

# AO2040-Fidas24 Ex

## Continuous gas analyzers



AO2040-Fidas24 Ex

### Introduction

The AO2040-Fidas24 Ex makes an impression with its compact design and has been specially developed for potentially explosive atmospheres. All relevant explosion protection measures are installed at the factory and certified.

The IP 65 housing with a robust design, combined with a Ex-p pressurized enclosure, meets the requirements for use in potentially explosive atmospheres of Zone 1, Zone 2, as well as Zone 21 and Zone 22 in accordance with European ATEX regulations and international IECEx regulations.

Ex-p protection is based on a continuous purge. Due to the already very high protection level of the Fidas24 analyzer module, the use of simple instrument air as the purge medium is sufficient. There is no need to use expensive nitrogen in addition to the instrument air, which is required anyway.

Flame ionization analyzer for use in potentially explosive atmospheres

### Measurement made easy

### Additional Information

Additional documentation on AO2040-Fidas24 Ex is available for download free of charge at [www.abb.com/analytical](http://www.abb.com/analytical).

Alternatively simply scan this code:



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# 1 Safety

## General information and instructions

These instructions are an important part of the product and must be retained for future reference.

Installation, commissioning, and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator accordingly. The specialist personnel must have read and understood the manual and must comply with its instructions.

For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer. The content of these instructions is neither part of nor an amendment to any previous or existing agreement, promise or legal relationship.

Modifications and repairs to the product may only be performed if expressly permitted by these instructions.

Information and symbols on the product must be observed. These may not be removed and must be fully legible at all times. The operating company must strictly observe the applicable national regulations relating to the installation, function testing, repair and maintenance of electrical products.

## Warnings

The warnings in these instructions are structured as follows:

### DANGER

The signal word ‘DANGER’ indicates an imminent danger. Failure to observe this information will result in death or severe injury.

### WARNING

The signal word ‘WARNING’ indicates an imminent danger. Failure to observe this information may result in death or severe injury.

### CAUTION

The signal word ‘CAUTION’ indicates an imminent danger. Failure to observe this information may result in minor or moderate injury.

### NOTICE

The signal word ‘NOTICE’ indicates possible material damage.

## Note

‘Note’ indicates useful or important information about the product.

## Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

## Intended use

The gas analyzer AO2040-Fidas24 Ex is designed to provide continuous measurement of the concentration of the individual components in gases or vapors.

The gas analyzer AO2040-Fidas24 Ex is suitable for use in Category 3G, 3D, 2G and 2D (EPL Gc, Dc, Gb, Db) hazardous areas, provided that the specification (refer to **Specification** on page 153) and the special operating conditions (refer to **Use in potentially explosive atmospheres** on page 8) are adhered to.

Any other use is not approved.

The intended use also includes taking note of this operating instruction.

The gas analyzer AO2040-Fidas24 Ex must not be used for the measurement of mixtures that could ignite during operation. Special measures must be taken to prevent an explosion hazard during the measurement of combustion gas which can form an explosive mixture in association with air or oxygen.

The following models of the gas analyzer AO2040-Fidas24 Ex are available, refer to **Ex marking and versions** on page 8:

- In Protection Class II 3G
- In Protection Class II 3D
- In Protection Class II 2G
- In Protection Class II 2D

The special conditions required for the safe operation of the gas analyzer in the respective protection classes can be found in the corresponding subchapters.

## Important safety instructions

In accordance with the EU Directive 2014/34/EU and the general requirements for explosion protection and as specified in the IEC 60079-0 standard, the scope of approvals for our explosion-protected apparatus is limited to **atmospheric conditions**, unless expressly stated otherwise in the certificates.

This also includes the sample gas that is fed in.

### Definition of atmospheric conditions

Temperature	-20 to 60 °C
Pressure $P_{abs}$	80 to 110 kPa (0.8 to 1.1 bar)
Ambient air with standard oxygen content, typically 21% vol.%	

If the **atmospheric conditions are not complied with**, the operator is obliged to guarantee the safe operation of our devices in the absence of the recommended atmospheric conditions, by means of further measures (e.g. evaluation of the gas mixture or explosion pressure) and / or supplementary protective devices.

## Improper use

The following are considered to be instances of especially improper use of the device:

- For use as a climbing aid, for example for mounting purposes.
- For use as a bracket for external loads, for example as a support for piping, etc.
- Material application, for example by painting over the housing, name plate or welding/soldering on parts.
- Material removal, for example by spot drilling the housing.

## ... 1 Safety

### 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.

#### Personnel qualifications

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

#### Special information and precautions

These include:

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

#### National regulations

The regulations, standards and guidelines cited in this operator's manual are applicable in the Federal Republic of Germany. The applicable national regulations should be followed when the device is used in other countries.

#### Safety of the equipment and safe operation

The device was built and tested in accordance with EN 61010 Part 1 'Safety regulations for electrical measuring, control and laboratory equipment' and it left the factory in perfect condition.

To maintain this condition and to assure safe operation, read and follow the safety instructions in this operating instruction. Failure to do so can put persons at risk and can lead to device damage as well as damage to other systems and devices.

#### Protective lead connection

The protective lead (ground) should be attached to the protective lead connector before any other connection is 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.

#### Risks involved in 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.

#### DANGER

##### Explosion hazard

There is a risk of explosion if the device is opened in a potentially explosive atmosphere.

Please take note of the following information before opening the device:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Turn off the power supply before opening the device, and observe a waiting period of 20 minutes, in order to allow any hot components to cool down.

#### Risks involved in working with an open device

All work on a device that is open and connected to power should only be performed by trained personnel who are familiar with the risks involved.

#### 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.

## Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).

Operator 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 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.

## Software downloads

By visiting the web page indicated below, you will find notifications about newly found software vulnerabilities and options to download the latest software. It is recommended that you visit this web page regularly:

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

## Services and ports on the Ethernet interface

Port	Description
22/tcp	Used for software update only. No direct access to the device.
502/tcp	Used for Modbus/TCP. The device allows connection to any Modbus client. The port must be activated via the LCD indicator, the port is delivered in a deactivated state.
8001/tcp	Used for Test and Calibration Software. Binary, proprietary protocol.

## Access authorizations

Access to the calibration and to the menus used to change the configuration of the instrument is restricted by password protection.

It is recommended that the factory-set passwords be changed by the operator, see **Password protection** on page 67.

## Manufacturer's address

### ABB AG

### Measurement & Analytics

Stierstädter Str. 5  
60488 Frankfurt am Main  
Germany  
Tel: +49 69 7930-4666  
Email: cga@de.abb.com

## Service address

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:

### Customer service center

Tel: +49 180 5 222 580  
Email: automation.service@de.abb.com

## 2 Use in potentially explosive atmospheres

### Ex marking and versions

The different versions and the corresponding Ex markings are listed below.

#### Standards and directives

All models comply with the regulations of the European Directive 2014/34/EU (ATEX Directive / IECEx-Scheme), and they are manufactured in accordance with the following standards:

- EN/IEC 60079-0
- EN/IEC 60079-2
- EN/IEC 60079-11

The gas analyzer must be designed, installed and operated in accordance with the following standards and directives:

- EN/IEC 60079-14
- EN/IEC 60079-17
- EN/IEC 60079-19

#### Note

The full designation of the applied standards, including the date of issue, is included in the declaration of conformity supplied with the device.

#### Temperature class

The gas analyzer corresponds to the Temperature Class T3.

### Versions

Design	Product code	Type examination certificate / Ex marking	Further requirements
Category "3G", Equipment protection level "Gc"	24041-XXX2XXXXXXXXX oder XXX3XXXXXXXXX	<b>ATEX</b> BVS 20 ATEX E 049 X II 3G Ex pxb ib IIC T3 Gc	—
		<b>IECEx</b> IECEx BVS 20.0039X Ex pxb ib IIC T3 Gc	
Category "2G", Equipment protection level "Gb"	24041-XXX1XXXXXXXX	<b>ATEX</b> BVS 20 ATEX E 048 X II 2G Ex pxb ib IIC T3 Gb	Installation of an additional interface relay for connections on the operator's side, if these can still remain live after the power supply has been switched off or if the pressurized encapsulation fails. <a href="#">Connecting the interface relay</a> on page 51
		<b>IECEx</b> IECEx BVS 20.0039X Ex pxb ib IIC T3 Gb	
Category "3D", Equipment protection level "Dc"	24041-XXX8XXXXXXXX	<b>ATEX</b> BVS 20 ATEX E 049 X II 3D Ex pxb ib [ib] IIIC T195°C Dc	Installation of a key switch to confirm that the interior of the housing has been cleaned of dust during commissioning. <a href="#">Connecting the key switch</a> on page 50
		<b>IECEx</b> IECEx BVS 20.0039X Ex pxb ib [ib] IIIC T195°C Dc	
Category "2D", equipment protection level "Db"	24041-XXX7XXXXXXXX	<b>ATEX</b> BVS 20 ATEX E 048 X II 2D Ex pxb ib [ib] IIIC T195°C Db	Installation of an additional interface relay for connections on the operator's side, if these can still remain live after the power supply has been switched off or if the pressurized encapsulation fails. <a href="#">Connecting the interface relay</a> on page 51
		<b>IECEx</b> IECEx BVS 20.0039X Ex pxb ib [ib] IIIC T195°C Db	
			Installation of a key switch to confirm that the interior of the housing has been cleaned of dust during commissioning. <a href="#">Connecting the key switch</a> on page 50

## Special conditions

### Using in category 3G / 3D

When using in category 3G / 3D, observe the following requirements:

- The analysis of explosive gas mixture is not permitted.
- The analysis of gas mixture is only allowed for a pressure limit up to 1100 hPa.
- The measurement function for the explosion protection is not part of this examination.

### Using in category 2G / 2D

When using in category 2G / 2D, observe the following requirements:

- The analysis of explosive gas mixture is not permitted.
- The analysis of gas mixture is only allowed for a pressure limit up to 1100 hPa.
- For the necessary shutdown of the gas analyser by default of the pressurized enclosure, a separately certified cut-off relay has to be used (only for EPL Gb / Db).
- The measurement function for the explosion protection is not part of this examination.

## ... 2 Use in potentially explosive atmospheres

### Installation of the gas analyzer and the gas connections

The operator must observe the conditions listed in this chapter when installing and operating the gas analyzer in hazardous areas.

The conditions are grouped thematically, based on the life phases of the gas analyzer.

#### Standards and directives

The gas analyzer must be installed and operated in accordance with the following standards and directives:

- EN/IEC 60079-2, Annex D
- EN/IEC 60079-14
- IEC/TR 60079-16
- IEC 61285

#### Specification

##### Sample gas

The gas analyzer may only be used for the measurement of combustion gases, provided that the following conditions are adhered to:

- The sample gas that is fed in must at no time exceed the C1-equivalent of 8 Vol-% CH<sub>4</sub>.
- The sample gas that is fed in must not be potentially explosive.
- The specifications must also be adhered to during the start-up and shut-down processes, and the pressure, temperature and gas matrix must be taken into account.
- The relevant safety regulations for working with combustion gases must be complied with.

##### Note

8 Vol.-% CH<sub>4</sub> or C1-equivalents exceed the lower explosion limit (UEG).



An explosive mixture of gases is defined as a mixture containing combustion components, that falls within the lower (UEG) and upper explosion limits (OEG), which is accompanied by the simultaneous presence of oxidizers (e.g. air, oxygen).

- Gas mixtures with combustion gas components that exceed the respective gas-specific lower explosion limits (UEG) may only be fed into the gas analyzer if it has been ascertained that the gas mixture is non-explosive.
  - This can be achieved by excluding the presence of atmospheric oxygen and/or other oxidizers.
- If the operator is unable to guarantee this, or if he is not sure about the composition of the gas mixture, the sample gas mixture may not be fed into the analyzer.

##### Combustion gas and combustion air

- The maximum pressures of combustion gas and combustion air may not be exceeded, refer to **Operational gases** on page 23.
- The operator must take appropriate measures to ensure that the pressure of the combustion gas does not exceed 6 bars (abs), even in the case of a fault.
- The maximum flow of combustion gas must not be exceeded, refer to **Combustion gas parameter** on page 24.
- The relevant safety regulations for working with combustion gases must be complied with.

##### Instrument and purge air (inert gas)

- If the inert gas and instrument air supply are connected to a single source, the quality requirements for the instrument air must be adhered to, refer to **Properties of the instrument air** on page 23.
- If the inert gas supply is separate from the instrument air supply, the (lower) quality requirements specified in the operating manual for the purging and monitoring unit FS870S must be adhered to for the inert gas.

### **Installation of the purge gas supply (inert gas)**

The purge gas supply to the system housing of the gas analyzer must be configured by the operator in accordance with the requirements, as specified below.

However, the list of requirements does not exempt the operator from his duty of care in implementing the installation of the gas analyzer and the associated supply lines, in accordance with the applicable national and international standards and regulations, including any additional requirements that might apply.

### **Installation of the purging gas supply lines**

- The source of the purging gas (compressor intake) must not be located in the explosion hazardous area, except in the case of a purging gas supply from cylinders.
- The purging gas supply lines must be installed outside of the hazardous area if possible.
- If the purging gas supply lines are laid within the explosion hazardous area, the supply lines must be made of a non-combustion material, and measures must be taken to protect them from mechanical damage and corrosion.
- If the purging gas pressure within the purging gas supply lines is lower than the ambient pressure, measures must be taken to ensure that no potentially explosive atmosphere can enter the purging gas supply line.
- Ensure that, in case of failure of the purging gas supply, no combustion gases or dusts can flow into the non-explosive area via the purging gas supply lines

**Adjusting the purging time of the pressurized encapsulation**  
 The pre-purge volumes to be considered as specified in the EN 60079-2 standard, Annex D.2.4, have already been included in the present analyzer via a 15 L buffer. This means that with a pre-purge using five times the volume, typical lines volumes between the shut-off valve / pressure reducer and the purge gas inlet valve in the amount of 3 L (15 L / 5) are considered.

If the free volumes of the connected lines should nevertheless up-scale 3 L (with an internal pipe diameter of 8 mm, this corresponds to a line length of 60 m), you should consult ABB Service regarding the adjustment of the pre-purge volume and the purging parameters associated with it.

### **Temperature of the purging gas**

Ensure that, inside the purging gas supply line, the dew point of the purging gas is not undershot.

### **Power supply for the inert gas supply**

The power supply for the inert gas supply (blower, compressor etc.) must be via a circuit that is separate from that of the gas analyzer.

Alternatively, the power supply for the inert gas supply can be connected to the power supply for the purging and monitoring unit.

### **Containment system**

The gas paths that come into contact with the combustion and sample gas are designed in the form of a containment system, in accordance with the IEC 60079-2 standard.

- Ensure that the permitted properties (composition, pressure, temperature and flow rate) of the measuring and operational gases are adhered to, refer to **Sample gas** on page 23 and **Operational gases** on page 23.
- Ensure that the specification, warnings and maintenance instructions for the device, as provided in the operating instruction, are adhered to.

### **Note**

Additional precautions may be required if the rating of the surrounding atmosphere could be affected by the unintentional release of combustion gases in the event of a fault (zone elevation).

## ... 2 Use in potentially explosive atmospheres

### ... Installation of the gas analyzer and the gas connections

#### Installation

The following requirements and conditions must be adhered to when installing the gas analyzer and the gas lines.

#### Installation site requirements

- The unobstructed exchange of air with the environment must be possible around the gas analyzer. The gas analyzer must not be directly covered. The outlet and the pressure compensation vent of the purging and monitoring unit FS870S may not be closed.
- All of the plastic and elastomer components of the housing must be protected against UV radiation.

#### Requirements for models II 3G / Gb and II 2G / Gb

- The housing must be protected against brush discharges or electrostatic charging; the housing may only be cleaned with a moist cloth.

#### Requirements for the Models II 3D/Dc and II 2D/Db

- Due to the risk of electrostatic charging of the painted surface of the housing, the gas analyzer AO2040-Fidas24 Ex may not be installed in areas with an increased risk of charging (e.g. near filling systems).
- Suitable measures must be taken for the blow-off vent (inert gas outlet) of the purging and monitoring unit FS870S, in order to prevent a zone elevation, due to dust being stirred up.  
It is preferable to evacuate the ignition protection gas into a dust-Ex free area.
- The operator must install a suitable key switch, in order to confirm that the interior of the housing is cleaned before commissioning, refer to **Connecting the key switch** on page 50.
- The operator must ensure that the inside of the housing is cleaned of dust before the gas analyzer is switched on.  
The initial purging of the housing is not intended for the purpose of cleaning the housing!

#### Connecting the combustion gas and the combustion air supply

- Observe the connection diagram when connecting the combustion gas and the combustion air supply, refer to **Connection diagram for the operational gases** on page 31.
- The combustion gas path in the gas analyzer must not be opened! The combustion gas path can become leaky as a result! Escaping combustion gas can cause fires and explosions, also outside the gas analyzer!
  - If the combustion gas path in the gas analyzer has been opened nonetheless, it must be checked for leakage (refer to **Check the integrity of combustion gas path** on page 145), using a leak detector (leak rate  $< 1 \times 10^{-4} \cdot \text{hPa l/s}$ ), once it has been closed again.
- The leak tightness of the combustion gas supply line outside the gas analyzer as well as the combustion gas path in the gas analyzer must be checked regularly, refer to **Check the integrity of combustion gas path** on page 145.
- A shut-off valve must be installed in the combustion gas supply line to increase safety in the following operating conditions, refer to **Shut-off valve in the combustion gas supply line** on page 24:
  - when shutting down the gas analyzer,
  - in case of instrument air supply failure,
  - in case of a leak in the combustion gas path, inside the gas analyzer.

This shut-off valve should be installed outside the analyzer house in the vicinity of the combustion gas supply (cylinder, line).

- Should the combustion gas supply to the analyzer module not shut off automatically in the event of an instrument air supply failure, an alarm that is visible or audible to the operator must be triggered, refer to **In case of instrument air supply failure** on page 139.

### Connecting the sample gas line

- No sample gas line with temperatures exceeding 130 °C may be connected to the sample gas input of the analyzer. Otherwise, Temperature Class T3 cannot be safely guaranteed, resulting in operation of the sample gas shut-off valve outside of the recommended specifications.
- When measuring combustion gases, it must be ensured that if either the instrument air supply or the analyzer module should fail, the sample gas supply to the analyzer module will be shut off and the sample gas path purged with nitrogen.
- When connecting zero and test gas, the operator must ensure that no explosive gas mixture is introduced into the analyzer at any point (e.g. due to residues of combustion gas components from the process gas in the sample gas line). For this reason, oxidizers such as atmospheric oxygen in zero and test gas should be avoided.
- If it is not possible to avoid the use of explosive gas mixtures temporarily, the operator must ensure reliable prevention of potential ignition in the exhaust pipe or re-ignition in the sample/testing or process gas supply. This can be accomplished by using additional flame arresters/detonation tube fuses, for example.

### Electrical connections

The following requirements and conditions must be observed for the electrical connection of the gas analyzer.

### Purging and monitoring unit FS870S

- To guarantee the IP 65 housing protection for the purging and monitoring unit FS870S observe the following points:
  - The cables must be inserted into the cable glands properly and sealed by tightening the screws.
  - All unused cable glands and gas connections must be sealed with suited sealing plugs.
  - Further measures may have to be taken for both the outlet vent and the pressure equalization vent. For this purpose, the information in the relevant operating instruction for the FS870S purging and monitoring unit must be observed.
- For the electrical connection of the purging and monitoring unit, the operating instruction for the FS870S purging and monitoring unit must also be observed.

### Requirements for the Models II 2G/Gb and II 2D/Db

- For Zone 1 installations, all connecting lines on the operator's side, which could remain live after switching off the power supply or failure of the pressurized encapsulation, must be routed via an interface cut-off relay. The interface cut-off relay must be controlled by the purging and monitoring unit and, in the event of a fault, it must disconnect all the poles of the relevant connection lines. Refer to **Connecting the interface relay** on page 51.

## ... 2 Use in potentially explosive atmospheres

### ... Installation of the gas analyzer and the gas connections

#### Commissioning

The following requirements and conditions must be observed when commissioning the gas analyzer.

#### Purging and monitoring unit

- The operator should adjust the PIN codes specified for the configuration of the purging and monitoring unit, in order to prevent unauthorized persons from making changes to the configuration, refer to **PIN codes and purging parameters** on page 55.

#### Requirements for the Models II 3D/Dc and II 2D/Db

The operator must ensure that the inside of the housing is cleaned of dust before the gas analyzer is switched on.

The initial purging of the housing is not intended for the purpose of cleaning the housing!

#### Operation

The following requirements and conditions must be observed when operating the gas analyzer:

- Cables have to be properly inserted in the screwed cable glands and sealed by screwing the nut firmly,
- The housing may not be opened while the power is switched on. If any work is needs to be performed on the analyzer during operation, with the housing open, a fire certificate must be provided. The operator must ensure that, if the gas analyzer is shut down,
  - the sample gas path is purged with pressurized air or an inert gas,
  - the combustion gas supply is switched off,
  - and the analyzer is separated from the exhaust gas (otherwise, any excess pressure in the exhaust manifold could contaminate the analyzer or leakage could lead to an unintended release).
- Before opening the housing in an Ex atmosphere, the operator must wait at least 20 minutes after switching off the power supply, in order to ensure that all internal components have cooled down safely, to below 195 °C (Temperature Class T3).

#### Maintenance

The following requirements and conditions must be observed when maintaining the gas analyzer.

#### Maintenance activities

- The housing may not be opened while the power is switched on. If any work is needs to be performed on the analyzer during operation, with the housing open, a fire certificate must be provided.  
The operator must ensure that the following steps are implemented if the gas analyzer is shut down:
  - Purge the sample gas path with pressurized air or inert gas before shutting down.
  - Switch off the combustion gas supply.
  - Disconnect the analyzer from the exhaust gas (otherwise, any excess pressure in the exhaust manifold could contaminate the analyzer or leakage could lead to an unintended release).
- The operator is obliged to carry out the following controls on the gas analyzer at regular intervals, at least once a year and whenever any work is carried out on the gas lines:
  - Leak tightness test in accordance with **Checking gas path leak tightness** on page 145 and **Check the integrity of combustion gas path** on page 145.
  - A functionality test of the purging and monitoring unit FS870S, pursuant to **Functional testing of the purging and monitoring unit** on page 147.
  - A functionality test of the pressure switch, for the monitoring of the minimum input pressure of the injector pump, pursuant to **Functional testing of the instrument air monitoring** on page 148.

#### Cleaning models II 3G/Gb and II 2G/Gb

- The housing must be protected against brush discharges or electrostatic charging; the housing may only be cleaned with a moist cloth.

#### Replacing the backup battery

- The system controller has a backup battery to retain the date and time settings in the case of a power cut. This battery may only be replaced with the original battery type:
  - Varta CR 2032 Type No. 6032 or
  - Renata Type No. CR2032 MFR
- Battery replacement in accordance with **Replacing the battery** on page 151.

### 3 Design and function

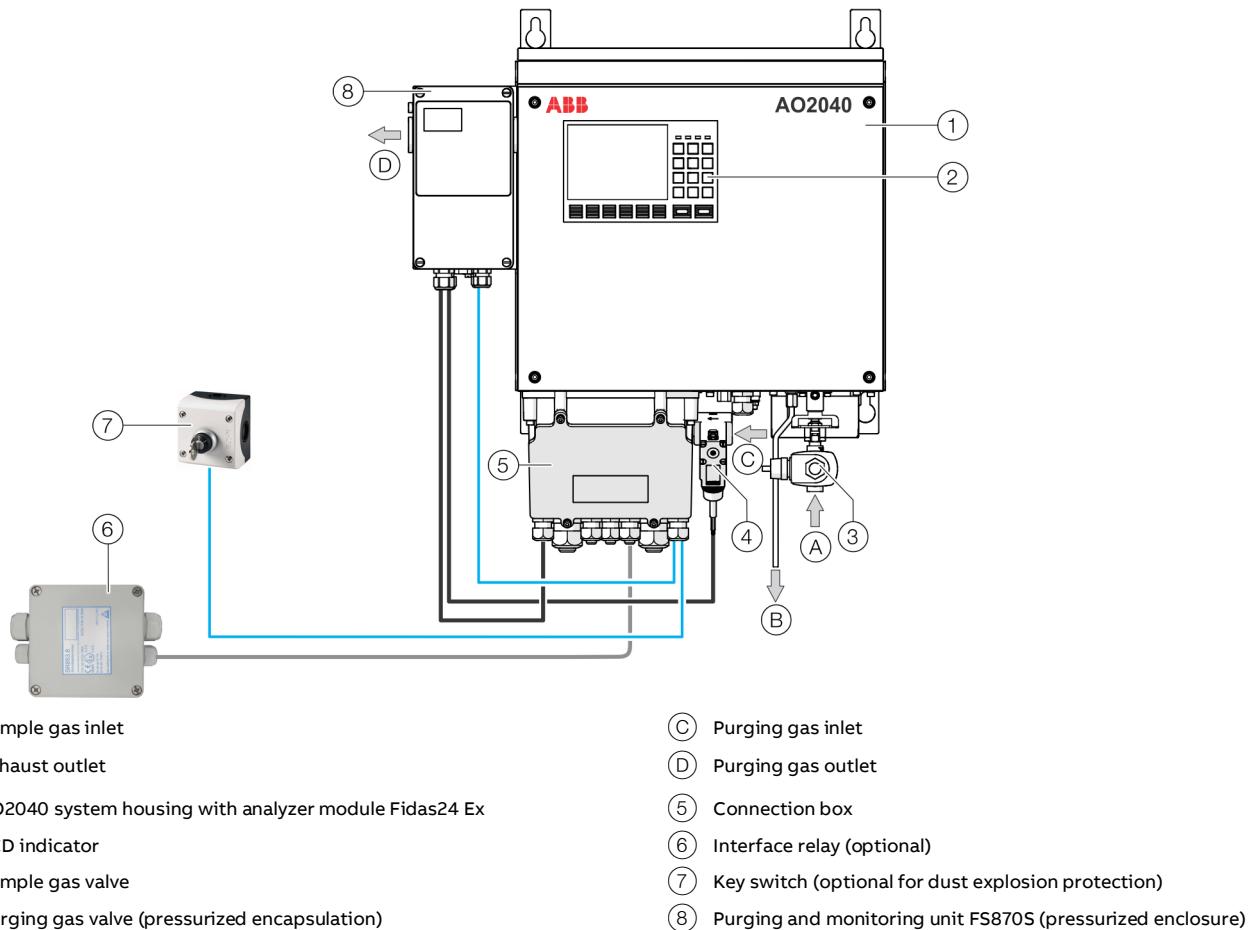


Image 1: Components (example)

#### Design

The gas analyzer AO2040-Fidas24°Ex consists of the AO2040 system housing with a Fidas24 analyzer module and an IP Protection Class IP°65 connecting box.

The housing forms a pressurized encapsulation, together with the purging and monitoring unit FS870S and the associated purging gas valve, in accordance with the IEC°60079-2 standard.

Compressed air is used as the purging gas. It safely separates the potentially explosive ambient atmosphere from the analyzer module.

Various models of the AO2040-Fidas24°Ex are available, refer to **Ex marking and versions** on page 8

Only the schematic structure differs between the Category 3G/2G and 3D/2D versions.

#### Overpressure version

The overpressure version is a special variant of the Fidas24-Ex, which makes it possible to discharge exhaust gas against a overpressure of maximum 1250 hPa.

Increased instrument air pressure will be needed for this purpose, see **Properties of the instrument air** on page 23.

The overpressure version is covered by the type examination certificate and documented in the device data sheet.

## ... 3 Design and function

### ... Installation of the gas analyzer and the gas connections

#### Safety features

##### Purging and monitoring unit

The purging and monitoring unit guarantees continual purging of the analyzer housing, in order to dilute potential leakages within the housing, and also maintains overpressure within the housing to securely prevent the ingress of the surrounding Ex atmosphere.

Therefore, the interior of the gas analyzer housing is not assigned to any explosion protection zone. No explosive gas mixture can escape to the outside from the interior of the housing.

The purging and monitoring unit monitors the pressurization of 2°hPa within the housing and disconnects the gas analyzer from the power supply if the pressure falls below the minimum pressurization, or if an external alarm (pressure switch/key switch) is triggered.

##### Pressure switch for monitoring the instrument air

The internal pressure switch monitors the supply of instrument air to the analyzer and disconnects the analyzer from the power supply if the instrument air supply (supply pressure <9°bar (rel.)) fails.

Therefore, the pressure switch is connected to the purging and monitoring unit via an intrinsically safe line with the input "ext. Alarm".

##### Sample gas valve

The sample gas valve interrupts the flow of sample gas to the analyzer when it is switched off, and when the sensor temperature is too low (e.g. during the warm-up phase).

##### Containment system

The gas paths that come into contact with the combustion and sample gas are designed in the form of a containment system, in accordance with the IEC 60079-2 standard.

The flow of combustion gas into the containment system is limited to a maximum volume flow rate of 10°l/h°H<sub>2</sub> by means of an integrated flow limiter.

The pressurized section of the containment system (combustion gas path to the first nozzle) is designed as a limited-release containment system, and the remaining section of the containment system is designed as a non-release containment system, due to the monitoring of the negative pressure control.

#### Options

##### Note

The optional key switch and interface relay must be approved for use in the corresponding explosion protection zone.

##### Key switch

In the version for Category 2D/3D, the optional key switch is required for acknowledgement of the internal cleaning of the housing before commissioning.

Therefore, the key switch is connected to the purging and monitoring unit via an intrinsically safe line with the input "ext. Alarm".

##### Interface relay

In the design for category 2G / 2D, the optional interface relay is used for isolating all of the poles on the operator's side (e.g. bus systems) which could remain live when the analyzer is disconnected from the power supply (e.g. due to a separate power supply).

## 4 Product identification

### Name plate

#### Note

The name plates displayed are examples. The device identification plates affixed to the device can differ from this representation.

The gas analyzer has several name plates:

- The gas analyzer name plate is located on the exterior of the side wall of the system housing.
- The name plate of the Fidas24 Ex analyzer module is located on the exterior of the terminal board.

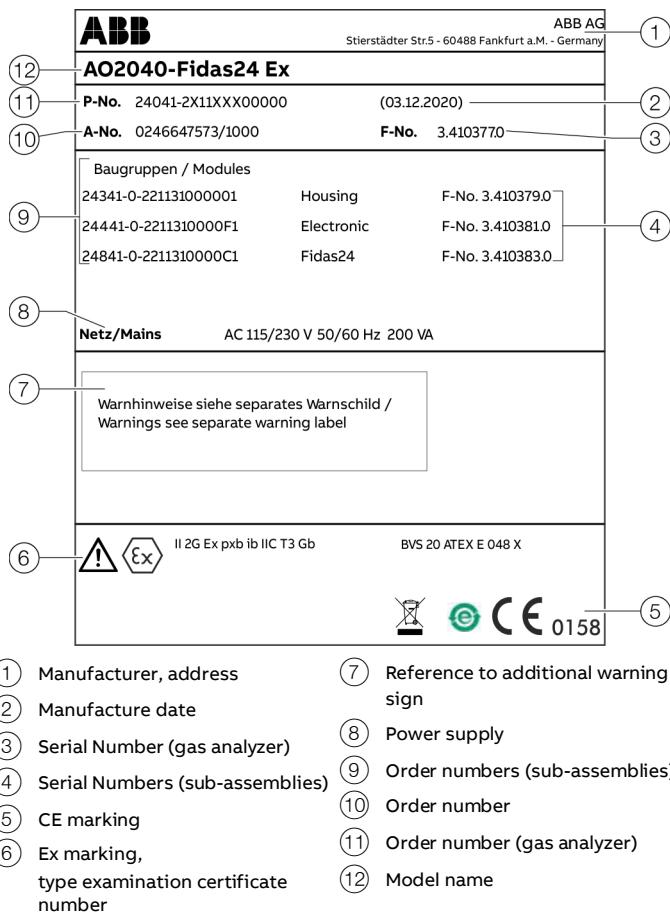


Image 2: Name plate, gas analyzer (example)

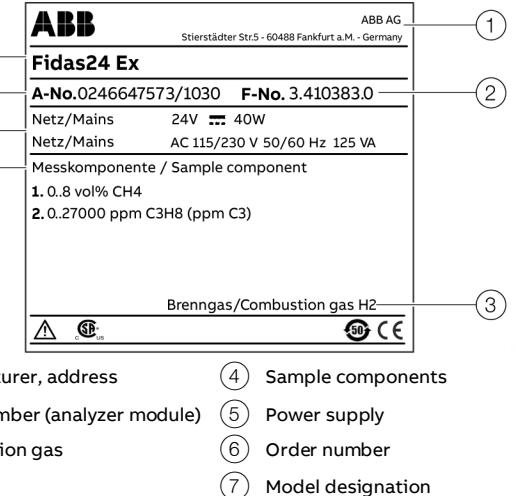


Figure 3: Analyzer module name plate (example)

### Plates and symbols

#### Note

- All pictograms, signs and labels attached to the device must be complied with and maintained in a clearly legible state.
- Damaged or illegible pictograms, signs and inscriptions must be replaced.

The signs and symbols listed below are attached to the unit.

Sign/Symbol	Position/Meaning
	Junction box Warning against dangerous electrical voltage.

Image 2: Name plate, gas analyzer (example)

## ... 4 Product identification

### ... Plates and symbols

#### Warning sign regarding protection against explosions

The warning sign for protection against explosions is located on the side wall of the system housing.

WARNINGS		
①	Pressurized Enclosure / Überdruckgekapseltes Gehäuse	
②	WARNING: Do not open when explosive atmosphere is present / WARNUNG: Nicht öffnen, wenn eine explosionsfähige Atmosphäre vorhanden ist.	
③	After De-Energizing, delay 20 Minutes before Opening / Vor Öffnen Spannung abschalten und 20 Minuten warten	
④	Enclosure has to be protected against brush discharges and electrostatic charges; Clean with moist cloth only / Gehäuse ist vor Büschelentladung bzw. elektrostatischer Aufladung zu schützen; nur mit feuchtem Tuch reinigen	
⑤	All plastic and elastomer parts as part of the housing must be protected from UV radiation / Sämtliche gehäusewirksame Kunststoff- und Elastomerteile müssen vor UV-Strahlung geschützt werden.	
⑥	Protective gas supply / Zündschutzgasversorgung	Air / Luft $p_e = 4000 \pm 500 \text{ hPa}$ $T = -20..40^\circ\text{C}$
⑦	Time of pre-purge / Vorspülzeit	> 235 s
⑧	Flow rate during pre-purge / Durchflussrate Zündschutzgas für Vorspülung	1 l/s
⑨	Flow rate during normal operation / Durchflussrate Zündschutzgas im Betrieb	1080 l/h
⑩	Overpressure range of purging / Überdruckregelbereich Zündschutzgas:	0,8..15 hPa
⑪	Containment System max. pressure / max. Druck Hydrogen H <sub>2</sub> max. flow rate of H <sub>2</sub> into containment system / max. Durchflussrate H <sub>2</sub> in das "Containment System":	$p_e = 1200 \pm 100 \text{ hPa}$ 10 l/h

- ① Pressurized-encapsulated housing
- ② WARNING: Do not open in a potentially explosive atmosphere.
- ③ Switch off power and wait 20 minutes before opening.
- ④ Protect the housing from brush discharge or electrostatic charging; clean only with a moist cloth.
- ⑤ All of the plastic and elastomer components of the housing must be protected against UV radiation.
- ⑥ Data for the inert gas supply, refer to page 23.
- ⑦ Duration of initial purging
- ⑧ Flow rate of the inert gas for initial purging
- ⑨ Flow rate of the inert gas during operation
- ⑩ Pressurized control range, inert gas,
- ⑪ max. pressure hydrogen H<sub>2</sub>; max. flow rate H<sub>2</sub> within the "Containment System", refer to page 24.

Image 4: Warning sign for Category 3G/2G

WARNINGS		
①	Pressurized Enclosure / Überdruckgekapseltes Gehäuse	
②	WARNING: Do not open when explosive atmosphere is present / WARNUNG: Nicht öffnen, wenn eine explosionsfähige Atmosphäre vorhanden ist.	
③	After De-Energizing, delay 20 Minutes before Opening / Vor Öffnen Spannung abschalten und 20 Minuten warten	
④	WARNING: Remove all dust from the inside of the enclosure before connecting or restoring the electrical supply / WARNUNG: Vor dem Einschalten Gehäuse von Staub reinigen	
⑤	For protection type dust a certified key switch has to be installed (see user manual) / In der Staub-Ex Ausführung muss ein zugelassener Schaltern installiert werden (siehe Betriebsanleitung)	
⑥	WARNING: For protection type dust an increase of the zone classification has to be considered due to purge gas outlet / WARNUNG: Bei Staub-Ex Zonenerhöhung durch Verwirbelungen am Zündschutzgasausgang möglich	
⑦	Must not be operated in areas with increased risk of static charging / Nicht in Bereichen mit erhöhter Aufladungsgefahr aufstellen	
⑧	All plastic and elastomer parts as a part of the housing must be protected from UV radiation / Sämtliche gehäusewirksame Kunststoff- und Elastomerteile müssen vor UV-Strahlung geschützt werden.	
⑨	Protective gas supply / Zündschutzgasversorgung	Air / Luft $p_e = 4000 \pm 500 \text{ hPa}$ $T = -20..40^\circ\text{C}$
⑩	Time of pre-purge / Vorspülzeit	> 235 s
⑪	Flow rate during pre-purge / Durchflussrate Zündschutzgas für Vorspülung	1 l/s
⑫	Flow rate during normal operation / Durchflussrate Zündschutzgas im Betrieb	1080 l/h
⑬	Overpressure range of purging / Überdruckregelbereich Zündschutzgas:	0,8..15 hPa
⑭	Containment System max. pressure / max. Druck Hydrogen H <sub>2</sub> max. flow rate of H <sub>2</sub> into containment system / max. Durchflussrate H <sub>2</sub> in das "Containment System":	$p_e = 1200 \pm 100 \text{ hPa}$ 10 l/h

- ① Pressurized-encapsulated housing
- ② WARNING: Do not open in a potentially explosive atmosphere.
- ③ Switch off power and wait 20 minutes before opening.
- ④ WARNING: Remove all dust from the housing before switching on.
- ⑤ For the Dust-Ex version, an approved key switch must be installed (refer to operating instructions)
- ⑥ WARNING: In the case of the Dust-Ex, zone elevation is possible due to turbulence at the inert gas outlet.
- ⑦ Do not install in areas with increased risk of electrostatic charging
- ⑧ All of the plastic and elastomer components of the housing must be protected against UV radiation.
- ⑨ Data for the inert gas supply, refer to page 23.
- ⑩ Duration of initial purging
- ⑪ Flow rate of the inert gas for initial purging
- ⑫ Flow rate of the inert gas during operation
- ⑬ Pressurized control range, inert gas,
- ⑭ max. pressure hydrogen H<sub>2</sub>; max. flow rate H<sub>2</sub> within the "Containment System", refer to page 24.

Image 5: Warning sign for Category 3D/2D

## Scope of delivery

- Gas analyzer model AO2040-Fidas24 Ex (wall-mounted housing)
- Screwed fittings with tubing connectors for the connection of flexible tubes
- Counter plug (socket housing) for the electrical connection of the I/O modules (plugged into the I/O module connections)
- Screwdriver (required for attaching the electric lines in the counter plugs)
- Accessory bag with fittings and O-rings for the connection of the sample gas lines
- Exhaust air pipe with connecting nut and locking ring
- Commissioning Instruction
- Analyzer data sheet

## Commissioning Instruction

The gas analyzer is delivered with a commissioning manual.

The commissioning instruction is an extract from the operating instruction, and it contains all the information required to install, commission and operate the gas analyzer safely, for its intended purpose.

The commissioning manual does not contain information regarding calibration, configuration and maintenance of the gas analyzer or about the Modbus® and PROFIBUS® interface.

### Analyzer data sheet

The design of the gas analyzer that has been supplied is documented in detail in the analyzer data sheet.

### Content of the analyzer data sheet

The analyzer data sheet primarily contains the following information:

- Order Number (O-No.),
- Job number (J-No.)
- Production Number (P-No.),
- Production Date,
- Power supply  
(Voltage, frequency, power consumption),
- Measuring components and measuring ranges,
- Serial numbers of the installed modules.

Production numbers of the installed modules.

The analyzer data sheet is located in a jacket that is attached to the door inside the wall housing.

### Note

- Keep the analyzer data sheet in the gas analyzer so that it is always at hand, especially in case of service/maintenance, refer to **Notify Service** on page 140.
- During commissioning, observe the information in the analyzer data sheet. The information given in the analyzer data sheet may differ from the general information in this Operating Instruction.

## Optional accessories

The following components are available as accessories.

Component	Order no.
Interface relay	3KXG758045U0100
Key switch	3KXG758072U0100
Pneumatic combustion gas shut-off valve	769440
Calibration gas valve	3KXG758053U0100

## 5 Transport and storage

### Safety instructions

#### CAUTION

##### Injury hazard due to heavy weight

Depending on the version, the gas analyzer weighs between 18°and 25 kg!

- Two persons are required for unpacking and transportation!

### Inspection

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents.

All claims for damages must be submitted to the shipper without delay and before installation.

### Transporting the device

Observe the following instructions:

- Do not expose the device to humidity during transport. Pack the device accordingly.
- Pack the device so that it is protected against vibrations during transport, for example, by using air-cushioned packing.

### Storing the device

Bear the following points in mind when storing devices:

- Store the device in its original packaging in a dry and dust-free location.
- Observe the permitted ambient conditions for transport and storage.
- Avoid storing the device in direct sunlight.
- In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

### Ambient conditions

#### Transport-/Storage temperature

-25 to 65 °C

### Packaging

1. If the original packing material is no longer available, wrap the device in bubble foil or corrugated cardboard. When shipping overseas, also heat-seal the device air-tight in 0.2 mm thick polyethylene, including a desiccant (e.g. silica gel). The amount of desiccant used should be adequate for the package volume and the probable shipping time (at least 3 months).
2. Pack the device in an adequately large box lined with shock absorbent material (e.g. foam material). The thickness of the cushioning material should be adequate for the weight of the device and the mode of shipping. The box should also be lined with a double layer of bitumen paper for overseas shipping.
3. Mark the box 'Fragile! Handle with care!'.

### Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.

Fill out the return form (see **Return form** on page 155) and include this with the device.

In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:

All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

#### Address for the return:

##### ABB AG

##### Service Analysentechnik – Parts & Repair

Stierstädter Straße 5

60488 Frankfurt, Deutschland

Fax: +49 69 7930-4628

E-Mail: repair-analytical@de.abb.com

## 6 Preparation for Installation

### Material required for installation

#### Note

The materials listed below are not included in the scope of delivery of the device, and must be provided by the customer.

#### Gas connections on the device

Metal screw-in fittings with  $\frac{1}{8}$ -NPT thread and PTFE sealing tape.

#### Gas lines

##### Process gases, test gases and waste air

- Combustion gas, combustion air:  
PTFE or stainless steel pipes with an inner diameter of 4 mm
- Purging gas, instrument air:  
PTFE or stainless steel pipes with an inner diameter of 6 mm
- Exhaust air:  
PTFE or stainless steel pipes with an inner diameter  $\geq 10$  mm
- Tube fittings
- Pressure regulator
- Automatic combustion gas shut-off valve, refer to **Shut-off valve in the combustion gas supply line** on page 24.

#### Sample gas

Heated sample gas line (recommended: TBL 01) or unheated sample gas line (PTFE or stainless steel tube with inner- / outer diameter 4 / 6 mm) set to a maximum of 130 °C.

The fittings and O-rings required for connection are included within the scope of delivery of the gas analyzer.

#### Installation Material

##### Wall-mount housing

- 4 screws M8 or M10
- Fastening materials suitable for the respective mounting surface (wall plugs etc.)

#### Signal Lines

Select conductive material which is appropriate for the length of the lines and the predictable current load.

Notes concerning the cable cross-section for connection of the I/O modules:

- The maximum capacity of terminals for stranded or solid conductors is  $1 \text{ mm}^2$  (17 AWG).
- The stranded conductor may be tinned on the tip or twisted for simplified connection.
- When using wire end ferrules the total section must not exceed  $1 \text{ mm}^2$ , i.e. the maximum stranded conductor section cannot be greater than  $0.5 \text{ mm}^2$ . The Weidmüller PZ 6/5 crimping tool must be used for crimping the ferrules.

#### Lengths and types of cables for the RS485 lines

- Maximum 1,200 m (transfer rate, maximum 19,200 bit/s).
- Three-core twisted-pair cable, conductor cross section  $0.25 \text{ mm}^2$  (e.g. order number 746620)

#### Length of the RS232 lines

Maximum 15 m.

#### Mating connector (socket housing)

The required mating connector (socket housing) for the plug-in terminal strips on the I/O modules is included in the scope of delivery.

#### Power supply

- Select conductive material which is appropriate for the length of the lines and the predictable current load.
- A mains separation device must be provided in order to enable all poles of the gas analyzer, including the purging and monitoring unit, to be disconnected from the power supply if necessary.
- The power supply cable is connected to the corresponding terminals of the purging and monitoring unit, refer to **Connecting the power supply** on page 52.

## ... 6 Preparation for Installation

### Requirements for the installation site

#### Installation location

##### DANGER

###### Explosion hazard

Risk of explosion due to electrostatic charging of the gas analyzer housing.

- The gas analyzer must not be installed in an area where process-related electrostatic charging of the housing could occur (e.g. near filling systems).

#### Note

When using the device in potentially explosive atmospheres, note the additional information in **Installation of the gas analyzer and the gas connections** on page 10!

- The gas analyzer is intended for indoor installation only.
- The mounting surface must be sufficiently stable to support the weight of the gas analyzer!
- All the components of the analyzer housing that made of plastic and elastomers must be protected against UV radiation (e.g. sunlight).

#### Installation location altitude

Maximum 2000 m (6560 ft) above sea level (over 2000 m (6560 ft) on request)

#### Short gas paths

The following points must be observed when installing the gas lines:

- Install the gas analyzer as close to the measuring point as possible.
- Install the modules for gas conditioning and calibration as close to the gas analyzer as possible.
- Keep the gas lines for the purging and instrument air as short as possible, and ensure that the inside diameters are sufficient ( $\geq 6$  mm).
- The pressure reducer for the purging and instrument air must be designed for the maximum volume flow during the initial purging phase (4000 l/h).

#### Adequate air circulation

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

The complete surface of the system housing is used to dissipate the heat losses.

#### Protection from adverse ambient conditions

Protect the gas analyzer from the following influences:

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

#### Climatic Conditions

##### Relative humidity

Maximum 75 %, no condensation

##### Ambient temperature during operation

5 to 45 °C (41 to 113 °F)

##### Transport-/Storage temperature

-25 to 65 °C

#### Housing protection (IP rating)

IP 65

#### Vibrations/shocks

##### AO2040-Fidas24 Ex

Maximum 0.5 g, maximum 150 Hz

## Fidas24

### Sample gas

Flammable sample gases

#### DANGER

##### Explosion hazard

Explosion hazards due to flammable sample gases with a C1-equivalent of  $\geq 8$  Vol-% CH<sub>4</sub>.

- The flammable sample gas that is fed in must have the following specifications:

### Sample gas specifications

- The sample gas that is fed in must at no time exceed the C1-equivalent of 8 Vol-% CH<sub>4</sub>.
- The sample gas that is fed in must not be potentially explosive.
- The specifications must also be adhered to during the start-up and shut-down processes, and the pressure, temperature and gas matrix must be taken into account.

### Note



An explosive mixture of gases is defined as a mixture containing combustion components, that falls within the lower (UEG) and upper explosion limits (OEG), which is accompanied by the simultaneous presence of oxidizers (e.g. air, oxygen).

### Sample gas inlet conditions

Parameter	Value/Description
Temperature	$\leq 130$ °C (also applies in the case of heated sample gas lines)
Inlet pressure p <sub>abs</sub>	800 to 1100 hPa
Outlet pressure	The outlet pressure must be the same as the atmospheric pressure. Overpressure version: maximum 1250 hPa abs
Flow rate	Approx. 80 to 100 l/h at atmospheric pressure (1000 hPa)
Humidity	$\leq 40$ % H <sub>2</sub> O

### Note

The temperature, pressure and flow of the sample gas must be kept constant, to such an extent that the influence of variations on the measuring accuracy is acceptable, refer to **Specification** on page 153.

### Further properties of the sample gas

The analyzer module must not be used for the measurement of gases containing organometallic compounds, e.g. lead-containing fuel additives or silicone oils.

### Operational gases

#### Properties of the instrument air

Parameter	Value/Description
Quality	According to ISO 8573-1 Class 2 Particle size: max. 1 µm, Particle density: max. 1 mg/m <sup>3</sup> , Oil content: max. 0.1 mg/m <sup>3</sup> , Dew point: At least 10 °C below the lowest expected ambient temperature
Inlet pressure p <sub>e</sub>	4000 hPa, $\pm 500$ hPa; 5000 hPa, $\pm 500$ hPa for overpressure version
Temperature	Maximum 40 °C
Flow rate	Typically approx. 1200 l/h, refer also to <b>Purge gas flow</b> on page 25.

### Note

For Fidas24-Ex in the overpressure version, the purge gas supply for the pressurized enclosure must be made separately from the instrument air supply. In the case of common supply, the pressure for the purge gas supply must be reduced using an additional pressure reducer.

#### Purging gas properties for pressurized enclosure (FS870S) (in the case of separate supply)

Parameter	Value/Description
Quality	Class 533, in accordance with DIN ISO 8573-1
Inlet pressure p <sub>e</sub>	4000 hPa, $\pm 500$ hPa
Temperature	Maximum 40 °C
Flow rate	Refer to <b>Purge gas flow</b> on page 25.

### Note

When using the instrument air of the Fidas24 as purging gas for the pressurized enclosure, the quality specified in the top table applies.

## ... 6 Preparation for Installation

### ... Fidas24

#### Combustion air

Parameter	Value/Description
Quality	<ul style="list-style-type: none"> <li>Synthetic air or catalytically purified air</li> <li>Organic hydrocarbon content: &lt; 1 % of the measuring range</li> </ul>
Inlet pressure $p_e$	1200 hPa, $\pm 100$ hPa
Flow rate	< 20 l/h

#### Combustion gas

##### Combustion gas parameter

Quality	Hydrogen ( $H_2$ ), Quality 5.0
Inlet pressure $p_e$	1200 hPa, $\pm 100$ hPa
Combustion gas flow rate*	Typical $\leq 3$ l/h, maximum 10 l/h

\* The combustion gas flow is limited to a maximum of 10 l/h  $H_2$  by an integrated flow limiter.

#### Note

The safety valve installed in the analyzer closes safely up to a combustion gas pressure of 6 bar.

The operator must take suitable measures to prevent the occurrence of higher pressures at the combustion gas inlet.

#### Shut-off valve in the combustion gas supply line

In order to increase the safety level under the following operational conditions, a pneumatic shut-off valve must be installed in the combustion gas supply line:

- when shutting down the gas analyzer,
- in case of instrument air supply failure,
- in case of a leak in the combustion gas path, inside the gas analyzer.

The pneumatic shut-off valve automatically interrupts the combustion gas supply if the instrument air supply pressure falls below 3 bar (abs.).

The pneumatic shut-off valve should be installed outside the analyzer house near the combustion gas supply.

ABB recommends the use of a pneumatic shut-off valve that is actuated by the instrument air. This shut-off valve can be supplied by ABB.

Order number 0769440.

#### Test gases

##### DANGER

###### Explosion hazard

Explosion hazard when using air as the zero point gas. Due to the oxygen contained in the air, there is a risk that a potentially explosive atmosphere could develop through back-purging during the process.

- Ensure that the zero point gas cannot flow back into the process:
  - Separation of the test gas supply from the process by means of a shut-off valve
  - Discharge of the excess test gas into an extraction or exhaust gas collection pipe.

#### Test Gases for Zero Calibration

Quality	<ul style="list-style-type: none"> <li>Nitrogen, quality 5.0; synthetic or catalytically purified air</li> <li>Organic hydrocarbon content of &lt; 1 % of the measuring range</li> </ul>
Inlet pressure $p_e$	Without pressure and in excess or at least 130 l/h
Flow rate	130 to 250 l/h

#### Test gases for endpoint calibration

Quality	Sample component or substitute gas component in nitrogen or synthetic air with concentration adjusted to the measuring range
Inlet pressure $p_e$	Without pressure and in excess or at least 130 l/h
Flow rate	130 to 250 l/h

#### Note

The calibration information under **Calibration** on page 107 must be taken into account.

#### Gas connections

Refer to **Position and design of the gas connections** on page 30.

## Instrument air and purging gas supply

In the case of AO2040-Fidas24 Ex a differentiation is made between instrument air and purging gas:

- **Instrument air:**  
The instrument air is used as propulsion air for the air jet injector of the analyzer module.
- **Purging gas:**  
The purging gas is used to supply the pressurized enclosure of the system housing.

Each connection has its own separate connection point:

- **Instrument air:**  
The instrument air supply is connected to the respective connection of the analyzer module.
- **Purging gas:**  
The purging gas supply is connected to the purging gas valve of the system housing.

Depending on the quality, for AO2040-Fidas24 Ex the supply of instrument gas and purging gas can be provided in two different ways:

- **Separate supply:**  
Instrument gas and purging gas supply from two separate sources.
- **Common supply:**  
Instrument gas and purging gas supply from a common source. The characteristics of the instrument air supply apply here!

The necessary pipes and hoses must be provided by the customer.

## Pressurized encapsulation Ex-p

### Purging and monitoring unit FS870S

The purging and monitoring unit ensures continual purging of the analyzer housing, in order to dilute potential leaks within the housing.

The purging and monitoring unit monitors the pressurization of 2 hPa within the housing and disconnects the gas analyzer from the power supply if the pressure falls below the minimum pressurization, or if an external alarm (pressure switch/key switch) is triggered. Initial purging is then restarted.

### Purge gas flow

#### DANGER

##### Explosion hazard

Danger of explosion if purging of the housing is deactivated or if the purging parameters are changed.

- The purging of the housing must not be deactivated in hazardous areas.
- The ex-works preset rinsing parameters must not be changed under any circumstances.

#### NOTE

##### Loss of explosion protection approval

Loss of explosion protection approval, due to changes to the purging parameters that have been preset at the factory.

- The ex-works preset rinsing parameters must not be changed under any circumstances.

### Note

The parameterization of the purging and monitoring unit is protected by PIN codes.

During commissioning, the PIN codes must be changed and documented by the operator. This ensures that only authorized persons are granted access to the parameterization of the purging and monitoring unit.

## ... 6 Preparation for Installation

### ... Pressurized encapsulation Ex-p

#### Note regarding the purging air supply

Long supply lines with small diameters can result in incorrect functioning of the pressurized control of the purging and monitoring unit FS870S.

The following points should be observed when configuring the purging air supply:

- The chosen pressure reducer must be able to supply not only the working pressure but also the corresponding volume flow of 4,000 l/h
- Long supply lines should be avoided in general, and the inner diameter of the supply lines should be at least 6 mm, or for longer lengths, even larger.
- Keep the distance between the pressure reducer of the purging air supply and the gas analyzer as short as possible.

#### Initial purge

The purging gas flow rate and the duration of the purging process for the purging and monitoring unit FS870S are preset at the factory.

Parameter	Factory setting
Initial purge volumes	250 l
Purging gas flow rate during initial purging	3600 l/h (1 l/s)

#### During operation

The purging gas flow rate and the pressurized control range of the purging and monitoring unit FS870S are pre-programmed at the factory.

Parameter	Factory setting
Purge Gas Flow Rate during Operation	1080 l/h
Monitored pressurized control range	0.8 to 15 hPa

### Power supply

The power supply of the gas analyzer is provided via the purging and monitoring unit FS870S. The cold-device cable of the gas analyzer is already permanently connected to the purging and monitoring unit FS870S at the factory.

The power supply cable is connected to the corresponding terminals of the purging and monitoring unit, refer to **Purging and monitoring unit FS870S** on page 49.

#### Electrical data for the power supply

The power supply unit built into the system housing is used to supply the 24 V DC to the Fidas24 Ex module and the associated electronics with DC energy.

#### Power supply (entire device)

Input voltage	110 to 230 V AC, ±10 %
Input Current	Maximum 2.0 A
Line Frequency Range	50 to 60 Hz, ±3 Hz
Power consumption (entire device)	Maximum 200 VA
Output Voltage	24 V DC, ±3 % (for optional cut-off relay control)
Connection	At the corresponding terminals of the purging and monitoring unit, refer to <b>Purging and monitoring unit FS870S</b> on page 49.

### Battery

#### Application

Supply to the built-in clock in case of a voltage failure.

#### Type

Lithium button cell 3 V CR 2032

#### Note

Only the original battery type may be used as a replacement:

- Varta CR 2032 type no. 6032 or
- Renata type no. CR2032 MFR

## 7 Installation

### Key switch

For the Category 3D/2D (Dc/Db) versions, an additional key switch must be installed by the operator.

The key switch is used to confirm the internal cleaning of the housing before commissioning (removal of dust deposits), and to enable purging of the housing.

The key switch must be installed close to the gas analyzer and clearly labeled as belonging to the gas analyzer.

The key switch is connected to the intrinsically safe line after preinstalled at the factory. The line is switched internally in series with the instrument air monitoring pressure switch and is connected to the 'Ext. Alarm' input of the purging and monitoring unit FS870S.

The key switch can be optionally ordered from ABB, for ordering information, see **Connecting the key switch** on page 50.

Alternatively, a suited key switch must be provided onsite by the operator.

#### Note

The optional key switch must be approved for use in the corresponding explosion protection zone.

**Optional accessories** on page 19

### Cut-off relay for signal lines

In the design for category 2G / 2D, the following points must be observed:

- All signal lines which could still be live after switching off the power supply, or in the event of failure of the pressurized encapsulation, must be switched off at all poles, via a cut-off relay.
- Installation of the cut-off relay, refer to **Connecting the interface relay** on page 51.

The cut-off relay can be optionally ordered from ABB, for ordering information, see **Optional accessories** on page 19.

Alternatively, a suited cut-off relay must be provided onsite by the operator.

#### Note

The optional cut-off relay must be approved for use in the corresponding explosion protection zone.

### Safety instructions

#### DANGER

##### Risk of explosion during installation and commissioning of the device

There is no explosion protection during the installation and commissioning of the device or its components.

- Ensure that no potentially explosive atmosphere could arise during installation and commissioning.

### Unpacking the Gas Analyzer

#### CAUTION

##### Injury hazard due to heavy weight

The gas analyzer weighs approx. 30 kg!

- Two persons are required for unpacking and transportation!

Check the devices immediately after unpacking for possible damage that may have occurred from improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents.

All claims for damages must be submitted to the shipper without delay and before installation.

1. Remove the accessories (refer to **Scope of delivery** on page 19) from the transport carton.  
Take care not to lose any of the accessories.
2. Remove the gas analyzer from the carton, together with the padding material.
3. Remove the padding material and place the gas analyzer in a clean area.
4. Clean the adhesive packaging residue from the gas analyzer.

#### Note

Keep the shipping carton and cushioning material for future transportation.

## ... 7 Installation

### Dimensions

#### Model AO2040-Fidas24 Ex

Dimensions in mm (in)

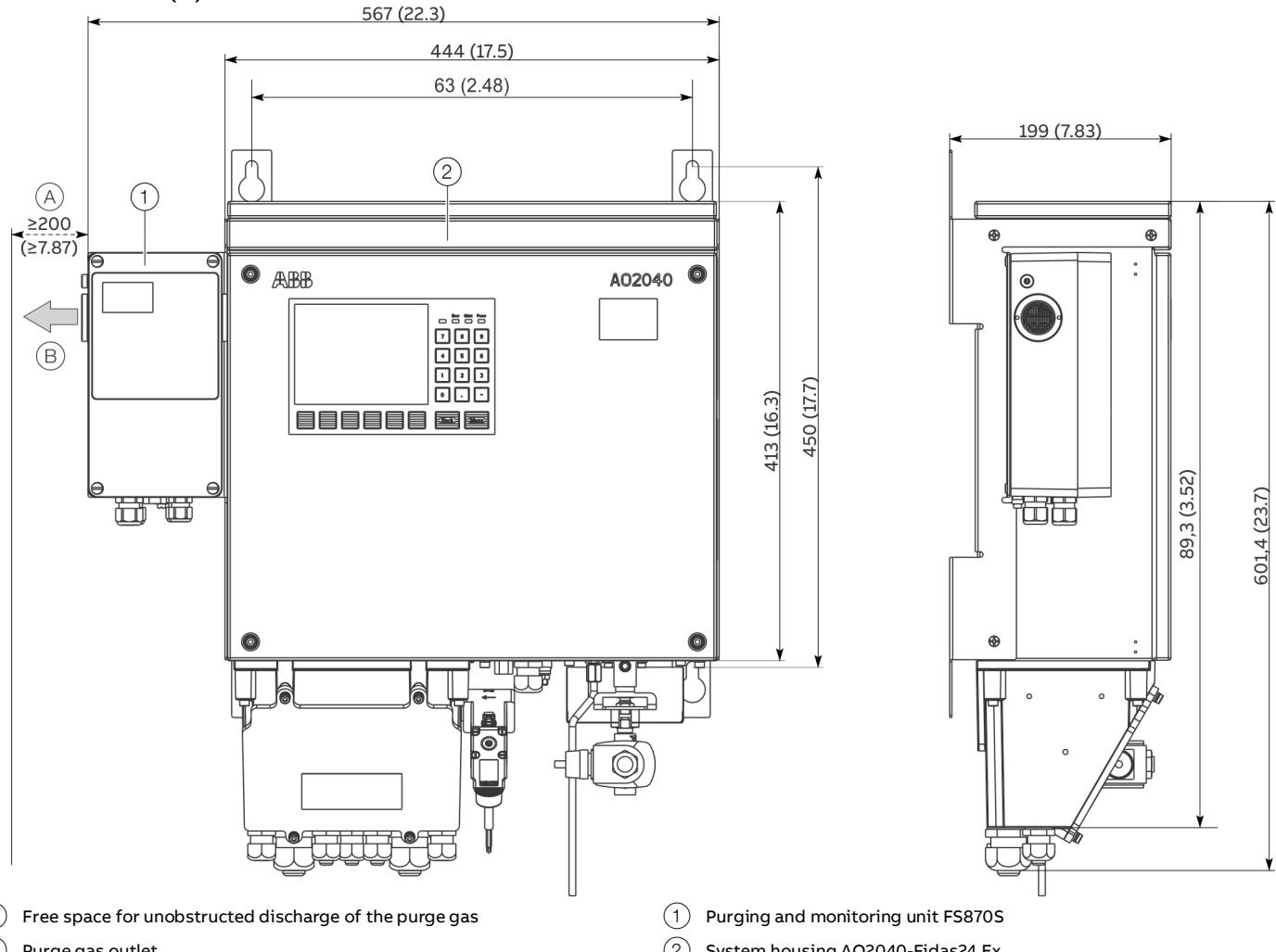


Figure 6: Dimensions, Model AO2040-Fidas24 Ex

## Mounting

### Installation Material

#### Wall-mount housing

- 4 screws M8 or M10
- Fastening materials suitable for the respective mounting surface (wall plugs etc.)

#### Additional information

- The connection box shown in the dimensional drawings is flange-mounted to the housing.
- Adhere to the requirements at the installation site , refer to **Requirements for the installation site** on page 22.
- The air outlet of the purging and monitoring unit must not be blocked.
- Take into consideration the additional space required for the connecting lines (approx. 100 mm).
- When mounting the gas analyzer, take the space required for the heated sample gas lines into account (observe the minimum bending radius, according to manufacturer's specifications).
- When installing the wall-mounted housing, ensure that there is additional free space above the housing, as some modules are only accessible from the top (approx. 300 mm).
- Mount the wall-mounted housing in such a way that the LCD display is clearly visible.

### Gas Analyzer Installation

#### ⚠ CAUTION

##### Injury hazard due to heavy weight

The gas analyzer weighs approx. 30 kg!

- Two persons are required for unpacking and transportation!

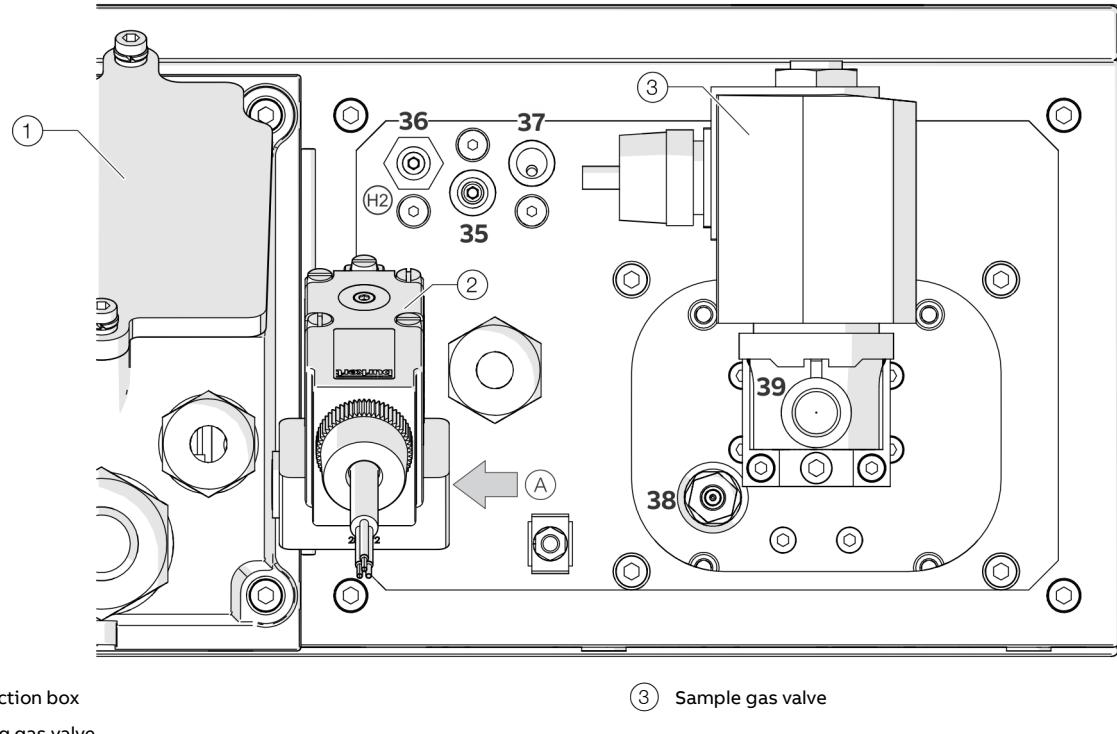
Mount the system housing on the wall with the fastening material of your choice.

Mounting hole distances, refer to **Dimensions** on page 28.

## ... 7 Installation

### Gas connections

#### Position and design of the gas connections



① Connection box

③ Sample gas valve

② Purging gas valve

Figure 7: Position of the gas connections AO2040-Fidas24 Ex

Pos.	Connection	Supplementary information	Design
35	Combustion air inlet	—	1/8" NPT female thread for threaded connections (not included in scope of supply)
36	Combustion gas inlet	with pre-assembled flow restrictor	
37	Instrument air inlet	—	
38	Exhaust outlet	—	Male thread for connection of the exhaust air pipe (stainless steel tube with an outside diameter of 10 mm, included in the scope of supply of the gas analyzer)
39	Sample gas inlet	Connection options for heated or unheated sample gas lines.	G 1/4" NPT female thread for threaded connections (not included in scope of supply)
(A)	Purging gas inlet	Purging gas inlet for the pressurized enclosure Ex-p.	G 3/8" NPT female thread for threaded connections (not included in scope of supply)

### Connection diagram for the operational gases

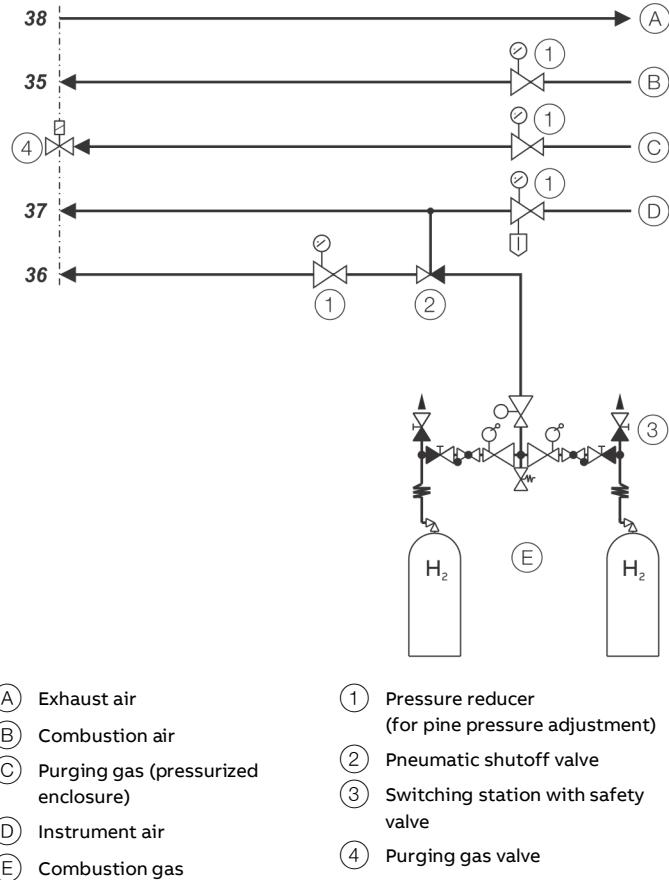


Image 8: Connecting the operational gases

The numbering of the gas connections corresponds to the numbering in **Position and design of the gas connections** on page 30 as well as the labeling on the rear of the gas analyzer.

### Connection diagram for the sample and test gases

#### DANGER

##### Explosion hazard

Explosion hazard when using air as the zero point gas. Due to the oxygen contained in the air, there is a risk that a potentially explosive atmosphere could develop through back-purging during the process.

- Ensure that the zero point gas cannot flow back into the process:
  - Separation of the test gas supply from the process by means of a shut-off valve
  - Discharge of the excess test gas into an extraction or exhaust gas collection pipe.

##### General

The sample gas connection (zero point and end point gas) is made via two external solenoid valves before the sample gas inlet valve. The solenoid valves are controlled by the gas analyzer during calibration.

Alternatively, the sample gas can also be supplied via appropriate manual valves. However, the possibility of automatic control of the valves during calibration is then no longer possible; the user has to open and close the valves manually.

The sample gas should be supplied in depressurized state (ambient pressure) at the sample gas inlet. To do this, the sample gas must be applied with an excess; this excess must be safely discharged.

Observe the following during commissioning:

- Sample gas supply without excess discharge is not permitted. It must be guaranteed that the sample gas pressure and flow rate at the sample gas inlet of the gas analyzer is constant.
- The negative pressure control of the gas analyzer cannot compensate for sample gas excess or sample gas deficiency. Fluctuations in sample gas supply can lead to calibration errors or the gas analyzer may fail.
- Pressure surges must be avoided when supplying the sample gas.

## ... 7 Installation

### ... Gas connections

#### Control of the sample gas valves

The solenoid valves for the sample gas connection are activated by the calibration function via the digital I/O module of the gas analyzer.

To do this, the standard function block application 'Calibration control' must be selected.

The solenoid valves used must be approved for the corresponding explosion protection zone. Suited solenoid valves can be obtained from ABB, see **Optional accessories** on page 19.

#### Note

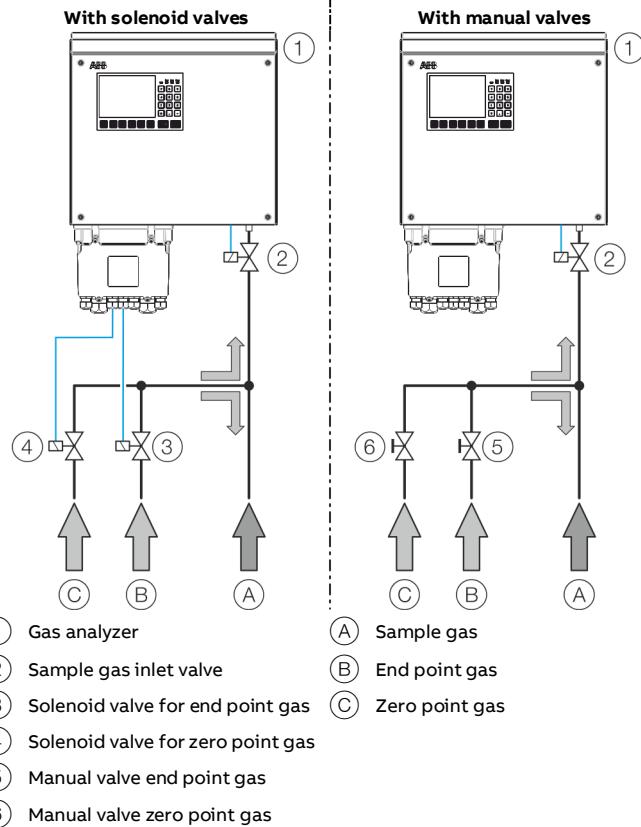
The power supply for the solenoid valves used must be provided by the operator outside the analyzer.

For applications in category 2G/2D, all live supply lines that are routed into the connection box of the Fidas24 Ex must be routed over all poles via the interface relay.

The lines shown in blue in the **Figure 9** and **Figure 10** represent the control signals only.

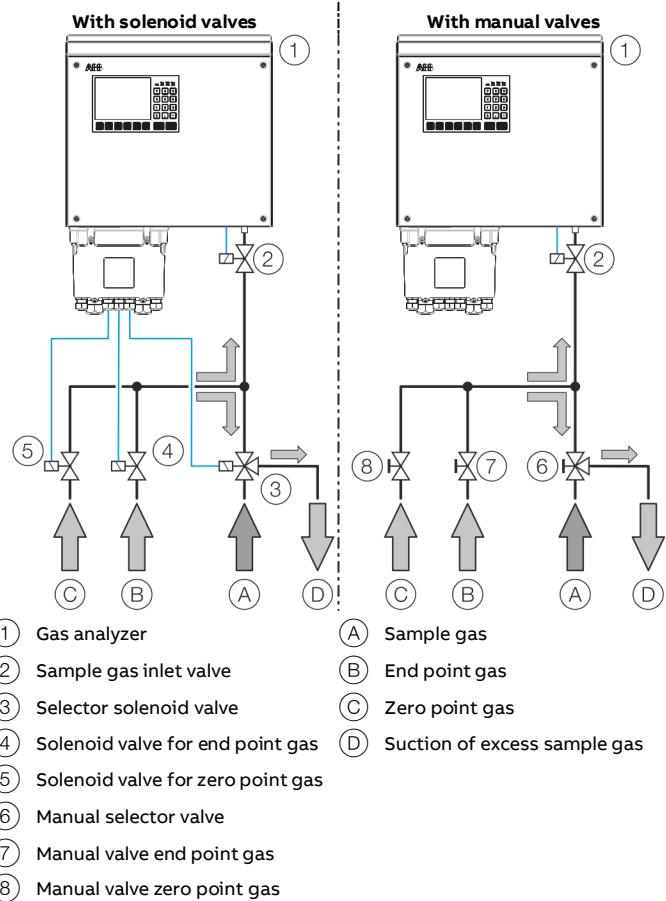
#### Example 1 - The sample gas may be fed into the process

With this variant, the excess sample gas is fed into the process.



**Figure 9:** Sample gas discharge into the process

**Example 2 - The sample gas must not be fed into the process**  
With this variant, the excess sample gas is diverted via a separate suction system.



**Figure 10:** Sample gas discharge via suction

## Connecting the gas lines

### DANGER

#### Risk of explosion and fire

Explosion and fire risk, due to leaks in the internal gas paths of the appliance and leaking combustion gas.

- Do not open the screw connections of the device internal gas paths!
- Check the seals of the internal gas paths and the combustion gas supply line, according to the maintenance plan!

If screw connections of the device internal gas pass have nevertheless been opened (only by trained personnel), a leakage test with a leak detector (thermal conductivity) must be carried out after closing the gas paths.

#### General information

In order to avoid damage and ensure trouble-free operation, observe the following instructions when connecting the gas lines.

### NOTICE

#### Potential adverse effect on the IP rating

Yellow sealing plugs (transport protection) are applied to the gas connections on the analyzer and housing to secure them during transport. The yellow sealing plugs do not guarantee a sufficient IP rating.

- Remove the yellow sealing plugs before commissioning.
- Close unused gas connections with suited sealing plugs to guarantee the IP rating.

#### Note

It is recommended that the fittings be installed on the analyzer module before the gas analyzer is mounted, as the connection ports are still easily accessible before the analyzer is mounted.

#### Handling of combustion gases

The relevant safety regulations for working with combustion gases must be complied with!

#### Fittings

- The fittings used must be clean and free of grease and residue!
  - Impurities from the fittings can enter the analyzer and damage it. They could also falsify the measurement result.
- Observe the installation instructions provided by the manufacturers of the fittings!
- Hold back the screw connections when connecting the gas lines!

#### Gaskets

- Do not use sealing compound to seal the fittings!
  - Components of the sealing compound could falsify the measurement results.
- The sealing material must be free of grease.

#### Gas lines

- When laying and connecting the gas lines, adhere to the installation instructions provided by the manufacturers of the piping!
- If gas lines made of stainless steel are connected to the analyzer modules, the gas lines must be connected to the building-side equipotential bonding.

#### Mounting the fittings on the gas analyzer

### NOTE

#### Damage to the gas analyzer

Damage to the gas analyzer, due to melting of the factory-mounted plastic plugs in the sample gas inlets.

- Remove the plastic plugs from the sample gas inlets before commissioning.

1. Screw out the yellow plastic screwing caps (5 mm hexagon socket) from the connection ports.
2. Wrap PTFE sealing tape tightly around the thread of the screw-in fitting twice, clockwise, and screw it into the connection socket.  
After mounting, two threads usually remain visible

#### Note

Screw fittings in carefully, and not too tightly!

#### Checking gas path seal integrity

The sealing integrity of the gas paths in the gas analyzer is tested at the factory.

However, since the tightness of the gas paths may have been affected during transport of the gas analyzer, it is recommended to check the tightness at the site of installation, refer to

**Checking gas path leak tightness** on page 145.

## ... 7 Installation

### ... Connecting the gas lines

#### Connecting the instrument air supply

The instrument air is used as propulsion air for the air jet injector of the analyzer module, and as purging gas for the pressurized enclosure, refer to **Pressurized encapsulation Ex-p** on page 25.

Observe the following points when connecting the instrument air supply:

- The quality of the instrument air must meet the requirements according to **Properties of the instrument air** on page 23.
- Connect the instrument air line to the instrument air inlet **37** of the gas analyzer, via a pressure regulator (0 to 6 bar), refer to **Position and design of the gas connections** on page 30.
- When providing the instrument air for the analyzer and the pressurized encapsulation together, ensure the following:
  - Keep the line distance between the pressure reducer and the analyzer as short as possible.
  - Select supply lines with an inner diameter of at least 6 mm.
 Otherwise, the drop in pressure during initial purging may be so great that the pressure monitor installed in the analyzer will detect an undersupply of instrument air and interrupt the initial purging process.
- The pressure reducer must be designed for a sufficiently large gas flow volume, refer to **Properties of the instrument air** on page 23.
- The pressure upstream of the pressure reducer must be sufficiently high.

#### Connect the purging air supply

Depending on the quality, for AO2040-Fidas24 Ex the supply of instrument gas and purging gas can be provided in two different ways:

- **Separate supply:**  
Instrument gas and purging gas supply from two separate sources.
- **Common supply:**  
Instrument gas and purging gas supply from a common source. The characteristics of the instrument air supply apply here!

Observe the following points when connecting the purging gas supply:

- The quality of the purging gas must meet the requirements according to **Purging gas properties for pressurized enclosure (FS870S)** on page 23.  
In the case of common instrument gas and purging gas supply, the quality must comply with **Properties of the instrument air** on page 23.
- Connect the purging gas lines to the purging gas valve at the connection chamber, via a pressure controller (0 to 6 bar).
  - Keep the line distance between the pressure reducer and the analyzer as short as possible.
  - The pressure reducer must be designed for a sufficiently large gas flow volume, refer to **Initial purge** on page 26.
  - The pressure upstream of the pressure reducer must be sufficiently high.

#### Connect the combustion air supply

Observe the following points when connecting the combustion air supply:

- The quality of the combustion air must meet the requirements according to **Combustion air** on page 24.
- Connect the combustion air line to the combustion air inlet **35** of the gas analyzer, via a pressure regulator (0 to 1.6 bar), refer to **Position and design of the gas connections** on page 30.

## Connecting the exhaust air line

Observe the following points when connecting the exhaust air pipe:

- Conduct exhaust gases from the gas analyzer directly into the atmosphere or through a de-pressurized pipe with a large inside diameter which is as short as possible, or into an exhaust pipe.
- Use PTFE or stainless steel as the material for the exhaust air line!

The temperature of the exhaust air can be up to 200 °C!

- Install the exhaust air line at a gradient, leading away from the gas analyzer.
- At a maximum of 30 cm after the exhaust air outlet, the exhaust air pipe must have an inside diameter of  $\geq 10$  mm!

If the exhaust air pipe is very long, its inside diameter must be much larger than 10 mm, otherwise you might have problems with pressure control in the gas analyzer.

- Do not install any throttle sections or shut-off valves in the exhaust air line!

### Note

Dispose of corrosive, toxic or combustion exhaust gases according to the regulations!

## Connecting the purging air vent

The FS870S purging and monitoring unit is equipped with a particle barrier, in accordance with the EN 60079-2 standard. The air flow at the purging gas outlet of the purging and monitoring unit can thus be led directly into the potentially explosive atmosphere.

If any splashing with water occurs, it is recommended that a pipe with a 90° downward angle be installed at the purging gas outlet.

Observe the following points for the Category II 3D / Dc and II 2D / Db versions:

- The air stream emitted at the purging gas outlet of the purging and monitoring unit must not stir up any dust in the dust-ignition proof area.
- The operator must take appropriate measures to prevent zone elevation due to dust being stirred up.

## Connect the combustion gas supply

Clean combustion gas line.

1. Pump a cleaning agent (alkaline cleaner, stainless steel pickling solution) through the stainless steel pipe.
2. Rinse the pipe thoroughly with distilled water.
3. Purge the pipe with synthetic air or nitrogen, at a  $> 100$  °C, for several hours (10 bis 20 l/h).
4. Seal the ends of the pipe.

## Connect combustion gas pipe

See also **Connection diagram for the operational gases** on page 31.

1. Connect a two-stage cylinder pressure reducer (a model suitable for high purity gases) to the combustion gas cylinder.
2. Connect the combustion gas pipe to the cylinder pressure reducer.
3. Install a shut-off valve in the combustion gas supply line.
  - It is recommended that a pneumatic shut-off valve be installed.
  - The pneumatic shut-off valve must be controlled by the instrument air supply, so that the combustion gas supply is interrupted in the event of a failure of the instrument air supply.
  - See also **Shut-off valve in the combustion gas supply line** on page 24.
4. Connect the combustion gas line to the combustion gas inlet **36** of the analyzer module, via a pressure reducer (0 to 1.6 bar) refer to **Position and design of the gas connections** on page 30.

## Check the tightness of the combustion gas line

5. Check the combustion gas line for tightness, refer to **Combustion gas supply from a cylinder** on page 146.

## ... 7 Installation

### ... Connecting the gas lines

#### Connecting the sample gas line

##### NOTE

###### Damage to the gas analyzer

Damage to the gas analyzer, due to melting of the factory-mounted plastic plugs in the sample gas inlets.

- Remove the plastic plugs from the sample gas inlets before commissioning.

###### Sample gas line connection

A heated or unheated sample gas line can be connected to the sample gas connection of the Fidas24 Ex.

Please note the following points when connecting the sample gas line:

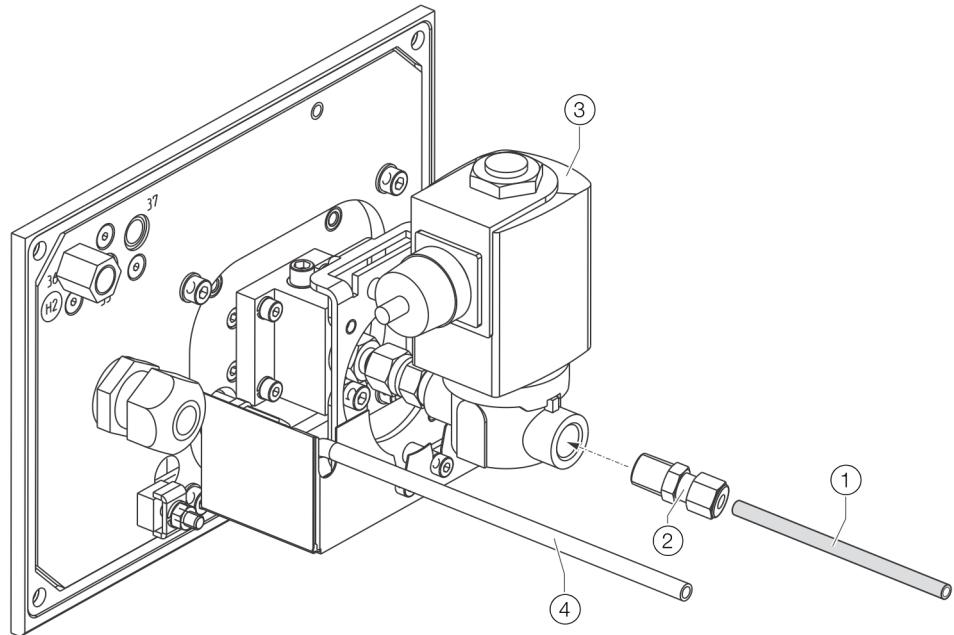
- If the sample gas is pressurized, a T-piece must be connected between the sample gas line and sample gas inlet.  
The free connection of the T-piece must be connected to an exhaust gas discharge line, so that no positive pressure builds up in the analyzer module.
- When connecting a heated sample gas line, the temperature at the sample gas connection may not exceed 130 °C!

#### Maximum length of the sample gas line

Sample gas line	Maximum length
Heated sample gas line	Maximum 60 m, with a 4 mm inside diameter
Unheated sample gas line	Maximum 50 m, with a 4 mm inside diameter

#### Provide for Sample Gas Line Purging

Install a shut-off valve in the sample gas line (highly recommended for pressurized sample gas) and provide the option of introducing an inert gas, e.g. nitrogen, from the gas sampling point, for purging of the sample gas line.

**Connection of the sample gas line to the unheated sample gas connection**

- (1) Sample gas line (heated or unheated, PTFE or stainless steel tubing with a 4/6 mm inside/outer diameter)  
(2) Screw-in connector G $\frac{1}{4}$ "  
(3) Sample gas valve  
(4) Exhaust gas tube

Figure 11: Connecting the sample gas line

## 8 Electrical connections

### Safety instructions

#### DANGER

##### **Explosion hazard**

There is a risk of explosion if the device is opened in a potentially explosive atmosphere.

Please take note of the following information before opening the device:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Turn off the power supply before opening the device, and observe a waiting period of 20 minutes, in order to allow any hot components to cool down.

#### WARNING

##### **Risk of injury due to live parts.**

Improper work on the electrical connections can result in electric shock.

- Connect the device only with the power supply switched off.
- Observe the applicable standards and regulations for the electrical connection.

The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.

The electrical connection information in this manual must be observed; otherwise, the IP rating may be adversely affected. Ground the measurement system according to requirements.

## Cable glands

### Connection box on the system housing

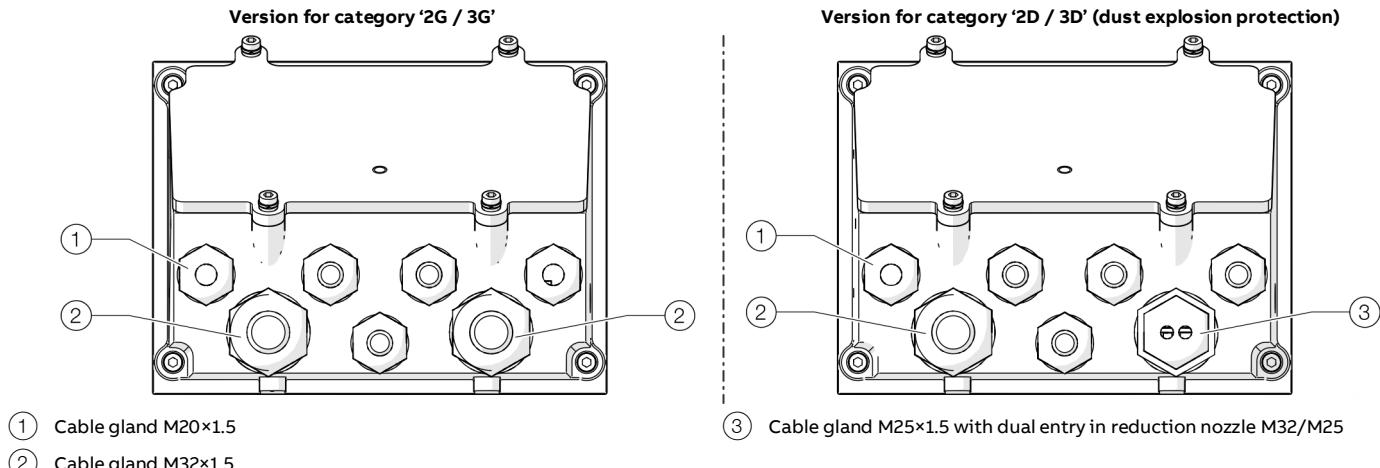


Image 12: Cable glands (view from below)

The electronics module connections are protected with a connection box.

Depending on the version of the instrument, the connection box is equipped with different cable entries:

- In the version for category '2G / 3G': five M20 and two M32 cable glands.
- In the version for category '2D / 3D': five M20, one M32 cable gland and a M25 cable gland with dual entry.

During installation, the clamping range for lines as well as the tightening torques of the cable glands must be observed. The cable glands have several gasket rings which need to be removed as needed depending on the cable diameter.

Cable gland	Clamping range for lines and tightening torque					
	Sealing ring 1+2+3		Sealing ring 1+2		Sealing ring 1	
M20x1.5	Ø 5.5 mm / 1.5 Nm	Ø 7.0 mm / 1 Nm	Ø 7.0 mm / 1.5 Nm	Ø 9.0 mm / 1.4 Nm	Ø 9.5 mm / 1.0 Nm	Ø 13 mm / 1.7 Nm
M32x1.5	—	—	Ø 14 mm / 3.0 Nm	Ø 17 mm / 4.0 Nm	Ø 17.5 mm / 1.5 Nm	Ø 21 mm / 1.3 Nm
M25x1.5	—	—	—	—	Ø 2x4.5 mm / 2.0 Nm	Ø 2x7 mm / 2.0 Nm
2-way						
Reduction nozzle	Tightening torque: 5 Nm					
M32/M25						

### Note

Only suited and cable glands and reduction nozzles approved for the Ex Zone may be used as spare parts.

- The use of other cable glands and blind plugs lead to a loss of Ex-approval!

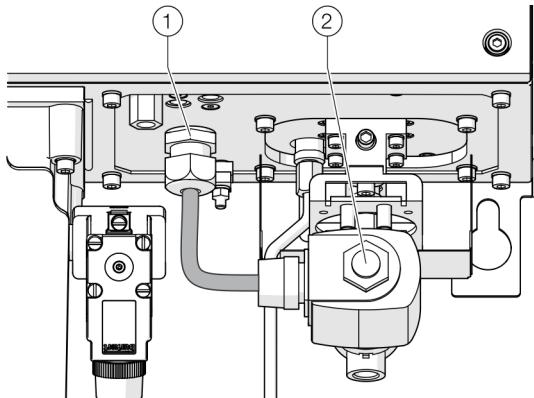
### Specifications for the selection of cable glands

Thread sizes in the connection box	M20x1.5; M32x1.5; M25x1.5 via reduction nozzles M32x1.5/M25x1.5
Sealing	Sealing through molded-on gasket ring on the contact surface of the cable gland
Maximum surface roughness of the connection box	max. Ra = 8 µm
Wall thickness range of the connection box	4 to 5 mm

## ... 8 Electrical connections

### ... Cable glands

#### Sample gas inlet valve



- (1) Cable gland M20x1.5  
 (2) Sample gas inlet valve

Figure 13: Cable gland sample gas inlet valve

During installation, the clamping range for lines as well as the tightening torques of the cable glands must be observed. The cable gland has several gasket rings which need to be removed as needed depending on the cable diameter.

#### Clamping range for lines and tightening torque

Sealing ring 1+2+3	$\varnothing 5.5 \text{ mm} / 1.5 \text{ Nm}$	$\varnothing 7.0 \text{ mm} / 1 \text{ Nm}$
Sealing ring 1+2	$\varnothing 7.0 \text{ mm} / 1.5 \text{ Nm}$	$\varnothing 9.0 \text{ mm} / 1.4 \text{ Nm}$
Sealing ring 1	$\varnothing 9.5 \text{ mm} / 1.0 \text{ Nm}$	$\varnothing 13 \text{ mm} / 1.7 \text{ Nm}$

#### Note

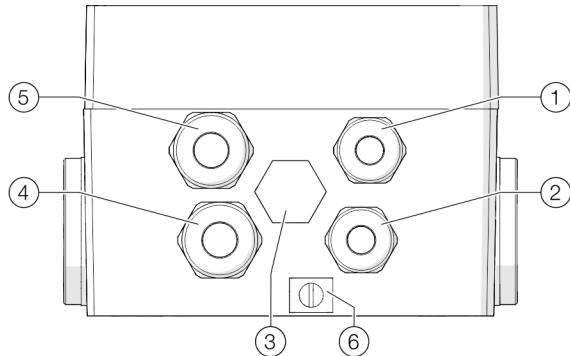
Only suited and cable glands and reduction nozzles approved for the Ex Zone may be used as spare parts.

- The use of other cable glands and blind plugs lead to a loss of Ex-approval!

#### Specifications for the selection of cable glands

Thread sizes	M20x1.5
Sealing	Sealing through molded-on gasket ring on the contact surface of the cable gland
Maximum surface roughness	max. Ra = 8 $\mu\text{m}$
Wall thickness range	4 to 5 mm

#### Purging and monitoring unit



- |     |  |     |   |
|-----|--|-----|---|
| (1) | Cable gland M16, blue<br>(intrinsically safe circuits) | (4) | Cable gland M16, gray<br>(power supply input)           |
| (2) | Cable gland M16, gray<br>(purging gas valve)           | (5) | Cable gland M16, gray<br>(power supply to gas analyzer) |
| (3) | Ex e blind plug  | (6) | Potential equalization PA                               |

Image 14: Cable glands (view from below)

Pos.	Clamping range	Tightening torque
(1)	4 to 8 mm	2 Nm
(2)	4 to 8 mm	2 Nm
(3)	—	4 Nm
(4), (5)	5 to 10 mm	3 Nm

#### Note

Only the cable glands and blind plugs listed below may be used as spare parts.

- The use of other cable glands and blind plugs lead to a loss of Ex-approval!
- The manufacturer information regarding installation and storage should be observed!

Pos.	Manufacturer, type	Manufacturer order number
(1)	Hummel, HSK-K-Ex-Active	1.292.1602.50
(2)	Hummel, HSK-K-Ex-Active	1.292.1601.50
(3)	Hummel, V-Ex Metr.	1.297.1601.50
(4), (5)	Hummel, HSK-K-Ex-Active	1.292.1611.50

## Terminal assignment

### Electronics module

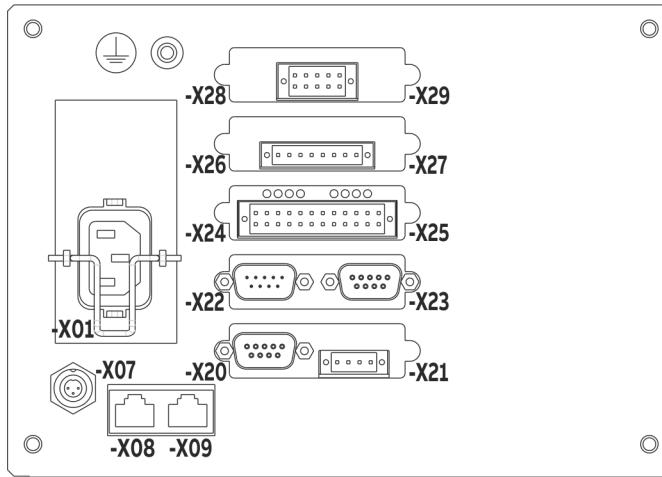


Image 15: Terminal assignment of electronic module (example)

Connection	Description
-X01	Power supply (refer to Connecting the power supply on page 52)
-X07	System bus (Not used with AO2040Fidas24 Ex)
-X08, -X09	Ethernet 10/100/1000BASE-T interfaces
-X20 to -X29	I/O modules (5 slots), options: <ul style="list-style-type: none"> <li>• Profibus-module (refer to PROFIBUS®-Module on page 41)</li> <li>• Modbus-module (refer to Modbus®-Module on page 42)</li> <li>• Analog output module (2 or 4-channel) (refer to Analog output modules on page 43)</li> <li>• Analog input module (refer to Analog input modules on page 44)</li> <li>• Digital-I/O-module (refer to Digital I/O module on page 44)</li> </ul>
	Connection for potential equalization (refer to Potential equalization on page 52)

The connection diagram shows an example for the equipment of the electronics module with I/O modules.

### PROFIBUS®-Module

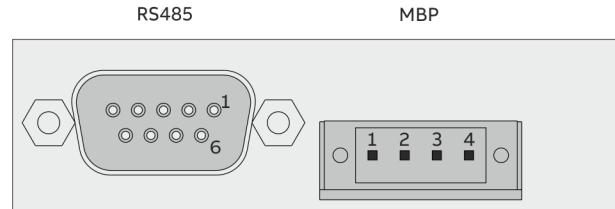


Image 16: PROFIBUS® module

### RS485 interface

Version: 9-pin sub-D female connector

Pin	Signal	Description
1	—	not assigned
2	M24	24 V output voltage, ground
3	RxD/TxD-P	Receive/transmit data plus, B-line
4	—	not assigned
5	DGND	Data transmission potential (Reference potential for VP)
6	VP	Supply voltage plus (5 V)
7	P24	24 V output voltage plus, max. 0.2 A
8	RxD/TxD-N	Receive/transmit data N, A-line
9	—	not assigned

### MBP Interface (not intrinsically safe)

Model: 4-pole plug-in terminal strip with mating connector (included in the scope of delivery).

Pin	Signal
1	+
2	Shield
3	-
4	not used

### Note

You will find detailed information regarding PROFIBUS® in the '30/24-315' technical information.

## ... 8 Electrical connections

### ... Terminal assignment

#### Note

The PROFIBUS® protocol is an unsecured protocol (in the context of IT or cyber security), therefore the intended application should be assessed before implementation, in order to ensure that the protocol is suitable.

#### PROFIBUS® plug

Due to the limited space available in the connection chamber, the PROFIBUS PA plug listed below must be used.

Manufacturer, type	Manufacturer order number
ERNI, ERbic PROFIBUS	366311

#### Note

The device must be de-energized before connecting the PROFIBUS plug (Sub-D).

#### Modbus®-Module

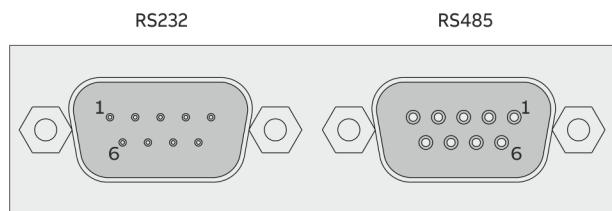


Figure 17: Modbus module

#### RS232 Interface

Version: 9-pin sub-D male connector

Pin	Signal
2	RxD
3	TxD
5	GND

#### RS485 interface

Version: 9-pin sub-D female connector

Pin	Signal
2	RTxD-
3	RTxD+
5	GND

#### Note

You will find detailed information regarding Modbus® in the '30/24-316' technical information.

#### Note

The Modbus® protocol is an unsecured protocol, as such the intended application should be assessed to ensure that these protocols are suitable before implementation.

## Analog output modules

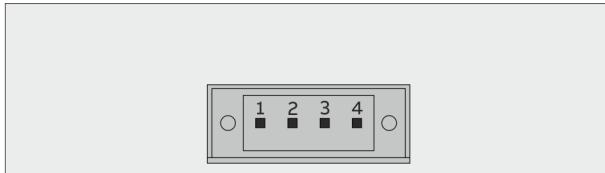


Figure 18: 2-way analog output module

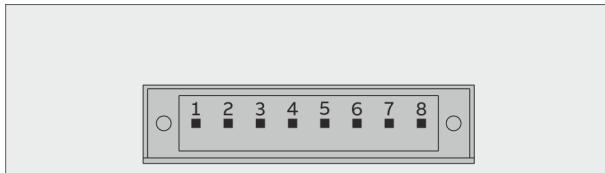


Figure 19: 4-way analog output module

Pin	Signal
1	AO1+
2	AO1-
3	AO2+
4	AO2-
5	AO3+
6	AO3-
7	AO4+
8	AO4-

### Analog outputs AO1 to AO4

0/4 to 20 mA (factory-set to 4 to 20 mA), common negative pole, electrically isolated from ground, freely connectible to ground, max. gain relative to protective ground potential 50 V, max. load 750 Ohm. Resolution 16 bit.

The output signal cannot be lower than 0 mA.

### Version

4-pole or 8-pole plug-in terminal strip with counter plug (included in the scope of delivery).

### Terminal assignment

An analog output is allocated in the sequence of the sample components for each sample component.

The sequence of the sample components is documented in the analyzer data sheet and on the name plate.

### Note

The allocation of the terminals can be changed in the configurator.

## ... 8 Electrical connections

### ... Terminal assignment

#### Analog input modules

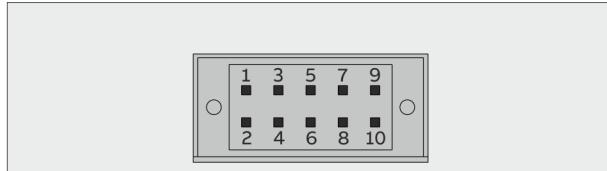


Figure 20: Analog input module

Pin	Signal	Description
1	AI1+	-20 to +20 mA, load 50 Ω,
2	AI1-	up to 10 V isolated from each other
3	AI2+	
4	AI2-	
5	AI3+	
6	AI3-	
7	AI4+	
8	AI4-	
9	+24 V	+24 V DC for supply of an external sensor, fused with
10	GND	100 mA (self-resetting fuse)

#### Design

2x5-pin terminal strip with mating connector (included in the scope of delivery).

#### Digital I/O module

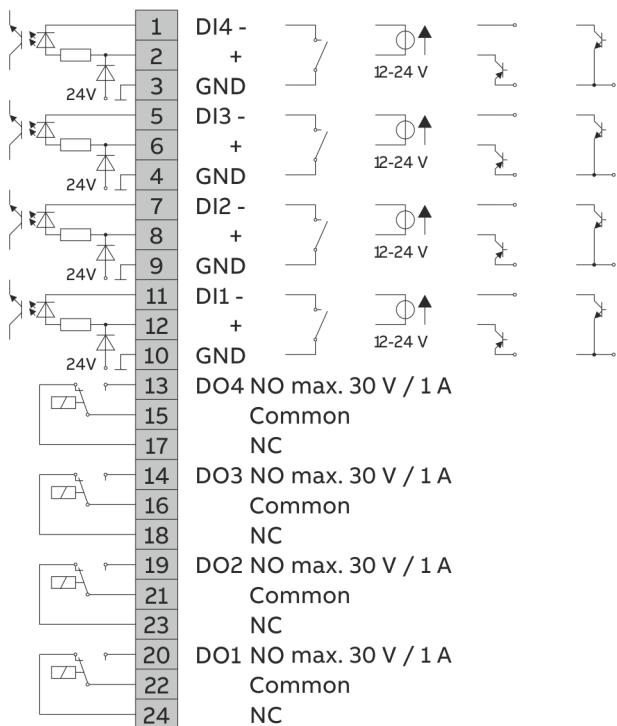
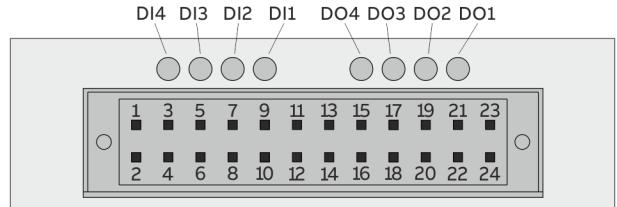


Figure 21: Electrical connections, digital I/O module

**Digital inputs DI1 to DI4**

Optocouplers with internal 24 V DC power supply. Control system alternatively available with potential-free contacts, with external voltage 12 to 24 V DC or with PNP or NPN open-collector driver.

**Digital outputs DO1 to DO4**

Potential-free changeover contacts, maximum contact load capacity 30 V/1 A.

Relays must at all times be operated within the specified data range.

Inductive or capacitive loads are to be connected with suitable protective measures (self-induction recuperation diodes for inductive loads and series resistors for capacitive loads).

Relays are shown in the unpowered state.

The unpowered state corresponds to the state in the event of a fault ("fail safe").

**Version**

2 × 12-pole plug-in terminal strip with mating connector (included in the scope of delivery).

## ... 8 Electrical connections

### ... Terminal assignment

Standard assignment of the digital inputs/outputs (I/O)

---

#### Status signals, externally controlled calibration:

Individual status signal:	Sum status signals:
DO1 Failure	Overall status
DO2 Function Check	Limitation
DO3 Maintenance Required	Limitation
DO4 External solenoid valve	External solenoid valve
DI1 Start auto-calibration	Start auto-calibration
DI2 Disable auto-calibration	Disable auto-calibration
DI3 Calibrate zero-point	Calibrate zero-point
DI4 Calibrate end-point	Calibrate end-point

#### Measurement range control

DO1 Measuring range feedback	
DO2	
DO3	
DO4	
DI1 Measuring range switch-over	
DI2	
DI3	
DI4	

#### Limit values

DO1 Limitation	
DO2 Limitation	
DO3 Limitation	
DO4 Limitation	
DI1 Calibration cells on/off	
DI2 Hold current output	
DI3 Pump on/off	
DI4 External failure	

#### Calibration control

DO1 External solenoid valve sample gas	
DO2 External solenoid valve zero gas	
DO3 External solenoid valve span gas	
DO4 External pump on/off	
DI1 Pump on/off	
DI2 External failure	
DI3 External failure	
DI4 External solenoid valve sample gas	

## Standard terminal connections

### Principles

The terminal connections are assigned as follows:

- in the order of the registered analyzer modules and
- in the order of the measuring components, within an analyzer module.

The sequence of the analyzer modules and sample components is documented in the analyzer data sheet and on the name plate.

Beginning with Analyzer Module 1 and Measuring Component 1, the input and output functions are distributed sequentially to the available free connections of the I/O modules (sockets **-X20 to -X29**).

### Profibus, Modbus

The socket for the optional Profibus module is always **-X20**, refer to **PROFIBUS®-Module** on page 41.

The socket for the optional Modbus module is **-X20**, or if there is also a Profibus module, **-X22**, refer to **Modbus®-Module** on page 42.

### Analog outputs

Analog outputs are available on the 2-channel analog output module or the 4-channel analog output module, refer to **Analog output modules** on page 43.

An analog output is allocated in the sequence of the sample components for each sample component.

### Limit value outputs

Limit value outputs are available on the digital I/O-module , with the following standard function block applications:

- Application “Status signals/ext. Calibration”,  
if the gas analyzer is set to total status when an analyzer module is installed.  
or
- Application “Limit values”

See **Digital I/O module** on page 44 and **Standard assignment of the digital inputs/outputs (I/O)** on page 46.

A limit is allocated in the sequence of the sample components for each sample component.

## ... 8 Electrical connections

### ... Terminal assignment

#### Standard Application Measuring Range Control

Measuring range control can be implemented for all sample components with more than one measuring range.

Each digital-I/O module contains:

- 4 digital inputs (DI) for switching the measuring range and
- 4 digital outputs (DO) for measuring range feedback.

Sample component with	Assignment	DI and DO configuration	
2 measurement ranges	1 DI and 1 DO	NO open:	Measuring range 1, Measuring range 2
3 measurement ranges	3 DI and 3 DO	NO closed:	active meas. range
4 measurement ranges	4 DI and 4 DO	NO closed:	active meas. range

The measuring range control is not installed across I/O modules.

#### Example:

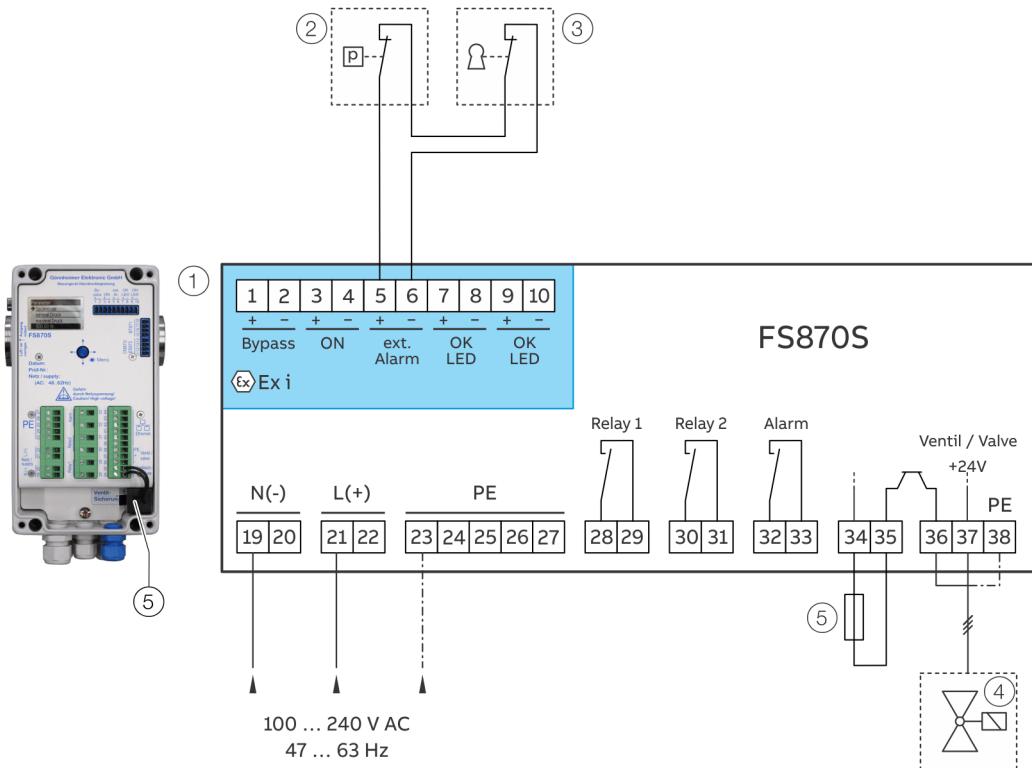
A gas analyzer contains 4 sample components with the following number of measuring ranges:

Sample components	Measurement range quantity
Sample component 1 (SC1)	3 measuring ranges (MR1, MR2, MR3)
Sample component 2 (SC2)	3 measuring ranges (MR1, MR2, MR3)
Sample component 3 (SC3)	2 measuring ranges (MR1, MR2)
Sample component 4 (SC4)	2 measuring ranges (MR1, MR2)

The following connection assignments result from this:

Allocation for 1. I/O module	Allocation for 2. I/O module
DI/DO 1: MK1: MB1	DI/DO 1: MK2: MB1
DI/DO 2: MK1: MB2	DI/DO 2: MK2: MB2
DI/DO 3: MK1: MB3	DI/DO 3: MK2: MB3
DI/DO 4: MK3: MB1, MB2	DI/DO 4: MK4: MB1, MB2

## Purging and monitoring unit FS870S



- ① Purging and monitoring unit FS870S
- ② Pressure switch for monitoring of the instrument air
- ③ Key switch for category 3D / 2D (Dc / Db)

- ④ Magnetic valve for the purging gas
- ⑤ Fuse for purging gas solenoid valve

Image 22: Purging and monitoring unit FS870S

### Note

The components ②, ③, ④, ⑤ as well as the power supply to the gas analyzer are pre-wired at the factory.

### Connections for power supply on the FS870S purging and monitoring unit

Terminal	Function/comments
19 / N	Neutral conductor
21 / L	Phase
23 / PE	Protective earth (PE)

### Relay output connections

Terminal	Function/comments
28 / 29	<b>Relay output 1 / 2</b> De-energize the gas analyzer, pre-wired at the factory
30 / 31	
32	<b>Alarm output</b> Potential-free relay output for external signal transmitter, maximum 235 V AC, 5 A

### Connections for intrinsically safe inputs/outputs

Terminal	Function/comments
1 / 2	<b>Not assigned</b>
3 / 4	<b>Not assigned</b>
5 / 6	<b>Input "Ext. Alarm"</b> Connected to the pressure switch internally, for monitoring of the instrument air supply. With devices for category 3D / 2D (Dc / Db), the additional key switch is also connected here.
7+ / 8-	<b>Not assigned</b>
9+ / 10-	<b>Not assigned</b>

## ... 8 Electrical connections

### Connecting the Signal Lines

#### Safety instructions

- Follow local regulations on installing and connecting electrical wiring.
- Lay the signal lines separately from the power supply lines.
- Lay analog and digital signal lines separately from each other.
- Label cables or counter plug so that they can be clearly allocated to the corresponding I/O modules.

#### Materials required (not included in the scope of delivery)

Refer to **Signal Lines** on page 21.

### Connecting the Signal Lines

1. Only for the system housing with a connection box:  
Feed the cables without connectors through the cable glands and strip the cable insulation over a length of approx. 20 cm.
  - M20 cable glands:  
Remove the plug from the insert; leave the ring in the gland to act as a seal and to provide strain relief.
  - M32 cable glands:  
Remove the plug from the gland. Feed the cable through the insert with holes from the accessory bag and close any free holes with dowel pins from the accessory bag.
2. Strip the cable ends and crimp the wire end ferrules.
3. Connect the cables to the opposite connectors, according to the connection diagrams of the I/O modules.
4. Connect the opposite connectors to the plug-in terminal strips on the I/O modules.

### Connecting the key switch

For the Category 3D/2D (Dc/Db) versions, an additional key switch must be installed by the operator.

The key switch is used to confirm the internal cleaning of the housing before commissioning (removal of dust deposits), and to enable purging of the housing.

The key switch must be installed close to the gas analyzer and clearly labeled as belonging to the gas analyzer.

The key switch is connected to the intrinsically safe line after preinstalled at the factory. The line is switched internally in series with the instrument air monitoring pressure switch and is connected to the 'Ext. Alarm' input of the purging and monitoring unit FS870S.

The key switch can be optionally ordered from ABB, for ordering information, see **Connecting the key switch** on page 50.

Alternatively, a suited key switch must be provided onsite by the operator.

#### Note

The optional key switch must be approved for use in the corresponding explosion protection zone.

#### Optional accessories on page 19

#### Electrical data (Ex-data)

The following maximum connection parameters must not be exceeded when connecting the key switch.

---

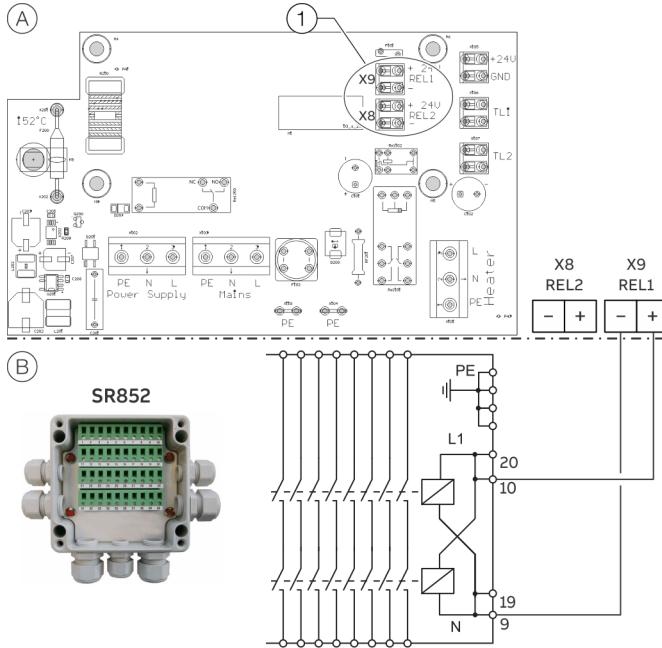
#### Input 'Ext. Alarm'

---

Maximum external inductivity	$L_O: 0.497 \text{ mH}$
Maximum external capacity	$C_O: 99.52 \text{ nF}$

---

## Connecting the interface relay



(A) Outputs for the interface relay

(B) Example connection for the interface relay SR852

(1) The terminals in the terminal compartment of the gas analyzer

Figure 23: External Interface relay (connection diagram, example)

The optional interface relay is used for isolating all of the poles on the operator's side (e.g. bus systems) which could remain live when the analyzer is disconnected from the power supply (e.g. due to a separate power supply).

### System bus, computer interfaces

Terminals	X9 (REL1), X8 (REL2)
Output Voltage	24 V DC
Maximum output current	0.27 A
Maximum output power	6.5 W
Short circuit protection	Self-resetting PTC fuse

\* The data specified applies to both outputs together!

### Electrical connection

Two 24 V DC outputs (X8, X9), for the control of the external interface relays, are located on the mains connection board, in the connection box of the gas analyzer.

- Designed for the interface relays with 16 contacts (24 V DC, 80 mA, 2 W) available from ABB as an accessory.
- The 24V control connections of the ABB interface relays can be set up as cascade relays (Terminals 19, 20).

### Note

The specified electrical data for the outputs may not be exceeded. This applies especially when connecting third-party relays and cascading relays.

## ... 8 Electrical connections

### Potential equalization

The electronic module and the analyzer modules each have a connection marked with the symbol , for connection to the equipotential bonding at the building.

The connection has a M5 female thread for screwing in suitable screws or terminals.

If required by the relevant installation regulations, the electronic module and each analyzer module must be connected to the building's equipotential bonding via this connection.

### Connecting the power supply

#### Protective lead connection

The protective lead (ground) should be attached to the protective lead connector before any other connection is 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.

#### Electrical data for the power supply

The power supply unit built into the system housing is used to supply the 24 V DC to the Fidas24 Ex module and the associated electronics with DC energy.

##### **Power supply (entire device)**

Input voltage	110 to 230 V AC, ±10 %
Input Current	Maximum 2.0 A
Line Frequency Range	50 to 60 Hz, ±3 Hz
Power consumption (entire device)	Maximum 200 VA
Output Voltage	24 V DC, ±3 % (for optional cut-off relay control)
Connection	At the corresponding terminals of the purging and monitoring unit, refer to <b>Purging and monitoring unit FS870S</b> on page 49.

#### Battery

##### Application

Supply to the built-in clock in case of a voltage failure.

##### Type

Lithium button cell 3 V CR 2032

##### Note

Only the original battery type may be used as a replacement:

- Varta CR 2032 type no. 6032 or
- Renata type no. CR2032 MFR

## 9 Commissioning

### Safety instructions

#### DANGER

##### Explosion hazard

There is a risk of explosion if the device is opened in a potentially explosive atmosphere.

Please take note of the following information before opening the device:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Turn off the power supply before opening the device, and observe a waiting period of 20 minutes, in order to allow any hot components to cool down.

#### NOTE

##### Damage to the gas analyzer

Damage to the gas analyzer, caused by the presence of condensate, dust or combustion gases in the sample gas lines during commissioning.

- Purge the sample gas path before commissioning (refer to **Purging the sample gas path** on page 56).
- Observe the condition of the sample gas inlet of the analyzer modules.

### 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.

### Connecting power supply lines

1. Ensure that the power supply feeder has an adequately dimensioned protective device (circuit-breaker).
2. Install an easily accessible supply circuit isolator or a switched socket in the power supply line, close to the device, so that all the poles of the device can be disconnected from the power supply if necessary.  
Label the supply circuit isolator to make it clear that it is associated with the device that needs to be isolated.
3. Connect the power supply to the corresponding terminals of the purging and monitoring unit FS870S.
  - The power supply line for the gas analyzer is already connected to the purging and monitoring unit at the factory.
4. If stipulated by the relevant installation regulations, connect the device to the building's potential equalization grounding system.

#### Note

The device can be put into operation as soon as it is connected to the power supply of the building.

### Connections for power supply on the FS870S purging and monitoring unit

Terminal	Function/comments
19 / N	Neutral conductor
21 / L	Phase
23 / PE	Protective earth (PE)

## ... 9 Commissioning

### Installation Check

#### **NOTICE**

##### Potential adverse effect on the IP rating

Yellow sealing plugs (transport protection) are applied to the gas connections on the analyzer and housing to secure them during transport. The yellow sealing plugs do not guarantee a sufficient IP rating.

- Remove the yellow sealing plugs before commissioning.
- Close unused gas connections with suited sealing plugs to guarantee the IP rating.

Before commissioning, check the installation of the gas analyzer, according to the following checklist.

Inspection	Additional Information	✓
Is the gas analyzer firmly mounted?	Refer to <b>Installation</b> on page 27.	<input type="checkbox"/>
Are all the gas lines connected correctly?	Refer to <b>Connecting the gas lines</b> on page 33.	<input type="checkbox"/>
Are all devices needed for gas conditioning, calibration and waste gas disposal correctly connected and ready for use?	—	<input type="checkbox"/>
Is the pneumatic shut-off valve (if present) correctly installed within the combustion gas line and has its functionality been checked?	Refer to <b>Shut-off valve in the combustion gas supply line</b> on page 24.	<input type="checkbox"/>
Have all the gas lines/gas connections (internal/external) been checked for seal integrity?	Refer to <b>Checking gas path leak tightness</b> on page 145.	<input type="checkbox"/>
Have all the signal, control and interface lines, the power supply lines and, if applicable, the system bus been correctly laid and connected?	Refer to <b>Electrical connections</b> on page 38.	<input type="checkbox"/>
Does the instrument air supply meet the quality requirements?	Refer to <b>Properties of the instrument air</b> on page 23.	<input type="checkbox"/>
Is the housing of the purging and monitoring unit FS870S closed properly, and have all cable glands been tightened and have the unused cable glands been sealed with dummy plugs?	—	<input type="checkbox"/>
Is the system housing closed properly, and have all cable glands been tightened and have the unused cable glands been sealed with dummy plugs?	—	<input type="checkbox"/>

**For Category 2G/2D versions, the following also apply:**

Inspection	Additional Information	✓
Are all externally connected input and output signals, which could remain live in the event of a power shutdown or failure of the pressurized enclosure, routed via an cut-off relay?	Refer to <b>Connecting the interface relay</b> on page 51.	<input type="checkbox"/>

**For Category 3D/2D (Dc/Db) versions, the following also apply:**

Inspection	Additional Information	✓
Is the key switch mounted and correctly connected to the intrinsically safe signal line designated for this purpose?	Refer to <b>Connecting the key switch</b> on page 50.	<input type="checkbox"/>
Is the purging air outlet of the purging and monitoring unit arranged in such a way that no dust can be stirred up?	Refer to <b>Connecting the purging air vent</b> on page 35.	<input type="checkbox"/>

## Information regarding the type of ignition protection “pressurized encapsulation – Ex p”

### Initial purging upon commissioning

The initial purging of the housing ensures that there is no explosive gas/air mixture inside the analyzer housing when the power supply is switched on.

The initial purging process is automatically controlled by the purging and monitoring unit FS870S.

- 1 As soon as the power and instrument air supply to the purging and monitoring unit has been set up, the initial purging process begins.
- 2 Once the initial purging process has been successfully completed and the specified internal housing pressure has been generated, the power supply to the analyzer is established and the analyzer commences the start routine.

### Special features of the design for Categories 3D/2D (Dc/Db)

The dust explosion protection version is also equipped with a key switch, to which the purging and monitoring unit is connected.

The operator must use this key switch to confirm that the interior of the housing has been cleaned of dust deposits before commissioning.

Otherwise, initial purging could stir up dust deposits inside the housing, creating a combustion atmosphere within

### PIN codes and purging parameters

#### NOTE

##### Loss of explosion protection approval

Loss of explosion protection approval, due to changes to the purging parameters that have been preset at the factory.

- The ex-works preset rinsing parameters must not be changed under any circumstances.

#### Note

The parameterization of the purging and monitoring unit is protected by PIN codes.

During commissioning, the PIN codes must be changed and documented by the operator. This ensures that only authorized persons are granted access to the parameterization of the purging and monitoring unit.

### PIN codes for the purging and monitoring unit FS870S

PIN code	Description	
<b>M-Code:</b> 0001	The M-Code allows writing access to the menu of the purging and monitoring unit.	
<b>By-Code</b> 0002	The By-Code allows the operator to bypass the pressurized enclosure. The gas analyzer can then be switched on, even when the housing is open.	
<b>E/A-Code</b> 0001	The E/A-Code enables one to switch the power supply of the gas analyzer on and off.	
<b>Request code</b> 1000	The request code allows reading access to the menu of the purging and monitoring unit.	

### Purging parameters of the purging and monitoring unit FS870S

#### Initial purging parameters

Min. initial purging volume	250 l
Min. through-flow for initial purging	0.3 l/s = 1080 l/h
Nominal flow rate for initial purging	1 l/s = 3600 l/h
Pre-adjusted working pressure	4 hPa

#### Operating parameters (continuous purging)

Purge gas	Air
Min. flow during operation	0.3 l/s = 1080 l/h
Nominal flow during operation	0.5 l/s = 1800 l/h
Nominal pressure during operation	2 hPa
Lower shut-off pressure during operation	0.8 hPa
Upper shut-off pressure during operation	15 hPa
Signal pressure during operation	< 1.5 hPa

## ... 9 Commissioning

### Commissioning of pressurized encapsulation

#### Note

If work has been carried out on gas-carrying components, the analyzer system must be rechecked for leaks.

Commission the pressurized encapsulation according to the following instructions:

1. Clean both the interior and the exterior of the gas analyzer system housing to remove any dust (only for Cat. 3D/2D, Dc/Db) and close it tightly with the 4 housing screws.
2. Switch on the instrument air supply and check the nominal pressure, in accordance with **Properties of the instrument air** on page 23.
  - With the purging air supply disconnected:  
Switch on the purging air supply and check the nominal pressure, in accordance with **Purging gas properties for pressurized enclosure (FS870S)** on page 23.
3. Switch on the power supply at the mains isolation device assigned to the gas analyzer.
  - The purging and monitoring unit will now perform a self-test. Thereafter, the inputs are checked for any pending errors.
  - Errors that might occur are an insufficient instrument air supply pressure or (if a key switch is present) no acknowledgement that the housing has been cleaned at the key switch.
4. Now confirm the cleaning of the system housing at the key switch (only for Cat. 3D/2D, Dc/Db). In order to do so, set the key switch to Position "I".
  - In the absence of errors, the purging and monitoring unit commences initial purging.
    - During initial purging, the purging and monitoring unit displays the remaining purging volume.
  - After successful initial purging, the purging and monitoring unit switches to operating mode and adjusts the purging air pressure and flow to the setpoints.
  - If the setpoints are stable, the power supply to the gas analyzer is opened and the gas analyzer begins with the startup procedure.

### Purging the sample gas path

Before the gas analyzer is commissioned the sample gas line must be purged, from the sampling point to the gas analyzer. This guarantees that the sample gas line is free of dust deposits and impurities, e.g. corrosive gases, during commissioning. This is also intended to prevent any potentially explosive gas / air mixture present in the sample gas line from igniting when the power supply is switched on.

For this purpose, the customer must install a T-piece in the sample gas line, close to the sample gas valve of the gas analyzer, since the sample gas valve is closed during initial purging.

#### Purge gas

Nitrogen or instrument air should be used as a purge gas. When purging with instrument air, 5 times the volume of the sample gas line must be purged to safely displace any potentially explosive gas / air mixture.

#### Purge time

The purging time depends on the purging gas flow rate and the volume to be purged (line length).

## Gas analyzer start-up

### Note

The power supply for the gas analyzer is switched on automatically once the pressurized encapsulation has been commissioned.

### Heating-up phase, connect supply gases

1. The following events will occur after the power supply is turned on:
  - The three LEDs "Power", "Maint" and "Error" light up.
  - The LCD indicator shows the individual phases of the starting procedure and the software version.
  - After a short time, the display changes to measuring mode, refer to **Measurement mode** on page 61.
2. Select the 'Controller values' menu item:  
'MENU / Diagnostic/Information / Module specific / Controller values'  
Under this menu item, both the actual and setpoint values and the manipulated variables of the internal temperature controllers are displayed:

**T-Re.D:** Detector temperature

**TR.VV1:** Temperature of the pre-amplifier

The temperature values increase slowly after activating the power supply.

3. Connect the supply of instrument air, combustion air and combustion gas ( $H_2$ ) When the instrument air is switched on, the air jet pump starts working immediately. The pressures that are set have not yet been regulated.  
First set the pressure to the values specified in **Operational gases** on page 23 by means of the respective external pressure regulator.
4. The 'Controller values' menu item also displays both the actual and set point values and the manipulated variables of the internal pressure controllers:

**C Air:** Combustion air pressure

**C Gas:** Combustion gas pressure ( $H_2$ )

**MGE:** Pressure at the sample gas nozzle

**MGA:** Pressure in the combustion chamber (output)

The following status messages are active during the heating-up phase:

5. During the heating phase, the following status messages are displayed:

Message	Description
Working temperature	the temperature of the detector has not yet reached the threshold.
Flame error	the flame has not yet ignited.
Temperature limit value 1, 2	The temperature of the detector ( <b>T-Re.D</b> ) exceeds or undercuts the upper or lower limit value 1 or 2.
Pressure limit value 1, 2	The pressure at one of the internal pressure controllers for instrument air ( <b>inlet, outlet</b> ), combustion air ( <b>air</b> ) or combustion gas ( $H_2$ ) is above or below the upper or lower limit value 1 or 2.

6. As soon as the temperature of the detector has reached the threshold value (150 °C), the external sample gas valve opens. The negative pressure regulation and the combustion air regulation attempt to adjust the pressures to the respective set point.  
When the external sample gas valve is opened, the sample gas begins to flow through the analyzer.
7. After the pressures have been adjusted to the respective set point, the respective solenoid valve in the analyzer automatically connects the combustion gas. The combustion gas regulation attempts to adjust the pressure to the set point.

**Adjust output variables of the internal pressure controllers**  
If the analyzer cannot be commissioned automatically with the pressure values specified in the device data sheet, the manipulated variables of the internal pressure controllers must be adjusted.

### Note

In order to bring the pressure regulators into a more favorable control range, the external supply pressures can be adapted with the aid of the manipulated variables. However, this should only be done once the flame has been ignited.

In general, this is not necessary.

8. Instrument air:

Use the external pressure regulator to set the controlled variable for **Outlet** to approx. 60 % (max. 70 %).

**Controlled variable too high** -> reduce pressure.

**Controlled variable too low** -> increase pressure.

(The controlled variable for "Inlet" depends on the sample gas flow rate.)

## ... 9 Commissioning

### ... Gas analyzer start-up

#### 9. Combustion air:

Use the external pressure regulator to set the control variable for "air" to approx. 55 % (max. 60 %).

**Controlled variable too high** -> increase pressure.

**Controlled variable too low** -> reduce pressure.

#### 10. Combustion air:

Use the external pressure regulator to set the manipulated variable for 'H<sub>2</sub>' to approx. 42 % (max. 52 %).

**Controlled variable too high** -> increase pressure.

**Controlled variable too low** -> reduce pressure.

### Igniting the flame

#### 11. Flame ignition is automatic.

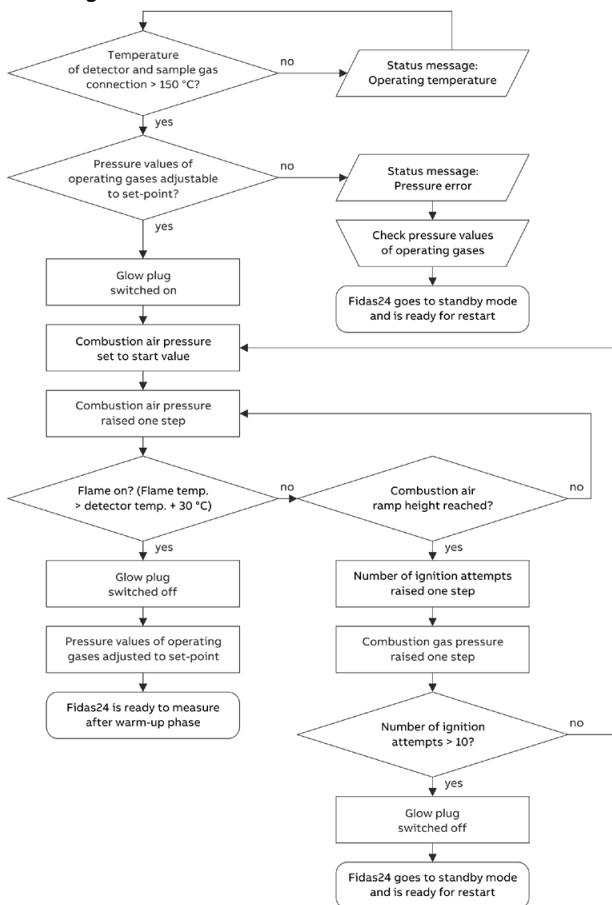


Image 24: Igniting the flame

Depending on the number of ignition attempts, flame ignition can take up to 10 minutes.

On initial commissioning of the gas analyzers, it may occur that, depending on the position of the combustion gas line, there is not sufficient combustion gas available to ignite the flame at first.

In this case, you need to go to the 'Standby/Restart FID' menu to restart the ignition of the flame, see **Fidas24 – Standby/Restart** on page 143.

The flame is considered to be 'on' when the flame temperature is above a determined threshold value. As long as the flame is not detected as 'on', the 'Flame-Error' error message is displayed in the status messages window.

The temperature of the flame is displayed under the 'Auxiliary raw values' menu item within the 'Flame' parameter.

With the ignition of the flame, the actual commissioning of the gas analyzers is ended.

#### Note

Unused sample gas lines and sampling probes may continue to emit hydrocarbons for an extended period after initial operation. As a result, the measured value drift after initial commissioning can exceed the measured value drift specified in the data sheet. Depending on the material, length of the sample gas line and sample probes as well as the selected measuring range, this time period can be up to a week.

## Warming-up phase

The duration of the warm-up phase of the Fidas24 Ex is usually  $\leq 2$  hours (at typical supply voltage and an ambient temperature of  $20^{\circ}\text{C}$ ).

### Note

- The warm-up phase may be prolonged if the gas analyzer has not yet reached room temperature before the power supply is switched on.
- During the warm-up phase, the measured values may be outside of the values specified in the data sheet.

### End of the warm-up phase

The warm-up phase is considered to be completed once the measured value drift has reached an acceptable value. This is dependent on the magnitude of the measuring range.

### Note

Unused sample gas lines and sampling probes may continue to emit hydrocarbons for an extended period after initial operation. As a result, the measured value drift after initial commissioning can exceed the measured value drift specified in the data sheet. Depending on the material, length of the sample gas line and sample probes as well as the selected measuring range, this time period can be up to a week.

### Ready for measurement

Once the warm-up phase is complete, the gas analyzer is ready to begin the measurement process.

When the minimum working temperature has been attained, the external sample gas valve opens automatically and allows the connection of the test or sample gas.

### Connecting the sample gas

The sample gas valve is automatically opened by the gas analyzer when the detector temperatures reaches  $150^{\circ}\text{C}$  and the sample gas is then sucked in.

## Check sample gas flow rate

The sample gas is supplied to the gas analyzer in depressurized state with an excess.

The sample gas flow rate then depends on the atmospheric pressure, length of the sample gas line and the pressure at the sampling point.

A sample gas flow rate of 80 to 100 l/h, with atmospheric pressure (1000 hPa) can be assumed.

The sample gas flow rate can be read off in the 'Diagnostic/Information / Module specific / Auxiliary raw values' menu.

### Checking the calibration

The gas analyzer is factory calibrated. However, transport influences as well as the pressure and temperature conditions at the installation site can influence the calibration.

It is therefore recommended that the calibration of the gas analyzer be verified at the installation site.

### Checking date and time

Setting the correct date and time is a prerequisite for the correct functioning of the automatic calibration and for the correct entry times of the status messages in the logbook.

1. Select menu item 'Date/Time':  
'MENU / Configure / System / Date/Time'
2. Check the date and time and correct as necessary.

### Note

The gas analyzer is set to the time zone GMT+1 at the factory.

# 10 Operation

## General

The AO2000 series gas analyzers have several user interfaces:

- The local operation user interface is the display and control unit on the gas analyzer ('local HMI').
- The remote operation user interface is a PC running the 'AO-HMI' software ('remote HMI'). For detailed information on remote operation, see the 'AO-HMI' technical bulletin.

### Note

The user interface is designated using the acronym 'HMI', which stands for 'human machine interface'.

### HMI priority

A gas analyzer (or more accurately an analyzer module) can only be operated via one HMI.

The password hierarchy controls which HMI has or retains priority for operation (refer to the following table).

As a rule, the HMI with the level  $n+1$  password has priority over an HMI with the level  $n$  password. An exception is the local HMI with level  $n$  password which has priority over a remote HMI with a level  $n$  password.

1st user:	2nd user:	
	Remote HMI receives ...	Local HMI receives ...
Remote HMI level $n$	Priority with level $n+1$	Priority with level $n$
Local HMI level $n$	Priority with level $n+1$	—

### Note

If a second user with an HMI receives priority over another HMI, all first user input not confirmed with the '**ENTER**' key is lost and processes in progress (e.g. calibration) will be stopped.

### Specifics for manual calibration

Manual calibration runs at level 0, thus no password is needed.

It is protected in the following manner from being stopped by another HMI.

On entering the **Calibrate** menu the level 1 password is automatically assigned.

Therefore, any other HMI must at least enter a level 2 password in order to assume priority for operation. In this event the calibration run would be stopped.

### Access lock

Independent of the user interface priority adjustment it is possible to completely lock the access to the operation of the gas analyzer from a certain user interface (HMI).

This lock is effected by configuration of the function block 'Access lock'.

The Technical Information 'Function Blocks – Descriptions and configuration' contains complete information on the individual function blocks.

### Access denied

When a user tries to operate the gas analyzer via a locked HMI, the following text is displayed after pressing the '**MENU**' key:

**ACCESS DENIED !**  
**The operation of the analyzer unit is not permitted at this time.**  
**Cancel: <BACK>**

### Access lock via password protection

As an alternative to the above-described complete access lock it is possible to inhibit entering the main menu and thus switching to the menu mode via password protection, see **Password protection** on page 67.

## LCD indicator

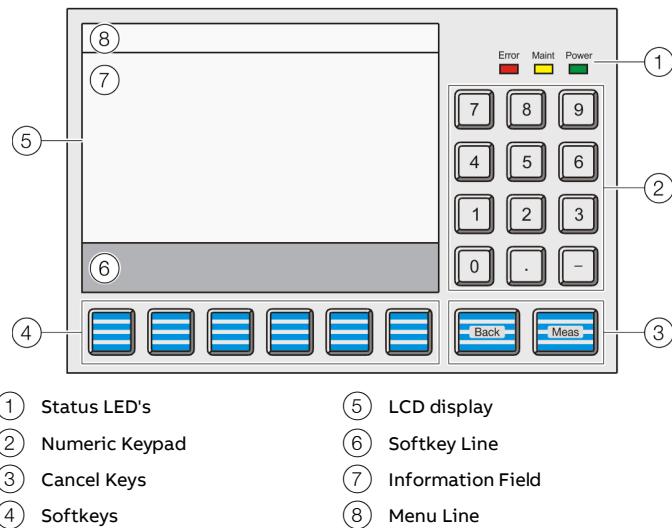


Figure 25: LCD indicator

The LCD indicator is located on the front face of the system housing.

### Menu levels of the LCD indicator

The LCD indicator operating modes have no effect on measurement operations, i.e. gas analyzer measurement functions continue while in menu mode.

#### Measurement mode

In the measurement mode the LCD display shows the actual process values.

#### Menu mode

In menu mode the LCD display shows the menu or individual menu items or parameters with the applicable values, as well as operator prompts.

### LCD display

The backlit graphics has a 320 x 240-pixel resolution.

The screen is divided into three panels:

- Menu line
- Information field
- Softkey line

#### The menu line

The menu line appears at the upper edge of the screen. A line separates it from the information field.

It shows the current menu path and thus allows the operator to see where the system is in the menu tree. Additionally it shows the name of the analyzer being processed.

#### The information field in measurement mode

In the measurement mode the information field shows the following information for each active sample component in the analyzer modules installed in the gas analyzer:

- Values in numeric form and as a bar graph
- The physical unit for the measured value
- The measurement component designation
- The measurement range lower and upper limit values on the horizontal bar graph
- The analyzer type
- The analyzer name

Values from up to six sample components can be displayed simultaneously.

It is user-configurable which measurement values are shown on the screen and at which positions on the screen the measurement values are displayed.

## ... 10Operation

### ... LCD indicator

In addition, the user can configure display elements that allow to:

- Enter values, see **Value Input** on page 103.
- Actuate keys, see **Key Entry** on page 105.

#### Note

For further information about the screen in the measurement mode refer to **LCD display** on page 97.

#### The information field in menu mode

In menu mode the information field contains the menu or individual menu items or parameters with the applicable values, as well as operator prompts.

#### The softkey line

The softkey line appears at the lower edge of the screen. Its gray background distinguishes it from the information field.

The softkeys are further explained in **Softkeys** on page 63.

#### Display of status messages

The softkey line also displays messages from the gas analyzer.

The blinking message display in the softkey line has the following functions:

- It prompts for the '**STATUS MESSAGE**' key to be pressed whenever a status message is pending.
- It shows that a password is active.
- It shows that the gas analyzer is being controlled from a remote HMI.
- It shows that an automatic calibration process is running in the gas analyzer.

#### Display of status messages

When a status message is generated by the 'Message insert' function block its short text is displayed on the message display as configured in the function block.

The Technical Information 'Function Blocks – Descriptions and configuration' contains complete information on the individual function blocks.

#### Status LEDs

The three LEDs next to the screen show the user the gas analyzer's status.

Status LED	Description
Power	The green 'Power' LED lights when the power supply is on. 
Maint	The yellow 'Maint' LED lights when the 'Maintenance request' status signal is active. 
Error	The red 'Error' LED lights when the 'Failure' status signal or the overall status signal is active. 

#### Note

For detailed information on status messages and status signals refer to **Display of status messages** on page 62.

## Numeric keypad

The numeric keypad is located to the right of the screen, under the status LED's.

### Numerical entry

Numerical values can be entered directly with the numeric keys '0' to '9', the decimal point key '.' and the minus sign '-'.

#### Examples:

Test gas concentration, Date and time, Air pressure, Password

### Note

Any digits displayed cannot be overwritten directly. They must be deleted with the '**BACKSPACE**' or '**CLEAR**' key before new digits can be entered.

### Entering text with the numeric keypad

The numeric keypad is also used to enter texts, such as sample component or user names.

Refer to **Entering text** on page 64.

### Cancel keys

The '**Back**' and '**Meas**' buttons located under the numeric keypad are designated as cancel keys.

Button	Description
 Back	<p>The '<b>Back</b>' key allows the operator to cancel a function or menu item and return to the previous menu level.</p> <p>Only entries confirmed with the '<b>ENTER</b>' softkey are stored; unconfirmed items are not accepted.</p> <p>The '<b>Back</b>' button also allows the operator to clear gas analyzer help text and messages.</p>
 Meas	<p>The '<b>Meas</b>' button allows the operator to cancel a function or menu item and to return to the measured value display in measurement mode.</p> <p>Only entries confirmed with the '<b>ENTER</b>' softkey are stored; unconfirmed items are not accepted.</p>

### Note

The gas analyzer automatically reverts to the measurement mode to display values if the operator has not pressed a key in menu mode in the last five minutes ('time out').

## Softkeys

The six buttons under the screen and the softkey line at the lower edge of the screen are known as softkeys.

- A softkey is the combination of the button and its designation in the softkey line.
- A softkey does not have any set function, but is assigned a function for a given situation as shown in the softkey line of the screen.
- Pressing a softkey is the equivalent of pressing the button assigned to the function; this process is illustrated by the quasi-three-dimensional softkey representation on the screen.
- Softkeys are also called buttons in this operating instruction.

### Softkeys in Measurement Mode

In measurement mode, the softkey line contains the '**MENU**' and '>>' softkeys. The '**STATUS MESSAGE**' softkey also appears if an error occurs.

Softkey	Description
 MENU	The ' <b>MENU</b> ' button is used to call up the main menu and switch to menu mode when in measurement mode.
>> softkey icon" data-bbox="512 491 575 521"/> >>	The '>>' button allows the operator to scroll to the next display page.
> softkey icon" data-bbox="512 531 575 561"/> >	This button only allows forward scrolling.
 STATUS MESSAGE	<p>The '<b>Back</b>' button is used for backward scrolling.</p> <p>The '<b>STATUS MESSAGE</b>' button is displayed in measurement mode if the 'Failure' or 'Maintenance Req.' status is pending.</p>
	<p>This button allows the operator to call up the status message summary and view the status messages.</p> <p>The user can also call up a detailed display for any message in the log.</p> <p><b>Note</b></p> <p>For detailed information on the possible status messages and status signals, see <b>Display of status messages</b> on page 62.</p>

## ... 10Operation

### ... LCD indicator

#### The Softkeys in Menu Mode

In menu mode, a series of softkeys appears on the softkey line, whose labeling and therefore function change based on the situation.

Their descriptions and functions depend on the specific situation.

Softkey	Description
	The operator uses the arrow keys to move the selection cursor up or down, e.g. in menus or lists to choose vertically arranged entries.
	The selected entry is reversed, i.e. appearing as bright characters on a dark background.
	The operator uses the arrow keys to move the selection cursor left or right, e.g. into or out of a submenu or to select entries arranged next to each other.
	The selected entry is reversed, i.e. appearing as bright characters on a dark background.
<b>BACK-SPACE</b>	The operator can use the ' <b>BACKSPACE</b> ' button to delete characters to the left of the cursor (as on a PC keyboard).
<b>CLEAR</b>	The operator can use the ' <b>CLEAR</b> ' button to delete all characters in a selected field.
<b>ENTER</b>	The operator can use the ' <b>ENTER</b> ' button to call up menu items for editing, trigger functions, confirm inputs, e.g. parameterization. The ' <b>ENTER</b> ' button is always at the right margin of the softkey line.
<b>HELP</b>	The operator can use the ' <b>HELP</b> ' button to access context-sensitive help. The screen will then show a help message explaining the menu item selected. The operator can use the ' <b>Back</b> ' button to clear the help text.

#### Presentation of entries in this Operating Instruction

In this operating instruction, entries to be made by the operator will not be identified by key symbols but by the following type styles (these are examples only):

Press cancel keys:

**'Back', 'Meas'**

Press softkeys:

**'MENU', 'HELP', 'ENTER', 'BACKSPACE'**

Select menu items:

**'Calibration Data', 'Configure'**

Enter numbers:

**'0' to '9'**

#### Entering text

When text, such as sample components or user names, needs to be entered, the keyboard layout of the numeric keypad appears on the screen.

The following characters are shown using a total of four pages:

- Letters A to Z and a to z
- Special characters \* ( ) % & : < > / and spaces
- Digits 0 to 9

Each character is accessed using the button in the corresponding position on the keyboard layout of a button of the numeric keypad.

Examples:

Letters:	A	L	t	Blank or space character
Button:	7	-	2	9

An input line appears at the lower edge of the screen for new text to be entered or existing text to be modified.

Text is entered and modified in two ways:

- The operator enters text in input mode.
- The operator modifies already entered text in edit mode.

#### Softkeys in input mode

The softkeys in the input mode have the following functions:

Button	Description
<b>PREV PAGE</b>	The ' <b>PREV PAGE</b> ' and ' <b>NEXT PAGE</b> ' buttons allow the operator to move to the previous or next keypad page.
<b>NEXT PAGE</b>	
<b>CAPS</b>	The ' <b>CAPS</b> ' button allows the operator to switch between uppercase and lowercase letters.
<b>EDIT</b>	The ' <b>EDIT</b> ' button allows the operator to switch into the edit mode.

## Softkeys in Edit Mode

The softkeys in the edit mode have the following functions:

Button	Description
<	The two arrow keys allow the operator to move the cursor left and right in the entry line.
>	
BACK-SPACE	The operator can use the 'BACKSPACE' button to delete characters to the left of the cursor (as on a PC keyboard).
INPUT	The 'INPUT' button allows the operator to switch to entry mode.

## Selecting and changing parameters

### Value Input

Numeric and alphanumeric parameter values can be entered directly via the keyboard using the value input.

Numbers on the keyboard are assigned to the individual parameters; the assignment is specified above the respective parameter (e.g.: 'Press key <4>').

The parameter is called up for editing by pressing the assigned number key.

### Example

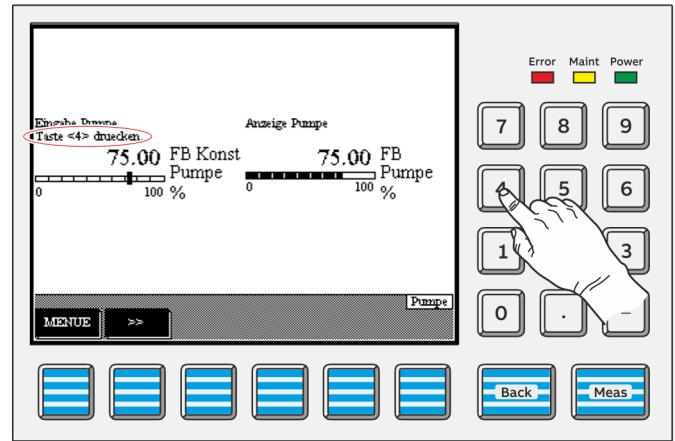


Figure 26: Select parameters (Example)

1. Press the '4' button to call up the parameter for editing.

## ... 10 Operation

### ... Selecting and changing parameters

- The LCD display will now display an entry field to change the parameter value.

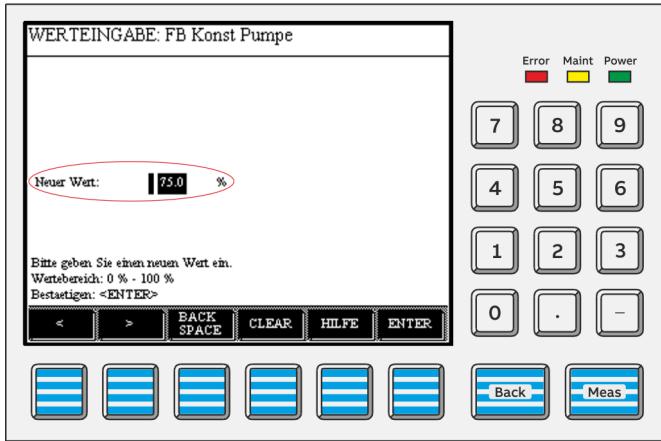


Figure 27: Change parameter value (Example)

- Enter the new value using the numeric keypad and then press the 'ENTER' to accept it.

#### Setup

The value input can be configured individually on the user pages, for detailed information, see **Value Input** on page 103.

#### Key Entry

Using the key entry, preset parameter values can be selected directly using the softkeys.

Numbers on the keyboard are assigned to the individual parameters; the assignment is specified above the respective parameter (e.g.: 'Press key <4>').

The parameter is called up for editing by pressing the assigned number key.

#### Example

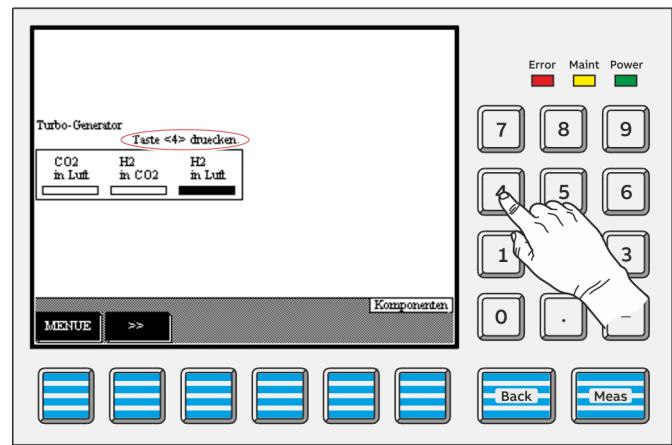


Figure 28: Select parameters

- Press the '4' button to call up the parameter for editing.

- The LCD display now shows the softkeys for selecting the parameters for changing the parameter value.

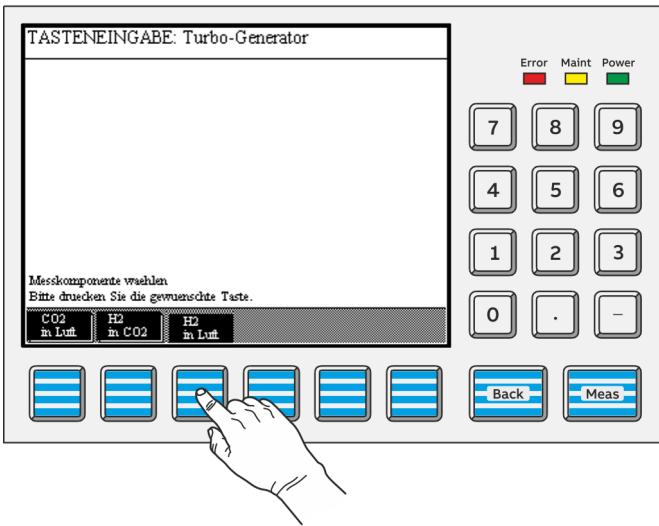


Figure 29: Select parameter value

- Select the new value using the corresponding softkey.

#### Setup

The key entry can be configured individually on the user pages, for detailed information, see **Key Entry** on page 105.

## Password protection

Password protection consists of three elements:

- Password level,
- User group and
- Password.

### Password level

Each menu item is assigned a password level. Password levels are numbered 0, 1, 2 and 3.

Menu items are assigned to different password levels in order to assure that specific menu items can only be changed by authorized users.

### User Group

The definition of a user group is that every user that belongs to it has access entitlement at certain password levels, i.e. the user can make changes to the menu items at these levels.

### Password

#### NOTICE

##### Damage to the configuration of the gas analyzer.

After entering the password for password level 3, you can access all of the function block applications!

- Make sure that changes in password level 3 are only made by appropriately trained personnel.

### Note

The 'Function Blocks – Descriptions and Configuration' Technical Information contains complete information on the 'Function Block' concept as well as detailed descriptions of the individual function blocks.

Every user group set-up in the system has a password. The password consists of six digits which can be entered via the numeric keypad.

## ... 10Operation

### ... Password protection

#### Factory setting

User Group	Access to password level	Password
Every user	0	None
Maintenance team	0, 1	471100
Specialist team	0, 1, 2	081500
Function block specialist	0, 1, 2, 3	325465

#### Viewing Menu Items

All users can view all menu items, regardless of password level, without the need to enter a password.

#### Changing Menu Items

All users can make changes to password level 0 menu items without entering a password.

The user can only make changes to menu items in password levels **1, 2 and 3** if the required password has been entered.

#### Note

Entering the main menu and thus switching to the menu mode can be password protected, refer to **Access lock** on page 60.

#### Duration of the change privilege

The change privilege therefore refers to the limited authorization to make changes to the menu items. By contrast, the access right designates the principle authorization defined per configuration to make changes to the menu items at certain password levels.

After entering the password, the user is authorized to make changes to any menu items on all password levels accessible at the user's level.

The change privilege remains in place until

- either the gas analyzer automatically switches to measuring mode if the user does not actuate a button for about five minutes ('time-out'),
- or the user presses the '**MEAS**' key twice in a row.

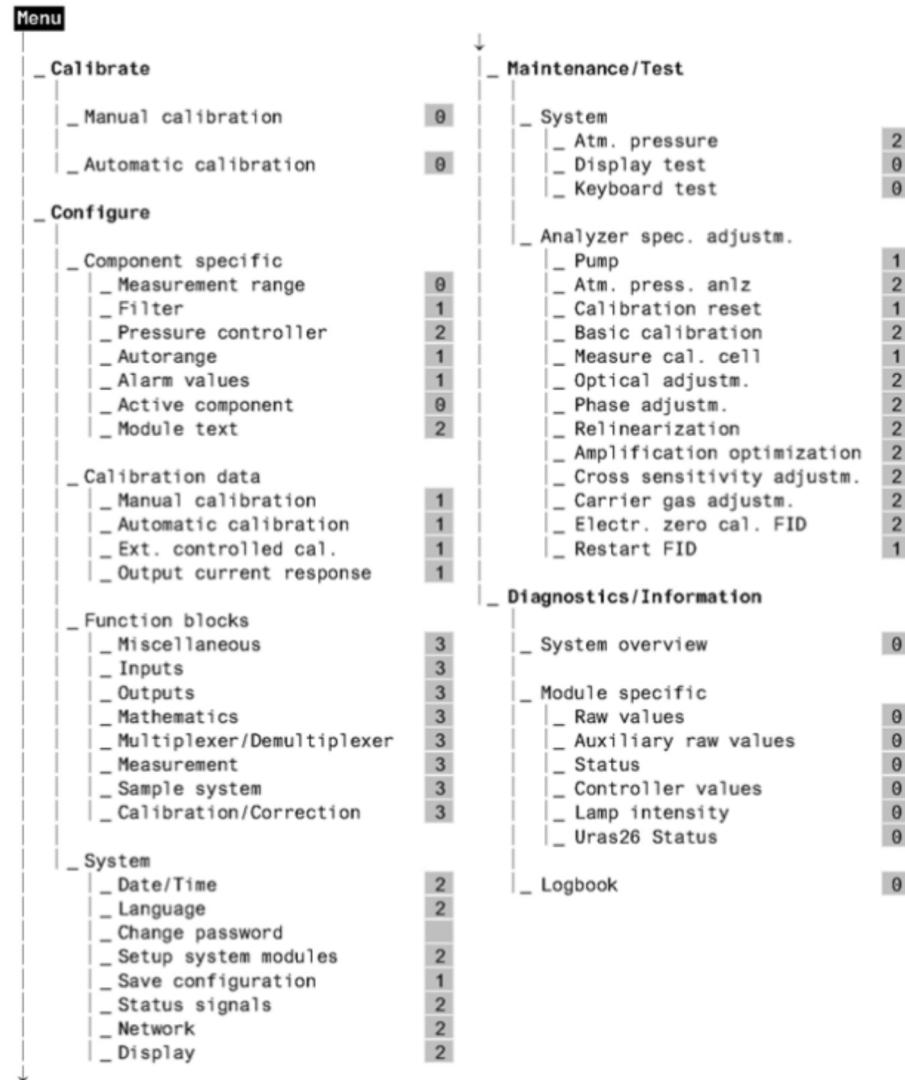
If the user presses the '**MEAS**' key only once to switch back to measuring mode, the change privilege initially remains in place. This is signaled by the flashing 'Password active' message display.

In this way, the user does not need to enter the password again before changing the menu items when switching back to menu mode within the following approx. five minutes.

#### Change password

Refer to **Change password** on page 86.

## Menu structure



For reasons of clarity, only the suitable parameters and functions are presented; the menu links onward at most menu items, e.g. to the various sample components or to the selection and settings of values.

Some menu items are analyzer-specific; they only appear if certain analyzer modules are built into the gas analyzer.

For 'Function blocks' submenu, see '**Function blocks' submenu**' on page 84.

For 'Calibration Data' submenu, see **Calibration** on page 107.

### Password levels

For every menu item, it is stated in the overview at what password level (0, 1, 2, 3) the menu item is found.

For some menu items, individual sub-menu items are at a higher password level. These are, in particular, sub-menu items in which accessing functional block applications is possible.

### Note

The 'Change password' menu item is not located at a specific password level. To change a password, the current password for this password level must be entered.

## 11 Configuration

### Sample component functions

#### Switch measuring range

##### Menu Path

'MENU / Configure / Component specific / Measurement range( / select component) / ...'

##### Selection

Displayed are all measuring ranges configured (at the plant) for a measured component.

##### Procedure

Select the measuring range with the arrow keys and press **ENTER** to confirm.

##### Note

The measuring range chosen is shown in the LCD display after switching to measuring mode.

#### Changing Measuring Range Limits

##### Menu Path

'MENU / Configure / Component specific / Measurement range( / select component) / ...'

##### Selection

Displayed are all measuring ranges configured (at the plant) for a measured component.

##### Procedure

Select measuring range using the arrow keys, press **CHANGE LIMITS**, **ZERO LIMIT** or select **SPAN LIMIT**, change the measuring range limit and confirm by selecting **ENTER**.

##### Note

For the automatic measuring range switching (see **Automatic measuring range switching** on page 72) to work smoothly, the measuring ranges MB1, MB2, ... need to be configured in ascending order, i.e. MB1 < MB2 < ....

The changed measuring range limits are shown in the LCD display after switching to measuring mode.

##### Measures after changing the measuring range limits

After changing the measuring range limits, the calibration of the relevant measuring range needs to be verified. If the relationship of the old to the new measuring range is  $\geq 1:10$ , we recommend that you calibrate the end point manually (see **Calibrate the gas analyzer** on page 122).

After changing the measuring range limits, the parameters of the automatic measuring range switching (see **Automatic measuring range switching** on page 72) should be verified.

## Change number of decimal places

### Menu Path

'MENU / Configure / Component specific / Measurement range( / select component) / ...'

### Selection

Displayed are all measuring ranges configured (at the plant) for a measured component.

### Procedure

Select measuring range using the arrow keys, press **CHANGE PLACES** and set the number of decimal places with the arrow keys and confirm by selecting **ENTER**.

### Note

- The setting only affects the display of the measured values in the LCD display.
- The number of decimal places cannot be increased.
- The changed number of decimal places is displayed after switching to measurement mode in the display.

### Number of decimal places

When displaying the measured value in physical units (such as ppm), the number of decimal places depends on how large the span of the set measuring range is:

Measuring span	Decimal places
≤ 0.05	5
≤ 0.5	4
≤ 5	3
≤ 50	2
≤ 500	1
> 500	0

For the display of the measured value in % of the measuring range scope (%Span), two decimal places are always displayed. The number of decimal places when setting the parameters is the same as in the display in measuring mode.

## Add measuring range

### Menu Path

'MENU / Configure / Component specific / Measurement range( / select component) / ...'

### Selection

Displayed are all measuring ranges configured (at the plant) for a measured component.

If the entry "Free" appears in the list, a measuring range can be added to the configuration of the sample component. To this end, the **NEW RANGE** softkey is displayed.

### Note

If the adding of measuring ranges for the configuration of the gas analyzer was blocked using the TCT Test and Calibration software, the 'Free' entry does not appear, even if fewer than the 4 maximum measuring ranges possible are displayed.

### Procedure

- Press **NEW RANGE**.
- Confirm the safety prompt by pressing **NEW RANGE**, enter password (level 1) if needed.  
Instead of the 'Free' entry, a new measuring range is displayed in the list.
- If needed, press **CHANGE LIMITS**, call up the menu to change the measuring range limits and change the limits of the measuring range added, see **Limit Value Monitor Parameterization** on page 73.
- If needed, press **CHANGE PLACES**, call up the menu to change decimal places and change the number of decimal places of the measuring range added.

## ... 11 Configuration

### ... Sample component functions

#### Delete measuring range

##### Menu Path

'MENU / Configure / Component specific / Measurement range( / select component) / ...'

##### Selection

Displayed are all measuring ranges configured (at the plant) for a measured component.

If a measuring range can be deleted from the configuration of the sample components, the **DELETE RANDE** softkey is displayed.

##### Note

The option to delete measuring ranges can be locked when configuring the gas analyzer via the TCT test and calibration software.

The active measuring range (in which measurement is currently being performed) as well as the measuring ranges of the calibration method currently active cannot be deleted.

##### Procedure

1. Press **DELETE RANDE**.
  2. Confirm the safety prompt by pressing **DELETE RANDE**, enter password (level 1) if needed.
- The 'Free' entry is displayed in the list instead of the deleted measuring range.

#### Automatic measuring range switching

##### Menu Path

'MENU / Configure / Component specific / Autorange / (select component) / ...'

##### Note

The automatic measuring range switching works only perfectly if the measuring ranges MB1, MB2, ... have been configured in ascending order, i.e.  $MB1 < MB2 < \dots$  (see page **Changing Measuring Range Limits** on page 70).

##### Lower threshold, upper threshold

When reaching the values set here for the lower threshold – in % of the span of the current measuring range – the analyzer module automatically switches to the next smaller measuring range. When reaching the values set here for the upper threshold – in % of the span of the current measuring range – the analyzer module automatically switches to the next larger measuring range.

##### Note

The values of the upper and lower thresholds need to be chosen such that the gas analyzer does not constantly switch between two measuring ranges (see also example below).

##### Assigned measuring ranges

The measuring ranges, which are to be included in the automatic measuring range switching, can be parameterized. The number of offered measuring ranges depends on the analyzer module.

##### Note

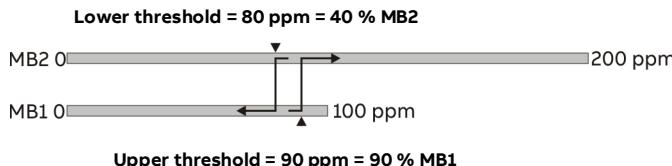
The parameter cannot be chosen if the analyzer module has only two measuring ranges, as they are always included in the automatic measuring range switching.

**Status**

Automatic measuring range switching can be activated or deactivated.

**Example for Auto-Ranging**

Measuring range 1: 0...100 ppm, measuring range 2: 0...200 ppm  
 Lower threshold = 80 ppm = 40 % MB2,  
 Upper threshold = 90 ppm = 90 % MB1

**Procedure**

Parameter	Range	Action
<b>Lower limit:</b>	0 to 100%	Set
<b>Upper limit:</b>	0 to 100%	Set
<b>Assigned ranges:</b>	MB1, MB2, MB3, MB4	Select
<b>Status</b>	on or off	Select

**Limit Value Monitor Parameterization****Menu Path**

'MENU / Configure / Component specific / Limit values / Limit monitor / ...'

**Selection**

All available limit value monitors are shown.

**Procedure**

Parameter	Explanation	Action
<b>Direction</b>	< = Alarm when falling below the limit or > = Alarm when exceeding the limit	Select
<b>Limit</b>	in physical units	Set
<b>Hysteresis</b>	in physical units	Set

**Standard configuration**

As a rule, limit value monitoring for those measured components to be measured by the gas analyzer is factory-set. This requires that there be enough digital outputs on the I/O modules to handle the number of sample components.

**Note**

Limit value monitors are factory-set or user-configured Limit monitor type function blocks.

The Technical Information "Function Blocks Descriptions and Configuration" contains complete information on the individual function blocks.

## ... 11 Configuration

### Filter parameterization

#### Menu Path

„MENU / Configure / Component specific / Filter / select component / ...“

#### Range

0 to 60 seconds

#### Procedure

Parameter	Explanation	Action
<b>T90</b>	Low-pass time constant	Set
Non-linear filter:		
<b>T90-1</b>	Low-pass time constant for constant measured value	Set
<b>T90-2</b>	Low-pass time constant for changes in measured value	Set
<b>Threshold</b>	Switching threshold. When up-scaled, T90-2 becomes effective	Set

#### Non-linear filter

For the non-linear filter, it makes sense to set  $T90-2 \leq T90-1$  einzustellen.

The switching threshold (in %) usually refers to the highest measuring range set (reference measuring range).

Setting recommendations:

- **Fidas24:**

$T_{90-1} = 20 \text{ s}$ ,  $T_{90-2} = 1 \text{ s}$ , Switching threshold = 0.001 %

#### Active component selection

#### Menu Path

‘MENU / Configure / Component specific / Active component’

#### Active component

With the Fidas24 analyzer module, several measured components can be configured; however, only one measured component is measured and displayed.

#### Procedure

Select the active component with the arrow keys and press **ENTER** to confirm.

Subsequently, select the ‘Measurement range’ menu item in the same menu and select the measuring range for the just selected active component.

#### Note

The selected active component and measuring range are shown on the screen after switching to measurement mode.

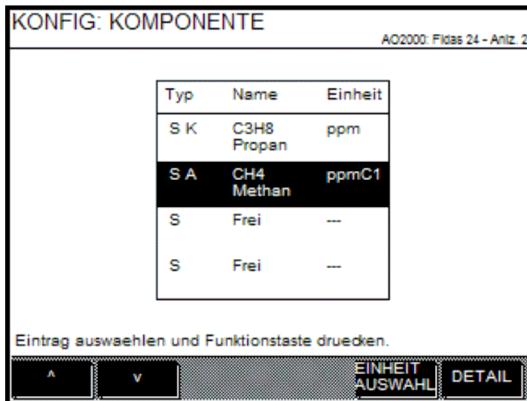
## Configuring a Component

### Menu Path

'MENU / Configure / Component specific / Active component'

After the component is selected, use the **COMP. CONFIG** to call up the 'CONFIG.: COMPONENT' menu.

### Display



All the components of a detector are listed in this menu ('component list').

The following information is displayed for each component:

Type	<b>S</b>	System component = a component configured at the factory
	<b>S A</b>	Active, i.e. system component currently being measured
	<b>S K</b>	System component used for calibration
	<b>B</b>	User component = a component configured by the user
	<b>B A</b>	Active, i.e. user component currently being measured
	<b>B K</b>	User component used for calibration
Name	<b>above</b>	Name of the component in the measured value display, e.g. total formula
	<b>below</b>	Full name of the component
Unit		The physical units used for readout values

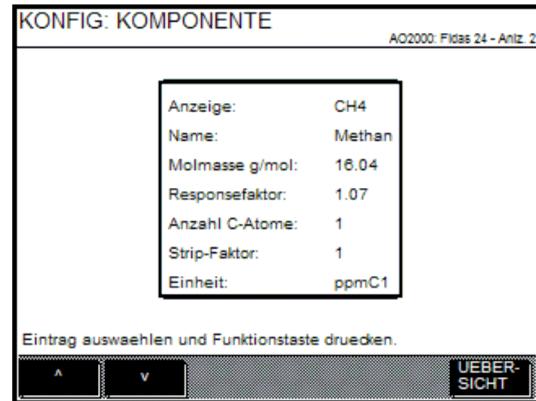
If not all four possible components of the detector are configured, the 'Free' entry appears in a position on the list.

### Softkeys

The following softkeys are displayed in the menu depending on which options for display or configuration of a particular component are available:

Softkey	Description
<b>DELETE COMP</b>	The component can be deleted, see page 80.
<b>CHANGE COMP</b>	The configuration of the component can be changed, see page 78.
<b>NEW COMP</b>	A new component can be added, see page 76.
<b>SELECT UNIT</b>	The physical unit used for the measured value display can be changed.
<b>DETAIL</b>	The detailed display, i.e. a separate window with a detailed list of the component data, is opened (see below).
<b>OVERVIEW</b>	The detailed display is closed.

### Detailed Display



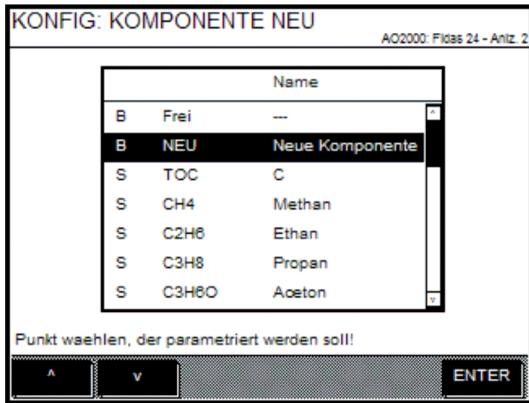
The following component data are listed in the detailed display:

Parameter	Description
<b>Display:</b>	Name of the component in the measured value display, e.g. structure formula
<b>Name:</b>	Full name of the component
<b>Molar mass g/mol:</b>	Molar mass in g/mol
<b>Response factor:</b>	Detector reply related to propane for the respective component
<b>Number of C atoms:</b>	Number of C-atoms in the molecule of the component
<b>Strip factor:</b>	Ratio of the concentration of a component in the water to the concentration of the same component in the gas flow after the strip event
<b>Unit:</b>	The physical units used for readout values

## ... 11 Configuration

### ... Filter parameterization

#### Component Selection List



The component selection list contains the following components:

- All (24 factory-configured) system components,
- If applicable, the user components already configured and
- An entry named 'Free'.

The following information is displayed for each component:

Type	S System component or B User component
Display	Name of the component in the measured value display, e.g. total formula
Name	Full name of the component

#### Adding a Component

If not all four positions of the component selection list are assigned, a new system or user component can be added.

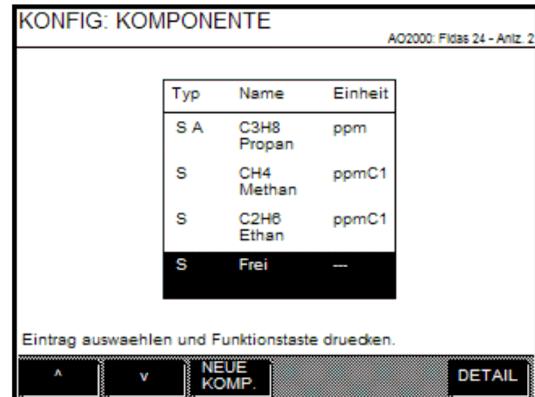
#### Menu Path

'MENU / Configure / Component specific / Active component'

Select component and confirm by selecting **ENTER**.

#### Adding a System Component

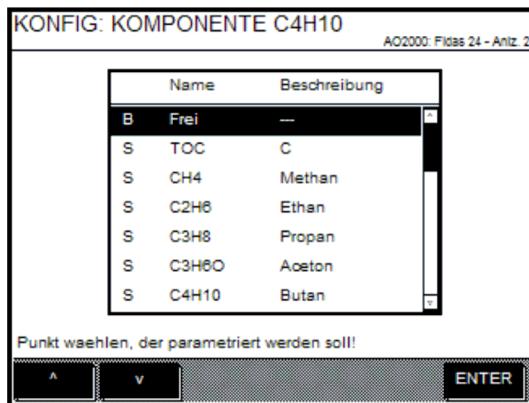
1. Press the **COMP. CONFIG** softkey.
  - The 'CONFIG.: COMPONENT' with the component list will be displayed.
2. Select the 'Free' entry in the component list.



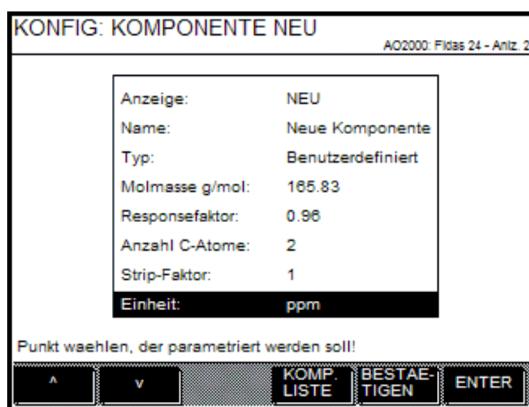
3. Press the **NEW COMP** softkey.
4. Press the **NEW COMP** softkey again. Enter password (level 3) if needed.
  - A window with the component data will appear.
    - If a component was not yet configured in the free entry position, no component data is displayed.
    - If a component has already been configured in the free entry position, its component data will be displayed..
  - If this component should be transferred to the component list, press the **BACK** button and return to the measured value display by pressing the **MEAS** button. Otherwise, proceed with step 5.
5. Press the **COMP LIST** softkey.  
The component selection list will appear.  
Depending on whether a user component or a system component is to be added, proceed according to one of the following two directions.

### Adding a User Component

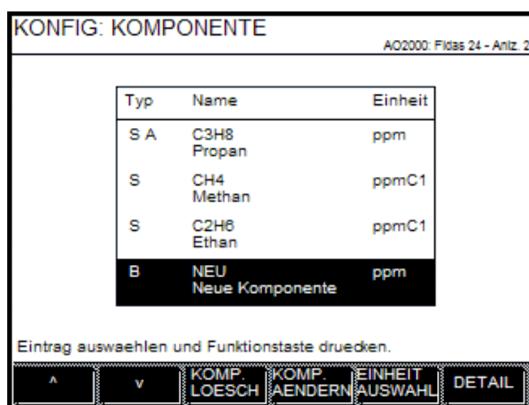
- Select the 'Free' entry in the component selection list and confirm by selecting **ENTER**.



- Enter the display name of the new component. This input is required as a minimum for the new component to be saved in the component list.



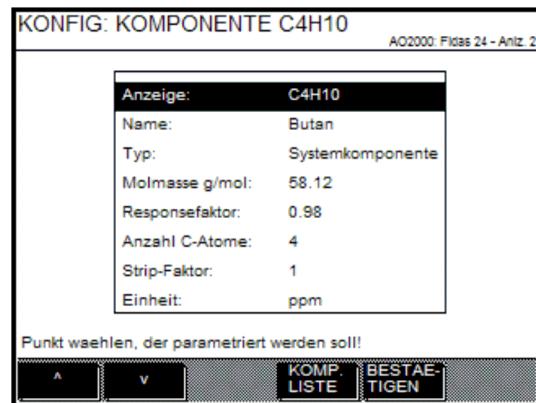
- Enter the additional parameters for the new component and save the configuration by selecting **COMMIT**.
- The component list is displayed.



- Quit the menu by selecting **Back** or **Meas**.

### Adding a System Component

- Select a (factory-configured) system component in the component selection list and confirm by selecting **ENTER**.

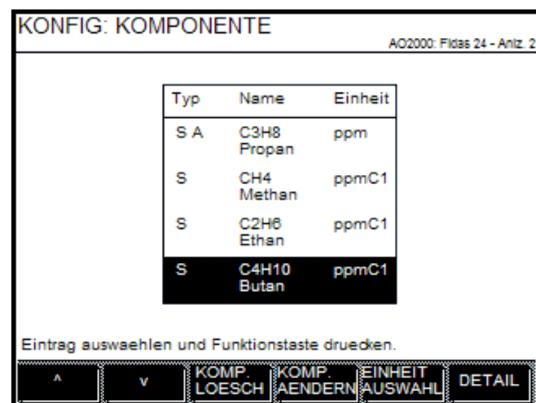


- If necessary, change the unit and save the configuration by selecting **COMMIT**.

#### Note

The other parameters of a system component cannot be changed.

- The component list is displayed.



- Quit the menu by selecting **Back** or **Meas**.

## ... 11 Configuration

### ... Filter parameterization

#### Changing a Component

The (maximum four) components, which are displayed in the component list (see **component** list on page 75) can be changed.

Either the parameters of a component can be changed or one component can be replaced by another.

#### Menu Path

'MENU / Configure / Component specific / Active component'

Select component and confirm by selecting **ENTER**.

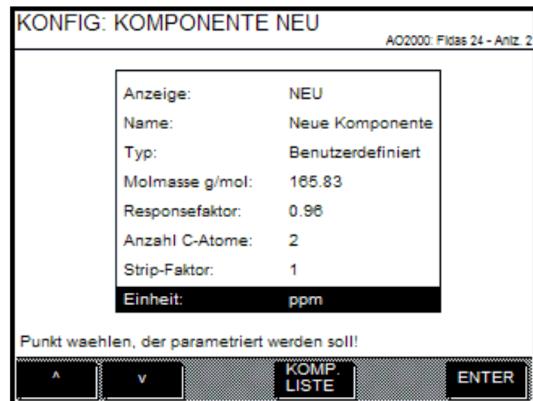
#### Changing a component parameter

##### Note

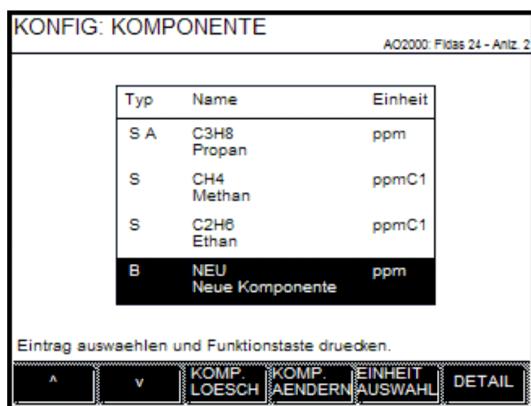
- For a system component (type **S**) only the 'Unit' parameter can be changed; in the case of a user component (type **B**), all parameters can be changed except for the 'Type' parameter.
- The parameters of the active component (type **SA** or **BA**) and the component used for calibration (type **SK** or **BK**) cannot be changed.

- Press the **COMP. CONFIG** softkey.
  - The 'CONFIG.: COMPONENT' with the component list will be displayed.
- Press softkey **CHANGE COMP**.

- Press the **CHANGE COMP** softkey. Enter password (level 3) if needed.
  - The parameters of the component are displayed.
- Select the parameters to be changed, introduce the change by selecting **ENTER**, enter the change and save by selecting **ENTER**.



- Quit the menu by selecting **Back** or **Meas**.



### Replacing a component

1. Press the **COMP. CONFIG** softkey.  
• The 'CONFIG.: COMPONENT' with the component list will be displayed.
2. Select the modules in the component list which is to be replaced by another component.

**KONFIG: KOMPONENTE**  
AO2000: Fidas 24 - Anz. 2

Typ	Name	Einheit
S A	C3H8 Propan	ppm
S	CH4 Methan	ppmC1
S	C2H6 Ethan	ppmC1
S	C4H10 Butan	ppmC1

Eintrag auswählen und Funktionstaste drücken.

A	V	KOMP. LOESCH	KOMP. AENDERN	EINHEIT AUSWAHL	DETAIL
---	---	-----------------	------------------	--------------------	--------

3. Press the **CHANGE COMP** softkey. Enter password (level 3) if needed.  
• The parameters of the component to be replaced are displayed.
4. Press the **COMP LIST** softkey.
5. Select the new component from the component list and press the **ENTER** softkey.

**KONFIG: KOMPONENTE C4H10**  
AO2000: Fidas 24 - Anz. 2

Name		
B	NEU	Neue Komponente
S	TOC	C
S	CH4	Methan
S	C2H6	Ethan
S	C3H8	Propan
S	C3H6O	Aceton
S	C4H10	Butan

Punkt wählen, der parametriert werden soll!

A	V	ENTER
---	---	-------

6. Confirm the overwrite of the components by selecting **ENTER** and save the components by selecting **COMMIT**.

**KONFIG: KOMPONENTE**  
AO2000: Fidas 24 - Anz. 2

Typ	Name	Einheit
S A	C3H8 Propan	ppm
S	CH4 Methan	ppmC1
B	NEU Neue Komponente	ppm
S	C3H6O Aceton	ppmC1

Eintrag auswählen und Funktionstaste drücken.

A	V	KOMP. LOESCH	KOMP. AENDERN	EINHEIT AUSWAHL	DETAIL
---	---	-----------------	------------------	--------------------	--------

7. Quit the menu by selecting **Back** or **Meas**.

## ... 11 Configuration

### ... Filter parameterization

#### Deleting a component

A (system or user) component can be deleted from the component list (see **component** list on page 75).

After deletion, the component is no longer available for display or calibration; however, it is still included in the component selection list and can be added to the component list again later on.

A user component which is no longer required can be permanently deleted from the component selection list. The system components cannot be deleted.

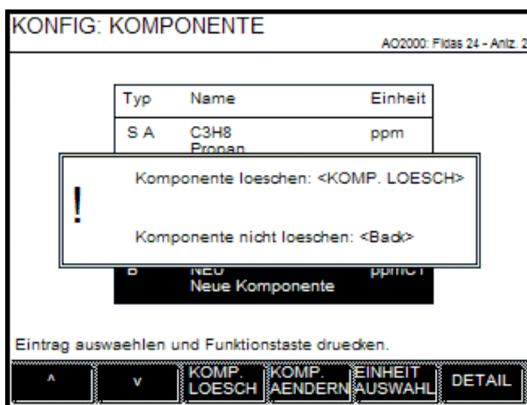
#### Menu Path

'MENU / Configure / Component specific / Active component'

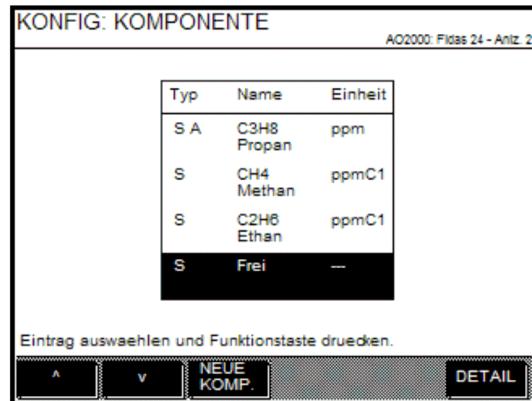
Select component and confirm by selecting **ENTER**.

#### Delete component from the component list

1. Press the **COMP. CONFIG** softkey.
  - The 'CONFIG.: COMPONENT' with the component list will be displayed.
2. Press softkey **COMP. DELETE**.
3. Press the **DELETE COMP** softkey.



4. Press the **DELETE COMP** softkey again. Enter password (level 3) if needed.
  - The component is deleted permanently from the component list and the 'Free' entry is displayed.

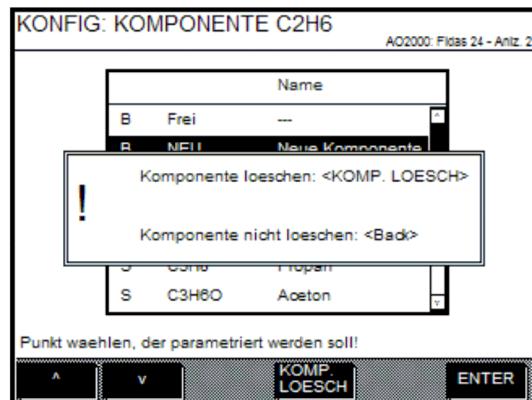


#### Note

Active components (type **A**) and the components used for calibration (type **K**) cannot be deleted.

#### Delete user component from the component selection list

1. Press the **COMP. CONFIG** softkey.
  - The 'CONFIG.: COMPONENT' with the component list will be displayed.
2. Select any component in the component list.
3. Press the **CHANGE COMP** softkey, enter the password (level 3) if needed and press the **COMP LIST** softkey.
  - The component selection list will appear.
4. The component selection list is displayed.
5. Press the **DELETE COMP** softkey.



6. Press the **DELETE COMP** softkey again.
  - The user component is permanently deleted from the component selection list.

## Changing the Unit of a Component

The physical unit used for the measured value display of a component, e.g. ppm or mg/m<sup>3</sup>, can be changed directly in the ‘CONFIG.: COMPONENT’ menu.

One of the units defined at the factory can be selected for system components.

For user components, the choice of units depends on which of the parameters required for the calculation have been entered during configuration (see **Adding a Component** on page 76) of the components.

Analyzer module	Unit
Fidas24	ppmC1, ppm, vol%, mgC/m <sup>3</sup> , gC/m <sup>3</sup> , mg/m <sup>3</sup> , g/m <sup>3</sup> , %UEG, mgC/l, gC/l, mg/l, g/l

Prerequisites for this are:

- AMC software version ≥ 3.3.2
- Measured value display set to ppm at the factory
- Unit switching activated at the factory.

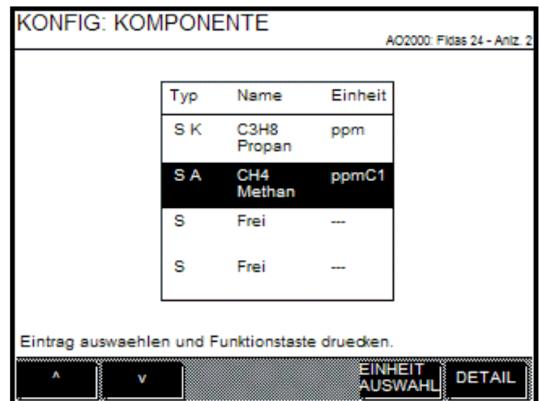
### Menu Path

‘MENU / Configure / Component specific / Active component’

Select component and confirm by selecting **ENTER**.

## Changing the Unit

1. Press the **COMP. CONFIG** softkey.
  - The ‘CONFIG.: COMPONENT’ with the component list will be displayed.
2. Press **UNIT SELECTION** softkey.



3. Press the **SELECT UNIT** softkey. Enter password (level 3) if needed.
  - A list of the units available is displayed.
4. Select the desired unit and confirm with **ENTER**.
  - A safety prompt is displayed with the information that when switching the unit, the range limits of the component are automatically adjusted.
5. Confirm the switching of the unit by selecting **ENTER** or cancel by selecting **Back**.
6. Quit the menu by selecting **Back** or **Meas**.
7. Check the measuring range limits (see **Changing Measuring Range Limits** on page 70) and the number of decimal places (see **Change number of decimal places** on page 71) and adjust as needed.

## ... 11 Configuration

### ... Filter parameterization

#### Changing module name

##### Menu Path

'MENU / Configure / Component specific / Module text'

##### Module Name

The module name is shown in the display next to the module type. Here you can enter a name relating to the measuring point, for example.

##### Monolingual or Bilingual

The module name can be entered independent of the language of the user interface or separately for both languages.

##### Text length

The length of the text for the module name is limited to 24 characters for a monolingual entry, and limited to 2x10 characters for a bilingual entry.

##### Entering the module name

When entering the module name, use the same procedure as for Entering Text, see **Entering text** on page 64

##### Note

The changed module name is shown in the display after switching to measuring mode.

Whether the module name appears next to or under the module type depends on the configured size for displaying the measured quantity, see page **Moving a Display Element from One Page to Another** on page 101.

### Function Blocks

#### Concept of function blocks

##### What are function blocks?

Function blocks are small units of the processing software.

Function blocks collect information at the inputs, processes it in specific ways and the output the results at the outputs.

##### What are function blocks used for?

Function blocks are used for overall and specific configuration and setting parameters of gas analyzer functions.

##### Examples of function blocks

The following examples illustrate the operation of function blocks:

- A **Limit monitor** tracks a value to determine if it violates limit values and passes the result to a digital output.
- A **Digital input** places a signal at a (hardware-) digital input for subsequent processing in other function blocks.
- An **Add** combines the signals at its two inputs and places the total at its output.
- A **component measured value** outputs the measurement signal from an analyzer module for further processing in other function blocks.

##### Linking of function blocks (application)

A function block is linked to other function blocks via its inputs and outputs.

A chain of linked function blocks is an application in the gas analyzer.

Various function blocks are already linked to other function blocks at the factory to form applications, for examples see **Standard configuration (applications)** on page 83.

### Parameterization of function blocks

The functionality of a function block is determined, in addition to the link via its inputs and outputs, by a variety of specific parameters.

When the gas analyzer is delivered, default values are assigned to these parameters. These standard values can be accepted or re-parameterized.

### Password

To configure password protection, the password must be entered for password level 3.

It is important to make sure that existing applications with their configurations and links are not damaged or destroyed during configuration.

### Detailed information

The 'Function Blocks – Descriptions and Configuration' Technical Information contains complete information on the 'Function Block' concept as well as detailed descriptions of the individual function blocks.

### Standard configuration (applications)

A variety of applications are configured at the factory. These so-called standard configurations are based, among other things, on the standard pin assignment of the inputs and outputs and the existing sample components.

In the case of individual factory-configured applications, it is necessary to configure the link to other function blocks on site.

### Example: Limit value monitoring

The limit value monitoring application consists of the factory-configured link between the following function blocks:

- **Component measured value**
- **Hold**
- **Limit monitor**
- **Digital output**.

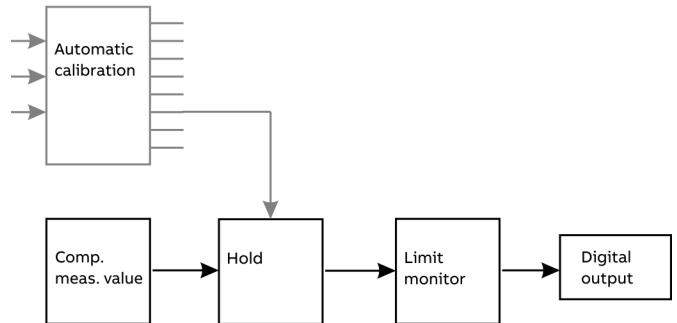


Figure 30: 'Limit value monitoring' application

### Example: Measuring range switchover/feedback

The measuring range switchover/feedback application consists of the following links configured at the factory:

- Linking of a **Measuring range switching** function block with several **Digital input** function blocks and a **Component measuring range** function block.

as well as

- Linking of **Measuring range feedback** a function block with the same **Component measuring range** function block and several **Digital output** function blocks.

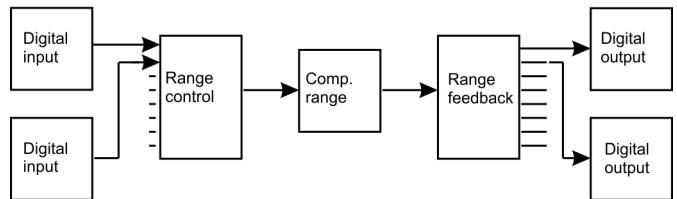
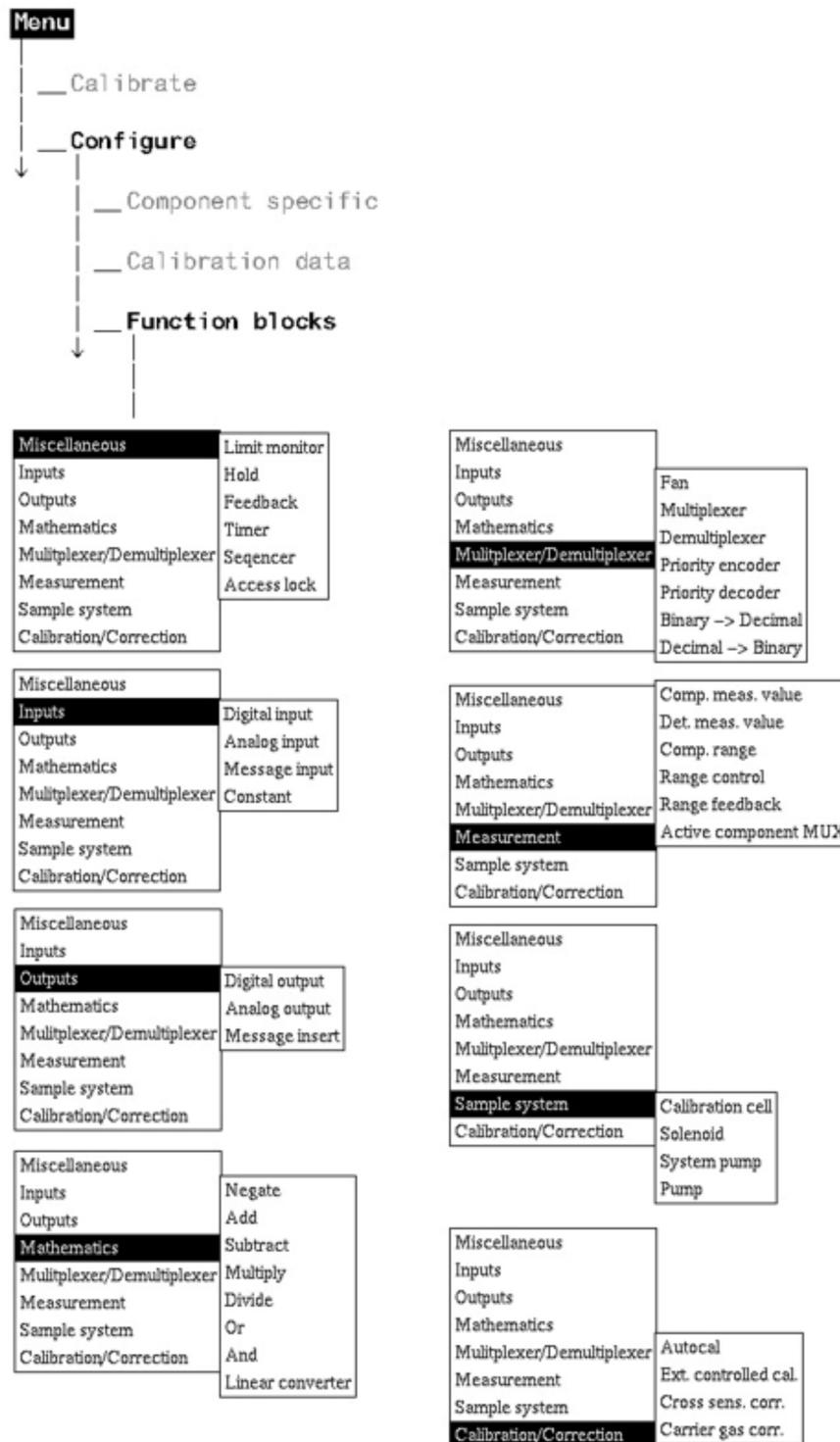


Figure 31: 'Measuring range switchover/feedback' application

## ... 11 Configuration

### ... Function Blocks

#### 'Function blocks' submenu



## System functions

### Setting the time zone, date and time

#### Menu path

'MENU / Configure / System / Date/Time'

#### Procedure

Parameter	Explanation
<b>Timezone</b>	The time zone can be selected either from the GMT (Greenwich Mean Time) values or from the continent/country/city list.
<b>Date</b>	Date must be entered in month/day/year format. Enter year with 4 digits.
<b>Time</b>	Time must be entered in hour: minute:second format. Enter seconds, too.

#### Definitions

- **GMT** = Greenwich Mean Time
- **CET** = Central European Time = GMT + 1 hour
- **CEST** = Central European Daylight-saving Time = GMT + 2 hours

#### Daylight-saving time

The gas analyzer is automatically set to daylight-saving time.

#### Note

This applies only when the time zone has been selected from the continent/country/city list and not from the GMT values list.

#### Condition as delivered

The gas analyzer is factory-set to the **GMT+1** time zone.

#### Accept the time settings

Press the softkey **SET TIME** to accept the modified time settings.

### Selecting user interface language

#### Menu path

'MENU / Configure / System / Language'

#### Language selection

Two user interface languages are factory-configured (per order) in the gas analyzer.

In the menu item **Language** the user can switch between these two languages.

#### Other languages

Other user interface languages can be loaded into the gas analyzer using the SMT Software Migration Tool.

SMT can be found on the USB stick which is delivered with the gas analyzer.

These language pairs are available:

- English – German
- English – French
- English – Italian
- English – Dutch
- English – Spanish
- English – Brazilian
- English – Polish
- German – Dutch

## ... 11 Configuration

### ... System functions

#### Change password

##### **NOTICE**

###### **Damage to the configuration of the gas analyzer.**

After entering the password for password level 3, you can access all of the function block applications!

- Make sure that changes in password level 3 are only made by appropriately trained personnel.

#### Block operation

##### Menu Path

'MENU / Configure / System / Change password'

#### Blocking operation

The operation of the gas analyzer, i.e. the calling up of the main menu and therefore the switchover to menu mode, can be protected with a password.

After blocking, the operation of the gas analyzer is only possible once the password has been entered for password level 1.

To configure the password protection, the password must be entered for password level 3.

#### Procedure

In the menu item 'Change password', press the **MENU ACCESS** softkey and make the desired password protection settings.

#### Factory setting

User Group	Access to password levels	Password
Every user	0	None
Maintenance team	0, 1	471100
Specialist team	0, 1, 2	081500
Function block specialist	0, 1, 2, 3	325465

#### Procedure

1. Select the menu item 'Change password' .
2. Select user group.
3. Enter old password.
4. Enter new password (6 digits).
5. Repeat new password.
6. Leave menu item using **Back**.

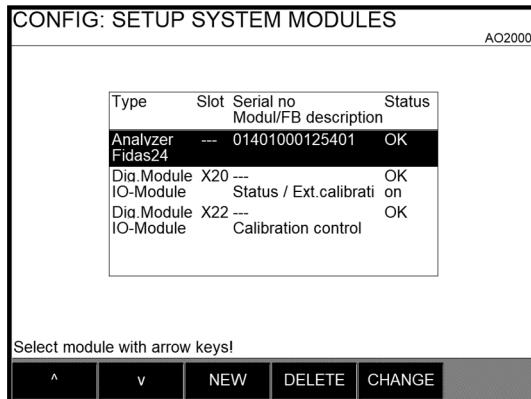
#### Note

Password level 0 is not displayed in the 'Change password' menu item.

## Setting System Modules

### Menu Path

'MENU / Configure / System / Setup system modules'



### Function

If system modules are added to a gas analyzer or replaced (changed) or removed, this also needs to be configured in the software.

### Definition

The modules listed below are system modules:

- The analyzer module: Fidas24
- The I/O modules: Profibus, Modbus, 2-way analog output, 4-way analog output, 4-way analog input, digital I/O
- The external I/O devices: e.g. the cooler I/O card

### Analyzer modules and external I/O devices

The analyzer modules and external I/O devices are connected via the system bus with the system controller. To be detected by the gas analyzer, they need to be identified using their serial number (see below).

### I/O modules

The I/O modules are placed on the system controller and connected to it directly. They do not have a serial number. An I/O module is automatically detected by the gas analyzer if it is new or has already been added as a replacement for an already existing I/O module.

### Serial number

The analyzer module's 14-digit serial number is stated in the device pass and on the sticker on the module; the sticker is usually on the CPU card.

The serial number contains the following information (example):

**01400000012301**

The first 3 digits refer to the module type:

Module type	Description
<b>014</b>	Analyzer module

The remaining 11 digits are the actual serial number of the module.

### Function block application

When setting up the digital I/O module, it is necessary to configure a function block application. It is also possible to assign another function block application to this system module during operation.

For the standard function block applications with the respective terminal assignments of the module, see **Standard assignment of the digital inputs/outputs (I/O)** on page 46.

### Unknown System Module

If a system modules in the Setup system modules menu item shows the 'Unknown' status, there are several possible causes:

Cause	Repair
After activating the power supply of the gas analyzer, the system module could not be found (status message no. 201).	Restore systembus connection to the system module and press the <b>Restart</b> softkey.
The systembus connection to the system module is interrupted (status message no. 209).	Restore systembus connection to the system module and press the <b>Restart</b> softkey.
The serial number of the system module was incorrectly entered.	Press the <b>CHANGE</b> softkey and correct the serial number.

### Note

While system modules are being set, the automatic calibration of an analyzer module is not possible.

## ... 11 Configuration

### ... System functions

#### Add System Module

##### Note

As long as no system module is configured in the gas analyzer at all or an added system module is not yet configured, the '**NEW**' softkey appears in the display in measuring mode.

By pressing this softkey, the user goes directly to the 'Setup system modules' menu.

The approach when adding an analyzer module or an external I/O device differs from that when adding an I/O module (see following instructions).

#### Add a new analyzer module or a new I/O device

1. Select the 'Setup system modules' menu point.
  - The list of the system modules available in the system is displayed.
2. Press the '**NEW**' softkey.
3. Enter the 14-digit serial number of the new system module.
  - The added system module appears in the list with the 'New' status.
4. Save the configuration change by selecting '**ENTER**' or reject it by selecting '**Back**'.

#### Add new I/O module

1. Select the 'Setup system modules' menu point.
  - The list of the system modules available in the system is displayed.
2. Select the added I/O module automatically detected by the gas analyzer and press the '**NEW**' softkey.

When setting up a digital I/O module:

Press the '**FB appl.**' and selec the function block applications.

- The added system module appears in the list with the 'New' status.
3. Save the configuration change by selecting '**ENTER**' or reject it by selecting '**Back**'.

##### Note

If a Profibus module is refitted, it needs to be installed as the bottom I/O module, i.e. on the **-X20 / -X21** slot.

#### Replacing the System Module

##### Uninstallation and reinstallation of the same system module

If an existing system module has been uninstalled and (e.g. after repairs) reinstalled, the setting of this system module is usually not necessary.

As soon as the system module is reconnected to the systembus, it is automatically identified and its configuration is saved automatically. The requirement for automatic detection is that the gas analyzer is in measuring mode.

### NOTICE

#### Data loss!

If an existing system module is replaced with another system module, the 'DELETE' function may not be used to delete the old system module. In the process, the parameterization and functional block configuration of the old system module would also be irrevocably deleted!

- To replace a system module, use the 'CHANGE' function only.

##### Note

- The type and configuration of the new system module must match the type and configuration of the old system module.
- If an existing I/O module is replaced by an I/O module of the same type, the new I/O module is automatically detected by the gas analyzer and does not need to be configured.

**Replace an existing system module (analyzer module or I/O device) with another system module**

1. Select the 'Setup system modules' menu item.
  - The list of the system modules available in the system is displayed.
2. Select the system module (analyzer module or I/O device) which was replaced and should now be reset.
  - This system module is displayed on the list either with the 'Unknown' or the 'Error' status.
3. Press the **CHANGE** softkey.
  - **NOTE**  
Under no circumstances should the **DELETE** softkey be pressed!  
This would delete irrevocably the parameter settings and the functional block configuration of this system module.
4. Enter the 14-digit serial number of the new system module.
  - In the list, the new system module now has the 'Replace' status.
5. Save configuration change by selecting **ENTER** or reject by selecting **Back**.

**Delete System Module****Sequence when removing system modules**

When removing system modules from the gas analyzer, the following sequence must always be applied:

1. Delete system module in the software  
(instructions see below).
2. Remove system module from the gas analyzer.

**Delete an existing system module without replacing**

1. Select the 'Setup system modules' menu item.
  - The list of the system modules available in the system is displayed.
2. Select system module to be deleted (and not replaced).
3. Press the **DELETE** softkey.  
This deletes irrevocably the parameter settings and the functional block configuration of this system module.
4. On the list, the system module now has the 'Delete'.
5. Save configuration change by selecting **ENTER** or reject by selecting **Back**.

## ... 11 Configuration

### ... System functions

#### Save Configuration

##### Menu Path

'MENU / Configure / System / Save configuration'

##### Automatic saving of the configuration

The database with the configuration data and logbook entries is saved automatically in two configuration files.

The database is always saved when changes are made to the parameters in menu mode.

The saving process takes place as soon as either the user has deactivated an entered password by pressing the '**MEAS**' key twice or when the analyzer system switches automatically to measuring mode using 'Time-out'.

When starting the analyzer system, the last valid configuration file saved is loaded.

#### Save configuration manually

It is also possible to save the database manually. This makes sense, for instance, for interim saving of a comprehensive functional block configuration.

#### Backup

In addition to the automatic or manual saving of the configuration, it is possible to create a backup of the current configuration.

This backup is archived in a separate area of memory and can be loaded when required, for example to restore the gas analyzer in a defined status.

#### Note

A backup of the current configuration on a separate data carrier can be created with the use of the 'SMT light' software tool.

'SMT light' is available on the data carrier that is included in the scope of delivery of the gas analyzer.

#### Configure Status Signals

##### Menu Path

'MENU / Configure / System / Status signals'

##### Function

The configuration of the status signals is already defined when ordering the gas analyzer and is set at the plant.

As a rule, it is not necessary to change this configuration during operation.

##### Selection

The following status signals are available for selection:

- Individual status signals, i.e. failure, maintenance requirement and function check
- Sum status signal

##### Note

If the configuration of the status signals is changed from 'Collective status' to 'Single status', the digital outputs DO2 and DO3 of the standard function block application 'Status signals/Ext. controlled cal.' (see **Calibration** on page 107) with assigned alarm signaling will be overwritten with individual status signals.

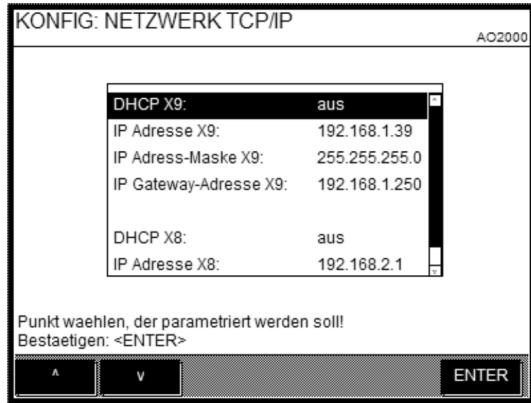
For additional information about status signals, see **Status Signals** on page 127.

## Digital communication

### Configure the Ethernet connection

#### Menu Path

'MENU / Configure / System / Network / TCP/IP Network'



#### Function

The analyzer system can be integrated in an Ethernet network (with TCP/IP protocol) via two Ethernet 10/100/1000BASE-T interfaces.

The first Ethernet interface is designated as X9 and the second X8.

#### Parameters

It depends on the DHCP settings what parameters need to be integrated:

DHCP setting	Parameter
DHCP on	Network name (max. 20 characters, no empty and special characters),
DHCP off	IP address, IP address mask and IP gateway address

#### Adresses

The IP address, IP address screen and IP gateway address need to be queried from the system administrator.

#### Note

- Addresses of TCP/IP categories D and E are not supported.
- The address bits variable from the address screen may not be set to 0 or 1 (broadcast addresses).

#### Notes on the MAC address

- The IP address must not be confused with the Ethernet hardware address or MAC address.
- The 12 character MAC address is unique worldwide and is stored on each device by the manufacturer.
- In the AO2000 series gas analyzers, the MAC address is referred to as the Ethernet address.
- The MAC address can be displayed in the 'Diagnostic/Information / System overview / SYS CON' .

## ... 11 Configuration

### ... System functions

#### Release of communication via port 8001/tcp

In AO2000, a proprietary protocol has been implemented on port 8001 for communication with remote clients:

- In the AO2000, communication is blocked on all Ethernet interfaces (X8 / X9) by default.

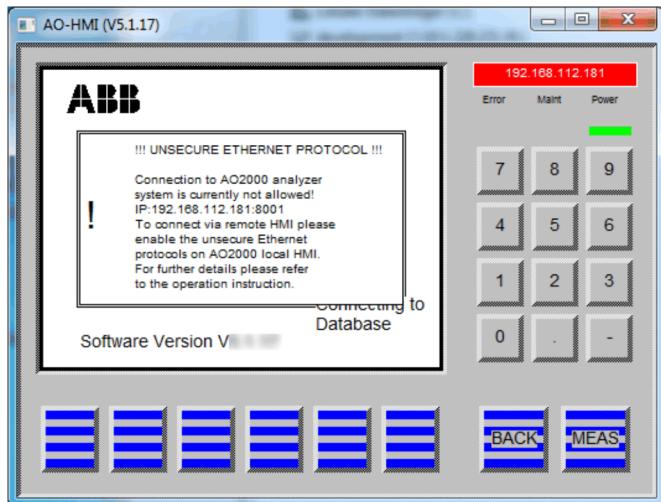


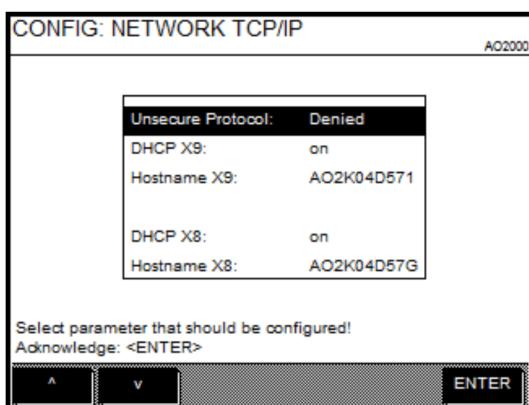
Figure 32: Message on the Remote HMI (example)

When communication is blocked, a corresponding message is issued on the Remote HMI.

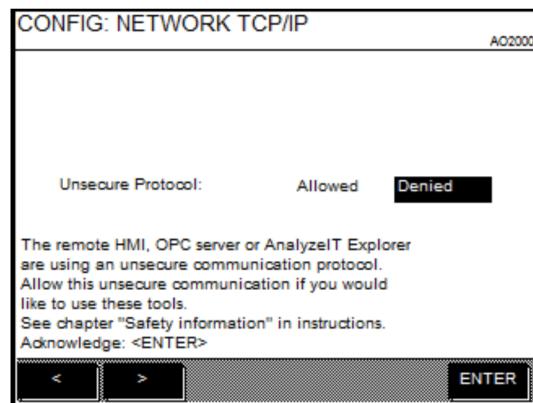
#### Release communication via the proprietary protocol

Implement the following steps to release communication via the proprietary protocol:

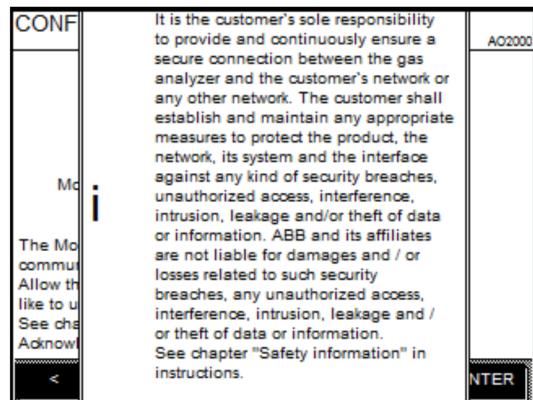
1. Select the '...\\Configure\\Network\\TCP/IP Network' menu.
2. Select the 'Unsecure protocol' menu item



3. Select the 'Unsecure protocol' menu item and set the parameter to 'Allowed'.



4. Confirm the information field by selecting <BACK>.



- Communication via the proprietary protocol has now been released.

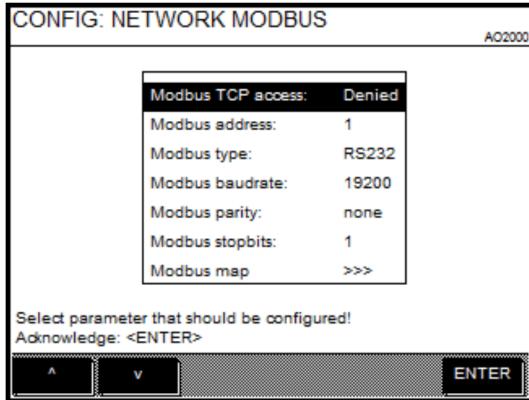
#### Note

The proprietary protocol via port 8001/tcp is an unsecured protocol (in the meaning of IT security or cybersecurity).

## Configure Modbus Connection

### Menu Path

'MENU / Configure / System / Network / Modbus"



### Function

The gas analyzer can, on the one hand, be integrated via the RS232 or the RS485 interface and, on the other hand, via the Ethernet interface (Modbus via TCP/IP) in a network with Modbus protocol.

### Note

- The **Modbus** menu item is only displayed if the Modbus module is installed in the analyzer system.
- Modbus communication must be explicitly enabled, see **Release of communication via Modbus® TCP/IP** on page 93.

### Parameters

The gas analyzer supports the Modbus slave protocol with RTU (Remote Terminal Unit) mode. The access interval of the Modbus master should be > 500 ms.

- The **Modbus address** can be set in the 1 to 255 range.
- As the **Modbus type**, the interface needs to be selected through which the gas analyzer is connected to the Modbus network (Ethernet, RS232 or RS485).

The standard settings for the data transmission are displayed in the above image.

The **Modbus image** allows an overview of the address position of the Modbus register.

### Note

For additional information on 'Modbus', refer to the Technical Information 'AO2000 Modbus and AO-MDDE'.

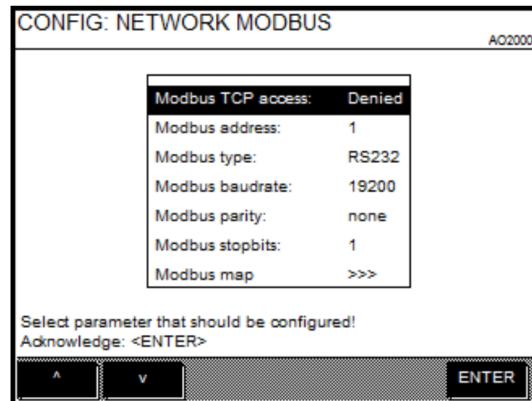
## Release of communication via Modbus® TCP/IP

In the AO2000, communication via Modbus® TCP/IP is blocked on all Ethernet interfaces (X8 / X9) by default.

### Release communication via Modbus® TCP/IP

Implement the following steps to release communication via Modbus® TCP/IP:

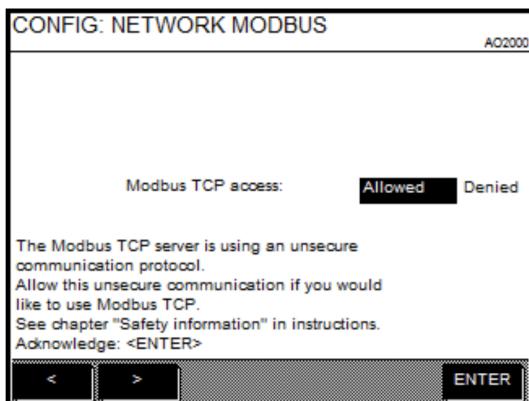
- With the Modbus card installed, select the '...\\Configure\\Network\\Modbus' menu.  
**or**
- The '...\\Configure\\Network\\Modbus' menu is **not** available if the Modbus card is not installed. In this case, the Release menu is called up directly via 'Modbus TCP'.
- Select the 'Modbus TCP Access' menu item and confirm by selecting <ENTER>.



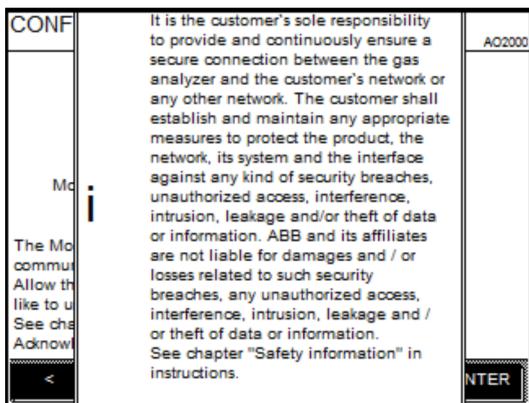
## ... 11 Configuration

### ... System functions

3. Select the 'Modbus TCP Access' menu item and set the parameter to 'Allowed'.



4. Confirm the information field by selecting <BACK>.



- Communication via the Modbus® TCP/IP protocol has now been released.

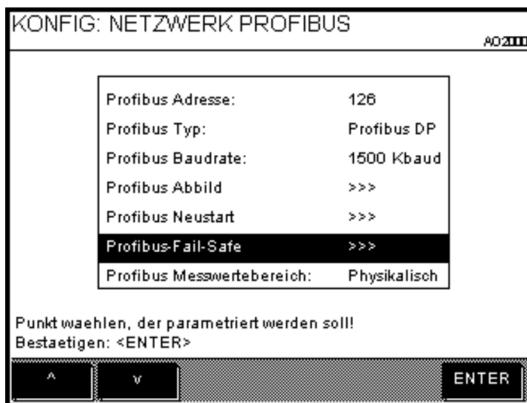
#### Note

The Modbus® protocol is an unsecured protocol (in the meaning of IT security or cybersecurity), as such the intended application should be assessed before implementation to make sure that the protocol is suited.

## Configure PROFIBUS® Connection

### Menu Path

'MENU / Configure / System / Network / Profibus'



### Parameters

Parameter	Selection	Description
Profibus address:	1 to 126	
Profibus type:	PROFIBUS DP Profibus PA	Connection to the RS485 interface Connection to the MBP interface (not intrinsically safe)
Profibus baudrate:	RS485 interface MBP interface	automatically, 9600 Baud, 19200 Baud, 93750 Baud, 187,5 KBaud, 500 KBaud, 1500 KBaud, 3000 KBaud, 6000 KBaud set to 31250 Baud
Profibus map	Profibus inputs Profibus outputs	Measured values, bus analog outputs, analog inputs, analog outputs, digital inputs, bus digital outputs, digital outputs Bus analog inputs, Bus digital inputs
Profibus restart	Warm start Cold start	With Warm start, the Profibus stack is reset comparable with a power off/on. With Cold start, all the parameters which are stored in the Profibus stack as store parameters are reset to the default value.
PROFIBUS FAIL SAFE	Measured value Hold value	The value of the Profibus function block comes after the output value of the AO2000 function block. The Profibus function block holds the last output value. The display of the AO2000 function block may differ from this.
Profibus meas. value range:	Physical VDI 4201	The Profibus-AI value is the physical measured value for AO2000. The physical measured values of the AO2000 are scaled to the -10000...0...+10000 range. Here, 0 is equal to physical 0 and 10000 equal to the final value of the display range (according to CDI 4201).

### Note

For additional information on 'Profibus', refer to the Technical Information 'AO2000 Profibus DP/PA Interface'.

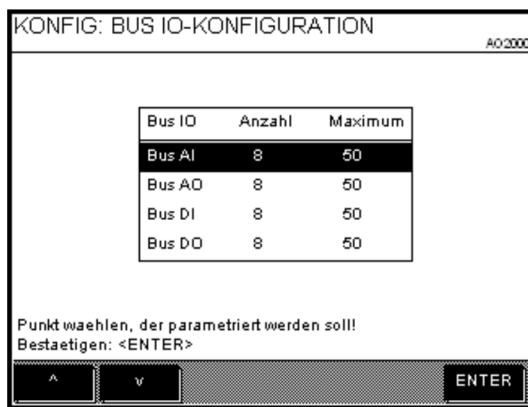
## ... 11 Configuration

### ... System functions

#### Configuring Bus I/Os

##### Menu Path

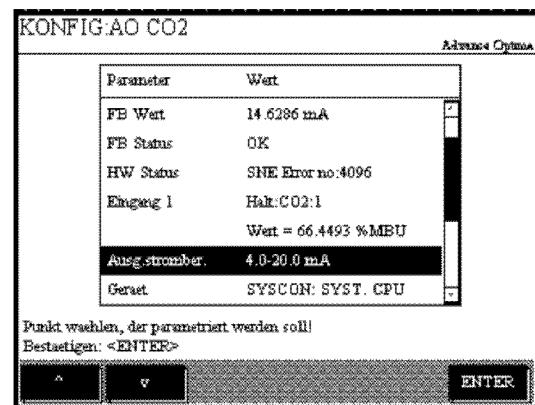
'MENU / Configure / System / Network / Bus IO'



#### Changing Analog Output Current Range

##### Menu Path

'MENU / Configure / Function blocks / Outputs / Analog output'



#### Number of Bus I/Os

Changing the number of Bus I/Os will affect the Modbus address range, Profibus map and Ethernet linking.

### NOTICE

#### Damage to the function block applications

Damage to the function block applications caused by changes in the number of Bus I/Os.

- Reducing the number of Bus I/Os may cause transmission errors if the settings of the communication partners are not matched.
- Reducing the number of Bus I/Os can also lead to function block applications being destroyed.

#### Parameters

Parameter	Function	Read	Write	Example
Bus AI	Bus analog inputs	x	x	Analog value input into the function block application
Bus AO	Bus analog outputs	x	-	Analog value output from the function block application
Bus DI	Bus digital inputs	x	x	Control of functions such as auto calibration, measurement range control after function block configuration
Bus DO	Bus digital outputs	x	-	Display of functionalities linked by function block configuration, e.g. alarm signaling

#### Change output current range

The output current range of the individual analog outputs can be changed using the parameterization of the corresponding **analog output** function blocks.

The Technical Information "Function Blocks Descriptions and Configuration" contains complete information on the individual function blocks.

The output current range is changed using the 'output current range' parameter.

#### Selection

The output current range choices are 0 to 20 mA, 2 to 20 mA and 4 to 20 mA.

#### Note

The output signal cannot be less than 0 mA and not greater than 22 mA.

#### Limit output current range

The output signal is limited to the range that is defined in the 'Lower limit' and 'Upper limit' parameters.

In the delivery state, these parameters have the value 0 mA or 22 mA.

## LCD display

### Display Features

In measurement mode, the LCD display of the gas analyzer is freely configurable. A standard layout is configured on each delivered unit.

### Display Elements

The following display elements are available:

- The default measured quantities in the gas analyzer (sample components, auxiliary quantities, current outputs and current inputs)
- Freely configured displays of measured quantities as well as value inputs or key entries.

### Pages

The individual display elements are compiled into so-called 'pages'.

- Up to six measurement values can be displayed per page.
- The pages brought up when scrolling with the >> softkey can be configured.
- A display element can only be displayed on a single page.

### System Pages (standard layout)

The gas analyzer normally displays its measured values in a fixed sequence on the various screen pages.

This holds true for the measured quantities of system modules that were added by the user (see **User Page Configuration** on page 101).

Since up to six values can be displayed on a page, the number of system pages depends on the number of values.

The user cannot delete system pages.

The following table shows the standard system page layout in a gas analyzer with no more than six sample components and variables each.

Page	Standard assignment	On/Off
1	Sample component measured values in physical units	On
2	Sample component measured values in %MRS	On
3	Current signals at the analog outputs	On
4	Variable measurement values (e.g. flow, temperature, pressure) in physical units	Off
5	Sample component auxiliary values in %MRS	Off
6	Current signals at the analog inputs (if available)	On

### User Pages

In addition to the system pages the user can set up so-called user pages, see **Display Overview** on page 99.

### Function Blocks as Sources

The values of all the function blocks in the system can be configured as a source for the display.

The source of the display of value inputs or key entries is also a function block that was created when configuring the display elements.

The display of the function block value is independent of the other links of the function block.

### Note

- All sample components, auxiliary quantities, current outputs and current inputs exist as function blocks in the system, i.e., all of these measured quantities are displays of function blocks in the system.
- Technical Information 'Function Blocks – Descriptions and Configuration' contains complete information on the 'Function Block' concept as well as detailed descriptions of the individual function blocks.

## ... 11 Configuration

### ... LCD display

#### Display Element Positioning on the Screen

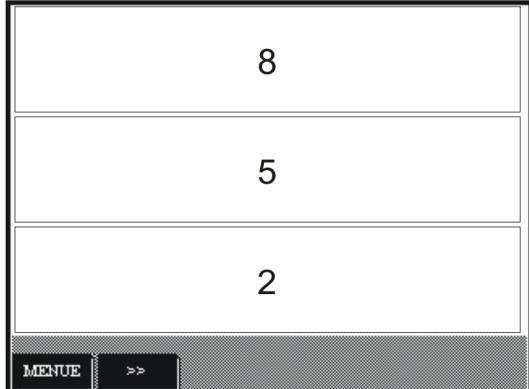
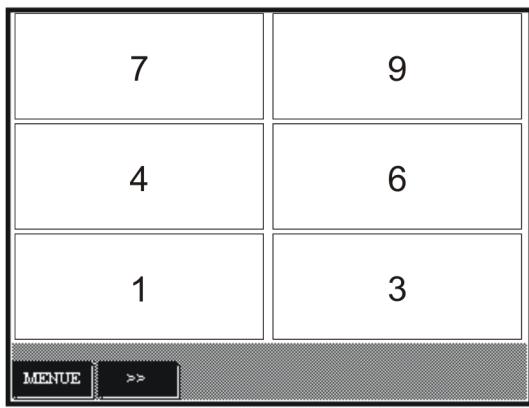
The display elements can be represented in two sizes.

A maximum of three large and six small display elements can be represented on a page.

Large and small display elements can be mixed with each other.

The positions are numbered as shown in the following figure.

The numbering of the positions corresponds to the arrangement of the number keys next to the LCD display.

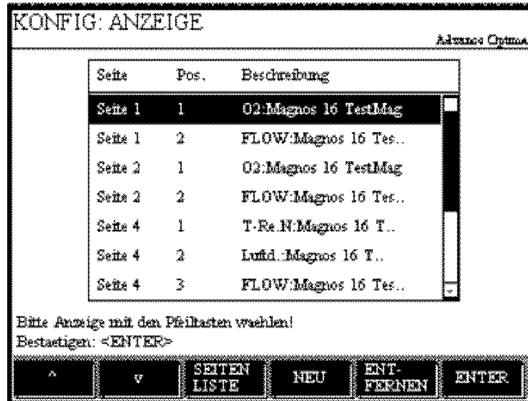


#### Views

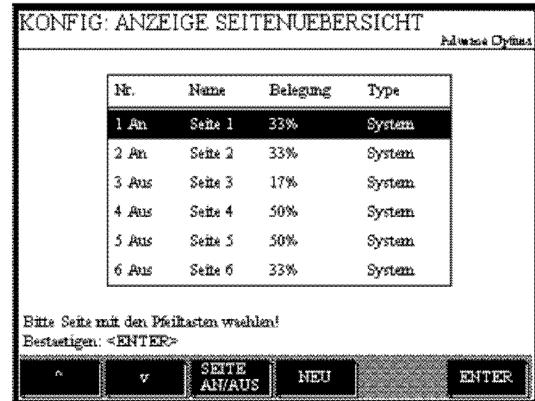
The following views are available for configuring the display:

- The display overview (see **Page overview** on page 99),
- The page overview (see **Parameter Overview** on page 100) and
- The parameter overview (see **Configure the Ethernet connection** on page 91)

## Display Overview



## Page overview



### Explanations

The screen overview contains the following information for each display element:

<b>Page</b>	Name of page on which the value is displayed
<b>Pos.</b>	Position of the display on the page
<b>Description</b>	Name of the value

### Softkeys in the Screen Overview

The screen overview softkeys have the following functions:

Softkey	Description
PAGE LIST	By selecting the <b>PAGE LIST</b> softkey, the user calls up the page view.
NEW	By selecting the <b>NEW</b> softkey, the user begins the configuration of a new display element, either as a bargraph or dot display (see page 102), value input (see page 105), button input (see page 100).
DELETE	By selecting the <b>DELETE</b> softkey, the user deletes the selected display.
ENTER	By selecting the <b>ENTER</b> softkey, the user calls up the parameter view (see page 101).

### Explanations

The page overview contains the following information:

<b>No.</b>	Page number and status 'On' or 'Off'
<b>Name</b>	Name of the page
<b>Usage</b>	Page Assignment
<b>Type</b>	System: page configured by the system with standard assignment User: page configured by the user

### Page overview softkeys

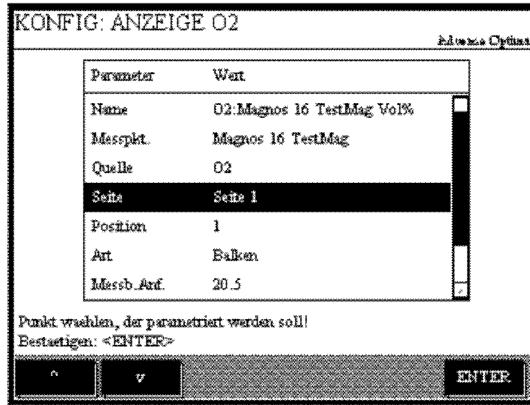
The page overview softkeys and buttons have the following functions:

Softkey	Description
PAGE ON/OFF	By selecting the <b>PAGE ON/OFF</b> softkey, the user toggles the selected screen page on or off.
NEW	By selecting the <b>NEW</b> softkey, the user starts the configuration of a new page (see page 102). <b>Page Configuration display page 101.</b>
DELETE	By selecting the <b>DELETE</b> softkey, the user deletes the selected page. Only empty "user" pages can be deleted.
ENTER	By selecting the <b>ENTER</b> softkey, the user can input text to change the name of the selected page.
Back	By selecting the <b>Back</b> key, the user returns to the Display Overview.

## ... 11 Configuration

### ... LCD display

#### Parameter Overview



#### Explanations

The display parameters have the following functions:

Parameter	Description
<b>Name</b>	The name of the display element set by the system cannot be changed.
<b>Measp.</b>	The description entered for the <b>Measp.</b> appears over the element display during measurement operation. The description is set by the system; it can be changed for the user-configured display elements. The maximum length is 20 characters.
<b>Source</b>	The <b>Source</b> of the display element is always a function block. The source cannot be changed for the display elements of the default assignment, i.e. the measured quantities, and for the key entries.
<b>Page</b>	The parameter <b>Page</b> indicates the page on which the display element is shown. Each display element can be moved to any system or user page.
<b>Position</b>	The <b>Position</b> of a display element on a system page is determined by the system. It can be changed by being exchanged with another display element. The user can freely configure the position on a user page.
<b>Style</b>	The <b>Style</b> of display depends on the source type. There following display types are available: bargraphs, dot displays, value input (see page 103) and key input (see page 66). Examples of the different display styles are shown as soon as this parameter is selected.
<b>Measuring Range Low, Measuring Range High</b>	The <b>Lower range value</b> and <b>Upper range value</b> parameters determine the measurement range span of the bargraph and the dot display. They cannot be changed for the display elements of the default assignment, i.e., the measured quantities.
<b>Places</b>	The <b>Places</b> parameter determines the number of decimal places for the digital display of the measured values, see page 71. It cannot be changed for the display elements of the default assignment, i.e., the measured quantities.

## User Page Configuration

Perform the following steps to configure a user page:

1. Select the 'Display' menu item.
2. Call up the page overview.
3. Start configuration of the new page using the '**NEW**' softkey.
  - Either: Enter the page name. The page overview is displayed.
  - Or: Go directly to the page overview. In this case the system assigns the name "Page #" (# = page number).
- The new page will now appear in the page overview:
  - No.: Assigned by the system, status 'on'
  - Name: As assigned in step 4
  - Allocation: 0% (no measurement value)
  - Type: User

## Moving a Display Element from One Page to Another

Display elements can be moved between the pages. Perform the following steps to move a display element:

1. Select the 'Display' menu item.
2. Select the display element in the display overview.
3. Select the 'Page' parameter.
4. In the displayed page overview, select the target page. Only those pages can be selected with an assignment < 100%, i.e. in which there is at least one free position.
5. In the displayed parameter overview of the display element, the new page and new position are displayed.
  - If the new page is a system page, the display element is located in the first free position.
  - If the new page is a user page, the display element is located in the same position as the old page, or if this is already taken, in position 8. If this was also already occupied, the move is failed (display —).
6. If the new page is a user page and other positions are free, the position of the display element can be changed. To do so, select the 'Position' parameter. The nine possible positions are graphically represented; free positions are identified by the position number. Select the desired position with the corresponding number key.
7. Switch to measuring mode.
  - The display element is now shown on the new page.

## ... 11 Configuration

### ... LCD display

#### Moving a Display Element within a Page

Display elements can be moved within a page. Perform the following steps to move a display element:

1. Select the 'Display' menu item.
  2. Select the display element in the display overview.
  3. Select the 'Position' parameter.
    - The nine possible positions are graphically represented.
    - If the display element is on a system side, its position can only be exchanged with that of another display element (the '**SWAP DISPLAY**' softkey is pressed).
- If the display element is on user page, its position can either be exchanged with that of another display element (the '**SWAP DISPLAY**' softkey is pressed), or it can be moved to a free position (the '**SWAP DISPLAY**' softkey is not pressed).
4. Select the desired position with the corresponding number key.
  5. Switch to measuring mode.
  - The display element is now displayed at the new position.

#### Configuring the bargraph or dot display

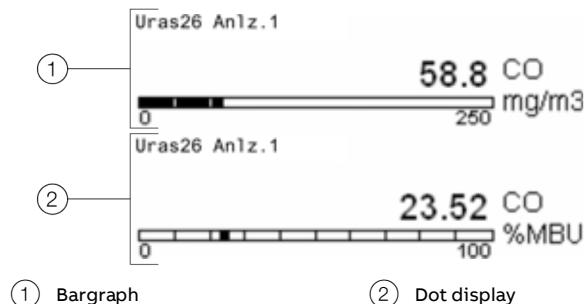


Figure 33: Display variants

The display of measured values can be configured as a bargraph or dot display.

1. Select the 'Display' menu item.
2. Start configuration of the new display element with '**NEW**'.
3. Select the 'Source' parameter.
  - The function block menu is displayed.
4. Select the function block whose value is displayed. When configuring the display, it does not matter if a link has been entered for the function block.
  - For the parameters 'Name', 'Measpt.' and 'Source' the system default values will now be displayed. The 'Name' cannot be changed.
5. Select the 'Page' parameter.
  - The page overview is displayed.
6. Select the page on which the display element should be displayed. Only those pages can be selected with an assignment < 100%, i.e. in which there is at least one free position.
  - If the selected page is a system page, the position of the display element is set by the system; it can only be changed using '**SWAP DISPLAY**', see **Moving a Display Element within a Page** on page 102.
  - If the new page is a user page, the position must be configured.

7. Select the 'Position' parameter.
  - The nine possible positions are graphically represented; free positions are identified by the position number.
8. Select the position with the corresponding number key.
9. Select the 'Style' parameter.
10. Select the desired display type: 'Bar graph' or 'Point graph'.
11. Set the parameters 'Range Low', 'Range High' and 'Places'. If necessary, change the description of the display element in the 'Measpt.' parameter.
12. Switch to measuring mode.

- The newly configured display element is now shown in the LCD display.

The description of the display element is shown above the display.

To the right of the display, the name and unit of the functional block selected in step 4 are displayed.

These two parameters can be changed with the function block configuration.

### Value Input



#### Description

The source of the **Value input** display element is a 'Constant' function block that is automatically generated during configuration.

The output of this function block accepts the entered value.

For the **Value input** display element to be effective, the generated function block must be linked using a function block application after the display is configured (See Technical Information 'Function Blocks – Descriptions and Configuration' for a detailed description).

#### Parameters

For the display element **Value input**, the following parameters should be configured:

- The start and end of the input range,
- The number of decimal places in the display,
- Two lines of text that are displayed when the display element is used, and
- The password level on which the input value can be changed.

## ... 11 Configuration

### ... LCD display

#### Configuring Value Input

1. Select the 'Display' menu item.
2. Start configuration of the new display element with the 'NEW' softkey.
3. Select the Page parameter.
  - The page overview is displayed.
4. Select the page on which the display element should be displayed. Only those pages can be selected with an assignment < 100%, i.e. in which there is at least one free position.
  - If the selected page is a system page, the position of the display element is set by the system; it can only be changed using '**SWAP DISPLAY**', see **Moving a Display Element within a Page** on page 102.
  - If the new page is a user page, the position must be configured.
5. Select the 'Position' parameter.
  - The nine possible positions are graphically represented; free positions are identified by the position number.
6. Select the desired position with the corresponding number key.
7. Select the 'Style' parameter.
8. Select the 'Input' display type.

This creates a 'Constant' function block, the system-issued name of which – 'Value page-position' is displayed in the 'Source' parameter.

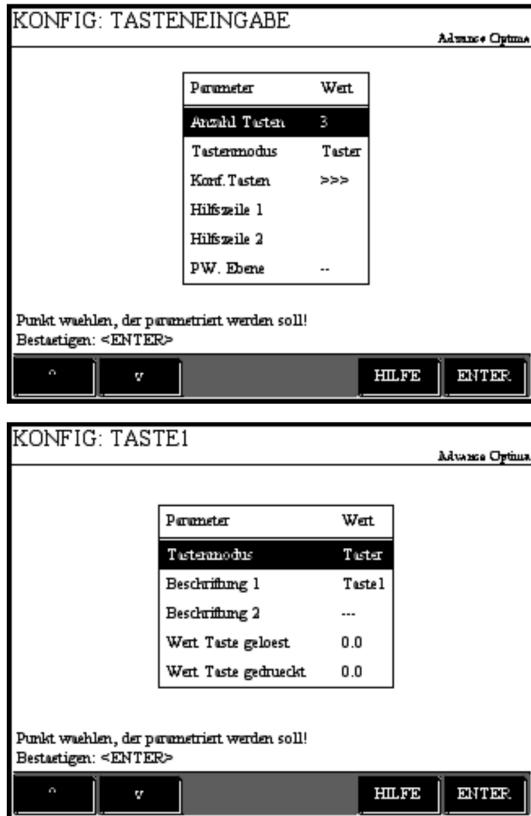
This name cannot be changed here; it can only be changed by configuring the function block (see Step 11).
9. Select the 'Config input' parameter and configure the other parameters: entry range, decimal places, text and password level. The configuration of reverse input ranges (e.g. 100–0 ppm) is possible.
10. The description of the display element is entered in the 'Measpt.' parameter.

11. Select the function block created in Step 8, enter the name and unit, and link the function block to an application via its Output 1 (See Technical Information "Function Blocks – Descriptions and Configuration" for detailed description).
12. Switch to measuring mode.
  - The newly configured display element is now shown in the display.  
The description of the display element is shown above the display.  
To the right of the display, the name and unit of the function block are displayed that were entered in Step 11.

#### Use

Values are entered during measurement by pressing the number key that corresponds to the position of the display element in the display and is indicated above the display element. A field then appears to enter the value: The **Value input** display element accordingly represents feedback to the actual value input.

## Key Entry



### Description

The source of the **Key input** display element are one or more **Constant** function blocks that are automatically generated during configuration. Upon ‘actuation’, the output of this function block assumes the value that was established during configuration.

For the key entry to be effective, the generated function blocks must be linked using a function block application after the display is configured (See Technical Information ‘Function Blocks – Descriptions and Configuration’ for detailed description).

### Parameters

For the display element **Key input**, the following parameters should be configured:

- The number of buttons (1 to 6) – the buttons are assigned to the softkeys,
- The button type – key, switch or option button,
- The parameters for each individual button - labeling, button value released and button value pressed,
- Two lines of text that are displayed when the display element is used, and
- The password level on which the buttons can be used.

### Configuring Key Entries

1. Select the ‘Display’ menu item.
2. Start the configuration of the new display element by selecting the ‘**NEW**’ softkey.
3. Select the ‘Page’ parameter.
  - The page overview is displayed.
4. Select the page on which the display element should be displayed. Only those pages can be selected with an assignment < 100%, i.e. in which there is at least one free position.
  - If the selected page is a system page, the position of the display element is set by the system; it can only be changed using ‘**SWAP DISPLAY**’, see **Moving a Display Element within a Page** on page 102.
  - If the new page is a user page, the position must be configured.
5. Select the ‘Position’ parameter.
  - The nine possible positions are graphically represented; free positions are identified by the position number.
6. Select the desired position with the corresponding number key.
7. Select the ‘Style’ parameter.

## ... 11 Configuration

### ... LCD display

8. Select the 'Keys' display type.
  - This creates a 'Constant' function block, the system-issued name of which – 'Value page-position' is displayed in the 'Source' parameter.  
This name does not appear in the display. If necessary, it can be changed by configuring the function block (see Step 11).
9. Select the 'Config keys' parameter and configure the other parameters 'No of keys', 'Key mode', 'Key label', 'Value key down/Value key up', 'Text' and 'Passwort level'. If all the keys are configured individually, a separate 'Constant' function block is created for each key.
10. The description of the display element is entered in the 'Measpt.' parameter.
11. Select each of the function blocks created in Steps 8 and 9 and link to an application with its output 1 (See Technical Information "Function Blocks – Descriptions and Configuration" for detailed description).
12. Switch to measuring mode.
  - The newly configured display element is now shown in the display. The description of the display element is shown above the display.

#### Use

Key entries are made in measurement mode by pressing the number button that corresponds to the position of the display element on the display and that is indicated over the display element.

A softkey line then appears with the configured buttons.

## 12 Calibration

### Principles

#### Calibration control

In regards to calibration of the analyzer modules, depending on the gas analyzer version and equipment, there are three methods for controlling calibration:

- Manual Calibration
- Automatic Calibration
- Externally controlled calibration

The analyzer module can be calibrated using any of the three methods.

#### Calibration Start

- Manual calibration is started manually via the gas analyzer's display and control unit.
- Automatic calibration is started at time intervals determined by the internal clock or by an external control signal or manually via the gas analyzer's display and control unit.
- Externally controlled calibration is triggered by an external control signal.

#### Wait until the warm-up phase has ended

Calibration should only be started after the warm-up phase.

Analyzer module	Duration of the Warm-up Phase
Fidas24	≤ 2 hours

#### Plausibility Check during calibration

If during calibration the gas analyzer finds implausible values (e.g. if the end point and zero values are equal), calibration is stopped and an error message is generated.

The values stored for the last calibration remain in effect.

#### Status Signal

The 'function check' status signal is set during calibration.

#### Manual Calibration

##### Definition

Manual adjustment means that zero and end point are calibrated separately by pressing the gas analyzer display and control unit buttons.

##### Test gas supply

The sample gases are switched on either via two solenoid valves or via corresponding manual valves.

The solenoid valves for the sample gas connection are activated by the calibration function via the digital I/O module of the gas analyzer.

Depending on the design of the gas feed, there are different possibilities available to supply the sample gas, see **Connection diagram for the sample and test gases** on page 31.

##### Waiting Period Following Manual Calibration

If the **Output Current Response** parameter is set to Hold, current output is halted for a specific time to allow the measurement value to stabilize after automatic calibration is ended.

This waiting period is:

Purging time sample gas  $\Rightarrow$  Sample gas +  $4 \times T_{90}$  or purging time sample gas  $\Rightarrow$  Sample gas +  $1 \times T_{90-1} + 3 \times T_{90-2}$ .

The waiting time for manual calibration corresponds to the waiting time after the end of the automatic calibration, please see **Waiting Period Following Automatic Calibration** on page 109.

##### Set calibration data

Refer to **Calibration data for manual calibration** on page 114.

##### Manual calibration of the analyzer module

Refer to **Gas Analyzer Manual Calibration** on page 122.

## ... 12 Calibration

### ... Principles

#### Automatic calibration

##### Definition

Automatic calibration means that the calibration of the zero point and end point proceed automatically after starting.

##### Test gas supply

The test gases are automatically fed in via external solenoid valves.

Depending on the design of the gas feed, there are different possibilities available to supply the sample gas, see **Connection diagram for the sample and test gases** on page 31.

#### Starting automatic calibration

Automatic calibration can be started in three ways:

- At time intervals determined by the internal clock
- By an external control signal
- Manually via the display and operation unit of the gas analyzer

##### Internal Start

Automatic calibration is normally started cyclically on a time-controlled basis by the internal clock of the gas analyzer.

The cycle time is parameterized with the calibration data, see **Calibration data for automatic calibration** on page 114.

##### External Start

The 'Start automatic calibration' control signal is needed for external starting of automatic calibration:

**Level:** Low Edge 0 to 3 V  $\Rightarrow$  High 12 to 24 V.

The transition from Low  $\Rightarrow$  High can also be generated via a contact. After the transition the High level must be present for at least 1 s.

**Input:** Digital input **DI1** on the digital I/O module.

Standard function block application 'Status signals/externally controlled calibration', see **Standard assignment of the digital inputs/outputs (I/O)** on page 46.

##### Manual Start

The automatic calibration can be manually started from the display- and control unit.

There are three options for manual start:

- Start the zero calibration individually
- Start the end point calibration individually, for restrictions see **Calibration data for automatic calibration** on page 114
- Start of the zero point and end point calibration jointly

See also **Manually starting the automatic calibration** on page 123.

##### Block automatic calibration

The 'Block automatic calibration' control signal is needed to block automatic calibration:

**Level:** High level 12 to 24 V.

Automatic calibration is blocked as long as the high level is active. The next automatic calibration after switching to a Low level will be started according to the parameterized cycle time.

**Input:** Digital input **DI2** on the digital I/O module.

Standard function block application 'Status signals/externally controlled calibration', see page 46.

## Automatic Calibration Start, Block and Cancel

Start	Block	Cancel
<b>Controlled by interval:</b>		
If 'Activation' parameter is set to 'on'	If 'Activation' parameter is set to 'off' or with the 'Block Automatic Calibration' control signal	Through appropriate configuration of the Cancel Management (see <b>Automatic Calibration</b> function block)
<b>Externally controlled:</b>		
With START	With STOP	

### Note

Automatic calibration of an analyzer module is impossible when it is operated with the test and calibration software TCT and during setup of system modules.

### Message Display

During automatic calibration an 'Autocal running' message blinks in the softkey line.

### Waiting Period Following Automatic Calibration

If the 'Output Current Response' parameter is set to Hold, current output is halted for a specific time to allow the measurement value to stabilize after automatic calibration is ended.

This waiting period is:

Purging time sample gas  $\Rightarrow$  Sample gas + 4  $\times$  T<sub>90</sub> or purging time sample gas  $\Rightarrow$  Sample gas + 1  $\times$  T<sub>90-1</sub> + 3  $\times$  T<sub>90-2</sub>.

### Set calibration data

Refer to **Calibration data for automatic calibration** on page 114.

### Set time constant T<sub>90</sub>

Refer to **Filter parameterization** on page 74.

## ... 12 Calibration

### ... Principles

#### Externally controlled calibration

##### Definition

Externally controlled calibration means that the adjustment of zero point and end point is triggered by control signals from an external control unit.

##### Test gas supply

The sample gases must be connected via external solenoid valves, which are also controlled via the digital outputs of the AO2040-Fidas24 Ex.

#### Control signals for externally controlled calibration

Control signal	Level*	Digital input***
Adjust the zero point	Low $\Rightarrow$ High** edge	DI3 'Status signals/'
Adjust end point	Low $\Rightarrow$ High** edge	DI4 externally controlled calibration'
Hold current signal	High	DI2 'Limit values'

\* Low level 0 to 3 V, high level 12 to 24 V

\*\* The Low  $\Rightarrow$  High transition can also be generated via a contact. After the transition the High level must be present for at least 1 s.

\*\*\* Standard function block applications, refer to **Standard assignment of the digital inputs/outputs (I/O)** on page 46.

#### Requirements for the design of the external controller

The external control unit must output the control signals for the adjustment of zero point and end point.

External control of the calibration must be designed in such a way that the calibration can only be started if there are no 'Failure' or 'Function check' status signals pending.

External control of the calibration must also be designed in such a way that a purging time must be allowed after each gas switchover until the measured value stabilizes, i.e. until the zero point or end point calibration is triggered. This purging time depends on the length of the sample gas paths in the gas analyzer and on the sample component; it can be several minutes.

The 'Hold current signal' control signal must be present for a certain time after the end of the calibration, during which the measured value stabilizes.

#### Set calibration data

Refer to **Calibration data for automatic calibration** on page 114.

#### Calibration methods

##### Calibration method

One or more (gas) components, each with one or more measuring ranges, can be implemented in an analyzer module (detector).

For the analyzer module calibration, you need to determine whether the components and measuring ranges should be calibrated jointly or individually. This is defined via the configuration of the calibration method.

##### Single calibration

The analyzer module is adjusted individually for each measured component in every measuring range at the zero point and at the end point.

The single calibration has no effect on the other measuring ranges of the same measured component and on the other measured component.

The single calibration is only possible and practical for the manual calibration. The single calibration is necessary if jumps in the display of measured value during the measuring range switching indicate that the calibrations of the individual measuring ranges differ from one another.

##### Common calibration

The analyzer module is calibrated in one measuring range at the zero point and end point for each measured component. The zero and end points of the other measuring ranges are then corrected electronically by the values established during this calibration.

The common calibration has no effect on the other measured components of the analyzer module.

In general, the zero point is adjusted in the smallest measuring range and the end point in that measuring range for which a suited sample gas is available.

**Substitute gas calibration**

If the sample gases for the calibration are not available, e.g. because they cannot be filled in sample gas bottles or because their components are not compatible with one another, a analyzer module can be set at the factory for calibration with a substitute gas in accordance with the order. In addition to the measuring ranges of the measured components, one or more measuring ranges are then set for the replacement gas component at the plant.

The analyzer module is calibrated in the measuring ranges of the substitute gas and/or sample components at a zero point and at an end point.

The zero and end points of the measuring ranges of all substitute gas and measured components are then corrected electronically by the values established during this calibration.

**Note**

In order to calibrate all (sample and substitute gas) components for analyzer modules that are set for calibration with a substitute gas, the substitute gas calibration must be carried out at all times.

A single or common calibration either only in the sample components or in the substitute gas measuring ranges results in an erroneous calibration of the analyzer module.

## ... 12 Calibration

### ... Principles

#### Overview

The following table presents the calibration methods at a glance.

Quantity	Calibration method	To be configured ...	This will be calibrated ...	The calibration has the effect ...
MK	MR			
1	1	Sample gas/Single		the zero point and the final point in every measuring range individually for every measured component
$\geq 1$	$> 1$	Sample gas/Common	the measuring ranges for zero point and end point calibration	the zero point in a measuring range and the final point in another measuring range for every measured component
$> 1$	$\geq 1$	Replacement gas	the components and measuring ranges for zero point and end point calibration	the zero point in a measuring range of a component and the final point in a measuring range of another component every detector

MK: Sample and substitute gas components

MB: Measuring ranges per component

#### Setting the calibration method

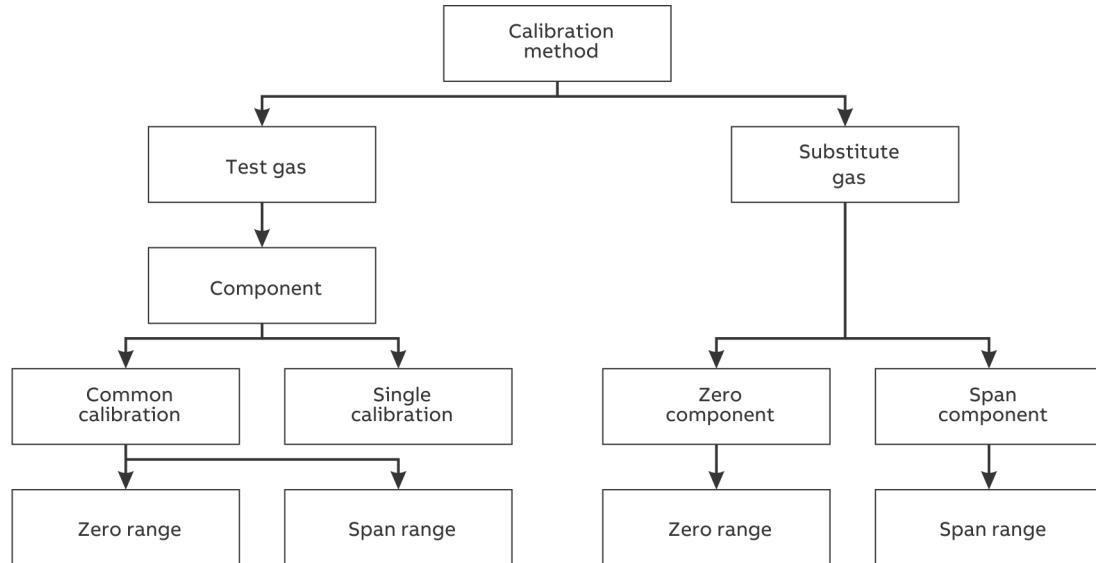


Figure 34: Adjusting the calibration method

The calibration method can be set separately for every one of the three types of control of the calibration (manual, automatic and externally controlled).

The measuring ranges for the zero point and end point calibration for common and substitute gas adjustment are set jointly for all three types of controls.

For the substitute gas calibration, the components need to be additionally set for the zero point and end point calibration.

## Gas analyzer configuration – calibration data

### 'Calibration data' submenu

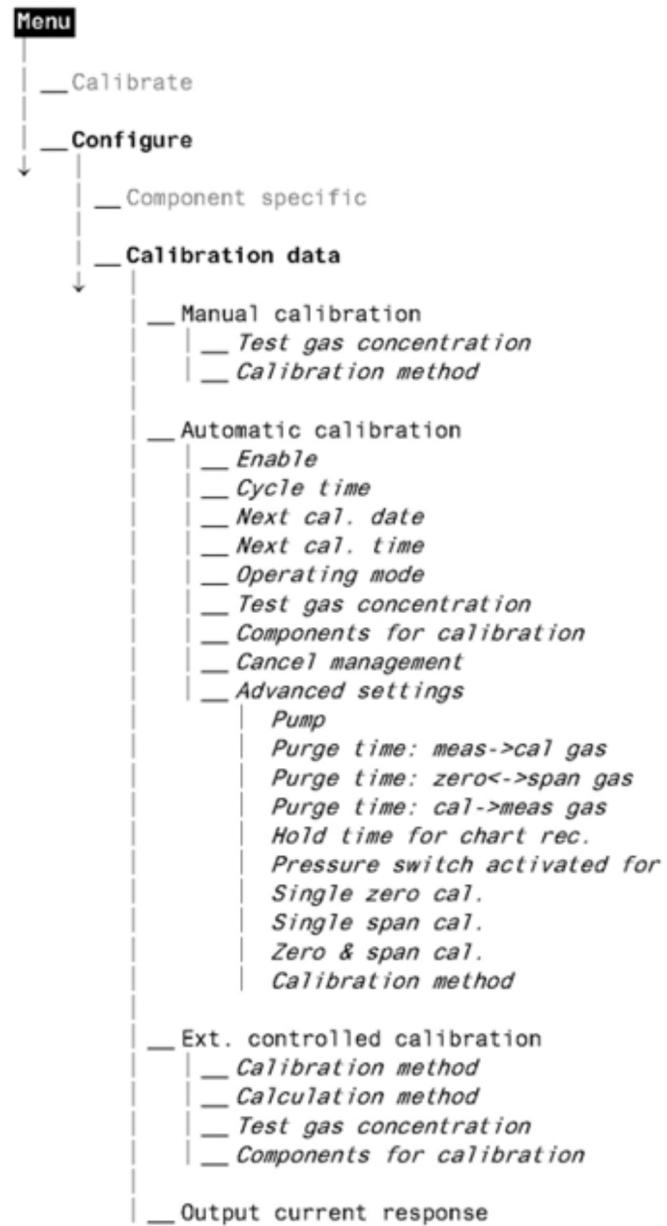


Figure 35: 'Calibration data' submenu

## ... 12 Calibration

### ... Gas analyzer configuration – calibration data

#### Calibration data for manual calibration

##### Menu Path

'MENU / Configure / Calibration Data / Manual Calibration / ...'

##### Test gas concentration

The initial point and end point test gas concentrations to be used as set points for manual calibration need to be set for the selected sample component and measuring range.

##### Calibration method

The calibration method should be set for manual calibration, see **Calibration methods** on page 110).

With ...	... are to be selected:
Common calibration	The sample components as well as the measuring ranges for the selected sample component for the initial point and end point calibration.
Substitute gas calibration	The (substitute gas) components for the initial and end point calibration as well as for the selected component of the measuring range.

##### Note

The settings of the components and measuring ranges apply both for the manual and for the automatic and externally controlled calibration.

##### Drift calculation

In 'MENU / Configure / Calibration Data / Drift Calculation', you can set whether the relative drift between two calibrations is calculated for automatic calibration only or for both the automatic and manual calibration.

Only one value is saved for the relative drift, i.e. if an automatic calibration is configured and active and a manual calibration is performed, then the relative drift is calculated with respect to the last automatic calibration and vice versa.

#### Calibration data for automatic calibration

##### Menu Path

'MENU / Configure / Calibration Data / Automatic Calibration / ...'

##### Activation

Automatic calibration is completed only when it is activated.

The 'off' setting only refers to the cyclically time-controlled start of automatic calibration.

##### Cycle time

The cycle time shows the time intervals over which automatic calibration is completed.

##### Date/time of the next calibration

The gas analyzer completes the next automatic calibration at the time specified here. From this moment in time, the cycle period starts to run.

##### Working mode

The 'Auto calibration' function block on which the automatic calibration is based works either as a calibration or as a Validation, refer to **Validation** on page 116.

The Technical Information "Function Blocks Descriptions and Configuration" contains complete information on the individual function blocks.

##### Sample gas concentration for calibration

The initial point and end point sample gas concentrations to be used as set points for automatic calibration need to be set for the selected sample component and measuring range.

### Components for calibration

The sample components to be calibrated during zero point and end point calibration need to be selected.

### Cancel management

Automatic calibration is always terminated when there is a system bus fault and when the input 'block' is set (for example, when the 'Block automatic calibration' control signal is applied).

You can configure if the automatic calibration is to be terminated when one of the three states occurs: 'System error', 'Analyzer error' or 'Analyzer maint.req.'.

You can also configure if gas analyzer should repeat automatic calibration after the cause of termination has been eliminated. Set the number of repetitions and the time between repetitions.

### Note

The configured repetition is not effective when the automatic calibration has been terminated by enabling the 'Cancel' input of the 'Autocalibration' function block.

### Purge Time

Setting should be made for the length of the interval

- between turning on the zero gas flow and starting zero point calibration,
- between turning on the sample gas flow and starting end point calibration
- between restarting the sample gas flow and initiating measurement

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

### Note

The purge time should be set to at least three times the  $T_{90}$ -time of the entire analyzer system.

### Single zero-point calibration

Settings should be made whether zero calibration will always or never be carried out alone, i.e. without subsequent span calibration.

### Single end point calibration

Settings should be made whether span calibration will always or never be carried out alone, i.e. without prior zero calibration.

### Joint zero and end point calibration

Settings should be made whether zero and span calibration will be carried out jointly always or never or at every nth automatic calibration.

### Example:

- Single zero point calibration: Always
- Single end point calibration: Never
- Joint zero point and end point calibration: each 7.

With a cycle time of 1 day, this setting initiates a zero point calibration every day and an end point calibration once a week

### Calibration method

The calibration method for automatic calibration needs to be set for the selected sample component, refer to **Calibration methods** on page 110.

The initial point and zero point calibration measuring ranges for common -and substitute gas calibration are selected in the 'Manual Cal. / Calibration method'.

## ... 12 Calibration

### ... Gas analyzer configuration – calibration data

#### Drift calculation

In 'MENU / Configure / Calibration Data / Drift Calculation', you can set whether the relative drift between two calibrations is calculated for automatic calibration only or for both the automatic and manual calibration.

Only one value is saved for the relative drift, i.e. if an automatic calibration is configured and active and a manual calibration is performed, then the relative drift is calculated with respect to the last automatic calibration and vice versa.

#### Validation

##### Validation Procedure

Validation runs in principle just like an automatic calibration.

The difference is that during validation a measurement value deviation from the set point values is not corrected automatically.

Instead the procedure is as follows:

- When the sample gas measured values for initial point and end point are within the respective limit values, the success of the validation is recorded in the logbook.
- When the sample gas measured values for initial point and end point are outside the parameterized limit values, the failure of the validation is recorded in the logbook and either the 'Maintenance Req.' status is set or a calibration of the sample component is performed.

#### Validation Parameters

The parameterization for automatic calibration also applies to the validation, refer to **Calibration data for automatic calibration** on page 114.

After selecting validation in the 'Working mode:' parameter, you need to set

- whether the validation result should be logged and
- whether the 'Maintenance Req.' status is set or a calibration of the sample component should be carried out.

In the 'Test gas concentration' parameter, the limit values for the initial point and end point should be set, for which their up-scaling or down-scaling will be set the validation as a failure.

## Calibration Data for Externally Controlled Calibration

### Menu Path

'MENU / Configure / Calibration Data / Ext. controlled cal. / ...'

### Note

The menu path refers to the 'Externally controlled calibration' function block.

The zero and span calibration parameters are selected separately. The Technical Information "Function Blocks Descriptions and Configuration" contains complete information on the individual function blocks.

### Calibration method

The calibration method for externally controlled calibration needs to be set for the selected sample component, refer to **Gas analyzer configuration – calibration data** on page 113.

The initial point and zero point calibration measuring ranges for common- and substitute gas calibration are selected in the 'Manual Calibration. / Calibration method' parameter.

### Calculation Method

Select whether the calibration is to be calculated as

- Offset calibration
- Amplification calibration
- As offset and amplification calibration

### Test gas concentration

The zero and span test gas concentrations to be used as set points for externally controlled calibration need to be set for the selected sample component and measurement range.

### Components for calibration

The sample components to be calibrated during zero and span calibration need to be selected.

### Output Current Response

#### Menu Path

'MENU / Configure / Calibration Data / Output current response / ...'

### Output Current Response

Signals at the current outputs (analog outputs) during the calibration

- are either held at the last measured value prior to starting calibration or
- they can follow measurement value changes during calibration.

## ... 12 Calibration

### Fidas24 – Notes for calibration

#### Sample components and measurement ranges

The Fidas24 analyzer module has always at least 1 sample component with 1 measuring range.

Up to 4 sample components with up to 4 measuring ranges are possible for each measuring component.

#### Note

One of the 4 possible sample components can be set up as a substitute gas at the factory even if it has not been ordered.

#### Setting measuring ranges

The measuring ranges are factory-set per customer order. The measuring range can be varied as follows depending on the adjusted amplification:

Gain	Meas. range
Low amplification	150000 to 100 ppm C1
High amplification	3000 to 10 ppm C1

The smallest measuring range is 0 to 5 mg org. C/m<sup>3</sup> corresponding to 0 to 10 ppm CH<sub>4</sub>.

The sample gas that is fed in must at no time up-scale the C1 equivalent of 8 Vol % CH<sub>4</sub>.

#### Note

The associated amplification levels are set at the factory during calibration. They can only be changed using the TCT test and calibration software.

#### Setting the calibration method

You can find additional information at **Calibration methods** on page 110.

#### Analyzer module with 1 sample component

1. Select calibration method:  
Parameter 'Test gas / Single/Common'
2. Select measuring range for zero calibration:  
Parameter 'Zero range: '
3. Select measuring range for end point calibration:  
Parameter 'Span range: '

#### Analyzer module with several sample components

1. Select calibration method:  
Parameter 'Test gas / Subst. gas'
2. Select components for zero calibration:  
Parameter 'Zero comp.: '
3. Select measuring range for zero calibration:  
Parameter 'Zero range: '
4. Select components for end point calibration:  
Parameter 'Span range: '
5. Select measuring range for end point calibration:  
Parameter 'Span range: '

## Test gases

### Test Gases for Zero Calibration

Quality	<ul style="list-style-type: none"> <li>Nitrogen, quality 5.0; synthetic or catalytically purified air</li> <li>Organic hydrocarbon content of &lt; 1 % of the measuring range</li> </ul>
Inlet pressure $p_e$	Without pressure and in excess or at least 130 l/h
Flow rate	130 to 250 l/h

### Test gases for endpoint calibration

Quality	Sample component or substitute gas component in nitrogen or synthetic air with concentration adjusted to the measuring range
Inlet pressure $p_e$	Without pressure and in excess or at least 130 l/h
Flow rate	130 to 250 l/h

## Test gas supply

Refer to **Connection diagram for the sample and test gases** on page 31.

## Wait until the warm-up phase has ended

Analyzer module may not be calibrated until the warm-up phase has ended.

## Fidas24 – Substitute gas calibration

### Example

Substitute gas calibration in the Fidas24 is described using the ‘Acetone measurement in room air’ example.

### Acetone measurement in room air

Acetone ( $C_3H_6O$ ) in higher concentrations cannot be filled in test gas containers.

For this reason, the analyzer module is factory-set for calibration with the substitute gas propane ( $C_3H_8$ ) in  $N_2$ .

## Measuring ranges

<b>Component 1</b>	Measuring range 1	0 to 10,000 ppm
$C_3H_6O$ in room air		
<b>Component 2</b>	Measuring range 1	0 to 10,000 ppm
$C_3H_8$ in $N_2$ (substitute gas)		

## Calibration data

Calibration method	Substitute gas calibration	
Zero component	Component 1 $C_3H_6O$	Measuring range 1 or
	Component 2 $C_3H_8$	Measuring range 1
Span component	Component 1 $C_3H_6O$	Measuring range 1 or
	Component 2 $C_3H_8$	Measuring range 1

## Calibration

- Calibrate zero point with air (Component 1 or Component 2).
- Calibrate end point with test gas propane in  $N_2$ .

## Other measurement tasks

For other measurement tasks select the test gases and measurement ranges in a similar manner according to the sample gas composition.

## ... 12 Calibration

### ... Fidas24 – Notes for calibration

#### Fidas24 – Response factors and other relevant variables

##### Response factors

###### Definition

$$\text{Response factor} = \frac{\text{Measured value display}}{\text{Concentration}}$$

or

$$\text{Concentration} = \frac{\text{Measured value display}}{\text{Response factor}}$$

The response factor of Propane ( $C_3H_8$ ) is equal to 1.00 in accordance with the definition.

##### Response factors for Fidas24 analyzer module

sample component		Response factor*
Toluol	$C_7H_8$	0.95
Chlorobenzene	$C_6H_5Cl$	0.95
p-Xylol	$C_8H_{10}$	0.92
Benzol	$C_6H_6$	0.99
Ethylbenzene	$C_8H_{10}$	0.92
Propane	$C_3H_8$	1.00
n-Hexane	$C_6H_{14}$	0.97
n-Octane	$C_8H_{18}$	0.93
iso-Octane	$C_8H_{18}$	1.04
Trichloroethylene	$C_2HCl_3$	0.96
Tetrachloroethylene	$C_2Cl_4$	1.00
Ethane	$C_2H_6$	1.01
Butane	$C_4H_{10}$	0.97
Methanol	$CH_3OH$	0.74
Butanol	$C_4H_9OH$	0.83
Acetic acid	$C_2H_4O_2$	0.52
Dichloromethane	$CH_2Cl_2$	1.00
Methane	$CH_4$	1.13

\* Measurement of the components in synthetic air

###### Note

The response factors for an individual analyzer module may differ slightly from the values indicated in the table.

##### Response factors for additional sample components

If a measuring component is added with a response factor which was not factory-set, we recommend determining this as follows:

$$\text{Response factor}_{\text{Component}} = \frac{\text{Measured value display}_{\text{Component}} \times \text{Test gas concentration}_{\text{Propane}}}{\text{Measured value display}_{\text{Propane}} \times \text{Test gas concentration}_{\text{Component}}}$$

The following information should therefore be noted in particular:

- The zero point should not differ essentially from the calibrated zero point, in particular when measuring with small concentrations. Otherwise the display must be offset against the deviation from the calibration of the zero point with the measured value display.
- The response factors of a gas in nitrogen and in synthetic air may differ considerably from each other.
- The measurements should always be performed with a sample component and a measuring range, for example THC in ppm C1. When calculating the test gas concentration, the number of C-atoms must be considered.
- Test gas cylinders with high accuracy (1 % and better) should be used.

##### Other relevant variables

The following variables must be stored in the software of the gas analyzer for each measuring component:

Molar mass, number of C-atoms, response factor and strip factor (K factor)

These variables are stored for the standard sample components; they must be entered when adding a user component.

##### Molar mass

$$M_C = 12.011 \text{ g/mol}$$

$$M_H = 1.008 \text{ g/mol}$$

##### Molar volumes

$$V_m = 22.414 \text{ l/mol for } 0^\circ\text{C and } 1013 \text{ hPa}$$

$$V_m = 24.05 \text{ l/mol for } 20^\circ\text{C and } 1013 \text{ hPa}$$

## Fidas24 – Conversion of concentration data

### Various units for concentration details

When measuring organic carbon compounds (total C) the concentration is indicated in various units.

The most important units are:

- mg C/m<sup>3</sup> (e.g. for measurements in accordance with 17 BlmSchV)
- mg C<sub>n</sub>H<sub>m</sub>/m<sup>3</sup>
- ppm C<sub>n</sub>H<sub>m</sub> (e.g. for measurements in accordance with Federal German Regulations on Air Purity, details on test gas cylinders)
- ppm C1 (for THC or methane CH<sub>4</sub>)

### Examples for the conversion of units and concentration details

#### Conversion of ppm in mg C<sub>n</sub>H<sub>m</sub>/m<sup>3</sup>

$$\text{mg C}_n\text{H}_m/\text{m}^3 = \text{ppm} \times \frac{\text{Molar mass}}{V_m}$$

#### Conversion of ppm in mg C/m<sup>3</sup>

$$\text{mg C}/\text{m}^3 = \text{ppm} \times \frac{\text{Number of C atoms} \times M_c}{V_m}$$

#### Conversion ppm © ppm C1

$$\text{ppmC1} = \text{ppm} \times \text{Number of C atoms}$$

#### Example 1

The analyzer module has a measuring range (MR) of 0 to 50 mg C/m<sup>3</sup>. As a test gas, propane (C<sub>3</sub>H<sub>8</sub>) in N<sub>2</sub> or in air is used.

What is the maximum test gas concentration in ppm or mg/m<sup>3</sup> so that the measuring range is not up-scaled?

$$\text{CC}_3\text{H}_8[\text{ppm}] = \frac{\text{MR}_{\text{max}} \times V_m}{\text{Number of C atoms} \times M_c} = \frac{50 \times 22.414}{3 \times 12.011} = 31,102$$

$$\begin{aligned} \text{CC}_3\text{H}_8[\text{mg}/\text{m}^3] &= \frac{\text{CC}_3\text{H}_8[\text{ppm}] \times (\text{Number C-Atoms} \times M_c + \text{Number H-Atoms} \times M_H)}{V_m} \\ &= \frac{31,102 \times (3 \times 12.011 + 8 \times 1.008)}{22.414} = 61.19 \end{aligned}$$

### Example 2

If a test gas other than propane is used, its response factor (see **Response factors** on page 120) must be considered.

What is the maximum test gas concentration in ppm or mg/m<sup>3</sup> if methane (CH<sub>4</sub>) is used?

$$\text{CCH}_4[\text{ppm}] = \frac{\text{MR}_{\text{max}} \times V_m}{\text{Number C Atoms} \times M_c} = \frac{50 \times 22.414}{1 \times 12.011} = 93.306$$

$$\begin{aligned} \text{CCH}_4[\text{mg}/\text{m}^3] &= \frac{\text{CCH}_4[\text{ppm}] \times (\text{Number of Catoms} \times M_c + \text{Number of Hatoms} \times M_H)}{V_m} \\ &= \frac{93.306 \times (1 \times 12.011 + 4 \times 1.008)}{22.414} = 66.785 \end{aligned}$$

The response factor for methane is Rf<sub>CH<sub>4</sub></sub> = 1.13; i.e. the measured value display is too great by this factor.

In order to determine the maximum test gas concentration to avoid exceeding the measuring range, the measured value display must be divided by the response factor.

$$\text{C}_{\text{max CH}_4}[\text{ppm}] = \frac{\text{C}_{\text{CH}_4}[\text{ppm}]}{\text{Rf}_{\text{CH}_4}} = \frac{93.306}{1.13} = 82.572$$

$$\text{C}_{\text{max CH}_4}[\text{mg}/\text{m}^3] = \frac{\text{C}_{\text{CH}_4}[\text{mg}/\text{m}^3]}{\text{Rf}_{\text{CH}_4}} = \frac{66.785}{1.13} = 59.102$$

A test gas cylinder with approx. 80 ppm CH<sub>4</sub> has been ordered.

The test gas concentration in the test gas cylinder is 81.2 ppm CH<sub>4</sub> in accordance with the certificate.

This is equivalent to a concentration of

$$\begin{aligned} \text{C}_{\text{CH}_4}[\text{mgC}/\text{m}^3] &= \frac{\text{C}_{\text{cylinder}} \times \text{Number of C atoms} \times M_c}{V_m} \\ &= \frac{81.2 \times 1 \times 12.011}{22.414} = 43.513 \end{aligned}$$

Considering the response factor, the indication should be adjusted to

$$\text{C}_{\text{max CH}_4}[\text{mg}/\text{m}^3] = \text{C}_{\text{CH}_4} \times \text{Rf}_{\text{CH}_4} = 43.513 \times 1.13 = 49.1697$$

•

## ... 12 Calibration

### Calibrate the gas analyzer

#### Gas Analyzer Manual Calibration

##### Note

Calibration should only be carried out after the warm-up phase.

#### Gas Analyzer Manual Calibration

##### Implementation:

1. Select the 'Manual Calibration' menu:  
‘MENU / Calibrate / Manual Calibration’
  2. For single calibration:  
Select 'Component' and 'Measurement range'.
- Zero calibration:**
3. Select 'Zero gas'
  4. Turn on the zero gas supply.
  5. If necessary, change the indicated sample gas concentration <sup>1)</sup>, 'ENTER'.
  6. When the sample value indication stabilizes, initiate zero calibration by selecting 'ENTER'.
  7. Accept the calibration by selecting 'ENTER'  
or Calibration 'REPEAT<sup>2)</sup>' (back to step 5)  
or reject calibration by selecting **Back** (back to step 6)  
or reject calibration by selecting **Meas** (back to measured value readout).

##### Span Calibration:

8. Select 'end point gas'.
9. Turn on the span gas.
10. If necessary, change the indicated sample gas concentration <sup>1)</sup>, 'ENTER'.
11. When the sample value indication stabilizes, initiate end point calibration by selecting 'ENTER'.
12. Accept the calibration by selecting 'ENTER'  
or Calibration **REPEAT<sup>2)</sup>** (back to step 10)  
or reject calibration by selecting **Back** (back to step 11)  
or reject calibration by selecting **Meas** (back to measured value readout).
13. For single calibration, repeat steps 2 to 12 for other components and measuring ranges.

- 1) The parameterized sample gas concentration is displayed. If the setpoint is altered here, the parameterized test gas concentration is overwritten.
- 2) A calibration may have to be repeated if the measured value is still not stable after initiation of the calibration. The repeated calibration is based on the measured value obtained in the preceding calibration.

## 13 Diagnosis / Troubleshooting

### Safety instructions

#### **WARNING**

##### Risk of injury

Risk of injury due to improperly performed error correction.  
The remedial measures described in this chapter require special knowledge and may require work to be done on the gas analyzer while it is open and under voltage!

- Work on the gas analyzer may only be performed by qualified and specially trained personnel!

#### **CAUTION**

##### Risk of burns

Risk of burns at the sample gas connection (temperature > 100 °C)!

- Before working on the sample gas connection, switch off the power supply and allow the sample gas connection to cool for about 30 minutes.

### Manually starting the automatic calibration

#### Note

Calibration should only be carried out after the warm-up phase.

### Automatic calibration

The automatic calibration can be conducted in three ways:

- as a zero point calibration only or
- as an end point calibration only or
- jointly as a zero point and end point calibration

### Manually starting the automatic calibration

1. Select the 'Automatic Calibration' menu:

'MENU / Calibrate / Automatic Calibration'

2. Select type of calibration:

- Only zero point calibration:

**ZERO AUTOCAL**

- Only end point calibration:

**SPAN AUTOCAL**

- Joint zero and end point calibration: **ZERO & SPAN AUTOCAL**

### Manually aborting the automatic calibration

The user can end the automatic calibration process by pressing the '**STOP**' softkey.

When automatic calibration is stopped, the analyzer module is in an indefinite state. For example, the zero point calibration may have been completed and calculated, but the end-point calibration has not yet been carried out.

For this reason, automatic calibration will have to be restarted and allowed to run to completion after any cancellation of automatic calibration.

### Validation

The procedure described above applies in the same way if the analyzer module is in 'Validation' operating mode, refer to **Validation** on page 116.

## ... 13 Diagnosis / Troubleshooting

### The Dynamic QR Code

#### Application

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

The QR code displayed contains static system information as well as dynamically generated information regarding system configuration and the status of the gas analyzer.

Static data for the identification of the device includes, for example:

- Manufacturing number
- Production date
- Software version
- Serial numbers of the analyzer modules and assemblies that have been installed

Dynamic data for diagnostic purposes in the case of a fault include, for example:

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

In combination with mobile devices (smartphone, tablet, etc.), Dynamic QR Code represents an innovative communication path for the user, enabling improved, case-specific assistance from the ABB service team.

This helps to shorten response times in the event of a fault, thereby increasing the availability of your gas analyzers.

Dynamic QR Code is compatible with both the ABB app "my Installed Base" and standard QR Code scanner apps

#### Handling

The QR code is accessed in the Diagnostic Menu of the gas analyzer and indicated on the display.

The QR Code Scanner App installed in the mobile device scans the QR Code that is displayed. The text information that is then displayed on the mobile device is sent to the local service contact specified in the "Measurement Care" contract, by email or other means of transmission.

Alternatively, it is possible to take a photograph of the displayed QR code and send the photograph to the service contact.

#### Dynamic QR-Code Accessing

##### Menu Path

'Menu/Diagnosis/Information/QR Code display'

##### Procedure

1. Select system overview or the required analyzer module.
2. Access the QR code by pressing **ENTER**.
3. Scan QR code.
4. Return to the menu selection by clicking on **Back**.

### Recommended QR code scanner apps

ABB recommends using the following QR code scanner apps (available free of charge for iOS and Android devices):

"my Installed Base" from ABB

iOS App Store	Google Play
	

"QR Scanner" from Kaspersky

iOS App Store	Google Play
	

## Process status

The Process status provides information on measurement values and the status of the process, which is monitored by the gas analyzer.

System status provides information on the gas analyzer itself, refer to **Status messages** on page 126.

### Definition

The term "process status" summarizes any breaching of the measuring range limits via the measured value and the breaching of limit values via the measured value.

### Transgression of Measuring Range Limits

If the measured value of a component is  $> +130\%$  or  $< -100\%$  of the span, the measured value for the component flashes in the display.

A status message is also generated in each case, these messages will not be entered into the logbook.

### Note

The thresholds established cannot be changed.

### Transgression of limit values

If a measured value is above or below a limit value, this status is output as a binary signal at one of the digital outputs.

Two prerequisites must be met to this effect:

- The limit value must have a digital output assigned to it, refer to **Standard configuration (applications)** on page 83.
- The limit value monitoring parameters (direction of effect, threshold value, hysteresis) must be set, refer to **Limit Value Monitor Parameterization** on page 73.

The assignment of limit values to certain digital outputs is factory-set; this is documented in the analyzer data sheet.

## ... 13 Diagnosis / Troubleshooting

### Instrument status

#### Status messages

##### Where are status messages generated?

The following components and modules generate status messages:

- By the gas analyzer, i.e.:
  - System controller (signal processing, calibration, system bus)
  - Analyzer modules
  - Pneumatic Module
  - Temperature and pressure regulators
  - I/O modules and external I/O devices
- By peripherals, for example:
  - System coolers
  - Other modules for sample gas processing

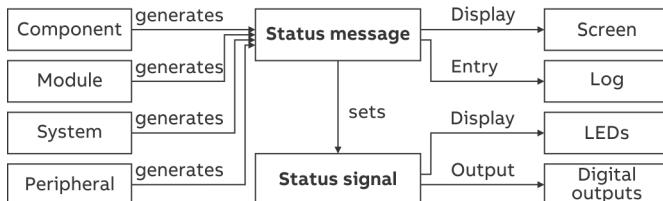
#### User-Configured Status Messages

Status messages are generated by the gas analyzer and by peripherals.

In addition, it is possible with the use of the **Message insert** functional block to integrate status messages for both the gas analyzer and from the periphery assemblies in the status message processing.

The Technical Information "Function Blocks Descriptions and Configuration" contains complete information on the individual function blocks.

#### Status Message Processing



- Status messages are shown on the screen and recorded in the log.
- Status messages set a corresponding status signal (overall status or individual status).
- The status signals are indicated via the status LEDs and the output takes place via the digital outputs of the system controller.

#### Status messages are shown in the LCD display

As soon as a status message is received, the message indicator flashes on the LCD display and the **STATUS MESSAGE** softkey is displayed.

By pressing the **STATUS MESSAGE** softkey the user can recall the status message summary and view status message details.

#### Logging Status Messages

Status messages are logged.

Messages concerning a transient gas analyzer state with no direct effect on measurements are not logged.

Such messages include the following:

- "A password is active!"
- "This system is currently being controlled remotely!"
- "Automatic calibration in progress."

## Status Signals

### Overall or Individual Status

The status signal is factory-configured to output as an overall or individual status, (refer to **Configure Status Signals** on page 90).

### Overall status

If the gas analyzer is configured to output overall status, status messages are issued as overall status indications.

### Individual Status

If the gas analyzer is configured to output individual status, status messages are issued as the "Failure" or "Maintenance Required" or "Function Check" individual status indications.

The following table shows possible causes of individual status signals and how to evaluate the measured values.

Individual Status Signal	Cause	Evaluation of Measured Value
Failure	The analyzer is in a state that requires immediate user intervention.	The measured value is invalid.
Maintenance Required	The analyzer is in a state that will soon require user intervention.	The measured value is valid.
Function Check	The gas analyzer is being calibrated or serviced.	The measured value is not a process measured value and is to be discarded.

### Individual Status by Analyzer Module or Sample Component

In principle, the individual status signals apply to the entire gas analyzer (system status).

However, by configuring the **Message input** function block, individual status messages for each analyzer module or for each sample component can be output separately via digital outputs.

The Technical Information "Function Blocks Descriptions and Configuration" contains complete information on the individual function blocks.

I/O device status messages are only reported as system status signals.

### Status Indication

Gas analyzer status is indicated by means of status LEDs.

LED	Status
Error	Overall status or individual "Error" status 
Maint	Individual "Maintenance Required" status 

## ... 13 Diagnosis / Troubleshooting

### Status Message Categories

There are three categories of status messages:

- Status messages not requiring acknowledgment
- Status messages requiring acknowledgment
- Status messages requiring acknowledgment and intervention

#### **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 measured values from the analog/digital converter.

#### **Status messages requiring acknowledgment and intervention**

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.

## Overview

The following table shows the chronological sequence of the three categories of status messages, and the marking of the status messages in the overview of status messages (**q**, **Q** and **I**).

### Status Messages Not Requiring Acknowledgement

Status begins	Status ends
LED lights up	LED goes out
Status signal set	Status signal reset
Status message appears	Status message canceled

### Status Messages Requiring Acknowledgment

Status begins	Status ends	Acknowledge
LED lights up	LED goes out	
Status signal set	Status signal reset	
Status message appears	<b>q</b> Status message remains	<b>I</b> Status message canceled
Status begins	<b>Acknowledge</b>	
LED lights up		
Status signal set		
Status message appears	<b>q</b> Status message remains	<b>Q</b> Status message canceled

### Status Messages Requiring Acknowledgment and Intervention

Status begins	Status ends	Acknowledge, correct
LED lights up		LED goes out
Status signal set		Status signal reset
Status message appears	<b>q</b> Status message remains	<b>I</b> Status message canceled
Status begins	<b>Acknowledge, correct</b>	
LED lights up		
Status signal set		
Status message appears	<b>q</b> Status message remains	<b>Q</b> Status message canceled

## ... 13 Diagnosis / Troubleshooting

### Possible status messages

#### Legend for the "status messages" table

##### Status Signals

No.	The status message number appears in the menu line display
Text	Full text of the status message is shown in the detailed display
S	x = Status message sets the overall status
A	x = Status message sets the "Error" individual status
W	x = Status message sets the "Maintenance Request" individual status
F	x = Status message sets the "Maintenance Mode" individual status
Reaction/Comment	Explanations and corrective measures in case of status messages

#### "Status messages" table

No.	Text	S	A	W	F	Reaction/Comment
<b>Runtime error</b>						
1...	Runtime Error 1 ...					When the same status message occurs repeatedly, inform Service.
21	Runtime Error 21					
<b>System Controller</b>						
101	The system controller shuts down at					for information; stating date and time
102	System controller system start at					for information; stating date and time and warm/cold start
103	Installed module:					for information
104	Delete module:					for information
105	Reactivate module:					for information
106	A user installed the module:					for information
107	A user deleted the module:					for information
108	A user replaced the module:					for information
109	A password is active! To delete, please press the <MEAS> button in the display of measured values.					Information on password protection, see <b>Password protection</b> on page 67; not in the logbook
110	The system starts up.					not in the logbook
111	This system is currently being operated remotely!					not in the logbook
112	The display and operating unit synchronizes with the analyzer. Please wait.					not in the logbook
113	The system time was changed from -> to:					not in the logbook
114	Changed parameters are saved. Please wait.					

No.	Text	S	A	W	F	Reaction/Comment
<b>System controller (continuation)</b>						
116	The profibus module is installed on a wrong slot! The profibus interface is therefore not functional. Please install the profibus module on the slot X20/X21.	x	x			see message text
117	The configuration backup was saved.					
118	The configuration backup was loaded and the system restarted.					
119	The system configuration could not be loaded. For that reason, the system does not currently contain a configuration. Please load the following from the menu: Configure/System/Configuration, save the backup configuration. Or load a configuration with the use of SMT.	x	x			see message text
<b>System Bus</b>						
201	The system bus module selected could not be found.	x	x			Check plug connections and terminal resistances on the system bus. Check whether the serial number of the system bus was entered correctly: <a href="#">MENU / Diagnostic/Information / System overview</a>
203	The system bus module does not exist.	x	x			Check plug connections and terminal resistances on the system bus.
208	The system bus could not transfer any data to the database.	x	x			The software version of the system bus module is not compatible with that of the system controller; carry out system update of the system controller.
209	The system bus connection to this module has been interrupted.	x	x			Check system bus connection to the system bus module displayed. Check power supply of the displayed system bus module.
210	The configuration of the system bus module has changed.	x	x			for information; the configuration data are updated automatically
211	The system bus module no longer has an internal memory.	x	x			Check the configuration of the system bus module: <a href="#">MENU / Diagnostic/Information / System overview</a>
214	The system is currently being maintained with Optima SMT.					
215	The analyzer module has an internal communication error!	x	x			Notify Service.
216	The analyzer module has an internal program error!	x	x			Notify Service.

## ... 13 Diagnosis / Troubleshooting

### ... Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
<b>System bus (continuation)</b>						
250	The analyzer module could not be found.	x	x			Check plug connection and wiring.
251	The connection to the analyzer module was lost.	x	x			Check plug connection and wiring.
252	The EEPROM data of the analyzer are faulty.	x	x			Check configuration with TCT.
253	The communication with the analyzer is disrupted!	x	x			Check plug connection and wiring.
254	The boot program of the analyzer module is faulty! Notify Service!	x	x			Notify Service.
255	The program of the analyzer module is faulty! Notify Service!	x	x			Notify Service.
<b>Analyzer modules</b>						
300	No new measured values from the analog/digital converter.	x	x			Notify Service.
301	The measured value exceeds the value range of the analog/digital converter.	x	x			Check sample gas concentration. Notify Service.
302	The offset drift exceeds the half of the range permissible.		x			Check analyzer module and sample preparation. Permissible range: 150 % of the smallest measuring range installed.
303	The offset drift exceeds the permissible range.	x	x			As soon as the drift exceeds these values, notify Service.
304	The amplification drift exceeds the half of the range permissible.		x			Calibrate the detector displayed manually at the zero point and span point. Check analyzer module and sample preparation. Permissible range: 50 % of the sensitivity of the detector. As soon as the drift exceeds this value, notify Service.
305	The amplification drift exceeds the permissible range.	x	x			
306	The offset drift between two calibrations exceeds the permissible range.		x			These messages are created by the automatic calibration. Check plausibility of the calibration. Rectify possible cause of an implausibility. Calibrate the displayed detector manually at the zero point (No. 306) or span point (No. 307). Permissible range: 15 % of the smallest measuring range that has been installed; 6 % of the smallest measuring range that has been installed for measurements on systems subject to approval and systems of the 27th and 30th. BImSchV
307	The amplification drift between the two calibrations exceeds the permissible range.		x			
308	A calculation error occurred while calculating the measured value.	x	x			Notify Service.
309	The thermostat works erroneously.		x			see status message of the relevant temperature
310	The temperature correction for this component was deactivated because the temperature measured value is invalid.		x			see status message of the relevant temperature

No.	Text	S	A	W	F	Reaction/Comment
<b>Analyzer module (continuation)</b>						
311	The pressure regulator works erroneously.	x	x			see status message of the relevant pressure detector
<b>Auxiliary detector</b>						
315	No new measured values from the analog/digital converter.	x				Notify Service.
316	The measured value exceeds the value range of the analog/digital converter.	x				Notify Service.
317	A calculation error occurred while calculating the measured value.	x				Notify Service.
<b>Fidas</b>						
321	The temperature of the detector falls below the minimum temperature.	x	x			Status message during the warm-up phase. If the status message occurs after the warm-up phase: check fuse and replace, if necessary.
322	The flame is off.	x	x			Status message during the warm-up phase. If the status message occurs after the warm-up phase: check supply gases, check glow plug.
323	The analyzer is currently in the fail-safe status.	x	x			Causes: flame temperature > Detector set point + 220 °C, hardware errors, Pt-100 line break or short-circuit.  Switch power supply off and back on after ≥ 3 seconds. If the status message recurs, notify Service.  Note: Fail-safe means: heater off, combustion gas valve closed, instrument air valve closed, housing purging on, zero gas valve open.
<b>Temperature controller</b>						
324	The temperature exceeds or falls below the top or bottom limit value 1.	x				Status messages during the warm-up phase. If the status messages occur after the warm-up phase:
325	The temperature exceeds or falls below the top or bottom limit value 2.	x				Check whether the permissible ambient temperature range (refer to <b>Ambient temperature during operation</b> on page 22) has been complied with. Check the overheating protection in the analyzer module and replace it if necessary.  Fidas24: The temperatures of the detector ( <b>T-Re.D</b> ) and, possibly that of the heated sample gas connection ( <b>T-Re.E</b> ) are outside of the permissible limit values.
<b>Pressure regulator</b>						
326	No new measured values from the analog/digital converter.	x	x			Notify Service.
327	The measured value exceeds the value range of the analog/digital converter.	x	x			Notify Service.
328	A calculation error occurred while calculating the measured value.	x	x			Notify Service.
329	The pressure exceeds or falls below the top or bottom limit value 1.	x				Fidas24: Check the pressure of the supply gas: <b>Output</b> = instrument air,
330	The pressure exceeds or falls below the top or bottom limit value 2.	x				<b>Air</b> = Combustion air, <b>H2</b> = Combustion gas.
331	The position value of the pressure is outside the valid area.	x	x			Fidas24: Check supply gas pressures.

## ... 13 Diagnosis / Troubleshooting

### ... Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
<b>I/O devices</b>						
332	Loss of auxiliary current in the I/O card.	x	x			The I/O card is faulty. Replace card.
333	An I/O type that is not yet available is configured.	x	x			Correct configuration with test and calibration software.
334	No new measured values from the analog/digital converter.	x	x			The I/O card is faulty. Replace card.
335	The measured value exceeds the value range of the analog/digital converter.	x	x			Check signals on the analog inputs. If OK, check configuration and calibration of the analog inputs.
336	A calculation error occurred while calculating the measured value.	x	x			Check configuration and calibration of the analog inputs and analog outputs.
337	Line break and analog output.	x	x			Check lines in analog output.
338	Line break in digital input (humidity sensor).	x	x			Check humidity sensor in the system cooler.
339	Line break or short-circuit in the analog input.	x	x			Check temperature of the system cooler.
340	The value of the analog input exceeds or falls below the top or bottom limit value 1.		x			Check temperature of the system cooler.
341	The value of the analog input exceeds or falls below the top or bottom limit value 2.		x			Check temperature of the system cooler.
<b>Flow controller</b>						
342	The flow rate is below the limit value 1.		x			Check sample conditioning. Limit value 1 = 25 % MBU.
343	The flow rate is below the limit value 2.	x	x			Check sample conditioning. Limit value 2 = 10 % MBU. The automatic calibration has been interrupted and blocked.
<b>Measured value</b>						
344	The measured value exceeds the value range of the measuring range.					Measured value > +130 % MRS; not in the logbook
345	The measured value falls below the value range of the measuring range.					Measured value < -100 % MRS; not in the logbook
<b>Fidas24</b>						
411	The analyzer is in standby. Reactivation in the menu: Service/Test..Standby/Restart FID	x		x		Restart Fidas24.
412	Ignition failed. The analyzer needs to be reactivated manually. Reactivation in the menu: Service/Test..Standby/Restart FID	x	x			Check operating gases. Restart Fidas24.
413	Failure of auxiliary current in the analyzer hardware.	x	x			Notify Service.
414	The position value of this controller is below the permissible range. (< 20%)	x		x		Check operating gases and connection leads. Restart Fidas24, where applicable. Notify Service.
415	The position value of this controller is above the permissible range. (> 90%)	x		x		

No.	Text	S	A	W	F	Reaction/Comment
<b>Calibration</b>						
500	System bus communication disrupted.					
501	Required functionality is not available in the system module.					Check software version of the analyzer module and carry out update, if applicable.
502	A system error occurred in the system module addressed.					Calibration interrupted. Notify Service.
503	Amplification error during calibration. Calibration not possible.	x				Calibration interrupted. Span point gas concentration too low – check.
507	A combination of the following errors has occurred: drift half, drift, amplification of the delta drift.					Calibrate the detector displayed manually at the zero point and span point.
508	Unknown error number. Check software versions.					Message during automatic calibration. Check software version of analyzer module and system controller.
509	Auto-calibration started.					for information
510	Auto-calibration ended.					for information
511	Auto-calibration canceled externally.					for information
512	Automatic calibration in progress.	x				for information; not in the logbook
513	System bus communication interrupted during automatic calibration.					
514	External calibration started.					for information
515	External calibration ended.					for information
516	External calibration in progress.	x				for information; not in the logbook
517	Device is being serviced.	x				for information, e.g. during a manual calibration; not in the logbook
518	Calibration could not be performed because the measured value is unstable.					
519	Pre-amplifier overrun error: The calibration could not be carried out, because the pre-amplifier is overdriven.					
520	Basic calibration zero point started.					for information
521	Basic calibration zero point ended.					for information
522	Basic calibration zero point canceled.					for information
523	Basic calibration zero point incomplete. System bus communication interrupted during calibration.					for information
524	Basic calibration zero point in progress.	x				for information; not in the logbook
525	Linearization not possible: The linearization provides no valid result. Measured value could possibly be inaccurate. Check center point gas.					see message text
526	Linearization not possible: The linearization could not be carried out, as the identification line is not linear.					see message text
527	Basic calibration for components:					for information

## ... 13 Diagnosis / Troubleshooting

### ... Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
<b>Calibration (continuation)</b>						
528	Automatic calibration could not be started, as the calibration was manual.				x	for information
529	The calibration was canceled, as no raw measured values can be entered.		x		x	
530	The calibration was canceled, as the pushbutton did not detect adjustment gas.		x		x	
531	Auto validation started.				x	for information
532	Auto validation ended.				x	for information
533	Auto validation canceled externally.				x	for information
534	Automatic validation in progress.			x		for information; not in the logbook
535	Automatic validation successful for:					
536	Automatic validation outside the limit for:				x	
537	Automatic validation outside the limit for:			x		
<b>User-configured messages</b>						
800	An external error occurred at:	x	x			Standard texts for the <b>Message insert</b> functional block are supplemented by the long text defined when configuring the functional block
801	An error defined by the user occurred at:	x	x			
802	A maintenance need defined by the user occurred at:			x		
803	Maintenance Mode defined by the user occurred at:			x		
<b>Various messages</b>						
1000	This functional block has an error:	x	x			is supplemented by the reference to the functional block type

## Troubleshooting

### Note

For the Fidas24 analyzer, the instructions under **Fidas24 – Troubleshooting** on page 138 must be observed.

### The measured value display flashes

The measuring signal exceeds the limits of the measuring range

### Note

Measured value > +130 % MBU or measured value < -100 % MBU. In addition, the status messages 344 or 345 are generated.

### The measured value display flashes alternately with --E--

Error in the processing of the measuring signal

1. View status messages.
2. Search and rectify fault cause.

### Only the mA display flashes alternately with --E--

Fault in the output circuit

Find the cause of the fault (e.g. a break in the line) and resolve it.

### Flow error

External gas lines or filters dirty, clogged or leaking

- disconnect the gas analyzer from the gas treatment system.
- blow out the lines with compressed air or unblock them mechanically.
- replace filter inserts and fill material.
- check gas lines for leaks.

### Requirements for sample gas flow

Analyzer module	Sample gas flow	
Fidas24	80 to 100 l/h	at atmospheric pressure (1000 hPa)

### Temperature Problem

Gas analyzer still in warm-up phase

Refer to **Warming-up phase** on page 59.

### Excessive air movement

- Reduce the flow of air around the gas analyzer.
- Install shielding against drafts.

### Ambient temperature outside of permissible range

- Protect the gas analyzer from cold and heat sources such as the sun, ovens and boilers.
- Observe climatic conditions, refer to **Climatic Conditions** on page 22.

## ... 13 Diagnosis / Troubleshooting

### Fidas24 – Troubleshooting

#### Flow Error

Sample gas inlet nozzle or sample gas filter clogged

- Checking the sample gas connection for blockages of the sample gas inlet nozzle and the sample gas filter.
- Replace sample gas filter (refer to **Cleaning the Fidas24 air jet injector** on page 150).

#### Temperature Problem

Connection leads of the temperature sensor or the heater disconnected

- Check the connection leads and connectors.
- Check the fit of the leads in the wire end ferrules.
- Checking the power supply to the heating system.

#### Unstable display of measured value

##### Vibrations

- Reduce vibration at the installation site.

#### Sample gas path leaking

- Checking for leaks in the sample gas path in the analyzer module and the sample extraction system.

#### Loss of sensitivity

- Having the service team replace the sample gas nozzle.

#### Sample gas outlet pressure too high

- Check the air jet injector for blocks, and clean it where applicable (refer to **Adjust output variables of the internal pressure controllers** on page 57). Increase instrument air pressure. Check air discharge line; it must have a large inside diameter.

#### Combustion air contaminated

- Check combustion gas supply

#### Fluctuating process gas pressures

- Check the supply of instrument air, combustion air and combustion gas

#### Pressure regulator fault

##### Unstable pressure values

- Set the external pressure of the operating gases so that the manipulated variable for instrument air “outlet” is approx. 60 %, for combustion air(air) approx. 55 %, for combustion gas ( $H_2$ ) approx. 42 % (refer to **Cleaning the Fidas24 air jet injector** on page 150).
- Have the pressure regulator modules checked.

##### Pressure regulator output variables not equal to set points

Manipulated variable	Measures
Air	Manipulated variable Reduce combustion air primary pressure. ≤ 50%
	Manipulated variable Increase combustion air primary pressure. ≤ 90 %
$H_2$	Manipulated variable Reduce combustion gas primary pressure. ≤ 40 %
	Manipulated variable Increase combustion gas primary pressure. ≤ 90 %
Input	Manipulated variable Reduce sample gas inlet pressure. ≤ 50%
	Output Manipulated variable Increase the instrument air pressure. ≤ 50% Cleaning the air jet injector (refer to <b>Possible status messages</b> on page 130). Reduce length of the gas discharge line or increase cross-section.
	Manipulated variable Reduce instrument air pressure. ≤ 90 %

#### Zero point drift

##### Sample gas line contaminated

- Cleaning the sample gas line.

##### Combustion air catalyst is not operating adequately

- Reduce hydrocarbon content.
- Exchange catalyst.

##### Combustion gas line contaminated

- Clean combustion gas line.

## Flame does not ignite

### Air in the combustion gas line

When connecting or replacing the combustion gas bottle make sure that no air penetrates into the combustion gas supply line. Air which has penetrated the gas supply line results in the flame in the analyzer going out.

The analyzer automatically tries to reignite the flame up to 10 times in a period of approx. 10 minutes with increased combustion gas pressure each time. If this is unsuccessful, the analyzer switches to operating condition "Wait for restart".

In this case, ignition of the flame must be restarted:

Refer to **Shut-off valve in the combustion gas supply line** on page 24.

### Note

The "Wait for Restart" operating condition means: heating on, combustion gas valve closed, instrument air valve open, housing purging on.

### Combustion air pressure too high

- Reducing the combustion air inlet pressure  
(Note the information given in the analyzer data sheet).

## Fidas24 in fail-safe status

If a serious error occurs in the analyzer, the device is automatically set to the fail-safe state.

### Note

The Fail-safe status means:  
heater off, combustion gas valve closed, instrument air valve closed, housing purging on, zero gas valve open.

The cause of the failure must be determined from the status messages (refer to **Pressurized encapsulation Ex-p** on page 25).

It is not possible to restart the analyzer in the "Fidas Restart" menu; after the error has been eliminated, the gas analyzer must be restarted by switching it off and on again.

## In case of instrument air supply failure

In case of a failure of the instrument air supply, the pressure switch ( $P = < 3$  bar) installed in the Fidas24 Ex will respond. The pressure switch is connected to the purging and monitoring unit. The pressure switch responds by switching off the purging and monitoring unit, which disconnects the entire gas analyzer from the power supply.

Furthermore, it must be guaranteed that the combustion gas supply to the analyzer module is shut off should the instrument air supply fail.

This is generally ensured by the installation of a pneumatic shut-off valve in the combustion gas supply line (refer to **Shut-off valve in the combustion gas supply line** on page 24); this valve must be controlled by the instrument air supply in such a way that, should it fail (and therefore, also in the event of failure of the continuous purging of the housing) the combustion gas supply is automatically shut off (refer to **Pressurized encapsulation Ex-p** on page 25).

If such a pneumatic shut-off valve is not installed, the following precautions and measures must be taken:

- The Overall Status or the 'Failure' status of the gas analyzer must be monitored.
- If this status arises, the on-site combustion gas supply must be interrupted.

### Note for measuring combustion gases

When measuring combustion gases, it must be made sure that in case of a failure of the instrument air supply or of the analyzer module itself the sample gas supply to the analyzer module is shut off and the sample gas path is purged with nitrogen.

## ... 13 Diagnosis / Troubleshooting

### Notify Service

#### Who should you contact for further help?

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

To find your local ABB contact visit:

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

For more information visit:

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

#### Before you notify Service ...

Before contacting the service department regarding a malfunction or a status message, please check whether there is, in fact, a fault in the sense that the gas analyzer is not complying with the metrological data (refer to data sheet).

#### If the Service Dept. has been informed ...

If the Service department has been informed due to an error or a status message, please provide the following data:

- The production number (P-No.) of the system housing where the malfunctioning or faulty component is installed
  - the production number is located on the name plate of the system housing as well as in the analyzer data sheet;
- the software version of the system controller and the system modules – the software version is located in the menu:  
'MENU / Diagnostic/Information / System overview'
- an exact description of the problem or status as well as the status message number.

That way, the service staff will be able to quickly help you.

Please also have the analyzer data sheet ready – it contains important information that will help the Service staff find the cause of the malfunction.

### Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes.

Fill out the return form (see **Return form** on page 155) and include this with the device.

In accordance with the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes:

All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

#### Address for the return:

##### ABB AG

##### Service Analysentechnik – Parts & Repair

Stierstädter Straße 5

60488 Frankfurt, Deutschland

Fax: +49 69 7930-4628

E-Mail: [repair-analytical@de.abb.com](mailto:repair-analytical@de.abb.com)

#### Transport-/Storage temperature

-25 to 65 °C

## 14 Maintenance

### Safety instructions

#### DANGER

##### **Explosion hazard**

There is a risk of explosion if the device is opened in a potentially explosive atmosphere.

Please take note of the following information before opening the device:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Turn off the power supply before opening the device, and observe a waiting period of 20 minutes, in order to allow any hot components to cool down.

#### **Use in potentially explosive Atmospheres**

The inspection and maintenance of the explosion-protected version of the gas analyzer requires special knowledge.

- Repairs and replacement of parts on the device may only be done by ABB service.
- For information on returning the device, refer to **Returning devices** on page 140.

#### DANGER

##### **Risk of explosion during maintenance of the device**

While the device or its components are being maintained/serviced, there is no explosion protection.

- ensure that no potentially explosive atmosphere can occur.

#### WARNING

##### **Risk of injury**

Risk of injury due to maintenance work being carried out incorrectly.

The work described in this chapter require special knowledge and may require work to be done on the gas analyzer while it is open and under voltage!

- Maintenance work on the gas analyzer should be performed by qualified and specially trained personnel only !

## ... 14 Maintenance

### Maintenance plan

The maintenance work described must be carried out at the specified maintenance intervals, pursuant to the maintenance schedule.

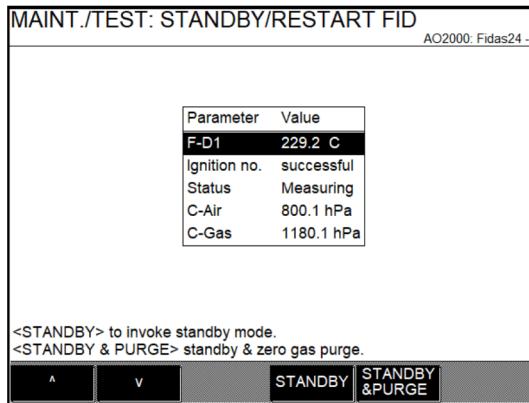
#### Gas analyzer

Module, Assembly	Maintenance activity / location	Maintenance interval	Additional Information
Gas analyzer	Check sample gas flow rate.	Regularly	Refer to page 59.
	Check the tightness of all the gas paths of the gas analyzer.	At least 1x a year, after the gas paths have been opened.	Refer to page 145.
System housing	Check the door seals for soiling and damage. Clean door seals as required and replace damaged seals if necessary.	Each time, before closing the doors.	—
Analyzer module Fidas24 ExClean air jet injector.			Refer to page 150.
	Replace sample gas filter	The sample gas filter in the heated sample gas connection must be replaced whenever it is polluted, resulting in the sample gas flow rate being too low.	Refer to page 149.
	Instrument air monitoring function test	At least 1xyear.	Refer to page 148.
Purging and monitoring unit FS870S	Purging and monitoring unit FS870S function test	At least 1xyear.	Refer to page 147.

## Fidas24 – Standby/Restart

### Menu Path

'MENU / Maintenance/Test / Analyzer spec. adjustm. / Standby/Restart FID'



### Display of the operating condition of the Fidas24

The key operating data of the Fidas24 are displayed:

Parameter	Description
Flame 1	Indication of the flame temperature.
Ignition no.	Indication of the number of ignition attempts before the flame is ignited. The "successful" display means that the first ignition attempt was successful.
Status	<ul style="list-style-type: none"> <li>Measuring: The analyzer module is OK, the measurement is running.</li> <li>Standby: The analyzer module is in standby mode; the measured values are invalid.</li> <li>Flame-Error: The flame is deactivated; the analyzer module needs to be restarted.</li> <li>Fail safe: The analyzer module has been deactivated due to a severe error.</li> </ul>
Air Pr.	Indication of combustion air pressure
H2	Indication of combustion gas pressure

### Definition of statuses

Standby mode means:

Heater on, combustion gas valve closed, combustion air valve closed, sample gas inlet valve closed, housing purging on, zero gas valve opened in standby mode with purging of the detector.

### Fail-safe status:

Heater off, combustion gas valve closed, sample gas inlet valve closed, housing purging on, zero gas valve open.

### Putting the Fidas24 in standby mode

If in the 'Standby/Restart FID' menu, the 'Standby' or 'STANDBY & PURGE' softkeys are displayed, the Fidas24 can be set to standby mode:

Softkey	Description/function
Standby	Standby mode is activated.
STANDBY & PURGE	Standby mode with opening of the zero gas valve for purging the detector is activated (only when executing with test gas connection).

### Setting the Fidas24 back to the measuring mode (restart)

If the Fidas24 is restarted from standby mode or after a flame error, in the 'Standby/Restart FID' menu, the 'Restart' softkey is displayed:

Softkey	Description/function
Restart	Restart is carried out.

After initiating the restart, you can leave the menu via the **Meas** or **Back** keys; the restart sequence continues to be executed.

The restart sequence can, however, also be observed further in the menu. The current values for the flame temperature, the combustion air pressure and the combustion gas pressure as well as the number of ignition attempts are displayed.

If the flame still fails to ignite after 10 attempts at ignition, the 'Ignition no.' parameter will display the text '10 - failed'.

You can initiate a restart of the system by pressing the 'Restart' softkey.

## ... 14 Maintenance

### ... Fidas24 – Standby/Restart

#### Fidas24 in fail-safe status

If a fatal error occurs in the analyzer module, the analyzer module will be set to the fail-safe state; in the 'Standby/Restart FID' menu, for the 'Status' parameter, the text 'Fail safe' will be displayed.

The cause of the failure must be determined from the status messages, refer to **Possible status messages** on page 130.

A cold restart in the menu is not possible; after fault correction the gas analyzer must be cold restarted by switching off and on again.

### Calibration Reset

#### What does the calibration reset do?

A calibration reset returns the analyzer module's calibration to basic calibration values.

Furthermore, the offset drift and amplification drift are electronically returned to basic calibration values, refer to **Basic Calibration** on page 145.

#### Note

- The absolute offset and amplification drift values are calculated cumulatively starting from the last basic calibration.
- The relative offset and amplification drift values are calculated between the last and next to last automatic calibration.
- The absolute and relative offset and amplification drift values can be viewed in the 'MENU / Diagnostic/Information / Module specific / Status' menu.

#### When should a calibration reset should be performed?

A calibration reset should be performed if an analyzer module can no longer be calibrated by normal means.

A possible cause of this is calibration of the analyzer module with the wrong test gases.

#### Menu Path

'MENU / Maintenance/Test / Analyzer spec. adjustm. / Calibration Reset'

#### Note

The analyzer module should be calibrated after a calibration reset.

## Basic Calibration

### What does the basic calibration do?

A basic calibration of an analyzer module sets the module back in an initial state.

The offset drift and amplification drift are set to 0; the drift history is thus lost.

### When should a basic calibration be performed?

The basic calibration of an analyzer module should only be carried out in exceptional cases if changes were made to the analyzer module that influence the calibration.

This can, for instance, be the case when replacing assemblies.

### Check prior to a Basic Calibration

Prior to a basic calibration, check and ensure the following:

- The gas analyzer is working fine
- The sample conditioning modules are in order
- The correct test gases are being used.

### Test gases

The zero and/or span calibration test gases are required for a basic calibration.

### Performing the Basic Calibration

The basic adjustment is carried out for a measuring range. The basic calibration can only be carried out together (one after the other) at the zero point and at the end point.

A Calibration Reset is also performed in the case of common basic calibration at the zero and span point, refer to **Calibration Reset** on page 144.

### Menu Path

'MENU / Maintenance/Test / Analyzer spec. adjustm. / Basic Calibration'

## Checking gas path leak tightness

Checking the sample gas path under negative pressure:

1. Connect zero gas at the sample gas inlet.
2. Shroud all joints successively with a small cloud of a gas that contains hydrocarbons (e.g. with a cold spray or a test gas that contains hydrocarbons, or a cloth soaked in acetone).
  - Observe the measured value display; if the measured value changes to a positive value, the relevant connection is **leaking**.

## Check the integrity of combustion gas path

### Combustion gas line

The seal integrity of the combustion gas feed line must be regularly checked in accordance with the two following instructions, depending on whether the combustion gas is offered from a bottle or a central supply.

## ... 14 Maintenance

### ... Check the integrity of combustion gas path

#### Combustion gas supply from a cylinder

1. Switch off the gas analyzer power supply. Ensure that the shut-off valve in the combustion gas supply line is open.
2. Set the combustion gas pressure at  $1.1 \times$  the normal pressure of the combustion gas, i.e. at approx. 1.3 bar.
3. Mark bottle pressure display on the high-pressure manometer.
4. Close the valve of the combustion gas bottle.
5. Observe the display on the high-pressure manometer – it should not change measurably in 10 minutes.
  - A measurable change in the display is an indication of a leak in the combustion gas path between the bottle pressure reducer and the combustion gas inlet valve of the gas analyzer.

In this case the following measures are to be taken:

- Check the combustion gas line between the bottle and gas analyzer with a leak detection spray. A leak in this area must be remedied and another leak test must be performed before the gas analyzer is put into operation again.
- If no leak is found, that means the gas analyzer combustion gas inlet valve is leaky.

#### DANGER

##### Explosion hazard

Explosion hazard if there is a leak in the combustion gas inlet valve.

If a leak is detected at the combustion gas inlet valve:

- Disconnect the combustion gas supply.
- Do not restart the gas analyzer.
- Have the combustion gas valve replaced by the ABB Service team.

6. After conclusion of the seal integrity test, set the combustion gas pressure to normal pressure again, i.e. 1.2 bar.

#### Combustion gas supply from a central unit

1. Switch off the gas analyzer power supply. Ensure that the shut-off valve in the combustion gas supply line is open.
2. Set the combustion gas pressure at  $1.1 \times$  the normal pressure of the combustion gas, i.e. at approx. 1.3 bar.
3. Mark pressure indication on the manometer of the pressure reducer.
4. Shut off the combustion gas supply.
5. Observe the display on the manometer – it should not change measurably in 10 minutes.
  - A measurable change in the display is an indication of a leak in the combustion gas path between the pressure reducer and the combustion gas inlet valve of the gas analyzer.

In this case the following measures are to be taken:

- Check the combustion gas line between the pressure reducer and gas analyzer with a leak detection spray. A leak in this area must be remedied and another leak test must be performed before the gas analyzer is put into operation again.
- If no leak is found, that means the gas analyzer combustion gas inlet valve is leaky.

#### DANGER

##### Explosion hazard

Explosion hazard if there is a leak in the combustion gas inlet valve.

If a leak is detected at the combustion gas inlet valve:

- Disconnect the combustion gas supply.
- Do not restart the gas analyzer.
- Have the combustion gas valve replaced by the ABB Service team.

6. After conclusion of the seal integrity test, set the combustion gas pressure to normal pressure again, i.e. 1.2 bar.

## Combustion gas path in the gas analyzer

### DANGER

#### Explosion hazard

Explosion hazard if there is a leak in the combustion gas path of the gas analyzer.

If a leak is detected in the combustion gas path within the gas analyzer:

- Shut down the gas analyzer and do not restart it under any circumstances.
- The cause of the leak must be determined and remedied by ABB Service.

### CAUTION

#### Risk of electric shock

Risk of electric shock during the leak tightness test.

The leak tightness test described in this section requires special training and under some circumstances involves working with the gas analyzer open and powered up.

- The leak tightness check may be carried out by qualified and specially trained persons only.
- If these conditions are not provided or the prescribed materials are not available, a seal integrity test must be carried out by ABB Service.

1. The gas analyzer must be in operation (flame on).
2. Inspection of combustion gas feed path with positive pressure (combustion gas inlet to combustion gas nozzle):
  - Check all connection points with a hydrogen detector (for example, based on thermal conductivity) for leakage of combustion gas.
    - The leakage rate may not up-scale  $1 \times 10^{-4}$  hPa l/s.
3. Inspection of the combustion gas feed path with negative pressure (in the detector, after the combustion gas nozzle):
  - Connect zero gas at the sample gas inlet.
  - Shroud all joints successively with a small cloud of a gas that contains hydrocarbons (e.g. with a cold spray or a test gas that contains hydrocarbons, or a cloth soaked in acetone).
    - Observe the measured value display; if the measured value changes to a positive value, the relevant connection is **leaking**.

## Functional testing of the purging and monitoring unit

### DANGER

#### Explosion hazard

An explosion hazard exists when performing the function test in a potentially explosive atmosphere.

- Before performing the functional test, ensure the absence of an explosive atmosphere in the vicinity of the analyzer.

Perform the functional test of the purging and monitoring unit according to the following instructions:

1. Ensure the absence of a potentially explosive atmosphere in the vicinity of the analyzer.
2. Switch on the power supply.
  - For initial purging, wait until the purging and monitoring unit switches to the normal range.
3. Now open the system housing.
  - The pressurization of the housing drops below the limit value and the purging and monitoring unit must switch off the power supply to the analyzer.
4. If the power supply is not automatically switched off by the purging and monitoring unit:
  - Shut down the gas analyzer and do not restart it under any circumstances.
  - Let ABB Service check and repair the gas analyzer.

## ... 14 Maintenance

### Functional testing of the instrument air monitoring

Perform the functional testing of the instrument air monitoring according to the following instructions:

1. During operation, reduce the instrument air supply pressure to below the minimum supply pressure of 43.5 psi (3 bar).
  - The purging and monitoring unit must switch off the power supply of the analyzer if it is below 2.7 to 3.0 bar (39.2 bis 43.5 psi).
2. If the power supply is not automatically switched off by the purging and monitoring unit:
  - Shut down the gas analyzer and do not restart it under any circumstances.
  - Let ABB Service check and repair the gas analyzer.

## Fidas24 – Replacement of the sample gas filter

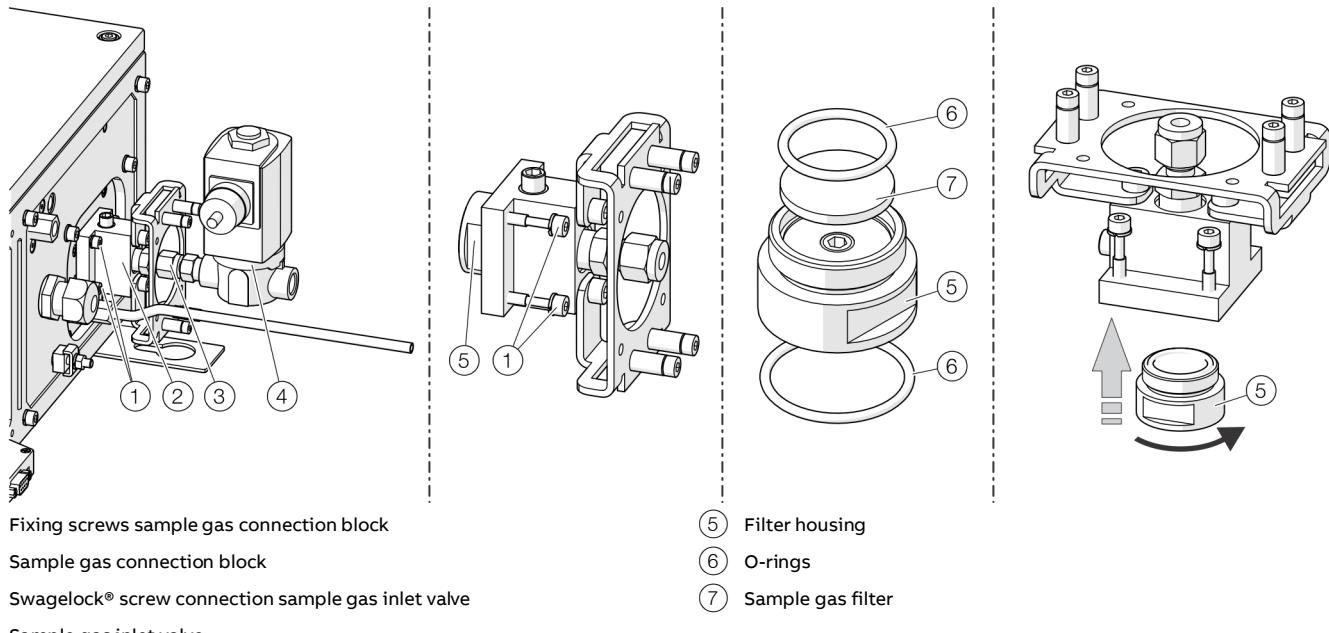


Figure 36: Replace the sample gas filter

### When is it necessary to replace the filter?

The sample gas filter must be replaced whenever it is soiled, resulting in the sample gas flow rate being too low.

#### Requisite Material

- Sample gas filters with O-rings (Part Number 0768649)
- Allen key 4 mm
- Open-end wrench 22 mm

#### Replace sample gas filter

### ⚠ CAUTION

#### Risk of burns

Risk of burns at the sample gas connection (temperature > 100 °C)!

- Before working on the sample gas connection, switch off the power supply and allow the sample gas connection to cool for about 30 minutes

1. Disconnect the supply of sample gas to the analyzer module! Switch off the gas analyzer power supply!
2. Loosen the Swagelock® screw connection (3) to the sample gas inlet valve and (4) remove the sample gas inlet valve.
3. Loosen the four fixing screws (1) and remove the sample gas connection block (2) from the back wall.
4. Using the 22 mm open-end wrench, loosen the filter housing (5) and unscrew by hand.
5. Remove the O-rings (6) and the contaminated sample gas filter (7) from the filter housing.

6. Insert the new sample gas filter and new O-rings (5).
- Note**
- Always change the O-rings when replacing the sample gas filter. Contaminated or damaged O-rings impair the seal integrity of sample gas path; this leads to erroneous measured values.
7. Screw the filter housing (5) into the sample gas connection block (2) and carefully tighten using the 22 mm open-end wrench up to the stop.

### NOTICE

#### Damage to the sample gas filter

Damage to the sample gas filter due to improper installation.

- Make sure that the filter inset does not fall out of the filter housing and become damaged when screwing in.
- It would be preferable to screw in the filter housing into the sample gas connection block from the bottom.

8. Screw the sample gas connection block using the four fixing screws (1) back onto the rear wall.
9. Connect the sample gas inlet valve (4) back with the Swagelock® screw connection (3).
10. Restore the sample gas supply to the analyzer module.
11. Switch on the power supply.
12. Check the manipulated variables of the internal pressure controllers for the operational gases, and adjust as necessary, refer to **Gas analyzer start-up** on page 57.
13. Once the warm-up phase is complete, calibrate the gas analyzer.

## ... 14 Maintenance

### Cleaning the Fidas24 air jet injector

#### When does a housing purge become necessary?

It is necessary to clean the air jet injector when the sample gas outlet pressure is too high, i.e. when the negative pressure can no longer be adjusted to  $p_{abs} < 600$  hPa.

#### Requisite Material

- Open-ended spanner 12 mm and 14 mm
- O-ring set for the detector (order number 769343)
- Ultrasonic bath with aqueous cleaner (e.g. Extran® MA 01 alkaline)
- High-temperature grease (order number 772341)

#### Clean air jet injector



- ① Exhaust air outlet with the air jet injector screwed in
- ② Exhaust pipe
- ③ O-ring
- ④ The removed air jet injector

Image 37: Removing the air jet injector

## ⚠ CAUTION

### Risk of burns

Risk of burns at the sample gas connection (temperature  $> 100^\circ\text{C}$ )!

- Before working on the heated sample gas connection, switch off the power supply and allow the sample gas connection to cool for about 30 minutes.
1. Disconnect the supply of sample gas to the analyzer module! Switch off the gas analyzer power supply!
  2. Unscrew the exhaust air pipe ② from the exhaust air outlet ① (open-end wrench 12 mm).
  3. Unscrew the air jet injector from the exhaust air outlet ① (open-end wrench 14 mm).
  4. Clean the air jet injector in an ultrasonic bath. Use an aqueous cleaner (e.g. Extran®).
  5. Replace the O rings ③ with new O-rings.

#### Note

- When cleaning the air jet injector, always replace all three O-rings! Dirty or damaged O-rings impair the suction power of the air jet injector; this can lead to the failure of the Fidas24.
- Lightly grease all three O-rings with high temperature grease (Part number 772341) before inserting them.
- 6. Screw the air jet injector ④ into the exhaust air outlet. Ensure that the O-rings are seated correctly.
- 7. Screw the exhaust air pipe ② onto the exhaust air outlet ①.
- 8. Restore the sample gas supply to the analyzer module.
- 9. Switch on the power supply.
- 10. Check the manipulated variables of the internal pressure regulators for the operational gases, and adjust as necessary (refer to **Gas analyzer start-up** on page 57).
- 11. Once the warm-up phase is complete, calibrate the gas analyzer.

## Replacing the battery

### **DANGER**

#### Risk of explosion!

There is an explosion hazard if the housing is opened in a potentially explosive atmosphere:

- Before opening the housing, make sure that no flammable or potentially explosive atmospheres are present.

### **WARNING**

#### Risk of injury due to live parts!

When the housing is open, contact protection is not provided and EMC protection is limited.

- Before opening the housing, switch off the power supply.

### **NOTICE**

#### Damage to components!

The electronic components of the printed circuit board can be damaged by static electricity (observe ESD guidelines).

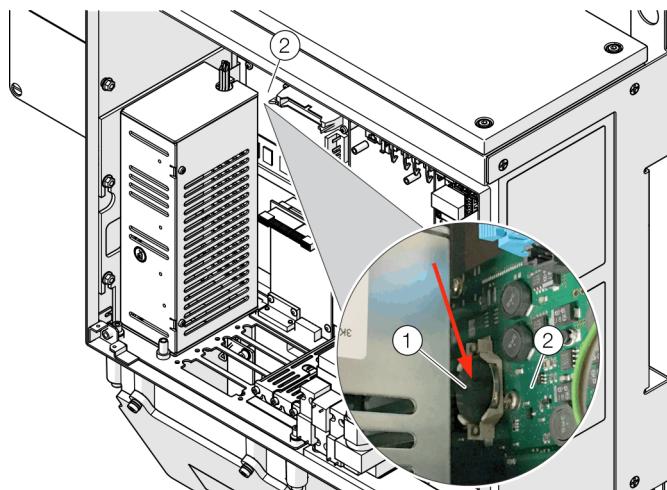
- Make sure that the static electricity in your body is discharged before touching electronic components.

The system controller board has a backup battery to retain the date and time settings in the case of a power cut.

This battery may only be replaced with the original battery type:

- Varta CR 2032 type no. 6032 or
- Renata type no. CR2032 MFR

1. Switch off the gas analyzer power supply.
2. Open the gas analyzer door.
3. Remove the old buffer battery and replace with a new battery of one of the types specified above.
4. Close the gas analyzer door.
5. Turn on the gas analyzer power supply.
6. Reset the time and date, refer to **Setting the time zone, date and time** on page 85.



① Buffer battery

① System controller board

Figure 38: Buffer battery on the system controller

## 15 Decommissioning

### Safety instructions

#### DANGER

##### Explosion hazard

There is a risk of explosion if the device is opened in a potentially explosive atmosphere.

Please take note of the following information before opening the device:

- A valid fire permit must be present.
- Make sure that there is no explosion hazard.
- Turn off the power supply before opening the device, and observe a waiting period of 20 minutes, in order to allow any hot components to cool down.

#### CAUTION

##### Injury hazard due to heavy weight

The gas analyzer weighs approx. 30 kg!

- Two persons are required for unpacking and transportation!

### Packing the Gas Analyzer

1. Tightly seal the cable gland of the connection box by inserting small plates.
2. Remove adapters from the gas ports and tightly seal the gas ports.
3. If the original packaging is not available, wrap the gas analyzer in bubble wrap or corrugated cardboard. For overseas shipment, always add a desiccant (e.g., silica gel) and hermetically seal the gas analyzer plus desiccant in a layer of polythene that is 0.2 mm thick. The amount of drying agent should be appropriate for the package volume and the expected shipping duration (at least 3 months).
4. 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.
5. Mark the box as "Fragile Goods".

### Note

If the device is returned to ABB Service (e.g. for repair), the following points must be observed:

- It is essential that the gases that were introduced into the gas analyzer are specified on the return form.
- See the information in **Returning devices** on page 20!

### Transport-/Storage temperature

-25 to 65 °C

### Decommissioning the gas analyzer

#### In the case of a temporary shutdown:

1. Shut off the sample gas supply at the sampling point.
2. Purge the sample gas line with nitrogen for at least 5 minutes, from the sampling point.
3. Set the gas analyzer to standby mode, refer to **Fidas24 – Standby/Restart** on page 143.
4. Shut off combustion air supply and combustion gas supply.

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

5. Shut off instrument air supply.
6. Switch off the gas analyzer power supply.
7. Remove the gas lines from the gas analyzer ports. Tightly seal the gas ports.
8. Disconnect the electrical leads from the gas analyzer.

## 16 Recycling and disposal

### Note



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 points in mind when disposing of them:

- As of 8/15/2018, this product will be under the open scope of the WEEE Directive 2012/19/EU and relevant national laws (for example, ElektroG - Electrical Equipment Act - in Germany).
- 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, our Service can take care of its pick-up and disposal for a fee.

## 17 Specification

### Note

The device data sheet is available in the ABB download area at [www.abb.com/analytical](http://www.abb.com/analytical).

### Note regarding the analyzers performance characteristics

- The metrological data of the analyzers is determined according to IEC 61207-1:2010 "Expression of performance of gas analyzers – Part 1: General".
- The metrological data are based on operation at atmospheric pressure (1013 hPa) and nitrogen as the associated gas.
- Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.
- The physical detection limit is the lower limit of the measurement-related data relative to the measuring range span.

### Stability

The following data only applies if all the influence variables (e.g. flow, temperature and air pressure) are constant.

They apply to measuring ranges  $\geq 50 \text{ mg org. C/m}^3$ ; for smaller measuring ranges these only apply if they are factory-set in accordance with the order.

### Linearity error

$\leq 2\%$  of span to  $5000 \text{ mg org. C/m}^3$ , this value applies in one (calibrated) measuring range

### Repeatability

$\leq 0.5\%$  of measurement range

### Zero drift

$\leq 0.5 \text{ mg org. C/m}^3$  per week

### Span drift

$< 2\%$  of the measured value per 10 K

### Output fluctuation at zero point ( $2\sigma$ )

$\leq 0.5\%$  of span at electronic  $T_{90}$ -time = 20 s

### Detection limit ( $4\sigma$ )

$\leq 1\%$  of span at electronic  $T_{90}$ -time = 20 s

## ... 17 Specification

### Influences

#### Oxygen dependence

$\leq 2\%$  of measured value for 0 to 21 vol. % O<sub>2</sub> or  
 $\leq 0.3 \text{ mg org. C/m}^3$ , the larger value applies in each case

#### Temperature effect

- Ambient temperature in permitted range:
  - Standard: 5 to 45 °C
  - Measuring ranges < 100 ppm: 5 to 40 °C
- At zero point and on the sensitivity:  
 $< 2\%$  of the measured value per 10 K or  $< 300 \text{ ppb C1 per 10 K}$ , the larger value shall respectively apply

#### Power supply effect

- DC 24 V  $\pm 5\%$ :  
 $\leq 0.2\%$  of span or
- AC 230 / 115 V  $\pm 10\%$ :  
 $\leq 0.2\%$  of span

## Dynamic response

#### Warm-up time

$\leq 2 \text{ h}$  at nominal voltage and 25 °C ambient temperature

#### T<sub>90</sub>time

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

## 18 Additional documents

#### Note

All documentation, declarations of conformity, and certificates are available in ABB's download area.

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

## Trademarks

Modbus is a registered trademark of Schneider Automation Inc.

PROFIBUS and PROFIBUS DP are registered trademarks of PROFIBUS & PROFINET International (PI)

Swagelok is a registered trademark of the Swagelok Company

Windows is a registered trademark of Microsoft Corporation.

## 19 Appendix

### Return form

#### Statement on the contamination of devices and components

Repair and/or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.

Otherwise, the device/component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

#### Customer details:

Company:

Address:

Contact person:

Telephone:

Fax:

Email:

#### Device details:

Type:

Serial no.:

Reason for the return/description of the defect:

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#### Was this device used in conjunction with substances which pose a threat or risk to health?

Yes       No

If yes, which type of contamination (please place an X next to the applicable items):

- |                                      |   |   |
|--------------------------------------|---|---|
| <input type="checkbox"/> biological  | <input type="checkbox"/> corrosive / irritating | <input type="checkbox"/> combustible (highly / extremely combustible) |
| <input type="checkbox"/> toxic       | <input type="checkbox"/> explosive              | <input type="checkbox"/> other toxic substances                       |
| <input type="checkbox"/> radioactive |   |   |
- 

Which substances have come into contact with the device?

1.

2.

3.

We hereby state that the devices/components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date

Signature and company stamp

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**ABB Measurement & Analytics**

For your local ABB contact, visit:

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

For more product information, visit:

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

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