ACF5000

Multi-component FTIR emission monitoring system

Measurement made easy

ACF5000

Introduction

The ACF5000 continuous emissions measurement system offers simultaneous measurement of up to 15 components, including water-soluble components, for precise monitoring of exhaust gas composition.

The standard system design combines the advantages of a FTIR spectrometer with flame ionization (FID) technology and oxygen measurement. The high resolution FTIR spectrometer provides selective measurement of infrared active gas molecules with high sensitivity and stability.

Additional Information

Additional documentation on ACF5000 is available for download free of charge at 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.

System documentation

The system documentation is supplied together with the analyzer system. The system documentation contains the following documents:

- Analyzer data sheet
- Commissioning instruction,
- Certificates (e.g. manufacturer declaration),
- Supplementary sheet with information on how to download software tools as well as the set of drawings and other documentation created individually for the analyzer system.

Further documents

Title	Doc. ID
ACF5000 Multi-component FTIR analyzer system - Datasheet	DS/ACF5000
ACF5000 Multi-component FTIR analyzer system - Commissioning instructions	CI/ACF5000
Advance Optima Function Blocks; Descriptions and Configuration – Technical Information	TD/AO2000/FUNCTION_BLOCKS
AO-HMI Remote Control Interface – ¬Technical Information	UM/AO-HMI
Advance Optima AO2000 – interface description Modbus protocol	COM/AO2000/MODBUS
Advance Optima AO2000 – interface description PROFIBUS DP/PA interface	COM/AO2000/PB
AO-OPC OPC Server – Operating instructions	OI/AO-OPC
Heatable sample gas lines – Operating instructions	42/23-24
Modular sample gas extraction system – Operating instructions	42/23-39
Gas sampling probe 2 – Operating instructions	42/23-12

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 ACF5000 analyzer system is designed for continuous measurement of the concentration of individual components in gases or vapors.

In normal service, the interior of the analyzer system contains no potentially explosive atmosphere. Accordingly, installation of explosion protection in the interior is not necessary for operation of the analyzer system.

Any other use is not approved.
The intended use also includes taking note of this operating instruction.

Special requirements for the operator

- The operator must ensure that the gas analyzer is only operated with a sample gas mixture in which the concentration of flammable sample gas is below the lower explosion limit (LEL).
- No explosive gas mixture may be introduced into the gas analyzer – with consideration of the pressure, temperature and gas matrix.
- Before commissioning the gas analyzer, the sample gas path must be purged to remove any explosive gas mixtures from the sample gas path.
- The operator is obligated to carry out a tightness test on the gas analyzer at regular intervals, at least once a year, as well as whenever any work is carried out on the sample gas path.
- The operator must ensure that, if the gas analyzer is decommissioned, the sample gas supply is disconnected and the sample gas path is purged with compressed air or an inert gas.

Improper use

The ACF5000 analyzer system must not be used for the measurement of mixtures that could ignite during operation. The analyzer system may not be set up in potentially explosive atmospheres.

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

- The measurement of gases that attack materials of parts in contact with the sample medium. See the notes in the section **Corrosive gases** of the individual analyzer modules in **Preparation for Installation** on page 22.
- 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.

Handling of toxic gases

Some gas components whose concentration is measured with the analyzer system are hazardous to health or poisonous.
For this reason, the sample gas must under no circumstances be allowed to escape from the sample gas path in either the measurement mode or when performing maintenance.

- The analyzer system must be checked for leaks regularly.
- The diluted stack gas must be discharged outside the room where the analyzer cabinet is installed.
- Ensure adequate ventilation of the room in which the analyzer system is installed.
- The legal requirements for the maximum workstation limit values (TRGS 900) of the measurement and test gases must be observed.

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.

Potential equalization

- The external potential equalization connection of the analyzer housing must be connected to the local potential equalization.
- The local potential equalization must be connected before any other connections are made.

Danger of interrupted potential equalization

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.

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.

Safety instructions for the control cabinet fan

The analyzer system is supplied with a control cabinet fan as standard.

General information
Devices with moving parts always carry the risk of injury and require compliance with the applicable safety regulations.
- The device may not be operated unless it is in perfect working order.
- Only authorized personnel may work on the devices.
- Improper use of the device is prohibited.
- Do not open the fan cover unless the device is at a standstill. The device must be disconnected from the power supply before opening

Requirements for operation
- The device is designed for operation inside buildings in a clean atmosphere.
- Immediately remove any contamination inside or outside the device.
- Avoid operating the device in dusty environments or with other contamination caused for example by insulation wool or similar.
- Operation outside the permissible ambient temperatures is not permitted.
- Avoid exposure to radiant heat.
- Do not close or cover the air inlet / outlet.
- Do not use aggressive cleaning agents.
- No modifications may be made to the device nor may the set operating parameters be changed. Changes may only be made by trained service personnel.

Warranty
The warranty will be invalid in the following cases:
- Failure to observe the above mentioned instructions.
- Improper work on and with the device.
- Use of improper equipment.
- Use of non-original spare parts.

… 1 Safety

Safety instructions for the control cabinet cooling unit

The analyzer system can be optionally equipped with a control cabinet cooling unit.

General information

Devices with moving parts always carry the risk of injury and require compliance with the applicable safety regulations.

- The device may not be operated unless it is in perfect working order.
- Only authorized personnel may work on the devices.
- Improper use of the device is prohibited.
- Open the device cover when it is at standstill only. The device must be disconnected from the power supply before opening

Requirements for operation

- The device is designed for operation inside buildings in a clean atmosphere.
- Immediately remove any contamination inside or outside the device.
- Avoid operating the device in dusty environments or with other contamination caused for example by insulation wool or similar.
- The device may only be operated in an upright position.
- Operation outside the permissible ambient temperatures is not permitted.
- Avoid exposure to radiant heat.
- Do not close or cover the air inlet or outlet.
- Do not use aggressive cleaning agents.
- No modifications may be made to the device nor may the set operating parameters be changed. Changes may only be made by trained service personnel.

Warranty

The warranty will be invalid in the following cases:

- Failure to observe the above mentioned instructions.
- Improper work on and with the device.
- Use of improper equipment.
- Use of non-original spare parts.
- Unauthorized in-house changes to the device or the factory settings.

Safety instructions for the FID analyzer module

⚠ DANGER

Explosion hazard

Explosion hazard due to improper installation.

- The FID analyzer module uses hydrogen as a combustion gas!
- All the information and instructions contained in this operator's manual must be complied with without fail to ensure safe operation of the gas analyzer!

Measures of the manufacturer

The following measures ensure that the enrichment of combustion gas or an explosive mixture of combustion gas and ambient air cannot occur inside the gas analyzer during normal operation:

- Installation of a hydrogen flow restrictor in the cabinet wall (bulkhead fitting with an integrated flow restrictor, maximum 10 l/h, for connection to the combustion gas line).
- Installation of pressure equalization fittings on the top of the cabinet to allow escape of hydrogen to the outside in the event of leaks.
- Use of stainless steel piping,-compression fittings and -valves.
- The tightness of the combustion gas feed path is checked for a leakage rate of $< 1 \times 10^{-4}$ hPa l/s before delivery.
- The combustion gas/air mixture (before and after the ignition point) is diluted in the detector with compressed air.
- The combustion gas feed is not connected to the supply during commissioning until the internal nominal pressures have been set.
- The combustion gas feed is switched off if the internal nominal pressures cannot be set during the ignition phase (e.g. because of insufficient compressed air or combustion air feed).
- The combustion gas feed is switched off after several unsuccessful ignition attempts.
- If the flame goes out during operation, the combustion gas feed is switched off if the following ignition attempts are unsuccessful.

As an additional safety measure, the analyzer system can be supplied with the 'Hydrogen monitoring of the analyzer cabinet' option, see page 15.

Conditions to be complied with by the end user

The end user must comply with the following prerequisites and conditions to ensure safe operation of the gas analyzer:

- The gas analyzer may be used for the measurement of flammable gases provided that the total flammable portion does not exceed the following values:
  – 15 vol. % CH_4 or C1 equivalent
- The relevant safety regulations for working with combustion gases must be complied with.
- Combustion gas that escapes from leaks in the gas paths can cause fires and explosions, even outside the analyzer system!
  Ensure adequate ventilation of the room in which the analyzer system is installed.
- Observe the gas connection diagram when connecting the combustion gas and the combustion air supply, refer to **Operating gases and test gases** on page 38.
- The bulkhead fitting with integral flow restrictor for connection of the combustion gas line is a safety-relevant component. It may only be removed, modified or replaced by certified service personnel!
- 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 using a leak detector (leak rate < 1×10^{-4} hPa l/s), see **Check the integrity of combustion gas path** on page 138.
- 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 138.
- The maximum pressures of combustion gas and combustion air may not be exceeded, refer to **Operating gases and test gases** on page 29.
- The combustion gas flow rate must be limited to a maximum of 10 l/h H_2. For this purpose, the operator has to provide suited measures outside the gas analyzer.
- A shut-off valve must be installed in the combustion gas supply line to increase safety in the following operating conditions:
  – when decommissioning 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 equipment room 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.
- 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.

… 1 Safety

Safety instructions for the FTIR spectrometer module

Electric safety

The FTIR spectrometer has an unprotected metal housing that is connected directly to ground potential via the power cable and is thus classified as 'Safety Class 1 Equipment'.

Consider the following items during operation:

- Before fuses are replaced, the device must be disconnected from the power supply.
- To avoid electric shock, the device may not be operated if there is an indication that any part of the outer surface is damaged.
- To protect against fires, only a fuse of the specified type and current rating may be used.
- To protect against electric shock, the protective ground conductor of the power cable must be connected to ground potential.
- The device must not be exposed to any source of the excessive moisture.
- Approval from the responsible authorities is required for measurement of combustible gases.

Laser safety

Under normal conditions, the FTIR spectrometer can be operated completely safely (Class 1 laser product – see name plate).

Type of laser installed in the interferometer:

- VCSEL laser Class 3B in accordance with IEC 60825-1 as well as 21 CFR Chapter 1, Subchapter J;
- Output: max. 3 mW;
- Wavelength: 760 nm (laser beam invisible to the human eye)

⚠ DANGER

Risk of eye injury caused by laser radiation

Opening the housing of the FTIR spectrometer module within **AU3** can result in contact with laser radiation. Radiation from Class 3B lasers poses a danger to the human eye both when viewed directly or if reflected.

- The housing of the FTIR spectrometer may be opened only by authorized ABB service personnel.
- Laser safety goggles approved for laser class 3B must be used when working on the open FTIR spectrometer module.

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.

On www.abb.com/cybersecurity under 'Additional resources', 'Alerts and notifications' you will find notifications about newly discovered software vulnerabilities. It is recommended that you visit this website regularly and activate 'Subscribe to email alerts' to receive email notifications about 'ABB cyber security alerts and notifications'.

Software downloads

We provide the software and technical documentation for your device for download on the My Measurement Assistant platform:

My Measurement Assistant

Please navigate to the product you have purchased and select 'Documentation' to download the content.

To guarantee optimal use of your device, we reommend that you always use current software and tools.

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.
We strongly recommend to change all passwords from their default value, see **Change password** on page 91.

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.

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

2 Design and function

Area of application and function of the analyzer system

Application area

The ACF5000 analyzer system is a multi-component analysis system for continuous measurement of the concentration of individual components in the flue gas of industrial incinerators. The field of application of this measurement equipment basically involves tasks associated with emissions monitoring. Use in process control is also possible.

Functional description

The gas to be measured is drawn from the gas channel by means of a gas sampling probe and conveyed to the analyzer cabinet via a heated sample gas line. The sampling probe contains a particulate filter to remove dust particles from the sample gas. Automatic probe cleaning can be selected as an option.

The gas path from the sampling location to the analyzer is heated throughout (180 °C) to prevent the temperature from dropping below the dew point / condensation of flue gas. The heating is controlled and monitored by the system's electronics.

Conveying of the sample to the analyzer is based on the injector principle and employs an air jet injector that is integrated into the heated sample handling block (ASP block). The ASP block is in turn directly connected to the heated sample gas cell of the FTIR spectrometer and the optional flame ionization detector.

By default, zero point and test gases can be connected automatically or manually to both the sample gas probe and directly to the analyzer.

Measurement principle

The analyzer system operates on the principle of FTIR spectrometry. The concentrations of a variety of stack gas components that exhibit absorption bands in the mid-infrared range can be determined.

Each gas absorbs infrared radiation in a specific region of the spectrum. The radiation absorbed at a given wavelength is a function of the gas concentration. The FTIR analyzer (spectrometer) measures how much radiation was absorbed at specific wavelengths.

The information about the absorption processes is processed in the system's electronics and converted into measured values. At the same time, the spectra of all components are recorded.

A zirconium dioxide sensor for measurement of the oxygen content is an integral part of the analyzer system.

Optional functionality

Validation

A validation tool can be installed in the beam path of the spectrometer to confirm the validity of the spectrometer adjustment.

Total carbon measurement

A flame ionization detector (FID) for measurement of the total carbon content (VOC) can be incorporated into the analyzer system.

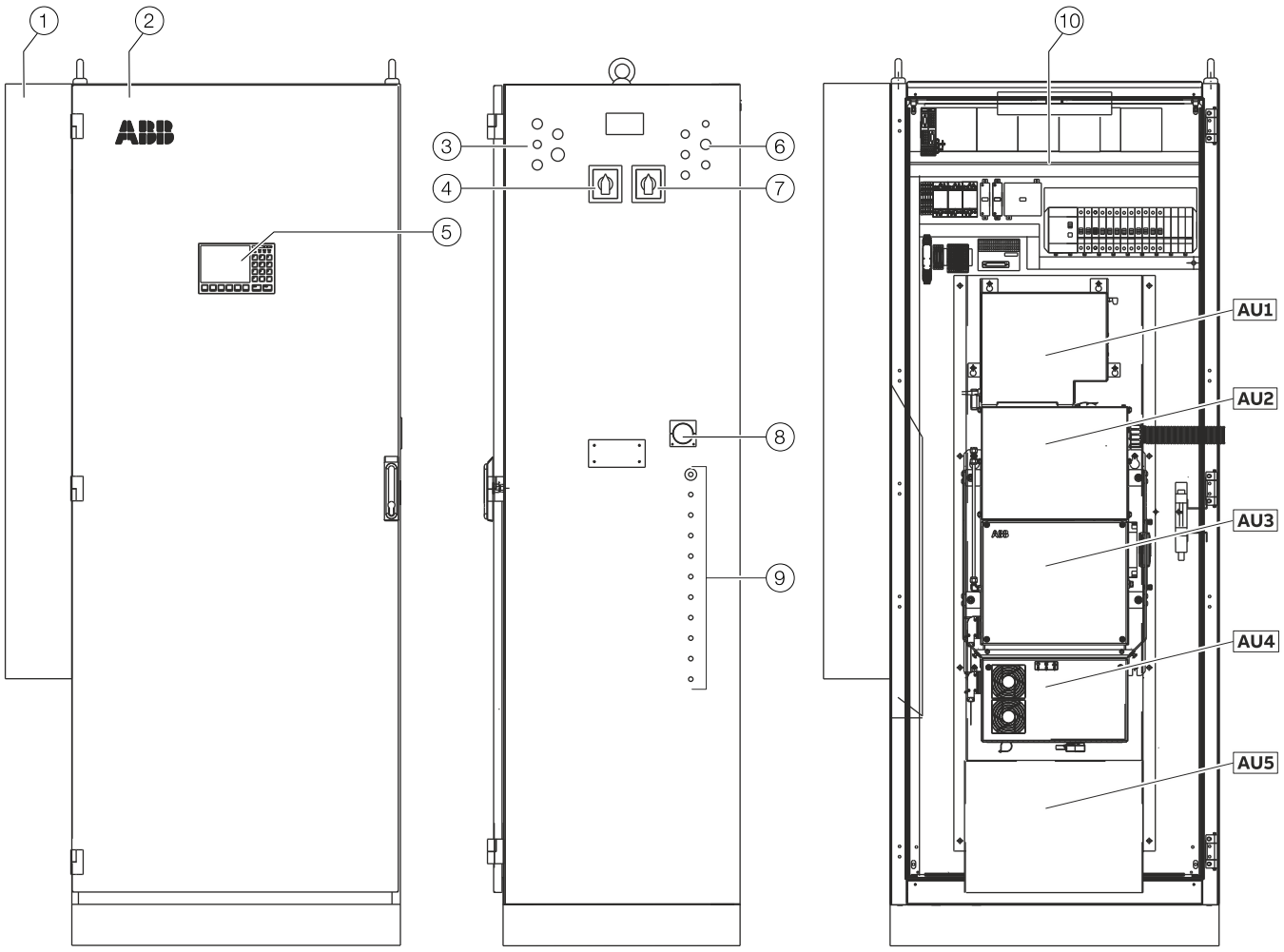
Display and signal processing

The current concentration of the individual measuring components and the status signals are shown on the system display.

The system controller has been designed for the requirements of emissions and process measurement. The system controller offers system-internal CAN bus and field bus systems such as Modbus® and PROFIBUS®. as interfaces.
An Ethernet interface for remote monitoring of the entire analyzer system and transmitting data via internal or external TCP/IP networks is included as standard.
The analyzer system can be remotely controlled via an optional mini PC (also via a mobile network connection).

Analog outputs for the measuring components and relay contacts for fault / status messages are available as an option.

Design



Front view **Side view right** **Front view open**

1. Control cabinet cooler
2. Analyzer cabinet
3. Cable entry for signal cable
4. Power supply main switch
5. LCD display
6. Cable entry for power supply
7. Main switch for uninterruptible power supply (UPS)
8. Sample gas inlet
9. Gas connections
10. Electrical connections, fuses, control components

AU1 ACF5000 Electronics box
AU2 Analyzer box
AU3 Interferometer box
AU4 FTIR electronics box
AU5 Air purifier

Figure 1: Device construction

Note
Depending on the measurement task and the version of the analyzer system ordered, not all of the assemblies shown and described here may be included.

… 2 Design and function

… Design

Gas sampling

NOTICE

Damage to components

For measurement gas extraction, only the assemblies specified by ABB may be used, as both the temperature controls and the securing functions are aligned to this.

- Stainless steel probe tube, unheated (Type 40) or heated (Type 42)
- Filter unit, heated (Type PFE2), with check valve, with back-purging (option)
- Sample gas line, heated (Type TBL01)

Sample gas conditioning

- Sample gas conditioning block (ASP block), heated, with stainless steel microfilter and air jet injector
- Automatic purge and sample gas switching
- Flow rate, pressure and temperature sensors

Air purifier

- Zero gas (air) for the spectrometer and reference gas for the oxygen sensor and combustion air for the FID
- Purge gas for the FTIR spectrometer and the entire measuring system

Analyzer modules

- FTIR spectrometer with heated measuring cell
- Oxygen sensor ($Z_rO_2$sensor)
- Flame ionization detector (FID, optional) for measuring the total carbon content (VOC)

Control, operation and display

- LCD display in the door of the analyzer cabinet
- AO2000 System controller in the door of the analyzer cabinet
- ACF5000 Electronics box AU1
- Controller for the air jet injector as well as the oxygen sensor and FID
- Interfaces for
  - Measured values and status signals (Standard: Ethernet with TCP/IP protocol and Modbus® TCP/IP protocol; options: Modbus, PROFIBUS®, analog and digital outputs, analog and digital inputs)
  - Remote control and diagnosis (mobile network and/or Ethernet)

For emission measurements in compliance with applicable European Directives, the analyzer system must be operated with certified AO2000 system software.

Hydrogen monitoring of the analyzer cabinet (optional)

Function

If an FID (VOC Analyzer) is installed, the analyzer system can be supplied with the 'Hydrogen monitoring of the analyzer cabinet' option as an additional safety measure.

If a leak occurs in the hydrogen path inside the analyzer cabinet and hydrogen accumulates inside the cabinet, both the hydrogen supply and the power supply are shut off before the explosion limit is reached – for example, at 40 % of the lower explosion level. This prevents formation of an ignitable mixture.

Scope of delivery

The following components are installed in the analyzer cabinet:

- An ATEX-certified gas sensor with connection socket in the upper area.
- A solenoid valve on the outside of the right-hand side panel, which interrupts the hydrogen supply if the power supply fails or if a set limit value for the hydrogen concentration is exceeded (H_2safety valve). The solenoid valve is connected to the combustion gas inlet of the analyzer cabinet.

The following is additionally supplied:

- A gas warning system for evaluating the gas sensor signal,
- A contactor for disconnecting the power supply to the analyzer cabinet,
- A contactor for disconnecting the UPS if the system is prepared for a UPS.
- Instructions and further documentation for the gas sensor and the manufacturer's gas warning system.

Installation

⚠ DANGER

Explosion hazard

Explosion hazard in the event of a fault due to incorrect installation of the hydrogen monitoring system.

- Follow the instructions in the provided manufacturer documentation!
- Also observe the following instructions for installing the hydrogen monitoring system!

Electric wiring of the gas sensor and the gas warning system to shut down the power supply in the event of an alarm is not present in the analyzer system in the factory-delivered condition.

- The gas warning system must be installed outside the analyzer cabinet in a non-hazardous area in a distribution cabinet or similar. The gas warning system must be electrically connected to the gas sensor (see the order-specific set of drawings in this regard).
- The solenoid valve for disconnecting the hydrogen supply (H_2) as well as the coils of the contactors and relays for disconnecting the power supply and UPS (if present) must be connected to an alarm contact in the gas warning system. The alarm contact must be set so that the voltage is shut off for example at 40 % of the LEL and the contact itself latches.
- The measuring signals (analog outputs and inputs), the status signals (digital outputs and inputs) as well as the bus systems of the analyzer system are designed such that after the power supply (and if present the UPS) are disconnected, no component in the analyzer cabinet (contactor, relay, motor etc.) that could generate an ignition spark can be actuated from the outside.
- The measurement and status signals supplied potential-free as well as bus connections must not be activated separately in the event of a gas alarm. If however a non potential-free external signal is fed in, the operator should make sure that if a gas alarm is triggered, it is activated via a cut-off relay, for example.

Note

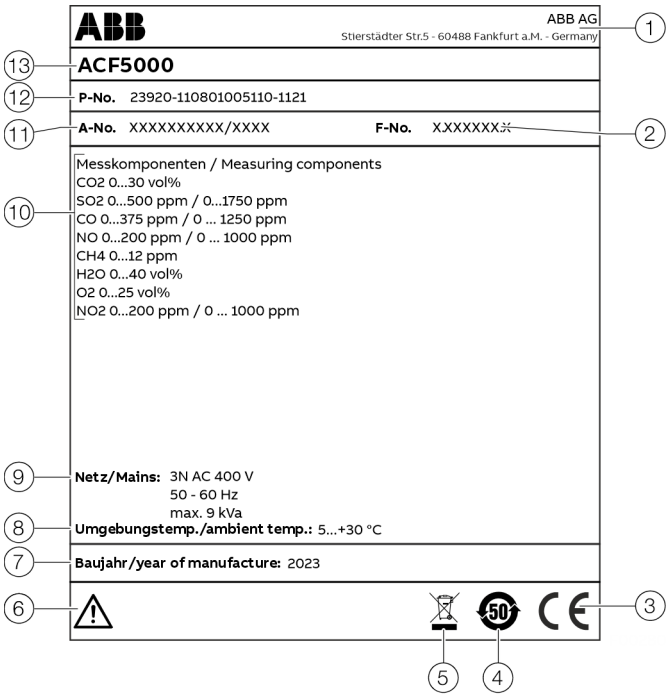
- The gas sensor installed in the analyzer cabinet is not factory calibrated; it is inoperable without calibration. Calibration of the gas sensor is the responsibility of the operator.
- Installation, commissioning, parameterization, operation, signal evaluation and maintenance of the supplied gas warning system are the responsibility of the operator.
- The initial commissioning of the 'Hydrogen monitoring of the analyzer system' option may only be performed by certified specialist personnel from the manufacturer of the gas warning system and the gas sensor.

3 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 name plate is located on the exterior of the side wall of the system housing.



1. Manufacturer, address
2. Serial number (F-No.) analyzer system
3. CE marking
4. EFUP marking (China RoHS)
5. Disposal instructions
6. Reference to additional warning sign
7. Year of manufacture
8. Ambient temperature
9. Power supply
10. Sample components
11. Order number (A-No.)
12. Product code (P-No.) analyzer system
13. Model designation

Figure 2: Analyzer system nameplate (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 device:

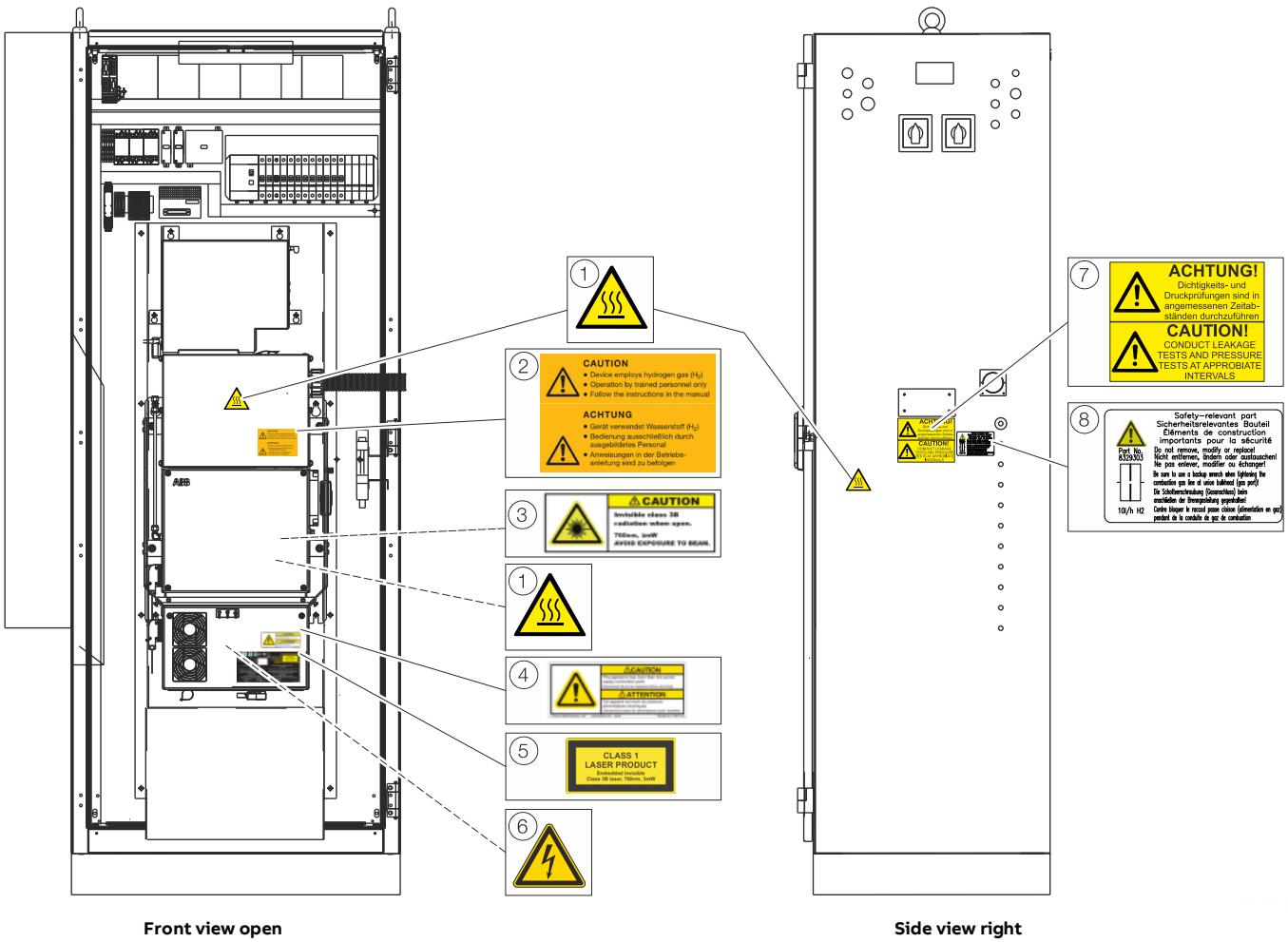
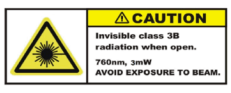
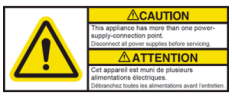


Figure 3: Positions of the signs

Pos.	Sign/Symbol	Position/Meaning
①		**FID analyzer housing, FTIR analyzer housing, solenoid valve (with hydrogen monitoring of the analyzer cabinet option)** Hot surface! (Temperature > 60°C)
②		**FID analyzer housing** CAUTION! • Device uses hydrogen (H_2) • Operation exclusively by trained personnel • Instructions in the operating instructions must be followed.
③		**FTIR analyzer module (inside)** CAUTION – Invisible laser radiation of laser class 3B. Avoid contact with laser radiation Wavelength 700 nm, radiant power 3 mW

… 3 Product identification

… Plates and symbols

Pos.	Sign/Symbol	Position/Meaning
④		**FTIR analyzer module (electronics box)** CAUTION – Device has more than one power supply. Before any work on the device, switch off all power supplies
⑤		**FTIR analyzer module (electronics box)** Type of laser installed in the interferometer: VCSEL laser class 3B in accordance with IEC 60825-1 and 21 CFR Chapter 1, Subchapter J Output: max. 3 mW Wavelength: 760 nm (laser beam invisible to the human eye)
⑥		**FTIR analyzer module (electronics box)** Warning against dangerous electrical voltage.
⑦		**Right side of the analyzer system** CAUTION! – Leak and pressure tests must be carried out at appropriate intervals.
⑧		**Right side of the analyzer system** Safety-relevant component Do not remove, change or replace! Hold the bulkhead fitting (gas connection) in place when connecting the gas line!

Scope of delivery

Standard scope of supply and delivery

- Analyzer cabinet (all components installed)
- 1 set of system documentation

Additional scope of supply and delivery

Depending on the version.

- Type 40 (unheated) or Type 42 (heated) gas sampling probe
- Type PFE2 filter unit, heated
- Type TBL01 sample gas line, heated
- System transformer, 100 V AC to 230 V AC (optional)

Additional scope of supply and delivery for the 'Hydrogen monitoring of the analyzer cabinet' option

- Unipoint gas warning system
- Contactor for disconnecting the power supply to the analyzer cabinet
- Contactor for disconnecting the UPS if the system is prepared for a UPS.
- Manufacturer documentation:
  - Unipoint Multilingual Manual CD
  - Sensepoint gas sensor Manuals CD

Note

Observe the installation instructions for hydrogen monitoring found at page 15.

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 (A-No.),
- Product code (P-No.)
- Serial Number (F-No.),
- Production Date,
- Power supply
  (Voltage, frequency, power consumption),
- Measuring components and measuring ranges,
- Serial numbers of the installed modules.

Additionally, the maintenance work and modifications performed on the gas analyzer can be documented in the analyzer data sheet.

Analyzer data sheet storage

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

Note

- Keep the device 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 133.
- 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.

4 Transport and storage

Safety instructions

⚠ WARNING

Injury hazard due to heavy weight

The analyzer system weighs approx. 300 kg!

- A crane with suitable transport gear is required for unpacking and transporting!

⚠ WARNING

Risk of injury due to heavy components

Improper handling of heavy components can lead to serious crushing, broken bones or even fatal injuries.

- Use suitable equipment to lift and transport heavy components.
- Wear safety shoes.
- Always maintain a sufficient safety distance from suspended loads.
- Never stand under a suspended load.

⚠ WARNING

Risk of injury caused by transport equipment

Improper use of transport equipment can lead to personal injury and damage to property.

- Only authorized personnel may use transport equipment such as industrial trucks or cranes.

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

For transport of the analyzer system, see **Unpacking and transporting the analyzer system** on page 32.

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 (–13 to 149 °F)

Packaging

Refer to **Packaging the analyzer system** on page 158.

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 160) 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
Germany
Phone: +49 69 7930-4591
Email: repair-analytical@de.abb.com

5 Preparation for Installation

Selection of the sample gas extraction point and installation of the conduit pipe

Selecting the sampling point

- The sampling point must be suited for sampling a representative sample stream.
- The probe tube must be readily accessible for maintenance work.
- The PFE2 filter unit must be protected from direct exposure to heat and heavy soiling. The IP protection class of the protective housing is IP 54.

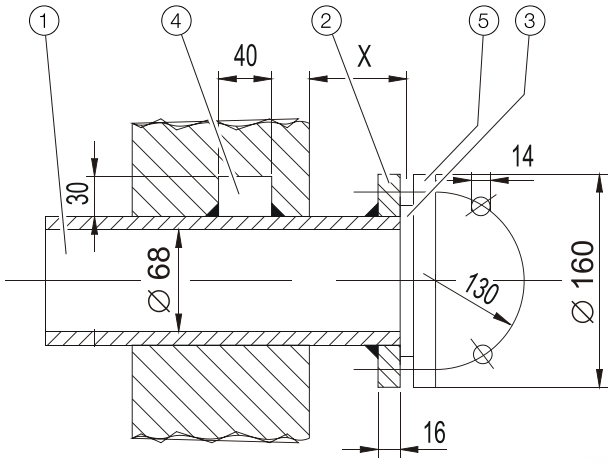
Note

In compliance with DIN EN 15259, the sampling point for emission measuring equipment is specified by the responsible entities accredited in accordance with DIN EN ISO/IEC 17025.

Installation of the conduit pipe with mounting flange

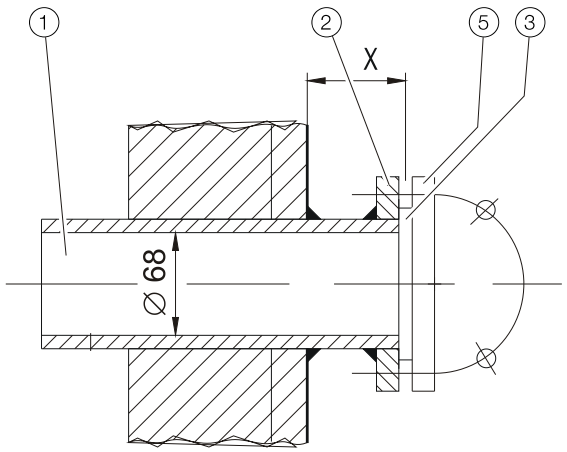
The conduit pipe with mounting flange (DN 65, PN 6, sealing surface type A according to DIN EN 1092-1; not included with delivery) should be installed at the sampling point such that the probe tube can be inserted and withdrawn without difficulty.

Installation variants



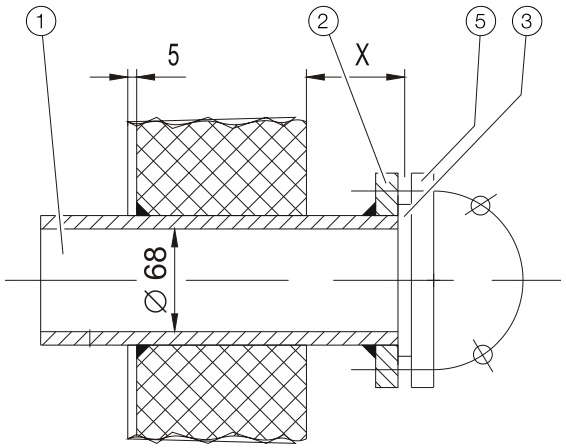
1. Conduit pipe
2. Assembly flange DN 65, PN 6, sealing surface type A according to DIN EN 1092-1
3. Gasket
4. Welded-on rectangular block
5. Gas sampling probe flange

Figure 4: Installation of the conduit pipe in the brickwork (dimensions in mm)



1. Conduit pipe
2. Assembly flange DN 65, PN 6, sealing surface type A according to DIN EN 1092-1
3. Gasket
5. Gas sampling probe flange

Figure 5: Installation of the conduit pipe in the brickwork with metal sheeting (dimensions in mm)



① Conduit pipe
② Assembly flange DN 65, PN 6, sealing surface type A according to DIN EN 1092-1
③ Gasket
⑤ Gas sampling probe flange

Figure 6: Installation of the conduit pipe in an insulated sheet-metal channel (dimensions in mm)

Conduit pipe installation position

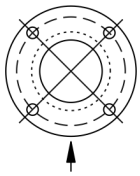


Figure 7: Conduit pipe installation position

The figure shows an image of the flange as viewed from the process to the filter. The arrow indicates the flow direction of the process gas.
Select the mounting position of the conduit pipe so that the holes are located in the position shown here.

Minimum distance between conduit pipe

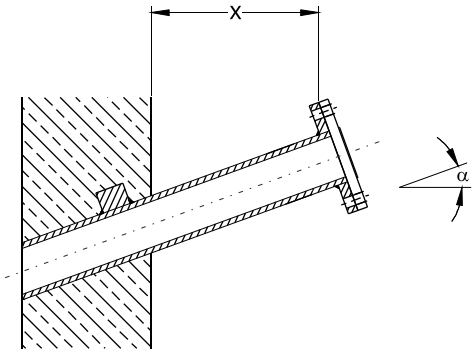


Figure 8: Installation of the conduit pipe

Minimum distance x_{min} of the mounting flange on the conduit pipe from the wall as a function of installation angle α:

Installation angle α	10°	15°	20°	25°	30°	35°
x_{min}/mm	229	248	268	287	307	324

… 5 Preparation for Installation

Requirements for the installation site

The analyzer system is intended for indoor installation only. The analyzer system must be protected from direct heat radiation, heavy dust exposure, corrosive atmospheres and vibrations.

Installation site altitude max. 720 m above sea level in accordance with EN 15267 (with length of sample gas line including probe = 60 m); greater heights on request.

Minimum distances when installing the analyzer cabinet:

Cabinet side	Minimum distance	
to the right	0.5 m (1.6 ft)	for the gas lines and the electrical lines as well as for air entry into the fan (option)
to the left	0.5 m (1.6 ft)	for air discharge from the fan (optional) or
	1 m (3.3 ft)	for the air conditioner (option)
at the front	1 m (3.3 ft)	for opening the door (hinged on the left)
above	0.5 m (1.6 ft)	

Protection from adverse ambient conditions

Protect the gas analyzer from the following influences:

- Jets of water,
- Contact with chemicals,
- 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.

Short gas paths

- The analyzer cabinet should be set up as close as possible to the measuring location. A short sample gas line translates into short dead times.
- Because of the pressure drop in the line and the required electrical protection, the length of the heated sample gas line must not exceed 60 meters when connected to 230 V AC and 40 meters when connected to 120 V AC. Depending on the altitude of the installation site, these values may be lower.
- The sample gas bottles should be set up as close as possible to the analyzer cabinet.

Climatic Conditions

Transport- / Storage temperature

−25 to 65 °C (−13 to 149 °F)

Ambient temperature during operation

- With built-in fan (optional):
  5 to 30 °C (41 to 86 °F)
- With built-in air conditioner (optional):
  5 to 45 °C (41 to 113 °F)

Relative humidity

- annual average max. 75%
- short-term: max. 95 %

Seldom and slight condensation permissible if the analyzer system is switched on and the FTIR spectrometer is purged.

IP rating

Analyzer cabinet: IP 54

Installation location

⚠ DANGER

Explosion hazard

Explosion hazard when setting up the analyzer cabinet in potentially explosive atmospheres.

- Set up the analyzer cabinet away from potentially explosive atmospheres only!

The analyzer cabinet is intended solely for installation indoors. The maximum altitude of the installation site is 720 m above sea level (for up to 60 m longer sample gas line with probe).

Note

The minimum inlet pressure at the analyzer cabinet is 900 hPa. This results in a maximum height of 720 m for the installation site. Higher altitudes would result in insufficient gas flow through the system. The inlet pressures for the ACF5000 may not be lowered, as this directly reduces the sensitivity of the FTIR spectrometer. As a consequence, the measuring accuracy and drift in accordance with QAL1, QAL2, and QAL3 for components with low concentration cannot be assured.

Space requirement

⚠ WARNING

Explosion hazard

The pressure equalization fittings in the top of the analyzer cabinet may not be closed or blocked in any event. The openings are necessary in order to prevent any accumulation of poisonous or combustible gases in the cabinet in the event of leaks.

- Always keep the pressure equalization screw connections in the top of the analyzer cabinet free.

Cabinet side	Minimum distance to the environment	
to the right	0.5 m	for the gas lines and the electrical lines as well as for air entry into the fan (option)
to the left	0.5 m	for air discharge from the fan (option)
	1 m	for the air conditioner (option)
at the front	1 m	for opening the door (hinged on the left)
above	0.5 m	—

Load-bearing capacity of the floor

The floor at the installation site must be level and sufficiently strong to support the weight of the analyzer cabinet (approx. 300 kg).

Dimensions, weights and noise level

Dimensions

See ‘Location diagram’ in the system documentation.

Weights

Part / component		Weight
Analysenschrank		ca. 300 kg (661.4 lb)
Analyzer cabinet	500 mm (19.7 in)	1 kg (2.2 lb)
Type 40 probe tube	1000 mm (39.4 in)	2 kg (4.4 lb)
(unheated) depends on	1500 mm (59.1 in)	3 kg (6.6 lb)
length	2000 mm (78.7 in)	4 kg (8.8 lb)
	2500 mm (98.4 in)	5 kg (11.0 lb)
Type 42 probe tube	1000 mm (39.4 in)	8 kg (17.6 lb)
(heated) depends on length	1500 mm (59.1 in)	10 kg (22.0 lb)
	2000 mm (78.7 in)	12 kg (26.5 lb)
Type PFE2 filter unit, heated, with protective enclosure		20 kg (44.1 lb)
Type TBL01 sample gas line, heated		1 kg/m (2.2 lb/m)
System transformer from 100 V to 230 V (optional)		42 kg (92.6 lb)

Noise level

Part / component		Noise level
Fan	50 Hz	59 dB(A)
	60 Hz	61 dB(A)
Air conditioner		70 dB(A)

… 5 Preparation for Installation

Power supply

Main power supply

Input voltage	• 230/400 V AC, ±10 %, 3 phases* or • 120/208 V AC, ±10 %, 3 phases* or • 100/200 V AC, ±10 %, 3 phases (via transformer, on request)
Fuse (external)	3 x 20 A or 3 x 25 A
Line Frequency Range	50 to 60 Hz, ±2 Hz

* L1, L2, L3, N, PE, current-carrying neutral is not allowed.

Power

Module	Power consumption
Analyzer	approx. 2200 VA when switching on approx. 1500 VA when in operation
Heated probe tube	+ approx. 800 VA
Heated filter unit	+ approx. 250 VA
Heated sample gas line	+ approx. 90 VA/m
air conditioner (option)	+ approx. 1000 VA

Leakage current

A leakage current of ≥ 9 mA can occur in the analyzer system during operation.

Uninterruptible power supply UPS

The option ‘prepared for UPS’ is not possible in the case of a 100 V AC power supply.

Input voltage	• 230 V AC, 1 phase* or • 120 V AC, 1 phase*
Fuse (external)	20 A
Power consumption	approx. 500 VA (incorporated into above values)
Line Frequency Range	50 to 60 Hz, ±2 Hz

* L, N, PE, current-carrying neutral is not allowed.

Service socket

230 V AC (socket type: F, CEE 7-3) or 120 V AC (socket type: B, NEMA 5-15R), 48 to 62 Hz, max. 5 A.

The service socket is located near the cabinet light fixture.

Fuses

Marking	Nominal current	Function
–F80	30 A/30 mA	Supply ground-fault circuit interrupter
–F81	6 A or 16 A at 230 V, 20 A at 120 V	Fan or control cabinet cooling unit (option)
–F82	6 A	Lighting, service socket
–F83	6 A (only PFE2) or 10 A (PFE2 + probe 42, 230 V) or 16 A (PFE2 + probe 42, 120 V)	Type 42 probe tube heater, PFE2 filter unit heater, back-purging valves
–F84	16 A	Heated sample gas line
–F85	6 A	ACF5000 electronics box AU1, ASP block heater, gas cell heater
–F86	10 A	Air purifier, FTIR spectrometer, flow monitor, system controller, power supply unit 24 V/5 A
–F90	25 A/30 mA	UPS supply ground-fault circuit interrupter
–F91 to –F99	T 2 A	Relay coils, contactor coils, solid-state relays, selector solenoid valve (ceramic fuses)

Safety

In accordance with EN 61010-1

Overvoltage category

II

Pollution degree

2

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 sampling

Conduit pipe with mounting flange
(DN 65, PN 6, sealing surface Type A according to DIN EN 1092-1)

Gas pipes, pressure reducers

Process gas	Material
Instrument air	1 pipe or compressed air hose, outer diameter 6 mm or ¼ in (with pressure regulator and shut-off valve)
Combustion gas for the FID	1 high-purity (hydrocarbon-free) tube made of stainless steel (SS316), Outer diameter 6 mm or ¼ in (ABB part no. 0017400, length = 6 m)
	1 two-stage cylinder pressure reducer (designed for high-purity gases) with flow restriction
Test gas for FTIR	1 PTFE tube 4/6x1 mm or ⅛ in/¼ in
Test gas O_2 measurement	1 PTFE tube 4/6x1 mm or ⅛ in/¼ in
Test gases for VOC measurement	2 PTFE tubes 4/6x1 mm or ⅛ in/¼ in
Test gases for drift check	3 PTFE tubes 4/6x1 mm or ⅛ in/¼ in
Purge gas for sampling	1 PTFE tube 4/6x1 mm or ⅛ in/¼ in, length about the same as the sample gas line
Waste gas	1 hose, outside diameter 12 mm or ½ in.
—	Pressure reducer for high-purity gases

Installation Material

Bolts and nuts for fastening the analyzer cabinet to the floor (see ‘Location diagram’ in the system documentation)

Power supply lines

Note

When selecting the cable material, observe the applicable national safety requirements for installing and operating electrical equipment.

Power supply	5 × 6 mm2 in accordance with DIN EN 61010-1 or 5 × AWG8
UPS (option)	3 × 2.5 mm2 or 3 × AWG 14
Connecting cables	For the connections from the analyzer cabinet to the heated sample gas probe, filter unit and sample gas line (possibly high- temperature design; take the power consumption of these components into account) • Probe tube type 42: 3 × 1.5 mm^2 or 3 × AWG 16 • Filter device PFE3: 3 × 1.5 mm^2 or 3 × AWG 16 • Back-purge for filter device PFE3: 8 ×1.5 mm^2 or 8 × AWG 16 • Sample gas line TBL01 1-phase: 3 × 2.5 mm^2 or 3 × AWG 14 • Sample gas line TBL01 3-phase: 5 × 2.5 mm^2 or 5 × AWG 14
Grounding cable	≥ 10 mm^2 or AWG 6
Reaction to fire	The reaction to fire of all cables and lines connected to the ACF5000 system must comply with flammability class VW1, FT1 or EN 60332-1-2/-2-2.

… 5 Preparation for Installation

… Material required for installation

Signal Lines

Note

When selecting the cable material, observe the applicable national safety requirements for installing and operating electrical equipment.

Analog outputs	Shielded cables for the analog outputs (current outputs): 2 × 0.5 mm^2 or 2 × AWG 20 per analog output
Analog inputs	Shielded cables for the analog inputs (current inputs with the 'external analog inputs' option): 2 × 0.5 mm^2 or 2 × AWG 20 per analog input
Digital outputs	Cables for the digital outputs: 5 × 0.5 mm^2 or 5 × AWG 20 per group of 4 digital outputs
Digital inputs	Cables for the digital inputs (with the 'external digital inputs' option): 2 × 0.5 mm^2 or 2 × AWG 20 per digital input
Data lines	Cable for the data lines (Modbus®, PROFIBUS®, Ethernet), if necessary also fiber optic cable for longer transmission distances (multimode 50/125 µm or 62.5/125 µm with ST-BFOC connector). There are plug connectors on the right-hand side wall of the analyzer cabinet for the direct connection of pre-assembled data cables (Sub-D 9-pin or RJ45 or M12 wall bushings 5-pin or 8-pin).
Resistance thermometer	Cables for the Pt 100 resistance thermometers in the heated components; 3 × 0.75 mm^2 or 3 × AWG 20 per temperature sensor
Reaction to fire	The reaction to fire of all cables and lines connected to the ACF5000 system must comply with flammability class VW1, FT1 or EN 60332-1-2/-2-2.

Sample gas inlet conditions

⚠ DANGER

Explosion hazard

Explosion hazard when measuring ignitable gas / air or gas / oxygen mixtures

- The gas analyzer may not be used for the measurement of ignitable gas / air or gas / oxygen mixtures
- The operator must ensure that the gas analyzer is only operated with a sample gas mixture in which the concentration of flammable sample gas is below the lower explosion limit (LEL).

ACF5000 – sample gas input conditions	
Temperature	
Controlled to 180 °C, ±2 °C by means of the heated sample gas line	
Pressure	
Permissible absolute pressure range:	Analyzer cabinet inlet leading to the sample gas handling block: 900 to 1100 hPa (0.9 to 1.1 bar)
Flow rate	80 to 300 l/h

Corrosive gases

- The analyzer module must not be used for the measurement of gases containing organometallic compounds, e.g. lead-containing fuel additives or silicone oils.
- If the analyzer system is used to measure HF, the seals in contact with the sample gas must be made of FFKM. This also applies in particular to the gas sampling probe including filter and the sample gas line, which may be supplied separately.

Note

The seals in the analyzer system that come into contact with the sample gas are generally made of FFKM.

Operating gases and test gases

Definition of inlet pressure P_e

$P_e = P_{abs} - P_{amb}$
where P_e = overpressure, P_{abs} = absolute pressure,
P_{amb} = atmospheric pressure

FTIR spectrometer

Test gases

⚠ WARNING

Risk of poisoning from escaping test gases

In the event of a leak in the components for the test gas task, there is a risk of poisoning when opening the analyzer cabinet.

- Test gases for the FTIR spectrometer may only be issued by trained service staff.
- Before opening the cabinet, the test gas supply needs to be locked and the tightness of the test gas line verified by observing the pressure on the pressure gauge. The leakproofness is ensured if the pressure remains constant.

Test Gases for Zero Calibration	
Quality	Clean compressed air from the air purifier
Inlet pressure p_e	2000 hPa ±100 hPa (2.0 bar ±0.1 bar)
Flow rate	maximum 500 l/h

Test gases for endpoint calibration	
Quality	Measuring component in N_2, 70 to 80 % of the measuring range (accuracy ±2 %)
Inlet pressure p_e	1500 hPa ±100 hPa (1.5 bar ±0.1 bar)
Flow rate	max. 500 l/h

Note

The test gases H_2O, HCl, HF and NH_3 are produced by a vapor generator through vaporization of distilled water, HCl, HF, or NH_3 solutions with known concentrations.

FID – Flame ionization detector (option)

Combustion air

Clean compressed air from the air purifier is used as combustion air.

Combustion gas

Combustion gas parameter	
Quality	Hydrogen (H_2), Quality 5.0
Inlet pressure p_e	1200 hPa, ±100 hPa (1.2 bar, ±0.1 bar)
Maximum combustion gas flow	approx. 4 l/h

Note

Provide two 40-l bottles and a selector station.
A flow restrictor that limits the combustion gas flow rate to 10 l/h is installed in the bulkhead fitting for connection of the combustion gas line.

Hydrogen monitoring of the analyzer cabinet

To increase operational safety in the event of a fault, ABB recommends using the 'Hydrogen monitoring of the analyzer cabinet' option, see also **Operating gases and test gases** on page 38.

… 5 Preparation for Installation

… Operating gases and test gases

Test gases

Test Gases for Zero Calibration	
Quality	Nitrogen (N_2), quality 5.0
Inlet pressure p_e	1500 hPa ±100 hPa (1.5 bar ±0.1 bar)
Flow rate	maximum 500 l/h

Test gases for endpoint calibration	
Quality	n-propane C_3H_8 in N_2, 70 to 80 % of the measuring range (accuracy ±2 %)
Inlet pressure p_e	1500 hPa ±100 hPa (1.5 bar ±0.1 bar)
Flow rate	max. 500 l/h

Note
Since the FID analyzer measures only the number of C atoms, the concentration of the end point gas must be converted from ppm or mg/m³ C_nH_m into ppm or mg/m³ C.
See **FID – Conversion of concentration data** on page 60.

Oxygen sensor

Test gases

Test Gases for Zero Calibration	
Quality	3 vol. % O_2 in N_2 (accuracy ±2 %)
Inlet pressure p_e	1500 hPa ±100 hPa (1.5 bar ±0.1 bar)
Flow rate	maximum 500 l/h

Test gases for endpoint calibration	
Quality	Clean compressed air (20.96 vol. % O_2) from the air purifier
Inlet pressure p_e	1500 hPa ±100 hPa (1.5 bar ±0.1 bar)
Flow rate	maximum 500 l/h

Instrument air

Parameter	**Value/Description**
Quality	According to ISO 8573-1 Class 2 Particle size: max. 1 to 5 µm, Particle density: max. 10 particles/m³, Oil content: max. 0.1 mg/m³, Dew point: max. vapor pressure dew point −40 °C
Inlet pressure p_e	5500 to 7000 hPa (5.5 to 7.0 bar)
Temperature	Maximum 40 °C
Flow rate	In normal mode 3000 to 3800 l/h, during adjustment briefly up to 5000 l/h

Note
Install a pressure controller and a shut-off fitting in the instrument air feed as close as possible to the installation site of the analyzer cabinet.

Compressed air for back-purge of the gas sampling probe (optional)

Compressed air is needed to clean the sampling filter and the probe tube as well as for controlling the control valves.

Parameter	**Value/Description**
Quality	Instrument air
Inlet pressure p_e	maximum 6 bar for back-purge, approx. 4 bar as control air (needed for 2-stage back-purge with type PFE2 filter unit and with FID)
Flow rate	approx. 1600 l/min (duration of the back-purge process approx. 45 seconds) See **Configure automatic back-purging of the gas extraction probe** on page 146.

6 Installation

Safety instructions

⚠ WARNING

Risk of injury due to heavy components

Improper handling of heavy components can lead to serious crushing, broken bones or even fatal injuries.

- Use suitable equipment to lift and transport heavy components.
- Wear safety shoes.
- Always maintain a sufficient safety distance from suspended loads.
- Never stand under a suspended load.

⚠ WARNING

Risk of injury caused by transport equipment

Improper use of transport equipment can lead to personal injury and damage to property.

- Only authorized personnel may use transport equipment such as industrial trucks or cranes.

Note

Consider the following items during transport:

- Having the analyzer cabinet transported by a specialist company is highly recommended
- For analyzer cabinets with the ‘control cabinet cooling unit’ option, leave the analyzer cabinet to rest for at least 30 minutes after setting it up at the installation site.

General Notes

- It is recommended to have the analyzer system installed by ABB.
- In addition to this operating instruction, refer to the order-specific set of drawings as well as the operating instructions and data sheets for the individual devices and components when installing the analyzer system.
- If there is transport damage which indicates improper handling, file a damage claim with the shipper (rail, mail, or freight carrier) within seven days.
- Make sure that the enclosed accessories do not get misplaced, see **Scope of delivery** on page 19.
- Retain the packaging material and the transport protection for possible future transport.

… 6 Installation

Installing the analyzer cabinet

Providing the foundation

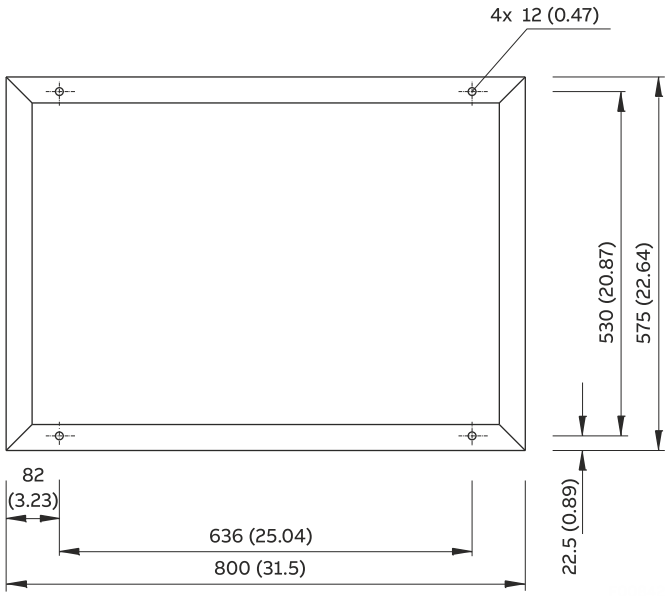


Figure 9: Installation holes, dimensions in mm (in)

- Comply with the “Requirements at the installation site,” refer to **Requirements for the installation site** on page 24.
- Observe the ‘Arrangement diagram’ in the system documentation.
- Build a concrete base with cast-in M10 stud bolts or base iron frame with holes or grating, see Figure 9.

Unpacking and transporting the analyzer system

⚠ WARNING

Risk of injury due to heavy components

Improper handling of heavy components can lead to serious crushing, broken bones or even fatal injuries.

- Use suitable equipment to lift and transport heavy components.
- Wear safety shoes.
- Always maintain a sufficient safety distance from suspended loads.
- Never stand under a suspended load.

⚠ WARNING

Injury hazard due to heavy weight

The analyzer system weighs approx. 300 kg!

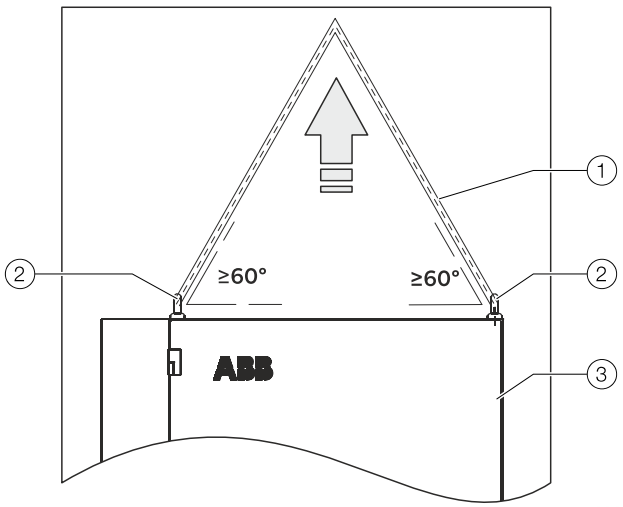
- A crane with suitable transport gear is required for unpacking and transporting!

NOTICE

Damage to the analyzer cabinet

The analyzer system may warp If the cable pull angle is too small.

- Use the provided transport lugs to attach the pull ropes to the analyzer system.
- The pull ropes must be long enough to ensure a minimum pull rope angle of 60° when under tension!



1 Pull rope
2 Transport lugs 4×
3 Analyzer system

Figure 10: Crane transport of the analyzer system

1. Open the transport box and lift out the analyzer system.
2. Do not remove the plastic film in which the analyzer system is wrapped for the time being! Unpacking the analyzer system when cold can cause condensation.
3. Do not remove the plastic film until the analyzer system has reached room temperature. This takes at least 24 hours.

Setup of the analyzer system

- Observe the requirements at the installation site , refer to page 24.
- Provide the material required for installation, see page 27.
- Observe the ‘Arrangement diagram’ in the system documentation.

Earthing the analyzer system

1. Route earthing cable (≥ 10 mm^2, AWG 6 with ‘CSA version’ option) through the M16 cable gland provided in the right-hand cabinet wall for this purpose.
2. Connect the earthing cable to the central earthing point near the connection terminals for the main power supply.
   - Check that the earthing cable is secure after connection.

… 6 Installation

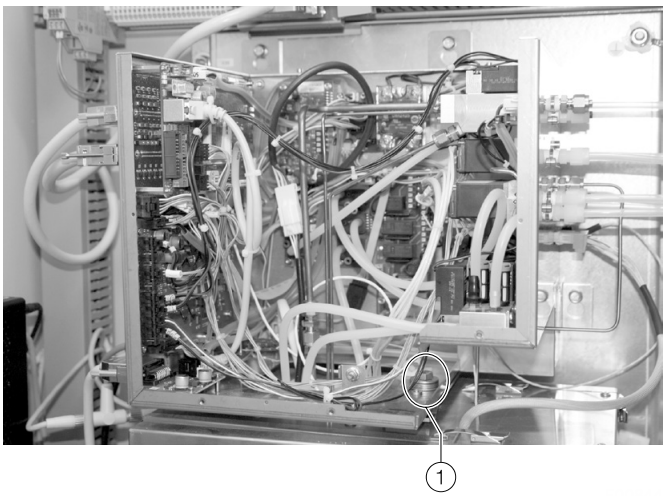
… Installing the analyzer cabinet

Remove transport protection

Note

Removing the transport protection immediately before commissioning the analyzer system is highly recommended.

Remove the transport protection of the ASP block



① Transport safety screw

Figure 11: Transport protection ASP block

The ASP block is fastened using an M8×80 transport protection bolt. This is routed from above through a hole in the housing of the ACF5000 electronics box AU1 and screwed into the ASP block.

1. Open the cover of the ACF5000 electronics box and take it out.
2. Using a 13 mm spanner, undo the transport protection bolt ① and remove it together with the washer.
3. Remount the cover of the ACF5000 electronics box and close it.
4. Keep the transport protection bolt together with the washer for transporting at a later time.

Installing the gas sampling probe and filter unit

Note

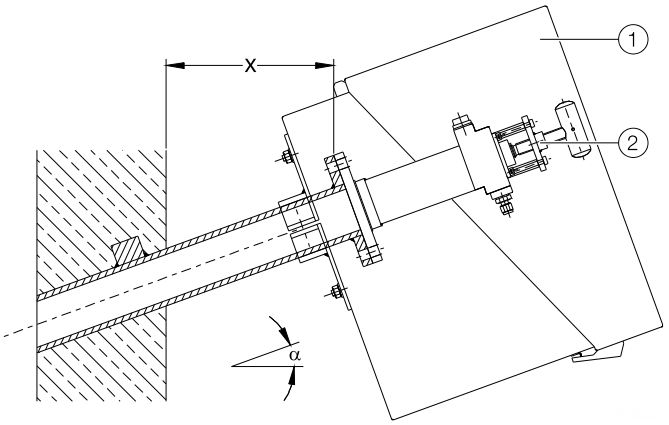
For detailed information on installing the gas sampling probe and filter device, refer to the relevant operating instructions, see **Further documents** on page 4.

⚠ CAUTION

Injury hazard due to heavy weight

The pre-assembled probe tube with filter unit weights approx. 17 to 32 kg, depending on the version!

- Two people are required for unpacking, transport, and assembly!



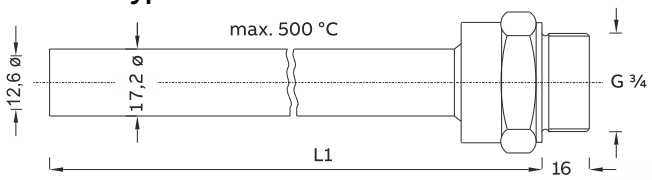
① Probe protection box ② Filter device PFE2

Figure 12: Probe protection box with filter device PFE2

Install the gas sampling probe and filter unit:

1. Observe the ‘Piping diagram’ in the system documentation.
2. Make sure that the distance ‘X’ of the conduit pipe has been adjusted to the installation angle ‘α’, see **Minimum distance between conduit pipe** on page 23.
3. Probe tube type 40
   Insert pre-assembled probe tube with filter unit into the conduit pipe and screw the assembly flange to the filter device flange.
   Heated probe tube type 42:
   Insert probe tube into the conduit pipe and screw to the assembly flange. Screw filter unit up to the flange.
4. Connect the electrical leads on the gas sampling probe and filter unit in accordance with the ‘Wiring diagram’ and ‘Terminal diagram’ in the system documentation.
5. Local potential equalization: Connect the heated special tube and the filter device at the sampling point with a large cross-section (≥ 10 mm^2 or ≥ AWG 7) to the potential equalization.

Probe tube type 40



L1 Length of the probe tube
500 / 1000 / 1500 / 2000/2500 mm

Figure 13: Dimensions of probe tube type 40 (dimensions in mm)

Probe tube type 42

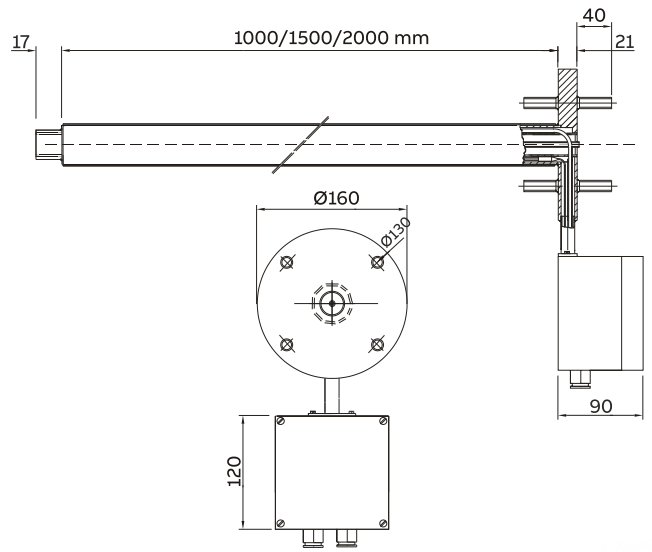
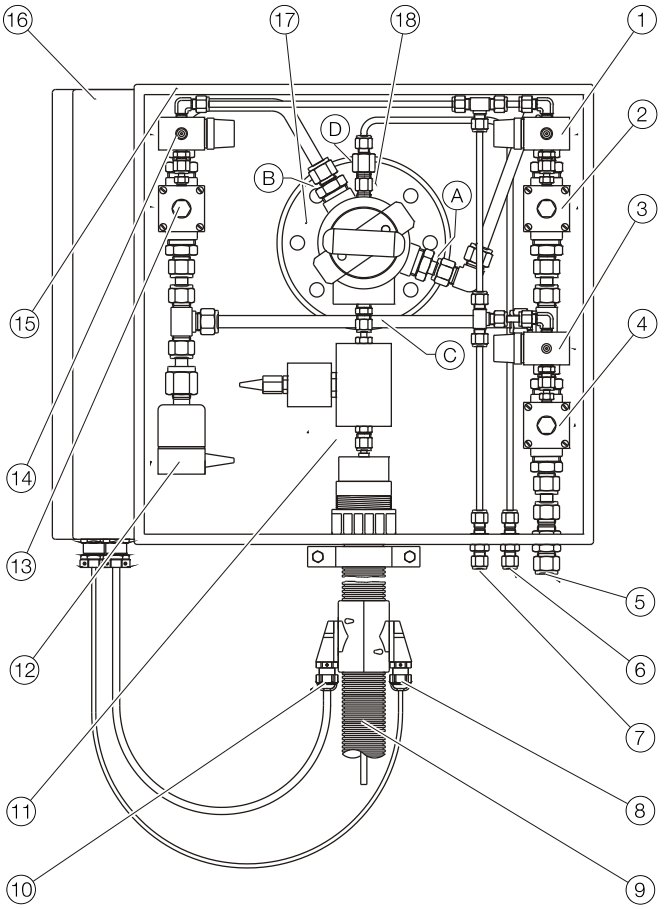


Figure 14: Dimensions of probe tube type 42 (dimensions in mm)

Note

- If the PFE2 filter unit with standard protective box (450 × 450 × 400 mm) is mounted to the heated probe tube type 42, the electrical connections on the probe tube must be connected to the terminal box of the filter unit; in this case, the small terminal box, which is part of the heated probe tube is not required.
- It must be ensured that the sample gas in the gland base, which is installed between the type 42 heated probe tube and the PFE2 filter unit, does not fall below operating temperature. The same applies for the conduit pipe with assembly flange. Insulation and, where necessary, heat tracing is required for this purpose.

Gas connections to the PFE2 filter device



1. Pilot valve Clean filter -Y2.1
2. Diaphragm valve Clean filter - Y2.2
3. Pilot valve pulse-instrument air - Y1.1
4. Diaphragm valve pulse-instrument air -Y1.2
5. Instrument air connection (max. 6 bar) bulkhead connector 12 mm
6. Sample gas connection bulkhead connector 6 mm
7. Control air connection (max. 6 bar) bulkhead connector 6 mm
8. Pt100 connection
9. Heated sample gas line
10. Main power supply
11. Heated shut-off valve -Y5 (optional)
12. Venting solenoid valve -Y4
13. Diaphragm valve Clean filter surface and probe tube -Y3.2
14. Pilot valve Clean filter surface and probe tube -Y3.1
15. Probe protection box
16. Terminal box
17. Filter unit
18. Check valve

A. Back-purge connection filter G½ to 12 mm pipe fitting
B. Back-purge connection filter surface and probe tube G½ to 12 mm pipe fitting
C. Sample gas outlet G¼ to 6 mm pipe fitting
D. Test gas connection G¼ to 6 mm pipe fitting

Figure 15: Gas connections Filter device PFE2

… 6 Installation

Installing the sample gas line

Note
For detailed information on installing the heated sample gas line, refer to the associated operating instructions, see **Further documents** on page 4.

Please observe the following instructions when installing the sample gas line:

- Observe the 'Piping diagram' in the system documentation.
- Connect the sample gas line to the gas sampling probe.

Note
Neither grease or lubricant may be used during installation of the sample gas line. This can falsify the measured values.

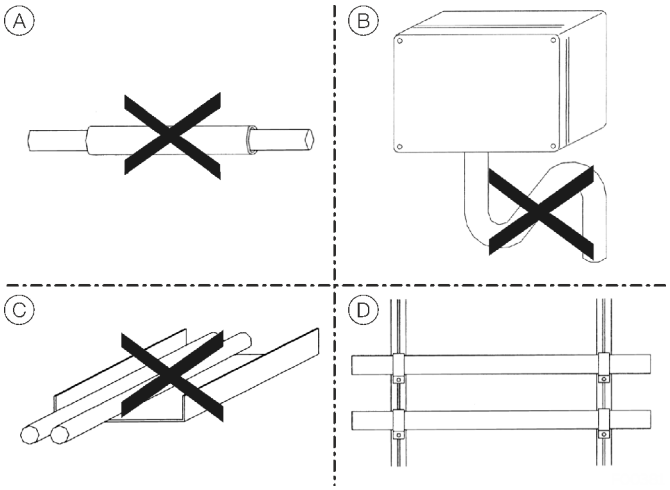


Figure 16: Installation instructions for the sample gas line

Ⓐ Do not install the heated sample gas line in a protection tube.
Ⓑ The sample gas line from the gas sampling probe to the analyzer cabinet must be inclined and run in a separate channel if possible. Water pockets must not be allowed to form, especially at the sampling point.
Ⓒ The heated sample gas line must not be laid in a cable tray and must not be laid in a cable grid next to other gas or power lines. This applies in particular for closed cable grids.
Ⓓ Assemble the heated sample gas lines on freely-laid C-profiles using BBS hose clamps with a counterpart. Do not over-tighten.

- The sample gas line must be laid so as to avoid sharp bends, kinks and the crossing of other lines. The minimum bending radius is 200 mm.

Installation in ducts or shafts

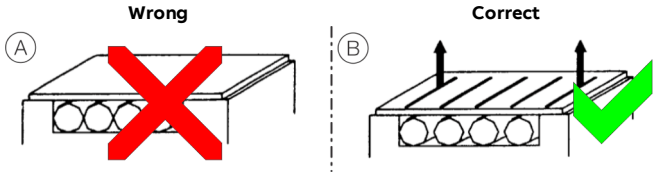


Figure 17: Installation in ducts or shafts

Ⓐ Do not lay the heated sample gas lines directly next to each other in a closed duct or shaft in order to avoid heat build-up.
Ⓑ Make sure that the heated sample gas lines do not touch each other. Maintain a distance of at least 25 mm. Ensure adequate ventilation to guarantee heat dissipation.

Contamination of the heated sample gas line

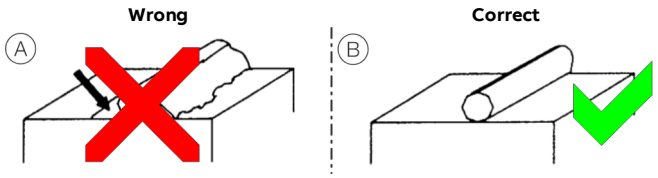


Figure 18: Contamination of the sample gas line

Ⓐ Ensure that no dust deposits, adhesives or other heat-insulating materials contaminate the heated sample gas line. Otherwise overheating will occur at these points.
Ⓑ Remove the contamination and rectify the cause to ensure heat dissipation.

Insulation of the heated sample gas line

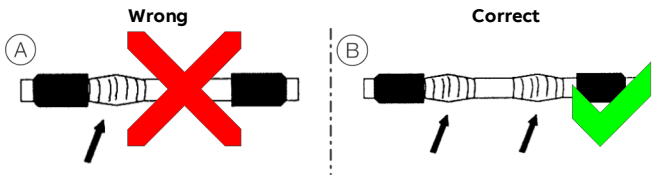


Figure 19: Insulation of the sample gas line

Ⓐ Insulation of the heated sample gas line is not permitted. The sample gas line would overheat at these points. Do not cover the area near the temperature sensor, otherwise the rest of the sample gas line will cool down.
Ⓑ Do not insulate the heated sample gas line. Make sure that the area near the temperature sensor is unobstructed. This will ensure correct temperature control of the sample gas line.

Wall ducts

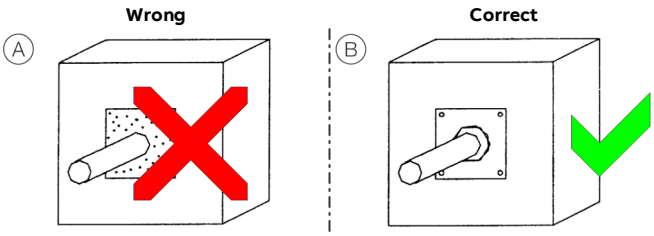


Figure 20: Wall ducts

Ⓐ The heated sample gas line must never be laid through wall ducts if there is a possibility of subsequent sealing by means of sealing compounds, since this may damage the sample gas line.

Ⓑ If the heated sample gas line is installed through a wall duct, bulkhead plates with cable glands must be used to ensure sufficient cooling of the sample gas line.

Lay several heated sample gas lines together

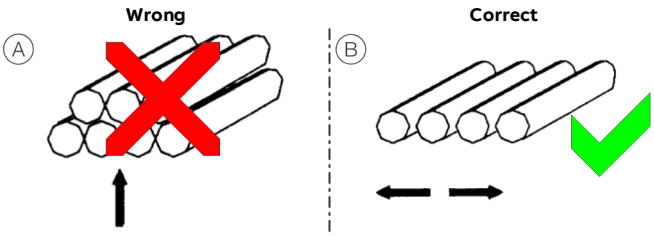


Figure 21: Bundling several gas lines

Ⓐ Do not bundle several heated sample gas lines or lay them in such a way that they touch each other. This will lead to overheating at the contact points.

Ⓑ Lay several heated sample gas lines separately from each other at a distance of at least 2.5 cm and ensure adequate ventilation to guarantee heat dissipation

Brackets

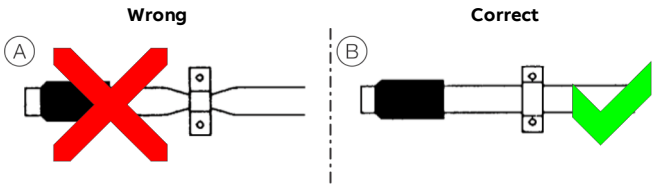


Figure 22: Supports

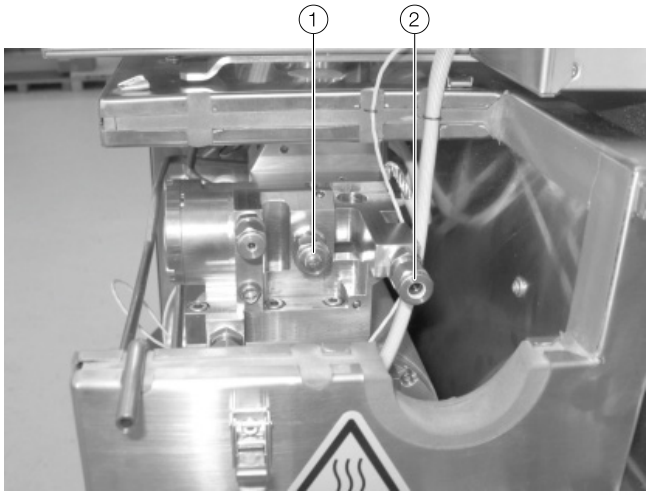
Ⓐ Make sure that the brackets or clamps do not compress the sheath of the heated sample gas lines in order to prevent damage to the sample gas line.

Ⓑ Do not overtighten the brackets or clamps to avoid damaging the sample gas line.

… 6 Installation

… Installing the sample gas line

Connect the sample gas line to the analyzer system



① Input for the water vapor generator

② Sample gas inlet

Figure 23: ASP block in the analyzer system

1. Insert the sample gas line through the opening in the right-hand cabinet wall.

NOTICE

Preparation of the sample gas connection

Do not connect the sample gas line to the sample gas inlet on the ASP block yet! This connection is made by ABB personnel during the commissioning procedure.

- First connect a PTFE tube of approx. 0.5 m in length to the sample gas input ② on the ASP block. Ambient air will then be sucked into the analyzer cabinet from outside once the FTIR spectrometer is powered up.
- The input for the water vapor generator ① on the ASP block must be closed by means of a blanking plug.

2. Connect the electrical leads on the sample gas line as per the 'Wiring diagram' and 'Terminal diagram' in the system documentation.

Operating gases and test gases

Installing the instrument air supply

- Observe the requirements at the installation site, refer to page 30.
- Provide the material required for installation, see page 27.
- Observe the 'Piping diagram' in the system documentation.
- Connect the instrument air feed line to the bulkhead fitting in the right-hand cabinet wall.
- Install a locking device in the instrument air feed line with a pressure gauge p_e = 5.5 to 7 bar.

Installing the test gas cylinders

- Observe the 'Piping diagram' in the system documentation.
- Fit the test gas cylinders with pressure reducers and install in the proximity of the analyzer cabinet. Short test gas lines translate into short dead times.
- Observe the national regulations for the operation of pressure tanks and the permissible ambient temperatures and the labels on the pressure reducers.

Connecting gas lines

Provide the material required for the installation, see page 27.

- Observe the 'Piping diagram' in the system documentation.
- Make sure that the gas lines are connected to the appropriate gas connections and are not mixed up! Once the gas lines have been connected, a second person should check that they are correctly assigned to the gas connections.
- Ensure the utmost cleanliness when connecting the gas lines! Gas inlets, outlets, fittings, hoses and pipes must be free of dust and grease.
- If there is a risk of frost, heat the gas lines.
- The gas connections (bulkhead fittings) are located in the right-hand cabinet wall. Hold back the bulkhead fittings when connecting the gas lines!

Combustion gas supply for the flame ionization detector (FID)

⚠ DANGER

Explosion hazard

Explosion hazard due to incorrect connection of the hydrogen supply. A faulty connection can lead to the ingress of hydrogen into the analyzer cabinet and the formation of an explosive mixture inside the analyzer cabinet.

- Make sure that the hydrogen supply is connected to the correct gas connection

- Connect a two-stage cylinder pressure reducer with flow restrictor (version for high purity gases) to the combustion gas cylinder.
- Connect combustion gas line to the bulkhead fitting provided. For safety reasons a flow restrictor, which limits the combustion gas flow to 10 L / h, is integrated into this bulkhead fitting. Refer to **Safety instructions for the FID analyzer module** on page 8.

⚠ WARNING

Explosion hazard

The bulkhead fitting with hydrogen flow restrictor is a safety-relevant component.

- The bulkhead fitting with hydrogen flow restrictor may only be removed, modified or replaced by certified service personnel!

- If the analyzer system is equipped with the 'Hydrogen monitoring of the analyzer cabinet' option (see page 15), connect the combustion gas line to the inlet of the H_2safety valve. The outlet of this valve is connected to the bulkhead fitting with the integrated flow restrictor at the factory.
- Check the seal integrity of the combustion gas line:
  Set the high-pressure stage of the pressure reducer of the combustion gas cylinder to p_e = 1200 hpa, ±100 hPa (1.2 bar, ±0.1 bar) and purge the combustion gas line. Using a hydrogen leak detector (measuring principle: thermal conductivity), check the seal integrity of the combustion gas line Close the combustion gas cylinder.

Waste gas

NOTICE

Leaks in the gas discharge line due to condensation

Corrosive condensates can cause leaks in the gas discharge line.

- Install the gas discharge line at a gradient so that the condensate can drain off.
- If a downward installation is not possible, the gas discharge line may have to be additionally insulated or heated.

Please observe the following information when installing the gas discharge line:

- Guide the waste gas from the gas analyzer in depressurized state through the shortest possible line with a large inside diameter into the atmosphere or into an exhaust pipe.
  The internal diameter of the gas discharge line must be expanded as close behind the analyzer cabinet as possible, in order to prevent dynamic air pressure on account of excessive line length.
- Install the gas discharge line at a gradient, leading away from the gas analyzer.
- Do not install any throttle sections or shut-off valves in the exhaust gas line!
- Make sure air and condensate are separated after discharge. According to the gas transport principle, the sample gas is diluted in a ratio of approx. 1:5 after being measured in the instrument air. Nonetheless, condensation can occur when the dew point of the water in the mixture has reached ambient temperature.

Note

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

Purging gas for gas sampling probe

Connect the purge gas line to the gas sampling probe (for emergency purging, see **Emergency purging** on page 141, and feeding test gas to the probe). The purge gas line can be laid on the same tray as the sample gas line.

Compressed air supply for back-purging the sample gas probe (option)

Connect compressed air for cleaning the sampling filter and the probe tube (back-purging option) to the corresponding connections on the protective box of the probe. For back-purge option, see **Gas connections to the PFE2 filter device** on page 35 and **Configure automatic back-purging of the gas extraction probe** on page 146).

… 6 Installation

Electrical connections

Description of the signal inputs and outputs

Analog outputs
4 to 20 mA, common negative pole, galvanically isolated, can be grounded as required, max. DC 30 V, load max. 600 Ω, resolution 16 bit

Analog inputs
4 to 20 mA, common negative pole, galvanically isolated from ground, max. DC 30 V, R_i = 41.2 Ω, R_u = 100 kΩ, resolution 16 bit

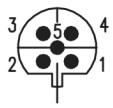
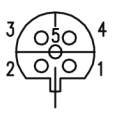
Note
If all the channels are not connected in an analog output or analog input module, the status LED lights up red even in normal operation. Recommendation: Apply a shorting jumper to unused channels.

Relay outputs
Potential-free contacts (normally open, 'fail safe'), max. 277 V AC/DC, max. current AC1 5 A, max. current

per group of 4 AC1 20 A

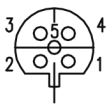
Digital inputs
Optoelectronic coupler with internal power supply DC 24 V, switched potential-free contacts, status 0: U_L < DC 5 V, Status 1: U_H > DC 11 V, I_H min / max = 2 mA / 4.5 mA

PROFIBUS® interface
One 9-pin Sub-D connector each for PROFIBUS IN and PROFIBUS OUT or one 5-pin M12 plug-in connector / -socket connector each for PROFIBUS IN and PROFIBUS OUT

M12 plug-in / socket connector	Terminal layout
PROFIBUS IN 	M12 plug-in connector 1 not used 2 IN (gn/1A) 3 not used 4 IN (rd/1B) 5 not used
PROFIBUS OUT 	M12 socket 1 not used 2 OUT (gn/2A) 3 not used 4 OUT (rd/2B) 5 not used

Note
If the analyzer system is installed at the end of a PROFIBUS network, the terminating resistor on the PROFIBUS connector located on the underside of the system controller housing on the inside of the cabinet door must be switched to 'ON'.

Modbus® interface
9-pin Sub-D socket connector or 5-pin M12 socket connector.

M12 socket	Terminal layout
Modbus 	1 not used 2 not used 3 RTxD– 4 GND 5 RTxD+

Ethernet interface
RJ45 socket or 8-pin M12 socket connector.

M12 socket	Terminal layout
Modbus 	1 DA+ 2 DA– 3 DB+ 4 DB– 5 DD+ 6 DD– 7 DC– 8 DC+

Connecting the electrical lines

- Provide the material required for installation, see page 27.
- Observe the 'Arrangement diagram', 'Wiring diagram' and 'Terminal diagram' in the system documentation.
- The cable glands for the electrical lines are located in the right-hand cabinet wall.
- When laying the electrical lines, observe the relevant national safety regulations for installing and operating electrical systems.
- Connect the electrical lines to the terminals on the terminal panel in the upper section of the analyzer cabinet.
- Ensure that the IP protection class of the analyzer system is complied with.

Connecting the Signal Lines

- Lay the signal lines separately from the power supply lines.
- Lay analog and digital signal lines separately from each other.
- Carefully plan the combination of signal lines in cables, including for the purpose of feeding through the cable glands.
- Connect signal lines to the terminal blocks on the I/O modules at the rear wall in the analyzer cabinet.
- Lay the shield of the shielded cable in accordance with the local regulations. In doing so, consider the potential differences and interspersion of interference signals.

Connect power supply lines

- Observe the “Requirements at the installation site”, refer to **Power supply lines** on page 27.
- Before connecting the power supply, make sure that the operating voltage set on the analyzer system and the main power supply matches the information on the name plate.
- The protective ground conductor must be attached to a protective conductor terminal before any other connections are made. The analyzer system is potentially hazardous if the protective ground conductor is interrupted inside or outside the analyzer system or the protective conductor terminal is unmade.
- Connect the power supply to the terminal strips **–X80** or **–X90** (UPS).
- Connect the power supply line to the heated samplingassemblies (where applicable in temperature-resistant design) on the corresponding terminal strips **–X81**, **–X91** and if applicable, to the corresponding circuit breaker.
- Attach the connection lines of the Pt100 resistance thermometers of the external heated sampling assembles to the interface module **–X82** on the right side wall.
- Connect the optional ‘Hydrogen monitoring of the analyzer cabinet’ (see page 15):
  - Power supply to the gas warning system.
  - Power supply of the contactor.
  - H_2-safety valve.

Note

The system operator is responsible for contracting the commissioning and calibration of the hydrogen monitoring system. Refer to **Hydrogen monitoring of the analyzer cabinet (optional)** on page 15.

7 Commissioning

Safety instructions

NOTICE

Damage to the gas analyzer

Damage to the gas analyzer due to condensing sample gas during commissioning.

- Observe the condition of the sample gas inlet of the analyzer modules.
- Purge the sample gas path before commissioning, see **Recommissioning** on page 42.
- Do not connect the sample gas until the gas analyzer has reached room temperature and after the warm-up phase has elapsed, see **Recommissioning** on page 42.

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 **Recommissioning** on page 42).
- 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.

Initial commissioning

The analyzer system is essentially commissioned by the authorized personnel of the manufacturer or of the supplier.

Note

The initial commissioning of the 'Hydrogen monitoring of the analyzer system' option may only be performed by certified specialist personnel from the manufacturer of the gas warning system and the gas sensor. The system operator is responsible for contracting the commissioning and calibration of the hydrogen monitoring system. Refer to **Hydrogen monitoring of the analyzer cabinet (optional)** on page 15.

Recommissioning

To restart the analyzer system from cold, after a prolonged shutdown for example, proceed as follows.

Procedure

Note

Switch on the instrument air and purge for 30 minutes before opening the door of the analyzer cabinet and switching on the power supply.

1. Open the analyzer cabinet door.
   - Check the pressure of the instrument air supply and set to p_e = 5.5 to 7 bar as needed.
   - Check pressures and flows on the pneumatic plate on the right-hand cabinet internal wall against the values in **Operating gases and test gases** from page 29 onwards.
   - Leave the hydrogen supply switched off!

Note

The purge line between the analyzer system and gas sampling probe must be installed.

2. Switch on the power supply.
   - Make sure that all circuit breakers are deactivated.
   - Turn on the main switch.
   - Activate the circuit breaker in the FTIR spectrometer.
3. Activate all other circuit breakers.

4. The analyzer system starts to heat up automatically.
   - The assemblies in the analyzer cabinet reach their target temperatures after approx. 2 hours. The gas sampling probe reaches its target temperature after 3-4 hours.
   - The gas feed begins as soon as the temperatures of the FTIR cell and ASP block reach 150 °C.
   - The sample gas input and output pressures should adjust automatically to MGE = 850 hPa or MGA = 750 hPa. Failure to reach these pressure values indicates a leak in the analyzer system.
5. Connect the sample gas line to the gas sampling probe.
6. Have a complete seal integrity test carried out by certified and authorized personnel.
7. Turn on the hydrogen supply and restart the FID, see **FID Recommissioning** on page 43.

Start of the measurement

On a restart, the analyzers start to measure automatically:

- the oxygen sensor within a few minutes after the circuit breakers are activated;
- the FTIR spectrometer within 5–10 minutes of the circuit breakers being activated (the Power and Status LEDs illuminate green);
- the FID on successful completion of the start sequence.

FID Recommissioning

Heating-up phase, connect supply gases

1. 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:	Temperature of the ASP block
T-Re.E	Temperature of the FTIR cell
T-Re.K	Instrument air preheating temperature
TR.VV1:	Temperature of the pre-amplifier

   The temperature values increase slowly after activating the power supply.
2. Connect the supply of instrument air, combustion air and combustion gas.
   First set the pressure to the values specified in the device data sheet using the respective external pressure regulator.
3. The ‘Controller values’ menu item also displays both the actual and setpoint values and the manipulated variables of the internal pressure controllers:

C Air:	Combustion air pressure
C Gas:	Combustion gas pressure
MGE:	Pressure at the sample gas nozzle
MGA:	Pressure in the combustion chamber (output)

   Random values can initially be displayed for the position values. The values are updated for the first time approx. 10 s after selecting the menu option and then approx. every 10 s. The pressure control is in progress in the background. It may take some time to set the pressures depending on the setting of the inlet pressure.
   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.

… 7 Commissioning

… FID Recommissioning

4. 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 ASP Block (**T-Re.D**) and if applicable of the FTIR cell (**T-Re.E**) is over or below the upper or lower limit value 1 (2).
Pressure limit value 1, 2	The pressure at one of the internal pressure regulators for instrument air (**inlet, outlet**), combustion air (**air**) or combustion gas (**H2**) exceeds or undercuts the upper or lower limit value 1 or 2.

5. As soon as the temperature of the detector reaches the threshold value (150 °C) the corresponding solenoid valve in the analyzer module automatically switches off the instrument air. The negative pressure regulation and the combustion air regulation adjust the pressures to the respective set point.
   The sample gas begins to flow through the analyzer after the instrument air is connected.
6. 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 adjusts the pressure to the set point.

Igniting the flame

7. Flame ignition is automatic.

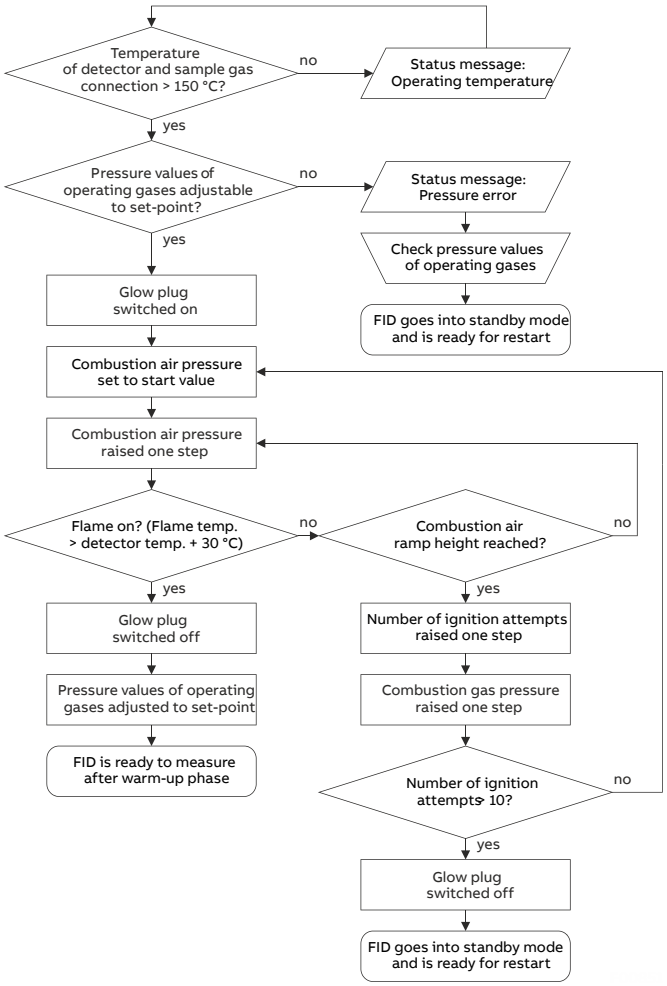


Figure 24: Igniting the flame

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, the ignition of the flame needs to be restarted in the 'Standby/Restart FID' menu, see **FID – Standby / Restart** on page 144.

The flame is considered to be 'on' when the flame temperature is at least 30 °C higher than the detector temperature. With the ignition of the flame, the actual commissioning of the FID is ended.

Note
The door of the analyzer cabinet must be closed at all times during operation!

8 Operation

General

The gas analyzer can be operated via several user interfaces:

- Local operation on the gas analyzer via the integrated LCD display ('local HMI').
- Remote access via a PC using the 'AO-HMI' ('Remote HMI') software. Detailed information on remote control can be found in the "AO-HMI" technical information.
- Operation via a web interface.

Note
The user interface is also referred to as 'HMI'; this abbreviation stands for 'Human Machine Interface'.
In this section, the password level is referred to as 'Level'. The letter 'n' stands for the numbers 0, 1, 2 and 3.

Operation via the local LCD display

All functions required for normal operation of the analyzer system can be accessed via the integrated LCD display ("local HMI") located in the door of the analyzer cabinet.

Remote HMI operation

All functions that are accessible via the integrated LCD display can also be operated from a computer that is connected to the analyzer system via Ethernet and has the 'AO-HMI Remote Control Interface' software tool installed. Detailed information on remote control can be found in the "AO-HMI" technical information.

Note
When describing the display and operation in this operating instruction, HMI is used to refer to both local HMI and remote HMI.

… 8 Operation

… General

Operation via the web interface

Functions

Some functions are only accessible via the web interface. The user has access to the following functions:

- graphic course of the measured value for every measuring component (see page page 55),
- automatic cyclical adjustment check (‘Automatic Adjustment Check’) and export of the QAL3 data (see page 65),
- Check for automatic processes with scheduling conflicts (see page 76).

All other functions are only determined for use by ABB Service; they are not described in this operating instruction.

Access and operation

The Mozilla® Firefox® web browser is recommended for operation via the web interface.
The web interface is accessed through the analyzer system's IP address via port 8080.

Example:
The analyzer system has the IP address 192.168.1.1.
The following must be entered in the address bar of the web browser: http://192.168.1.1:8080.

The user will see only those sub-menus which can be accessed with the password entered previously (see page page 52).

Priority of a user interface

The analyzer system can only be operated from one single HMI.

The hierarchy of the passwords regulates what HMI has or is given preference during operation (see also following table).

As a rule, the HMI with the password for level n+1 has priority over an HMI with the password for level n. However, the local HMI with the password for Level n already has priority over a remote HMI with the password for Level n.

1. User:	2. User:	
	Remote HMI receives…	**Local HMI receives…**
Remote HMI level n	Preference with level n+1	Preference with level n
Local HMI level n	Preference with level n+1	—

Note
If a 2nd user with an HMI is given preference over another HMI, any entries made by the 1st user not confirmed by selecting **ENTER** will be lost and any ongoing processes (e.g. calibration) will be canceled.

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 – 30/24-200’ contains complete information on the individual function blocks.

Access denied

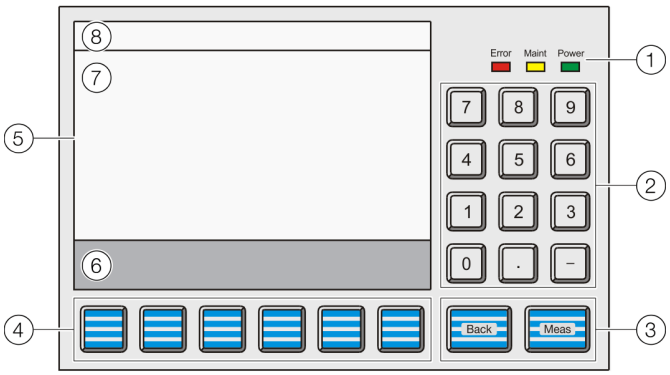
When a user tries to operate the gas analyzer via a locked HMI, the following text is displayed after pressing the **‘MENU’** key:

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 **Block operation** on page 92.

LCD-indicator



1 Status LED's
2 Numeric Keypad
3 Cancel Keys
4 Softkeys
5 LCD display
6 Softkey Line
7 Information Field
8 Menu Line

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.

… 8 Operation

… LCD-indicator

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

- Enter values, see **Value Input** on page 109.
- Actuate keys, see **Key Entry** on page 111.

Note
For further information about the screen in the measurement mode refer to **LCD display** from page 103 onwards.

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 49.

Display of status messages
Messages from the gas analyzer are also displayed in the softkey line.

The blinking message display has the following functions:

- Prompt to press the '**STATUS MESSAGE**' softkey when a status message is received.
- Indication that a password is active.
- Indication of a remote control connection via a remote HMI.
- Indication of an ongoing automatic calibration.

Display of status messages
The message display shows faults in the gas analyzer as a status message.
The 'Message insert' function block can also be used to display self-defined 'status messages' as a short text.
For this purpose, the function block must be configured accordingly.

Note
The 'Function Blocks – 30/24-200' technical information contains detailed information on the function blocks.

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

Status LED	Description
	The green 'Power' LED lights when the power supply is on.
	The yellow 'Maint' LED lights when the 'Maintenance request' status signal is active. The 'STATUS MESSAGE' softkey appears on the screen at the same time.
	The red 'Error' LED lights when the 'Failure' status signal or the overall status signal is active. The 'STATUS MESSAGE' softkey appears on the screen at the same time.

Note
For detailed information on status messages and status signals refer to **Possible status messages** from page 119 onwards.

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 50.

Cancel keys

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

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

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').

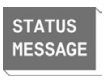
Softkeys

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
	The '**MENU**' button is used to call up the main menu and switch to menu mode when in measurement mode.
	The ;**>>**' button allows the operator to scroll to the next display page. This button only allows forward scrolling. The **'Back'** button is used for backward scrolling.
	The '**STATUS MESSAGE**' button is displayed in measurement mode if the 'Failure' or 'Maintenace Req.' status is pending. This button allows the operator to call up the status message summary and view the status messages. The user can also call up a detailed display for any message in the log. **Note** For detailed information on the possible status messages and status signals, see **Diagnosis / Troubleshooting** on page 113.

… 8 Operation

… 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.
	The operator can use the '**BACKSPACE**' button to delete characters to the left of the cursor (as on a PC keyboard).
	The operator can use the '**CLEAR**' button to delete all characters in a selected field.
	The operator can use the '**ENTER**' button to call up menu items for editing, trigger functions, confirm inputs, e.g. parameterization. The '**ENTER**' button is always at the right margin of the softkey line.
	The operator can use the '**HELP**' button to access context-sensitive help. The screen will then show a help message explaining the menu item selected. The operator can use the '**Back**' 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

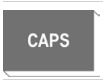
An input line appears at the lower edge of the screen for new text to be entered or existing text to be modified.

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
 	The '**PREV PAGE**' and '**NEXT PAGE**' buttons allow the operator to move to the previous or next keypad page.
	The '**CAPS**' button allows the operator to switch between uppercase and lowercase letters.
	The '**EDIT**' 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 through the respective parameter (e.g.: 'Press the <4> key').
The parameter is called up for editing by pressing the assigned number key.

Example

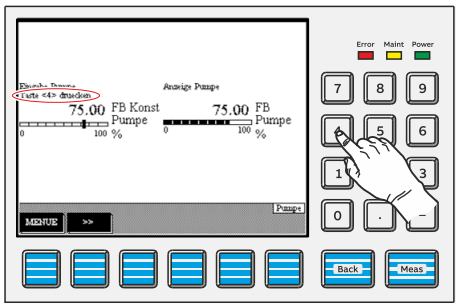


Figure 26: Select parameters (example)

1. Press the **'4'** key to call up the parameter for editing.
   - The LCD display will now display an entry field to change the parameter value.

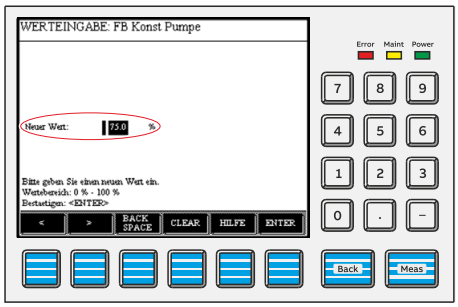


Figure 27: Change parameter value (example)

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

Setup

The value input can be configured individually on the user pages, for detailed information, see **Value Input** on page 109.

… 8 Operation

… Selecting and changing parameters

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 through the respective parameter (e.g.: 'Press the <4> key'). The parameter is called up for editing by pressing the assigned number key.

Example

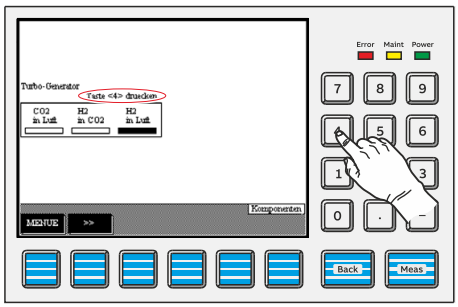


Figure 28: Select parameters

1. Press the '4' button to call up the parameter for editing.
   - The LCD display now shows the softkeys used to select or change the parameter value.

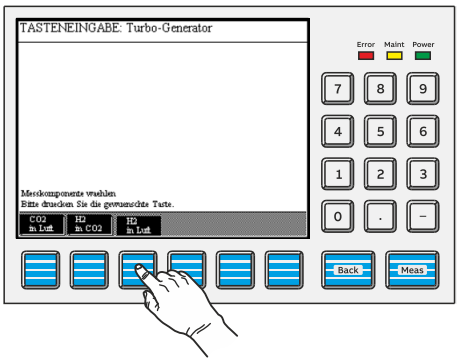


Figure 29: Select parameter value

2. 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 111.

Password protection

Note

We strongly recommend to change all passwords from their default value. All passwords can be changed by the user. It is therefore strongly recommended to carefully document every change of password. The passwords can only be reset to the factory setting by ABB Service.

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 – 30/24-200' technical information contains a complete explanation of 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.

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
Field service	0,1,2,3,4,S	737842

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 **Block operation** on page 92.

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.

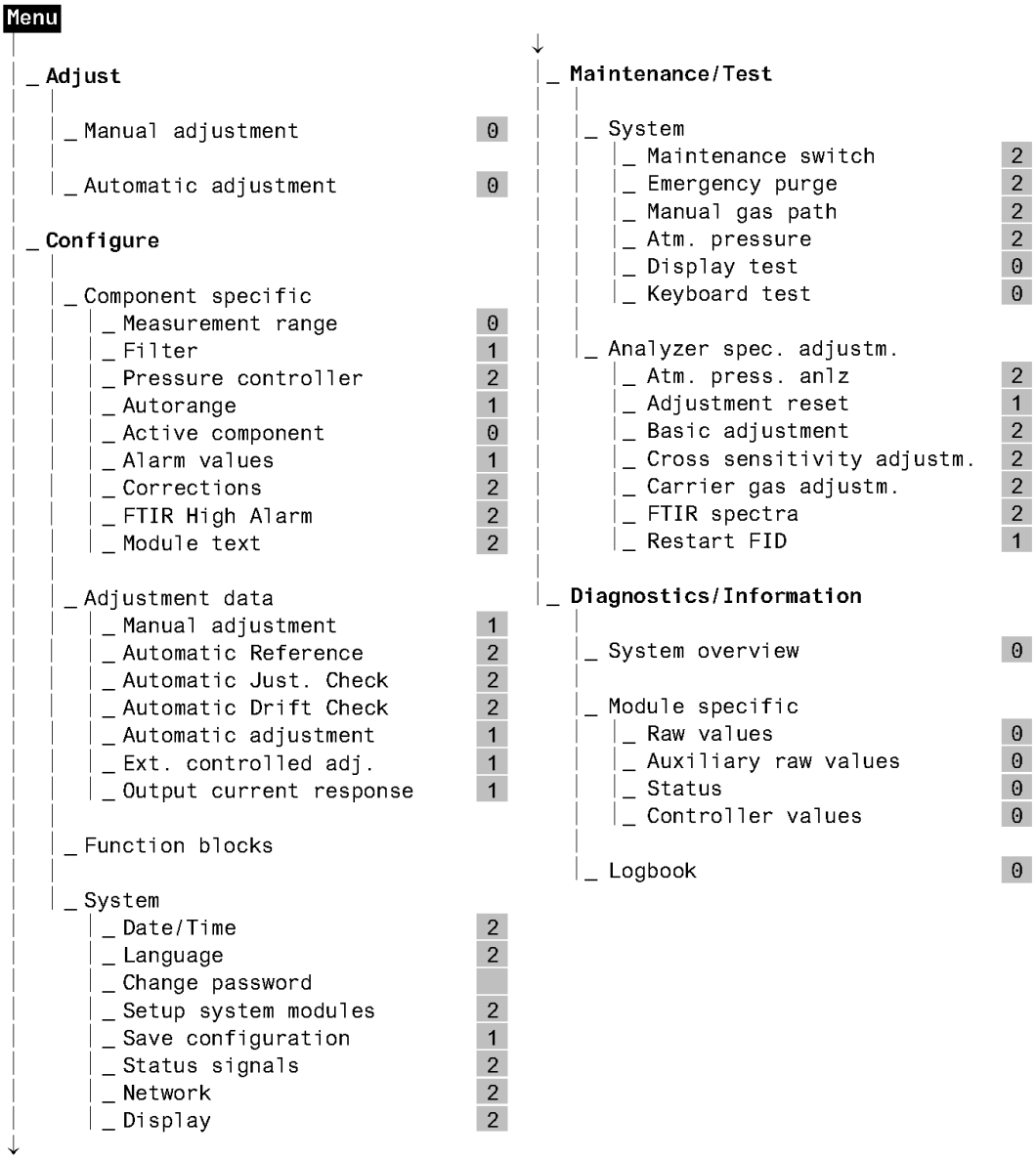
In this way, the user does not need to enter the password again before changing the menu items when switching back to menu mode within the following approx. five minutes.

Change password

Refer to **Change password** on page 91.

… 8 Operation

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.

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.

Process display

Notification on the LCD display

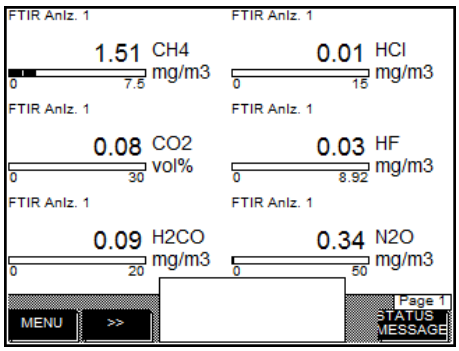


Figure 30: Process notification on the LCD display

Each display page shows the measured values of six measuring components.

- The '**>>**' key allows the operator to scroll to the next display page. This button only allows forward scrolling.
- The '**Back**' button is used for backward scrolling.

Display in the web interface

Measurements | ACF5000 Settings

Measurements

Component	Measurement value	Unit	Measurement Range		Device Type		
			From	To			
O2	1.724	vol%	0	25	ZrO2		Hide
CH4	-0.029	mg/m3	0	50	FTIR		Hide
CO2	-0.020	vol%	0	30	FTIR		Hide
NH3	-0.048	mg/m3	0	80	FTIR		Hide
NO	-0.066	mg/m3	0	500	FTIR		Hide
NO2	-0.533	mg/m3	0	100	FTIR		Hide
H2O	-0.001	vol%	0	40	FTIR		Hide
CO	0.234	mg/m3	0	2500	FTIR		Hide

Figure 31: Process display in the web interface (example)

The start page displays an overview of all measuring components with their current measured values and measuring range limits. Dry basis corrections or fixed O_2 concentrations are also displayed alongside the corresponding measurement values, as long as these correction functions are configured. Refer to **Configuring dry base and O2 reference** on page 89.

The measured value progression for each measuring component can also be displayed as a graph. The graph showing the progression of the measured values is refreshed every 5 s regardless of whether a new measured value is available.

9 Adjusting the analyzer system

Note
The descriptions in this section refer to the adjustment of the analyzer module FID and oxygen sensor.

Principles

Controlling the adjustment

For the adjustment of the analyzer system, there are three methods of control:

- manual adjustment,
- automatic adjustment and
- externally controlled adjustment.

Starting the adjustment

- Manual adjustment is started manually via the analyzer system's display and control unit.
- Automatic adjustment is started at time intervals determined by the internal clock or by an external control signal or manually via the analyzer system's display and control unit.
- Externally controlled adjustment is triggered by an external control signal.

Wait until the warm-up phase has ended

Adjustment should only be started after the warm-up phase.

Plausibility check during adjustment

If during adjustment the analyzer system 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 adjustment remain in effect.

Status Signal

The ‘function check’ status signal is set during adjustment.

Manual adjustment

Definition

Manual adjustment means:
Zero point and end point are adjusted separately using the keys on the LCD display of the analyzer system.

Test gas supply

The test gas supply can be started by activating a multiple-way ball valve or solenoid valve.

Waiting period following manual adjustment

If the ‘Output current response’ parameter is set to ‘Hold’, current output is halted for a specific time to allow the measured value to stabilize after automatic adjustment is ended.

This waiting period is:

- Test gas purging time → Measurement gas + $4 \times T_{90}$ or
- Test gas purging time → Measurement gas + $1 \times T_{90\text{-}1} + 3 \times T_{90\text{-}2}$.

If different T_{90}-times are specified for several measurement components, the largest T_{90}time is used for all measurement components.

The waiting period is the same as the period following automatic adjustment, see page 57.

Adjustment data

- Setup of the adjustment data is described in **Configure Manual Adjustment** on page 71.
- Setup of the time constant T_{90} is described in **Configure filter** on page 86.

Manual adjustment of the analyzer system

Manual adjustment of the analyzer system is described in **Carry out manual adjustment** on page 81.

Automatic adjustment

Definition

Automatic adjustment means:
Adjustment of the zero point and end point runs automatically after start.

Test gas supply

The test gases are automatically fed in via external solenoid valves.

Starting the automatic adjustment

Automatic adjustment can be started in three ways:

- At time intervals determined by the internal clock
- By an external control signal.
- Manually via the analyzer system's display and control unit

Internal Start

Automatic adjustment is normally started cyclically on a time-controlled basis by the internal clock.
The parameters of the cycle time are set with the adjustment data.

External Start

The 'Start automatic adjustment' control signal is needed for to start automatic adjustment from an external source:

'Start Automatic Adjustment' control signal	
Level	Edge Low 0–3 V → High 12–24 V. The Low → High transition 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 Digital I/O Module ('Status signals/externally controlled adjustment' standard function block application

Manual Start

Automatic adjustment can be manually started on the LCD display.
Automatic adjustment can be performed as follows:

- as a zero point adjustment individually or
- as an end point adjustment individually or
- as a zero point and end point adjustment jointly

The manual start of the automatic adjustment of the analyzer system is described in **Manual start of automatic adjustment** on page 82.

Starting and canceling automatic adjustment

Start	**Cancel**
Controlled by interval:	
If the 'Activation' parameter is set to 'on'	By appropriate configuration of the Cancel Management parameter or the Autoadjustment function block
Externally controlled:	
using the 'Start Automatic Adjustment'	As per interval controlled Start control signal
Manually activated:	
With **START**	With **STOP**

Note

Automatic adjustment of the analyzer system is impossible when it is operated with TCT and when setting up system modules.

Message Display

During automatic adjustment, an "Auto adjustment running" message blinks in the softkey line.

Waiting period following automatic adjustment

If the 'Output current response' parameter is set to 'Hold', current output is halted for a specific time to allow the measured value to stabilize after automatic adjustment is ended.

This waiting period is:

- Test gas purging time → Measurement gas + $4 \times T_{90}$ or
- Test gas purging time → Measurement gas + $1 \times T_{90\text{-}1} + 3 \times T_{90\text{-}2}$.

If different T_{90}-times are specified for several measurement components, the largest T_{90}time is used for all measurement components.

Adjustment data

- Setup of the adjustment data is described in **Configure Automatic Adjustment of the FID** on page 72 and **Configure Automatic Adjustment of the Oxygen Sensor** on page 74.
- Setup of the time constant T_{90} is described in **Configure filter** on page 86.

… 9 Adjusting the analyzer system

… Principles

Adjustment methods
One or more (gas) components, each with one or more measuring ranges, can be implemented in an analyzer module (detector).

For the adjustment of the analyzer module, it needs to be defined whether the components and measuring ranges are to be adjusted jointly or individually. This definition takes place using the configuration of the adjustment method.

Single adjustment
The analyzer module is adjusted individually for each measuring component in every measuring range at the zero point and at the final point.

The single adjustment has no effect on the other measuring ranges of the same measuring component and on the other measuring component.

The single adjustment is only possible and practical for the manual adjustment. The single adjustment is necessary if jumps in the display of measured value during the measuring range switching indicate that the adjustments of the individual measuring ranges differ from one another.

Common adjustment
The analyzer module is adjusted in one measuring range at the zero point and final point for each measuring component. The zero and final points of the other measuring ranges are then corrected electronically by the values established during this adjustment.

The common adjustment has no effect on the other measuring components of the analyzer module.
In general, the zero point is adjusted in the smallest measuring range and the final point in that measuring range for which a suitable test gas is available.

Substitute gas adjustment
If the test gases for the adjustment are not available, e.g. because they cannot be filled in test gas bottles or because their components are not compatible with one another, an analyzer module can be set at the plant for adjusting with a substitute gas in accordance with the order. In addition to the measuring ranges of the measuring components, one or more measuring ranges are then set for the substitute gas component at the plant.

The analyzer module is adjusted in the measuring ranges of the substitute gas and/or sample components at a zero point and at an end point. The zero and final points of the measuring ranges of all substitute gas and measuring components are then corrected electronically by the values established during this adjustment.

Note
In order to adjust all (measuring and substitute gas-)components for analyzer modules that are set for adjustment with a substitute gas, the substitute gas adjustment must be carried out at all times.
A single or common adjustment either only in the measuring components or in the substitute gas measuring ranges results in an erroneous adjustment of the analyzer module.

Overview

The following table presents the adjustment methods at a glance.

Quantity		Adjustment Method			
MK	**MR**		**To be configured ...**	**To be adjusted ...**	**The adjustment affects ...**
1	1	Sample gas/ Single		the zero point and the final point in every measuring range individually for every measuring component	only on the relevant measuring range
≥ 1	> 1	Sample gas/ Common	the measuring ranges for zero point and end point adjustment	the zero point in a measuring range and the final point in another measuring range for every measuring component	on all measuring ranges of the relevant measuring component
> 1	≥ 1	Substitute gas	the components and measuring ranges for zero point and end point adjustment	the zero point in a measuring range of a component and the end point in a measuring range of another component every detector	on all components and measuring ranges of the relevant detector

MK = measuring and substitute gas components

MB = measuring ranges per component

Setting the adjustment method

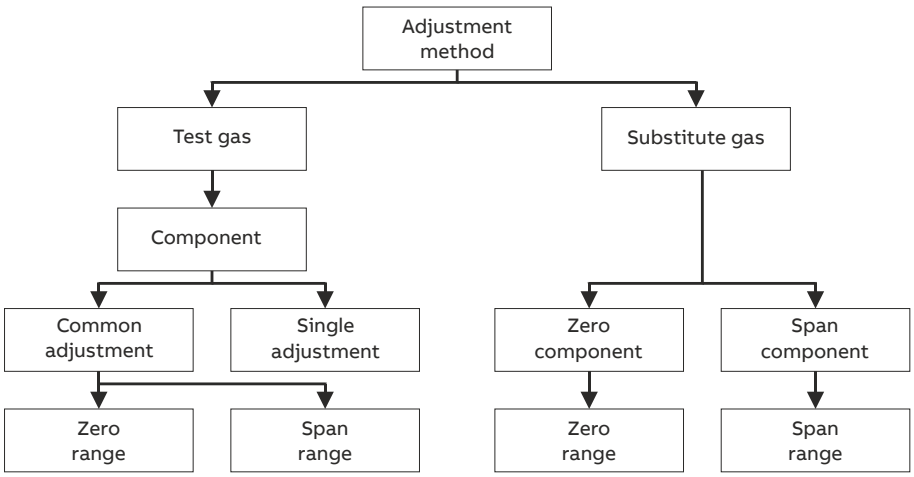


Figure 32: Setting the adjustment method

The adjustment method can be set separately for every one of the three types of controlling the adjustment (manual, automatic and externally controlled).

the measuring ranges for the zero point and end point adjustment for common and substitute gas adjustment are set jointly for all three types of controls.

For the substitute gas adjustment, the components need to be additionally set for the zero point and end point adjustment.

… 9 Adjusting the analyzer system

FID – Conversion of concentration data

Response factors

Definition

$$\text{Response factor} = \frac{\text{Measured value display}}{\text{Concentration}} \quad \text{or} \quad \text{Concentration} = \frac{\text{Measured value display}}{\text{Response factor}}$$

The response factor of Propane (C_3H_8) is equal to 1.00 in accordance with the definition.
The FID analyzer in the ACF5000 is used exclusively for the measurement of total hydrocarbons (VOC). The table of response factors is therefore only necessary for required conversions of concentrations.

Response factors for the FID 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

Sample component		Response factor*
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_3	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.

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^3 (e.g. for measurements in accordance with 17 BImSchV)
- mg C_nH_m/m^3
- ppm C_nH_m (e.g. for measurements in accordance with Federal German Regulations on Air Purity, details on test gas cylinders)
- ppm C1 (for VOC or methane CH_4)

Relevant variables

Molar mass

M_C = 12.011 g/mol

M_H = 1.008 g/mol

Molar volumes

V_m = 22.414 l/mol for 0 °C and 1013 hPa

V_m = 24.05 l/mol for 20 °C and 1013 hPa

Examples for the conversion of units and concentration details

Conversion of ppm in mg C_nH_m/m^3

$$\text{mg } C_nH_m/m^3 = \text{ppm} \times \frac{\text{Molar mass}}{V_m}$$

Conversion of ppm in mg C/m³

$$\text{mg C}/m^3 = \text{ppm} \times \frac{\text{Number of C atoms} \times M_C}{V_m}$$

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/m³. As a test gas, propane (C_3H_8) in N_2 or in air is used.
What is the maximum test gas concentration in ppm or mg/m³ so that the measuring range is not up-scaled?

$$CC_3H_8[\text{ppm}] = \frac{MR_{max} \times V_m}{\text{Number of C atoms} \times M_C} = \frac{50 \times 22.414}{3 \times 12.011} = 31{,}102$$

$$CC_3H_8[\text{mg}/m^3] = \frac{CC_3H_8[\text{ppm}] \times (\text{Number C-Atoms} \times M_C + \text{Number H-Atoms} \times M_H)}{V_M} = \frac{31{,}102 \times (3 \times 12.011 + 8 \times 1.008)}{22.414} = 61.19$$

Example 2

If a test gas other than propane is used, its response factor must be taken into consideration, see **Response factors** on page 60.

What is the maximum test gas concentration in ppm or mg/m³ if methane (CH_4) is used?

$$CCH_4[\text{ppm}] = \frac{MR_{max} \times V_m}{\text{Number C Atoms} \times M_C} = \frac{50 \times 22.414}{1 \times 12.011} = 93.306$$

$$CCH_4[\text{mg}/m^3] = \frac{CCH_4[\text{ppm}] \times (\text{Number of C atoms} \times M_C + \text{Number of H atoms} \times M_H)}{V_M} = \frac{93.306 \times (1 \times 12.011 + 4 \times 1.008)}{22.414} = 66.785$$

The response factor for methane is Rf_{CH_4} = 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.

$$C_{max\,CH_4}[\text{ppm}] = \frac{C_{CH_4}[\text{ppm}]}{Rf_{CH_4}} = \frac{93.306}{1.13} = 82.572$$

$$C_{max\,CH_4}[\text{mg}/m^3] = \frac{C_{CH_4}[\text{mg}/m^3]}{Rf_{CH_4}} = \frac{66.785}{1.13} = 59.102$$

A test gas cylinder with approx. 80 ppm CH_4 has been ordered. The test gas concentration in the test gas cylinder is 81.2 ppm CH_4 in accordance with the certificate.
This is equivalent to a concentration of:

$$C_{CH_4}[\text{mgC}/m^3] = \frac{C_{Cylinder} \times \text{Number of C atoms} \times M_C}{V_M} = \frac{81.2 \times 1 \times 12.011}{22.414} = 43.513$$

Considering the response factor, the indication should be adjusted to

$$C_{max\,CH_4}[\text{mg}/m^3] = C_{CH_4} \times Rf_{CH_4} = 43.513 \times 1.13 = 49.1697$$

… 9 Adjusting the analyzer system

Configuration

Configuring the FTIR Automatic Reference

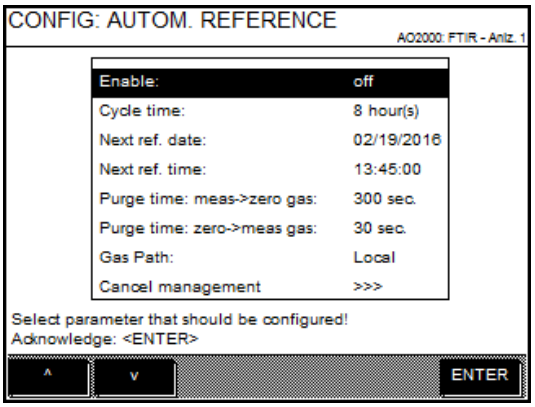
Function

For the FTIR spectrometer, the automatic recording of the reference can be configured.

Menu Path

'Menue / Configure / Adjustment data / Automatic Reference'

Display



The recommended settings are stated in the following table.

Implementation

Parameter	Description
Enable:	Automatic reference recording is completed only when it is activated.
Cycle time	The cycle time shows the time intervals over which automatic recording of references is completed. Recommended setting: 12 hours.
Date/Time next reference	The analyzer system completes the next automatic reference recording process at the time specified here. From this moment in time, the cycle period starts to run.
Purge time: meas->zero gas: Purge time: zero->meas gas:	Two parameters must be set: The time after connecting the zero air until reference recording begins and the time after re-connecting the measurement gas until the gas paths are purged at the beginning of measuring, so that no residual gas can influence the results of the reference recording or the measurement. Recommended setting: Purging should last at least triple the T_{90} time of the entire analyzer system (typically 240 seconds).
Gas path	The setting must also be configured as to whether the zero air, which is piped through the analyzer system while the reference is being recorded, is emitted locally at the analyzer system or via sampling.
Cancel management	The automatic reference recording is always canceled in the event of a system bus error and when setting the block input. You can configure it if the automatic reference recording is to be canceled when one of the three states occurs during the procedure: 'System error', 'Analyzer error' or 'Analyzer maintenance required'. The automatic reference recording cannot be interrupted. If the cancellation criterion is canceled, the reference entered is dismissed. If the FTIR reports that the reference is not OK, it is also dismissed, even if no cancelation criterion is fulfilled.

Automatic Adjustment Check (AAC) – Configuring the Duration (optional)

Note

Contact ABB Service to have this option retrofitted.

Function

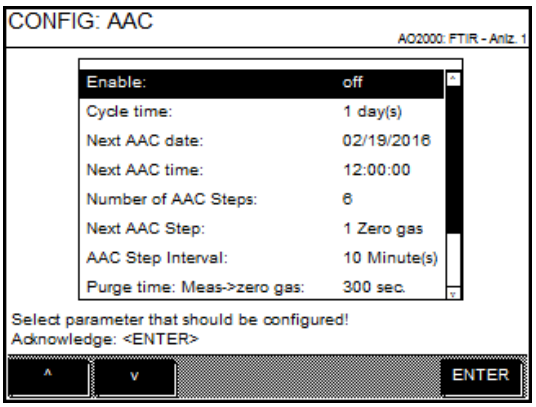
Optionally, the cycle that automatically monitors the adjustment (Automatic Adjustment Check – AAC) of the FTIR spectrometer under QAL3 monitoring can be configured. A validation filter wheel fitted with AAC measurement equipment must be provided in the FTIR spectrometer and the 'Automatic Calibration Check' function must be enabled in the configuration file.

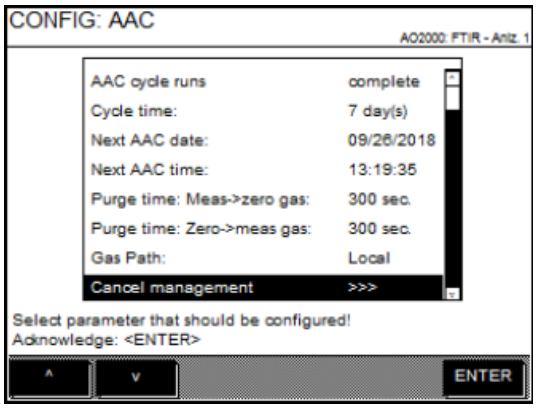
In the menu described here, only the time sequence of an AAC is controlled. The QAL3 monitoring can only be configured and evaluated via the web interface, see page page 65.

Menu Path

'Menue / Configure / Adjustment data / Automatic Adj. Check'

Display





The recommended settings are stated in the following table.

… 9 Adjusting the analyzer system

… Configuration

Implementation

Parameter	Explanation
Enable:	The AAC is only completed when it is activated.
AAC cycle runs	The run mode of the AAC must be set.
split	The AAC is performed step by step; the individual steps are separated by the set waiting time (interval). Each step takes approx. 18 minutes - with 240 seconds of purging time. Depending on the number of installed measuring components, the cycle consists of a maximum of 6 steps: 1. Recording the FTIR reference and O_2 endpoint adjustment, 2. Measurement AAC measurement equipment 1, etc. to 6. measurement AAC measurement equipment 5. After the first step, the target and actual values for the FTIR reference and the O_2 end point are output. After the last step, the target and actual values for the FTIR endpoints are output.
complete	The AAC is performed continuously without FTIR reference and O_2 endpoint adjustment. The entire process takes a maximum of 45 minutes: Purging with zero gas, recording and validation of 10 1measured values (zero point validation), output of the measured values – measurement AAC measuring medium 1 – measurement AAC measuring medium 2 – measurement AAC measuring medium 3 – measurement AAC measuring medium 4 – measurement AAC measuring medium 5 – purging with measuring gas, output of the target and actual values for the FTIR end points (end point validation).
complete & Reference	The AAC is performed continuously with FTIR reference and O_2 endpoint adjustment. The entire process takes a maximum of 45 minutes: Purging with zero gas – recording of the FTIR reference and O_2 endpoint adjustment, output of the target and actual values – measurement of AAC measuring medium 1 – measurement of AAC measuring medium 2 – measurement of AAC measuring medium 3 – measurement of AAC measuring medium 4 – measurement of AAC measuring medium 5 – purging with measuring gas, output of the target and actual values for the FTIR endpoints.
Cycle time:	The cycle time specifies the time intervals in which the AAC is completed. Recommended setting: 7 days.
Next AAC date:	The analyzer system completes the next AAC at the time specified here. From this moment in time, the cycle period starts to run. Recommendation for the step-by-step process of the AAC: Set this time so that no half-hourly averages are lost.
Next AAC time:	
Number of AAC steps	Information display. The number of AAC steps depends on the number of components.
Next AAC Step:	Information display.
AAC Step Interval:	The waiting time between two AAC steps must be set. Recommendation for the step-by-step process of the AAC: Set this waiting time so that no half-hourly averages are lost (at least 1 hour).
Purge time: meas->zero gas:	The analyzer system is purged with zero air before the AAC. Two parameters must be set: The time after connecting the zero air until the AAC begins and the time after re-connecting the measurement gas until the gas paths are purged at the beginning of measuring, so that no residual gas can influence the results of the AAC or the measurement. Recommended setting: Purging should last at least triple the T_{90} time of the entire analyzer system (typically 240 seconds).
Purge time: zero->meas gas:	
Gas Path:	Zero air is piped through the analyzer system during the AAC. The setting must be configured as to whether the zero air is emitted locally at the analyzer system or via sampling.
Cancel management	The AAC is always canceled in the event of a system bus error and when setting the block input. You can configure it if the AAC is to be canceled when one of the following states occurs: ‘System error’, ‘Analyzer error’ or ‘Analyzer maintenance required’. When canceling, the sequence of the AAC is reset. This means that ‘1 zero point’ is executed as the first step when restarting the AAC. When canceling, no QAL3 data set is generated.

Automatic Adjustment Check (AAC): settings and export of the QAL3 data

Function

The settings for the cyclical 'Automatic Adjustment Check' are to be made in the web interface.

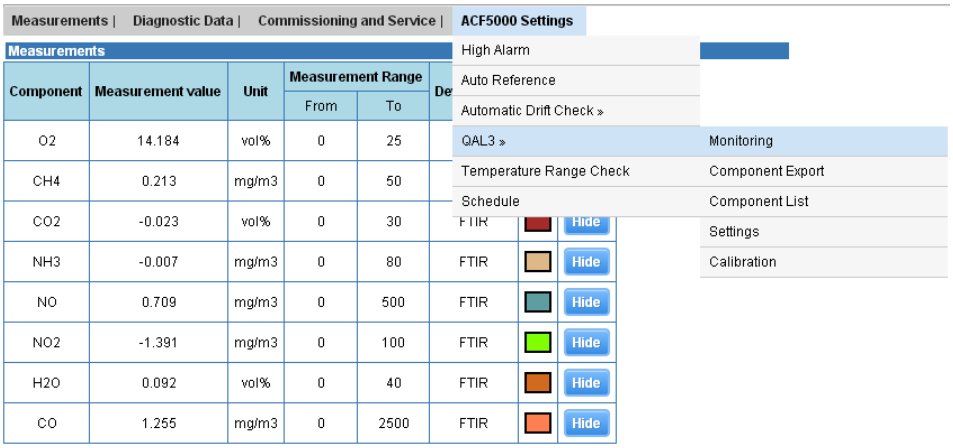
Menu Path

'ACF5000 Settings / QAL3'

Password

A level 2 password is required to access this submenu.

Display



Measurement

The results of the AAC can be displayed in the 'Measurement' submenu.

The data for the zero point or reference point can be displayed in a detailed or simplified report. Selecting the required control chart to check the automatic adjustment (CUSUM or Shewhart) opens a view of the relevant results table.

- If the results table for the QAL3 measurements has extensive results, use the << < 1 of 1 > >> buttons to switch between the individual pages.
- The AAC results for a measuring component can be printed or exported using the Print Export buttons.

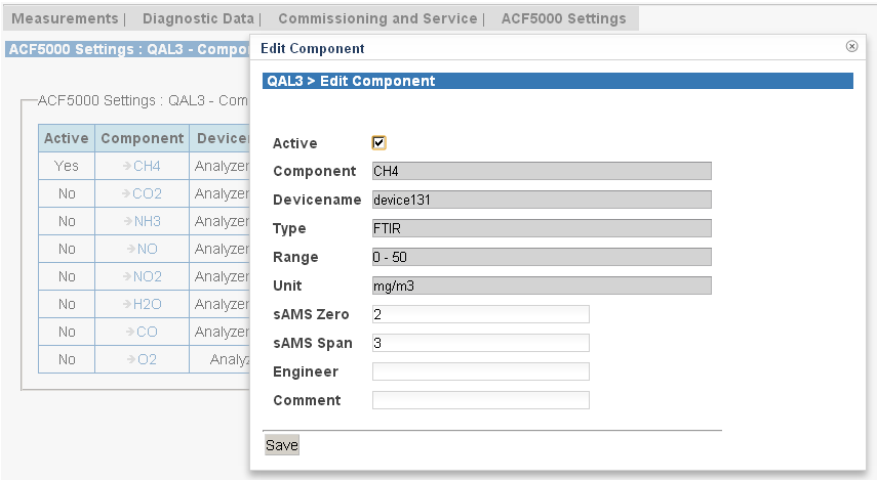
… 9 Adjusting the analyzer system

… Configuration

Export Components

The AAC results for all measuring components are combined in a text file that can be exported in the Export Components submenu.

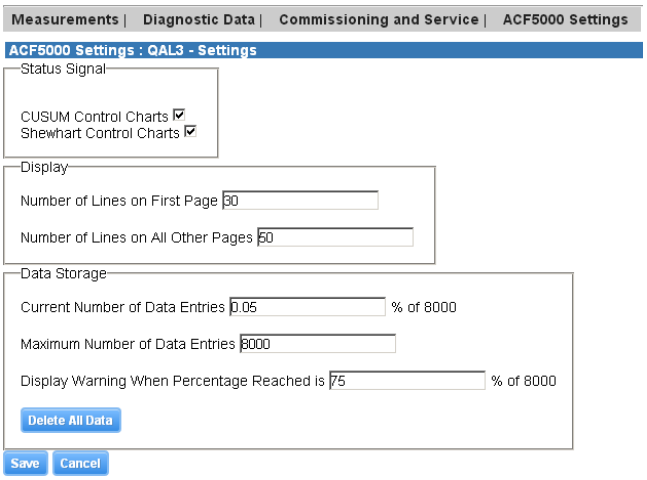
Select components



Measuring components that must be checked during the AAC can be activated and configured in the Select Components submenu. A level 3 password is required to access this submenu.

Parameter	Explanation	
Active	QAL3 monitoring of measuring components can be activated and the following parameters can be configured.	
sAMS Zero	Enter the value of standard deviation from the zero point.	The unit corresponds to the unit of the measuring range.
sAMS Span	Enter the value of standard deviation from the reference point.	System conditions must be taken into account when using the performance test data. Minimum value = 3% of the measurement range.
Engineer	Enter name.	
Comments	Enter comments	

Settings



- Whether the analyzer system transmits a status signal according to the limit values criteria on the CUSUM control chart or the Shewhart control chart, or according to both control charts, can be selected in the 'Settings / Available options for QAL3 control chart' submenu.
- The number of lines shown in the results table in the `Measurement` submenu can be set in the Settings / Display submenu. The number of lines for the first page and the following pages can be set separately.
- The storage properties for the QAL3 report can be configured in the Settings / Data management submenu. The size of the QAL3 report can be defined (number of lines). If the maximum number of lines is reached, the oldest entries are overwritten.

Parameter	Description
Current number of data entries	Displays the current number of data entries.
Maximum number of data entries	The maximum number of lines for the QAL3 report must be set.
Display warning when percentage reached is	A storage level must be set (a % of the maximum number) that will trigger a warning when it is reached.

All previous recorded QAL3 results tables can be deleted using the **Delete Data** button. As this process cannot be undone, it is recommended that all results tables are exported before proceeding.

… 9 Adjusting the analyzer system

… Configuration

Configuring the Automatic Drift Check (ADC)

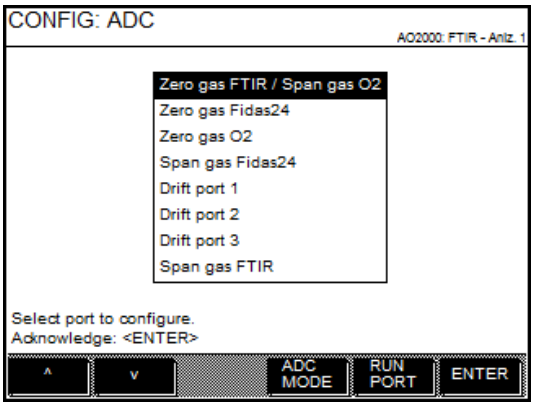
Function

On the analyzer system, the cyclical drift check with automatically connected test gases can be configured as an option. The ‘Automatic Drift Check’ function must be enabled in the configuration file.

Menu Path

‘Menue / Configure / Adjustment data / Automatic Drift Check’

Display

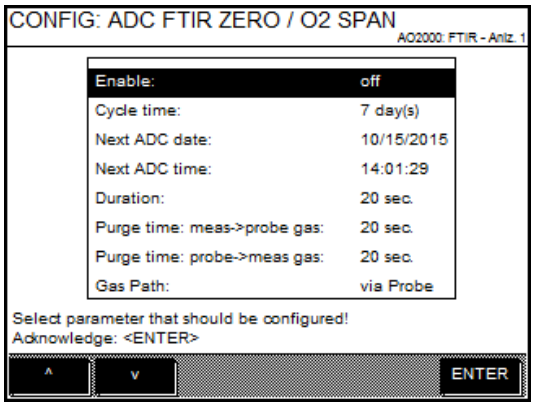


The recommended settings are stated in the following table on page 69 .

Start gas port manually

Start the required gas port immediately in the ADC menu with the ‘RUN PORT’ softkey.

Configuring the gas port



Select the gas inlet that will connect to the test gas in the ADC menu and press '**ENTER**' to call up inlet configuration.

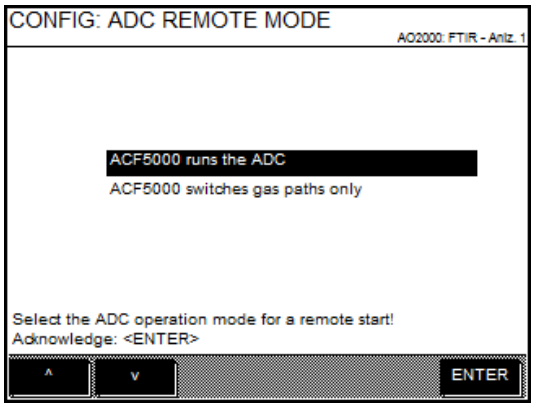
Parameters	**Explanation**
Enable:	The cyclical automatic drift check (ADC) is only completed when it is activated.
Cycle time:	The cycle time specifies the time intervals in which the ADC is completed. Recommended setting: 7 days.
Next ADC date:	The analyzer system completes the next ADC at the time specified here. From this moment in time, the cycle period starts to run.
Next ADC time:	
Duration:	Set up time during which the test gas is conducted through the analyzer system – after purge time Sample gas → Test gas.
Purge time: meas->probe gas:	Two parameters must be set: The time after connecting the test gas until the ADC begins and the time after re-connecting the measurement gas until the gas paths are purged at the beginning of measuring, so that no residual gas can influence the results of the ADC or measurement. Recommended setting: The purge time should be set to at least three times the T_{90} time of the entire analyzer system.
Purge time: probe->meas gas:	
Gas path:	The setting must be configured as to whether the test gas is emitted locally at the analyzer system or via sampling.

… 9 Adjusting the analyzer system

… Configuration

Configuring the ADC operating mode

Call up operating mode configuration in the ADC menu by selecting '**ADC MODE**'.



Operating mode	Explanation
ACF5000 runs the ADC	The ports are controlled as configured. The analyzer system informs the evaluation computer via digital outputs that the port is ready for evaluation. The duration (purging times and measurement time) is controlled by the analyzer system.
ACF5000 switches gas paths only	The analyzer system is informed of which gas path needs to be connected by the 'FTIR Automatic Adjustment' function block via the input wiring. The analyzer system informs the evaluation computer via digital outputs that the gas path has been activated. All times are checked by the evaluation computer. After disconnecting the gas path, the analyzer system remains in 'Function control' status for the set test gas →measurement gas purge time plus 4 x T_{90} time.

Configure Manual Adjustment

Note

The descriptions in this section refer to the adjustment of the analyzer module FID and oxygen sensor.

Menu Path

'MENUE / Configure / Adjustment data / Manual adjustment / ...'

Test gas concentration

The zero and span test gas concentrations to be used as set points for manual adjustment need to be set for the selected sample component and measuring range.

Adjustment Method

The adjustment method should be set for manual adjustment, see **Adjustment methods** on page 58.

With ...	... are to be selected:
Common adjustment	the measuring components and or the selected measuring component the measuring ranges for the start and end point adjustment.
Subst. gas adjustment	the (substitute gas) components for the start and end point adjustment as well as for the component of the measuring range selected.

Note

The settings of the components and measuring ranges apply both for the manual and for the automatic and externally controlled adjustment.

… 9 Adjusting the analyzer system

… Configuration

Configure Automatic Adjustment of the FID

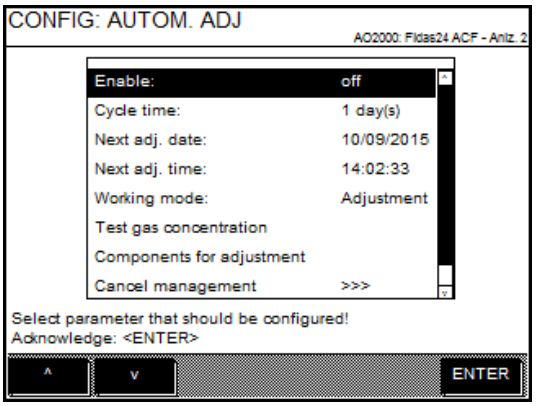
Function

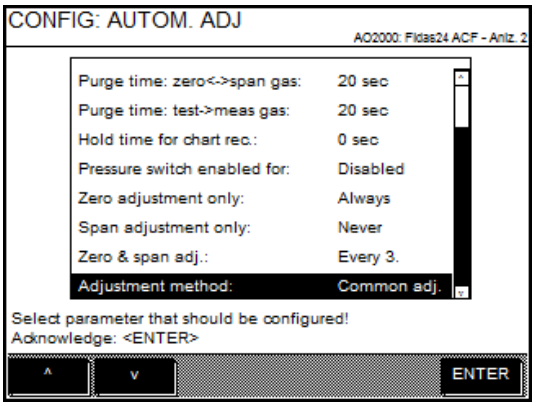
For the FID, an automatic adjustment with test gas at the zero and final point can be configured.

Menu Path

'Menue / Configure / Adjustment data / Automatic adjustment'

Display





The recommended settings are stated in the following table.

Duration

Automatic adjustment takes about 18 minutes.

Implementation

Parameter	Explanation
Enable:	Automatic adjustment is completed only when it is activated.
Cycle time:	The cycle time shows the time intervals over which automatic adjustment is completed. Recommended setting: 21 days
Next adj. date:	The analyzer system completes the next automatic adjustment at the time specified here.
Next adj. time:	From this moment in time, the cycle period starts to run.
Working mode:	It is to be set whether an adjustment or a validation should take place. In the working mode parameter, after the validation has been selected, it must be set whether the result of the validation is to be entered in the logbook and whether the 'Maintenace Req.' status is to be set in the event of failure of validation or an adjustment of the measuring components should be carried out.
Test gas concentration:	The zero and span test gas concentrations to be used as set points for automatic adjustment need to be set for the selected sample component and measuring range. In addition, for every measuring component the limit values must be set or the start and end points, and, in the event of the component falling below or exceeding these, the validation is rated as a failure.
Components for adjustment:	The measuring components to be adjusted with the zero point and end point adjustment must be selected.
Cancel management:	Automatic adjustment is always canceled in the event of a system bus error and when setting the block input. You can configure it if the automatic adjustment is to be canceled when one of the following states occurs during the procedure: 'System error', 'Analyzer error' or 'Analyzer maintenance required'. You can configure if the analyzer system should repeat automatic calibration after the cause of termination has been eliminated. Set the number of repetitions and the time between repetitions.
Pump	without function
Purge time: meas->test gas: Purge time: zero gas↔span gas Purge time: test->meas gas:	This setting (recommended settings in brackets) specifies how long after feeding in the test gas until the start of the adjustment ((> 180 seconds), for joint zero point and end point adjustment after feeding in the final point test gas until the start of the end point adjustment (> 240 seconds) and after the fresh feeding in of the measuring gas until the start of the measuring procedure (240 seconds) the gas paths are to be purged so that no gas residues falsify the adjustment or measurement result.
Hold time for chart rec.:	When using an analogue trend recorder, this parameter can be used to set a waiting time before starting the adjustment. This waiting time allows the trend recorder to record the test gas concentration over the set duration. Recommended setting: 0 seconds
Gas path	The setting specifies whether the zero air, which is piped through the analyzer system during automatic adjustment, is emitted locally at the analyzer system or via sampling.
Pressure switch enabled for:	If the test gases are connected at the separate test gas inlets, the built-in pressure switch can be activated during automatic adjustment to monitor the flow of the test gases. If the flow is insufficient, adjustment is stopped. The pushbutton can be activated for zero point gas, final point gas and zero point and final point gas.
Zero adjustment only:	Whether zero adjustment will always or never be carried out individually, i.e. without subsequent end point adjustment, should be set.
Span adjustment only:	Whether end point adjustment will always or never be carried out individually, i.e. without prior zero point adjustment, should be set.
Zero & span adj.:	Whether zero and end point adjustment will always or never be carried out jointly, or at every nth automatic adjustment, should be set.
Adjustment method:	The adjustment method for automatic adjustment needs to be set for the selected sample component. The initial point and zero point adjustment measuring ranges for common and substitute gas calibration are selected in the 'Manual adjustment / Adjustment method:' parameter.

… 9 Adjusting the analyzer system

… Configuration

Configure Automatic Adjustment of the Oxygen Sensor

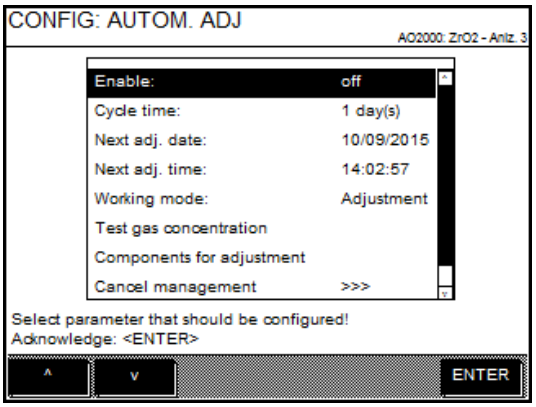
Function

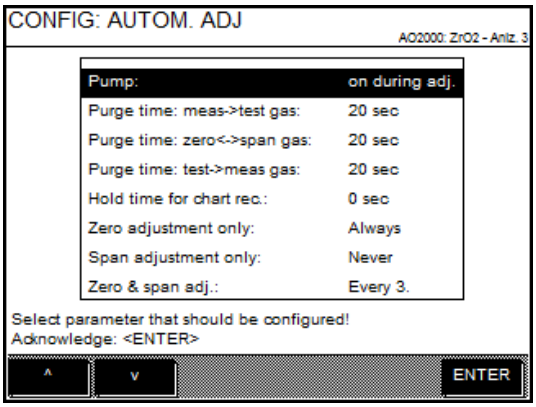
For the oxygen sensor, an automatic adjustment with test gas at the zero and final point can be configured.

Menu Path

'Menue / Configure / Adjustment data / Automatic adjustment'

Display





The recommended settings are stated in the following table.

Duration

Automatic adjustment takes about 18 minutes.

Implementation

Parameter	Explanation
Enable:	Automatic adjustment is completed only when it is activated.
Cycle time:	The cycle time shows the time intervals over which automatic adjustment is completed. Recommended setting: 14 days
Next adj. date:	The analyzer system completes the next automatic adjustment at the time specified here. From this moment in time, the cycle period starts to run.
Next adj. time:	
Working mode:	It is to be set whether an adjustment or a validation should take place. In the working mode parameter, after the validation has been selected, it must be set whether the result of the validation is to be entered in the logbook and whether the 'Maintenace Req.' status is to be set in the event of failure of validation or an adjustment of the measured components should be carried out.
Test gas concentration:	The zero and span test gas concentrations to be used as set points for automatic adjustment need to be set for the selected sample component and measuring range. In addition, for every measuring component the limit values must be set or the start and end points, and, in the event of the component falling below or exceeding these, the validation is rated as a failure.
Components for adjustment:	The measuring components to be adjusted with the zero point and end point adjustment must be selected.
Cancel management:	Automatic adjustment is always canceled in the event of a system bus error and when setting the block input. You can configure it if the automatic adjustment is to be canceled when one of the following states occurs during the procedure: 'System error', 'Analyzer error' or 'Analyzer maintenance required'. You can configure if the analyzer system should repeat automatic calibration after the cause of termination has been eliminated. Set the number of repetitions and the time between repetitions.
Pump	without function
Purge time: meas->test gas:	This setting (recommended settings in brackets) specifies how long after feeding in the test gas until the start of the adjustment (> 240 seconds), for joint zero point and final point adjustment after feeding in the final point test gas until the start of the end point adjustment (> 240 seconds) and after the fresh feeding in of the measuring gas until the start of the measuring procedure (240 seconds) the gas paths are to be purged so that no gas residues falsify the adjustment or measurement result.
Purge time: zero gas↔span gas	
Purge time: test->meas gas:	
Hold time for chart rec.:	When using an analogue trend recorder, this parameter can be used to set a waiting time before starting the adjustment. This waiting time allows the trend recorder to record the test gas concentration over the set duration. Recommended setting: 0 seconds
Gas path	The setting specifies whether the zero air, which is piped through the analyzer system during automatic adjustment, is emitted locally at the analyzer system or via sampling.
Zero adjustment only:	Whether zero adjustment will always or never be carried out individually, i.e. without subsequent end point adjustment, should be set.
Span adjustment only:	Whether end point adjustment will always or never be carried out individually, i.e. without prior zero point adjustment, should be set.
Zero & span adj.:	Whether zero and end point adjustment will always or never be carried out jointly, or at every nth automatic adjustment, should be set.

… 9 Adjusting the analyzer system

… Configuration

Check time conflicts of the automatic processes

Automatic processes in the analyzer system

The following automatic processes can be configured in the analyzer system:

- The automatic reference (see **Configuring the FTIR Automatic Reference** on page 62),
- The automatic check of the adjustment (see **Automatic Adjustment Check (AAC) – Configuring the Duration (optional)** on page 63),
- The automatic drift check (see **Configuring the Automatic Drift Check (ADC)** on page 68) and
- The automatic adjustment of FID (see **Configure Automatic Adjustment of the FID** on page 72) and oxygen sensor (see **Configure Automatic Adjustment of the Oxygen Sensor** on page 74).

In principle, the duration of each of these processes can be set independently of one another. The web page can display the durations of these processes in calendar form to check if they overlap.

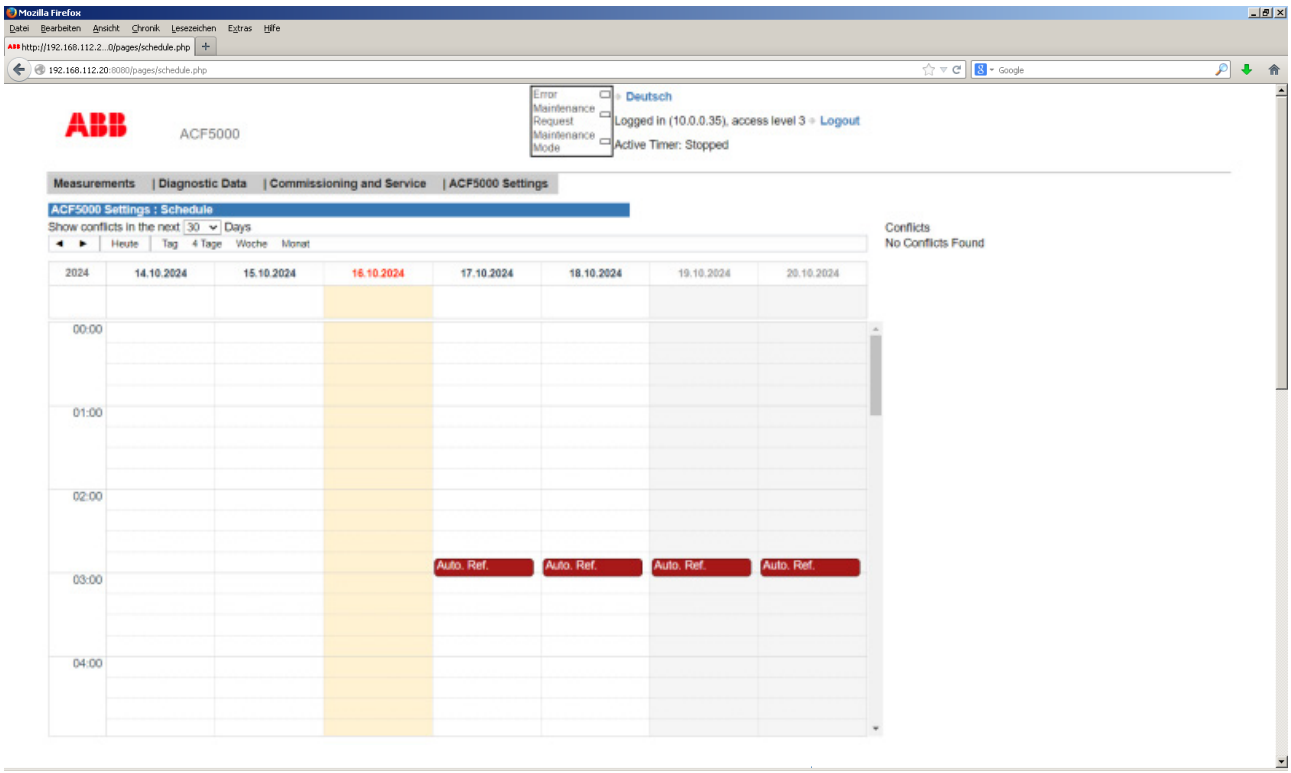
Menu Path

‘ACF5000 Settings / Shedule’

Password

A level 1 password is required to access this submenu.

Display



Calendar view can be set with the ◄ ► | Heute | Tag | 4 Tage | Woche | Monat buttons.

Any scheduling conflicts are displayed as both a graph in the calendar and a table. The example shown depicts a scheduling conflict between the automatic reference and the automatic check of the adjustment.
The scheduling conflicts can only be corrected in the settings for the individual process duration in the corresponding HMI menus.

Output Current Response

Menu Path

'MENUE / Configure / Adjustment data / Output current response / ...'

Output Current Response

- The signals at the current outputs (analog outputs) are either held at the last measured value before the start of the adjustment.

or

- The signals at the current outputs (analog outputs) can follow measurement value changes during adjustment.

Operation

Creating manual reference

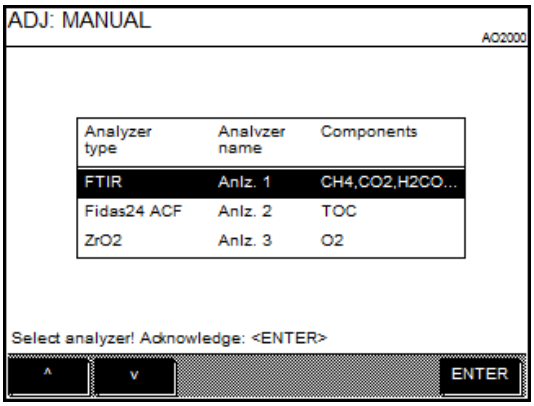
Function

A manual reference can be created for the FTIR spectrometer. You first need to set in 'Menue / Maintenance/Test / System / Manual Gas Path' whether the zero air is applied locally or via the sampling, see **Connecting gas paths and inserting validation cells** on page 142.

Menu Path

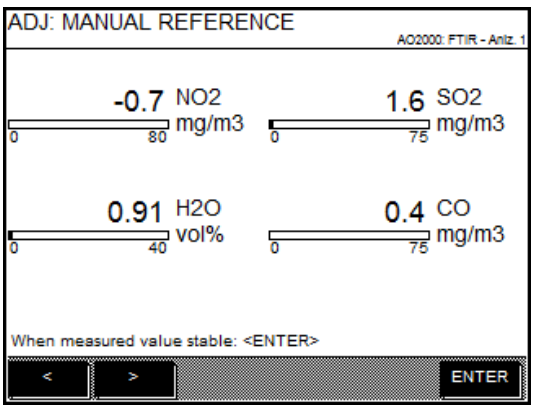
'Menue / Adjust / Manual adjustment'

Display



Implementation

1. Press ENTER to select the FTIR spectrometer.
   The analyzer system automatically switches to zero air and the Manual reference menu is displayed.

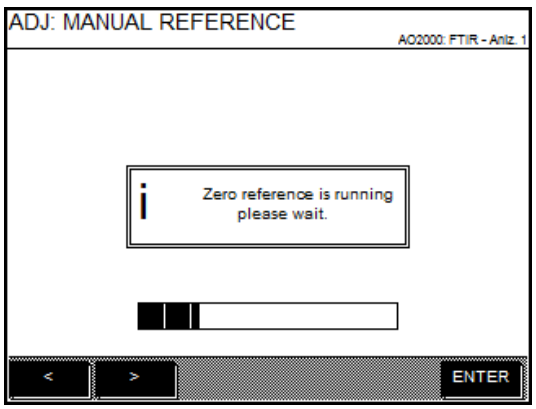


   Use the '**<**' and '**>**' softkeys to switch between the different display pages.

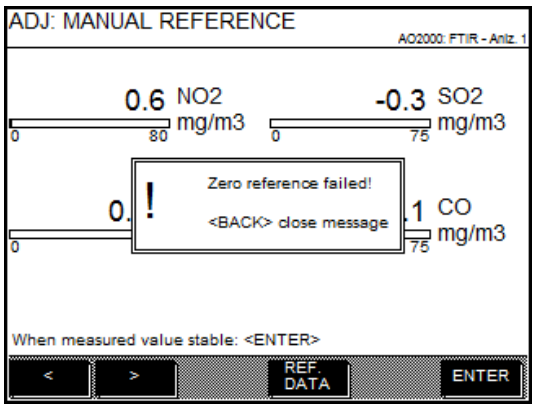
… 9 Adjusting the analyzer system

… Configuration

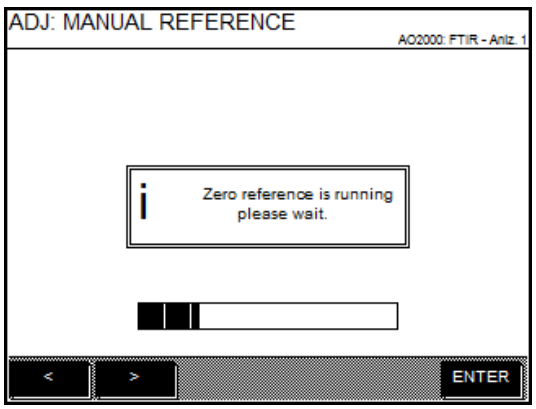
2. If the measured value is stable, start recording the manual reference by pressing '**ENTER**'.



3. Once the recording of the manual reference has stopped, a message confirms if the process was completed successfully or not.



4. If the manual reference was recorded successfully, save the reference using SAVE AS LKG (Last Known Good). It is then activated in the FTIR.



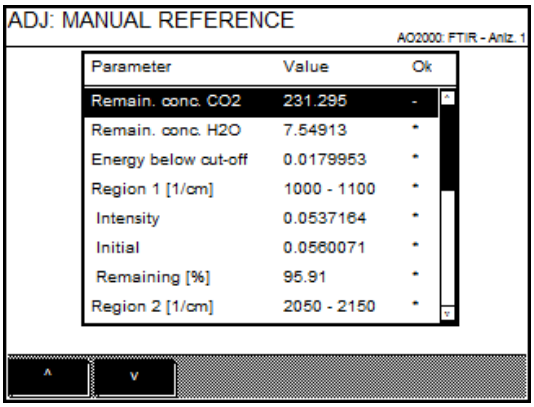
Manual reference – Show status of the last reference

Menu Path

'MENU / Adjust / Manual adjustment'

Implementation

1. Select '**FTIR**' analyzer and press '**ENTER**' to select the 'Manual reference' menu.
2. Select '**REF. DATA**' to show the status of the last reference.



The parameters of all the defined intensity regions of the IR radiation source will be displayed.

The symbol in the '**OK**' column means:

* Parameter OK

– Parameter not OK; the reference could not be recorded.

Manual reference – Display diagnostic values of the reference measurement

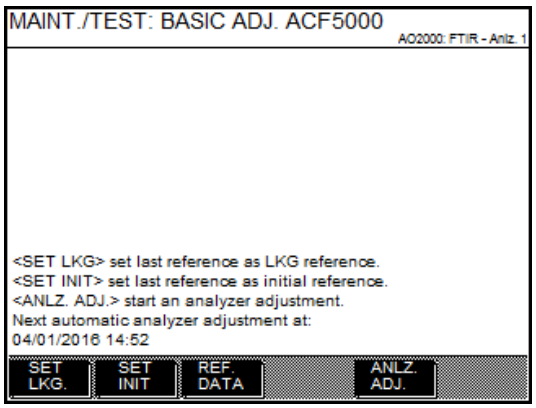
Function

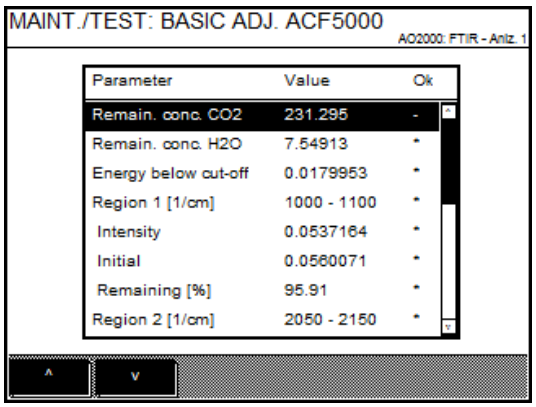
The last reference measurement's diagnosis values for the FTIR spectrometer can be displayed on the HMI.

Menu Path

'MENU / Maintenance/Test / Analyzer spec. adjustm. / Basic adjustment'

Display





Use

Select '**FTIR**' analyzer and in the following menu, press the '**REF. DATA**' softkey.

Manual reference – Saving the reference as initial reference

Function

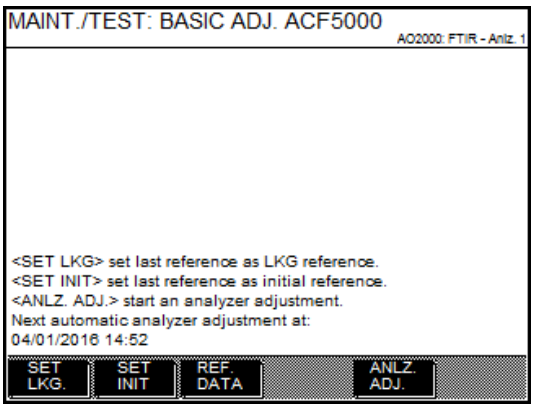
After recording the manual reference, it can be saved as an initial reference.

The initial reference serves as the valuation basis for the following reference recordings. It should only be re-recorded after changes to the FTIR spectrometer.

Menu Path

'MENU / Maintenance/Test / Analyzer spec. adjustm. / Basic adjustment'

Display



Use

Select '**FTIR**' analyzer and in the following menu, press the '**SET INIT**' softkey.

… 9 Adjusting the analyzer system

… Configuration

Start Automatic Adjustment Check (AAC) manually

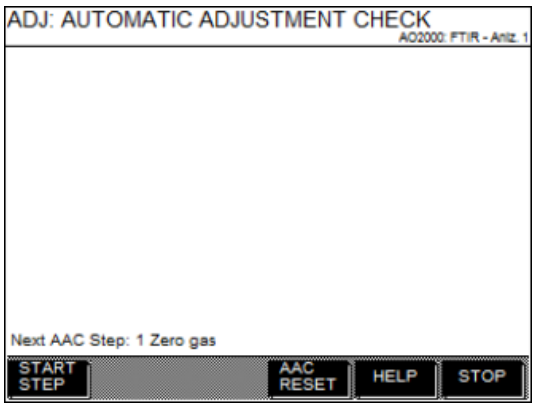
Function

The automatic cyclical check of the adjustment of the FTIR spectrometer (Automatic Adjustment Check – AAC) can be started manually. Operation differs depending on whether the AAC duration is configured to ‘split’, ‘complete’ or ‘complete with Reference’. Refer to **Implementation** on page 64.

Menu Path

‘MENU / Adjust / Automatic adjustment / FTIR’

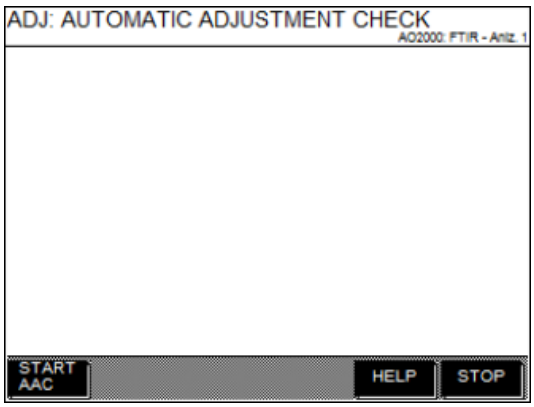
AAC duration ‘step by step’



Use

Softkey	Description
START STEP	Start the next step in the AAC cycle (see display).
AAC RESET	Reset the step counter to 1.
STOP	Cancel the current AAC step. The analyzer system will be purged with sample gas and return to measuring mode; no target and actual values are output for the FTIR end points. The AAC cannot be canceled during automatic reference recording.

AAC duration ‘continuous’ or ‘continuous with reference’



Use

Softkey	Description
START AAC	Start the continuous AAC.
STOP	Cancel the current AAC. The analyzer system will be purged with sample gas and return to measuring mode; no target and actual values are output for the FTIR end points. The AAC cannot be canceled during automatic reference recording.

Carry out manual adjustment

Note

The descriptions in this section refer to the adjustment of the analyzer module FID and oxygen sensor.
Adjustment should only be carried out after the warm-up phase.
Before a manual end point adjustment, a manual zero point adjustment must be carried out.

Adjust analyzer module manually

1. Select the 'Manual adjustment' menu:
   'MENU / Adjust / Manual adjustment'
2. For single adjustment:
   Select 'Component' and 'Measurement range'.

Zero point adjustment:

3. Select 'Zero gas'
4. Turn on the zero gas supply.
5. If necessary, change the indicated sample gas concentration*, '**ENTER**'.
6. When the sample value indication stabilizes, initiate zero point adjustment by selecting '**ENTER**'.
7. Accept the adjustment by selecting '**ENTER**' or '**REPEAT**'** the adjustment (back to step 5) or reject the adjustment by selecting '**Back'** (back to step 6) or reject adjustment by selecting '**Meas'** (back measured value display).

* The parameterized test gas concentration is displayed. If the setpoint is altered here, the parameterized test gas concentration is overwritten.

** An adjustment may have to be repeated if the measured value is not stable after initiation of the adjustment. The repeated adjustment is based on the measured value obtained in the preceding adjustment .

End point adjustment:

8. Select Span Gas.
9. Turn on the span gas.
10. If necessary, change the indicated sample gas concentration, '**ENTER**'.
11. When the measured value indication stabilizes, initiate end point calibration by selecting '**ENTER**'.
12. Accept the adjustment by selecting '**ENTER**'or '**REPEAT**' the adjustment (back to step 10) or reject the adjustment by selecting '**Back**' (back to step 11) or reject calibration by selecting '**Meas**' (back to measured value display).
13. For single adjustment, repeat steps 2–12 for other components and measuring ranges.

… 9 Adjusting the analyzer system

… Configuration

Manual start of automatic adjustment

Note

The descriptions in this section refer to the adjustment of the analyzer module FID and oxygen sensor.
Adjustment should only be carried out after the warm-up phase.

Automatic adjustment

Automatic adjustment can be performed in three ways:

- As a zero point adjustment alone or
- As an end point adjustment alone or
- As a zero point and end point adjustment jointly

Manual start of automatic adjustment

1. Select the 'Automatic adjustment' menu:
   'MENU / Adjust / Automatic adjustment'
2. Zero point adjustment alone: '**ZERO AUTOCAL**'
   Endpoint adjustment alone: '**SPAN AUTOCAL**'
   Zero point and end point adjustment jointly: '**ZERO & SPAN AUTOCAL**'

Manual cancel of automatic adjustment

The user can end the automatic adjustment process by pressing the '**STOP**' softkey.

When automatic adjustment is stopped, the analyzer module is in an indefinite state (as regards adjustment). For example, the zero point adjustment may have been completed and calculated, but the end point adjustment has not yet been carried out.
For this reason, automatic calibration will have to be restarted and allowed to run to completion after any cancelation of automatic adjustment.

10 Configuration

Sample component functions

Switch measuring range

Menu Path

'MENU / Configure / Component specific / Measurement range / Select component / ...'

Selection

Displayed are all measuring ranges configured for a measuring component.

Procedure

Select the measuring range using 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

Note

The measuring range limits of the FTIR measuring components cannot be changed.

Menu Path

'MENU / Configure / Component specific / Measurement range / Select component / ...'

Selection

Displayed are all measuring ranges configured for a measured component.

Procedure

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

Note

For the automatic measuring range switching (see **Automatic measuring range switching** on page 85) to work smoothly, the measuring ranges MR1, MR2, … need to be configured in ascending order, i.e. MR1 < MR2 < … .
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 ratio of the old to the new measuring range is ≥ 10:1, we recommend that you calibrate the end point manually (see **Carry out manual adjustment** on page 81).

After changing the measuring range limits, the parameters of the automatic measuring range switching (see **Automatic measuring range switching** on page 85) should be verified.

… 10Configuration

… Sample component functions

Change number of decimal places

Menu Path

'MENU / Configure / Component specific / Measurement range / Select component / …'

Selection

Displayed are all measuring ranges configured 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'.**

Number of decimal places

When displaying the measured value in physical units, the maximum 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.

Note

- The setting only affects the display of the measured values in the LCD display.
- The changed number of decimal places is displayed after switching to measurement mode in the display.

Add measuring range

Note

Adding measuring ranges is only possible with the FID analyzer module.

Menu Path

'MENU / Configure / Component specific / Measurement range / Select component / …'

Selection

Displayed are all measuring ranges configured for a measured component.

If a 'Free' entry appears in the list, a measuring range can be added to the configuration of the sample component. The **'NEW RANGE'** is displayed for this purpose.

Note

If adding measuring ranges was blocked in the default configuration, the 'Free' entry does not appear, even if fewer than the maximum 4 possible measuring ranges are displayed.

Procedure

1. Press **'NEW RANGE'**.
2. Confirm the safety prompt by pressing **'NEW RANGE'**, enter the password (Level 1) if needed.
   Instead of the 'Free' entry, a new measuring range will be displayed in the list.
3. If needed, press **'CHANGE LIMITS'** to call up the Change measuring range limits menu and change the limits of the measuring range added, see **Changing Measuring Range Limits** on page 83.
4. If needed, press **'CHANGE PLACES'** to call up the Change decimal places menu and change the number of decimal places of the measuring range added, see **Change number of decimal places** on page 84.

Delete measuring range

Note

Measuring ranges can be deleted only with the FID analyzer module.

Menu Path

'MENU / Configure / Component specific / Measurement range / Select component / ...'

Selection

Displayed are all measuring ranges configured for a measuring component.

If a measuring range can be deleted from the configuration of the sample components, the **'DELETE RANGE'** softkey will appear.

Note

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 RANGE'**.
2. Confirm the safety prompt by pressing **'DELETE RANGE'**, enter the 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 properly only if the measuring ranges MR1, MR2, … have been configured in ascending order, i.e. MR1 < MR2 < …. Refer to **Changing Measuring Range Limits** on page 83.

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 for the lower and upper threshold apply to all measuring ranges of the component set up in the gas analyzer. The values 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.

… 10 Configuration

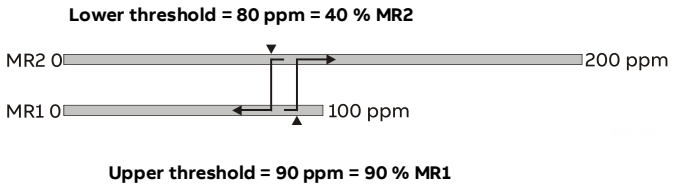
… Sample component functions

Status

Automatic measuring range switching can be activated or deactivated.

Example for Auto-Ranging

Measurement Range 1: 0 to 100 ppm, measurement range 2: 0 to 200 ppm
Lower threshold = 80 ppm = 40 % MR2,
Upper threshold = 90 ppm = 90 % MR1



Procedure

Parameter	Range	Action
Lower limit:	0 to 100%	Set
Upper limit:	0 to 100%	Set
Assigned ranges:	MR1, MR2, MR3, MR4	Select
Status	on or off	Select

Configure filter

Menu Path

„MENU / Configure / Component specific / Filter / Select component / …'

Procedure

Parameter	Explanation	Action
Non-linear filter:		
T90-1	Low-pass time constant for constant measured value. Setting range: FTIR measurement components: 0 to 300 s FID-/O_2 measurement components: 0 to 60 s	Set
T90-2	Low-pass time constant for changes in measured value. Setting range: 0 to 60 s	Set
Threshold	Switching threshold. If the measured value change exceeds this threshold, **T90-2** becomes effective.	Set

Non-linear filter

For the non-linear filter, it makes sense to set **T90-2** ≤ **T90-1**. That way, the measured value follows dynamic changes in the measurement signal more quickly.
The switching threshold (in %) refers to the highest measuring range set (reference measuring range).

Recommendations for FID:

T90-1 = 20 s, **T90-2** = 1 s, **Threshold** = 0.001 %

Active component selection

Menu Path

'MENU / Configure / Component specific / Active component'

Active component

In the FID analyzer module, several measuring components can be configured however, only one measuring component is measured and displayed.

Procedure

Select the desired 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 LCD display after switching to measurement mode.

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
Direction	< = Alarm when falling below the limit or > = Alarm when exceeding the limit	Select
Limit	in physical units	Set
Hysteresis	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 – 30/24-200' contains complete information on the individual function blocks.

… 10 Configuration

… Sample component functions

Configuring FTIR limit value monitoring

Function

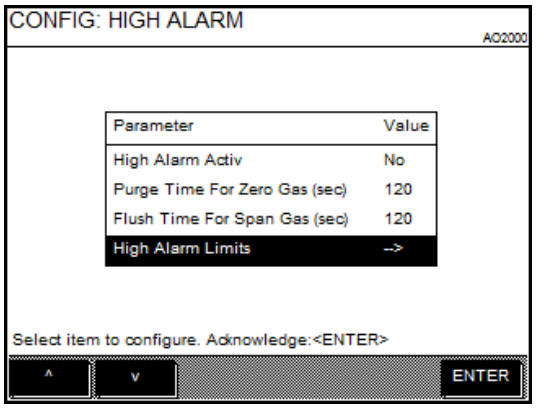
The monitoring of the FTIR measured values can be configured to detect down-scale of the limit values.

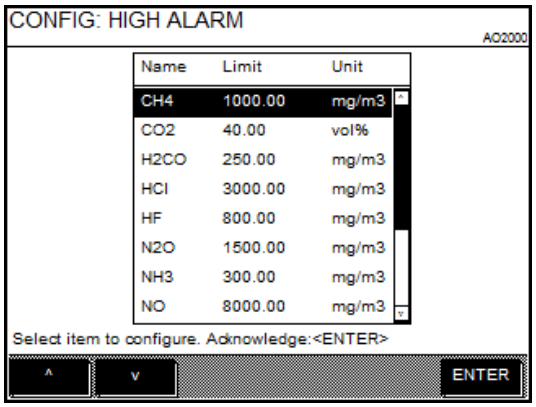
If a measured value exceeds the configured limit value, the analyzer system switches to zero air. After the set purging time for zero gas expires, the system switches to sample gas. After set purging time for sample gas expires, the system switches back to normal measuring mode.

Menu Path

'MENU / Configure / Component specific / FTIR High Alarm'

Display





Implementation

Parameters	Explanation
High Alarm Activ	Activate ('yes') or deactivate ('no') limit value monitoring.
Purge Time For Zero Gas:	Enter purging time for zero air in seconds.
Flush Time For Span Gas:	Enter purging time for measuring gas in seconds.
High Alarm Limits->	Enter the limit value for every measuring component in the physical unit displayed.

Configuring dry base and O_2 reference

Measurement value corrections

The measurement gas concentrations can be converted to dry waste gas or normal conditions. The measurement gas concentrations can also be based on a pre-determined oxygen concentration. The correction functions are only available if the corresponding option has been ordered and factory-configured in the analyzer system.

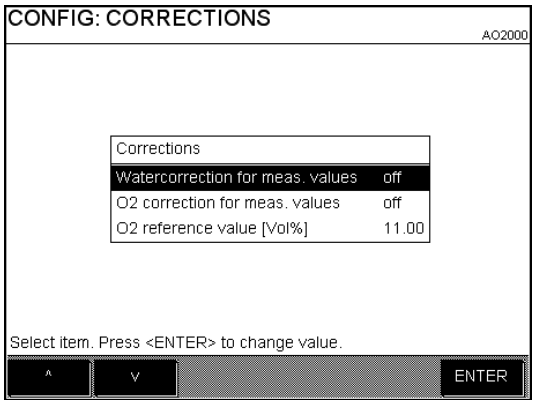
The correction functions are automatically switched off during adjustment as soon as no more sample gas is connected. As soon as the sample gas is reconnected, the correction functions are reactivated (even before the adjustment process is complete).

The correction functions only affect those measured values that are determined after the function is activated. It can therefore take up to 30 seconds until a corrected measured value is shown on the FTIR spectrometer.

Menu Path

'MENU / Configure / Component specific / Corrections'

Display



Only the enabled and configured corrections are shown in the menu. The image shows maximum configuration.

Implementation

Parameter	Description
Watercorrection for meas. values	Activates or deactivates the correction function.
O2 correction for meas. values	Activates or deactivates the correction function.
O2 reference value [Vol%]	Enter the officially prescribed O2 reference value in vol%. The O2 reference value is limited to the range of ≥ 0 vol% to < 21.00 vol%.

Measured value display

The measuring components marked with the '*****' symbol in the measured value display in HMI can be corrected. Provided at least one of the measuring components displayed is corrected, the type of correction is displayed in a small text box above the MENU softkey: ' *Dry', '*O2corr.' or '*Dry&O2corr.'

… 10 Configuration

… Sample component functions

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 2×10 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 50

Note

The changed module name is shown in the LCD 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 **Display element positioning on the page** on page 104.

System functions

Setting the time zone, date and time

Menu path

'MENU / Configure / System / Date/Time'

Procedure

Parameter	Explanation
Timezone	The time zone can be selected either from the GMT (Greenwich Mean Time) values or from the continent/country/city list.
Date	Date must be entered in month/day/year format. Enter year with 4 digits.
Time	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 the user interface language

Menu Path

'MENU / Configure / System / Language'

Language Selection

The user interface of the gas analyzer has two languages factory-set according to the order.

You can switch between these languages in the 'Language' menu item.

Additional languages

You can load other user interface languages into the analyzer system using the 'SMT' software tool.
For information on downloading the software, see **Software downloads** on page 11.

The following language combinations are available:

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

Change password

Note

We strongly recommend to change all passwords from their default value. All passwords can be changed by the user. It is therefore strongly recommended to carefully document every change of password. The passwords can only be reset to the factory setting by ABB Service.

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.

Menu Path

'MENU / Configure / System / Change password'

Password Protection

For basic information on the 'Password protection' topic, see **Password protection** on page 52.

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
Field service	0,1,2,3,4,S	737842

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 by selecting **'Back'**.

Note

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

… 10 Configuration

… System functions

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.

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

System modules are the analyzer modules, the I/O modules and the external I/O devices.

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 14-digit serial number of the analyzer module is provided in the device data sheet and on a sticker on the module; the sticker is usually on the CPU card.

The serial number contains the following information (example):

01400000012301 (analyzer module)
13000000001600 (u-remote module, bus address 16 or H=1 L=1)

The first 3 digits refer to the module type:

Module type	Description
014	Analyzer module
130	u-remote module

The remaining 11 digits are the actual serial number of the module.

Unknown System Module

If a system module shows the 'Unknown' status in menu item 'Setup system modules', there are several possible causes for this:

Cause	Repair
After activating the power supply of the gas analyzer, the system module could not be found (status message no. 201).	Restore system bus connection to the system module and press the **'Restart'** softkey.
The systembus connection to the system module is interrupted (status message no. 209).	Restore system bus connection to the system module and press the **'Restart'** softkey.
The serial number of the system module was incorrectly entered.	Press the **'CHANGE'** softkey and correct the serial number.

Note

While system modules are being set, the automatic calibration of an analyzer module is not possible.

Add System Module

Note

As long as there is no system module configured in the gas analyzer at all or none of the integrated I/O modules has configured a function block application, the **'NEW'** softkey will appear on the LCD display in measuring mode.

- Pressing the **'NEW'** softkey will take the user 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 select **'Back'** to reject it.

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.
   When setting a digital I/O module:
   Press the **'FB appl.'** softkey and select function block application.
   - The adjusted I/O module appears on the list with the 'FB appl.' status.
3. Save the configuration change by selecting **'ENTER'** or select **'Back'** to reject it.

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. If this is not done, a corresponding message will appear in the message system.

… 10 Configuration

… System functions

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 of the same type, 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 set up again.
   - This system module is displayed on the list either with the 'Unknown' or the 'Error' status.
3. Press the **'CHANGE'**.
   - **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 the configuration change by selecting **'ENTER'** or reject it 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.
   - On the list, the system module now has the 'Delete ' status.
4. Save the configuration change by selecting **'ENTER'** or reject it by selecting **'Back'**.
   - Saving the configuration change by selecting **'ENTER'** will irretrievably delete the parameter settings and the function block configuration of this system module!

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.
For information about downloading the software, see **Software downloads** on page 11.

… 10 Configuration

… System functions

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

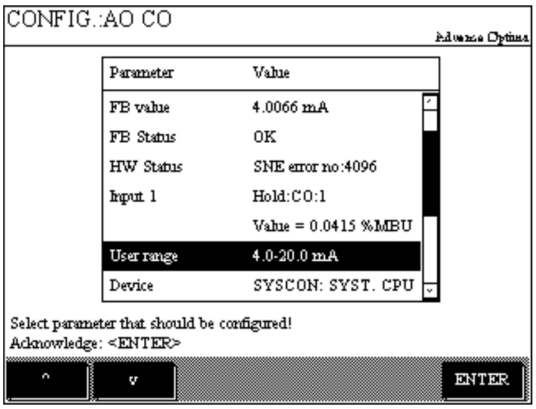
If the configuration of the status signals is changed from 'Collective status' to 'Single status', the digital outputs DO2 and DO3 of the standard function block application 'Status signals / Ext. controlled adj.' with assigned alarm signaling will be overwritten with individual status signals.
For additional information about status signals, see **Status Signals** on page 116.

Analog outputs

Changing Analog Output Current Range

Menu Path

'MENU / Configure / Function blocks / Outputs / Analog output'



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 'Function Blocks – 30/24-200' technical information contains detailed information on the 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

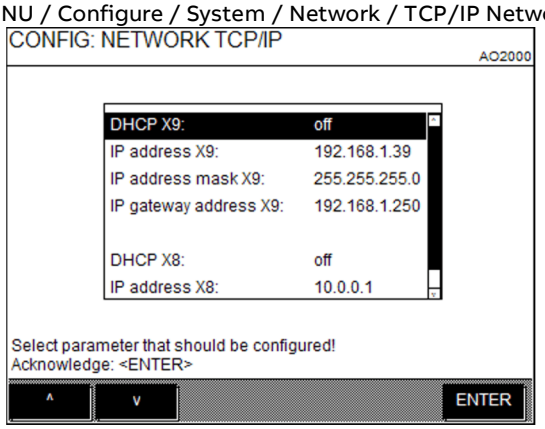
The output signal is limited to the range that is defined in the 'Lower Limit' and 'Upper Limit' parameters. The limits cannot be set lower (Upper Limit) or higher (Lower Limit) than the selected output current range. In the delivery state, these parameters have the value 0 mA or 22 mA.

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 (external communication) and the second X8 (internal system communication).

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).
- The IP address X9 must not be set to the group 10.0.0.X, as this group is used for internal system communication (X8).

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 ACF5000 analyzer system, the MAC address is referred to as the Ethernet address.
- The MAC address can be displayed in the 'Diagnostic/Information / System overview / SYSCON' .

… 10Configuration

… Digital communication

Release of communication via port 8001/tcp

In ACF5000, a proprietary protocol has been implemented on port 8001 for communication with remote clients.

Note

The proprietary protocol via port 8001/tcp is an unsecured protocol (in the meaning of IT security or cybersecurity).

- In the ACF5000, communication is blocked on all Ethernet interfaces (X8 / X9) by default.

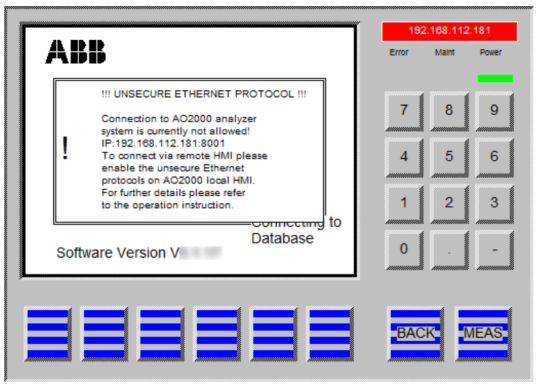


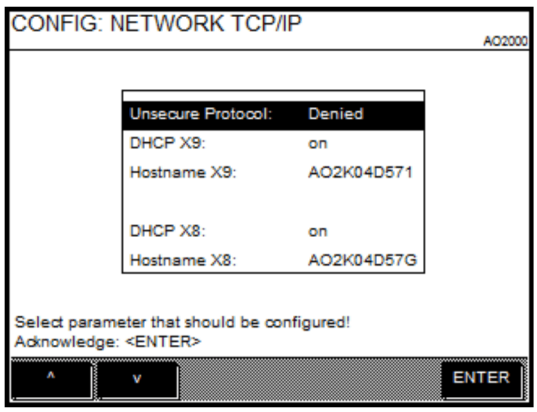
Figure 33: Message on the Remote HMI (example)

When communication is blocked, a corresponding message is issued on the Remote HMI.

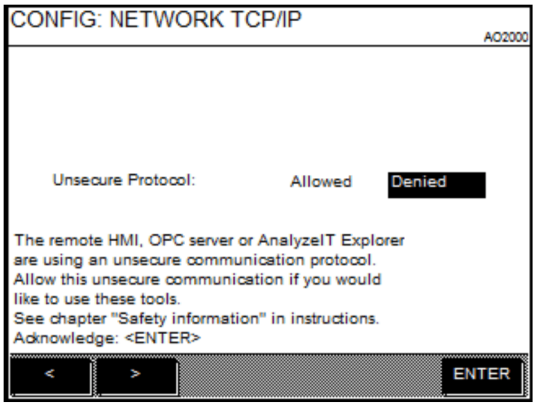
Release communication via the proprietary protocol

Implement the following steps to release communication via the proprietary protocol:

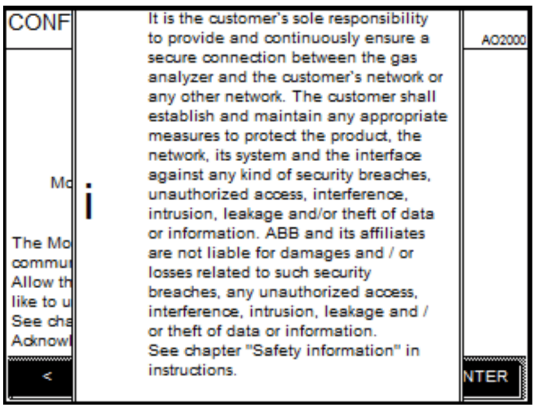
1. Select the ‘MENU / Configure / Network / TCP/IP Network’ menu.
2. Select the ‘Unsecure Protocol’ menu item



3. Select the ‘Unsecure Protocol’ menu item and set the parameter to ‘Allowed’.



4. Confirm the information field by selecting ‘**BACK**’.



5. Communication via the proprietary protocol has now been released.

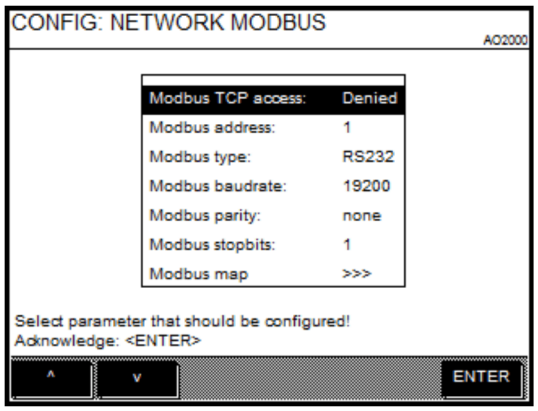
Configure Modbus Connection

Note

The Modbus® protocol is an unsecured protocol (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is suitable before implementation.

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. Without the Modbus module, the menu item 'Modbus TCP' is displayed.
- Modbus communication must be explicitly enabled, see **Release of communication via Modbus® TCP/IP** on page 99.

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 map' menu allows an overview of the address position of the Modbus register.

Note

For additional information on 'Modbus', refer to the Interface description 'COM/AO2000/MODBUS'

Release of communication via Modbus® TCP/IP

In the ACF5000, communication via Modbus® TCP/IP is blocked on all Ethernet interfaces (X8 / X9) by default.

Note

The Modbus® protocol is an unsecured protocol (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is suitable before implementation.

Release communication via Modbus® TCP/IP

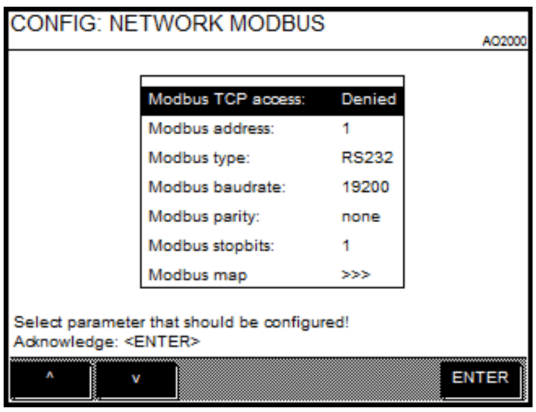
Implement the following steps to release communication via Modbus® TCP/IP:

1. With the Modbus card installed, select the 'MENU / Configure / Network / Modbus' menu.

or

The 'MENU / 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'.

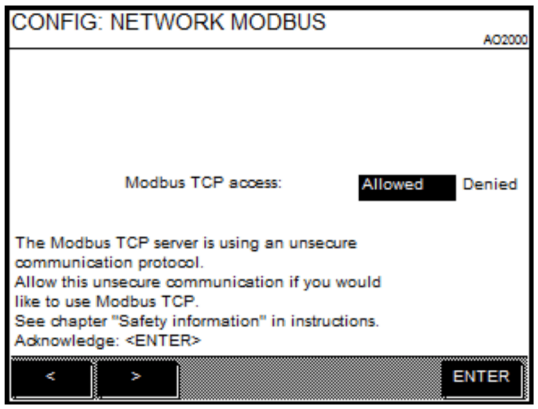
2. Select the 'Modbus TCP access' menu item and confirm by selecting '**ENTER**'.



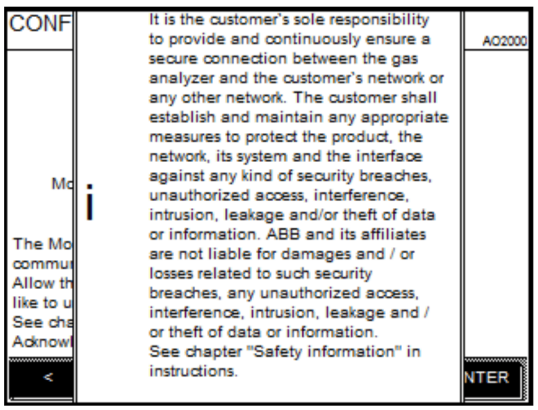
… 10 Configuration

… Digital communication

3. Select the ‘Modbus TCP access’ menu item and set the parameter to ‘Allowed’.



4. Confirm the information field by selecting ‘**BACK**’.



5. Communication via the Modbus® TCP/IP protocol has now been released.

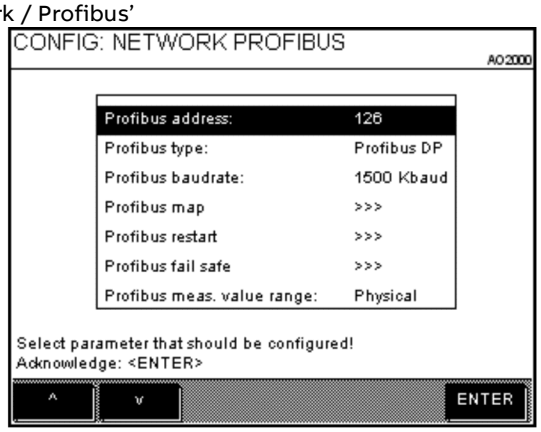
Configure PROFIBUS® Connection

Note

The PROFIBUS® protocol is an unsecured protocol (in terms of IT and cyber security), as such the intended application should be assessed to ensure that this protocol is suitable before implementation.

Menu Path

'MENU / Configure / System / Network / Profibus'



Parameters

Parameter	Selection	Description
Profibus address:	1 to 126	
Profibus type:	PROFIBUS DP	Connection to the RS485 interface
	Profibus PA	Connection to the MBP interface (not intrinsically safe)
Profibus baudrate:	RS485 interface	automatically, 9600 Baud, 19200 Baud, 93750 Baud, 187,5 KBaud, 500 KBaud, 1500 KBaud, 3000 KBaud, 6000 KBaud
	MBP interface	set to 31250 Baud
Profibus map	Profibus inputs	Measured values, bus analog outputs, analog inputs, analog outputs, digital inputs, bus digital outputs, digital outputs
	Profibus outputs	Bus analog inputs, Bus digital inputs
Profibus restart	Warm start	With Warm start, the Profibus stack is reset comparable with a power off/on.
	Cold start	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	The value of the Profibus function block comes after the output value of the ACF5000 function block.
	Hold value	The Profibus function block holds the last output value. The display of the ACF5000 function block may differ from this.
Profibus meas. value range:	Physical	The Profibus-AI value is the physical measured value for ACF5000.
	VDI 4201	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 VDI 4201).

Note

For additional information on 'Profibus', refer to the Interface description 'COM/AO2000/PB'.

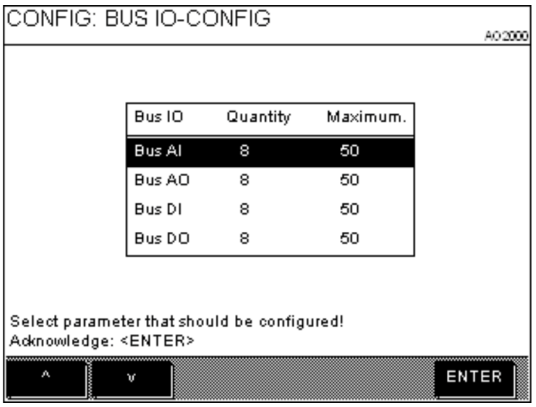
… 10 Configuration

… Digital communication

Configuring Bus I/Os

Menu Path

'MENU / Configure / System / Network / Bus IO'



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

Note

Bus AIs and bus DIs should not be used in combination with Profibus® and Modbus®, as the Profibus transmits data cyclically and changes are therefore overwritten by Modbus write accesses. It is recommended to use an AI or DI only for Modbus or only for Profibus.

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.

Menu Path

'MENU / Configure / System / Display'

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 **Setting System Modules** on page 92).

Since up to six values can be displayed on a page, the number of system pages depends on the number of values.

System pages can be shown and hidden by the user, but not deleted. Refer to **Page overview** on page 105.

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 **User Page Configuration** on page 107.

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.
- The 'Function Blocks – 30/24-200' technical information contains complete information on the 'Function Block' concept as well as detailed descriptions of the individual function blocks.

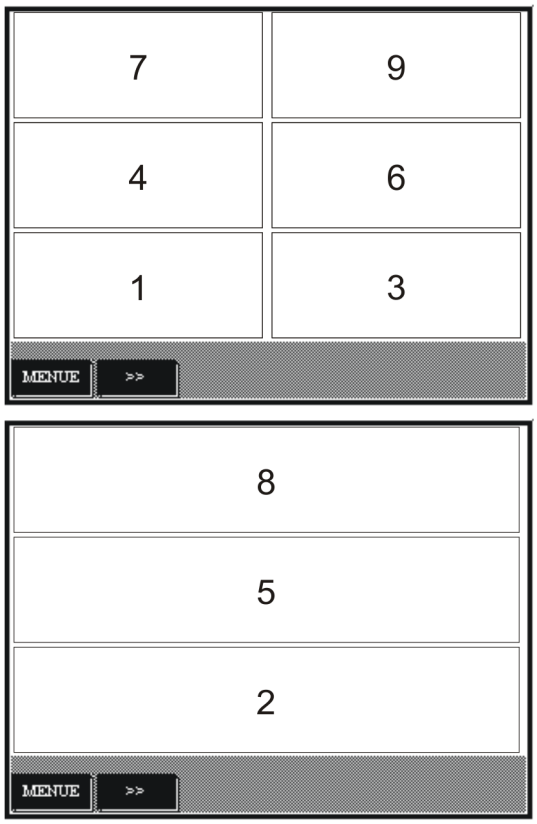
… 10Configuration

… LCD display

Display element positioning on the page

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.

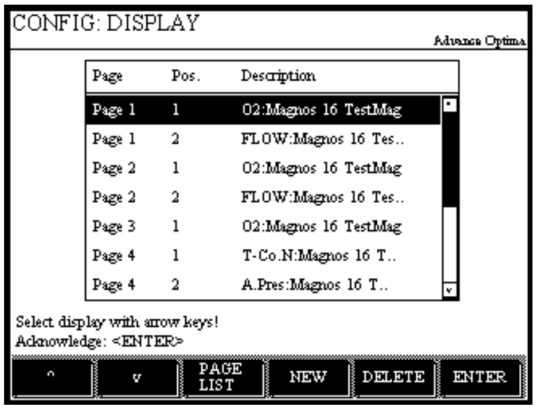


Views

The following views are available for the configuration of the display:

- The display overview, see page 104.
- The page overview, see page 105.
- The parameter overview, see page 106.

Display Overview



Explanations

The screen overview contains the following information for each display element:

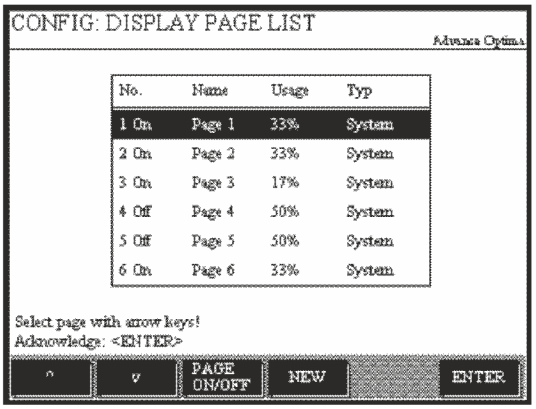
Page	Name of page on which the value is displayed
Pos.	Position of the display on the page
Description	Name of the value

Softkeys in the Screen Overview

The screen overview softkeys have the following functions:

Softkey	Description
PAGE LIST	By selecting the '**PAGE LIST**' softkey, the user calls up the page view.
NEW	By selecting the '**NEW**' softkey, the uses begins the configuration of a new display element, such as a bargraph or dot display (see page 108), value input (see page 109), button input (see page 111).
DELETE	By selecting the '**DELETE**' softkey, the user deletes the selected display element.
ENTER	By selecting the '**ENTER**' softkey, the user calls up the parameter view (see page 106) of the selected display element.

Page overview



Parameter

The page overview contains the following information:

No.	Page number and status 'On' or 'Off'
Name	Name of the page
Usage	Page Assignment
Type	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 **'PAGE ON/OFF'** softkey, the user toggles the selected screen page on or off.
NEW	By selecting the **'NEW'** softkey, the user starts the configuration of a user page (see **User Page Configuration** on page 107).
DELETE	By selecting the **'DELETE'** softkey, the user deletes the selected page. Only empty "user" pages can be deleted.
ENTER	By selecting the **'ENTER'** softkey, the user can input text to change the name of the selected page.
Back	BY selecting the '**Back**' key, the user returns to the Display Overview.

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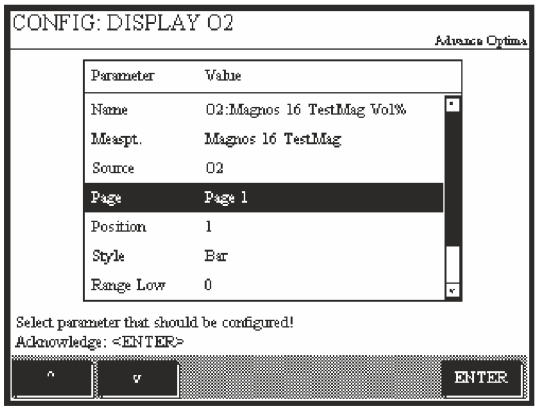
… LCD display

Parameter Overview



Parameter

The display parameters have the following functions:

Parameter	Description
Name	The name of the display element set by the system cannot be changed.
Measpt.	The description entered for the **Measpt.** 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.
Source	The **Source** 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.
Page	The parameter **Page** indicates the page on which the display element is shown. Each display element can be moved to any system or user page.
Position	The **Position** 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.
Style	The **Style** of display depends on the source type. There following display types are available: bargraphs, dot displays, value input (see page 109) and key input (see page 111). Examples of the different display styles are shown as soon as this parameter is selected.
Range Low, Range High	The 'Range Low' and 'Range High' 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.
Places	The **Places** parameter determines the number of decimal places for the digital display of the measured values, see page 84. 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.
4. Enter the page name.
   - The page overview is displayed.

   Alternatively, go directly back to the page overview.
   - In this case the system assigns the name "Page #" (# = page number).
5. The new page will now appear in the page overview:
   – No.: assigned by the system, status 'on'
   – Name: As assigned in step 4
   – Assignment: 0% (no measurement value)
   – Type: User

Moving a Display Element from One Page to Another

Display elements can be moved between the pages. Peform 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.
8. The display element is now shown on the new page.

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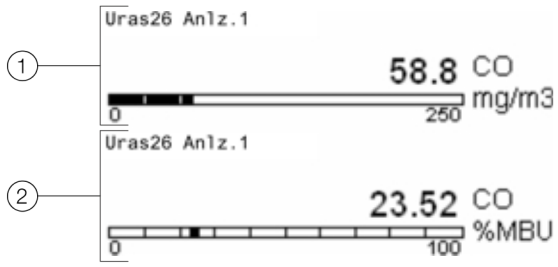
… LCD display

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.
6. The display element is now displayed at the new position.

Configuring the bargraph or dot display



1 Bargraph 2 Dot display

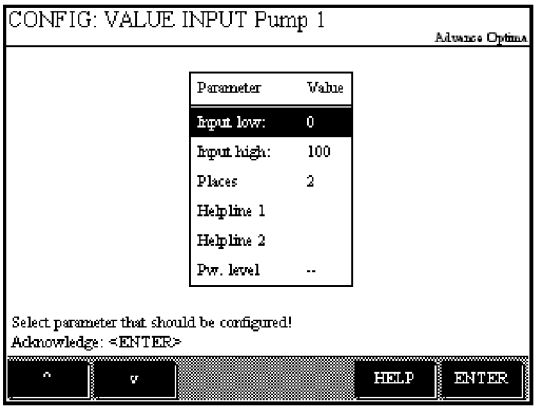
Figure 34: Display variants

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 108.
   - 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.
13. 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 the ‘Function Blocks – 30/24-200’ technical information for a detailed description).

Parameters

For the ‘Value input’ display element, the following parameters should be configured:

Parameter	Description
Input low: Input high:	Enter the start and end of the entry range,
Places	Enter the number of decimal places in the display.
Helpline 1 /2	Enter two lines of text that are displayed when the display element is operated.
Pw. level	Selection of the password level on which the input value can be changed.

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… LCD display

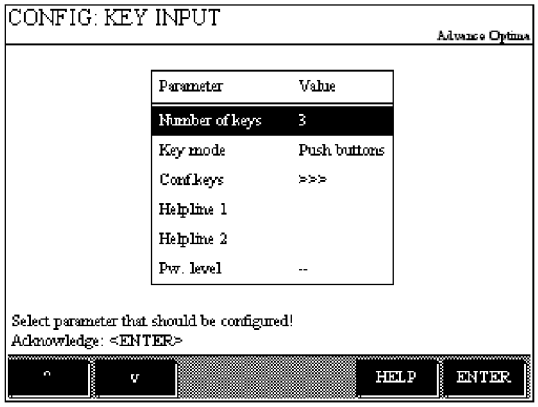
Configuring Value Input

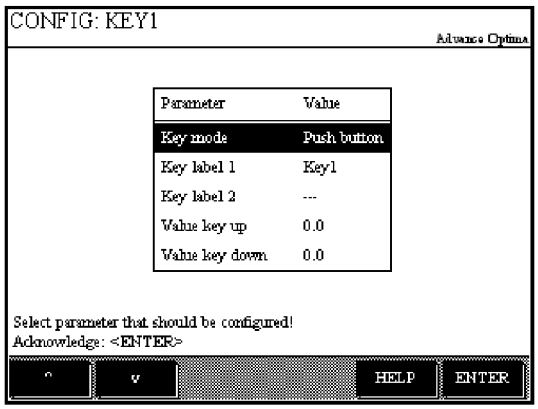
1. Select the **‘**Display’ menu item.
2. Start configuration of the new display element with the **‘NEW’** softkey.
3. Select the ‘Page’ parameter.
   - The page overview is displayed.
4. Select the page on which the display element should be displayed. Only those pages can be selected with an assignment < 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 later using **‘ SWAP DISPLAY’** , see **Moving a Display Element from One Page to Another** on page 107.
   - 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 '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 the ‘Function Blocks – 30/24-200’ technical information for a detailed description).
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 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 LCD display and is indicated above the display element. A field then appears to enter the value:

Key Entry





Description

The source of the 'Key input' display element are one or more 'Constant' type 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 the 'Function Blocks – 30/24-200' technical information for a detailed description).

Parameters

For the display element 'Key input', the following parameters should be configured:

Parameter	Description
No of keys	The number of keys (1 to 6) – the keys are assigned to the softkeys,
Key mode	Enter the key type: Key, Switch or Option keys.
Config keys	Enter the parameters for each button: Key label, Value key up and Value key down.
Helpline1 / 2	Enter two lines of text that are displayed when the display element is operated.
Pw. level	Selection of the password level on which the input value can be changed.

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 later using **' SWAP DISPLAY'** , see **Moving a Display Element within a Page** on page 108.
   - 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.

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… LCD display

8. Select the ‘Keys’ display type.
   - This creates a ‘Constant’ function block; the system-issued name 'Value page-position' is displayed in the ‘Source’ parameter.
     This name does not appear on the LCD 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 through its Output 1 (See the ‘Function Blocks – 30/24-200’ technical information for a detailed description).
12. Switch to measuring mode.
13. The newly configured display element is now shown in the LCD display. The description of the display element is shown above the display.

Use

Keys are entered during measurement by pressing the number key that corresponds to the position of the display element in the LCD display and is indicated above the display element.
A softkey line then appears with the configured buttons.

11 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!
- Only if absolutely necessary should work be performed on an open, energized gas analyzer.

⚠ 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.

⚠ CAUTION

Risk of burns caused by hot components in the device

The surface temperature of components in the device can up-scale 60 °C (140 °F)!

- Before opening the housing, switch off the power supply.
- Observe a cooling time of > 20 min before working on the device.

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.

Furthermore, the AutoID link is included which enables quick and direct access to product-specific information for the corresponding 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.

The Dynamic QR Code is compatible with the ABB website My Measurement Assistant:

my-measurement-assistant.abb.com

… 11 Diagnosis / Troubleshooting

… The Dynamic QR Code

Handling

The QR code is accessed in the Diagnostic Menu of the gas analyzer and indicated on the display.

The website opened on the mobile device scans the QR code that is displayed. All available QR Codes in the gas analyzer have to be scanned, one after the other. The text information that is then displayed on the mobile device can be sent to the local service contact via ‘Contact Support’.

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

To be able to use the full service, ABB recommends using the website My Measurement Assistant:

My Measurement Assistant

Process and device 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 **Instrument status** on page 115.

Process status

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 measuring span, the measured value for the component flashes in the LCD display.

A status message is also generated in each case, but it 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 imit value must have a digital output assigned to it, refer to **Limit Value Monitor Parameterization** on page 87.
- The limit value monitoring parameters (direction of effect, threshold value, hysteresis) must be set, refer to **Limit Value Monitor Parameterization** on page 87.

The assignment of limit values to certain digital outputs is factory-set; this is documented in the analyzer data sheet.

Instrument status

Status messages

The following components and modules generate status messages:

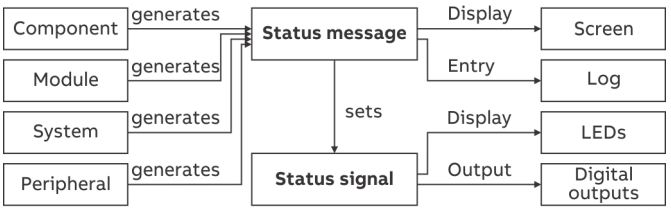
- By the gas analyzer, i.e.:
  - System controller (signal processing, calibration, system bus)
  - Analyzer modules
  - Pneumatic Module
  - Temperature and pressure regulators
  - I/O modules and external I/O devices
- From peripheral assemblies, e.g. from other assemblies for sample gas conditioning

User-Configured Status Messages

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 ‘Function Blocks – 30/24-200’ technical information contains detailed information on the function blocks.

Status Message Processing



- Status messages are shown on the LCD display 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.

… 11 Diagnosis / Troubleshooting

… Process and device status

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 adjustment 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 96.

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 – 30/24-200' 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

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 device operates normally after the status has been cleared. When the status is cleared, the status signal is reset and the status message disappears.

Example:
The controller temperature has not yet reached its set point 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 device 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 adjustments exceeds the permissible range.

… 11 Diagnosis / Troubleshooting

… Status Message Categories

Overview

Status messages requiring acknowledgment and intervention

In the status message overview, the status messages requiring acknowledgment and intervention are marked as follows.

Symbol	Description
q	status that has occurred and is still pending and requires acknowledgment or acknowledgment and intervention
Q	status acknowledged by the user but still pending or status requiring acknowledgment and intervention
I	status not yet acknowledged by the user but no longer pending and requiring acknowledgment or acknowledgment and intervention

Timing and labeling of status messages

The following table shows the chronological sequence of the three categories of status messages, and the marking of the status messages (**q**, **Q** and **I**, see See Table **Status messages requiring acknowledgment and intervention**)

Status Messages Not Requiring Acknowledgement	
Status occurs	**Status expires**
LED lights up	LED goes out
Status signal set	Status signal reset
Status message appears	Status message canceled

Status Messages Requiring Acknowledgment				
Status occurs		**Status expires**		**Acknowledge**
LED lights up		LED goes out		
Status signal set		Status signal reset		
Status message appears	**q**	Status message remains	**I**	Status message canceled
Status occurs		**Acknowledge**		**Status expires**
LED lights up				LED goes out
Status signal set				Status signal reset
Status message appears	**q**	Status message remains	**Q**	Status message canceled

Status Messages Requiring Acknowledgment and Intervention				
Status occurs		**Status expires**		**Acknowledge and intervene**
LED lights up				LED goes out
Status signal set				Status signal reset
Status message appears	**q**	Status message remains	**I**	Status message canceled
Status occurs		**Acknowledge**		**Intervene**
LED lights up				LED goes out
Status signal set				Status signal reset
Status message appears	**q**	Status message remains	**Q**	Status message canceled

Possible status messages

Legend for the 'Status messages' table

Column in 'Status messages' table	
No.	The status message number appears in the detailed display in the menu line. **Note** Message numbers ≥ 10000 are exclusive messages of a function block application.
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
Runtime error						
1… 21	Runtime Error 1 … Runtime Error 21					When the same status message occurs repeatedly, inform Service.
System controller						
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.					not in the logbook; for information on password protection, see **Password protection** on page 52
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:					only in the logbook
114	Changed parameters are saved. Please wait.					

… 11 Diagnosis / Troubleshooting

… Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
System controller (continuation)						
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 in the menu: Configure/System/ Save configuration to save the backup configuration. Or load a configuration with the use of SMT.	x	x			see message text
120	All passwords have been reset to the default setting. Please save the configuration, shut down the system and remove the bridges. Then restart the system.					see message text
121	The maintenance switch is ON.				x	for information
122	The system memory has been reinitialized! For that reason, the system does not currently contain a configuration. Please load a configuration with the use of SMT.			x		see message text
QAL3						
126	The QAL3 data memory is full. Please export the data.			x		see message text
127	The drift values up-scale the QAL3 limits.			x		see message text
System bus						
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. 'MENU / Diagnostic/Information / System overview'
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 configuration of the system bus module: 'MENU / Diagnostic/Information / System overview'
214	The system is currently being maintained with Optima SMT.					

No.	Text	S	A	W	F	Reaction/Comment
System bus (continuation)						
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.
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.
Analyzer modules						
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 measuring 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 installed measuring range; for Uras26 50 % of the physical measuring range. As soon as the drift exceeds these values, notify Service.
303	The offset drift exceeds the permissible range.	x	x			
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 adjustments exceeds the permissible range.			x		These messages are created by the automatic adjustment. Check plausibility of the adjustment. 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 two adjustments 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 controller
310	The temperature correction for this component was deactivated because the temperature measured value is invalid.			x		see status message of the relevant temperature detector

… 11 Diagnosis / Troubleshooting

… Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
Analyzer module (continuation)						
311	The pressure regulator works erroneously.	x	x			see status message of the relevant pressure controller
312	The pressure correction for this component was deactivated because the pressure measured value is invalid.			x		see status message of the relevant pressure detector
313	No excess sensitivity correction for this component is possible, as the correction value is invalid.			x		see status message of the relevant correction detector
314	No carrier gas correction for this component is possible, as the correction value is invalid.			x		see status message of the relevant correction detector
Auxiliary detector						
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.
FID						
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 the fuse and replace it 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 status: heater off, combustion gas valve closed, instrument air valve closed, housing purging on, zero gas valve open.
Temperature controller						
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 is observed, see **Climatic Conditions** on page 24. Check the overheating protection in the analyzer module and replace it if necessary. Fidas24: The temperatures of the detector (**T-Re.D**) and, where applicable, of the heated measuring gas connection (**T-Re.E**) are outside the limit values.

No.	Text	S	A	W	F	Reaction/Comment
Pressure regulator						
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 supply gas pressures: Output = instrument air, Air = combustion air, H2 or H2/He = combustion gas.
330	The pressure exceeds or falls below the top or bottom limit value 2.			x		
331	The position value of the pressure is outside the valid range.	x	x			Fidas24: Check supply gas pressures.
I/O devices						
332	Loss of auxiliary current in the I/O card.	x	x			The I/O card is faulty. Replace card.
333	An I/IO type that is not yet available is configured.	x	x			Correct configuration with TCT.
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 adjustment of the analog inputs.
336	A calculation error occurred while calculating the measured value.	x	x			Check configuration and adjustment of the analogies and outputs.
337	Line break in 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.
	Flow monitor (Pneumatic module)					
342	The flow rate down-scales the limit value 1.			x		Check sample conditioning. Limit value 1 = 25 % MRS.
343	The flow rate down-scales the limit value 2.	x	x			Check sample conditioning. Limit value 2 = 10 % MRS. The automatic adjustment has been interrupted and blocked.

… 11 Diagnosis / Troubleshooting

… Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
Measured value						
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
Flow controller						
398	No new measured values from the analog/digital converter.	x	x			Notify Service.
399	The measured value exceeds the value range of the analog/digital converter.	x	x			Check measuring gas path. Check connectors on the gas analyzer. Notify Service.
400	A calculation error occurred while calculating the measured value.	x	x			Notify Service.
401	The flow exceeds or falls below the top or bottom limit value 1.			x		Check measuring gas path. Notify Service.
402	The flow exceeds or falls below the top or bottom limit value 2.	x	x			Check measuring gas path. Notify Service.
403	The position value of the flow controller is outside the valid area.	x	x			Notify Service.
ZO23						
404	The temperature exceeds or falls below the top or bottom limit value 2.	x	x			Notify Service.
405	A ZO23 functional test was carried out.					for information
406	This ZO23 analyzer did not pass the functional test.			x		Change test factor or check the measuring cell with test gases.
407	A ZO23 functional test is running.				x	for information
408	The ZO23 functional test was canceled.				x	Keep measured gas concentration stable or use test gas.
FID						
411	The analyzer is in standby. Reactivation in menu: Service/Test..Standby/Restart FID.	x			x	Restart Fidas24.
412	Ignition failed. The analyzer needs to be reactivated manually. Reactivation in 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	
Adjustment						
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.					Adjustment is canceled. Notify Service.
503	Amplification error during adjustment. Adjustment impossible.			x		Adjustment is canceled. Final point gas concentration too low – check.

No.	Text	S	A	W	F	Reaction/Comment
Adjustment (continued)						
507	A combination of the following errors has occurred: Drift half, drift, reinforcement or delta drift.					Calibrate the detector displayed manually at the zero point and span point.
508	Unknown error number. Check software versions.					Message during automatic adjustment. Check software version of analyzer module and system controller.
509	Automatic adjustment started.					for information
510	Automatic adjustment ended.					for information
511	Automatic adjustment canceled externally.					for information
512	Automatic adjustment in progress.				x	for information; not in the logbook
513	System bus communication disrupted during automatic adjustment.					
514	External adjustment started.					for information
515	External adjustment ended.					for information
516	External adjustment in progress.				x	for information; not in the logbook
517	Device is being serviced.				x	for information, e.g. during a manual adjustment; not in the logbook
518	The adjustment could not be carried out, because the measured value is instable.					
519	Preamplifier overflow Error: The adjustment could not be carried out, because the pre-amplifier is overdriven.					
520	Basic adjustment zero point started.					for information
521	Basic adjustment zero point ended.					for information
522	Basic adjustment zero point canceled.					for information
523	Basic adjustment zero point incomplete. System bus communication disrupted during adjustment.					for information
524	Basic adjustment 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 adjustment for component:					for information
528	Automatic adjustment could not be started, as the calibration was manual.					for information

… 11 Diagnosis / Troubleshooting

… Possible status messages

No.	Text	S	A	W	F	Reaction/Comment
Adjustment (continued)						
529	The adjustment was canceled, as no raw measured values can be entered.	x		x		
530	The adjustment was canceled, as the pushbutton did not detect calibration gas.	x		x		only with Fidas24
531	Auto validation started.					for information
532	Auto validation ended.					for information
533	Auto validation canceled externally.					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:					During validation, you can choose whether a status message should be set: • 536: Without status message ‘Maintenance required’ • 537: With status message ‘Maintenance required’
537	Automatic validation outside the limit for:			x		
User-configured messages						
800	An external error occurred at:	x	x			Standard texts for the Message Generator 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	
810	A reference is connected.				x	This is set if a reference is connected via the VDI4201 reference register of the Modbus® interface (requires a function block application).
Various messages						
1000	This functional block has an error:	x	x			is supplemented by the reference to the functional block type
1001	Condensate ingress.					Collective message for controlling the handling of a condensate ingress; not in the logbook
1002	The flow rate at this point is too high!	x	x			Message from the sample gas delivery unit
1003	The flow rate at this point is too low!	x	x			Message from the sample gas delivery unit

Possible status messages – FTIR

Legend for the 'status messages' table

Column in 'Status messages' table	
No.	The status message number appears in the detailed display in the menu line. **Note** Message numbers ≥ 10000 are exclusive messages of a function block application.
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

Note

- When status messages occur with numbers > 2000 that are not specified in the list, the Service department must be notified.
- Status messages 2013, 2014, 2015, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032 are for information purposes only.

'Status messages - FTIR' – table

No.	Text	S	A	W	F	Reaction/Comment
424	Temperature error The temperature value of the controller and the redundant temperature measurement differ.	x	x			Check temperatures of the measuring gas collection components: 'MENU / Diagnostic/Information / Module specific / Auxiliary raw values / MGEn' Where applicable, Notify Service.
425	Temperature exceeded The temperature value of the controller exceeds the maximum limit value.	x	x			Check temperatures: 'MENU / Diagnostic/Information / Module specific / Controller values' Notify Service in the event of constant or increasing values.
426	Emergency switch-off The temperature controller was deactivated due to a malfunction. To activate, rectify fault and confirm this message.	x		x		Check temperatures: 'MENU / Diagnostic/Information / Module specific / Controller values' After cooling down to T < 190°C, confirm message to reactivate the heating. Notify Service if this occurs again.
2001	WARNINGLOW Alarm state: WARNINGLOW			x		Check sample gas concentration. Notify Service.
2002	WARNINGHIGH Alarm state: WARNINGHIGH			x		Check sample gas concentration. Notify Service.
2003	WARNING Alarm state: WARNING					Check sample gas concentration. Notify Service.

… 11 Diagnosis / Troubleshooting

… Possible status messages – FTIR

No.	Text	S	A	W	F	Reaction/Comment
2004	OFFLINE Alarm state: OFFLINE		x			Check sample gas concentration. Notify Service.
2005	MAINTENANCE Alarm state: MAINTENANCE			x		Check sample gas concentration. Notify Service.
2006	ALARMLOW Alarm state: ALARMLOW		x			Check sample gas concentration. Notify Service.
2007	ALARMHIGH Alarm state: ALARMHIGH		x			Check sample gas concentration. Notify Service.
2008	ALARM Alarm state: ALARM		x			Check sample gas concentration. Notify Service.
2009	FAULT Alarm state: FAULT		x			Check sample gas concentration. Notify Service.
2218	InstrEboxTmpHm Instrument health error: EBOX Temperature(HM) The health monitoring reports a problem with the EBOX temperature					Check internal and external cabinet temperatures. Check function of the ventilator or cooling device. Notify Service.
2219	InstrBMXSTempHm Instrument health error: BMXS Temperature(HM) The health monitoring reports a problem with the board temperature of the BMXS					Check internal and external cabinet temperatures. Check function of the ventilator or cooling device. Notify Service.
2222	InstrDetTempHm Instrument health error: Detector Temp. (HM) The health monitoring reports a problem with the detector temperature					Check internal and external cabinet temperatures. Check function of the ventilator or cooling device. Notify Service.
2226	InstrCoAddFwdHm Instrument health error: CoAdd. Rej. Fwd (HM) CoAdd reports a problem with the forwards movement. Please check for vibrations.					See message text
2227	InstrCoAddRevHm Instrument health error: CoAdd. Rej. Rev (HM) CoAdd reports a problem in reverse movement Please check for vibrations					See message text
2500	Ref. Temp. >> The analyzer temperature is outside the defined range for the last zero point reference.			x		For a deactivated ‘Automatic reaction to temperature violation’, enter manual reference. For an activated ‘Automatic reaction to temperature violation’, the message is for information purposes. ‘Web page / ACF5000 settings / Temperature range check’
2501	Auto ref. Start Automatic zero point reference started.					For information
2502	Auto ref. End Automatic zero point reference ended.					For information
2503	Auto ref. Cancel Automatic zero point reference canceled externally.					For information
2504	Auto reference running Automatic zero point reference is running.				x	For information

No.	Text	S	A	W	F	Reaction/Comment
2505	Auto ref. Error			x		Enter manual reference
	Automatic zero point reference failed.					Notify Service if this occurs again.
2506	High alarm	x	x			For information
	High alarm triggered by the components:					
2507	AAC Start					For information
	Automatic Adjustment Check started.					
2508	AAC end					For information
	Automatic Adjustment Check ended.					
2509	AAC cancelation					For information
	Automatic Adjustment Check externally canceled.					
2510	AAC in progress.				x	For information
	Automatic Adjustment Check is in progress.					
2511	ADC Start					For information
	Automatic Drift Check started.					
2512	ADC end					For information
	Automatic Drift Check ended.					
2513	ADC cancelation					For information
	Automatic Drift Check externally canceled.					
2514	ADC in progress				x	For information
	Automatic Drift Check is in progress.					
2515	Zero point gas				x	For information
	Zero point gas was switched on manually.					
2516	End point gas				x	For information
	End point gas was switched on manually.					
2517	Gas port 1 active				x	For information
	Gas port 1 switched on manually.					
2518	Gas port 2 active				x	For information
	Gas port 2 switched on manually.					
2519	Gas port 3 active				x	For information
	Gas port 3 switched on manually.					
2520	AAC cell 1 active				x	For information
	Validation cell 1 switched on manually.					
2521	AAC cell 2 active				x	For information
	Validation cell 2 switched on manually.					
2522	AAC cell 3 active				x	For information
	Validation cell 3 activated manually.					
2523	AAC cell 4 active				x	For information
	Validation cell 4 switched on manually.					
2524	AAC cell 5 active				x	For information
	Validation cell 5 activated manually.					
2525	Back purging				x	For information
	Back purging of the probe in progress.					
2526	FTIR adjust.				x	For information
	FTIR analyzer adjustment in progress,					

… 11 Diagnosis / Troubleshooting

… Possible status messages – FTIR

No.	Text	S	A	W	F	Reaction/Comment
2527	Emergency purging Temperature error on the emergency purging is active. To end the emergency purging, please select the menu: Service/TestSelect emergency purging.	x	x			See message text
2528	Ext. Purging External temperature error emergency purging is activated.					For information
2529	Ambient temp.> The ambient temperature exceeds limit value 1.			x		For information
2530	Ambient temp.> The ambient temperature exceeds limit value 2.	x	x			For information
2531	FTIR purging The flow rate of FTIR purging falls below the limit value.			x		Check settings of the pressure and flow controller.
2534	Cabinet temp. >> The internal cabinet temperature is too high. The analyzer heaters were deactivated. To activate the heaters, please select the menu: Service/TestSelect emergency purging.	x	x			See message text
2535	Bypass activated The air purifier is inactive. The analyzer is purged via the bypass and not via the air purifier.					For information

Troubleshooting

The measured value display flashes

The measuring signal exceeds the limits of the measuring range

Note

Measured value > +130 % MRS or measured value < -100 % MRS. 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 analyzer system from the gas conditioning system.
- blow out the lines with compressed air or unblock them mechanically.
- replace filter inserts and fill material.
- check gas lines for leaks.

Gas paths in analyzer system kinked or leaking

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

Temperature Problem

Analyzer system still in the warm-up phase

- The assemblies in the analyzer cabinet reach their target temperatures after approx. 2 hours.
- The gas sampling probe reaches its target temperature after 3 to 4 hours.

Excessive air movement

- Reduce air movement around the analyzer system.
- Install shielding against drafts.

Ambient temperature outside of permissible range

- Protect the analyzer system from cold and heat sources such as the sun, ovens and boilers.
- Observe climatic conditions, refer to **Climatic Conditions** on page 24.

… 11 Diagnosis / Troubleshooting

FID – Troubleshooting

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.

Leaks in the gas feed paths

- Checking for leaks in the sample gas path in the analyzer module and the sample extraction system.

Loss of sensitivity

- Notify the Service department.

Sample gas outlet pressure too high

- Check air discharge line; it needs to have a large inside diameter.
- Notify the Service department:
  Have blockage of the air jet injector and the instrument air pressure checked.

Combustion air contaminated

- Notify the Service department:
  Have the combustion air supply and air purifier checked.

Fluctuating process gas pressures

- Check the supply of instrument air and combustion gas

Outgassing of hydrocarbons in the H_2safety valve
('Hydrogen monitoring of the analyzer cabinet' option)

- The outgassing of hydrocarbons only occurs in the first few weeks after commissioning the analyzer system.

Pressure regulator fault

Unstable pressure values

- Check the inlet pressures of the operating gases.
- Notify the Service department.

Zero drift

Sample gas line contaminated

- Cleaning the sample gas line.

ASP block or FID contaminated

- Reduce the hydrocarbon content of the combustion air.

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 **FID – Standby / Restart** on page 144.

Note

The "Wait for restart" operating status means: Heater on, Combustion gas valve closed, Instrument air valve open, Housing purge on.

Combustion air pressure too high

- Reducing the combustion air inlet pressure
  (Note the information given in the analyzer data sheet).

FID in fail-safe status

If a fatal error occurs in the analyzer module, the analyzer module will be set to the fail-safe status; in the 'Standby/Restart FID' menu, for the 'Status' parameter, the text 'Fail safe' will be displayed.

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 **Possible status messages** on page 119).

A cold restart in the menu is not possible; after fault correction the analyzer module must be cold restarted by switching off and on again.

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

For more information visit:
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 (F-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.

The device's dynamic QR code can also be used to collect and provide data, see **The Dynamic QR Code** on page 113.

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.

… 11 Diagnosis / Troubleshooting

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 160) 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
Germany
Phone: +49 69 7930-4591
Email: repair-analytical@de.abb.com

Transport-/Storage temperature
–25 to 65 °C

12 Maintenance

Safety instructions

⚠ WARNING

Risk of injury

Risk of injury due to maintenance work being carried out incorrectly.

The work described in this chapter requires 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 !
- Only work on an open and live gas analyzer if it is absolutely necessary to do so.

⚠ 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.

⚠ CAUTION

Risk of burns caused by hot components in the device

The surface temperature of components in the device can up-scale 60 °C (140 °F)!

- Before opening the housing, switch off the power supply.
- Observe a cooling time of > 20 min before working on the device.

Note

Only persons familiar with the maintenance of comparable analyzer systems and who possess the qualification required for such work are allowed to work on the analyzer system.

The following points should be observed during maintenance:

- Observe the general safety instructions in **Safety instructions** from page 6 onwards.
- For safety Instructions on handling the analyzer system with integrated FID, see **Safety instructions for the FID analyzer module** from page 8 onwards,
- For safety instructions on handling the FTIR spectrometer, see **Safety instructions for the FTIR spectrometer module** on page 10,
- For safety instructions on working with poisonous gases, see **Handling of toxic gases** on page 6.

… 12 Maintenance

Visual inspection

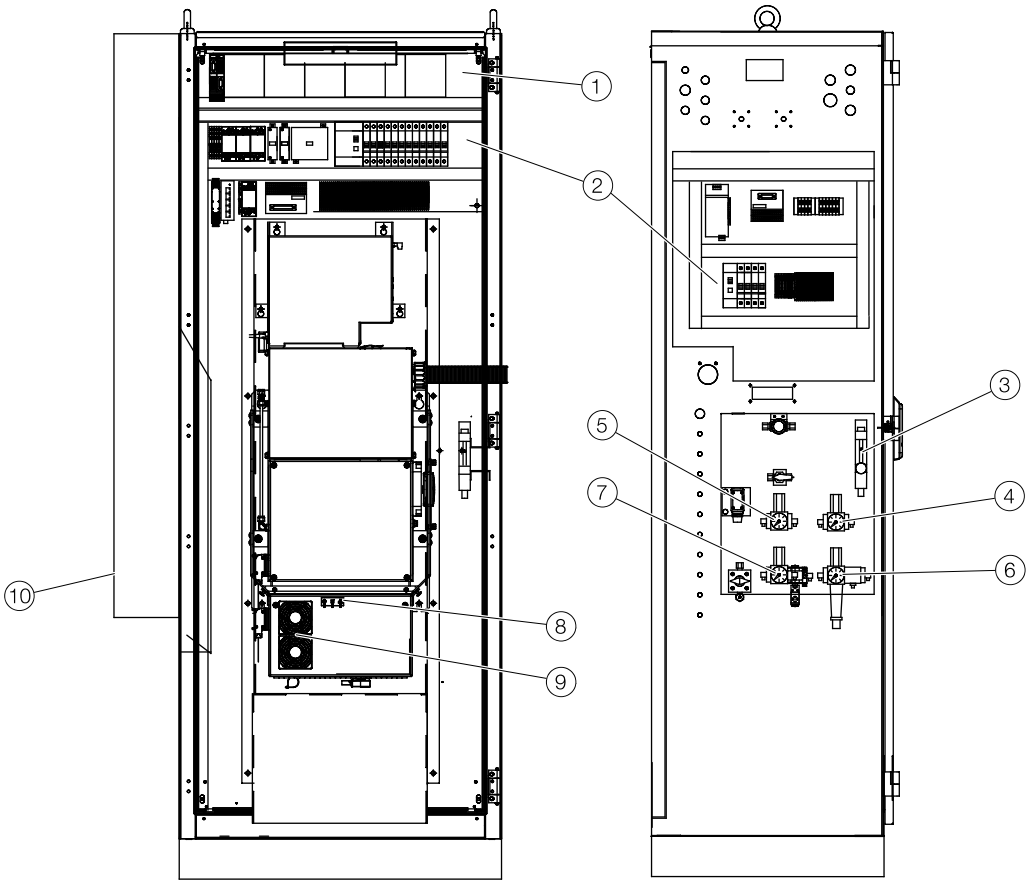


Figure 35: Internal view of the analyzer cabinet

Pos.	Component		Test / set point
–	External instrument air regulator		5.5 to 7 bar
–	External gas cylinder pressure reducer:		
	Zero point gas O_2 analyzer (3 vol.% O_2 in N2)		1.5 ±0.1 bar
	Combustion gas VOC analyzer (H_2)		1.2 ±0.1 bar
	Zero point gas VOC analyzer (N_2 or zero gas O_2 analyzer)		1.5 ±0.1 bar
	Endpoint gas VOC analyzer (propane in N_2)		1.5 ±0.1 bar
①	Status LEDs of the analog and digital output modules		Green*
②	Circuit breakers and ground fault circuit interrupters activated		ON
③	Purge gas flowmeter		125 L/h
④	Instrument air pressure regulator, combustion air, VOC analyzer (–J86)		1.2 ±0.1 bar
⑤	Instrument air pressure regulator, purge air, spectrometer (–J88)		2.0 ±0.1 bar
⑥	Instrument air regulator with filter (–J85)		5.5 bar
⑦	Instrument air pressure regulator, injector air (–J96)		4.5 ±0.1 bar
⑧	Status LEDs on the cover of the FTIR e-box	“Power"	Green
		"Status"	Green
		"Network"	Orange/green flashing
⑨	Filter pads on the cover of the FTIR e-box		White
⑩	Cooling unit display		Actual temperature value (set point: 25 °C)
	Filter pads in cabinet fan and exit filter		White

* If all the channels are not connected in an analog output or analog input module, the status LED lights up red even in normal operation.

Cleaning the analyzer cabinet

Note
The door of the analyzer cabinet must be closed at all times during operation!

Notes on cleaning the analyzer cabinet
- Never use water or solvents to clean parts of the analyzer cabinet interior.
- Use a brush and vacuum cleaner to remove the dust that has penetrated the analyzer cabinet.
- Clean the outside of the analyzer cabinet with a damp cloth and mild detergent as and when required. Make sure that water droplets do not enter the analyzer cabinet.

Seal integrity test

NOTICE

Damage to the analyzer system
The use of leak detection spray or similar leak detection tools may result in damage to the analyzer system in the event of a leak.
- Do not use leak detection spray or similar leak detection tools in the underpressure area of the analyzer system!

Complete seal integrity test of the analyzer system
Complete seal integrity tests of the analyzer system are reserved for certified service personnel.
- A complete leak test should be carried out regularly with every maintenance, but at least every 12 months.
- A complete leak test must be carried out if gas paths within the analyzer system have been opened and following a restart from cold state.

Simplified seal integrity test of the sample gas path
Note
The simplified seal integrity test is not suitable for testing the overall analyzer system for seal integrity. Therefore, it cannot replace the regular complete seal integrity test in particular (see above).

When must the simplified seal integrity test be performed?
A simplified seal integrity test must be performed in the following cases:
- Following work on the gas sampling probe (e.g. filter replacement),
- Following replacement of the sample gas line,
- Following replacement of the sample gas filter in the ASP block.

The simplified seal integrity test serves to check the seal integrity of the analyzer system, from the gas sampling probe to the ASP block.

Simplified seal integrity test via oxygen measurement
This method is based on connecting oxygen and observing the oxygen measured value.
1. Feed-in nitrogen, either locally or via the gas sampling probe.
2. Observe the oxygen measured value. After a running-in time of approx. 5 minutes with local feed-in or 20 minutes with feed in via the gas sampling probe, the oxygen measured value should drop to approx. 0.08 %.
3. Failure to do so indicates a leak in the selected gas path (see 'Piping diagram' in the system documentation).

… 12 Maintenance

… Seal integrity test

Simplified seal integrity test using FID

⚠ CAUTION

Risk of burns
Risk of burns at the ASP block
(temperature approx. 180 °C)!
- Wear suitable protective gloves and safety goggles!

This method can be employed only if an FID is built into the analyzer system. It is based on allowing hydrocarbon to act on any leaking points in the sample gas path and observing the measured value on the FID at the same time. A commercially available felt pen is used as a punctiform 'Hydrocarbon source' for this purpose.

1. Starting at the sample gas sampling probe and working towards the analyzer cabinet, hold the felt pen briefly against each fitting, connection and screw.
2. Observe the FID measured value. In the presence of a leak, the measured value rises and drops back to the normal value relatively quickly. Due to the calibration times, the measured value can rise after a delay; after each 'contact' with the felt pen, wait at least 2 minutes for a possible reaction.
3. Open the cover of the ASP block and hold the felt pen close to the sample gas line connection at the ASP block for a few seconds.

Other indications of leaks
The following states can indicate a leak in the analyzer system:
- The SGI and SGO pressures to be regulated by the analyzer system are no longer reached.
- The controlled variables for the SGI and SGO pressures in control mode are too high (> 90).
  – The control variables can be found in the 'Diagnostic/Information / Module specific / Controller values → FID' menu.
- The measured oxygen concentration is much higher than the expected values.

This is only a possible indication of a leak. The absence of the states mentioned must not be used to conclude that the analyzer system is tight.

FID – Leak and function tests

NOTICE

The seal integrity check and function tests described in this section 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 check and function tests must be carried out by ABB Service.

Check the integrity of combustion gas path

⚠ DANGER

Explosion hazard
Explosion hazard due to improper leak tightness test.
- 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.

Combustion gas path in the analyzer cabinet
The seal integrity of the combustion gas line within the analyzer system must be checked on a regular basis at least every 12 months using a hydrogen leak detector (leak rate $< 2 \times 10^{-4}$ hPa l/s).

Do not use leak detection spray inside the analyzer cabinet!

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.

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 x 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 pressure reducer on the fuel gas cylinder and the combustion gas line between the cylinder and the 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 on the pressure reducer and in the combustion gas line, this means that the combustion gas inlet valve on the gas analyzer is leaky.

⚠ DANGER

Explosion hazard

Explosion hazard if there is a leak in the combustion gas inlet valve.

If a leak has been 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 x 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 has been 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.

… 12 Maintenance

… FID – Leak and function tests

Function test of the H_2 safety valve

A component of the 'Hydrogen monitoring of the analyzer cabinet' option (see **Hydrogen monitoring of the analyzer cabinet (optional)** on page 15) is a solenoid valve, which is mounted on the outside of the right side wall of the analyzer cabinet and which interrupts the hydrogen supply to the analyzer system if the power supply fails or if a specified percentage of the LEL is reached (H_2 safety valve).

The function of this H_2 safety valve must be checked with a sensitive hydrogen leak detector at every service, but at least every 12 months.

Procedure

1. Switch off the analyzer system power supply.
2. Switch off the 24 V supply to the H_2 safety valve: The valve closes.
3. Shut off the hydrogen supply (from a central supply source or from a cylinder).
4. Disconnect the hydrogen supply line from the inlet of the H_2safety valve.
   – Wait a few minutes until the residual hydrogen has evaporated from the now open line.
5. Use the leak detector (highest sensitivity) to sniff the inlet of the H_2 safety valve.

⚠ DANGER

Explosion hazard

Risk of explosion if the H_2 safety valve has a leak.

If a leak has been detected on the H_2 safety valve:

- Disconnect the combustion gas supply.
- Do not restart the gas analyzer.
- Have the H_2 safety valve replaced by the ABB Service team.

If the leak detector does not indicate any hydrogen leakage, the analyzer system can be recommissioned:

6. Connect the hydrogen supply line to the inlet of the H_2 safety valve.
7. Open the hydrogen supply.
8. Switch on the 24 V supply to the H_2 safety valve: The valve opens.
9. Turn on the power supply to the analyzer system and restart the FID, see **FID Recommissioning** on page 43.
10. After a few minutes, sniff the screw connection of the hydrogen supply line at the inlet of the H_2 safety valve with the leak detector once again.

Maintenance switch

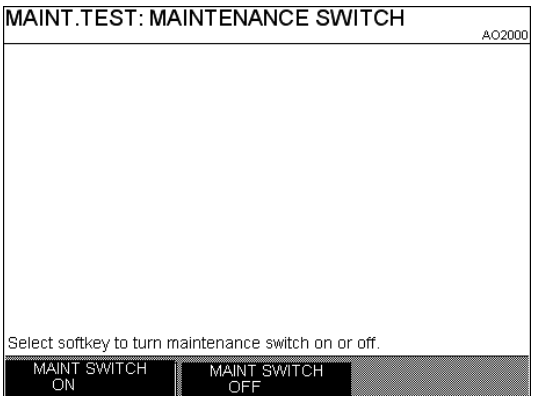
Function

The analyzer system can be set permanently to the 'Maintenance' status using the '„Maintenance switch' function ('Maintenace Mode' status signal).

Menu Path

'MENU /Maintenance/Test /System / Maintenance switch'

Display



The appearance of the softkeys indicates the current status of the maintenance switch. The maintenance switch displayed in the figure above is switched on.

Message

When the maintenance switch is switched on, a message (no. 121) is displayed on the measurement screen and as a status message.

Emergency purging

Automatic switching to emergency purging

As soon as one of the temperatures in the analyzer box AU2 (except for the injection air heater) or in the measurement gas sampling unit falls below the 120 °C limit value, the analyzer system automatically switches to emergency purging, i.e. zero air is piped via the purge gas line to the sampling probe.

Message

If the analyzer system is switched to emergency purging, this is displayed on the measurement screen and as a status message (no. 2527).

Ending emergency purging manually

Once all temperatures have risen above the threshold, emergency purging must be ended manually in order to return to measuring mode. To assess whether emergency purging can be ended, the temperatures are re-measured every 30 seconds.

Menu Path

'MENU / Maintenance/Test / System / Emergency Purge'

Once all temperatures are above the threshold, emergency purging can be ended by pressing the 'FINISH EMERGENCY PURGE' softkey. Emergency purging cannot be ended if one temperature remains too low.

External trigger of the emergency purging

If a digital I/O module is installed with the 'ACF5000 cabinet status', the emergency purging can also be triggered externally via the digital input 4. The digital input has an inverted design, i.e. no signal on the input results in an emergency purging.

The temperatures are reassessed every 30 seconds; for that reason, an emergency purging triggered externally can be delayed by a maximum of approx. 45 seconds.

Monitoring the internal cabinet temperature

Automatic deactivation of internal heaters

As soon as the internal temperature of the analyzer cabinet exceeds the limit value of 45 °C, the analyzer system switches to excess temperature error, and all internal heaters are deactivated.

Message and status signaling

If the analyzer system is switched to excess temperature error, this is displayed on the measurement screen and as a status message (no. 2534).

The digital output 4 of a digital I/O module with the 'ACF5000 cabinet status' functional block application is set. As a result, the air purifier is switched off and the bypass valve is opened to bypass the air purifier. An excessively high internal cabinet temperature also results in the triggering of the emergency purging. The status message and the emergency purging remain in place until the internal cabinet temperature has fallen back below the limit value.

Activating heating manually

As soon as the internal cabinet temperature has fallen back below the limit value, the heating needs to be activated manually again in order to return to measuring mode. The internal cabinet temperature is reassessed every 30 seconds.

Menu Path

'MENU / Maintenance/Test / System / Emergency Purge'

Use

By pressing the '**ENABLE HEATER' softkey, the heaters are reactivated.**

As soon as all heaters have heated up to values of > 120 °C again, the emergency purging can also be acknowledged in the same menu.

… 12 Maintenance

Connecting gas paths and inserting validation cells

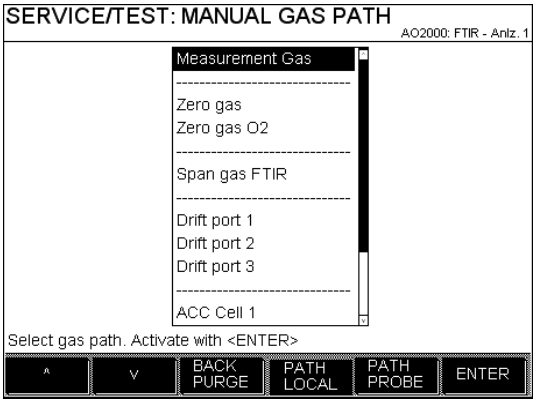
Function

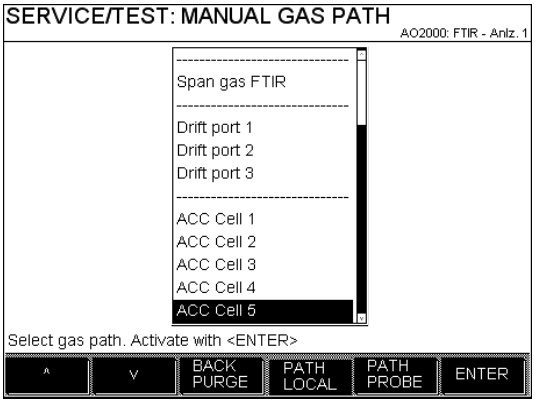
The gas path in the analyzer system can be connected manually, e.g. to emit test gases.
The menu can be exited without waiting for the purging times and any necessary switchover of the measuring model.
When a gas path is activated, the 'Maintenace Mode' status signal is set; the status signal is reset as soon as the purge time has ended after the final activation of the sample gas.

Menu Path

'MENU / Maintenance/Test / System / Manual Gas Path'

Display





Selection

Gas path	Description
Zero gas	If the analyzer system is permanently switched to the 'zero air' gas path, the air purifier may overload. The air purifier is circumvented with a bypass valve after 12 hours of permanent operation. This means that the instrument air offered directly in the analyzer system is used as zero air. The bypass can be deactivated by switching to measuring gas or another gas path. The activation of the bypass valve is displayed in the measurement screen and as a status message (no. 2535) and noted in the logbook.
Drift port 1 – 3	The gas paths are used to feed in test gases for the 'Automatic Drift Check' ADC, see **Configuring the Automatic Drift Check (ADC)** on page 68.
AAC cell 1-5	The gas paths are used to insert the validation cells for the 'Automatic Adjustment Check' AAC, see **Automatic Adjustment Check (AAC) – Configuring the Duration (optional)** on page 63. **Notice:** Selecting a validation cell not only inserts the cell but also switches to zero air. The verification of the validation cells must also be activated in the FTIR analyzer (this can take several minutes).
Softkey	**Description**
BACK PURGE	By pressing the softkey, a back-purge of the gas sampling probe is started, see **Configure automatic back-purging of the gas extraction probe** on page 146.
PATH LOCAL **PATH PROBE**	Pressing one of these softkeys sets the gas path valve to measuring mode ready to emit gas manually. Each time a softkey is pressed, it activates the relevant path. This setting is permanently stored (backup configuration).

Adjustment reset

Note
The adjustment reset is only possible for the FID and oxygen sensor analyzer modules.

Menu Path
'MENU / Maintenance/Test / Analyzer spec. adjustm. / Adjustment reset'

What does the adjustment reset do?
An adjustment reset returns the analyzer module's adjustment to basic adjustment values. Furthermore, the offset drift and amplification drift are electronically returned to basic adjustment (see page **Basic adjustment** on page 143).

Note
The absolute offset and amplification drift values are calculated cumulatively starting from the last basic adjustment. The relative offset and amplification drift values are calculated between the last and next to last automatic adjustment. The absolute and relative offset and amplification drift values can be viewed in the 'MENU / Diagnostic/Information / Module specific / Status' menu.

When should an adjustment reset be performed?
An adjustment reset of an analyzer module should be performed if an analyzer module can no longer be adjusted by normal means.

A possible cause of this is adjustment of the analyzer module with the wrong test gases.

Note
The analyzer module should be adjusted after an adjustment reset.

Basic adjustment

Note
Basic adjustment is only possible for the FID and oxygen sensor analyzer modules.

Menu Path
'MENU / Maintenance/Test / Analyzer spec. adjustm. / Basic adjustment'

What does the basic adjustment do?
A basic adjustment of an analyzer module sets the module back in an initial state. The offset drift and amplification drift are set to zero. The drift history is lost.

When should a basic adjustment be performed?
The basic adjustment of an analyzer module should only be carried out if changes were made to the analyzer module that influence the adjustment. This can, for instance, be the case when replacing assemblies.

Check prior to a basic adjustment
Prior to a basic adjustment, check the followings points and make sure that:
- The analysis system is in proper order,
- The sample conditioning assemblies are in order and
- The correct test gases are being used.

Test gases
The zero and/or span adjustment test gases are required for a basic adjustment.

Carrying out the basic adjustment
The basic adjustment is carried out for a measuring component. The basic adjustment can be conducted in three ways:
- Individually at the zero point or
- Individually at the end point or
- Together (successively) at the zero and end points

An adjustment reset is also performed in the case of joint basic adjustment at the zero and end points.

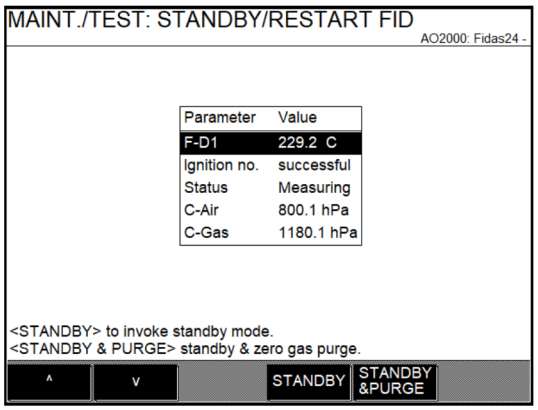
… 12 Maintenance

FID – Standby / Restart

Menu Path

'MENU / Maintenance/Test / Analyzer spec. adjustm. / Standby/Restart FID'

Display of the FID operating status



The key operating data of the FID 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	• Measuring: The analyzer module is OK, the measurement is running. • STANDBY: The analyzer module is in standby mode; the measured values are invalid. • Flame-Error: The flame is deactivated; the analyzer module needs to be restarted. • Fail safe: The analyzer module has been deactivated due to a severe error.
Air Pr.	Indication of combustion air pressure
C-Gas	Indication of combustion gas pressure

Definitions of the statuses

Standby mode means:

Heater on, combustion gas valve closed, combustion air valve closed, instrument air valve closed, housing purging on, zero point gas valve opened in standby mode with purging of the detector.

Fail-safe status:

heater off, combustion gas valve closed, instrument air valve closed, housing purging on, emergency purging on.

Putting the FID in standby mode

If in the 'Standby/Restart FID' menu, the **'STANDBY'** or **'STANDBY&PURGE'** softkeys are displayed, the FID 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 FID back to the measuring mode (restart)

If the FID 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.

FID 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 119.

A restart in the menu is not possible; after fault correction the analyzer module must be restarted by switching off and on again.

Configure saving of FTIR spectra

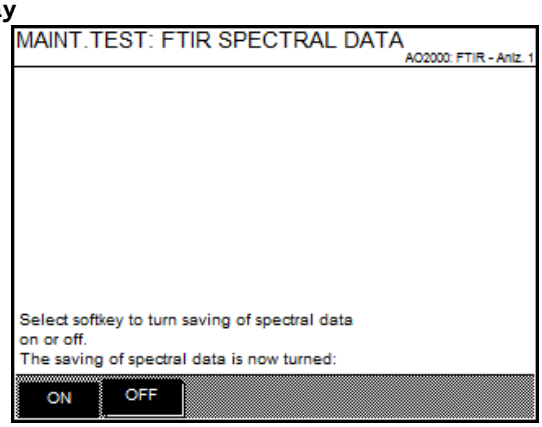
Function

It can be configured whether the FTIR spectra are saved in the analyzer system.
The spectra saved can be loaded via web access from the analyzer system.

Menu Path

"MENU / Maintenance/Test / Analyzer spec. adjustm. / FTIR Spectral data"

Display

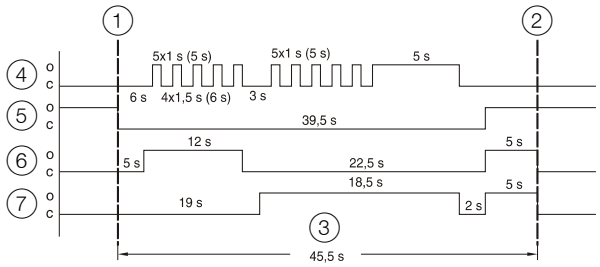


The appearance of the softkeys indicates the current status of the function. The image shows that the saving of FTIR spectra is activated. The saving of spectra is ended automatically after two hours.

… 12 Maintenance

Configure automatic back-purging of the gas extraction probe

Recommended program sequence for back-purging



1. Start cleaning
2. End cleaning
3. Cleaning cycle
4. -Y1.1/-Y1.2: Pulse compressed air
5. -Y4: Venting
6. -Y2.1/-Y2.2: Clean filter
7. -Y3.1/-Y3.2: Clean filter surface and probe tube

o Open
c Closed

Figure 36: Program process for back-purging

Function block application 'Back purging'

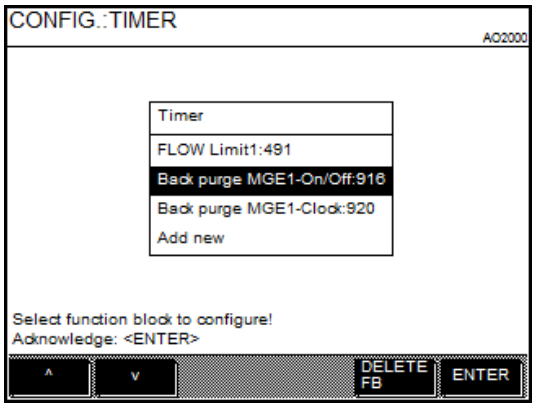
The automatic back purging of the gas collection probe is implemented as a function block application. The start time and cycle time of automatic back purging are to be set by the user.

Menu Path

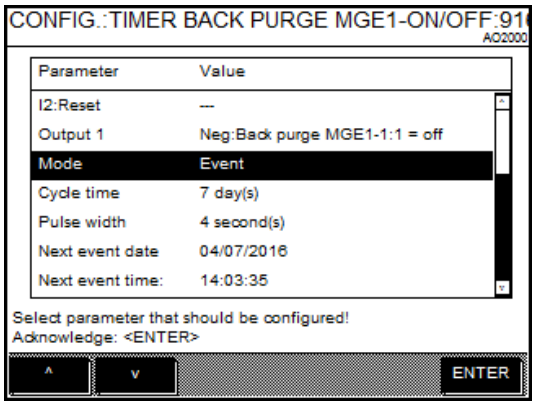
"MENU / Configure / Function blocks / Miscellaneous / Timer"

Use

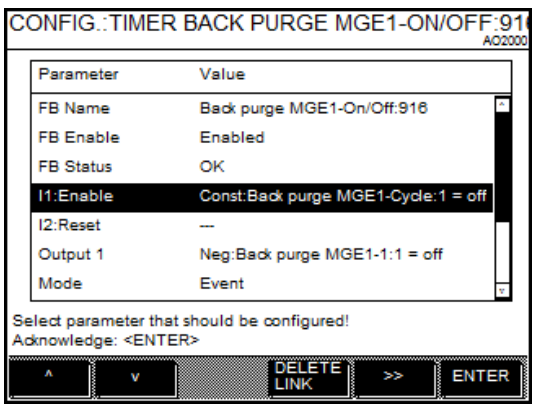
1. In the ' Timer" menu select the ' Blow back MGE1 on/off' function block.



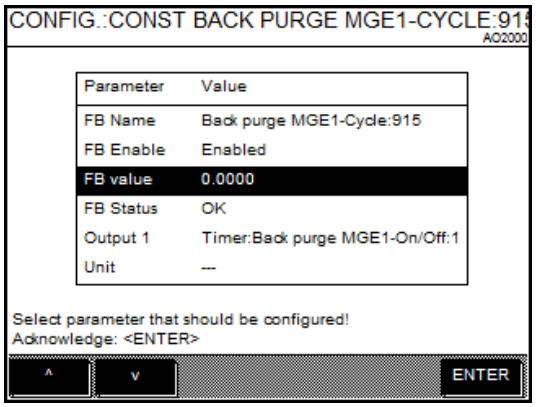
2. „Cycle time" and set ' Date" and ' Time: " for the next back-purge.



3. Select the ' I1:Enable" parameter and press '>>'.



4. In the selected ‘ Constant“ function block, switch on back-purging:
   - „FB value“ = 0 : Back-purging is switched off.
   - „FB value“ = 1 : Back-purging is switched on.



… 12 Maintenance

Replacement of wear parts

⚠ CAUTION

Risk of burns

Risk of burns on the sample gas extraction components (temperature approx. 180 °C)!

- Before working on the sample gas extraction unit, switch off the power supply and allow the sample gas extraction unit to cool for about 30 to 60 minutes.
- Wear suitable protective gloves and safety goggles.

⚠ CAUTION

Carrying out maintenance work

Risk of injury on contact with sample gas:

- Before executing maintenance work on the analyzer system, the maintenance control must be activated in the ‘Control’ display in order to set the ‘Function control’ status signal.
- Furthermore, the gas flow control in the ‘Control’ display must either be set to ‘zero gas local’ (zero air inlet directly on the measuring cell) or ‘zero gas probe’ (zero air inlet via probe) in order to avoid any contact with the measuring gas.
- After completing the maintenance work, the maintenance control and the gas flow control must be reset.

Note

For work on hot device parts, the temperature may drop and lead to a temperature error of the system and, where applicable, to the activation of emergency purging.
Once maintenance work is completed, wait until the temperature error is no longer active; where applicable, emergency purging needs to be deactivated.

Replacement cycle

Wearing parts	Replacement cycle
Filter on the gas extraction probe (see page 149)	At least every 12 months, depending on the dust content of the sample gas
Sample gas filter in the ASP block (see page 150)	At least every 12 months, depending on the dust content of the sample gas
Filter in the compressed air main controller (see page 152)	Every 12 months
Filter in the sample gas pressure controller (see page 153)	At least every 12 months, depending on the dust content in the ambient air
Filter cartridges in the air purifier (see page 154)	As required
Filter pad in the fan (see page 155)	At least every 12 months, depending on the dust content in the ambient air
Battery on the system controller (see page 155)	Approx. every 4 years
Pressure equalization screws in the top of the cabinet (see page 156)	Every 12 months

Spare part information

Information regarding spare parts can be found online in ‘ABB Business Online’ at https://online.abb.com/.

Note

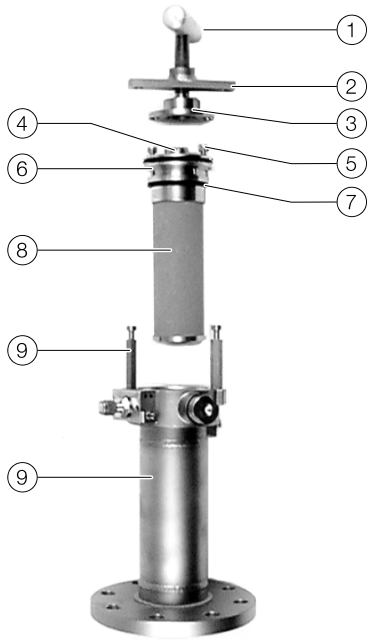
Only genuine ABB spare parts and consumables may be used!

Replacing filter on the gas sampling probe

Wearing parts

Wearing parts	Item no.	Replacements
Stainless steel filter with two FFKM O-ring seals	8329410	At least every 12 months, depending on the dust content of the sample gas
Seal set with two FFKM O-ring seals	801994	

The filter on the gas collection probe is fitted with seals from FFKM. Seals from FFKM must also be used when replacing the filter.



1. T-handle
2. Bridge
3. Detaching disk
4. Screw plug
5. Removal screws
6. Filter holder
7. O-ring seals
8. Filter
9. Bridge holding device
10. Housing

Figure 37: Filter unit

Cleaning or replacing filters

⚠ CAUTION

Risk of burns

Risk of burns on the sample gas extraction components (temperature approx. 180 °C)!

- Before working on the sample gas extraction unit, switch off the power supply and allow the sample gas extraction unit to cool for about 30 to 60 minutes.
- Wear suitable protective gloves and safety goggles.

⚠ CAUTION

Contact with sample gas

Risk of injury on contact with sample gas.

- Wear suitable protective gloves and safety goggles.

Note

Grease or other impurities on a new or cleaned filter – particularly with an analyzer system with integrated FID – can falsify the measured values.

When fitting a new or cleaned filter, wear disposable gloves nitrile, latex or similar material in order to prevent the filter from coming into contact with your skin.

Interrupt measurement operation, prepare filter removal

1. Switch analyzer system to “zero gas local”.
2. Wait until all FTIR measured values have dropped to zero.
3. Disconnect the sample gas line from the gas sampling probe and seal the probe connection with a blind fitting.
4. Remove thermal insulating hood from the filter unit.

Removing the filter element

5. On the filter unit, turn the T-handle (1) anti-clockwise. The filter insert (6) with the filter (8) is then pulled over the detaching disk (3) and out of the housing (10).
6. Rotate the bridge (2) until it can be pulled off the bridge holding device (9) through the elongated holes.
7. Pull out filter insert with bridge (2) and detaching disk (3).
8. Rotate the detaching disk (3) until it can be pulled off the hexagon bolts (5) through the elongated holes. Never loosen or tighten the hexagon bolts (5). They are factory-set to enable the detaching disk (3) to be moved easily.

Cleaning or replacing filters

9 **Either** clean filter (8)(10) Blow adherent dirt off the surface using compressed air; allow the compressed air to act diagonal to the surface.

… 12 Maintenance

… Replacing filter on the gas sampling probe

Or replace filter (8):

(4) Screw plug

(12) Hexagon socket screw

Figure 38: Replacing the filter

1. Remove screw plug (4) with a with a 22 mm open-end wrench.
2. Unscrew the hexagon socket screw (12) under the screw plug (4).
3. Remove filter.
4. Insert the new filter.

10. Replace seals (7) (O-rings from the accessories). The O-rings must not be greased; grease would falsify the measured values.

Fitting the filter insert

11. Refit the filter insert: Perform steps 5 to 8 in reverse order.

Restoring measuring mode

12. Remove blind fitting from the gas sampling probe and re-connect the sample gas line.
13. Perform seal integrity test (see **FID – Leak and function tests** on page 138) on the gas sample probe, including the sample gas line connection.
14. Fasten thermal insulating hood to the filter unit.
15. Restore sample gas feed.

Replacing sample gas filter in the ASP block

Wearing parts

Wearing parts	Item no.	Replacement, comment
Sample gas filter in the ASP block, mounted	769427	At least every 12 months, depending on the dust content of the sample gas
Spare bag O-rings	769424	1 large and 1 small O-ring

Replacing the entire sample gas filter

To avoid the analyzer system from being shutdown for prolonged periods, the entire sample gas filter should be replaced. The filter can then be removed, cleaned or replaced and assembled separately.

Cleaning or replacing sample gas filters

⚠ CAUTION

Risk of burns

Risk of burns at the ASP block
(temperature approx. 180 °C)!

- Wear suitable protective gloves and safety goggles!

Note

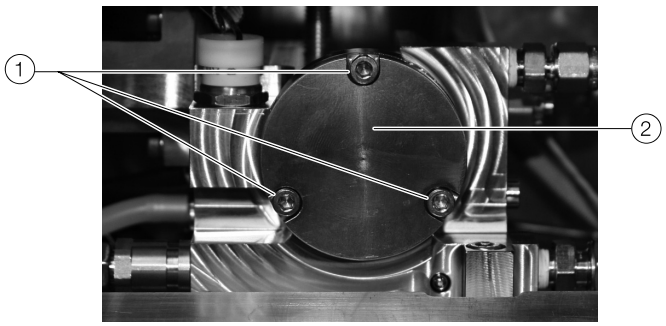
Hydrocarbons can – particularly on an analyzer system with integrated FID – falsify the measured values.
When fitting a new or cleaned filter, make sure that no hydrocarbons are introduced into the analyzer system. When handling a new or cleaned filter, wear disposable nitrile or latex gloves and use a degreased tool.

Prepare filter removal, interrupt measuring mode

1. Prepare a grease-free and heat-resistant working surface/shelf.
2. Lay out the degreased gripping tool (tongs, coarse tweezers or similar).
3. Lay out new filter. Make sure that the O-ring is correctly located in the groove of the filter provided for this purpose.
4. Switch analyzer system to ‘zero gas probe’.
5. Wait until all FTIR measured values have dropped to zero.

Removing the filter

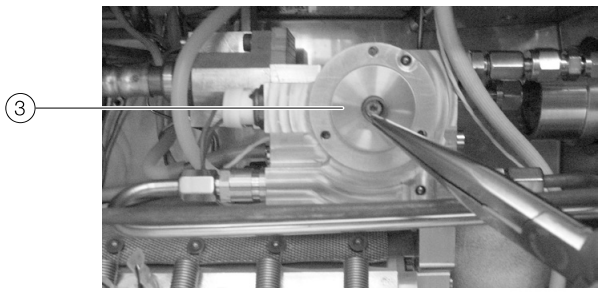
1. Open analyzer box AU2.
2. Undo three fixing screws ① (4 mm hexagonal spanner).



① Fixing screws ② Cover of the sample gas filter

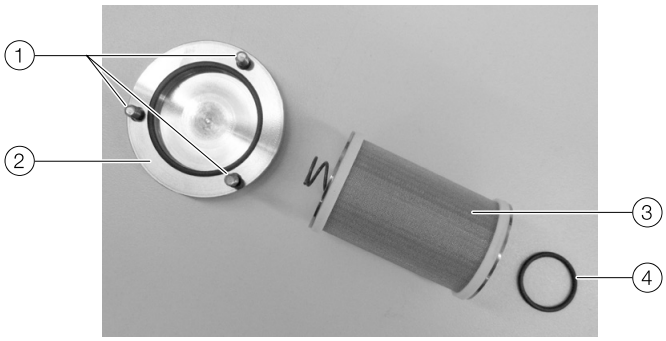
Figure 39: Remove filter 01

3. Remove the cover of the sample gas filter ② from the ASP block and set down on the prepared working surface and cool down to room temperature.
4. Use the degreased tool to grip the sample gas filter unit ③ at the spring, remove from the ASP block and set down on the working surface.



③ Sample gas filter unit

Figure 40: Remove filter 02



① Fixing screws ③ Sample gas filter unit
② Sample gas filter cover ④ O-ring

Figure 41: Remove filter 03

Fitting the filter

1. Use the degreased tool to grip the new filter at the spring and carefully insert it into the ASP block. Make sure that the O-ring ④ is correctly located in the groove of the new filter provided for this purpose. Always use only new O-rings, even with a cleaned sample gas filter. Contaminated or damaged O-rings impair the seal integrity of sample gas path; this leads to erroneous measured values.
2. Set the cover of the sample gas filter ② on the ASP block and tighten with the three fixing screws ①. Tighten the fixing screws until there is contact with the metal of the sample gas filter holder.

Restoring measuring mode

1. Perform the simplified seal integrity test (see **FID – Leak and function tests** on page 138).
2. Restore sample gas feed.

… 12 Maintenance

Replacing filter in the compressed air main regulator (-J85)

Wearing parts

Wearing parts	Item no.	Replacements
Filter in the compressed air main controller	990048	Every 12 months

Replacing the filter element

⚠ CAUTION

The compressed air main controller is under pressure (5.5 to 7 bar)!

Risk of injury when replacing the filter element.

- Switch off the compressed air supply before work on the compressed air main controller.
- Slowly unscrew the filter housing and release the residual pressure.

Prepare filter replacement, interrupt measuring mode

1. Switch analyzer system to ‘zero gas probe’.
2. Wait until all measured values have dropped to zero.
3. Disconnect the sample gas line from the gas sampling probe and seal the probe connection with a blind fitting.
4. Shut off the instrument air at the connection lead (source in front of the analyzer cabinet).
5. Wait until the pressure at the inlet has dropped (display on the compressed air main **–J85**).

Replacing the filter element

① Filter housing
② Cylinder
③ Filter plate

Figure 42: Replacing the filter element

1. Slowly unscrew the filter housing ① to relieve the residual pressure in the filter. If necessary, position a 22 mm open-end wrench at the bottom end of the filter housing.
2. Unscrew filter housing and remove.
3. Unscrew the filter plate ③ by hand; at the same time, fix the upper cylinder ② using your other hand.
4. Remove the used filter element and insert a new filter element.
5. Reassemble the filter: Perform steps 4 to 1 in reverse order. Screw on the filter housing only hand-tight.

Restoring measuring mode

1. Restart the instrument air supply.
2. Remove blind fitting from the gas sampling probe and re-connect the sample gas line.
3. Restore sample gas feed.

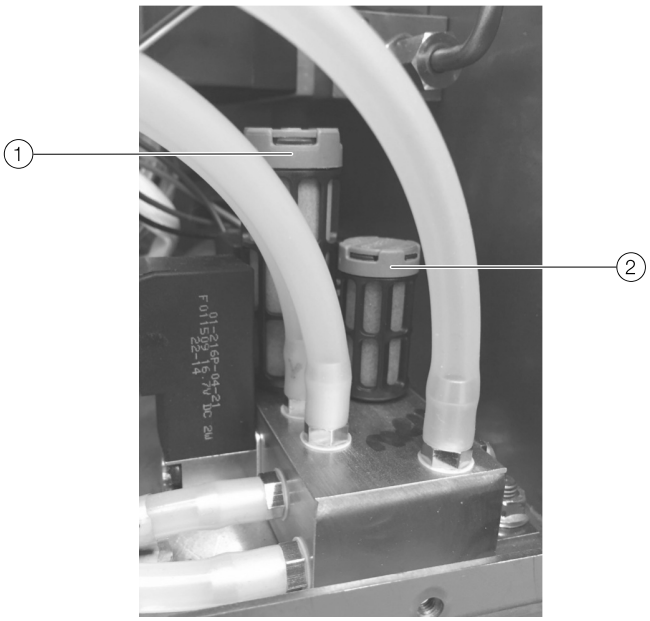
Replacing filters in the sample gas pressure controller

Wearing parts

Wearing parts	Item no.	Replacements
Filter in the sample gas pressure controller	4868313, 4805885	At least every 12 months, depending on the dust content in the ambient air

Replacing the filter

1. Loose 5 screws and remove the cover of the ACF5000 electronics box AU1. The paper filters in the sample gas pressure regulator are located on the right-hand side in the ACF5000 electronics box.



① large filter, item no. 4868313

② small filter, item no. 4805885

Figure 43:

2. Undo the used paper filter by hand and insert new filter.
3. Mount cover of the ACF5000 electronics box and fasten using the screws.

Note

Before replacement, the control variables need to be noted (for control variables > 85 the filters should be replaced) and compared with the control variables after replacement. They should be smaller after replacement. In the event of frequent soiling of the filters, the quality of the instrument air must be verified.

… 12 Maintenance

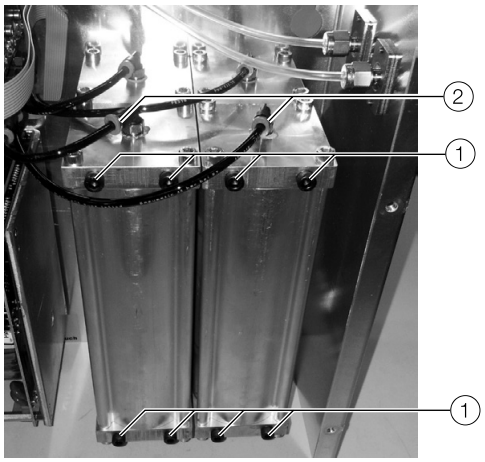
Replace filter cartridges in air purifier AU5

Wearing parts

Wearing parts	Item no.	Replacements
2 PU+CA filter in air purifier (AU5), mounted	8329425	Approx. every 3 years (depending on the quality of the instrument air)

Note
Do not leave connections of the new filter cartridge open for too long to avoid the penetration of moisture.

Replace filter cartridges



① hexagon socket screws ② Clamping ring

Figure 44: Replace filter cartridges

1. Interrupt instrument air supply to the air purifier **AU5** by closing the pressure reducer **–J85**.
2. Interrupt the power supply of the air purifier by pulling the cold device plug.
3. Loosen the four screws on the cover of the **AU5** air purifier and remove the cover.

Note
Only the two front filter cartridges must be replaced.

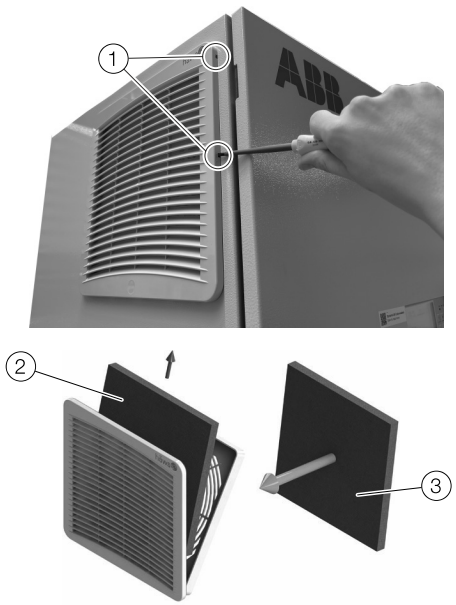
4. Loosen four hexagonal screws ① at the top and bottom on one of the filter cartridges.
5. Press the clamp ring ② at the top and bottom in the direction of the connection and pull out the hose.
6. Remove old filter cartridge and insert new filter cartridge (Input labeling downward).
7. Insert the hose against the resistance until the stop in the clamp ring, first down, then up.
8. Fasten the filter cartridge using the four hexagonal screws.
9. Repeat steps 4 to 8 on the other filter cartridge.
10. Mount the cover of the air purifier and fasten using the four screws.
11. Restore instrument air supply to the air purifier by opening the pressure reducer **–J85**.
12. Restore the power supply of the air purifier by re-inserting the cold device plug.
13. If an FID is installed in the analyzer system, the ‘Flame error’ status message is issued, because the instrument air supply was interrupted. Rectify this status by restarting the FID (see **Recommissioning** on page 42).

Replacing filter pad in the fan

Wearing parts

Wearing parts	Item no.	Replacements
Filter pad in the inlet and outlet filter	990046	At least every 12 months, depending on the dust content in the ambient air

Replacing the filter pad



① Openings
② Filter pad
③ Dense side of the filter mat

Figure 45: Replacing the filter pad

1. Use a screwdriver to lever the ventilation grille of the outlet filter (at the top of the left cabinet wall) out of the frame at the side openings ①.
2. Replacing the filter pad ② in the fan grille
   - Make sure that the dense side ③ of the filter pad is inserted in the direction of the air flow.
3. Insert fan grille into the frame and push in until it engages.
4. Repeat steps 1 to 3 at the inlet filter (at the right-hand cabinet wall, bottom).

Replacing the system controller battery

Wearing parts

Wearing parts	Type	Replacements
Battery on the system controller	Varta CR3032 (Type no. 6032) or Renata CR2032	Approx. every 4 years (as part of the maintenance work on the analyzer system)

NOTICE

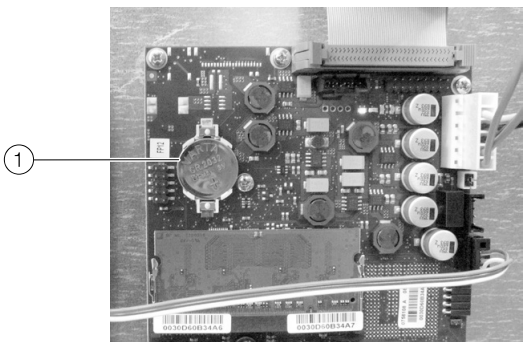
Danger from electrostatic discharge

Located on the system controller are electronic components, which are susceptible to damage by electrostatic discharges.

- Measures for preventing electrostatic discharges must be taken during battery replacement.
- Before the batteries are replaced, make sure that the power supply to the analyzer system is switched off.

Replacing the battery on the system controller

1. Loosen 10 screws and remove the cover of the system controller housing.
2. Remove the used battery ① from the holder and insert new battery into the holder.



① Battery

Figure 46: Replacing the battery on the system controller

3. Mount cover of the system controller housing and fasten using the screws.
4. Dispose of used battery in accordance with the locally applicable regulations.

… 12 Maintenance

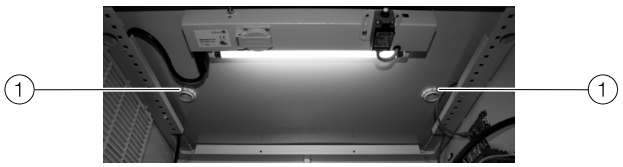
Replace pressure equalization screws

Wearing parts

Wearing parts	Item no.	Replacements
Pressure equalization screw connection	8329416	Every 12 months

Replace pressure equalization screws

1. Loosen the counter nut (1) in the top of the cabinet and remove the screw upwards.



(1) Counter nut

Figure 47:

2. Clean the area around the fastening boring with a damp cloth.
3. Insert new screw with sealing ring from the top and fasten with a counter nut from below.

13 Decommissioning

Safety instructions

⚠ 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.

⚠ WARNING

Risk of injury due to heavy components

Improper handling of heavy components can lead to serious crushing, broken bones or even fatal injuries.

- Use suitable equipment to lift and transport heavy components.
- Wear safety shoes.
- Always maintain a sufficient safety distance from suspended loads.
- Never stand under a suspended load.

⚠ WARNING

Risk of injury caused by transport equipment

Improper use of transport equipment can lead to personal injury and damage to property.

- Only authorized personnel may use transport equipment such as industrial trucks or cranes.

Shutting down the analyzer system

Shutting down the analyzer system temporarily

1. Switch the gas flow control on ‘zero gas probe’ (zero air connection via the probe) in order to interrupt the sample gas supply.
2. Wait until all measured values match the values of the cleaned zero point air from the air purifier.
3. Disconnect the sample gas line from the gas sampling probe and seal the probe connection with a blind fitting.
4. Switch the gas flow control to ‘Zero gas local’ (zero air supply local).
5. FID analyzer (optional):
   Shut off the combustion gas supply.
6. Switch off the power supply to the individual assemblies and finally the turn off the main switch on the right-hand side of the cabinet wall; with UPS, also turn off the two main switches.
7. Shut off the instrument air supply to the analyzer system.

… 13 Decommissioning

Packaging the analyzer system

⚠ WARNING

Injury hazard due to heavy weight

The analyzer system weighs approx. 300 kg!

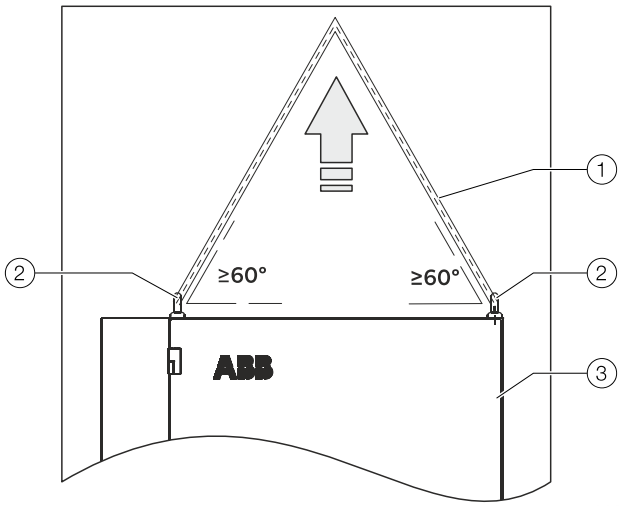
- A crane with suitable transport gear is required for unpacking and transporting!

NOTICE

Damage to the analyzer cabinet

The analyzer system may warp If the cable pull angle is too small.

- Use the provided transport lugs to attach the pull ropes to the analyzer system.
- The pull ropes must be long enough to ensure a minimum pull rope angle of 60° when under tension!



1 Pull rope
2 Transport lugs 4×
3 Analyzer system

Figure 48: Crane transport of the analyzer system

Vacuum pack the analyzer system in foil.

1. Lay out dessicant in the transport crate. Use an amount of desiccant that is appropriate for the packing volume and the expected transport time (min. 3 months).
2. Place the analyzer system into the transport crate on snubbers and chock.
3. Mark the transport crate as specified (in particular as ‘Fragile product’).

Note

- Moisture that could freeze at low storage and transportation temperatures must not remain in the analyzer system.
- The analyzer system and/or the FTIR spectrometer must be packaged at a dry and heated location, preferably at the installation site.
- Having the analyzer system transported by a specialist company is highly recommended.
- The analyzer system must be transported on its back side in the horizontal position.

Transport- / Storage temperature

−25 to 65 °C (−13 to 149 °F)

14 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.

15 Specification

Note

The device data sheet is available in the ABB download area at www.abb.com/analytical.

16 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:	

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):

☐ biological	☐ corrosive / irritating	☐ combustible (highly / extremely combustible)
☐ toxic	☐ explosive	☐ other toxic substances
☐ 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

Trademarks

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PROFIBUS and PROFIBUS DP are registered trademarks of PROFIBUS & PROFINET International (PI)

Notes

Notes

ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/analytical

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