8100/tcp	Used for Test and Calibration Software. Binary, proprietary protocol.

Modbus and PROFIBUS interfaces

The customer shall be aware that Modbus and PROFIBUS protocols are insecure protocols.

Access credentials

Access to the calibration and to the menus used to change the configuration of the device can be restricted by password protection (see page 102). Password protection is not activated ex works (except for gas analyzers used for emission monitoring).

It is recommended to activate the password protection using the software tool ECT ("EasyLine Configuration Tool", see page 53). Thus, the access to the software tool ECT itself as well as to the device's calibration and configuration functions is restricted.

Description of the gas analyzer

Versions and characteristics

Versions

EL3060-CU	Control unit with no analyzer installed (with power supply for a separate analyzer unit)
EL3060-Caldos25	EL3060-CU with Caldos25 analyzer installed
EL3060-Caldos27	EL3060-CU with Caldos27 analyzer installed
EL3060-Magnos206	EL3060-CU with Magnos206 analyzer installed
EL3060-Magnos28	EL3060-CU with Magnos28 analyzer installed
EL3060-Uras26	Separate analyzer unit with Uras26 for connection to EL3060-CU, -Caldos25, -Caldos27, -Magnos206 or -Magnos28

Control unit

The case of the control unit EL3060-CU is designed as a field housing of die-cast aluminum in the type of protection "Flameproof Enclosure 'd'" to IEC/EN 60079-1. The display and operator control unit is mounted behind a glass window on the front of the case.

A terminal housing in the type of protection "Increased Safety 'e'" to IEC/EN 60079-7, in which the terminal block for the electrical connections is mounted, is flange-mounted on the underside of the flameproof case. Certified electrical conductor bushings are mounted between the inside of the flameproof case and the terminal housing in Increased Safety.

The degree of protection of case is IP65.

Caldos25, Caldos27, Magnos206 and Magnos28 analyzers

The Caldos25, Caldos27, Magnos206 and Magnos28 analyzers are installed in the flameproof case of the control unit. Only one of the analyzers can be installed at the same time.

Uras26 analyzer

The case of the analyzer Uras26 is designed as a cylindrical field housing of die-cast aluminum in the type of protection "Flameproof Enclosure 'd'" to IEC/EN 60079-1. The data transmission and the power supply cable for connection to the control unit have been securely connected ex works and led through pressure-proof cable glands on the underside of the case.

The degree of protection of case is

- IP65 with O-ring seal inserted between case bottom and case (vertical or horizontal mounting allowed) or
- IP54 without O-ring seal (only vertical mounting allowed).

Gas connections

The gas connections are led through flame barriers. The material of the flame barriers and the screwed pipe joints is stainless steel 1.4571 (SAE 316Ti).

Case purging

In order to protect the electronic assemblies from an ingressing aggressive atmosphere or corrosive sample gas components, the flameproof case can be purged with air or nitrogen.

The purge gas is fed in and conducted away via two flame barriers, which are open on the inside of the flameproof case.

Remark: The case purging has no meaning in the sense of a pressurized enclosure to IEC/EN 60079-2.

Explosion protection

The gas analyzers are designed for use in hazardous areas. They are certified in accordance with the European Directive 2014/34/EU ("ATEX Directive") and the pertinent IEC standards.

The housings are designed as field housings in the type of protection "Flameproof Enclosure 'd'". They comply with the requirements of the explosion group IIC. As a result, the gas analyzers can also be used in atmospheres containing hydrogen or acetylene.

Certification to ATEX Directive

EL3060-CU control unit (with or without Magnos206, Magnos28, Caldos25, Caldos27 analyzers)

EC Type Examination Certificate	BVS 08 ATEX E 048 X
Marking	 II 2G Ex db e IIC T4 Gb

Analyzer unit EL3060-Uras26

EC Type Examination Certificate	BVS 08 ATEX E 055 X
Marking	 II 2G Ex db IIC T4 Gb

Remark: The measurement function according to Directive 2014/34/EU Annex II, Paragraph 1.5.5 is not an object of these EC type examination certificates.

Certification to IEC standards

EL3060-CU control unit (with or without Magnos206, Magnos28, Caldos25, Caldos27 analyzers)

IECEx Certificate of Conformity	IECEx BVS 13.0037X
Marking	Ex db e IIC T4 Gb

Analyzer unit EL3060-Uras26

IECEx Certificate of Conformity	IECEx BVS 13.0056X
Marking	Ex db IIC T4 Gb

NOTES
The certificates can be found on the DVD-ROM which is enclosed with the gas analyzer.
Please note the "Information for the installation, maintenance and repair of electrical installations in hazardous areas" (see page 11).

Safety

Test to	EN 61010-1:2010
Class of protection	I
Overvoltage category	Power supply: II
Degree of pollution	2
Safe isolation	Electrical isolation of the power supply from the other circuits through increased or double insulation. Functional extra-low voltage (PELV) on the low-voltage side.

Electromagnetic compatibility

Interference immunity	Test to EN 61326-1:2013. Inspection severity: Industrial area, complies at least with the requirements to Table 2 of EN 61326.
Emitted interference	Test to EN 61326-1:2013. Threshold class B for interference field strength and interference voltages is complied with.

Preparation for installation

Scope of supply and delivery

Scope of supply and delivery

- Gas analyzer model EL3060
- Accessories pack with:
  - DVD-ROM "Software tools and technical documentation"
  - Installation instruction
  - Analyzer data sheet (see page 33)
  - 2 spacer bolts M5 x 100
    The spacer bolts are required, in order to install the display and operator control unit at a distance from the open case of the control unit during service work. They may **not be stored under any circumstances** in the case or in the terminal housing!
  - For EL3060-Uras26 in addition: O-ring seal Ø 220 x 3 mm

Material required for the installation (not supplied)

Gas connections

- Threaded connections with ⅛ NPT threads
- PTFE sealing tape

Flow meter / Flow monitor

- Flow meter or flow monitor with a needle valve for adjustment and monitoring of the sample gas flow rate and purge gas flow rate if required
- Recommendation: Flow meter 7 to 70 l/h, Order no. 23151-5-8018474

Flow limiting device

- The flow of sample gas entering the gas analyzer must be limited by means of an external flow limiting device.
- The flow limiting device must comply with the requirements of EN 60079-1:2014, Annex G, Section 3.3.
- The maximum permissible flow rate data of the individual analyzers and device variants must be observed.

Shut-off valve

- Install a shut-off valve in the sample gas supply line (definitely recommended with pressurized sample gas).

Purging of the gas line system

- Provide a means for purging the gas line system by feeding in nitrogen from the gas sampling point.

Installation material

- EL3060-CU control unit: 4 bolts M8 or M10
- EL3060-Uras26 analyzer unit: 4 bolts M8

Electrical cables

- Design of the electrical connections: Terminal strips with screw connection
- Conductor size:
  - single-core: 0.5 to 4 mm^2
  - multi-core: 1.5 to 4 mm^2
  - stranded: 0.5 to 2.5 mm^2 (only with wire end ferrule)
- Select conductor material which is appropriate for the length of the lines and the predictable current load.
- Provide disconnecting devices in the power supply cable and the signal lines, in order to be able to disconnect all poles of the gas analyzer from all power sources if required.

Requirements at the installation site, power supply

Installation site

The gas analyzer is only intended for installation indoors; it may not be installed outdoors.

The installation site must be stable enough to bear the weight of the gas analyzer!

Short gas paths

Install the gas analyzer as close as possible to the sampling location.

Install the gas conditioning and calibration modules as close as possible to the gas analyzer.

Adequate air circulation

Provide for adequate natural air circulation around the gas analyzer. Avoid heat build-up.

Protection from adverse conditions

Protect the gas analyzer from

- Cold
- Exposure to heat from e.g. the sun, furnaces, boilers
- Temperature variations
- Strong air currents
- Accumulation and ingress of dust
- Corrosive atmosphere
- Vibration.

Climatic conditions

Atmospheric pressure	Atmospheric conditions
Relative humidity	Max. 75 %, slight condensation permissible
Ambient temperature	
EL3060-CU	+5 to +50 °C
EL3060-Caldos25	+5 to +50 °C / +45 °C [1)]
EL3060-Caldos27	+5 to +50 °C / +45 °C [1)]
EL3060-Magnos206	+5 to +50 °C / +45 °C [1)]
EL3060-Magnos28	+5 to +50 °C / +45 °C [1)]
EL3060-Uras26	+5 to +45 °C
for storage/transport	–25 to +65 °C

1) +45 °C when used together with EL3060-Uras26

Remark: The explosion protection is not impaired when the gas analyzer is operated at temperatures below +5 °C to –20 °C. However, compliance with the measurement data is not guaranteed in this temperature range.

Power supply

Input voltage	100 to 240 V AC, 50 to 60 Hz ± 3 Hz
Power consumption	Max. 187 VA

Battery

Use	Supply of the integrated clock during a power failure
Type	Lithium 3 V CR2032 button cell

NOTE
Only the original battery Varta type no. 6032 may be used as replacement.

Sample gas inlet conditions under atmospheric conditions

Sample gas composition

The standard version of the gas analyzer is suitable for measuring non-flammable and flammable gases under atmospheric conditions, which can occasionally form a potentially explosive atmosphere.

The oxygen content of the sample gas mixture may be max. 21 % vol. as per atmospheric conditions.

If the sample gas only consists of a mixture of oxygen and flammable gases and vapors, it may be not potentially explosive under any circumstances. This can normally be achieved if the oxygen content is safely limited to max. 2 % vol.

Flammable gases which are potentially explosive under the conditions applicable for the analysis, even without the presence of oxygen, may only be contained in the mixture to be analyzed in non-safety-critical concentrations.

The gas analyzer may not be used for measuring gases that attack the materials in contact with the sample medium (e.g. gases containing chlorine).

Sample gas inlet and outlet conditions

Temperature

The sample gas dew point must be at least 5 °C lower than the lowest ambient temperature in the overall sample gas feed path. Otherwise, a sample gas cooler or condensate trap is required. Fluctuations in water vapor content cause volume errors.

Inlet pressure

Absolute pressure max. 1100 hPa and gauge pressure max. 100 hPa

Flow rate

Uras26	20 to 100 l/h
Magnos206	30 to 90 l/h
Magnos28	30 to 90 l/h
Caldos25	max. 100 l/h
Caldos27	max. 100 l/h

Pressure drop at the 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.

Sample gas inlet conditions with positive pressure in the sample gas feed path

Sample gas composition

A special version of the gas analyzer is suitable for measuring non-flammable and flammable gases under positive pressure. Under no circumstances may the sample gas be potentially explosive.

If the sample gas consists of non-flammable gases and vapors, the oxygen content may be max. 21 % vol. as per atmospheric conditions.

If the sample gas consists solely of oxygen and flammable gases and vapors, it is generally not potentially explosive if the oxygen content is safely limited to max. 2 % vol.

Flammable gases which are potentially explosive under the conditions applicable for the analysis, even without the presence of oxygen, may only be contained in the mixture to be analyzed in non-safety-critical concentrations.

The gas analyzer may not be used for measuring gases that attack the materials in contact with the sample medium (e.g. gases containing chlorine).

Housing designs

Control unit with Magnos206 or Magnos28 or Caldos25 or Caldos27 analyzer

The control unit housing must be equipped with a vent if one of the analyzers is installed in the control unit.

Uras26 analyzer unit

The analyzer unit housing must be equipped with two vents.

The "flowing reference gas" option is not available.

Sample gas inlet and outlet conditions for Magnos206, Magnos28, Caldos25, Caldos27 analyzers

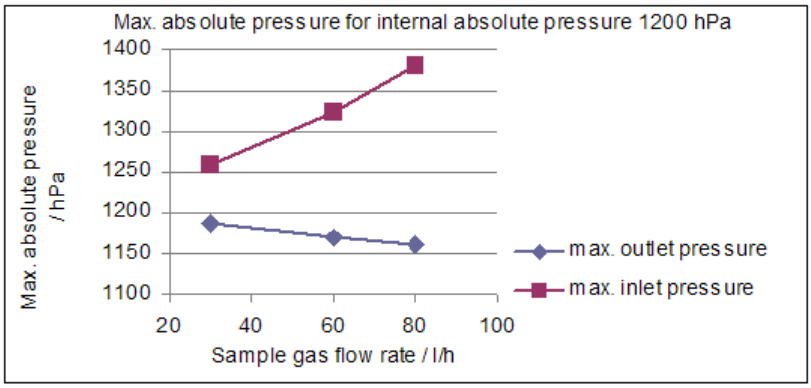
Temperature

+5 to +50 °C

Inlet and outlet pressure

The sample gas pressure in the sample gas feed path of the analyzer may be max. 200 hPa positive pressure (1200 hPa absolute pressure). The pressure drop at the flame barrier at the sample gas inlet means this can be achieved by

- Maintaining max. 200 hPa positive pressure (1200 hPa absolute pressure) at the sample gas inlet or
- Adhering to the pressure limits for the sample gas inlet and outlet as shown in the following diagram:



Flow rate

Max. 80 l/h

Pressure drop at the flame barriers

Approx. 155 hPa at a flow rate of 50 l/h

Sample gas inlet and outlet conditions for Uras26 analyzer

Temperature

+5 to +45 °C

Inlet pressure

Absolute pressure max. 1200 hPa and gauge pressure max. 200 hPa

Flow rate

Max. 100 l/h

Pressure drop at the flame barriers

Approx. 40 hPa at a flow rate of 50 l/h

Test gases for the calibration

Uras26

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Uras26 with calibration cells (automatic calibration)	N_2 or air or IR sample component-free gas	– (calibration cells)
Uras26 without calibration cells (automatic calibration)	N_2 or air	Span gas*
Uras26 without calibration cells (manual calibration)	N_2 or air	Test gas for each sample component or for each detector
Uras26 + Magnos206 (automatic calibration, i.e. Magnos206 with single-point calibration)	IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Calibration cells or span gas*
Uras26 + Magnos206 (manual calibration)	Zero reference gas for Uras26 or Magnos206, or IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Span gas for all sample components in the Uras26 and Magnos206 (possibly only for the Uras26 if a single-point calibration is carried out for the Magnos206)
Uras26 + Magnos28 (automatic calibration, i.e. Magnos28 with single-point calibration)	IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Calibration cells or span gas*
Uras26 + Magnos28 (manual calibration)	Zero reference gas for Uras26 or Magnos28, or IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Span gas for all sample components in the Uras26 and Magnos28 (possibly only for the Uras26 if a single-point calibration is carried out for the Magnos28)
Uras26 + Caldos27 (automatic calibration, i.e. Caldos27 with single-point calibration)	IR sample component-free test gas with a known and constant rTC value (possibly also dried room air)	Calibration cells or span gas*
Uras26 + Caldos27 (manual calibration)	Zero reference gas for Uras26 or Caldos27, or IR sample component-free test gas with a known rTC value	Span gas for all sample components in the Uras26 and Caldos27 (possibly only for the Uras26 if a single-point calibration is carried out for the Caldos27)
Uras26 + Caldos25 (automatic calibration)	Sample component-free test gas or substitute gas for Uras26 and Caldos25	Test gas or substitute gas mixture for all sample components in the Uras26 and in the Caldos25*
Uras26 + Caldos25 (manual calibration)	IR sample component-free test gas for Uras26 and sample component-free test gas or substitute gas for Caldos25	Span gas for all sample components in the Uras26 and test gas or substitute gas with known sample component concentration for Caldos25

* Test gas mixture for multiple sample components possible if no or negligible cross-sensitivity is present

Magnos206

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Magnos206	Oxygen-free process gas	Process gas with a known O_2 concentration
Magnos206 with a suppressed measuring range	Test gas with O_2 concentration near the starting point of the measuring range	Test gas with O_2 concentration near the end point of the measuring range
Magnos206 with single-point calibration	Test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	–
Magnos206 with substitute gas calibration	Oxygen-free process gas or substitute gas (O_2 in N_2)	Substitute gas, e.g. dried air

Magnos28

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Magnos28	Oxygen-free process gas	Process gas with a known O_2 concentration
Magnos28 with a suppressed measuring range	Test gas with O_2 concentration near the starting point of the measuring range	Test gas with O_2 concentration near the end point of the measuring range
Magnos28 with single-point calibration	Test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	–
Magnos28 with substitute gas calibration	Oxygen-free process gas or substitute gas (O_2 in N_2)	Substitute gas, e.g. dried air

Caldos27

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Caldos27	Sample component-free test gas or process gas	Test gas or process gas with a known sample component concentration
Caldos27 with a suppressed measuring range	Test gas with a sample component concentration near the starting point of the measuring range	Test gas with a sample component concentration near the end point of the measuring range
Caldos27 with single-point calibration	Test gas with a known and constant rTC value (standard gas; possibly also dried room air)	–

Caldos25

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Caldos25	Sample component-free test gas or process gas	Test gas or process gas with a known sample component concentration near the end point of the measuring range
Caldos25 with substitute gas calibration	Sample component-free substitute gas	Substitute gas with a known sample component concentration near the end point of the measuring range

Pressure sensor

In which gas analyzers is a pressure sensor installed?

Gas analyzer	Pressure sensor
Uras26, Caldos27	installed ex works
Magnos206, Magnos28	installed ex works as an option
Caldos25	not installed

Information for the safe and correct operation of the pressure sensor

- The pressure sensor measures the air pressure inside the housing as standard. As an option, the pressure sensor is connected to a gas port (flame barrier) via an FPM tube.
- If the pressure sensor is connected to a gas port, the yellow plastic screw cap must be screwed out of the connection fittings of the pressure sensor before the gas analyzer is commissioned.
- For a precise pressure correction (see page 122) the connection of the pressure sensor and sample gas outlet have to be connected to each other via a T-piece and short lines. The lines must be as short as possible or – in the case of a greater length – have a sufficiently large internal diameter (minimum 10 mm) so that the flow effect is minimized.
- If the pressure sensor connection is not connected to the sample gas outlet, the pressure sensor and the sample gas outlet must be on the same pressure level for an exact pressure correction.
- Pressure sensor working range: p_{abs} = 600 to 1250 hPa

CAUTION
The pressure sensor connection must not be connected to the sample gas feed path for the measurement of flammable and corrosive gases.

Case purging

Use

The cases of the control unit and the analyzer unit Uras26 can be purged as an option for protection of the gas analyzers in a corrosive environment or with corrosive sample or associated gases.

Purge gas

Clean instrument air from non-hazardous areas or nitrogen is to be used as a purge gas. The purge gas for purging the EL3060-Uras26 analyzer unit may not contain any fractions of the sample components.

CAUTION
Leaks may cause the purging gas to escape from the case. When applying nitrogen as purging gas, appropriate precautionary measures must be taken against asphyxiation!

Operating statuses of the case purging

Two operating statuses of the purging are permissible to maintain the atmospheric conditions in the flameproof case:

- Restriction of the purge gas inlet pressure and outlet pressure to positive pressure $p_e \leq 80$ hPa (absolute pressure $p_{abs} \leq 1080$ hPa).
- The purge gas is provided at zero pressure at the inlet and extracted at the outlet ($p_e \geq -100$ hPa).

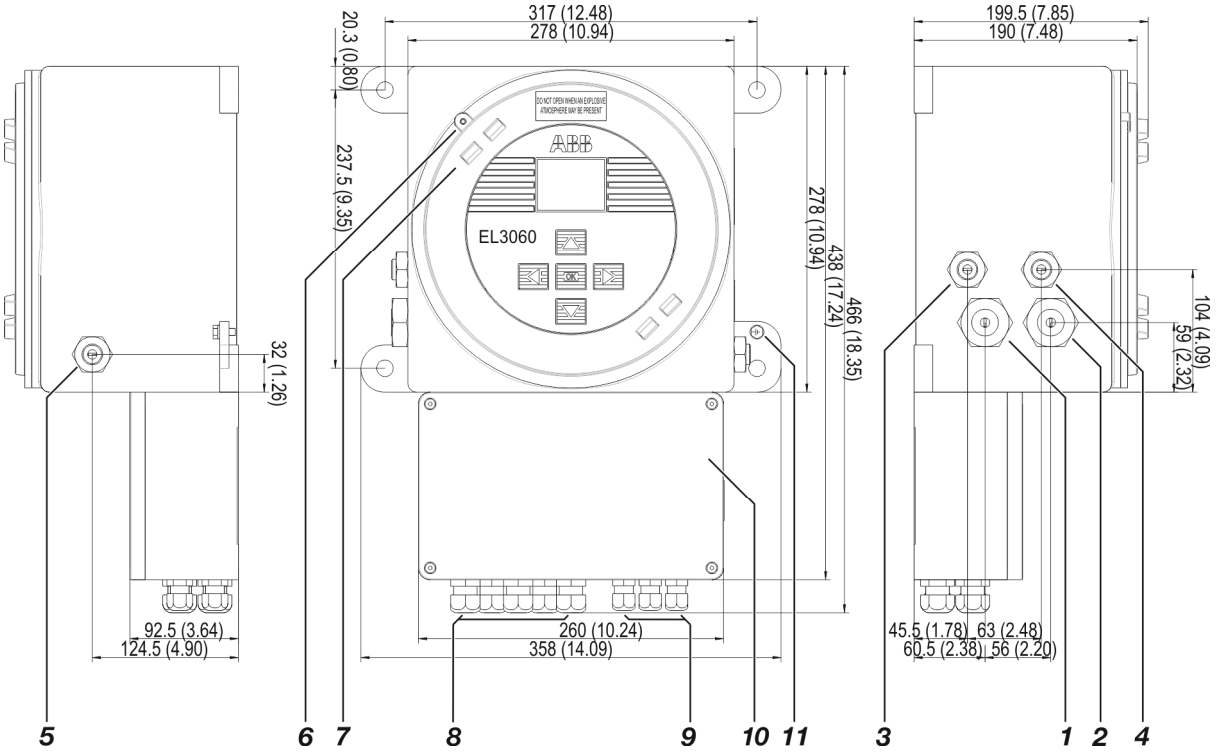
The purge gas flow in operation must be restricted to 10 l/h. The pressure drop at the flame barriers is approx. 20 hPa with a flow of 10 l/h.

The flameproof cases are specially sealed, so that the purge gas loss during case purging remains low. The purge gas loss in the EL3060-Uras26 analyzer unit can be further reduced by inserting the supplied O-ring (Ø 220 × 3 mm) in the groove provided between the bottom of the case and the case.

Dimensions and gas connections of the EL3060-CU control unit

EL3060-CU control unit

Dimensions in mm (inches)



	Standard version:	**Version for measuring gases under positive pressure:**
1	Sample gas inlet [1)]	Vent [1)]
2	Sample gas outlet [1)]	Sample gas outlet [1)]
3	Purge gas inlet [2)]	Purge gas inlet [2)]
4	Purge gas outlet [2)]	Sample gas inlet [1)]
5	Connection of the pressure sensor [3)]	Connection of the pressure sensor [3, 4)] or purge gas outlet [2)]
6	Socket-head hex screw for securing the case cover	
7	Case cover	
8	Screwed cable glands M20	
9	Screwed cable glands M16	
10	Terminal housing with terminal strip (see page 39)	
11	Connection for equipotential bonding	

1) If a Magnos206 or Magnos28 or Caldos27 or Caldos25 analyzer has been installed in the control unit

2) Option

3) Option. The pressure sensor (see page 26) connection must not be connected to the sample gas feed path when measuring flammable or corrosive gases.

4) Not in the version with housing purge

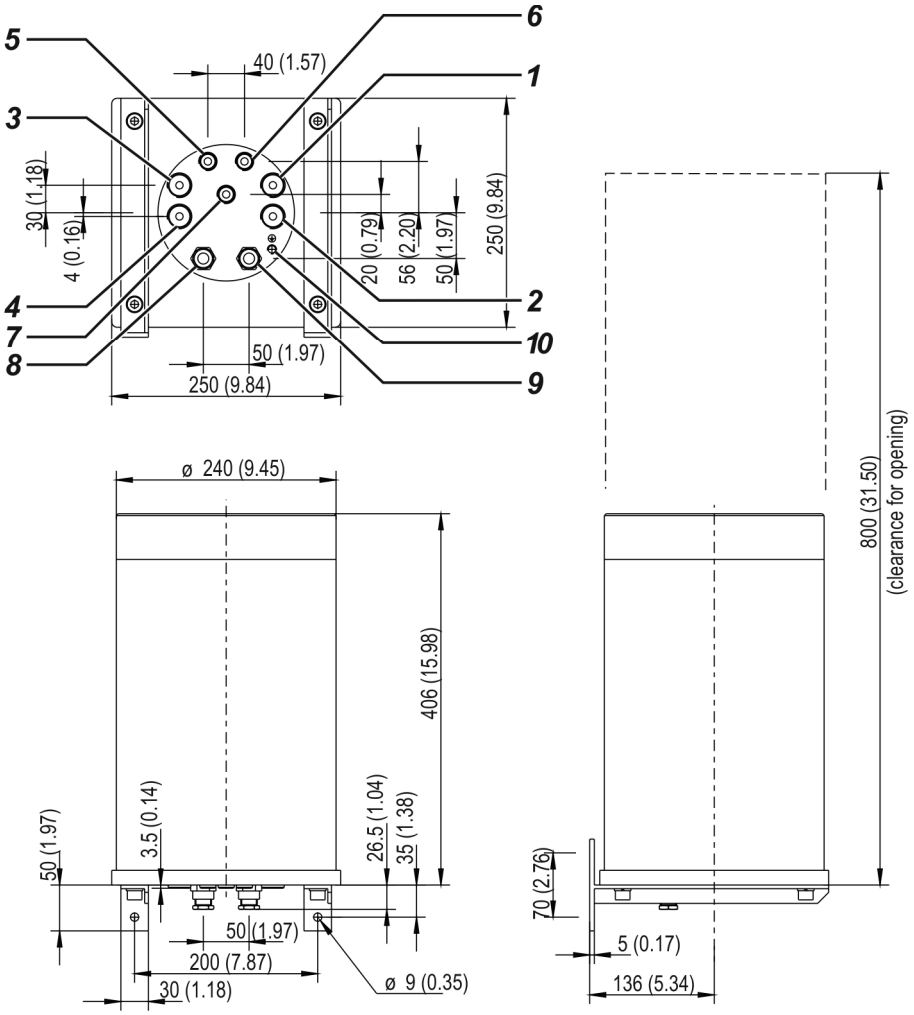
Design of the gas connections: Internal flame barriers made of stainless steel 1.4571 (SAE 316Ti) with ⅛ NPT female thread

NOTE
Bear in mind the extra space required for the connection leads under and immediately to the left and right of the control unit (approx. 10 cm in each case).

Dimensions and gas connections of the EL3060-Uras26 analyzer unit

EL3060-Uras26 analyzer unit

Dimensions in mm (inches)



1) Assignment of the

2) gas connections

3) see

4) analyzer data sheet (see page 33)

5 Purge gas inlet [1)]

6 Purge gas outlet [1)]

7 Connection of the pressure sensor [2)]

8 Conduit for data transmission cable

9 Conduit for 24 VDC connecting cable

10 Connection for equipotential bonding

1) Option

2) The connection of the pressure sensor (see page 26) must not be connected to the sample gas feed path when measuring flammable or corrosive gases.

Design of the gas connections: Internal flame barriers made of stainless steel 1.4571 (SAE 316Ti) with ⅛ NPT female thread

Connecting cable: The non-detachable connecting cables for data transmission and the 24 V DC supply are an integral component of the flameproof case of the analyzer unit. In each case, they are 10 m long and may not be shortened to a length of less than 1 m.

NOTE
The extra space required below the analyzer unit for the connecting cables (approx. 10 cm) and above the analyzer unit for opening the case (approx. 40 cm) must be considered.

Installing the gas analyzer

Unpacking the gas analyzer

CAUTION
The EL3060-CU control unit weighs approx. 20 kg. The EL3060-Uras26 analyzer unit weighs approx. 25 kg.
Unpacking and installing of the gas analyzer require two persons!

Unpacking the gas analyzer

1. Remove the accessories (see scope of supply and delivery, page 17) from the shipping box.
   Ensure that the accessories do not get lost.
2. Remove the gas analyzer from the shipping box together with the respective protective packaging.
3. Remove the protective packaging and place the gas analyzer in a clean location.
4. Remove the adhesive packaging residues from the gas analyzer.

NOTES
Keep the shipping box and the protective packaging for future shipping needs.
If there is shipping damage which indicates improper handling, file a damage claim with the shipper (rail, mail or freight carrier) within seven days.

Type plate

Contents of the type plate

The type plate contains the following information:

- Production number (F-No.)
- Order number (A-No.)
- Power supply (voltage, frequency, max. power consumption)
- Installed analyzers with sample components and measuring ranges

Analyzer data sheet

Contents of the analyzer data sheet

The analyzer data sheet is in the accessories pack. It contains the following information:

- Order number (A-No.)
- Part number (P-No.)
- Production number (F-No.)
- Date of manufacture
- Power supply (voltage, frequency, power consumption)
- Sample components and measuring ranges
- Serial numbers of the installed modules

NOTES

Store the analyzer data sheet in the vicinity of the gas analyzer, so that it is always available, especially in case of service (see page 138).

Take note of the specifications in the analyzer data sheet when commissioning. They may deviate from the general specifications in the present operating instruction.

Checking the seal integrity of the gas feed paths

Checking the seal integrity of the gas feed paths

The seal integrity of the sample gas feed path and, if applicable, of the reference gas feed path is checked ex works with a helium leak test for a leakage rate of $< 2 \times 10^{-4}$ hPa l/s.

We recommend that the seal integrity of the gas feed path is checked before commissioning the gas analyzer at the installation site, since it may have been affected during transport (e.g. through strong vibrations).

Requisite material

- Pressure gauge
- Flexible tubing, length approx. 1 m
- T-piece with shut-off valve
- Air or nitrogen

CAUTION
If the seal integrity test is to be carried out with air and if flammable gas could be present in the sample gas feed path, the sample gas feed path must be purged with nitrogen beforehand! The seal integrity test can be carried out with nitrogen instead.

Checking the seal integrity of the gas feed paths

1. Seal the outlet of the gas feed path to be tested so that it is gas-tight.
2. Connect the T-piece with the shut-off valve to the inlet of the gas feed path to be tested by means of the flexible tubing.
3. Connect the free end of the T-piece to the pressure gauge.
4. Blow air or nitrogen through the shut-off valve until the sample gas feed path is under a positive pressure of $p_e \approx 50$ hPa. Maximum positive pressure $p_e = 150$ hPa.
5. Close the shutoff valve. The pressure should not change measurably in 3 minutes. A sharp drop in pressure is an indication of a leak in the gas feed path being tested.
6. Repeat steps 1 to 5 for all gas feed paths in the gas analyzer.

Mounting the gas analyzer

CAUTION
The EL3060-CU control unit weighs approx. 20 kg. The EL3060-Uras26 analyzer unit weighs approx. 25 kg.
Unpacking and installing of the gas analyzer require two persons!

Mounting the EL3060-CU control unit

4 bolts M8 or M10 are required to mount the EL3060-CU control unit (not supplied).

The control unit must be fitted in such a way that the terminal housing points downwards (as shown in the dimension drawing, see page 28).

Mounting the EL3060-Uras26 analyzer unit

4 bolts M8 are required to mount the EL3060-Uras26 analyzer unit (not supplied).

The analyzer unit can be mounted with a vertical or with horizontal alignment of the case.

- Vertical alignment:
  The gas connections must face downwards (as shown in the dimension drawing (see page 30) at the bottom left). In order to ensure degree of protection IP65, the supplied O-ring seal (Ø 220 x 3 mm) must be inserted between the housing bottom and the housing in the groove provided for this purpose. Without the inserted O-ring seal, only degree of protection IP54 is guaranteed.
- Horizontal alignment:
  The conduits for the connection cables must be at the bottom (as shown in the dimension drawing at the top left, see page 30). The supplied O-ring seal (Ø 220 x 3 mm) must be inserted between the housing bottom and the housing in the groove provided for this purpose; this ensures degree of protection IP65.

NOTE
If the O-ring seal is inserted, it is only possible to open and close the housing with suitable tools.

Connecting the gas lines

Position and layout of the gas connections

The position and layout of the gas connections are shown in the dimension drawings of the control unit (see page 28) and the analyzer unit (see page 30).

Design of the gas connections

Design of the gas connections: Internal flame barriers of stainless steel 1.4571 (SAE 316Ti) with ⅛ NPT female thread

- Sample gas inlets and outlets
- Flowing reference gas with EL3060-Uras26 (option)
- Case purging (option)
- Pressure sensor (option)

The assignment of the gas connections in a supplied EL3060-Uras26 analyzer unit is documented in the analyzer data sheet.

Special safety measures for operation with positive pressure in the sample gas feed path

For operation with positive pressure in the sample gas feed path, a special version of the gas analyzer is required. This version is marked as such by the information on the type plate: "Sample gas pressure, see special conditions".

For operation with positive pressure in the sample gas feed path, the following special safety measures must be observed:

- Additional vents are fitted (designed as sample gas flame barriers) in order to protect the pressure-resistant housing:
  - One vent in the control unit housing if one of the Magnos206 or Magnos28 or Caldos25 or Caldos27 analyzers is installed in the control unit,
  - Two vents in the Uras26 analyzer unit housing.

  The inner and outer vent openings must always remain open.
- If the sample gas outlet and inlet side are subject to positive pressure, sample gas may flow from both sides in case of faulty operation (for instance if the sample gas line in the analyzer ruptures). In this case, it must be ensured that the total of the sample gas flows from both sides do not exceed the maximum value of 80 l/h (Magnos206, Magnos28, Caldos25, Caldos27) or 100 l/h (Uras26).

Connecting the gas lines

Connect the stainless steel pipes to the fittings (flame barriers) professionally and taking tightness requirements into consideration.

CAUTION
The maximum permissible tightening torque is 50 Nm. If this value is exceeded, the internal gas connections could be damaged. The explosion protection could be impaired as a result.

Connecting the pressure sensor

- The pressure sensor (see page 26) measures the air pressure inside the housing as standard. As an option, the pressure sensor is connected to a gas port (flame barrier) via an FPM tube.
- If the pressure sensor is connected to a gas port, the yellow plastic screw cap must be screwed out of the connection fittings of the pressure sensor before the gas analyzer is commissioned.
- If the pressure sensor connection is not connected to the sample gas outlet, the pressure sensor and the sample gas outlet must be on the same pressure level for an exact pressure correction.
- Pressure sensor working range: p_{abs} = 600 to 1250 hPa

CAUTION
The pressure sensor connection must not be connected to the sample gas feed path for the measurement of flammable and corrosive gases.

Installing the flow meter

Install a flow meter or flow monitor with a needle valve before the sample gas inlet and if required before the purge gas inlet in order to be able to adjust and monitor the gas flow rate.

Installing the flow limiting device

- The flow of sample gas entering the gas analyzer must be limited by means of an external flow limiting device.
- The flow limiting device must comply with the requirements of EN 60079-1:2014, Annex G, Section 3.3.
- The maximum permissible flow rate data of the individual analyzers and device variants must be observed.

Provide for gas line system purging

Install a shut-off valve in the sample gas line (definitely recommended with pressurized sample gas), in order to provide a means for purging the gas line system by feeding in nitrogen from the gas sampling point.

Discharge exhaust gases

Conduct exhaust gases directly into the atmosphere or through a line with a large internal diameter which is as short as possible, or into a gas discharge line. Do not conduct exhaust gases via restrictions or shut-off valves!

Important notes

- Dispose of corrosive and toxic exhaust gases according to the regulations!
- Comply with the gas inlet and outlet conditions (see page 21)!
- Purge the sample gas feed path before commissioning (see page 46).
- Do not feed in the sample gas until the gas analyzer has reached room temperature and the warm-up phase has ended! Otherwise, the sample gas could condense in the cold analyzer.

Connecting the electrical leads – Safety information

CAUTION
Follow all applicable national safety regulations for the installation and operation of the electrical apparatuses as well as the following safety instructions!

Equipotential bonding

The external equipotential bonding connections of the control unit and the analyzer unit must be connected to the local potential equalization. The local potential equalization must be connected before any other connections are made. The capacity of terminals is of max. 4 mm^2.

Risks of a disconnected equipotential bonding

The gas analyzer can be hazardous if the equipotential bonding is interrupted inside or outside the device or if the equipotential bonding is disconnected. Carrying out work on the equipotential bonding or the equipotential bonding connection is prohibited if there is an explosion hazard.

Lay electrical lines in such a way that they are non-detachable

The electrical lines, including the connections between the analyzer unit and the control unit, must be non-detachable.

Connecting cable of the EL3060-Uras26 analyzer unit

The non-detachable connecting cables for data transmission and the 24 V DC supply are an integral component of the flameproof case of the analyzer unit. In each case, they are 10 m long and may not be shortened to a length of less than 1 m.

Shielded leads

Shielded leads must be led through the EMC screwed cable glands. The braided shield must be placed on the EMC screwed cable glands.

Separate laying

Signal lines must be installed separately from the power supply lines. Analog and digital signal lines must be laid separately from each other.

Unused screwed cable glands

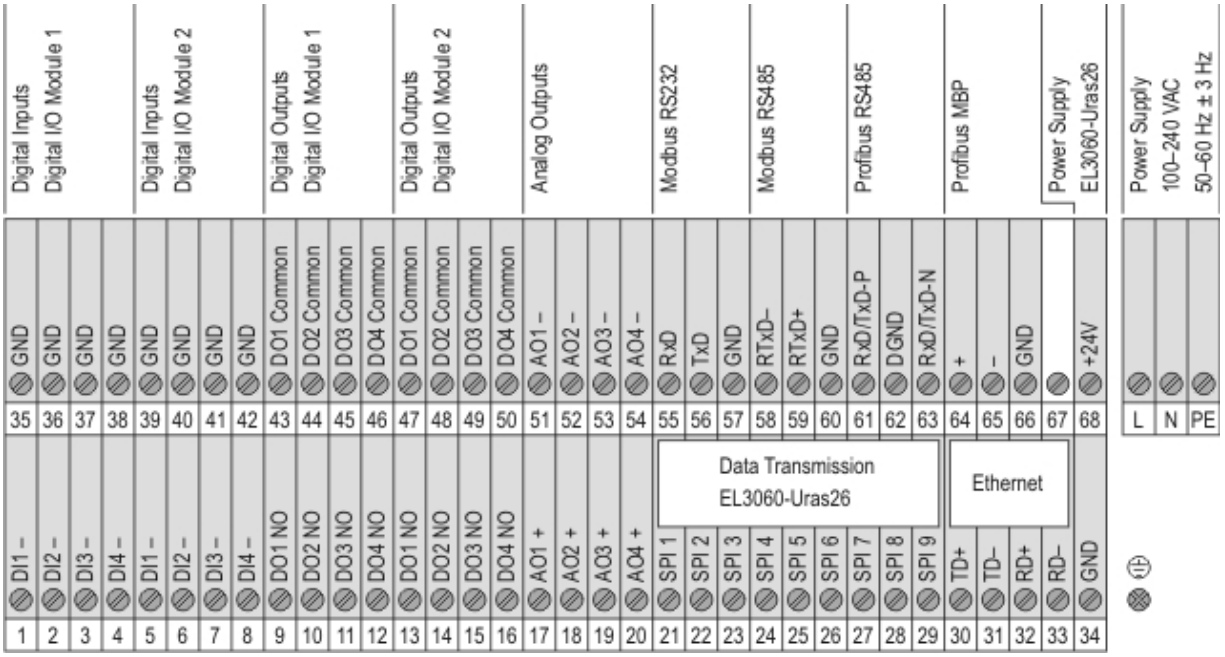
Unused screwed cable glands must be sealed with sealing plugs. The cap nuts on the unused screwed cable glands must be non-removable.

Before connecting the power supply

Before connecting the power supply, it must be ensured that the mains voltage is in the permissible range 100 to 240 VAC for operation of the gas analyzer.

Electrical connections

Terminal assignment in the terminal housing of the control unit



NOTE
Not all signal input and outputs are actually assigned, depending on the configuration of the gas analyzer.

Digital inputs

Opto-electronic coupler with 24 V DC internal power supply. Activation with floating contacts or with Open-Collector drivers NPN.

Digital outputs

Floating double-throw contacts, max. contact load rating 30 V/1 A. The relays must always be operated within the specified data. Inductive or capacitive loads are to be connected with appropriate protective measures (freewheeling diodes for inductive and series resistors with capacitive loads).

Standard assignment of the digital inputs and digital outputs

Signal	Standard assignment [1]	
	Digital I/O module 1	Digital I/O module 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-reference gas valve		
Span reference gas valves 1 to 5		
Alarm value 1	DO2	
Alarm value 2	DO3	
Alarm value 3		DO1
Alarm value 4		DO2
Alarm value 5		DO3
Alarm value 6		DO4
Alarm value 7		
Alarm value 8		
Alarm value 9		
Alarm value 10		
Measuring range switch-over		
Measuring range feedback		
Sample component switch-over		
Sample component feedback		
Bus DI 1		
Bus DI 2		
Bus DI 3		
Bus DI 4		
Bus DI 5		
Bus DI 6		
Bus DI 7		
Bus DI 8		
External error [2]	DI3	
External maintenance request [2]	DI4	

1) Set ex works, can be reconfigured in operation (see page 95).

2) Depending on the number of available digital inputs several external signals can be configured.

Analog outputs

0/4 to 20 mA (pre-set ex works to 4 to 20 mA, see page 95), common negative pole, electrically isolated to ground, can be connected to ground as required, in this regard, max. gain compared to local protective ground potential 50 V, working resistance max. 750 Ω. Resolution 16 bit. The output signal may not be less than 0 mA.

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 (see page 33) and on the type plate (see page 33).

NOTE
The assignment of the terminals (see page 95) can be changed in the configurator.

Modbus, Profibus

As an option, either the Modbus module or the Profibus module can be installed in the gas analyzer.

Ethernet port

The Ethernet 10/100BASE-T interface of the gas analyzer is used

- for communication with the ECT configuration software (see page 53) for gas analyzer configuration and software update
- for data transmission using the Modbus TCP/IP protocol and
- for transmission of the QAL3 data, if the option QAL3 monitoring (see page 107) has been integrated in the gas analyzer.

Analyzer unit EL3060-Uras26

- Data transfer: terminals 21 to 29 (SPI1 to SPI9) for lines 1 to 9 (inscription on the lines)
- Power supply: terminals 34 (GND) and 68 (+24V, line with red marking), separate PE connection

Power supply

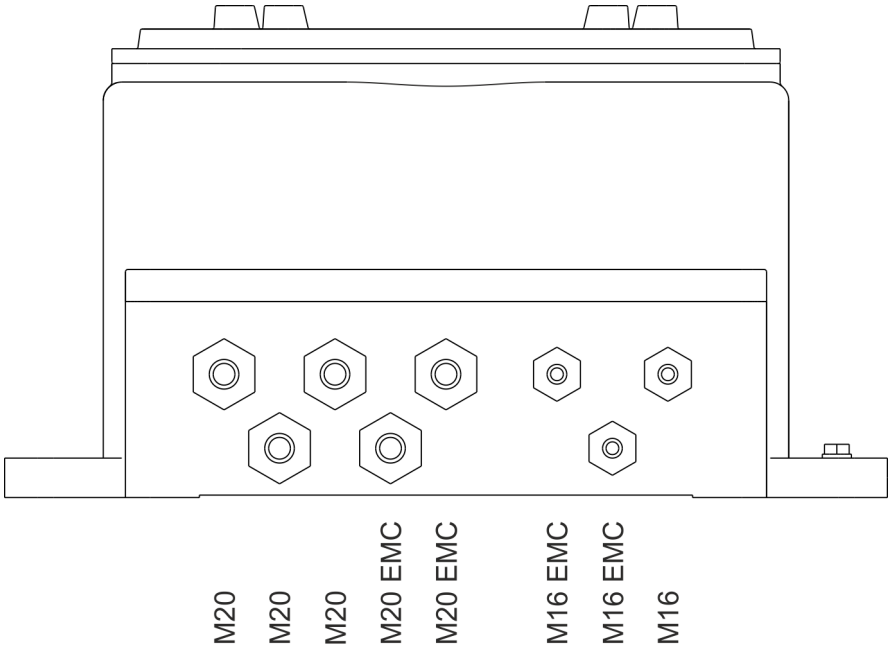
- Terminals L, N, PE

Design of the electrical connections

- Terminal blocks with screw connection
- Conductor size:
  - single-core: 0.5 to 4 mm^2
  - multi-core: 1.5 to 4 mm^2
  - stranded: 0.5 to 2.5 mm^2 (only with wire end ferrule)

Assignment of the connecting cables to the screwed cable glands

The shielded connection cables for Modbus, Profibus and Ethernet as well as for the data transmission and the power supply of the analyzer unit EL3060-Uras26 must be fed into the terminal housing through the EMC cable glands with clamping insert for the braided shield (M16 EMC and M20 EMC, see the following overview).



Connecting cable	Screwed cable gland	Permissible external diameter of cable
Digital inputs/outputs	M20	6 to 12 mm
Analog outputs	M20	6 to 12 mm
EL3060-Uras26 data transmission	M20 EMC	7 to 12 mm
EL3060-Uras26 power supply	M20 EMC	7 to 12 mm
Modbus, Profibus	M16 EMC	3 to 7 mm
Ethernet	M16 EMC	3 to 7 mm
Gas analyzer power supply	M16	4 to 8 mm

Connecting the electrical leads

Pass shielded cable through an EMC screwed cable gland with clamping insert

The shielded connection cables for Modbus, Profibus and Ethernet as well as for the data transmission and the power supply of the analyzer unit EL3060-Uras26 must be fed into the terminal housing through the EMC screwed cable glands with clamping insert for the braided shield.

1. Bare the braided shield of the cable over a length of approx. 10 mm.
2. Undo the coupling nut on the screwed cable gland and remove the clamping insert.
3. Slide the coupling nut and the clamping insert over the cable.
4. Turn the braided shield back over the clamping insert. The braided shield must cover the sealing gasket approx. 2 mm.
5. Insert the clamping insert and the cable in the gland body and screw up the coupling nut.

Pass cable through a screwed cable gland without clamping insert

1. Undo the coupling nut on the screwed cable gland and remove the sealing gasket.
2. Slide the coupling nut and the sealing gasket over the cable.
3. Insert the cable and the sealing gasket in the gland body and screw up the coupling nut.

Connect power supply to the control unit

1. Check that the mains voltage is in the permissible range 100 to 240 V AC.
2. Ensure that the power supply feeder has an adequately dimensioned protective device (circuit-breaker max. 6 A).
3. Connect the power supply lead to the terminals L, N and PE.

NOTE
If required, install disconnecting devices in the power supply cable and in the signal lines, in order to be able to disconnect **all poles** of the control unit from all power sources. Mark the isolators in such a way that the assignment of the devices to be disconnected can be clearly recognized.

Starting up the gas analyzer

Checking the installation

CAUTION
The housing of the gas analyzer must not be opened if the surrounding atmosphere is explosive. The relevant warning notice on the housing must be observed.

Checking the installation

Before you put the gas analyzer into operation, you should ensure that it has been correctly installed. Proceed in accordance with the following checklist:

Installation site

- Do the conditions in the field (zone, group of enclosure, temperature class) comply with the specifications on the type plate?
- Have the control unit and the analyzer unit been installed indoors?
- Have the control unit and the analyzer unit been securely attached?

Connection of the gas lines

- Have all gas lines been correctly connected?
- If flammable or corrosive gases are to be measured, is the pressure sensor not connected to the sample gas feed path?

Connection to the potential equalization

- Has the external equipotential bonding connection of the analyzer unit been connected to the local potential equalization?
- Has the external equipotential bonding connection of the control unit been connected to the local potential equalization?

Connection of the electrical lines

- Does the mains voltage correspond to the permissible operating voltage (100 to 240 V AC, see type plate)?
- Are all electrical lines non-detachable according to the specifications, and have they been correctly connected to the terminal block in the terminal housing?
- Are there any loose wire ends? Have all unused wires been insulated and mechanically secured?
- Have the correct cable types been used are for the lines led through the screwed cable glands of the control unit?
- Are the lines securely located in the screwed cable glands?
- Have the shielded leads been led through the EMC screwed cable glands? Has the braided shield been correctly placed on the screwed cable glands?
- Do the 24 VDC connecting cable and the data transmission cable which are securely connected to the EL3060-Uras26 analyzer unit have a length of more than 1 m and do they have any damage?

Integrity of the housing of the EL3060-Uras26 analyzer unit

- Is the housing of the analyzer unit intact?
- Are all flame barriers and screw plugs present?
- In the case of horizontal assembly of the analyzer unit: Are the O-rings, which have been inserted in the grooves provided between the bottom of the case and the case and between the case and the case cover, clean and not pinched?
- Have all components of the housing been completely bolted together and locked against rotation with the socket-head hex screws?

Integrity of the housing of the control unit

- Is the housing of the control unit intact?
- Is the housing of the control unit tightly closed?
- Is the housing cover screwed in all the way and locked against rotation with the socket-head hex screw?
- Is the seal in the cover of the terminal housing intact? Is the cover of the terminal housing tightly closed?
- Are all screwed cable glands present and tightly screwed in?
- Are the openings of the unused screwed cable glands tightly closed with sealing plugs?

Connection of the peripheral units

- Are all devices needed for gas conditioning, calibration and waste gas disposal correctly connected and ready for use?

Initial purging of gas feed paths

Initial purging of gas feed paths

Initial purging of gas feed paths

Initial purging of the gas feed paths inside and outside the gas analyzer is required before the power supply is switched on. A potentially explosive gas/air mixture in the gas feed paths is thereby removed.

Purge gas for non-flammable sample gas	Clean instrument air from non-hazardous areas
Purge gas for flammable sample gas	Nitrogen
Purge gas volume	5x volume of the gas feed paths
Purge gas flow	approx. 30 l/h
Purging time	at least 3 min

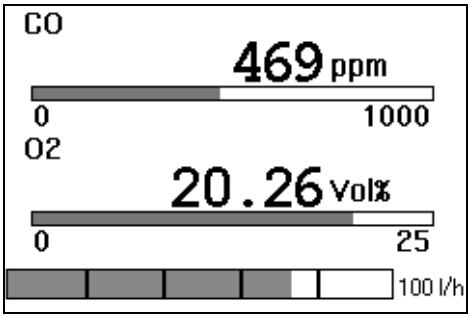
The purge gas for purging the EL3060-Uras26 analyzer unit may not contain any fractions of the sample components.

Start up the gas analyzer

Start up the gas analyzer

Start up the gas analyzer

1. Switch on the power supply of the gas analyzer.
2. The name of the gas analyzer and the number of the software version are shown in the display while booting.
3. After the start-up phase has ended, the display switches over to the measured value display.
   Example:



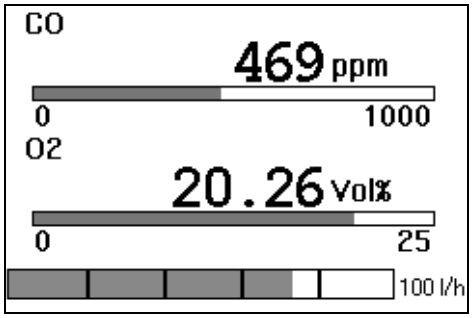
4. Check the configuration (see page 80) of the gas analyzer and alter if necessary.
5. After the warm-up phase has ended, the gas analyzer is ready to carry out measurements.
   Duration of the warm-up phase:
   Uras26: approx. ½ hour without, approx. 2.5 hours with thermostat
   Magnos206: approx. 2 hours
   Magnos28: approx. 2 to 4 hours
   Caldos27: approx. ½ hour
   Caldos25: 1 to 4 hours, depending on the measuring range
6. Check the calibration (see page 58) of the gas analyzer.
   The gas analyzer is calibrated ex works. However, transport stresses and the pressure and temperature conditions at the installation site may influence the calibration.
7. Feed in the sample gas.

Operating the gas analyzer

NOTE
All the illustrations of the displays in this operating instruction are examples. The displays on the gas analyzer will normally differ from these.

Display – Measuring mode

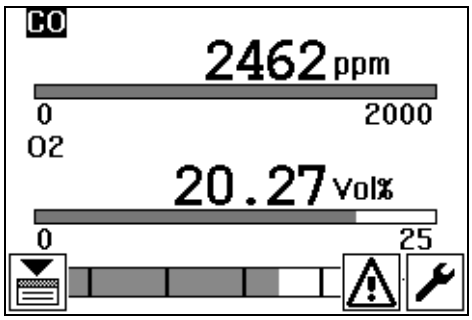
Display in measuring mode



In measuring mode, the screen displays the name, the measured value in numerals and the physical unit of the measured value for each sample component.

If the display of the name of the sample components flashes alternately with the inverted display, this signals that the measured value exceeds the measuring range limits.

Status icons



An automatic calibration (see page 62) is executed.
The icon also appears in the menu title line in menu mode (see page 50).

A status message (see page 132) is active.

The status signal (see page 130) "Maintenance request" is active.
The icon also appears in the menu title line in menu mode (see page 50).

The status signal (see page 130) "Error" is active or the maintenance switch (see page 118) has been set to "On".
The icon is blinking. The icon also appears in the menu title line in menu mode (see page 50).

The configuration is being saved. The icon is blinking.
Do not switch off the power supply of the gas analyzer when the icon is displayed!

Key functions in measuring mode

◄ ►	Switch over the display of each individual measured value; in addition to the digital display, an analog bar with information on the range limits is shown in this display.
▼▲	Reduce or increase the contrast of the display. When a status message is active, press key ▲ first.
OK	Switch to menu mode (see page 50).
▼	If a status message is active : press the key to display the message list (see page 132).

Number of decimal places

When the screen displays the measured value in physical units (e.g. ppm) the number of places after the decimal point depends on the size of the set measuring range:

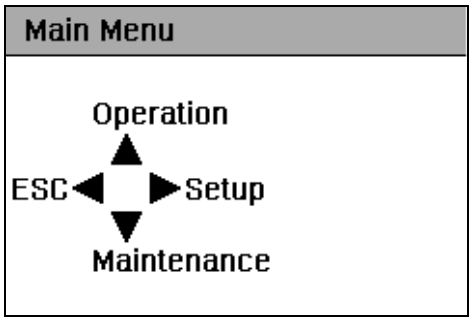
Span	Places after the decimal point
≤ 0.05	5
≤ 0.5	4
≤ 5	3
≤ 50	2
≤ 500	1
> 500	0

For the display of the measured value as a percentage of the whole measuring range (%Span) two places are always shown after the decimal point.

When setting the parameters, the number of decimal places is the same as in the display in measuring mode.

Operation – Menu mode

Display in menu mode



Structure of the menus

Starting from the main menu, each menu (see page 52) contains a maximum of three menu items ("3-point menu"). Each menu option is assigned to one of the three keys ▲, ▶ and ▼; each menu option can therefore be selected directly. The button ◀ is used to return to the next higher menu.

The functions which are normally most frequently required are arranged in the menu in such a way that they can be called by repeatedly pressing the same button:

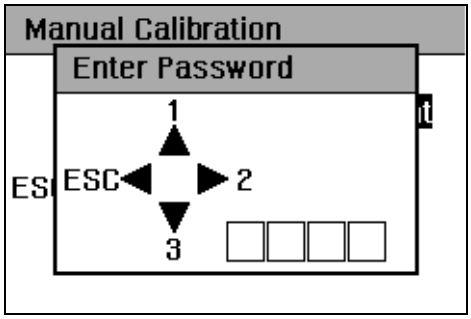
▲ `Operation` ▲ `Calibration` ▲ `Manual Calibration`
▲ `Zero Point / Single Point`
▶ `Setup` ▶ `Calibration Data` ▶ `Test Gas Set Points`
▼ `Maintenance` ▼ `Diagnosis` ▼ `Device Status` ▼ `Status Messages`

Key functions in menu mode

	3-point menu
▲ ▶ ▼	Select menu item
◀	Return to the next higher menu
OK	Return to measuring mode (see page 48)
	Component list
▲▼	Select component
▶ or **OK**	Call up selected component for processing
	Parameter list ("selector")
▲▼	Select parameters
▶	Call up change in value
OK	Accept all displayed values and return to the next higher menu
◀	Discard all displayed values and return to the next higher menu
	Change in value
▲▼	Change selected position
▶	Select position to be changed
OK	Confirm altered value and return to the parameter list
◀	Discard altered value and return to the parameter list

Entering the password

As soon as the user wishes to access a password-protected menu or a password-protected value change, he is requested to enter the password (see page 102).



In this respect, the numbers 1, 2 and 3 are assigned to the three keys ▲, ▶ and ▼, as shown in the illustration.
Example: If the password "1213" has been configured, the user has to press the keys ▲, ▶, ▲ and ▼ in succession. Each key stroke is acknowledged by display of the character *.

The entered password remains active until the user returns to the measuring mode or the gas analyzer automatically switches over to the measuring mode through the time-out function.

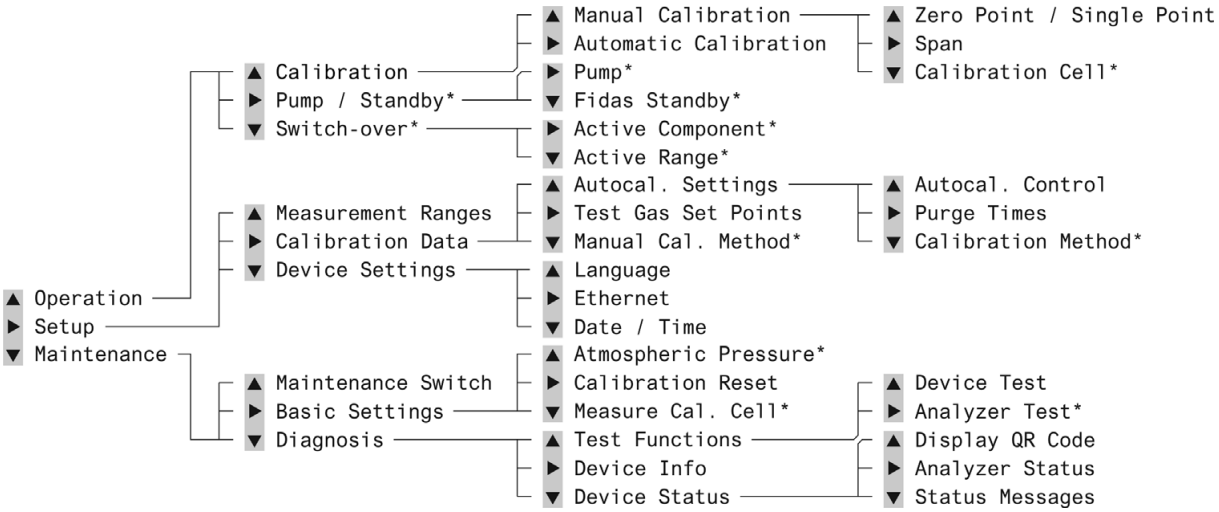
Time-out function

If the user does not press a key for more than approx. 5 minutes during the selection of menu items, the gas analyzer will automatically return to the measuring mode (time-out function).

The time-out function is deactivated as soon as the user changes the value of a parameter or starts a calibration.

Menu

Overview of the menu



* This menu depends on the configuration of the gas analyzer.

Information on the concept of operation

Concept of operation

The concept of operation of the gas analyzers is designed in such a way that the functions required in normal operation are operated and configured directly on the device. On the other hand, the functions which are only seldom required, e.g. during the commissioning of the device, are configured offline using the software tool ECT ("EasyLine Configuration Tool" on the enclosed DVD-ROM, also referred to as "configurator" in this instruction) and then loaded into the gas analyzer.

Overview of the functions

Function	Device	Configurator	Modbus
Automatic calibration:			
Start/cancel automatic calibration (see page 66) (also possible via digital inputs)	X		X
Activate/deactivate cyclically time-controlled automatic calibration (see page 62)	X	X	X
Cycle time of the automatic calibration (see page 63)		X	
End-point calibration together with zero-point calibration (see page 63)		X	X
Date and time of the next automatic calibration (see page 63) (start of the cycle)	X	X	
Test gas concentration (see page 61)	X	X	X
Purging times (see page 63)	X	X	
Output current response (see page 63) (for automatic and manual calibration)		X	
Calibration method (see page 63) (Magnos206, Magnos28)	X	X	
Manual calibration:			
Calibration method (see page 67)	X	X	
Test gas concentration (see page 61)	X	X	
Execute calibration (see page 68)	X		
Maintenance functions:			
Calibration reset (see page 119)	X		
Calibration of the pressure sensor (see page 122) / Set atmospheric pressure value	X		
Measuring calibration cell (see page 120) (Uras26)	X		
Drift, delta drift (see page 121) (display)	X		X
Software version (see page 127)	X	X	
Status information (see page 132)	X		X
Component parameters:			
Range limits (see page 80)	X	X	
Alarm value parameters (see page 89)		X	
Low pass time constant (see page 90) (T90 time, filter)		X	X
Active component (see page 91)	X	X	X
Modbus parameters[1]		X	
Profibus parameters[2]		X	
Ethernet parameters (see page 96)	X	X	
Signal inputs and outputs (see page 95) (I/O connections)		X	

[1] For detailed information on "Modbus", refer to the Technical Information "EL3000, EL3060, EL3010-C – Modbus".

[2] For detailed information on "Profibus", refer to the Technical Information "EL3000, EL3060 – PROFIBUS DP/PA Interface".

Communication between the gas analyzer and the computer

Communication via Ethernet

Communication between the gas analyzer and the computer is executed via an Ethernet connection, either as a point-to-point connection or via a network.

The Ethernet connection enables communication

- with the test and calibration software TCT-light,
- with the configuration software ECT,
- for transmission of the QAL3 data, if the option QAL3 monitoring has been integrated in the gas analyzer,
- for reading the measured values and for calibrating and controlling the gas analyzer via the Modbus TCP/IP protocol.

NOTE
Detailed information on "Modbus" can be found in the technical information "EL3000 Modbus" and "EL3010-C – Modbus via TCP/IP".

Setting up the communication between the gas analyzer and the computer

Basically, the following steps are required to set up the communication between the gas analyzer and computer:

1. Check and set the TCP/IP parameters in the gas analyzer and the computer.
2. Establish and test the Ethernet connection.
3. Start the communication between the gas analyzer and the computer.

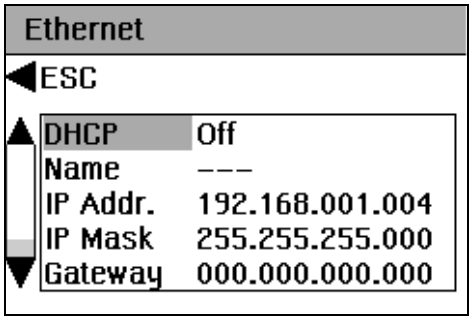
Check the TCP/IP parameters in the gas analyzer and the computer

The TCP/IP parameters in the gas analyzer and the computer must be checked and changed if necessary for operation of the configurator. In the case of a point-to-point connection, the IP addresses in the gas analyzer and the computer must be carefully matched.

Example: gas analyzer: 192.168.1.4, computer: 192.168.1.2

Set the IP address in the gas analyzer

▶ Setup ▼ Device settings ▶ Ethernet



Parameters

The parameters which have to be input depend on the DHCP setting:

DHCP on: Network name (max. 20 characters, no blanks or special characters),

DHCP off: IP address, IP address mask and IP gateway address.

The network name can only be altered in the configurator (see page 53). The default network name consists of "EL3K" and the last six positions of the MAC address (example: "EL3KFF579A").

If the parameter "DHCP" is set to "off", the Ethernet configuration is reset to the standard configuration (default IP address); this will prevent the inadvertent assignment of an IP address from a DHCP pool.

NOTE
The parameter "DHCP" must be set to "off" when the gas analyzer is not connected to a network. This prevents the gas analyzer from constantly trying to connect to a network.

Addresses

The IP address, IP address mask and IP gateway address must be obtained from the system administrator.

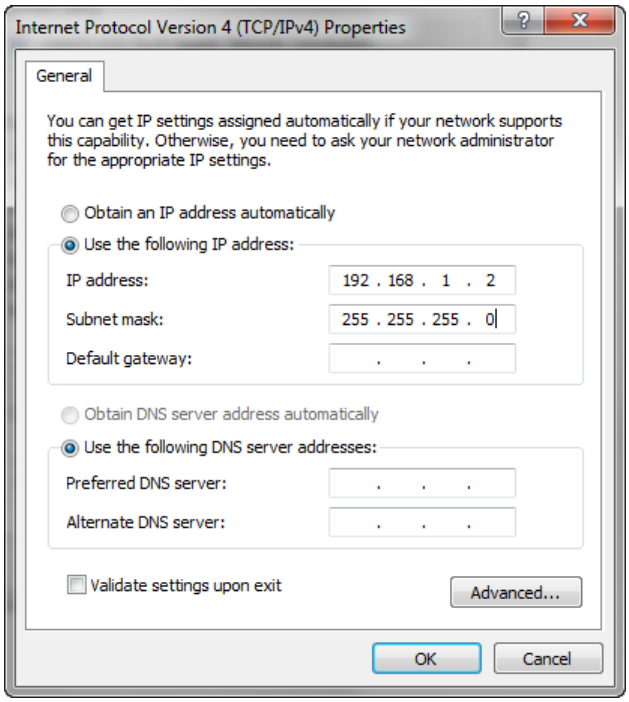
NOTE
The address bits that can be varied in the address mask may not all be set to 0 or 1 (broadcast addresses).

MAC address

The 12-digit MAC address is unique and stored in each device during manufacture. It cannot be altered.

Set the IP address in the computer

Start – Control Panel – Network and Sharing Center – Change adapter settings – Right click on "Local Area Connection" – Properties: Select "Internet Protocol Version 4 (TCP/IPv4)" – Properties – "General" tab: Use the following IP address: – Enter IP address (see the following example).



Establish and test the Ethernet connection

Cable

Point-to-point connection: Twisted-pair cable with RJ45 connectors, terminal layout: 1–3, 3–1, 2–6, 6–2
Connection via an Ethernet network: twisted-pair cable with RJ45 connectors

The cables are standard Ethernet cables and are not part of the scope of supply and delivery of the gas analyzer.

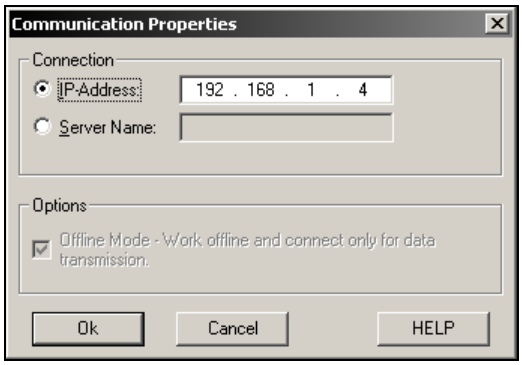
Test the Ethernet connection

To test the Ethernet connection, enter the following in the computer in "Start – Execute…": "ping *IP address*" (with *IP address* = IP address of the gas analyzer). If the connection is OK, the gas analyzer reports "Answer from *IP address*: Bytes=32 Time<10ms TTL=255" (the numbers are device-specific). In the case of the message "Request timed-out", the connection is not OK.

The network name can also be entered instead of the IP address.

Start the communication between the gas analyzer and the computer

Communication between the configurator and the gas analyzer is started in the menu "Options – Communication Properties…" or by clicking the symbol  . Input either the IP address or the network name (server name) of the gas analyzer (see the following example of a point-to-point connection).



Receiving configuration data

After communication has been started, the configuration data can be received from the gas analyzer.

Menu "File – Receive Data" or  .

Sending configuration data

After the configuration data been has edited, it can be sent to the gas analyzer. The configuration mode is active after an automatic cold restart of the gas analyzer.

Menu "File – Send Data" or  .

Saving configuration data

The configuration data of the gas analyzer can be stored in the computer. The stored configuration file can be edited at a later date and sent to the gas analyzer.

Menu "File – Save As…" or  .

Calibrating the gas analyzer

Calibration control

Manual and automatic calibration

Manual calibration

The manual calibration (see page 68) is normally controlled on the display and operator control unit of the gas analyzer. It is carried out individually for each sample component.

Automatic calibration

The automatic calibration (see page 62) is started cyclically on a time interval basis by the internal clock of the gas analyzer. It is carried out jointly for all sample components

Automatic calibration can also be started by an external control signal or via the Modbus[3] or manually on the display and operator control unit of the gas analyzer.

Automatic calibration can be disabled by an external control signal or via the Modbus.

Status signal during the calibration

The status signal "Maintenance mode" is active during the calibration.

In automatic calibration, this is the interval from the gas change sample gas → test gas until the end of the longest pre-set low pass time constants (see page 90) plus the purging time (see page 63) after the following gas change test gas → sample gas.

There are two possibilities in the case of manual calibration:

- If no valves are configured, the status signal is cleared on exiting the calibration menu.
- If at least one sample gas valve (or a digital output with a valve function) has been configured, the status signal is cleared at the end of the longest low-pass time constant plus the purging time after the following gas change test gas → sample gas.

Depending on the configuration of the signal inputs and outputs (see page 95) the status signal is output to a digital output with the function "Maintenance mode".

Current signal during the calibration

The configurator (see page 63) can be used to set whether the current signals at the analog outputs

- follow the changes in measured values during the calibration or
- are held at the last value measured before the start of the calibration.

If the current signals are configured to "Hold", the analog outputs are held until the status signal "Maintenance mode" has been cleared.

[3] For detailed information on "Modbus", refer to the Technical Information "EL3000, EL3060, EL3010-C – Modbus".

Alarm values during the calibration

If alarm values (see page 89) have been activated, they are also active during the calibration. Alarm value monitoring is not active during the calibration if the current signals have been configured to "Hold" (see above).

Plausibility check during the calibration

If the gas analyzer discovers implausible values during the calibration (e.g. the end-point value is the same as the zero-point value), it aborts the calibration and outputs status message 503 (see page 132). The values stored for the last calibration remain in effect.

Wait until the warm-up phase has ended

The gas analyzer may not be calibrated until the warm-up phase has been concluded.

Duration of the warm-up phase:
Uras26: approx. ½ hour without, approx. 2.5 hours with thermostat
Magnos206: approx. 2 hours
Magnos28: approx. 2 to 4 hours
Caldos27: approx. ½ hour
Caldos25: 1 to 4 hours, depending on the measuring range

Atmospheric pressure effect

If a pressure sensor (see page 26) for atmospheric pressure correction has not been installed in the gas analyzer, the atmospheric pressure value must always be checked before calibration and reset (see page 122) if necessary,

- if the height of the operating site of the gas analyzer has been changed since the last calibration or
- if the atmospheric pressure effect on the measured value is too high.

Test gases

Dew point of the test gases

The dew point of the test gases (see page 24) must be approximately the same as the dew point of the sample gas (see page 21), i.e. it must be at least 5 °C lower than the lowest ambient temperature in the overall gas path.

Test gas flow

The test gas flow should be 30 to 60 l/h ± 5 l/h.

Test gas infeed

The test gas must be connected at the sample gas inlet of the gas analyzer:

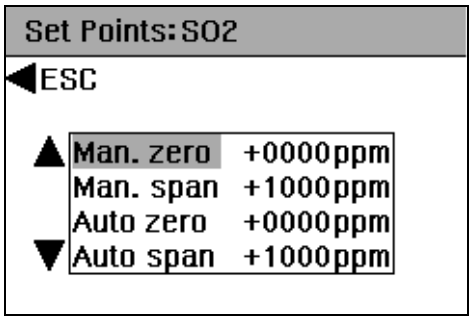
- either by means of an external solenoid valve, which is controlled via digital output DO4 on digital I/O module 1 (see page 39) (standard configuration),
- or by means of three external solenoid valves for sample gas, zero reference gas and span gas, each of which is controlled via an appropriately configured digital output (see page 39),
- or by means of a multidirectional cock.

Test gas infeed for automatic calibration

The prerequisite for the automatic calibration procedure is that at least one external solenoid valve is installed, which is controlled via an appropriately configured digital output.

Especially in situations where the automatic calibration is executed as a simplified calibration, the test gas required for that purpose (zero-reference gas or air or standard gas) has to be connected to an external solenoid valve.

Setting the test gas concentration



Menu path

▶ Setup ▶ Calibration Data ▶ Test Gas Set Points

Test gas concentration

The set points of the test gas concentrations for the zero-point and the end-point calibration must be set separately for the manual and automatic calibration.

The set points of the test gas concentrations for the manual calibration can also be set during calibration (see page 68) and in the configurator (see page 63).

Zero-point set point

Value range: Lower range value of the physical measuring range minus 20 % of the measurement span up to the upper range value of the physical measuring range

End-point set point

Value range: Lower range value of the physical measuring range up to the upper range value of the physical measuring range plus 20 % of the measurement span

Automatic calibration: Control

Starting the automatic calibration

Start on a cyclically time-controlled basis

Automatic calibration is normally started cyclically on a time-controlled basis by the internal clock of the gas analyzer. The cycle time is set in the configurator (see page 53).

Externally controlled start

A control signal at digital input DI1 "Start automatic calibration" on digital I/O module 1 (see page 39) (standard configuration) is required for the external start of the automatic calibration.
Requirements for the control signal: Edge Low 0 to 3 V → High 12 to 24 V. After the transition Low → High, the high level must be present for at least 1 s.

A further digital input must be configured for the external stop of the automatic calibration. The control signal must fulfill the same requirements as for the signal for the external start.

The automatic calibration can also be started and stopped via the Modbus.

Manual start

The automatic calibration can be manually started (see page 66) on the display and operator control unit. Menu path:
▲ `Operation` ▲ `Calibration` ▶ `Automatic Calibration`

Disabling the automatic calibration

A control signal at digital input DI2 "Disable automatic calibration" on digital I/O module 1 (see page 39) (standard configuration) is required to disable the automatic calibration.
Requirements for the control signal: High level 12 to 24 V. Automatic calibration is disabled as long as the high level is active. Automatic calibration in progress is aborted by switching on the control signal.

The next automatic calibration after switch-over to low level is started in accordance with the cycle time set in the configurator.

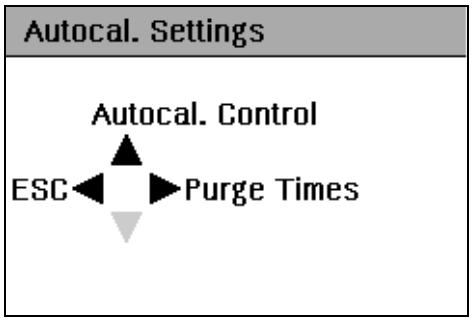
The automatic calibration can also be disabled via the Modbus.

Process display

The status icon appears in the display during automatic calibration. The status message "Autocalibration running" is active, and the status signal "Maintenance mode" is output.

NOTE
Automatic calibration may not be initiated when the gas analyzer is being operated with the test and calibration software TCT.
When automatic calibration is running, it is not possible to carry out manual calibration, measure a calibration cell, carry out a calibration reset or operate the pump.

Automatic calibration: Settings

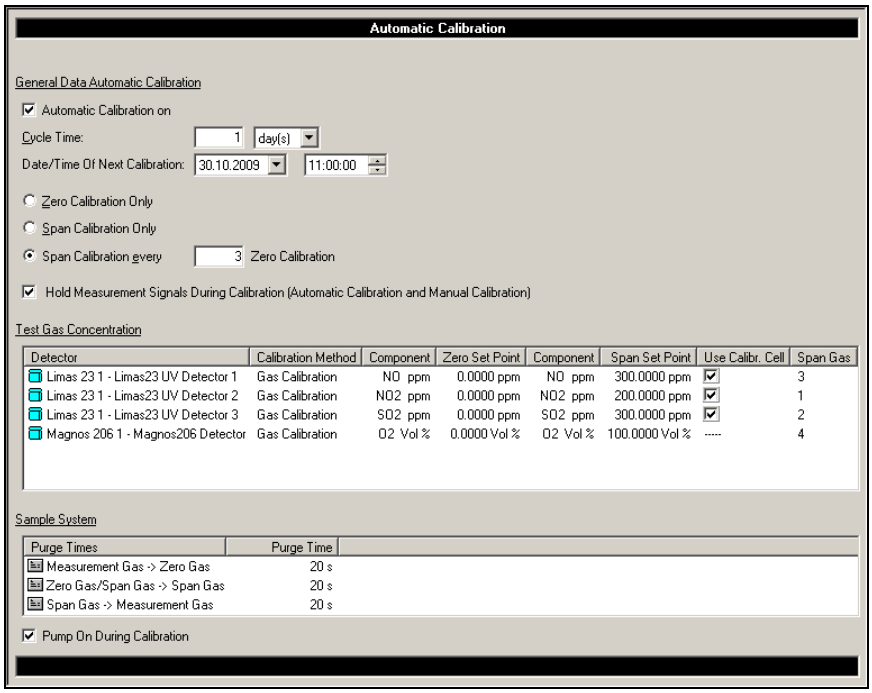


Menu path

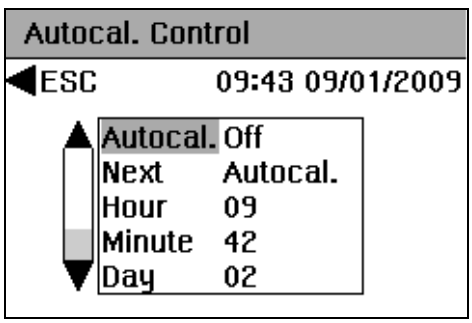
▶ Setup ▶ Calibration Data ▲ Autocal. Settings

Settings in the configurator and in the instrument

All parameters of the automatic calibration can be set in the configurator (see page 53). Some of the settings can also be made directly on the instrument.



Control of the automatic calibration



Activation

Automatic calibration is only performed if it has been activated. The "Off" setting is only effective for the cyclic time-controlled start of automatic calibration; it does not apply for the externally controlled start and the manual start.

Cycle time

The cycle time must be set in the configurator. It specifies the intervals at which automatic calibration is carried out.

Date and time of the next automatic calibration

The gas analyzer carries out the next automatic calibration at the time set here. The cycle time starts from this point of time.

End-point calibration together with zero-point calibration

The cycles in which end-point calibration is to be carried out together with zero-point calibration must be set in the configurator.

Example: End-point calibration at every 7th zero-point calibration
With a cycle time of 24 hours, this setting causes a zero-point calibration to be carried out every day and an end-point calibration once a week.

If the automatic calibration is started manually, a zero-point and an end-point calibration are always carried out; the cycle configured for the time-controlled calibration is not affected by this.

Output current response

The configurator must be used to set whether the signals at the current outputs (analog outputs) follow the changes in measured values during the calibration or are held at the last value measured before the start of the calibration.

If the current signals are configured to "hold", the alarm value monitoring is not active during the calibration.

The setting of the output current response is effective for both automatic and manual calibration.

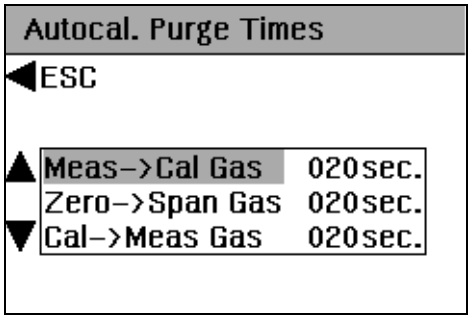
Uras26: Automatic calibration with or without calibration cells

If the Uras26 analyzer is equipped with calibration cells, automatic calibration with calibration cells is to be activated ex works.

If the automatic calibration with calibration cells has been deactivated for individual sample components in the configurator and it is to be carried out with test gases instead, please note the following:

- The test gases for the zero-point and end-point calibration must be fed in via solenoid valves; control of the solenoid valves via digital outputs must be configured (see page 95).
- The automatic calibration is executed in the following steps:
  1. The zero reference gas is fed in, and all the sample components are calibrated at the zero point.
  2. The zero reference gas remains connected, and the sample components with an activated calibration cell are calibrated at the end point.
  3. The span gas is fed in, and the sample components with a deactivated calibration cell are calibrated at the end point.

Gas feed system



Purging times

The purging time settings for the individual phases of the calibration determine the period of time that the gas feed paths are purged

- after switch-over from sample gas to zero reference gas until the start of the zero-point calibration,
- after switch-over from zero reference gas to span gas until the start of the end-point calibration and
- after switch-over from span gas to sample gas until the clearance of the status signal "Maintenance mode"

so that gas residues do not distort the calibration or the measurement result.

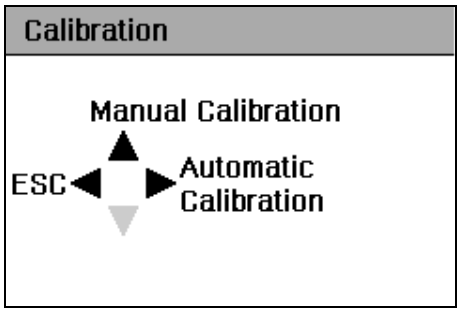
The total purging time for each phase is the sum of the respectively set purging time plus 3 × low pass time constant plus 1× low pass time constant for non-linear filter.

NOTE
The purging time should be set at least three times the T_{90} time of the overall analyzer system.

Calibration method

Analyzer	Calibration method	Remark
Uras26	Zero-point/end-point calibration	cannot be changed
Magnos206, Magnos28	Zero-point/end-point calibration or substitute gas calibration or single-point calibration	If a substitute gas component has been installed in the Magnos206 (see page 73) or Magnos28 (see page 75) analyzer, the substitute gas calibration is set ex works as the calibration method; otherwise, the zero-point/end-point calibration is set. The single-point calibration can be selected as an alternative.
Caldos27	Single-point calibration	with standard gas (see page 77); cannot be changed
Caldos25	Zero-point/end-point calibration or substitute gas calibration	If a substitute gas component has been installed in the Caldos25 (see page 79) analyzer, the substitute gas calibration is set ex works as the calibration method; otherwise, the zero-point/end-point calibration is set (cannot be changed).

Automatic calibration: Manual start



Menu path

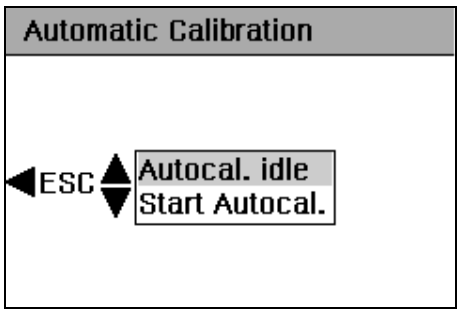
▲ Operation ▲ Calibration ▶ Automatic Calibration

Wait until the warm-up phase has ended

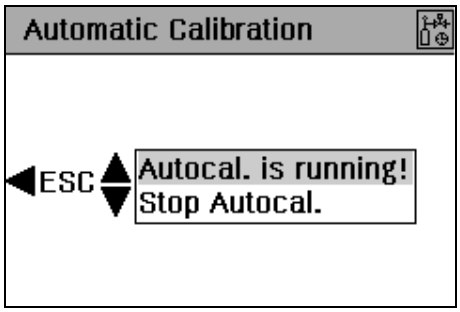
The gas analyzer may not be calibrated until the warm-up phase has been concluded.

Duration of the warm-up phase:
Uras26: approx. ½ hour without, approx. 2.5 hours with thermostat
Magnos206: approx. 2 hours
Magnos28: approx. 2 to 4 hours
Caldos27: approx. ½ hour
Caldos25: 1 to 4 hours, depending on the measuring range

Start automatic calibration manually

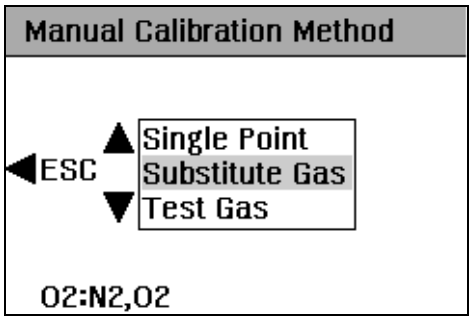


Abort automatic calibration manually



NOTE
If the automatic calibration is aborted, the analyzer is in an undefined state (with respect to the calibration). For example, the zero-point calibration may have been completed and calculated, but the end-point calibration has not yet been carried out. As a result, the automatic calibration must be restarted after it has been aborted and allowed to run through to the end.

Manual calibration: Calibration method



Menu path

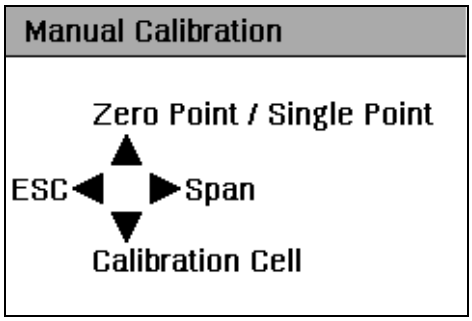
▶ Setup ▶ Calibration Data ▼ Manual Cal. Method

The calibration method can also be set in the configurator (see page 63).

Calibration method

Analyzer	Calibration method	Remark
Uras26	Zero-point/end-point calibration	cannot be altered
Magnos206, Magnos28	Zero-point/end-point calibration or substitute gas calibration or single-point calibration	If a substitute gas component has been installed in the Magnos206 (see page 73) or Magnos28 (see page 75) analyzer, the substitute gas calibration is set ex works as the calibration method; otherwise, the zero-point/end-point calibration is set. The single-point calibration can be selected as an alternative.
Caldos27	Zero-point/end-point calibration or single-point calibration	set ex works with standard gas (see page 77)
Caldos25	Zero-point/end-point calibration or substitute gas calibration	set ex works can be selected if a substitute gas component has been set up in the Caldos25 (see page 79) analyzer

Manual calibration: Execution



Menu path

▲ Operation ▲ Calibration ▲ Manual Calibration

Wait until the warm-up phase has ended

The gas analyzer may not be calibrated until the warm-up phase has been concluded.

Duration of the warm-up phase:
Uras26: approx. ½ hour without, approx. 2.5 hours with thermostat
Magnos206: approx. 2 hours
Magnos28: approx. 2 to 4 hours
Caldos27: approx. ½ hour
Caldos25: 1 to 4 hours, depending on the measuring range

NOTES
A zero-point calibration must always be carried out before an end-point calibration. A zero-point calibration can also be carried out on its own.
Manual calibration cannot be carried out when an automatic calibration is running.

Calibrate the sample component manually

Zero-point calibration

1 Select menu **`Zero point/Single point.`**
2 Select individual sample component or "All" (according to the configuration in the ECT dialog "Manual Calibration").
3 Check zero-point set point[4] and adjust if required.
4 Connect zero reference gas (if it is not automatically connected).
5 Start calibration as soon as the measured value display is stable.
6 Store calibration or repeat calibration[5].

End-point calibration

1 Select menu **Span**.
2 Select sample component.
3 Check span set point[6] and adjust if required.
4 Connect span gas (if it is not automatically connected).
5 Start calibration as soon as the measured value display is stable.
6 Store calibration or repeat calibration.

End-point calibration with calibration cell (option with Uras26)

1 Select menu **`Calibration Cell`**.
2 Select sample component or "All".
3 Connect zero reference gas (if not already connected).
4 Start calibration as soon as the measured value display is stable.
5 Store calibration or repeat calibration.

[4] The parameterized test gas concentration is displayed. If the set point is altered here, the parameterized test gas concentration is overwritten.
[5] A calibration may have to be repeated if the measured value is not stable after initiation of the calibration. The repeated calibration is based on the measured value obtained in the preceding calibration.
[6] The parameterized test gas concentration is displayed. If the set point is altered here, the parameterized test gas concentration is overwritten.

Uras26: Notes on calibration

Calibration methods

Automatic calibration:	Zero-point/end-point calibration
Manual calibration:	Zero-point/end-point calibration

Calibration cells

The use of calibration cells (option) enables the end-point calibration of the Uras26 to be carried out without test gas cylinders.

A calibration cell is installed in each optical beam path of the analyzer as per the order. Each calibration cell is filled with a test gas, whose composition and concentration has been adapted to the sample components and measuring ranges which have been installed in the respective optical beam path. They are moved into the optical beam path for the end-point calibration.

Information on the installed calibration cells is contained in the analyzer data sheet (see page 33).

The set points of the calibration cells should be checked at prolonged intervals (see page 120, recommendation: once a year).

Manual calibration

The menu `Manual Calibration` is used to select whether each sample component is calibrated individually or all sample components are calibrated together in the zero-point calibration of the Uras26. It is also used to select whether the end-point calibration of the Uras26 is carried out with calibration cells or test gases.

Calibration of the Uras26 together with a Magnos206 or Magnos28 or Caldos27 or Caldos25

Automatic calibration

Zero-point calibration of the Caldos25 (see page 79) or an end-point calibration of Magnos206 (see page 73) or Magnos28 (see page 75) or Caldos27 (see page 77) is executed simultaneously during the zero-point calibration of the Uras26. The test gas (see page 24) is to be selected accordingly.

Manual calibration

The zero-point/end-point calibration is permanently set as the calibration method for the (infrared) sample components of the Uras26.

The calibration method for the (non-infrared) sample component of the Magnos206 or the Magnos28 or the Caldos27 or the Caldos25 has to be configured. For the manual calibration it is possible to select whether these sample components are to be calibrated individually or together with the sample components the Uras26.

Calibration of the Uras26 with internal cross-sensitivity correction

Possible electronic cross-sensitivity corrections by other sample components measured by Uras26 are disabled for the calculation of the calibration. The following information should therefore be noted in particular:

Zero-point calibration

All the sample components must always be calibrated in the following sequence for the zero-point calibration:

- firstly the sample component which is not corrected,
- then the sample component which is affected by the smallest number of corrections,
- up to the sample component which is affected by the largest number of corrections.

End-point calibration

All the sample components must also always be calibrated in the end-point calibration. Here, a corrected sample component may only be calibrated using a test gas which does not contain any components which cause cross-sensitivity, i.e. which only consists of the sample component and an inert gas, e.g. N_2.

Test gases

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Uras26 with calibration cells (automatic calibration)	N_2 or air or IR sample component-free gas	– (calibration cells)
Uras26 without calibration cells (automatic calibration)	N_2 or air	Span gas*
Uras26 without calibration cells (manual calibration)	N_2 or air	Test gas for each sample component or for each detector
Uras26 + Magnos206 (automatic calibration, i.e. Magnos206 with single-point calibration)	IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Calibration cells or span gas*
Uras26 + Magnos206 (manual calibration)	Zero reference gas for Uras26 or Magnos206, or IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Span gas for all sample components in the Uras26 and Magnos206 (possibly only for the Uras26 if a single-point calibration is carried out for the Magnos206)

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Uras26 + Magnos28 (automatic calibration, i.e. Magnos28 with single-point calibration)	IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Calibration cells or span gas*
Uras26 + Magnos28 (manual calibration)	Zero reference gas for Uras26 or Magnos28, or IR sample component-free test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	Span gas for all sample components in the Uras26 and Magnos28 (possibly only for the Uras26 if a single-point calibration is carried out for the Magnos28)
Uras26 + Caldos27 (automatic calibration, i.e. Caldos27 with single-point calibration)	IR sample component-free test gas with a known and constant rTC value (possibly also dried room air)	Calibration cells or span gas*
Uras26 + Caldos27 (manual calibration)	Zero reference gas for Uras26 or Caldos27, or IR sample component-free test gas with a known rTC value	Span gas for all sample components in the Uras26 and Caldos27 (possibly only for the Uras26 if a single-point calibration is carried out for the Caldos27)
Uras26 + Caldos25 (automatic calibration)	Sample component-free test gas or substitute gas for Uras26 and Caldos25	Test gas or substitute gas mixture for all sample components in the Uras26 and in the Caldos25*
Uras26 + Caldos25 (manual calibration)	IR sample component-free test gas for Uras26 and sample component-free test gas or substitute gas for Caldos25	Span gas for all sample components in the Uras26 and test gas or substitute gas with known sample component concentration for Caldos25

* Test gas mixture for multiple sample components possible if no or negligible cross-sensitivity is present

Dew point

The dew point of the test gases must be approximately the same as the dew point of the sample gas.

Magnos206: Notes on calibration

Calibration methods

Automatic calibration:	Zero-point/end-point calibration or substitute gas calibration (set ex works if a substitute gas component is installed) or single-point calibration
Manual calibration:	Zero-point/end-point calibration or substitute gas calibration (set ex works if a substitute gas component is installed) or single-point calibration

Substitute gas calibration

If test gases are not available for calibration, e.g. because they cannot be filled in test gas cylinders or because their components are not compatible with each other, the analyzer can be set ex works as per the order for calibration with a substitute gas. In addition to the measuring range of the sample component, a measuring range for the substitute gas component is installed ex works; this is normally O_2 in N_2. This setting is documented in the analyzer data sheet (see page 33).

The substitute gas calibration is a zero-point/end-point calibration of the substitute gas component. The zero and end points of measuring range of the sample component in the analyzer are then corrected by the values determined in this calibration.

NOTE
Substitute gas calibration must **always** be used to calibrate **all** (sample gas and substitute gas) components if the analyzer is set up for substitute gas calibration. Zero-point/end-point calibration either in the sample component or substitute gas measurement ranges leads to erroneous analyzer calibration.

Single-point calibration

The long-term sensitivity drift of the Magnos206 is less than 0.05 % vol. O_2 per year. Thus only an offset correction needs to be routinely carried out in the measuring ranges from 0–5 to 0–25 % vol. O_2. This so-called single-point calibration can be conducted at each point on the characteristic curve since a parallel shift of the curve is effected. Depending on the measurement task, we also recommend that an end-point calibration is carried out at least once a year.

Note: The sensitivity drift can amount to 1 % of the measured value per week in the short-term.

Single-point calibration in measuring ranges with suppressed zero point

The single-point calibration can also be carried out in a measuring range with a suppressed zero point, provided that the suppression ratio is less than 1:5. The O_2 concentration of the test gas must be within the measuring range.

Air pressure correction

The current atmospheric pressure must be considered for the single-point calibration. This is carried out automatically if a pressure sensor (see page 26) has been installed in the analyzer.

Suppressed measuring ranges

If suppressed measuring ranges with a suppression ratio of be more than 1:5 have been set up in the Magnos206 analyzer, a special adjustment of the pressure sensor which is installed as standard has been carried out ex works; in this case, substitute gas calibration is also not installed in the analyzer.

Test gases

Analyzer	Test gas for zero-point calibration and single-point calibration	Test gas for end-point calibration
Magnos206	Oxygen-free process gas	Process gas with known O_2 concentration
Magnos206 with suppressed measuring range	Test gas with O_2 concentration near the starting point of the measuring range	Test gas with O_2 concentration near the end point of the measuring range
Magnos206 with single-point calibration	Test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	–
Magnos206 with substitute gas calibration	Oxygen-free process gas or substitute gas (O_2 in N_2)	Substitute gas, e.g. dried air

CAUTION
In order to avoid accumulations of explosive gas mixtures, do not use air as a test gas for single-point calibration when measuring flammable gases!

Dew point

The dew point of the test gases must be approximately the same as the dew point of the sample gas.

Magnos28: Notes on calibration

Calibration methods

Automatic calibration:	Zero-point/end-point calibration or substitute gas calibration (set ex works if a substitute gas component is installed) or single-point calibration
Manual calibration:	Zero-point/end-point calibration or substitute gas calibration (set ex works if a substitute gas component is installed) or single-point calibration

Substitute gas calibration

If test gases are not available for calibration, e.g. because they cannot be filled in test gas cylinders or because their components are not compatible with each other, the analyzer can be set ex works as per the order for calibration with a substitute gas. In addition to the measuring range of the sample component, a measuring range for the substitute gas component is installed ex works; this is normally O_2 in N_2. This setting is documented in the analyzer data sheet (see page 33).

The substitute gas calibration is a zero-point/end-point calibration of the substitute gas component. The zero and end points of measuring range of the sample component in the analyzer are then corrected by the values determined in this calibration.

NOTE
Substitute gas calibration must **always** be used to calibrate **all** (sample gas and substitute gas) components if the analyzer is set up for substitute gas calibration. Zero-point/end-point calibration either in the sample component or substitute gas measurement ranges leads to erroneous analyzer calibration.

Single-point calibration

The long-term sensitivity drift of the Magnos28 is less than 0.15 % of measured value per three months (minimum 0.03 vol.% O_2 per three months). Thus only an offset correction needs to be routinely carried out in the measuring ranges from 0–5 to 0–25 % vol. O_2. This so-called single-point calibration can be conducted at each point on the characteristic curve since a parallel shift of the curve is effected. Depending on the measurement task, we also recommend that an end-point calibration is carried out at least once a year.

Note: The sensitivity drift can amount to 1 % of the measured value per week in the short-term.

Single-point calibration in measuring ranges with suppressed zero point

The single-point calibration can also be carried out in a measuring range with a suppressed zero point, provided that the suppression ratio is less than 1:5. The O_2 concentration of the test gas must be within the measuring range.

Air pressure correction

The current atmospheric pressure must be considered for the single-point calibration. This is carried out automatically if a pressure sensor (see page 26) has been installed in the analyzer.

Test gases

Analyzer	Test gas for zero-point calibration and single-point calibration	Test gas for end-point calibration
Magnos28	Oxygen-free process gas	Process gas with known O_2 concentration
Magnos28 with suppressed measuring range	Test gas with O_2 concentration near the starting point of the measuring range	Test gas with O_2 concentration near the end point of the measuring range
Magnos28 with single-point calibration	Test gas with O_2 concentration in an existing measuring range or ambient air. Same moisture content as process gas.	–
Magnos28 with substitute gas calibration	Oxygen-free process gas or substitute gas (O_2 in N_2)	Substitute gas, e.g. dried air

CAUTION
In order to avoid accumulations of explosive gas mixtures, do not use air as a test gas for single-point calibration when measuring flammable gases!

Dew point

The dew point of the test gases must be approximately the same as the dew point of the sample gas.

Caldos27: Notes on calibration

Calibration methods

Automatic calibration:	Single-point calibration
Manual calibration:	Zero-point/end-point calibration (set ex works) or single-point calibration

Single-point calibration

Owing to the operating principle of the sensor in the Caldos27 analyzer, the zero point and end point do not drift independently of each other. The routine calibration of the Caldos27 can therefore be carried out as a so-called single-point calibration with standard gas. Measurements which are relevant to safety are excluded from this process. The zero point and end point must be checked regularly with test gases depending on the measuring task (Recommendation: once a year).

Standard gas

The component "Standard gas" is always the last of the maximum of five sample components (see page 91) in the Caldos27 to be configured. The single-point calibration with standard gas has an effect on all the other sample components configured in the Caldos27.

N_2 with the measured value 10,000 rTC is set ex works as the standard gas. If another standard gas is used for the manual calibration, its rTC set point must be input during the calibration.

Standard gas	rTC set point
N_2	10,000 rTC
Air	10,070 rTC
Ar	7,200 rTC
CO_2	7,500 rTC
CH_4	14,000 rTC
He	50,000 rTC
H_2	60,000 rTC

Zero and end points of the sample components configured in the Caldos27 must be checked and re-calibrated if necessary after the standard gas has been changed.

Associated gas effect

The measurement technique of the Caldos27 analyzer is based on the differing thermal conductivity of the various gases. Since this measurement technique is nonselective, the concentration of a sample component can only be measured exactly in a binary or quasi-binary gas mixture. If additional associated gas components are present in the sample gas, their influence must be considered in the ex-works initial calibration.

Test gases

Analyzer	Test gas for zero-point calibration and single-point calibration	Test gas for end-point calibration
Caldos27	Sample component-free test gas or process gas	Test gas or process gas with a known sample gas concentration
Caldos27 with a suppressed measuring range	Test gas with a sample component concentration near the starting point of the measuring range	Test gas with a sample component concentration near the end point of the measuring range
Caldos27 with single-point calibration	Test gas with a known and constant rTC value (standard gas; possibly also dried room air)	–

Dew point

The dew point of the test gases must be approximately the same as the dew point of the sample gas.

Caldos25: Notes on calibration

Calibration methods

Automatic calibration:	Zero-point/end-point calibration or substitute gas calibration (set ex works if a substitute gas component is installed, cannot be altered).
Manual calibration:	Zero-point/end-point calibration (set ex works) or substitute gas calibration (can be selected if a substitute gas component is installed)

Substitute gas calibration

If test gases are not available for calibration, e.g. because they cannot be filled in test gas cylinders or because their components are not compatible with each other, the analyzer can be set ex works as per the order for calibration with a substitute gas. In addition to the measuring range of the sample component, a measuring range for the substitute gas component is installed ex works. This setting is documented in the analyzer data sheet (see page 33).

The substitute gas calibration is a zero-point/end-point calibration of the substitute gas component. The zero and end points of measuring range of the sample component in the analyzer are then corrected by the values determined in this calibration.

NOTE
Substitute gas calibration must **always** be used to calibrate **all** (sample gas and substitute gas) components if the analyzer is set up for substitute gas calibration. Zero-point/end-point calibration either in the sample component or substitute gas measurement ranges leads to erroneous analyzer calibration.

Associated gas effect

The measurement technique of the Caldos25 analyzer is based on the differing thermal conductivity of the various gases. Since this measurement technique is nonselective, the concentration of a sample component can only be measured exactly in a binary or quasi-binary gas mixture. If additional associated gas components are present in the sample gas, their influence must be considered in the ex-works initial calibration.

Test gases

Analyzer	Test gas for zero-point calibration	Test gas for end-point calibration
Caldos25	Sample component-free test gas or process gas	Test gas or process gas with a known sample component concentration near the end point of the measuring range
Caldos25 with substitute gas calibration	Sample component-free substitute gas	Substitute gas with a known sample component concentration near the end point of the measuring range

Dew point

The dew point of the test gases must be approximately the same as the dew point of the sample gas.

Configuring the gas analyzer

Measuring range switch-over

Limits of the measuring ranges

The limits of the measuring ranges can be set in compliance with the rules applicable for the respective analyzer: Uras26 (see page 85), Magnos206 (see page 86), Magnos28 (see page 87), Caldos27 (see page 88).

Only one measuring range is implemented in the Caldos25 analyzer. The limits of this measuring range cannot be changed.

Combination of the measuring ranges

The following conditions apply for combination of the measuring ranges.

Two initial measuring ranges

Measuring range 2 (MR2): Initial measuring range (≤ physical measuring range)
Measuring range 1 (MR1): Initial measuring range (≤ physical measuring range)
Span MR1 ≤ span MR2

One measuring range with a suppressed zero point, one initial measuring range

Measuring range 2 (MR2): Measuring range with suppressed zero point
Measuring range 1 (MR1): Initial measuring range
Upper range value of MR1 > lower range value of MR2

Two measuring ranges with suppressed zero point

Measuring range 2 (MR2): Measuring range with suppressed zero point
Measuring range 1 (MR1): Measuring range with suppressed zero point
Lower range value of MR1 ≤ lower range value of MR2
Upper range value of MR1 > lower range value of MR1

NOTE
Other measuring range combinations are not allowed.

Measuring range switch-over and feedback signal

There are three ways of executing the measuring range switch-over:

- Manually on the gas analyzer
- Automatically (autorange) by means of appropriately configured switch-over thresholds
- Externally controlled via appropriately configured digital inputs (see page 82).

The measuring range feedback signal can be implemented via appropriately configured digital outputs (see page 82); 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.

Measuring range configuration

The measuring ranges can be configured either in the configurator (see page 82) or in the gas analyzer (see page 84):

Configuration of	**in the configurator**	**in the gas analyzer**
Type of measuring range switch-over	X	X
Range limits	X	X
Switch-over thresholds for autorange	X	X
Digital inputs, digital outputs	X	–

Manual measuring range switch-over

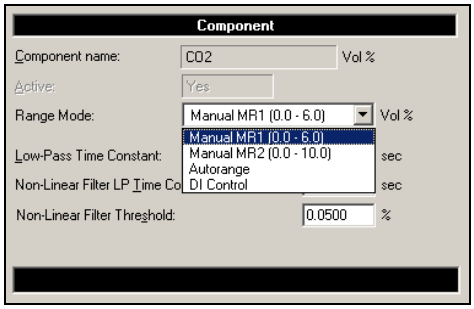
▲ Operation ▼ Switch-over ▼ Active Measuring Range

Measuring range configuration with ECT

Range limits

Measuring range switch-over

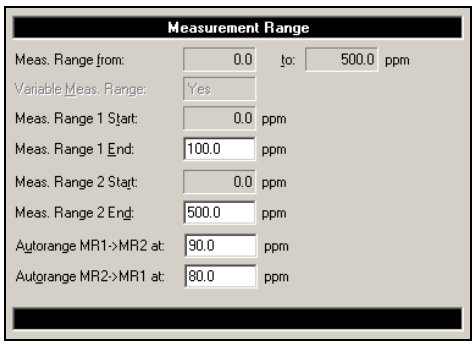
The type of measuring range switch-over ("Range Mode") is configured in the "Component" dialog:



NOTE
The automatic measuring range switch-over ("Autorange") can only be configured if an analog output has been assigned to the detector.
The externally controlled measuring range switch-over ("DI Control") can only be configured if an analog output and a digital input is assigned to the detector).

Range limits and autorange switch-over thresholds

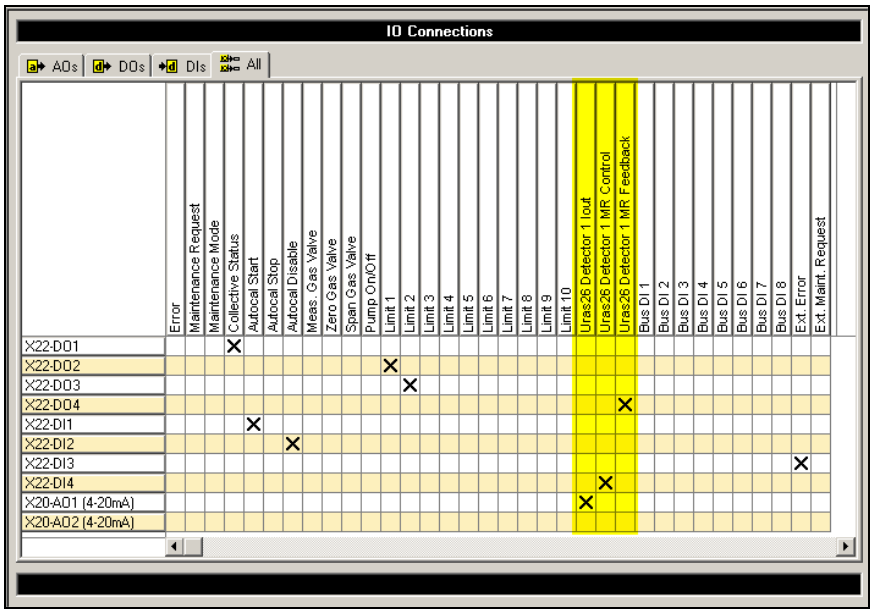
The lower and final values of the measuring range and the autorange changeover thresholds are configured in the measuring range dialog "Measurement Range":



NOTE
The values of the autorange switch-over thresholds must both be in the range "Measuring range 2 lower range value up to measuring range 1 final value".
The value of the autorange switch-over threshold MR2→MR1 must be less than the value of the switch-over threshold MR1→MR2.

The conditions (see page 80) for the limits and combinations of the measuring ranges must be complied with.

Configuration of the inputs and outputs for the measuring range switch-over and feedback signals



In the example shown in the figure, the following inputs and outputs are assigned to Uras26 detector 1 (see yellow marking):

- The analog output X20-AO1 for output of the measured values ("Iout")
- The digital input X22-DI4 for external control of the measuring range switch-over ("MR Control"),
- The digital output X22-DO4 for the measuring range feedback signal ("MR Feedback").

Mode of functioning of the digital inputs and outputs for the measuring range switch-over and feedback

Active range	Switching state	Digital input	Digital output
	Inputs and outputs not inverted	Possible circuitry for the inputs and outputs, see "Electrical connection of the digital I/O module" (see page 39)	
Measuring range 1	0	open	Relay deenergized
Measuring range 2	1	closed	Relay energized

Measuring range configuration in the gas analyzer

Menu path

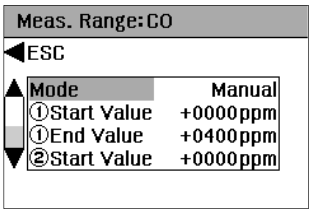
▶ Setup ▲ Measurement Ranges

The measuring range parameters must be individually set for each sample component.

Measuring range parameters

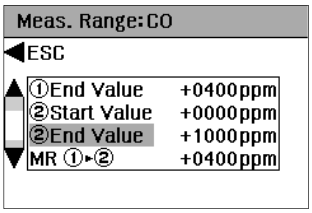
Mode of the measuring range switch-over

- Manual
- Automatic (autorange)
- Externally controlled (DI control)



Range limits

- Measuring Range 1 starting value
- Measuring Range 1 final value
- Measuring Range 2 starting value
- Measuring Range 2 final value



Autorange switch-over thresholds

- Switch-over from measuring range 1 to measuring range 2
- Switch-over from measuring range 2 to measuring range 1

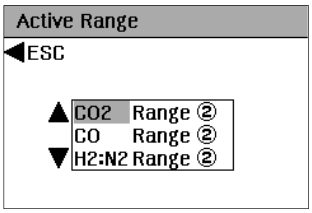
NOTES

The automatic measuring range switch-over ("Autorange") can only be configured if an analog output has been assigned to the detector.
The externally controlled measuring range switch-over ("DI Control") can only be configured if an analog output and a digital input is assigned to the detector).
The values of the autorange switch-over thresholds must both be in the range "Measuring range 2 lower range value up to measuring range 1 final value".
The value of the autorange switch-over threshold MR2–>MR1 must be less than the value of the switch-over threshold MR1->MR2.

The conditions (see page 80) for the limits and combinations of the measuring ranges must be complied with.

Manual measuring range switch-over

▲ Operation ▼ Switch-over
▼ Active Range



Uras26: Changing the range limits

Menu path

▶ Setup ▲ Measurement Ranges

The range limits can also be set in the configurator (see page 82).

NOTES
Measuring ranges must not be set within ignition limits.
The calibration of the measuring range should be checked after the range limits have been changed.

Range limits

The **start value of the measuring range** cannot be altered. The **end value of the measuring range** must be within the physical measuring range.

Setting range

The measuring range can be freely set within the limits of the physical measuring range.

Physical measuring range

The analyzer has one physical measuring range per sample component. The limits of this measurement range are determined by the minimum and the maximum value of the product of the gas concentration and measurement cell length $(c \times l)_{min}$ or $(c \times l)_{max}$.

Calibration cells

If the analyzer is equipped with calibration cells, their set points for each sample component amount to approximately 80 % of the physical measuring range or 80 % of the set measuring range as per the order.

Magnos206: Changing the range limits

Menu path

▶ Setup ▲ Measurement Ranges

The range limits can also be set in the configurator (see page 82).

NOTES
Measuring ranges must not be set within ignition limits.
The calibration of the measuring range should be checked after the range limits have been changed.

Range limits

The **start value of the measuring range** and the **end value of the measuring range** must be within the physical measuring range.

Setting range

The measuring range can be freely set within the limits of the physical measuring range. It is set ex works to 0 to 25/100 % vol. of O_2 or per order.

The smallest measuring range is 0 to 0,5 % vol. of O_2.

Measuring range with a suppressed zero point ("suppressed measuring range")

The suppression ratio is max. 1:10, e.g. 19 to 21 % vol. of O_2. Pressure correction with pressure sensor (see page 26) is required.

Physical measuring range

The analyzer has a physical measuring range. The limits of this measuring range are 0 % vol. of O_2 and 100 % vol. of O_2.

Magnos28: Changing the range limits

Menu path

▶ Setup ▲ Measurement Ranges

The range limits can also be set in the configurator (see page 82).

NOTES
Measuring ranges must not be set within ignition limits.
The calibration of the measuring range should be checked after the range limits have been changed.

Range limits

The **start value of the measuring range** and the **end value of the measuring range** must be within the physical measuring range.

Setting range

The measuring ranges can be freely set within the limits of the physical measuring range (see page 80).

The measuring ranges are set ex works to 0 to 25 % vol. of O_2 and 0 to 100 % vol. of O_2 or per order.

The smallest measuring range is 0 to 0.5 % vol. of O_2. The smallest span of a measuring range with a suppressed zero point is 1 % vol. of O_2.

Physical measuring range

The analyzer has a physical measuring range. The limits of this measuring range are 0 % vol. of O_2 and 100 % vol. of O_2.

Caldos27: Changing the range limits

Menu path

▶ Setup ▲ Measurement Ranges

The range limits can also be set in the configurator (see page 82).

NOTES
Measuring ranges must not be set within ignition limits.
The calibration of the measuring range must be checked after the range limits have been changed.

Range limits

The **start value of the measuring range** and the **end value of the measuring range** must be within the reference measuring range.

Setting range

The measuring range can be set by the user within the limits applicable for the sample component. It is permanently set to rTC = 0 to 64,000 for the factory-set component "Relative thermal conductivity".

The largest measuring range is 0 to 100 % vol. or 0 % vol. to saturation, depending on the measuring task.

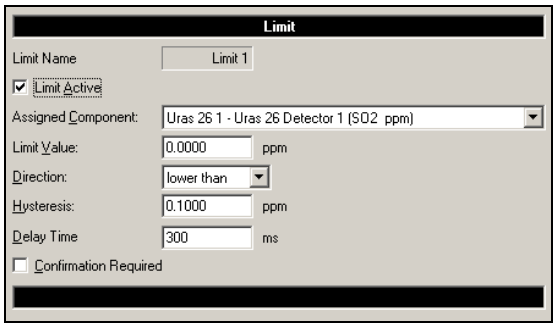
Physical measuring range

The gas analyzer has one physical measuring range for each sample component. The limits of this measuring range are normally 0 % vol. and 100 % vol.

Alarm value configuration

Configuration

The limit values can only be set in the configurator (see page 53) and not in the gas analyzer.



Parameters

Limit Active	The alarm value monitoring can be activated or deactivated.
Assigned Component	Selection from all the sample components available in the gas analyzer.
Limit Value	Value range: within the physical measuring range of the analyzer.
Direction	The alarm signal is output if the measured value is larger or smaller than the set alarm value.
Hysteresis	Value range: within the physical measuring range of the analyzer.
Delay Time	Waiting time from the occurrence of an alarm value event (in or out) to the update of the output. Value range 0 to 60,000 ms.
Confirmation Required	If an alarm value is exceeded, the output signal is not reset until the alarm value has been fallen below again and the status message has been acknowledged by the user.

NOTE
If several sample components have been configured in the gas analyzer and alarm values assigned to these sample components, the status of the inactive sample components is set to "normal" after the active sample component has been changed, and the active sample component is monitored.

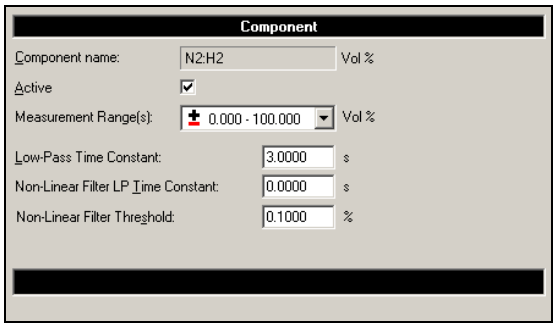
Standard configuration

The alarm value monitoring for the sample components which are measured in the gas analyzer is normally configured ex works. The prerequisite for this is that there is a digital output available on the digital I/O modules (see page 39) for each sample component.

Low pass time constant configuration

Configuration

The low pass time constants can only be set in the configurator (see page 53) and not in the gas analyzer.

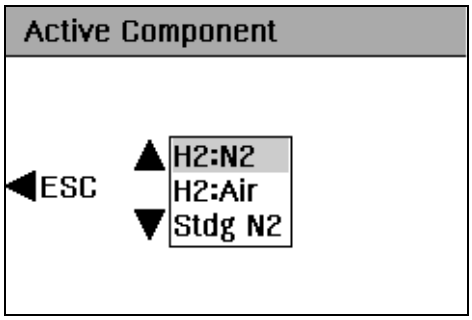


Parameters

A non-linear filter with 2 low pass time constants and a switching threshold can be configured for each sample component:

Low-pass time constant	Value range: 0 to 60 s
Low-pass time constant for non-linear filter	Value range: 0 to 60 s
Switching threshold for non-linear filter	Value range: 0 to 9.99 % of the physical measuring range. If the threshold is crossed, the low pass time constant for non-linear filter will be activated.

Active component selection



Menu path

▲ Operation ▼ Switch-over ▶ Active Component

Active component

The "Active component" parameter appears in the Magnos206, Magnos28, Caldos27 and Caldos25 analyzers.

Several sample components can be configured and calibrated in these analyzers; however, only the active component is measured and displayed.

Externally controlled sample component switch-over

Description

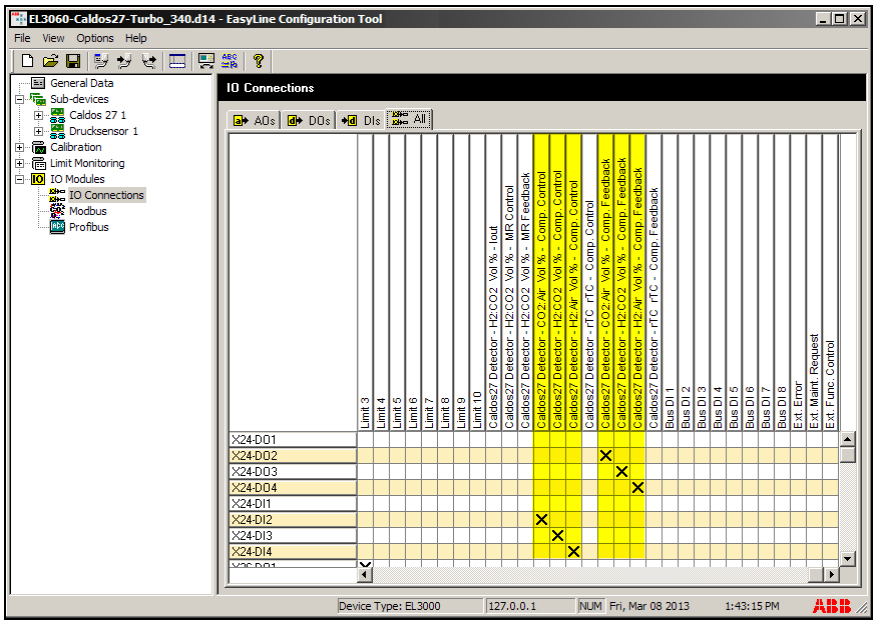
Externally controlled switch-over of the active sample component is possible via appropriately configured digital inputs (see page 39). The respectively configured digital outputs are required for sample component feedback.

Function

The sample component is activated via a signal on the digital input which is assigned to the sample component switch-over. The respectively configured digital output is set for feedback of the active sample component.

After a restart of the gas analyzer, the sample component which was last saved as active is active again unless there is a signal present on one of the configured digital inputs.

Configuration with ECT



In the example shown in the figure, the following digital inputs and outputs are assigned to the sample components of the Caldos27 detector (see yellow marking):

- The digital inputs X24-DI2 to X24-DI4 are for the external control of the sample component switch-over ("Comp. Control") and
- The digital outputs X24-DO2 to X24-DO4 are for the sample component feedback signal ("Comp. Feedback").

Changing the physical unit of a sample component

Configuration

The physical unit used for the measured value of a sample component, e.g. ppm or mg/m^3, can be changed in the configurator (see page 53).

For system components, one of the units defined ex-works can be selected. For user components, the unit selection depends on which parameters required for the calculation have been entered during the configuration of the component.

Changing the unit of a component is possible for the following analyzers:

Analyzer	Physical units
Uras26	ppm, vol%, mg/m^3, g/m^3
Magnos206	ppm, vol%
Magnos28	ppm, vol%

Procedure

1. In ECT, start the communication with the gas analyzer and transfer the configuration data from the gas analyzer to the computer.
2. In the tree view, click the sample component whose physical unit is to be changed.
3. In the "Component" dialog, select the desired physical unit from the drop down list at the "Component Name:" parameter.
4. Transfer the configuration data from the computer back to the gas analyzer.

Caldos27: Configuration and calibration of sample components

Configuring a new sample component

In the configurator

In the configurator (see page 53), up to four sample components can be selected from all the available sample components loaded in the gas analyzer in the shortcut menu of the Caldos27 detector.

If necessary, an already configured sample component must be deleted. The "Standard Gas" component configured ex works cannot be deleted. A "user component" configured in the analyzer ex works can also not be deleted.

NOTE
If a sample component is deleted, its calibration data will be lost. It is therefore recommended that the ECT software tool is used to make a back-up copy of the instrument data record before a sample component is deleted.

In the gas analyzer

In the gas analyzer, a sample component which is to be measured and displayed is selected from a maximum of five sample components in the `Active Component` menu.

Calibrating a new sample component

All available sample components are pre-calibrated ex works. The zero point and end point must be checked and recalibrated if necessary after a user-configured sample component has been activated for the first time.

NOTE
The sample components configured as per the order have been fully calibrated ex works.

Configuration of signal inputs and outputs (I/O connections)

Configuration

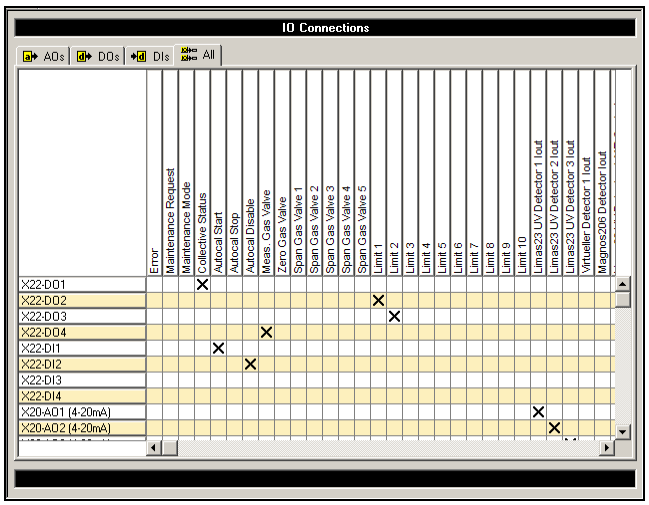
The signal inputs and outputs (I/O connections) can only be set in the configurator (see page 53) and not in the gas analyzer.

Function

The assignments of the following are configured:

- The analog outputs (AOs),
- the digital outputs (DOs) and
- the digital inputs (DIs).

Assignment

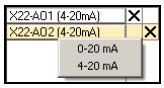


Only one function can be assigned to each signal input or output. A function can be assigned to several signal inputs or outputs. Depending on the number of available digital inputs several external signals can be configured.

Analog outputs

The measured values are assigned to the analog outputs (see page 39) AO1, AO2, etc. in the order of the configuration.

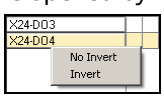
A short cut menu, in which you can toggle between 0–20 mA and 4–20 mA is opened by right-clicking the name of the analog output:



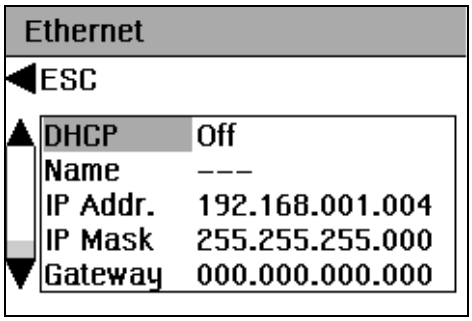
Digital outputs, digital inputs

Refer to the description of the digital I/O module (see page 39) for the standard assignment of the digital inputs and outputs.

A short cut menu, in which you can toggle between "No Invert" and "Invert", is opened by right-clicking the name of the digital input or output:



Configuration of the Ethernet connection



Menu path

▶ Setup ▼ Device Settings ▶ Ethernet

Function

The Ethernet connection enables communication

- with the test and calibration software TCT-light,
- with the configuration software ECT,
- for transmission of the QAL3 data, if the option QAL3 monitoring has been integrated in the gas analyzer,
- for reading the measured values and for calibrating and controlling the gas analyzer via the Modbus TCP/IP protocol.

Parameters

The parameters which have to be input depend on the DHCP setting:

DHCP on: Network name (max. 20 characters, no blanks or special characters),

DHCP off: IP address, IP address mask and IP gateway address.

The network name can only be altered in the configurator (see page 53). The default network name consists of "EL3K" and the last six positions of the MAC address (example: "EL3KFF579A").

If the parameter "DHCP" is set to "off", the Ethernet configuration is reset to the standard configuration (default IP address); this will prevent the inadvertent assignment of an IP address from a DHCP pool.

Addresses

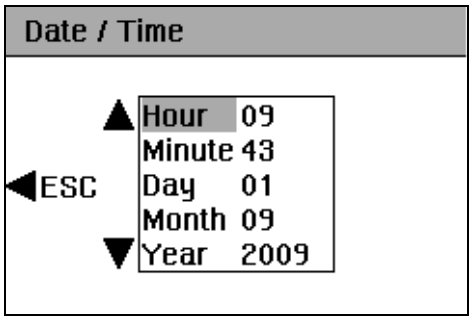
The IP address, IP address mask and IP gateway address must be obtained from the system administrator.

NOTE
The address bits that can be varied in the address mask may not all be set to 0 or 1 (broadcast addresses).

MAC address

The 12-digit MAC address is unique and stored in each device during manufacture. It cannot be altered.

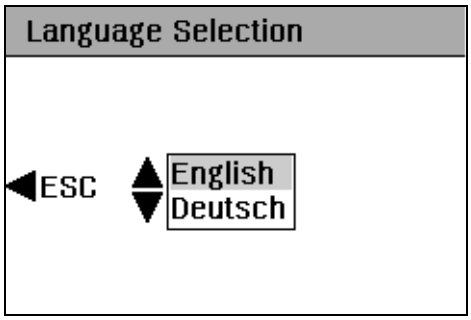
Setting the date and time



Menu path

▶ Setup ▼ Device Settings ▼ Date / Time

Selecting the language of the user interface



Menu path

▶ Setup ▼ Device Settings ▲ Language

Language selection

Two languages, which can be toggled, are available in the gas analyzer's user interface. English is permanently set ex works; the second language can be configured by means of the ECT software tool (see page 99).

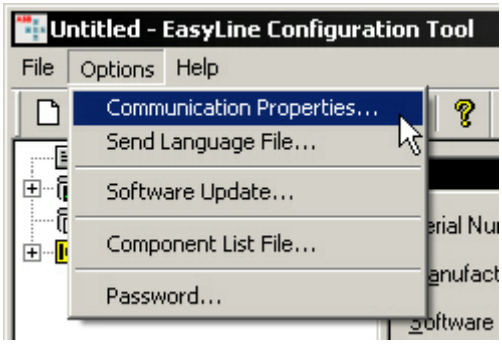
Configuring the language of the user interface

Uploading the language file to the gas analyzer

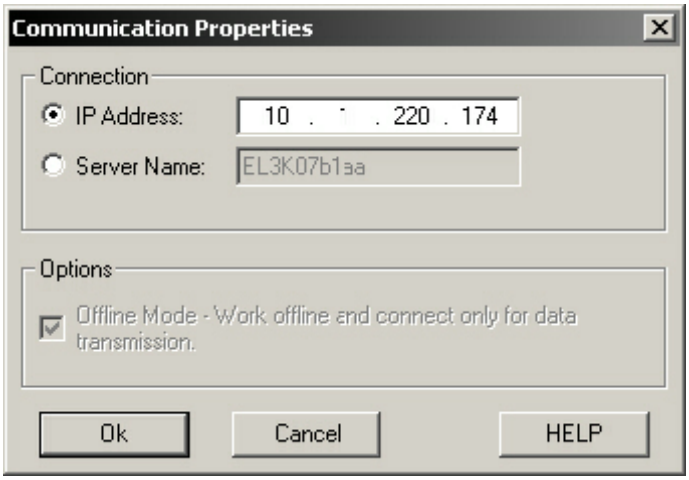
Prerequisites: The ECT software tool ("configurator") has been installed on the computer and the current language files are stored in the folder "Analyze IT" – "ECT" – "Languages".

1 Open the ECT software tool.

2 Click the command "Communication Properties..." in the "Options" menu or click the icon  in the toolbar.

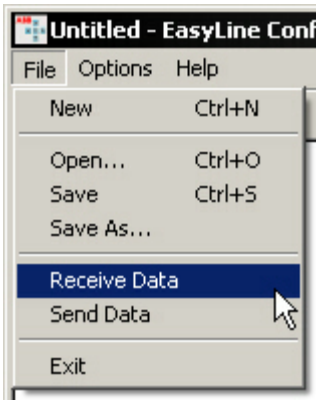


3 Enter either the network name (server name) or the IP address of the gas analyzer in the "Communication Properties" dialog.

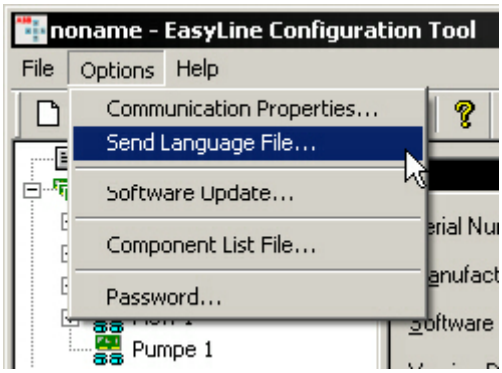


4 Close the dialog by clicking "OK".

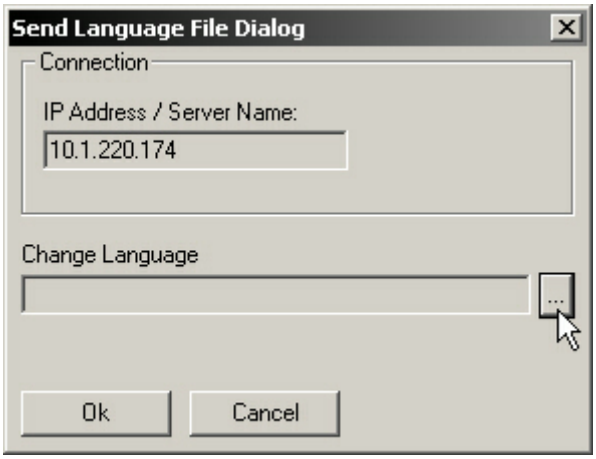
5 Click the command "Receive Data" in the "File" menu or click the icon  in the toolbar.
The configuration data is transferred from the gas analyzer to the computer.



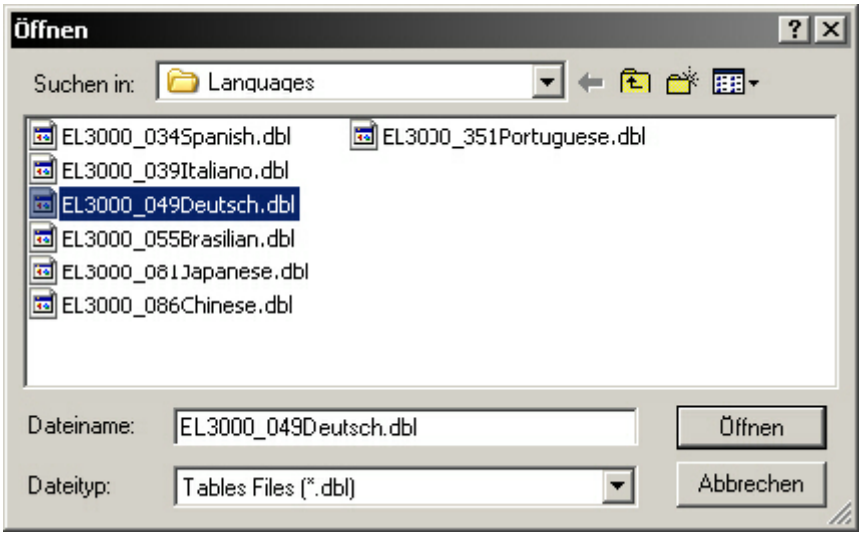
6 Click the command "Send Language File..." in the "Options" menu or click the icon  in the toolbar.



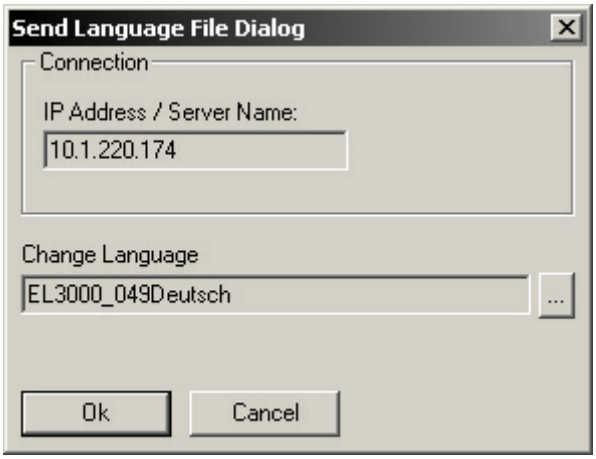
7 Click the browse button  beside the "Change Language" field in the "Send Language File" dialog.



8 Select the desired language file in the "Open" dialog and continue by clicking "Open".



9 The selected language is displayed in the "Change Language" field in the "Send Language File" dialog.



10 Close the dialog by clicking "OK".
The selected language is transferred from the computer to the gas analyzer.

Password

Password protection

Access to the calibration and to those menus in which the configuration of the instrument can be changed can be protected by a password. Password protection is not activated ex works.

Password protection variants:

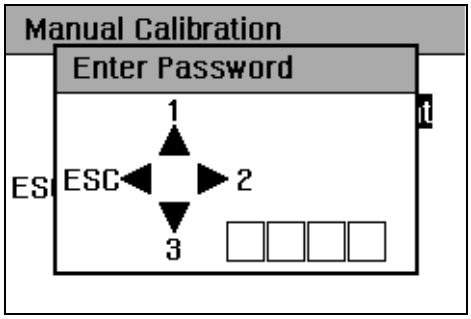
- Access to the calibration menu is not included in the password protection.
- Access to all instrument functions is included in the password protection (for instruments with SIL certification).

Configuring the password

The password is set in the configurator (see page 53) in the "Options – Password…" menu. It consists of a four-digit number; each of the numbers may only have the values 1, 2 and 3 (example: "1213"). The setting "0000" means that password protection is not activated.

Entering the password

As soon as the user wishes to access a password-protected menu or a password-protected value change, he is requested to enter the password (see page 102).



In this respect, the numbers 1, 2 and 3 are assigned to the three keys ▲, ▶ and ▼, as shown in the illustration.
Example: If the password "1213" has been configured, the user has to press the keys ▲, ▶, ▲ and ▼ in succession. Each key stroke is acknowledged by display of the character *.

The entered password remains active until the user returns to the measuring mode or the gas analyzer automatically switches over to the measuring mode through the time-out function (see page 50).

Software update

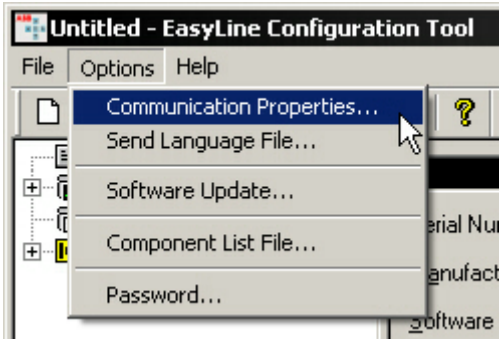
Software update

In the software update, the current data set is transferred from the gas analyzer to the computer and uploaded back to the gas analyzer together with the new software. Additional changes to the configuration of the gas analyzer using the ECT software tool must be carried out in a separate step.

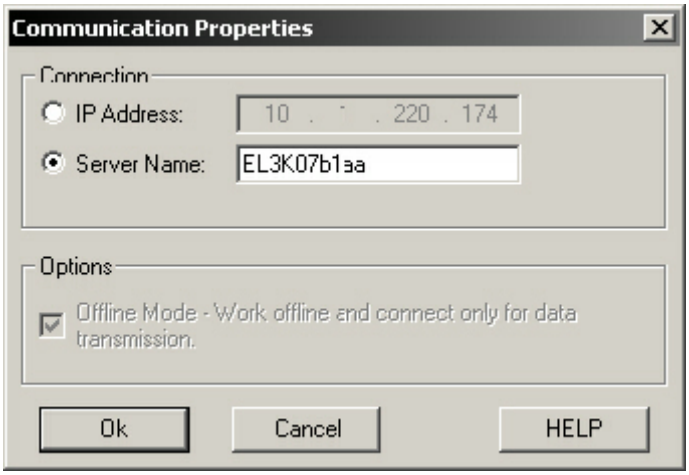
Executing a software update

1 Open the ECT software tool.

2 Click the command "Communication Properties..." in the "Options" menu or click the icon  in the toolbar.

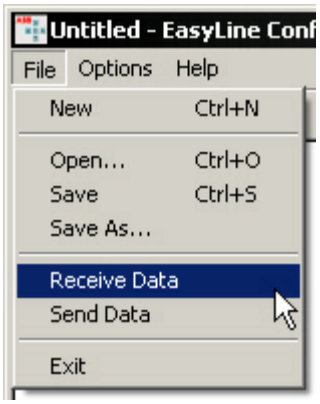


3 Enter either the network name (server name) or the IP address of the gas analyzer in the "Communication Properties" dialog.



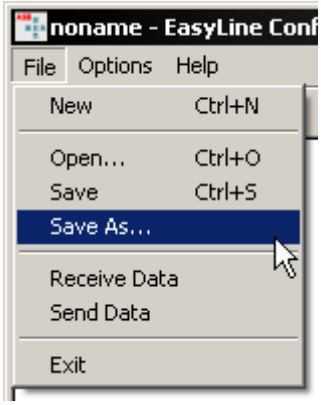
4 Close the dialog by clicking "OK".

5 Click the command "Receive Data" in the "File" menu or click the icon  in the toolbar.
The configuration data is transferred from the gas analyzer to the computer.

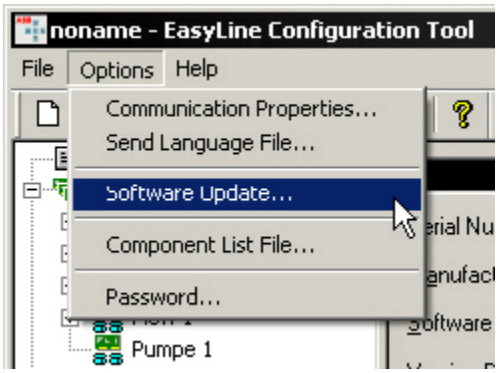


6 It is recommended that a back-up copy of the configuration data is made before carrying out a software update:

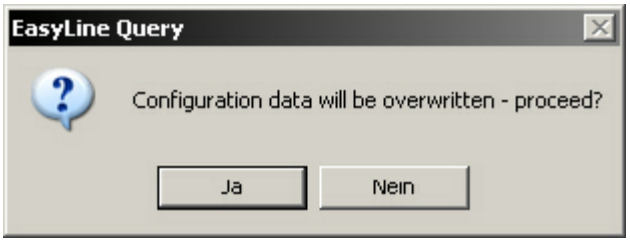
Click the command "Save" or "Save as..." in the "File" menu  in the toolbar and store the configuration data under a suitable file name.



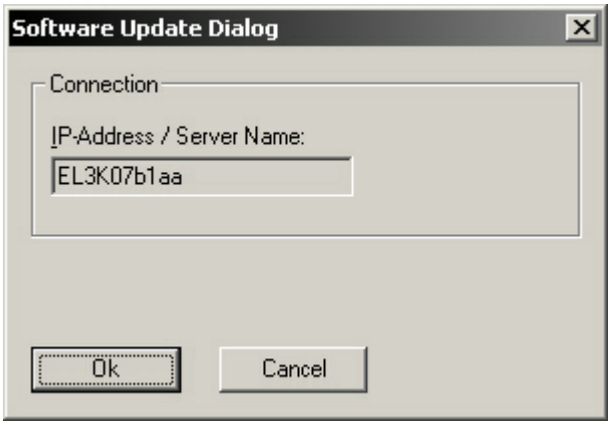
7 Click the command "Software Update..." in the "Options" menu or click the icon  in the toolbar.



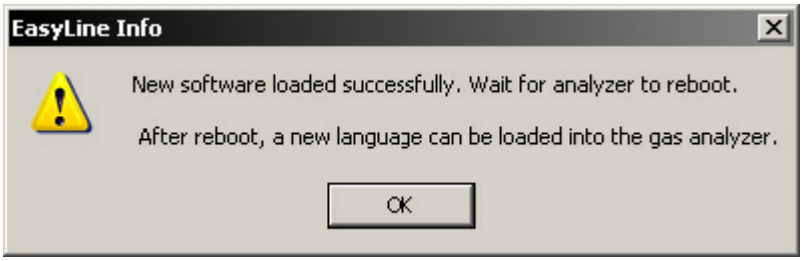
8 Acknowledge the query "Configuration data will be overwritten - proceed?" by clicking "Yes".



9 The address of the gas analyzer set in Step 3 appears in the "Software update" dialog. Close the dialog by clicking "OK".
The new software is uploaded to the gas analyzer.



10 After completion of the update, the following message is displayed. Close the window by clicking "OK".
The gas analyzer restarts ("Booting").



NOTE
The software update and the restart of the gas analyzer take approx. 5 minutes.

QAL3 monitoring

Use and description

Use

The QAL3 monitoring is used to continuously monitor the quality of the measuring results of an automated measuring system (AMS) in normal operation.

The requirements for the various quality assurance processes are described in the European standard EN 14181 "Stationary source emissions – Quality assurance of automated measuring systems". The quality assurance level QAL3 defined in this standard relates to the monitoring of the AMS during operation; it is the basis of the functional scope of the QAL3 monitoring.

Description

The QAL3 monitoring is integrated on a memory card in the gas analyzer as an option. It has the following characteristics:

- Automatic detection, checking and documentation of drift and precision at the zero point and the reference point
- Analysis by means of CUSUM and Shewhart control charts (see page 108)
- Storage of the QAL3 data in the gas analyzer (max. 1 year)
- Display and request of the QAL3 data and configuration (see page 110) by means of Web browser
- Status messages if deviations outside the specifications occur
- Export of the data for further processing, e.g. in a spread-sheet program

Prerequisites

The prerequisites for operation of the QAL3 monitoring are as follows:

- The gas analyzer must be connected to a PC via the Ethernet port.
- The latest version of a Web browser must be installed on the PC.
- Cookies and JavaScript must be activated in the Web browser.
- The "QAL3 monitoring" option must be integrated in the gas analyzer. The memory card with the "QAL3 monitoring" option is located in a slot on the AMC board (behind the front panel).
  The following is displayed in the menu ▼ `Maintenance` ▼ `Diagnosis` ▶ `Device Info`: "`Option QAL3:OK`".

Control charts

CUSUM control charts

CUSUM control charts enable the precision and drift of the AMS at the zero point and reference point to be determined separately.

Performance characteristics for determination of the precision		
hs	hs = 6,90 $\mathbf{s}^2_{AMS}$	Test value for detection of a decrease in the precision
ks	ks = 1,85 $\mathbf{s}^2_{AMS}$	Constant for the calculation of the interim sum total for the standard deviation
dt	Difference between the current instrument display of the AMS and the reference value (Note the preceding sign)	
sp	Interim standardized sum total of the standard deviations of the AMS	
st	Interim standardized sum total of the standard deviations of the AMS at the point of time **t**	
N(s)t	Number of instrument displays since a standard deviation from zero occurred	
Performance characteristics for determination of the drift		
hx	hx = 2,85 $\mathbf{s}_{AMS}$	Test value for detection of a drift
kx	kx = 0,501 $\mathbf{s}_{AMS}$	Constant for calculation of the interim sum total of the positive and negative differences and for calculation of the requisite correction of the AMS
dt	Difference between the current instrument display of the AMS and the reference value (Note the preceding sign)	
Sum(pos)p	Interim standardized sum total of the positive drift of the AMS	
Sum(pos)t	Standardized sum total of the positive drift of the AMS at the point of time **t**	
N(pos)t	Number of instrument displays since a positive deviation occurred	
Sum(neg)p	Interim standardized sum total of the negative drift of the AMS	
Sum(neg)t	Standardized sum total of the negative drift of the AMS at the point of time **t**	
N(neg)t	Number of instrument displays since a negative deviation occurred	

Test for "decrease of precision"	
st smaller than or equal to **hs** for both zero point and end point	AMS is operating in the control range, carry out a drift test
st greater than **hs** for either zero point or end point	Determine cause of fault, notify manufacturer if instrument is defective (drift test not necessary)
Drift test	
Sum(pos)t smaller than or equal to **hx** and **Sum(neg)t** smaller than or equal to **hx** for both zero point and end point	AMS is operating in the control range
Sum(pos)t greater than **hx** or **Sum(neg)t** greater than **hx** for either zero point or end point	Measured value is outside the control range ("Out of Control"), carry out a readjustment of the AMS

Shewhart control charts

Shewhart control charts are used to determine the combined precision and drift of the AMS.

The differences $\mathbf{d}_t$ between the measured values and the set points at the zero point and the reference point are determined. These differences must be less than or equal to the standard deviation $\mathbf{s}_{AMS}$ multiplied by a factor of 2. If the difference for a measured value is greater, the measured value is marked with the status "Out of Control".

Configuring the QAL3 monitoring

ATTENTION
The QAL3 data stored on the memory card is lost if the ECT software tools ("configurator") or the TCT are used to change the configuration of the gas analyzer or if the memory card is installed in another gas analyzer. In these cases, the QAL3 data must be exported (see page 114) beforehand.

NOTES
The QAL3 monitoring is deactivated ex works for all sample components, i.e. no QAL3 data is stored.
If a password (see page 102) has been configured in the gas analyzer, this password must also be input in the configuration of the QAL3 monitoring.

Call up the home page of the QAL3 monitoring

1. Ensure that the gas analyzer is connected to a PC via the Ethernet port.
2. Open the Web browser on the PC, enter the IP address of the gas analyzer (if necessary, ask the network administrator) and establish the connection.

   The QAL3 monitoring home page of the EasyLine EL3000 Series is opened.

Configuring the sample component

1. Click "QAL3 Monitoring" on the QAL3 monitoring home page.
2. Click "Components" (sample components) on the "QAL3 Monitoring" page.
3. Click the sample component to be configured on the "Components" page.
4. Enter the following data and values in the "Edit Component" page:
   - "Active" (QAL3 Monitoring of the sample component activated),
   - "Installation" (installation location)
   - "Technician",
   - "Comment",
   - "sAMS Zero" (**S**$_{AMS}$ value for zero point)
   - "sAMS Span" (**S**$_{AMS}$ value for reference point)
5. Exit the page by clicking "Save" or "Cancel".

Configuring the printer output

1. Click "QAL3 Monitoring" on the QAL3 monitoring home page.
2. Click "Settings" in the "QAL3 Monitoring" page.
3. Check and, if required, change the number of lines on the first page ("Number of lines on first page" - recommendation for portrait format: 35) in the "Printing" window, as well as on the following pages ("Number of lines on all other pages" - recommendation for portrait format: 50).
4. Exit the page by clicking "Save" or "Cancel".

Configuring the data storage

1. Click "QAL3 Monitoring" on the QAL3 monitoring home page.
2. Click "Settings" on the "QAL3 Monitoring" page.
3. The following data is displayed in the "Data storage" window:
   - "Current number of data entries" (also in percentage of the maximum number).
   - "Maximum number of data entries" (sufficient for at least n calibrations of all sample components).

   Check and, if required, change the value for "Display Warning when percentage is reached" (Display warning when the percentage value set here has been reached).
4. Exit the page by clicking "Save" or "Cancel".

NOTE
The configuration changes are securely stored against power failure if the user makes no entry for more than one minute or if he ends the configuration by clicking "Logout".

Displaying and printing the control chart

Displaying the control chart

1. Click "QAL3 Monitoring" on the QAL3 monitoring home page.
2. Select the type of display on the "QAL3 Monitoring" page:
   - "Zero point simple"
   - "Reference point simple",
   - "Zero point details"
   - "Reference point details".
3. Select the type of control chart (see page 108, "Control Chart to Display") for the desired sample component.

   The QAL3 values are printed in order of date and time. The latest value is shown at the top of the display.

   If required, change the number of lines to be displayed per page in the "Display n lines per page" field at the end of the page.

Printing the control chart

1. Click "Print list" at the end of the "QAL3 Monitoring" page.

   The list is displayed in a new Web browser window.

   Recommendation: select the page orientation "Landscape" to print the detailed control charts.
2. Use the printing function of the Web browser to print the displayed list.

   The QAL3 values are printed in order of date and time. The latest value is shown at the top of the display.

Editing or deleting QAL3 values

Editing an individual QAL3 value

1. Click the number of the QAL3 value (column "No.") to be edited in the control chart display (see page 112) in the "QAL3 Monitoring" page.
2. The following data and values can be changed in the "Edit data" page:
   - "Technician",
   - "Comment",
   - "sAMS" ($\mathbf{S}_{AMS}$ value for zero point or reference point).
3. Exit the page by clicking "Save" or "Cancel".

Deleting an individual QAL3 value

1. Click the number of the QAL3 value (column "No.") to be deleted in the control chart display (see page 112) on the "QAL3 Monitoring" page.
2. Click "Delete" on the "Edit data" page.
3. Acknowledge the subsequent query (Are you sure you want to delete this data?) by clicking "OK".

   The data is deleted, and the control chart is displayed again.

Exporting or deleting QAL3 data

Exporting QAL3 data

The QAL3 data can be exported from the gas analyzer for archiving or processing in e.g. a spread-sheet program.

1. Click "QAL3 Monitoring" on the QAL3 monitoring home page.
2. Select the type of display on the "QAL3 Monitoring" page:
   - "Zero point simple"
   - "Reference point simple",
   - "Zero point details"
   - "Reference point details".
3. Select the type of control chart (see page 108) ("Control Chart to Display") for the desired sample component.
4. Click "Export data" at the end of the page.

   The QAL3 data of the displayed control chart is exported to a text file (.txt).
5. Open the text file or store it (if required, under a new name).
6. If required, repeat steps 2 to 5 for further control charts.

Deleting QAL3 data

1. Click "QAL3 Monitoring" on the QAL3 monitoring home page.
2. Click "Settings" on the "QAL3 Monitoring" page.
3. Click "Delete all data" in the "Data storage" window:

   The following warning is displayed:
   "Are you sure you want to delete all data? This operation cannot be undone. Ensure that all data has been exported before you continue."
4. Click "OK". The QAL3 data is deleted.
5. Exit the page by clicking "Save" or "Cancel".

Inspection and maintenance

CAUTION
The tasks described in this chapter require special training and under some circumstances involve working with the gas analyzer open and powered up. Therefore, they should only be performed by qualified and specially trained personnel.

Inspection

Regular inspection

Proceed in accordance with the checklist "Checking the installation" (see page 44).

Checking the seal integrity of the gas feed paths

The seal integrity of the sample gas feed path and, if applicable, the reference gas feed path should be checked during operation at least once a year. The seal integrity of the gas feed path must always be checked after the gas feed path inside the gas analyzer has been opened (see below).

If measured values are output slowly during operation (e.g. after feed in of the test gas) or implausible measured values are obtained, a leak in the sample gas feed path is a possible cause.

A simple procedure for testing the seal integrity of the gas feed paths is described in the section "Checking the seal integrity of the gas feed paths" (see page 117).

Measures taken after opening the gas paths inside the gas analyzer

All components of the case of the control unit and the analyzer unit EL3060-Uras26 must be completely bolted together and locked against rotation with the socket-head hex screws.

If the gas feed path or reference gas path inside the gas analyzer has been opened, the seal integrity should be tested with helium at a leak rate of $< 2 \times 10^{-4}$ hPa l/s. As an alternative to the helium leak test, the pressure drop method described in the section "Checking the seal integrity of the gas feed paths" (see page 117) can be used. In this respect, the test pressure is increased to $p_e \approx 400$ hPa (= 400 mbar) and the test duration to 15 minutes. The maximum excess pressure $p_e = 500$ hPa (= 500 mbar).

Initial purging of the gas feed paths inside and outside the gas analyzer is required before the power supply is switched on. A potentially explosive gas/air mixture in the gas feed paths is thereby removed.

Purge gas for non-flammable sample gas	Clean instrument air from non-hazardous areas
Purge gas for flammable sample gas	Nitrogen
Purge gas volume	5x volume of the gas feed paths
Purge gas flow	approx. 30 l/h
Purging time	at least 3 min

The purge gas for purging the EL3060-Uras26 analyzer unit may not contain any fractions of the sample components.

Reseal cable glands after opening

If the pressure-proof cable glands, through which the data transmission cable and the 24 VDC connecting cable are routed to the flameproof cylinder of the EL3060-Uras26 analyzer unit, have been opened, the external nuts must be screwed tight with a torque wrench (size 20); tightening torque = 17 Nm.

Checking the seal integrity of the gas feed paths

Requisite material

- Pressure gauge
- Flexible tubing, length approx. 1 m
- T-piece with shut-off valve
- Air or nitrogen

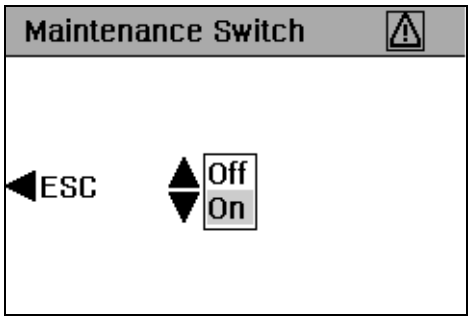
CAUTION
If the seal integrity test is to be carried out with air and if flammable gas could be present in the sample gas feed path, the sample gas feed path must be purged with nitrogen beforehand! The seal integrity test can be carried out with nitrogen instead.

Checking the seal integrity of the gas feed paths

1. Seal the outlet of the gas feed path to be tested so that it is gas-tight.
2. Connect the T-piece with the shut-off valve to the inlet of the gas feed path to be tested by means of the flexible tubing.
3. Connect the free end of the T-piece to the pressure gauge.
4. Blow air or nitrogen through the shut-off valve until the sample gas feed path is under a positive pressure of $p_e \approx 50$ hPa. Maximum positive pressure $p_e = 150$ hPa.
5. Close the shutoff valve. The pressure should not change measurably in 3 minutes. A sharp drop in pressure is an indication of a leak in the gas feed path being tested.
6. Repeat steps 1 to 5 for all gas feed paths in the gas analyzer.

CAUTION
The following values apply for the test pressure and test duration after the gas feed paths inside the gas analyzer have been opened:
Test pressure $p_e \approx 400$ hPa, maximum positive pressure $p_e = 500$ hPa.
Test duration 15 minutes.

Maintenance switch



Menu path

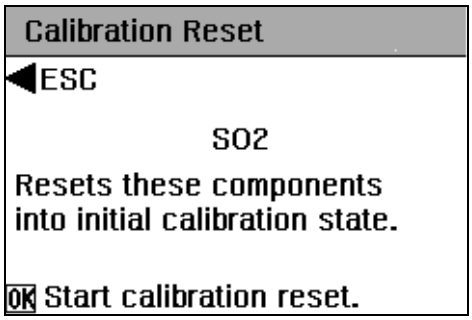
▼ Maintenance ▶ Maintenance Switch

Function of the maintenance switch

The maintenance switch is used to set the status "Maintenance mode" (see page 130) while maintenance work on the gas analyzer, e.g. a seal integrity test, is in progress.

As long as the maintenance switch is set to "On", the icon ⚠ is flashing in the display. The status signal "Maintenance mode" is output, and thus the gas analyzer signals that the current measured values are to be discarded as process measured values.

Carrying out a calibration reset



Menu path

▼ Maintenance ▶ Basic Settings ▶ Calibration Reset

When should a calibration reset be carried out?

A calibration reset should only be carried out if the gas analyzer can no longer be calibrated by normal means. A possible cause is e.g. that the gas analyzer has been calibrated with the wrong test gases.

What does the calibration reset do?

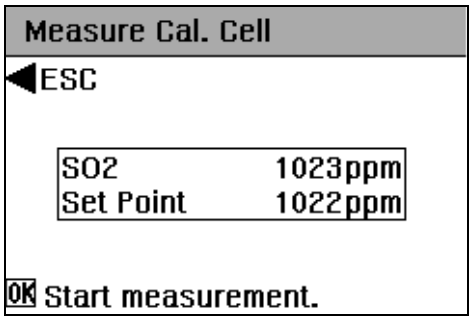
The calibration of the gas analyzer is reset to the ex-works calibration settings by the calibration reset. Furthermore, the offset drift and the amplification drift are electronically reset to the ex-works calibration settings.

Status signal

The status signal "Maintenance mode" (see page 130) is active during the calibration reset.

NOTE
The calibration reset cannot be carried out while an automatic calibration is in progress.

Uras26: Measurement of calibration cells



Menu path

▼ Maintenance ▶ Basic Settings ▼ Measure Cal. Cell

Definition

The "deflection" of the calibration cell which is equivalent to the calibration reading with test gas is determined in the measurement of the calibration cell. The "deflection" is stored as the "set point" of the calibration cell.

When should the calibration cell be measured?

We recommend measuring the calibration cell once a year. We also recommend measuring the calibration cell after the measuring range (see page 86) set by the user has been calibrated with test gases for the first time and always after the test gas has been changed.

Before measuring the calibration cell

Before the calibration cell is measured, the zero point and end point of the sample components must be calibrated with test gases.

Feed in zero reference gas

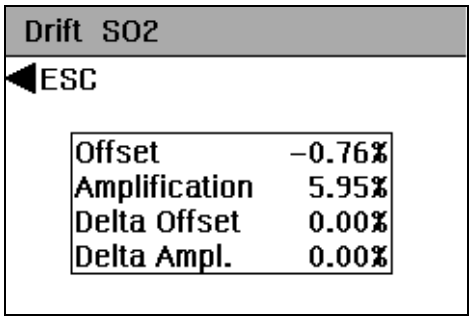
Zero reference gas must be fed in during the measurement of the calibration cell.

Status signal

The status signal "Maintenance mode" (see page 130) is active during the measurement of the calibration cell.

NOTE
The calibration cell cannot be measured while an automatic calibration is in progress.

Drift reading



Menu path

▼ Maintenance ▼ Diagnosis ▼ Device Status ▶ Analyzer Status ▶ Drift Indication

Drift

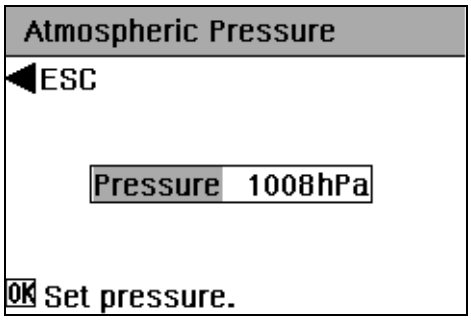
The offset and amplification drift values are calculated cumulatively starting from the last basic calibration.

Delta drift

The offset and amplification delta drift values are calculated between the last and last but one automatic calibration. They are deleted by a manual zero-point or end-point calibration.

NOTES
The drift values are displayed in percentages of the customer measuring range, i.e. the measuring range (see page 80) pre-set at the factory (see analyzer data sheet (see page 33)).
The drift values are deleted by a calibration reset.

Pressure correction



Menu path

▼ Maintenance ▶ Basic Settings ▲ Atmospheric Pressure

Atmospheric pressure effect

A change in atmospheric pressure or sample gas pressure will generally result in a change in the measured value and thus in an apparent change of the concentration of the measured gas component.

Integrated pressure sensor

A pressure sensor has been installed in the gas analyzer (see page 26, standard for Uras26 and Caldos27, option for Magnos206 and Magnos28). The effect of a change in atmospheric pressure on the measured value is minimized by the automatic internal pressure correction.

Pressure correction in the Magnos206

The Magnos206 without an integrated pressure sensor is calibrated ex works for an atmospheric pressure of 1013 hPa. If the atmospheric pressure at the installation site deviates from 1013 hPa, the current atmospheric pressure can be entered manually as a corrective.

Pressure correction in the Magnos28

The Magnos28 without an integrated pressure sensor is calibrated ex works for an atmospheric pressure of 1013 hPa. If the atmospheric pressure at the installation site deviates from 1013 hPa, the current atmospheric pressure can be entered manually as a corrective.

Calibration of the pressure sensor

The installed pressure sensor can be recalibrated if the reading deviates from the current atmospheric pressure.

NOTE
The pressure sensor can be connected to the sample gas outlet line via an external T-piece for the measurement of non-flammable sample gases. In this case, the sample gas flow must be interrupted during calibration of the pressure sensor, so that the sample gas pressure does not distort the measured pressure value.
After the pressure sensor has been calibrated, the zero point and end point must be checked and recalibrated if necessary.
The pressure sensor cannot be calibrated while an automatic calibration is in progress.

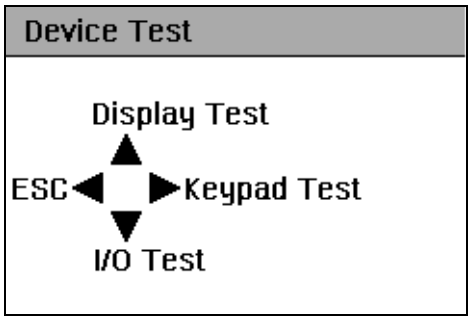
Calibrate the pressure sensor

1. Select the menu item `Atmospheric Pressure`.
2. Set the pressure set point.
3. Start the adjustment.
4. Calibration is executed.
5. Return to the measured value display with **OK**.

Status signal

The status signal "Maintenance mode" (see page 130) is active during the calibration of the pressure sensor.

Device test



Menu path

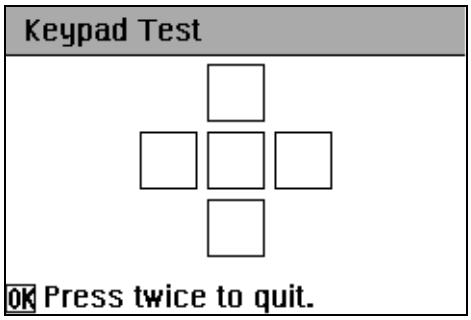
▼ Maintenance ▼ Diagnosis ▲ Test Functions ▲ Device Test

Display test

Test: A gray-scale field, over which a textbox moves, runs horizontally through the display from right to left.

The display test is ended by pressing any key.

Keypad test



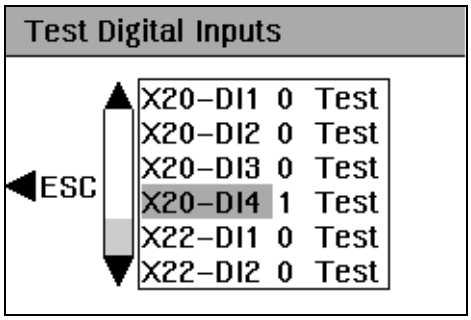
5 square fields appear in the display.

Test: If the user presses any key, the field assigned to the key is inverted (dark) as long as the key is held down.

The keyboard test is ended by pressing the **OK** key twice.

I/O test (test of the inputs and outputs)

Test of the digital inputs



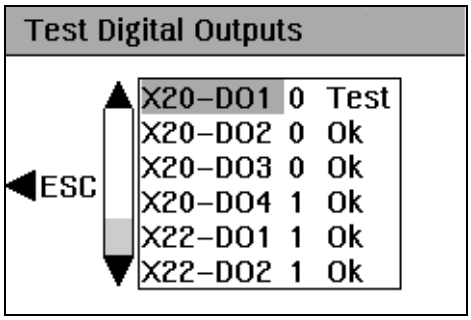
The digital inputs (DI) available in the digital I/O modules (see page 39) installed in the instrument are shown in the list. They are named according to the installation locations of the digital I/O modules (X20, X22, X24, X26).

Test:

1. Remove the connector with the connected signal lines from the digital I/O module.
2. Close the digital input to be tested with a wire jumper or similar.
   Result: The status display changes from "OK" to "Test", and the status signal "Maintenance mode" is output.
   The function assigned to the digital input is not activated during the test.
3. Test another digital input in the same way.

The test of the digital inputs is ended by pressing the ◀ key or after approx. 5 minutes through the time-out function (see page 50); all digital inputs are thereby reset to the status "OK" and the status signal "Maintenance mode" is canceled.

Test of the digital outputs



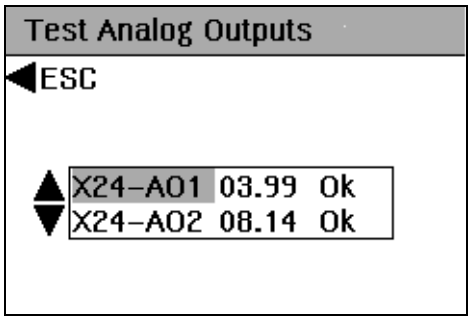
The digital outputs (DO) available in the digital I/O modules (see page 39) installed in the instrument are shown in the list. They are named according to the installation locations of the digital I/O modules (X20, X22, X24, X26).

Test:

1. Remove the connector with the connected signal lines from the digital I/O module.
2. Select the digital output to be tested with ▼ or ▲.
3. Call up the value change with ▶.
4. Change the displayed value with ▼ or ▲ and confirm the change with **OK**.
   Result: the relay at the digital output is actuated, the status display changes from "OK" to "Test", and the status signal "Maintenance mode" is output.
5. Either test another digital output in the same way or reset the tested digital output.

The test of the digital outputs is ended by pressing the ◀ key or after approx. 5 minutes through the time-out function (see page 50); all digital outputs are thereby reset to the status "OK" and the status signal "Maintenance mode" is canceled.

Test of the analog outputs



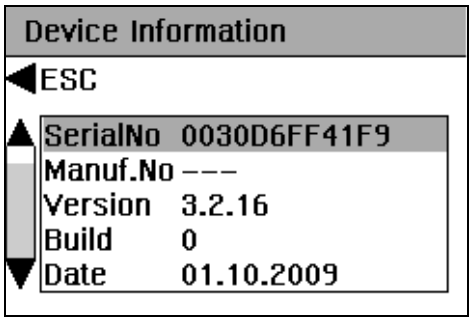
The analog outputs (AO) available in the analog output modules (see page 39) installed in the instrument are shown in the list. They are named according to the installation locations of the analog output modules (X20, X22, X24, X26).

Test:

1. Remove the connector with the connected signal lines from the analog output module.
2. Select the analog output to be tested with ▼ or ▲.
3. Call up the value change with ▶.
4. Change the displayed value digit by digit with ▼ or ▲ and confirm the change with **OK**.
   Result: the current signal at the analog output changes its value, the status display changes from "OK" to "Test", and the status signal "Maintenance mode" is output.
5. Either test another analog output in the same way or reset the tested analog output.

The test of the analog outputs is ended by pressing the ◀ key or after approx. 5 minutes through the time-out function (see page 50); all analog outputs are thereby reset to the status "OK" and the status signal "Maintenance mode" is canceled.

Device information



Menu path

▼ Maintenance ▼ Diagnosis ▶ Device Information

Display

The serial number, the version number, the date of the software and the hardware index are displayed for the instrument and the installed modules.

Status messages, troubleshooting

CAUTION
The tasks described in this chapter require special training and under some circumstances involve working with the gas analyzer open and powered up. Therefore, they should only be performed by qualified and specially trained personnel.

Dynamic QR Code

Application

Dynamic QR Code is a unique feature to display dynamically generated QR codes on the gas analyzer screen.

The QR code contains static information for device identification as well as dynamically generated information on system configuration and gas analyzer health status .

Static data for device identification are among other data:

- Production number
- Production date
- Software version
- Serial numbers of built-in analyzer modules and components

Dynamic data for error diagnosis are among other data:

- Status messages
- Measured values
- Temperature, pressure and flow values
- Drift values
- Analyzer-specific values

In combination with mobile devices (smartphone, tablet, etc.) Dynamic QR Code represents an innovative way of customer’s communication which allows, for instance, improved case-specific support by ABB resulting in an increased availability of analyzer assets.

Dynamic QR Code is compatible with the ABB application "my Installed Base" as well as with standard QR code scanner applications.

Handling

The QR code is selected in the gas analyzer's diagnosis menu and displayed on the gas analyzer's screen.

There is a direct link from the status messages overview to the diagnosis menu. In addition, the QR code can be selected in Remote HMI and scanned from the computer screen.

The displayed QR code is scanned using the QR code scanner application installed in the mobile device. The resulting text information displayed on the mobile device's screen is then sent by e-mail or a suitable messenger service to the local service representative defined in the "Measurement Care" agreement.

As an alternative, a photo of the displayed QR code can be sent to the service representative.

Select QR code

Menu path

▼ Maintenance ▼ Diagnosis ▼ Device Status ▲ QR Code Display

Procedure

1. Select system overview or specific analyzer module.
2. Select QR code with **OK**.
3. Modify QR code resolution with ▶ if necessary.
4. Scan QR code.
5. Return to selection with ◀.

Recommended QR code scanner applications

ABB recommends the use of the following QR code scanner applications (available free of charge for iOS and Android):

"my Installed Base" by ABB

Download from App Store:

Download from Google Play:

"QR Scanner" by Kaspersky

Download from App Store:

Download from Google Play:

Status messages – Explanatory information

Status signals

The status messages (see page 132) initialize the status signals "Error", "Maintenance request", "Maintenance mode" and "Overall status". The assignment of the status signals to the digital outputs can be configured (see page 95).

Error

A status has occurred in the gas analyzer which requires the immediate intervention of the user. The measured value is invalid.

Maintenance request

A status has occurred in the gas analyzer which will soon require the intervention of the user. The measured value is valid.

Maintenance mode

A calibration is being carried out in the gas analyzer, or the maintenance switch has been set to "On". The measured value is not a process measured value and is to be discarded.

Overall status

The overall status is always set in conjunction with the status "Error" and for individual messages in conjunction with the status "Maintenance request"; it is not set in conjunction with the status "Maintenance mode".

Status icons

An automatic calibration (see page 62) is executed.
The icon also appears in the menu title line in menu mode (see page 50).

A status message (see page 132) is active.

The status signal (see page 130) "Maintenance request" is active.
The icon also appears in the menu title line in menu mode (see page 50).

The status signal (see page 130) "Error" is active or the maintenance switch (see page 118) has been set to "On".
The icon is blinking. The icon also appears in the menu title line in menu mode (see page 50).

The configuration is being saved. The icon is blinking.
Do not switch off the power supply of the gas analyzer when the icon is displayed!

Status message categories

In terms of operator reaction, there are three categories of status messages:

- Status messages not requiring acknowledgment
- Status messages requiring acknowledgment
- Status messages requiring acknowledgment and troubleshooting

Status messages not requiring acknowledgment

The instrument operates normally after the status has been cleared. When the status is cleared, the status signal is reset and the status message disappears.
Example: Temperature error during the warm-up phase.

Status messages requiring acknowledgment

The instrument operates normally after the status has been cleared; however, the operator must be informed of the status. When the status is cleared, the status signal is reset. The status message disappears as soon as the operator has acknowledged it. The operator is thus informed about the malfunction of the instrument.
Example: No new measurement values from the analog/digital converter.

Status messages requiring acknowledgment and troubleshooting

The instrument may not operate normally after the status has been cleared; the operator must therefore acknowledge the status and eliminate the cause of the status message. The status signal is reset and the status message disappears as soon as the operator has acknowledged it, and the cause of the status message has been eliminated.
Example: The offset drift between two calibrations exceeds the permissible range.

Representation of the categories

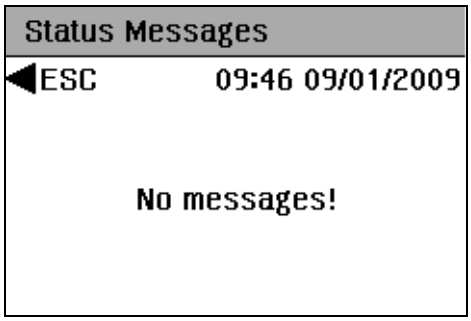
The categories are indicated by the following symbols in the list of the status messages and in the detail view of the individual status messages:

Symbol	Status messages requiring acknowledgment	Status messages not requiring acknowledgment
☐	The status message has not been acknowledged.	The status message has arrived (detail view).
☑	The status message has been acknowledged.	
⬚		The status message has been cleared (detail view). The status message is inactive (message list).

Acknowledgment of status messages

Status messages requiring acknowledgment must be acknowledged with **OK**. This can be carried out in the message list and in the detail view.

Status messages – List

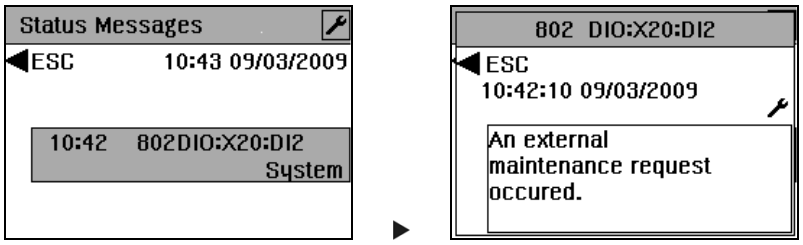


Menu path

▼ Maintenance ▼ Diagnosis ▼ Device Status ▼ Status Messages

If a status message is active, the display of the message list is called directly by pressing the key ▼ once.

Message list and detail view



The message list with the short text of the status messages is displayed in the menu item Status Messages. The detail view of the individual status messages is called by pressing the ▶ key; the time and date of arrival and clearance or the acknowledgment (see page 130) of the status message are displayed in the detail view.

Legend for the table "Status messages"

Status signals		
A	Status "Failure"	A status has occurred in the gas analyzer which requires the immediate intervention of the user. The measured value is invalid.
W	Status "Maintenance request"	A status has occurred in the gas analyzer which will soon require the intervention of the user. The measured value is valid.
F	Status "Maintenance mode"	A calibration is being carried out in the gas analyzer, or the maintenance switch has been set to "On". The measured value is not a process measured value and is to be discarded.
S	Overall status	The overall status is always set in conjunction with the status "Error" and for individual messages in conjunction with the status "Maintenance request"; it is not set in conjunction with the status "Maintenance mode".

Status message categories	
a	Active status messages not requiring acknowledgment
aQ	Active status messages requiring acknowledgment
aL	Active status messages requiring acknowledgment and troubleshooting
iQ	Inactive status message requiring acknowledgment

Status messages

No.	Status			Message	Reaction/Troubleshooting
110	A	S	a	The instrument is booting.	
116	A	S	a	The Profibus module is installed in the wrong slot! The interface is therefore not operative. Please install the Profibus module in slot X20/X21.	Install the Profibus module in slot X20/X21.
119	A	S	iQ	The configuration could not be loaded! This instrument is therefore currently not configured. Please load a configuration using TCT.	This instrument is therefore currently not configured. Notify service if this occurs again.
120	F		a	The maintenance switch is ON.	
121			aL	The limit value has alarm status.	
122	A	S	a	The IO module is defective.	Exchange the IO module.
123	A	S	a	Communication error while accessing the IO module.	Exchange the IO module.
124			iQ	The configuration data was corrupt! The configuration was restored using the back-up data.	
125			a	The limit value has alarm status.	
126	W		a	The QAL3 data store is full. Please read out the data.	Export QAL3 data.
127	W		a	The drift values exceed the QAL3 limits.	Repeat the calibration. Maintenance of AMS required.
250	A	S	aQ	The analyzer could not be found!	Check the connectors and cabling.
251	A	S	aQ	The connection to the analyzer has been lost!	Check the connectors and cabling.
252	A	S	aL	The EEPROM data of the analyzer is defective!	Check the configuration with TCT.
253	A	S	aL	Communication with the analyzer is faulty!	Check the connectors and cabling.
254	A	S	a	The boot program of the analyzer is defective! Notify Service!	Notify Service.
255	A	S	a	The program of the analyzer is defective! Notify Service!	Notify Service.
300	A	S	aL	No new measured values from the analog/digital converter.	Notify Service.
301	A	S	a	The measured value exceeds the value range of the analog/digital converter.	Check the sample gas concentration. Check connectors in the gas analyzer. Notify Service.
302	W		aQ	The offset drift exceeds half the permissible range.	Monitor the drift. The measured value is valid as long as the drift remains below the value specified in the measurement data. As soon as the drift exceeds this value, notify Service.
303	A	S	aQ	The offset drift exceeds the permissible range.	Notify Service. Carry out a basic calibration (with TCT).

No.	Status	Message	Reaction/Troubleshooting
304	W aQ	The amplification drift exceeds half the permissible range.	Monitor the drift. The measured value is valid as long as the drift remains below the value specified in the measurement data. The detector concerned will have to be exchanged in the near future. Manually calibrate the indicated detector at the zero and end point. Permissible range: 50 % of the detector sensitivity. As soon as the drift exceeds this value, notify Service.
305	A S aQ	The amplification drift exceeds the permissible range.	Exchange the detector concerned. Notify Service. Carry out a basic calibration (with TCT).
306	W aQ	The offset drift between two calibrations exceeds the permissible range.	Manually calibrate the indicated detector at the zero point. (This message is generated by automatic calibration.) Permissible range:15% of the smallest installed measuring range; 6% of the smallest installed measuring range for measurements on plants subject to approval pursuant to the 27th and 30th Federal Regulation on Immissions
307	W aQ	The amplification drift between two calibrations exceeds the permissible range.	Manually calibrate the indicated detector at the end point. (This message is generated by automatic calibration.) Permissible range: 15% of the sensitivity; 6% of the sensitivity for measurements on plants subject to approval pursuant to the 27th and 30th Federal Regulation on Immissions
308	A S aQ	A calculation error occurred during calculation of the measured value.	Switch the power supply off and on. Notify Service.
309	W a	The temperature regulator is defective.	Notify Service.
310	W a	The temperature correction has been turned off for this component because the measured temperature value is invalid.	Notify Service.
311	A S a	The pressure regulator is defective.	See status message of the pressure detector concerned
312	W a	The pressure correction has been turned off for this component because the measured pressure value is invalid.	Notify Service.
313	W a	Cross-sensitivity correction is not possible for this component because the correction value is invalid.	Check with TCT.
314	W a	Carrier gas correction is not possible for this component because the correction value is invalid.	Check with TCT.
315	W aL	No new measured values from the analog/digital converter.	Notify Service.
316	W a	The measured value exceeds the value range of the analog/digital converter.	Notify Service.
317	W a	A calculation error occurred during calculation of the measured value.	Notify Service.

No.	Status			Message	Reaction/Troubleshooting
324	W		a	The temperature is above or below the upper or lower alarm value 1.	Status messages during the warm-up phase. If the status message appears following the warm-up phase: Check whether the permissible ambient temperature range is being maintained. Check the connecting leads and connectors. Check the fit of the leads in the wire end ferrules. Check the overtemperature cutout and replace if necessary.
325	W		a	The temperature is above or below the upper or lower alarm value 2.	
326	A	S	aL	No new measured values from the analog/digital converter.	Notify Service.
327	A	S	a	The measured value exceeds the value range of the analog/digital converter.	Notify Service.
328	A	S	a	A calculation error occurred during calculation of the measured value.	Notify Service.
329	W		a	The pressure is above or below upper and/or lower limit value 1.	Fidas24: Check the supply gas pressures.
330	W		a	The pressure is above or below upper and/or lower limit value 2.	Fidas24: Check the supply gas pressures.
331	A	S	a	The pressure regulator output variable is beyond the valid range.	Fidas24: Check the supply gas pressures.
342	W		a	The flow falls below limit value 1	Check sample preparation. Alarm value 1 = 25 % of MRS.
343	A	S	a	The flow falls below limit value 2.	Check sample preparation. Alarm value 2 = 10 % of MRS. Automatic calibration is interrupted and disabled.
378	A	S	aL	The chopper wheel is blocked.	Visual check. Notify Service.
379	A	S	aL	Chopper wheel speed not OK.	Notify Service.
380	A	S	aL	IR source element or electronics defective.	Notify Service.
381	A	S	aL	High voltage in the preamplifier defective.	Notify Service.
382	A	S	aL	Measured value is influenced by shocks.	
390	A	S	aQ	Failure of the power supply inside the module. Notify Service.	Notify Service.
397	A	S	a	The sensor of the temperature regulator is defective.	Notify Service
398	A	S	aL	No new measured values from the analog/digital converter.	Notify Service.
399	A	S	a	The measured value exceeds the value range of the analog/digital converter.	Check the sample gas concentration. Check connectors in the gas analyzer. Notify Service.
400	A	S	a	A calculation error occurred during calculation of the measured value.	Switch the power supply off and on. Notify Service.
401	W		a	The flow is above or below the upper or lower alarm value 1.	Check sample gas path. Notify Service.
402	A	S	a	The flow is above or below the upper or lower alarm value 2.	Check sample gas path. Notify Service.
403	A	S	a	The flow controller output variable is beyond the valid range.	Notify Service.
404	A	S	a	The temperature is above or below the upper or lower alarm value 2.	Notify Service.

No.	Status			Message	Reaction/Troubleshooting
500			iQ	An internal calibration error has occurred.	Repeat the calibration. Check the configuration with TCT. Notify Service.
501			iQ	The requested functional capability is not available in the instrument.	Check the configuration with TCT.
502			iQ	A calibration error has occurred in the instrument.	Calibration will be terminated. Notify Service.
503	W	S	iQ	The sensitivity is too low! The calibration has been terminated.	Incorrect test gas! Check the test gas supply and infeed; repeat the calibration.
508			iQ	Unknown calibration error. Check the configuration.	Message during the automatic calibration. Check the configuration with TCT.
511			iQ	Autocalibration terminated	For information
512	F		a	Autocalibration is in progress.	For information
513			iQ	An internal calibration error has occurred.	Repeat the calibration. Check the configuration with TCT. Notify Service.
517	F		a	Instrument is in operation.	
518			iQ	The calibration could not be carried out because the measured value is unstable.	Check the test gas supply and infeed; repeat the calibration.
519			iQ	The calibration could not be carried out because the preamplifier is overdriven.	Check the test gas supply and infeed; repeat the calibration.
529	W	S	iQ	The calibration was stopped because no raw measured values can be recorded.	Check the test gas supply and infeed; repeat the calibration.
538	W	S	iQ	The zero-point calibration was stopped, because the analyzer is contaminated!	Clean the sample cell. Notify Service.
539	W	S	iQ	The zero-point calibration was stopped, because the analyzer is contaminated!	Clean the sample cell. Notify Service.
801	A	S	a	An external failure has occurred.	Input signal at the correspondingly configured digital input.
802	W		a	An external maintenance request has occurred.	Input signal at the correspondingly configured digital input.
803	F		a	A user-defined maintenance mode occurred during:	

Troubleshooting

Flow error

Gas lines or filter fouled, clogged up or leaky

- Disconnect gas analyzer from the gas conditioning system.
- Blow compressed air through gas lines or mechanically clear them.
- Exchange filter elements and filter beds.
- Check gas lines for seal integrity.

Gas feed paths in the gas analyzer kinked or leaky

- Disconnect gas analyzer from the gas conditioning system.
- Check whether the gas lines in the gas analyzer are kinked or have become detached from the connections.
- Check gas feed paths in the gas analyzer for seal integrity.

Outlet pressure not the same as atmospheric pressure

- Ensure that the outlet pressure is the same as the atmospheric pressure.
- Conduct waste gases directly into the atmosphere or through a line with a large internal diameter which is as short as possible, or into a gas discharge line.
- Do not conduct waste gases via restrictions or shut-off valves!

Measured value display is not stable

Vibrations

- Provide measures to reduce the vibrations.
- Increase the low pass time constant (see page 90).

Leaks in the gas feed paths

- Check the gas feed paths for seal integrity (see page 117).

Loss of sensitivity

- Check amplification drift display of the sample component (see page 121).

Uras26: Emitter modulation uneven

- Have the emitter and modulator checked by service.

Notify service

Who should you contact for further help?

Please contact your local service representative. For emergencies, please contact

ABB Service,
Telephone: +49-(0)180-5-222 580, Telefax: +49-(0)621-381 931 29031,
E-mail: automation.service@de.abb.com

Before you notify service ...

Before you notify service because of a malfunction or a status message, please check whether there actually is an error and whether the gas analyzer is actually operating out of specifications.

When you notify service ...

If you call Service because of a malfunction or a status message, please state the following:

- The production number (F-No.) of the gas analyzer – you will find it on the type plate and in the analyzer data sheet;
- The software version of the gas analyzer – you will find it in the analyzer data sheet and in the menu
  ▼ `Maintenance` ▼ `Diagnosis` ▶ `Instrument Info`;
- An exact description of the problem or the status as well as the number of the status message.

This information will enable the service personnel to help you quickly.

Have the analyzer data sheet (see page 33) ready – it contains important information that will help the service personnel to find the cause of the malfunction.

When you return the gas analyzer to the service department ...

CAUTION
When you return the gas analyzer to the service department, e.g. for repair, please state which gases have been supplied to the gas analyzer. This information is needed so that service personnel can take any requisite safety precautions for harmful gases.

Shutting down and packing the gas analyzer

Shutting down the gas analyzer

Shutting down

In the case of a temporary shutdown:

1. Shut off the sample gas.
2. Purge the gas lines and gas feed paths in the gas analyzer with dry fresh air or nitrogen for at least 5 minutes.
3. Switch off the power supply to the gas analyzer.

In the case of a long-term shutdown, carry out the following in addition:

1. Remove the gas lines from the gas analyzer ports. Tightly seal the gas ports.
2. Disconnect the electrical leads from the gas analyzer.

Ambient temperature

Ambient temperature during storage and transport: –25 to +65 °C

Packing the gas analyzer

Packing

1. Remove adapters from the gas ports and tightly seal the gas ports.
2. If the original packaging is not available, wrap the gas analyzer in bubble wrap or corrugated cardboard. When shipping overseas, additionally shrink-wrap the gas analyzer air-tight in 0.2 mm thick polyethylene film adding a drying agent (such as silica gel). The amount of drying agent should be appropriate for the package volume and the expected shipping duration (at least 3 months).
3. Pack the gas analyzer in an adequately sized box lined with shock-absorbing material (foam or similar). The thickness of the shock-absorbing material should be adequate for the weight of the gas analyzer and the mode of dispatch. When shipping overseas, additionally line the box with a double layer of bitumen paper.
4. Mark the box as "Fragile Goods".

CAUTION
When you return the gas analyzer to the service department, e.g. for repair, please state which gases have been supplied to the gas analyzer. This information is needed so that service personnel can take any requisite safety precautions for harmful gases.

Ambient temperature

Ambient temperature during storage and transport: –25 to +65 °C

Disposal

Notes for disposal

Products that are marked with the adjacent symbol may not be disposed of as unsorted municipal waste (domestic waste). They should be disposed of through separate collection of electric and electronic devices.

This product and its packaging are manufactured from materials that can be recycled by specialist recycling companies.

Bear the following in mind when disposing of this product and its packaging:

- This product is under the open scope of the WEEE Directive 2012/19/EU and relevant national laws.
- The product must be supplied to a specialist recycling company. Do not use municipal waste collection points. These may be used for privately used products only in accordance with WEEE Directive 2012/19/EU.
- If there is no possibility to dispose of the old equipment properly, ABB service can take care of its pick-up and disposal for a fee.
  To find your local ABB service contact visit abb.com/contacts or call +49 180 5 222 580.

Index

A

C

D

E

F

G

I

V

W

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