

ACF5000

Multi-component FTIR analyzer system



Measurement made easy

—
ACF5000

Introduction

ACF5000 can measure up to 15 components simultaneously including water soluble components to accurately monitor the composition of exhaust gases.

The standard system design combines the advantages of a FTIR spectrometer, 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:



Contents

Preface	6
Safety instructions	8
Intended use	8
Safety instructions	8
Safety instructions for handling the analyzer system	11
Safety instructions for handling the analyzer system with integrated FID	12
Safety instructions for handling the FTIR spectrometer	13
Safety instructions for working with poisonous gases.....	14
Description of the analyzer system	15
Application and function of the analyzer system	15
Components of the analyzer system	17
Option "Hydrogen monitoring of the analyzer cabinet"	19
Preparation for installation.....	21
Selection of the sampling point, installation of the wall tube	21
Requirements for the installation site of the analyzer cabinet.....	23
Sample gas inlet conditions	25
Operating gases and test gases	26
Power supply	29
Dimensions, weights and noise level	31
Scope of supply and delivery	32
Material required for the installation (not supplied)	33
Installation.....	35
General notices	35
Installing the analyzer cabinet.....	36
Installing the gas sampling probe and filter unit	39
Installing the sample gas line	42
Installing the operating gases.....	44
Connecting the electrical leads	47
Commissioning	50
Recommissioning	50

Operation.....	54
Display and operation unit.....	54
Display	55
Message display.....	57
Status LEDs.....	58
Numeric keypad	59
Cancel keys.....	60
Softkeys.....	61
Text entry	63
Operating by value input	64
Operating by key entry	65
Password protection.....	66
Blocking operation	69
Operating the analyzer system	70
Menu structure	72
Display of measured value	73
Adjustment: Basics	74
Controlling the adjustment	74
Manual adjustment.....	75
Automatic adjustment.....	76
Adjustment methods	78
FID: Conversion of concentration data.....	81
Adjustment: Configuration	83
Configuring the automatic reference FTIR	83
Automatic Adjustment Check (AAC): Configuring the time sequence	85
Automatic Adjustment Check (AAC): Settings and export of the QAL3 data	88
Configuring the Automatic Drift Check (ADC)	91
Configuring manual adjustment.....	94
Configuring automatic adjustment of the FID.....	95
Configuring automatic adjustment of the oxygen sensor	98
Check time conflicts of the automatic processes	100
Output current response.....	102
Adjustment: Operation	103
Carrying out manual reference.....	103
Start Automatic Adjustment Check (AAC) manually	109
Carry out manual adjustment.....	111
Manual start of automatic adjustment	112
Configuration: Component functions	113
Configuring measuring range	113
Configuring automatic measuring range switching.....	118
Configuring filter	120
Active component selection	121
Configuring limit monitoring	122
Configuring FTIR limit monitoring	123
Configuring dry base and O ₂ reference	125
Changing module name.....	127

Configuration: System functions	128
Setting time zone, date and time	128
Selecting user interface language	129
Change password	130
Blocking operation	131
Setting system modules.....	132
Add system module.....	134
Replace system module.....	135
Delete system module	136
Save configuration	137
Configuring status signals.....	138
Configuring Ethernet connection.....	139
Configuring Modbus connection.....	140
Configuring Profibus.....	141
Configuring Bus I/Os	143
Configuration: Display functions	144
Display features	144
Display overview	147
Page overview.....	148
Parameter overview.....	149
User page configuration	151
Moving a display element from one page to another	152
Moving a display element within a page	153
Configuring the bar display or point display.....	154
Value input	156
Configuring value input	157
Key entry.....	158
Configuring key entries	160
Maintenance	161
General notices	161
Visual inspection.....	162
Cleaning the analyzer cabinet	163
Seal integrity test	164
FID: Seal integrity and functional checks	166
Maintenance switch	169
Emergency purging	170
Monitoring the internal cabinet temperature	171
Connecting gas paths and inserting validation cells	172
Changing analog output current range.....	174
Adjustment reset	175
Basic adjustment	176
FID: Standby/Restart	177
Configuring saving of FTIR spectral data.....	179
Configuring automatic back-purging of the gas extraction probe	180
Replacing wearing parts.....	183
Replacing filter on the gas sampling probe.....	184
Replacing sample gas filter in the ASP block.....	187
Replacing filter in the compressed air main regulator (-J85)	190
Replacing filters in the sample gas pressure regulator	192
Replacing filter cells in air purifier AU5.....	193

Replacing filter pad in the fan	195
Replacing the battery on the system controller.....	196
Replacing pressure equalization screws	197
Status messages, troubleshooting	198
Dynamic QR code	198
Process status	200
System status: Status messages.....	201
System status: Status signals	203
Status message categories	205
Status message system	207
Status messages FTIR.....	217
Analyzer system: Troubleshooting	221
FID: Troubleshooting	223
Notify service.....	226
Decommissioning	227
Shutting down the analyzer system.....	227
Packing the analyzer cabinet	227
Disposal	228
Index	229

Preface

Content of the operating instruction

This operating instruction contains all the information you will need to safely and properly install, commission, operate and maintain the analyzer system.

This operating instruction contains information on all functional components of the analyzer system. It is possible that the analyzer system delivered differs from the version described here.

System documentation

The system documentation is supplied together with the analyzer system. It includes:

- Analyzer Data Sheet,
- Commissioning instruction,
- Certificates (e.g., manufacturer declaration),
- DVD-ROM "Software tools & technical documentation" with
 - Software tools,
 - Operating instructions,
 - Data sheets,
 - Technical information,
 - Certificates.
- CD-ROM with the set of drawings prepared specifically for the analyzer system delivered:
 - Component location diagram,
 - Piping diagram,
 - Interface diagram,
 - Wiring diagram,
 - Connection diagram.

Further information

Internet

You can find information on ABB Analytical products and services online at <http://www.abb.de/analytical>.

Service contact

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




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

ABB Service,

Telephone: +49-(0)180-5-222 580, Fax: +49-(0)621-381 931 29031,

E-mail: automation.service@de.abb.com

Identification of safety instructions in this operating instruction

 DANGER	If the safety instruction identified in this way is not observed, an accident will occur. This will result in severe bodily injury or death.
 WARNING	If the safety instruction identified in this way is not observed, an accident may possibly occur. This may result in severe bodily injury or death.
 CAUTION	If the safety instruction identified in this way is not observed, an accident is likely to or will definitely occur. This may result in moderately severe or slight bodily injury.
CAUTION!	Denotes information about possible equipment damage when there is no danger to personnel.
NOTICE	Denotes information about particular features with regard to the handling of the analyzer system and the use of this operating instruction.

Letters and numbering used in this operating instruction

1, 2, 3, ...	Is the way reference numbers are used in the figures.
Display	Is the way information is presented in the display.
Input	Indicates an input by the user <ul style="list-style-type: none"> • either by pressing a softkey • or by selecting a menu item • or via the numeric keypad
p_e	Gauge pressure
p_{abs}	Absolute pressure
p_{amb}	Atmospheric pressure

Safety instructions

Intended use

Intended use

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

Any other use is not approved.

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

The analyzer system may not be used for the measurement of ignitable gas/air or gas/oxygen mixtures during normal service. The analyzer system may not be set up in potentially explosive atmospheres.

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.

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, commissioning, 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 instructions 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 operating instruction are applicable in the Federal Republic of Germany. The applicable national regulations should be followed when the device is used in other countries.

Device safety and safe operation

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

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 conductor terminal

The protective ground conductor should be attached to the protective conductor terminal before any other connection is made.

Danger of a disconnected protective ground conductor

The device can be hazardous if the protective ground conductor is interrupted inside or outside the device or if the protective conductor terminal is disconnected.

Dangers 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.

Dangers 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 dangers 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 handling the analyzer system

⚠ WARNING

The warning symbols affixed to the analyzer system must be observed:



Heed the operating instruction!



Hot surface! (Temperature > 60°C)



Danger of electric shock!

The following must also be observed:

- The safety instructions for handling the analyzer system with integrated VOC analyzer (see page 12),
- the safety instructions for handling the FTIR spectrometer (see page 13), and
- the safety instructions for working with poisonous gases (see page 14).

⚠ WARNING

The gas paths in the analyzer system and the integral analyzer must not be opened! The gas paths can become leaky as a result.

If the gas paths inside the analyzer system must nevertheless be opened, it is essential that they be subjected to a leak test after being closed again.

Safety instructions for handling the analyzer system with integrated FID

Safety measures

If an FID (VOC analyzer) is installed in the analyzer system, the following safety measures are taken at the factory to ensure safe operation:

- Installation of a hydrogen flow restrictor in the cabinet wall (bulkhead fitting with an integrated flow restrictor, max. 10 l/h, for connection to the combustion gas line),
- Use of stainless steel piping, compression fittings and valves,
- Shutoff of the hydrogen supply in the event of malfunctions,
- Check of the combustion gas paths for leaks inside the analyzer cabinet,
- Installation of pressure equalization fittings on the top of the cabinet to allow escape of hydrogen to the outside in the event of leaks.

As an additional safety measure, the analyzer system can be equipped with the option "Hydrogen monitoring of the analyzer cabinet" (see page 19)

WARNING

The combustion gas path in the analyzer cabinet and especially in the integral FID must not be opened! The combustion gas feed path can become leaky as a result!

If the combustion gas path inside the analyzer cabinet nevertheless is opened, it is essential that it be subjected to a leak test with a hydrogen leak detector after it is closed again!

The bulkhead fitting with integral flow restrictor for connection of the combustion gas line is a safety-relevant component. It may be replaced only by certified service personnel.

The integrity of the combustion gas path in the analyzer system as well as the combustion gas feed line must be checked prior to commissioning as well as regularly during operation.

Combustion gas that escapes from leaks in the gas paths can cause fires and explosions, even outside the analyzer system!

Sufficient ventilation must be provided at the installation site of the analyzer system.

Safety instructions for handling the FTIR spectrometer


Central unit with electronics module (power supply):

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".

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

Laser safety

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

	<p>Type of laser installed in the interferometer: Class 3B VCSEL laser to IEC 60825-1 as well as 21 CFR Chapter 1, Subchapter J</p> <p>Output: max. 3 mW</p> <p>Wavelength: 760 nm (laser beam invisible to the human eye)</p>
⚠ WARNING	<p>The housing of the interferometer AU3 may not be opened during normal operation. It contains no user-operated parts.</p> <p>The housing of the interferometer may be opened only by authorized ABB service personnel.</p>
⚠ DANGER	<p>Opening the housing of the interferometer AU3 and the interferometer module in particular can result in contact with laser radiation.</p> <p>Radiation from Class 3B lasers poses a danger to the human eye both when viewed directly and if reflected.</p>

Safety instructions for working with poisonous gases

WARNING

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 work place limit values of the measurement and test gases must be observed.

Description of the analyzer system

Application and function of the analyzer system

Application

The ACF5000 analyzer system is a multi-component analyzer system for continuous measurement of the concentration of individual components in the flue gas of industrial incinerators.

The field of application of this measuring equipment basically involves tasks associated with emissions monitoring; use in process control applications, however, is also possible.

Function

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 that removes dust particles from the gas. As a standard feature, the analyzer system controller offers the ability to connect the zero gas and test gas to the sampling probe upstream of the filter element automatically. Automatic cleaning of the sampling probe filter is available 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 or condensation of flue gas. The heating is controlled and monitored by the system's electronics.

An optional heated measuring point selector can be configured for process measurements.

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). This, in turn, is connected directly to the heated gas cell.

Test gases can be connected either automatically or manually to both the gas sampling probe and directly to the analyzer.

Measuring 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.

Options

Validation

A validation unit 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 measured 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. It offers a 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. Remote control of the analyzer system is possible via a UMTS router. Analog outputs for the measured components and relay contacts for fault/status messages are optional.

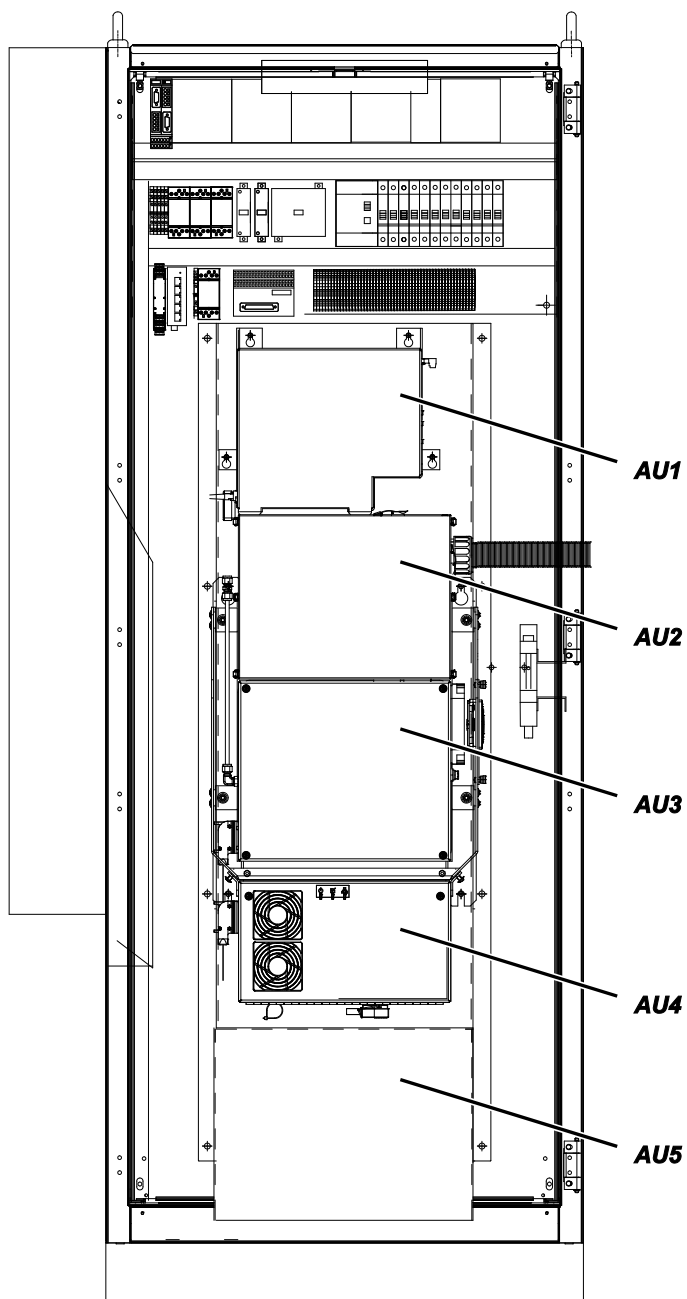
Components of the analyzer system

NOTICE

A delivered analyzer system may not include certain individual assemblies described in this section depending on the measurement task and execution ordered.

Assemblies in the analyzer cabinet

- AU1** ACF5000 E-box
- AU2** Analyzer box
- AU3** Interferometer box
- AU4** FTIR E-box
- AU5** Air purifier



Gas sampling

- 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)
- Heated selector valve for switching between two sampling points (option)

CAUTION!

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

Sample gas conditioning

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

Air preparation

- Zero air for the spectrometer and end point gas for the oxygen sensor and combustion air for the FID
- Purge gas for the spectrometer and the entire measuring system

Analyzers

- FTIR spectrometer with heated measuring cell
- Oxygen sensor (ZrO₂ sensor)
- Flame ionization detector (FID, option)

Control, operation and display

- Display and control unit in the door of the analyzer cabinet
- AO2000 system controller in the door of the analyzer cabinet
- ACF5000 electronics box AU1
- Controls 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 (modem and/or Ethernet)

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

Option "Hydrogen monitoring of the analyzer cabinet"

Function

The "Hydrogen monitoring of the analyzer cabinet" option is an additional safety measure when an FID analyzer is built-in in the analyzer system. 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 – at 40% LEL. This prevents formation of an ignitable mixture.

Scope of supply and delivery

Installed in the analyzer cabinet:

- In the upper area, an ATEX-certified gas sensor with connection socket,
- Outside on the right side wall, a solenoid valve that interrupts the hydrogen supply at 40% LEL and at power supply failure (H₂ safety valve).

Also supplied:

- A gas warning center 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.

Installation

The electrical wiring of the gas sensor and the gas warning center for switching off the power supply in the event of an alarm has not yet been completed in the factory delivered condition of the analyzer system.

The gas warning center must be installed outside the analyzer cabinet in a non-hazardous area in a distribution cabinet or similar. It 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 as well as the coils of the contactors and relays for disconnecting the power supply and UPS (if present) must be connected to a fault-signaling contact in the gas warning center. The fault-signaling contact must be set so that the voltage is shut off at 40% 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 so designed that after the power supply (and possibly 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.

Potential-free measurement and status signals as well as bus connections do not have to be disconnected separately in the event of a gas alarm. If, however, an external signal that is not potential-free is fed in, the operator must ensure that it is shut-off when the gas alarm is triggered, e.g. via an isolating relay.

NOTICES

The gas sensor installed in the analyzer cabinet is not calibrated at the factory; it is not functional without calibration. The calibration of the gas sensor is the responsibility of the operator.

Installation, commissioning, parameterization, operation, signal evaluation and maintenance of the supplied gas warning center are the responsibility of the operator.

WARNING

If the above-mentioned instructions are not observed or the hydrogen monitoring of the analyzer cabinet is installed incorrectly, a hydrogen explosion may occur in the event of a malfunction.

Preparation for installation

Selection of the sampling point, installation of the wall tube

Selection of the sampling point

- The sampling point must be suited for extracting 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 soiling. The protective enclosure provides protection class IP54.

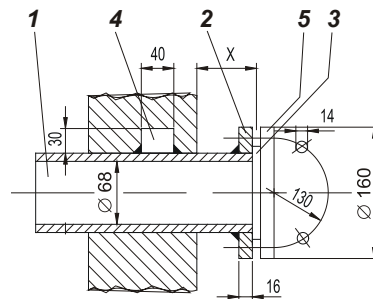
NOTICE

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.

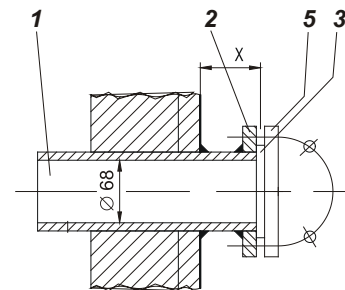
Installation of the wall tube with mounting flange

The wall tube with mounting flange (DN 65, PN 6, facing type A 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.

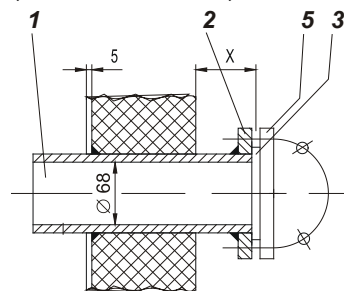
Installation of the wall tube
in brickwork
(dimensions in mm):



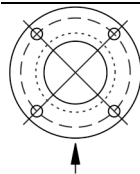
Installation of the wall tube
in brickwork with metal sheeting
(dimensions in mm):



Installation of the wall tube
in an insulated sheet-metal channel
(dimensions in mm):



1	Wall tube
2	Assembly flange DN 65, PN 6, facing type A to DIN EN 1092-1
3	Gasket
4	Welded-on rectangular block
5	Sampling probe flange



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 wall tube so that the holes are located in the position shown here.

Minimum distance x_{\min} of the mounting flange on the wall tube 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

Requirements for the installation site of the analyzer cabinet

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 VAC and 40 meters when connected to 120 VAC. Depending on the altitude of the installation site, these values may be lower.
- The test gas bottles should be set up as close as possible to the analyzer cabinet.

Protection from adverse ambient conditions

- The analyzer cabinet must be protected from
 - Jets of water,
 - Contact with chemicals,
 - Strong sunlight and heat,
 - Strong air currents
 - Extremely dusty environments,
 - Corrosive atmosphere
 - Vibration.

Climatic conditions

- Ambient temperature for storage and transport -25 to +65°C
- Ambient temperature during operation
 - with built-in fan (option) +5 to +30°C
 - With built-in air conditioner (option) +5 to +45°C
- Relative humidity during operation
 - Annual average max. 75%
 - briefly max. 95%
- seldom and slight condensation permissible if the analyzer system is switched on and the FTIR spectrometer is purged

NOTICE

The analyzer cabinet should be packaged during storage and transport!

IP rating

Analyzer cabinet: IP 54

Installation site

CAUTION!

The analyzer cabinet may not be set up in potentially explosive atmospheres!

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 installation site height of 720 m. 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 a low concentration cannot be assured.

Space requirement

- 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

WARNING

The pressure equalization fittings in the top of the analyzer cabinet may not be closed 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.

Floor

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

Sample gas inlet conditions

⚠ WARNING

The analyzer system may not be used for the measurement of ignitable gas/air or gas/oxygen mixtures during normal service.

CAUTION!

The analyzer system may 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, all seals in contact with the sample gas must be made of FFKM. This applies also and particularly in the case of a gas sampling probe with filter and a sample gas line delivered separately.

NOTICE

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

Sample gas inlet conditions

Temperature	Controlled to $180 \pm 2^\circ\text{C}$ by means of the heated sample gas line
Inlet pressure	Analyzer cabinet inlet leading to the sample gas handling block: $p_{\text{abs}} = 900 \text{ to } 1100 \text{ hPa}$ (0.9 to 1.1 bar)
Flow rate	80 to 300 l/h

Operating gases and test gases

FTIR spectrometer

Zero air:

Quality	Clean compressed air from the air purifier
Inlet pressure	$p_e = 2000 \pm 100 \text{ hPa}$ ($2.0 \pm 0.1 \text{ bar}$)
Flow rate	max. 500 l/h

Span gas:

Quality	Measured component in N_2 , 70 to 80% of the measuring range (accuracy $\pm 2\%$)
Inlet pressure	$p_e = 1500 \pm 100 \text{ hPa}$ ($1.5 \pm 0.1 \text{ bar}$)
Flow rate	max. 500 l/h

NOTICE	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.
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⚠ WARNING	Test gases for the FTIR spectrometer may only be issued by trained service personnel. 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. Before opening the cabinet, the test gas supply therefore needs to be shut-off and the leakproofness of the test gas line verified by observing the pressure on the manometer. The leakproofness is ensured only if the pressure remains constant.
------------------	--

FID

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

Combustion gas:

Quality	H ₂ , quality 5.0
Inlet pressure	$p_e = 1200 \pm 100 \text{ hPa}$ ($1.2 \pm 0.1 \text{ bar}$)
Flow rate	approx. 4 l/h

NOTICE 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.

Zero gas:

Quality	N ₂ , quality 5.0
Inlet pressure	$p_e = 1500 \pm 100 \text{ hPa}$ ($1.5 \pm 0.1 \text{ bar}$)
Flow rate	max. 500 l/h

Span gas:

Quality	n-Propane C ₃ H ₈ in N ₂ , 70 to 80% of the measuring range (accuracy $\pm 2\%$)
Inlet pressure	$p_e = 1500 \pm 100 \text{ hPa}$ ($1.5 \pm 0.1 \text{ bar}$)
Flow rate	max. 500 l/h

NOTICE Since the FID analyzer measures only the number of C atoms, the concentration of the zero gas must be converted from ppm or mg/m³ C_n H_m into ppm or mg/m³ C (see page 81).

Oxygen sensor

Zero gas:

Quality	3 vol.% O ₂ in N ₂ (accuracy $\pm 2\%$)
Inlet pressure	$p_e = 1500 \pm 100 \text{ hPa}$ ($1.5 \pm 0.1 \text{ bar}$)
Flow rate	max. 500 l/h

Span gas:

Quality	Clean compressed air (20.96 vol.% O ₂) from the air purifier
Inlet pressure	$p_e = 1500 \pm 100 \text{ hPa}$ ($1.5 \pm 0.1 \text{ bar}$)
Flow rate	max. 500 l/h

Instrument air

Quality	On the basis of ISO 8573-1:2001 class 2 (max. particle size 1 to 5 μm , max. 10 particles/ m^3 , max. oil content 0.1 mg/ m^3 , max. vapor pressure dew point -40°C)
Inlet pressure	$p_e = 5500$ to 7000 hPa (5.5 to 7.0 bar)
Flow rate	In normal mode 3000 to 3800 l/h, during adjustment briefly up to 5000 l/h
NOTICE	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-purging

Quality	Instrument air
Inlet pressure	max. 6 bar for back-purging, approx. 4 bar as control air (needed for 2-stage back-purging with Type PFE2 filter unit and with FID)
Flow rate	approx. 1600 l/min (duration of the back-purging procedure approx. 45 seconds, see page 180)
NOTICE	Compressed air is needed to clean the sampling filter and the probe tube as well as for controlling the control valves.

Definition

$p_e = p_{\text{abs}} - p_{\text{amb}}$ with p_e = gauge pressure, p_{abs} = absolute pressure, p_{amb} = atmospheric pressure

Power supply

Power supply

Voltage	230/400 VAC, 3 phases ¹⁾ or 120/208 VAC, 3 phases ¹⁾ or 100/200 VAC, 3 phases (via transformer), ± 10%, 48 to 62 Hz	
Fuse (external)	3 x 20 A or 3 x 25 A	
Power consumption	approx. 2200 VA, approx. 1500 VA	during power-up, during operation
	+ approx. 800 VA	for heated probe tube
	+ approx. 250 VA	for heated filter unit
	+ approx. 90 VA/m	for heated sample gas line
	+ approx. 1000 VA	for air conditioner
	+ approx. 350 VA	for heated selector valve with "2nd measuring location" option
1) L1, L2, L3, N, PE, current-carrying neutral is not allowed.		

Uninterruptible power supply (UPS)

The option "prepared for UPS" is not possible in the case of a 100 VAC power supply.


Voltage	230 VAC, 1 phase ¹⁾ or 120 VAC, 1 phase ¹⁾ , 48 to 62 Hz
Fuse (external)	20 A
Power consumption	approx. 500 VA (incorporated into above values)
1) L, N, PE, current-carrying neutral is not allowed.	

Service socket

230 VAC or 120 VAC, 48 to 62 Hz, max. 5 A.

The service socket is located in the cabinet light fixture.

Fuses

	Function	Rated value
–F80	Supply ground-fault circuit interrupter	30 A/30 mA
–F81	Fan or air conditioner (option)	6 A or 16 A at 230 V, 20 A at 120 V
–F82	Lighting, service socket	6 A
–F83	Type 42 probe tube heater, PFE2 filter unit heater, back-purging valves	6 A (only PFE2) or 10 A (PFE2 + probe 42, 230 V) or 16 A (PFE2 + probe 42, 120 V)
–F84	Heated sample gas line	16 A
–F85	ACF5000 electronics box AU1, ASP block heater, gas cell heater	6 A
–F86	Air purifier, FTIR spectrometer, flow monitor, system controller, power supply unit 24 V/5 A	6 A
–F87	Option "2nd measuring location": Type 42 probe tube heater, PFE2 filter unit heater, back-purging valves	6 A (only PFE2) or 10 A (PFE2 + tube 42, 230 V) or 16 A (PFE2 + tube 42, 120 V)
–F88	Option "2nd measuring location": heated sample gas line	16 A
–F89	Option "2nd measuring location": heated selector valve and heated sample gas line to analyzer cabinet	6 A
–F90	UPS supply ground-fault circuit interrupter	25 A/30 mA
–F91 to –F99	Relay coils, contactor coils, solid-state relays, selector to solenoid valve (ceramic fuses)	T 2 A
<div>  <div>High leakage current: 9 mA!</div> </div>		

Safety

Overvoltage category

II

Pollution degree

2

Dimensions, weights and noise level

Dimensions

see "Location diagram" in the system documentation

Weights

Analyzer cabinet		approx. 300 kg
Type 40 probe tube (unheated) depends on length	500 mm	1 kg
	1000 mm	2 kg
	1500 mm	3 kg
	2000 mm	4 kg
	2500 mm	5 kg
Type 42 probe tube (heated) depends on length	1000 mm	8 kg
	1500 mm	10 kg
	2000 mm	12 kg
Type PFE2 filter unit, heated, with protective enclosure		20 kg
Type TBL01 sample gas line, heated		1 kg/m
System transformer from 100 V to 230 V		42 kg
Electrical distribution cabinet for "2nd measuring location" option		60 kg
Heated selector valve for "2nd measuring location" option		8 kg

Noise level

Fan	50 Hz	59 dB(A)
	60 Hz	61 dB(A)
Air conditioner		70 dB(A)

Scope of supply and delivery

Standard scope of supply and delivery

Qty.	Description
1	Analyzer cabinet (all components installed)
1 set	system documentation

Included with delivery if ordered

Qty.	Description
1	Type 40 (unheated) or Type 42 (heated) gas sampling probe
1	Type PFE2 filter unit, heated
1	Type TBL01 sample gas line, heated
1	System transformer, 100 V to 230 V (option)

2nd measuring location option

Qty.	Description
1	Type 40 (unheated) or Type 42 (heated) gas sampling probe
1	Type PFE2 filter unit, heated
1	Type TBL01 sample gas line, heated
1	Heated selector valve
1	Heated sample gas line to analyzer cabinet
1	Electrical distribution cabinet for 2nd measuring location

"Hydrogen monitoring of the analyzer cabinet" option

Qty.	Description
1	Gas warning center Unipoint
1	Contactator for disconnecting the power supply to the analyzer cabinet
1	Contactator for disconnecting the UPS if the system is prepared for a UPS
1	Unipoint Multilingual Manual CD
1	Sensepoint Manuals CD

NOTICE The gas sensor and the H₂ safety valve are installed in the analyzer cabinet.

Material required for the installation (not supplied)

Gas sampling

Wall tube with mounting flange (DN 65, PN 6, facing type A to DIN EN 1092-1)

Gas lines

Instrument air	1 tube or compressed-air hose, O.D. 8 mm or $\frac{3}{8}$ in. (with pressure regulator and shut-off fitting)
Combustion gas for the FID	1 extremely clean (hydrocarbon-free) stainless steel tube (SS316), O.D. 6 mm (ABB item no. 0017400, length = 6 m) or $\frac{1}{4}$ in. 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 $\frac{1}{6}$ in./ $\frac{1}{4}$ in.
Test gas O ₂ measurement	1 PTFE tube 4/6x1 mm or $\frac{1}{6}$ in./ $\frac{1}{4}$ in.
Test gases for VOC measurement	2 PTFE tubes 4/6x1 mm or $\frac{1}{6}$ in./ $\frac{1}{4}$ in.
Test gases for drift check	3 PTFE tubes 4/6x1 mm or $\frac{1}{6}$ in./ $\frac{1}{4}$ in.
Purge gas for sampling	1 PTFE tube 4/6x1 mm or $\frac{1}{6}$ in./ $\frac{1}{4}$ in., length about the same as the sample gas line
Waste gas	1 hose, O.D. 12 mm or $\frac{1}{2}$ in. Pressure reducer for high-purity gases

Power supply lines

Power supply	5 x 6 mm ² in compliance with DIN EN 61010-1 or 5 x AWG8
UPS (option)	3 x 2.5 mm ² or 3 x AWG14
Connecting cables	for the connections from the analyzer cabinet to the heated gas sampling probe, filter unit, and sample gas line (possibly in temperature-resistant design; take the power consumption of these components into account) <ul style="list-style-type: none"> Probe tube type 42: 3 x 1.5 mm² or 3 x AWG16 Filter device PFE3: 3 x 1.5 mm² or 3 x AWG16 Backflush for filter device PFE3: 8 x 1.5 mm² or 8 x AWG16 Sample gas line TBL01 1-phase: 3 x 2.5 mm² or 3 x AWG14 Sample gas line TBL01 3-phase: 5 x 2.5 mm² or 5 x AWG14
Grounding cable	≥ 10 mm ² or AWG6
Fire resistance	The fire resistance of all cables and wires connected to the ACF5000 system must comply with flammability class VW1, FT1 or EN60332-1-2/-2-2.

NOTICE

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

Signal lines

Analog outputs	Shielded cables for the analog outputs (current outputs): 2 x 0.5 mm ² or 2 x AWG20 per analog output
Analog inputs	Shielded cables for the analog inputs (current inputs with the option "external analog inputs"): 2 x 0.5 mm ² or 2 x AWG20 per analog input
Digital outputs	Cables for the digital outputs: 5 x 0.5 mm ² or 5 x AWG20 per group of 4 digital outputs
Digital inputs	Cables for the digital inputs (with the option "external digital inputs"): 2 x 0.5 mm ² or 2 x AWG20 per digital input
Data lines	Cables for the data lines (Modbus, PROFIBUS, Ethernet), possibly fiber-optic cables for longer transmission distances. On the right side wall of the analyzer cabinet, connectors for the direct connection of assembled data cables can be found (Sub-D 9-pin or RJ45 or M12 panel feed-through 5-pin or 8-pin).
Resistance thermometer	Cables for the Pt 100 resistance thermometers in the heated components; 3 x 0.75 mm ² or 3 x AWG20 per temperature sensor
Fire resistance	The fire resistance of all cables and wires connected to the ACF5000 system must comply with flammability class VW1, FT1 or EN60332-1-2/-2-2.
NOTICE	When selecting the cable material, observe the applicable national safety requirements for installing and operating electrical equipment.

Assembly

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

Installation

General notices

- It is recommended that the analyzer system be 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 shipping damage which indicates improper handling, file a damage claim with the shipper (rail, mail, or freight carrier) within seven days.
- Ensure that the enclosed accessories are not lost (see "Scope of supply and delivery", see page 32).
- Retain the packaging material and the transport protection for possible future transport.

Installing the analyzer cabinet

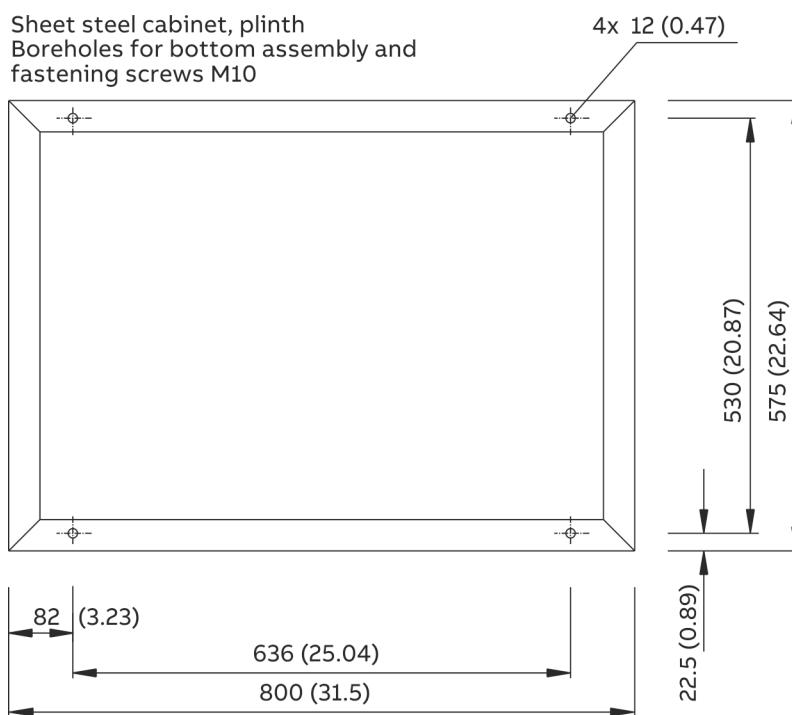
NOTICE

It is strongly recommended to have the analyzer cabinet

- transported by a qualified company
- while the cabinet is lying on its back as long as possible and
- to stand it up only immediately prior to installation!

Providing the foundation

- Refer to the "Requirements for the installation site" (see page 23)
- Observe the "Arrangement diagram" in the system documentation.
- Provide concrete base with cast-in stud bolts (M10) or iron base frame with holes or grate (see following image, dimensions in mm (inch)).



Unpacking the analyzer cabinet

CAUTION

The analyzer cabinet weighs approx. 300 kg! A crane with suitable transport gear is required for unpacking and transporting!

To attach the towing ropes to the analyzer cabinet, use the provided transport lugs.

The pull ropes must be long enough to ensure a minimum angle of 60° when under tension! Otherwise, the analyzer cabinet may warp.

- 1 Open the transport case and take out the analyzer cabinet.
- 2 Do not remove the plastic film in which the analyzer cabinet is wrapped for the time being! Unpacking the analyzer cabinet when cold can cause condensation.
- 3 Remove the plastic film only when the analyzer cabinet has reached room temperature. This takes at least 24 hours.

Installing the analyzer cabinet

- Refer to the "Requirements for the installation site" (see page 23)
- Provision the "Required material" (see page 33).
- Observe the "Arrangement diagram" in the system documentation.
- Grounding via central grounding screw, route grounding cable ($\geq 10 \text{ mm}^2$, AWG6 with "CSA version" option) through the M16 cable gland provided in the right-hand cabinet wall for this purpose.

Removing transport protection in the analyzer unit

NOTICE

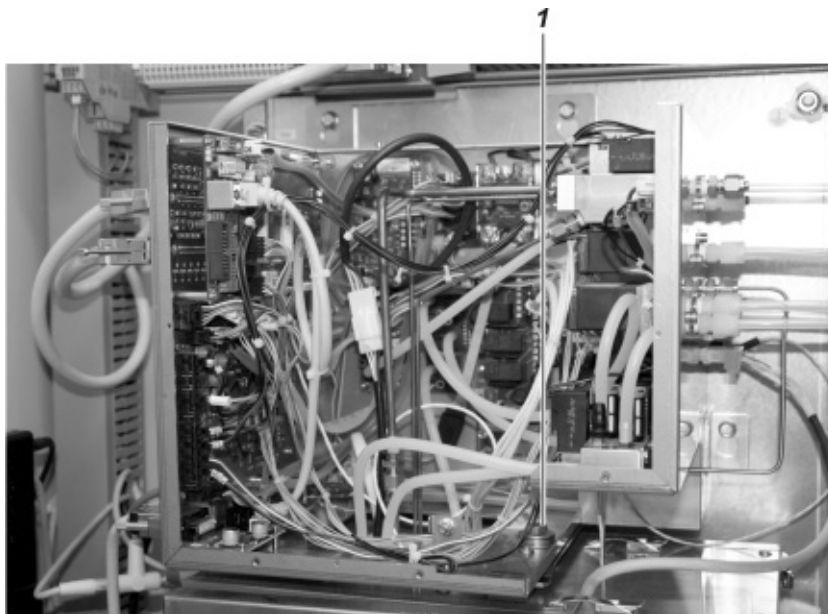
Removing the transport protection immediately before commissioning the analyzer system is highly recommended.

Removing the transport protection of the ASP block

The ASP block is fastened using a M8x80 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.

"2nd measuring location" option

Installing the electrical distributor cabinet

The electrical distributor cabinet for connecting the 2nd measuring location must be installed as close to the analyzer cabinet as possible.

On the analyzer cabinet, cables of about 5 m in length are applied for connection to the electric distribution cabinet.

Installing the heated switchover valve

The heated 3/2-way solenoid valve for switching between the two measuring locations must be assembled as close to the analyzer cabinet as possible.

The sample gas lines from the two sampling points and the 1.5 m sample gas line to the analyzer cabinet must be connected to the switchover valve. During installation of the sample gas lines, the information in the section "Installing the sample gas line" (see page 42) must be observed.

Installing the gas sampling probe and filter unit

Installing the gas sampling probe and filter unit

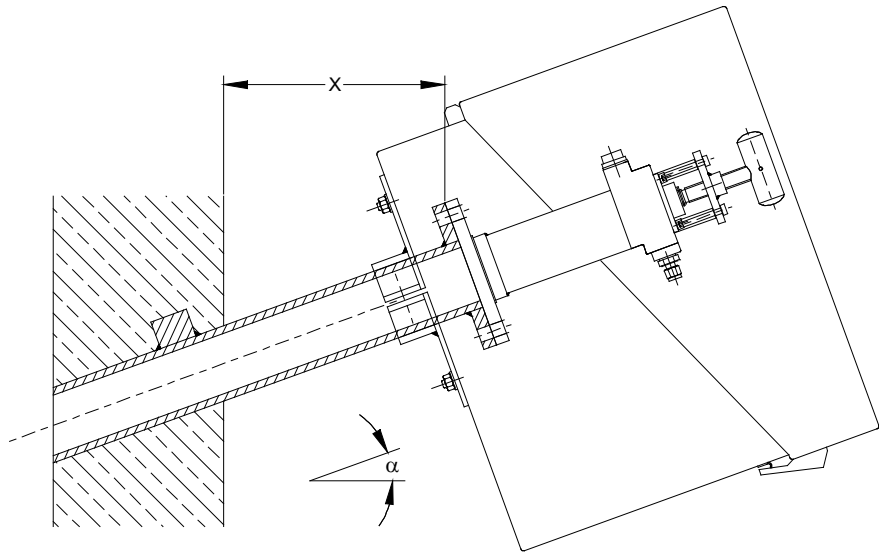
- Observe the "Piping diagram" in the system documentation.
- Install the gas sampling probe and filter unit:

CAUTION

The pre-assembled probe tube with filter unit weights approx. 17 to 32 kg, depending on the version! Two persons are required for the transporting and assembly operations!

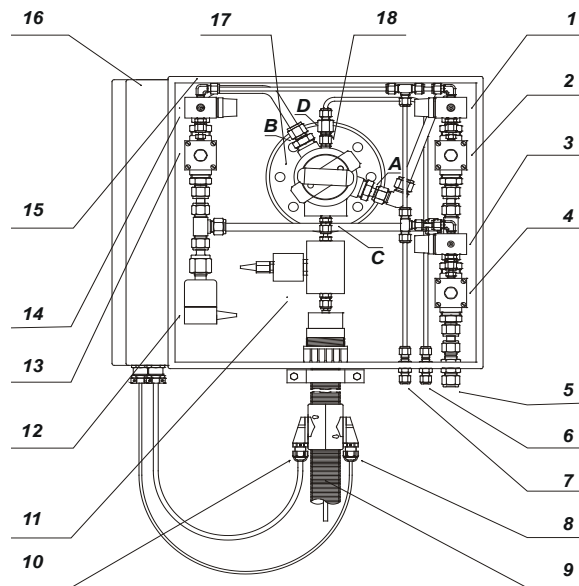
- Probe tube 40: Insert pre-assembled probe tube with filter unit into the wall tube and screw the assembly flange to the filter device flange.
- Heated probe tube type 42: Insert probe tube into the wall tube and screw up to the assembly flange. Screw filter unit up to the flange.
- Connect the electrical leads on the gas sampling probe and filter unit as per the "Wiring diagram" and "Terminal diagram" in the system documentation.
- Local grounding: Connect the heated special tube and the filter device at the collection point with a large cross-section ($\geq 10 \text{ mm}^2$ or $\geq \text{AWG7}$) on the potential equalization.

Assembling the probe's protective case with the filter unit PFE2



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

Gas connections of PFE2 Filter unit

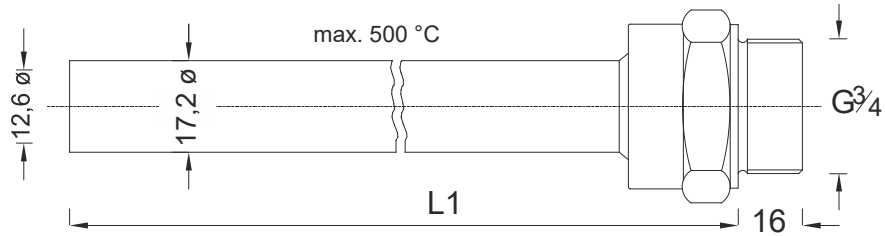


1	Pilot valve for cleaning filter -Y2.1
2	Diaphragm valve for cleaning filter -Y2.2
3	Pilot valve for pulsed instrument air -Y1.1
4	Diaphragm valve for pulsed instrument air -Y1.2
5	Connection for instrument air (max. 6 bar) bulkhead fitting 12 mm
6	Connection for test gas bulkhead fitting 6 mm
7	Connection for control air (max. 6 bar) bulkhead fitting 6 mm
8	Connection for Pt100
9	Heated sample gas line
10	Power supply
11	Heated cutoff valve -Y5 (option)
12	Solenoid valve for venting -Y4
13	Diaphragm valve for cleaning filter surface and probe tube -Y3.2
14	Pilot valve for cleaning filter surface and probe tube -Y3.1
15	Protective case for the probe
16	Terminal box
17	Filter unit
18	Check valve
A	Connection for back-purging filter G½ to 12 mm pipe coupling
B	Connection for back-purging filter surface and probe tube G½ to 12 mm pipe coupling
C	Sample gas outlet G¼ to 6 mm pipe coupling
D	Test gas connection G¼ to 6 mm pipe coupling

Probe tube type 40

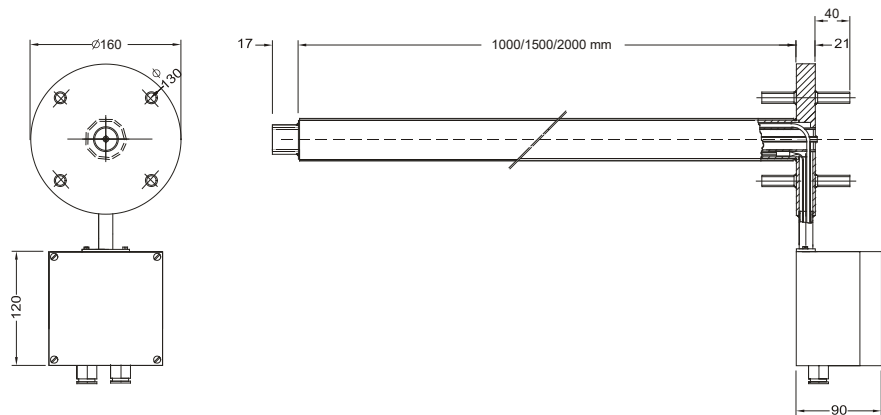
L1 = length of the probe tube (dimensions in mm)

L1 = 500/1000/1500/2000/2500 mm



Probe tube type 42

(dimensions in mm)



- If the PFE2 filter unit with standard protective box (450 x 450 x 400mm) 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 wall tube with assembly flange. Insulation and, where necessary, heat tracing is required for this purpose.

Installing the sample gas line

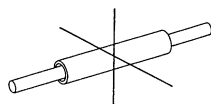
Installing the sample gas line

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

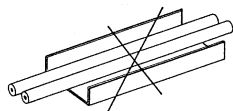
NOTICE

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

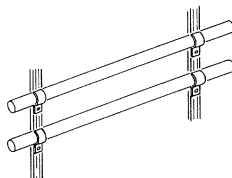
- The sample gas line from the gas sampling probe to the analyzer cabinet must be inclined and run as close as possible in a separate channel. Water pockets must not be allowed to form, especially at the sampling point.
- The sample gas line must be laid so as to avoid sharp bends, kinks and the crossing of other lines. The minimum bending radius is 200 mm.
- The heated sample gas line
 - must never be laid through walls if there is a possibility of subsequent sealing by means of sealing compounds, since this may damage the sample gas line;
 - must not be laid in a cable channel;



- must not be laid near other gas or power lines in a cable grid. This applies in particular for closed cable grids.



- Assemble the heated sample gas lines on freely-laid C-profiles using a counterpart. Do not over-tighten.



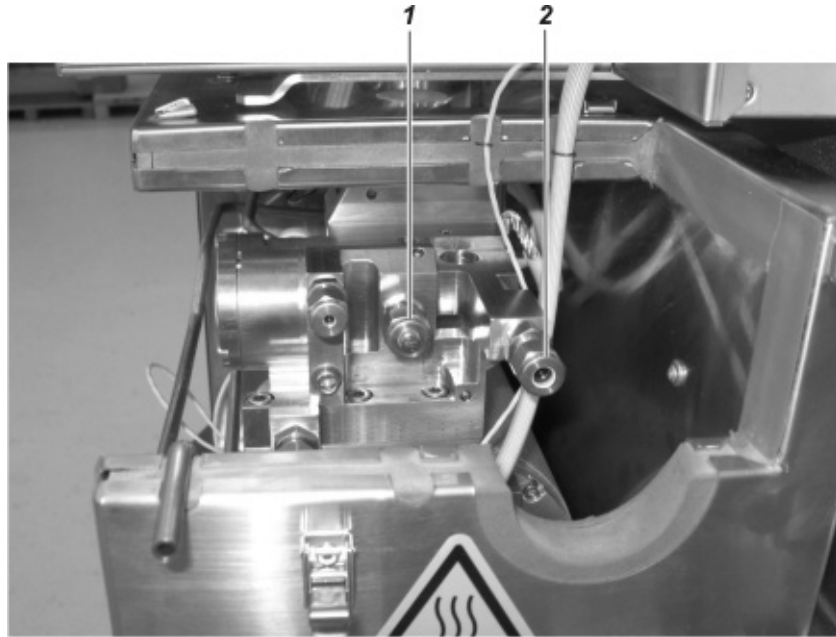
- Insert the sample gas line through the opening in the right-hand cabinet wall.

CAUTION!

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 inlet **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 inlet for the water steam generator **1** on the ASP block must be closed by means of a blanking plug.



1 Inlet for the water vapor generator

2 Pressure sensor

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

Installing the operating gases

Installing the instrument air supply

- Observe the "Requirements for the instrument air supply" (see page 26).
- Provide the material required for the installation (see page 33).
- 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 manometer $p_e = 5.5$ 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.

Gas line connection

- Provide the material required for the installation (see page 33).
- Observe the "Piping diagram" in the system documentation.
- Ensure that the gas pipes are connected to the gas connections provided for this purpose and are not interchanged! After connecting the gas lines, the correct assignment to the gas connections should be checked by a second person.
- 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 for the FID

- Connect 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 (see page 12) a flow restrictor, which limits the combustion gas flow to 10 l/h, is integrated into this bulkhead fitting.

WARNING

This bulkhead fitting is a safety-relevant component. It may be replaced only by certified service personnel!

- If the analyzer system is equipped with the option “Hydrogen monitoring of the analyzer cabinet” (see page 19) connect the combustion gas line to the inlet of the H₂ safety valve. The outlet of this valve is connected ex-works to the bulkhead fitting with integrated flow restrictor.
- Check the seal integrity of the combustion gas line: Set the high-pressure stage of the pressure reducer of the combustion gas cylinder to $p_e = 1200 \pm 100 \text{ hPa}$ ($1.2 \pm 0.1 \text{ bar}$) and purge the combustion gas line. Using a hydrogen leak detector (measuring principle: thermal conductivity) to check the seal integrity of the combustion gas line. Close the combustion gas cylinder.

Waste gas

- Connect the gas discharge line (shortest possible line with largest possible internal diameter). Allow waste gas to discharge freely; do not install restrictions or shut-off fittings. 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.
- Ensure 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.

CAUTION!

The exhaust gas line on the measuring gas output needs to be laid in a falling manner in any event. Otherwise, there is a danger that condensate forms with corrosive components, which may result in leaks.

Purging gas for gas extraction probe

- Connect the purge gas line to the gas sampling probe (for emergency purging (see page 170) 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 gas extraction probe (option)

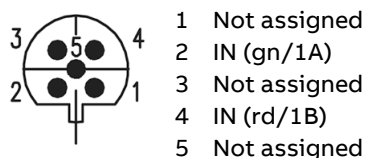
- Connect compressed air for cleaning the sampling filter and the probe tube (back-purging option, see page 180) to the corresponding connections on the probe's protective box.

Connecting the electrical leads

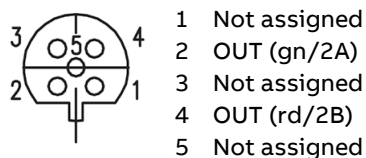
Description of the signal inputs and outputs

- Analog outputs: 4 to 20 mA, joint minus pin, electrically isolated, randomly groundable, max. DC 30 V, load max. 600 Ω , resolution 16 bit
- Analog inputs: 4 to 20 mA, joint minus pin, electrically isolated against mass, max. DC 30 V, $R_i = 41.2 \text{ } \Omega$, $R_u = 100 \text{ k}\Omega$, resolution 16 bit
NOTICE: When not all channels are connected in an analog output or analog input module the status LED lights red also in normal operation. Recommendation: Short-circuit unused channels with a jumper wire.
- Digital relay outputs: potential-free contacts (powerless status opened, fail safe), max. AC/DC 277 V, 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: $U_L < \text{DC } 5 \text{ V}$, status 1: $U_H > \text{DC } 11 \text{ V}$, $I_H \text{ min / max} = 2 \text{ mA} / 4.5 \text{ mA}$
- PROFIBUS: One 9-pole sub-D plug each for PROFIBUS IN and PROFIBUS OUT or one 5-pole M12 panel feed-through each for PROFIBUS IN and PROFIBUS OUT

PROFIBUS IN:

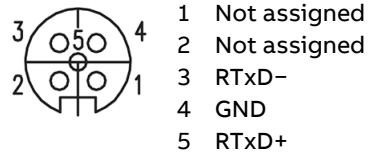


PROFIBUS OUT:

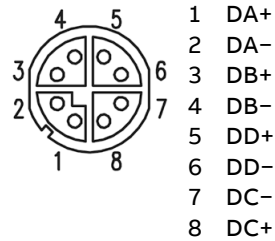


NOTICE: If the ACF5000 is installed at the end of a PROFIBUS network, the load resistor on the PROFIBUS plug, which is on the bottom of the system controller housing on the inside of the cabinet door, must be switched to ON.

- Modbus: 9-pole sub-D plug or 5-pole M12 panel feed-through



- Ethernet: RJ45 female connector or 8-pole M12 panel feed-through



Connecting the electrical leads

- Provide the material required for the installation (see page 33).
- Observe "Arrangement diagram", "Wiring diagram" and "Terminal diagram" in the system documentation.
- The cable glands for the electrical leads are located in the right-hand cabinet wall.
- When laying the electrical leads, observe the relevant national safety regulations for installing and operating electrical systems.

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.
- Lay the screen of the screened cable in accordance with the local regulations. In doing so, consider the potential differences and interspersion of interference signals.

Connect power supply

⚠ CAUTION

High leakage current: 9 mA!

- Observe the "Requirements for the power supply" (see page 29).
- Before connecting the power supply, make sure that the operating voltage set on the analyzer system matches the mains voltage.
- 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 (USV).
- Connect the power supply lines to the heated collection assemblies (where applicable in temperature-resistant design) on the terminal strips -X81, -X91 and, where applicable, on the corresponding line protection switches.
- Connect the connection leads to the Pt100 resistance thermometers of the external, heated sampling assemblies to the interface module -X82 on the right side wall.
- Option "Hydrogen monitoring of the analyzer cabinet" (see page 19): Connect the power supply lines of the gas warning central, the contactors and the H₂ safety valve.

Commissioning

Recommissioning

Initial commissioning

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

NOTICE

The initial commissioning of the option "Hydrogen monitoring of the analyzer cabinet" may only be performed by certified personnel of the manufacturer of the gas warning central and the gas sensor.

Recommissioning

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

Procedure

- 1 **IMPORTANT!** Connect instrument air and purge the analyzer system for 30 minutes before opening the analyzer cabinet door and powering up the analyzer system.
- 2 Open analyzer cabinet door.
 - 1 Check pre-pressure and, where applicable set to $p_e = 5.5$ to 7 bar.
 - 2 Check pressures and flows on the pneumatic plate on the right-hand cabinet internal wall against the values in section "Operating gases and test gases" (see page 26).

CAUTION! The hydrogen supply must remain switched off!
NOTICE: The purge line between the analyzer system and gas sampling probe must be laid.
- 3 Power supply power-up
 - 1 Make sure that all circuit breakers are deactivated.
 - 2 Turn on the main switch.
 - 3 Activate the circuit breaker for the FTIR spectrometer.
- 4 Activate all other circuit breakers.
- 5 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 to 4 hours.
 - The gas extraction 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 $SGI = 850$ hPa and $SGO = 750$ hPa.
Failure to reach these pressure values indicates a leak in the analyzer system.
- 6 Connect the sample gas line to the gas sampling probe.
- 7 Have a complete seal integrity test carried out by certified and authorized personnel.
- 8 Turn on the hydrogen supply and restart the FID (see below).

Start of the measurement

On a restart, the analyzers start to measure automatically:

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

FID restart

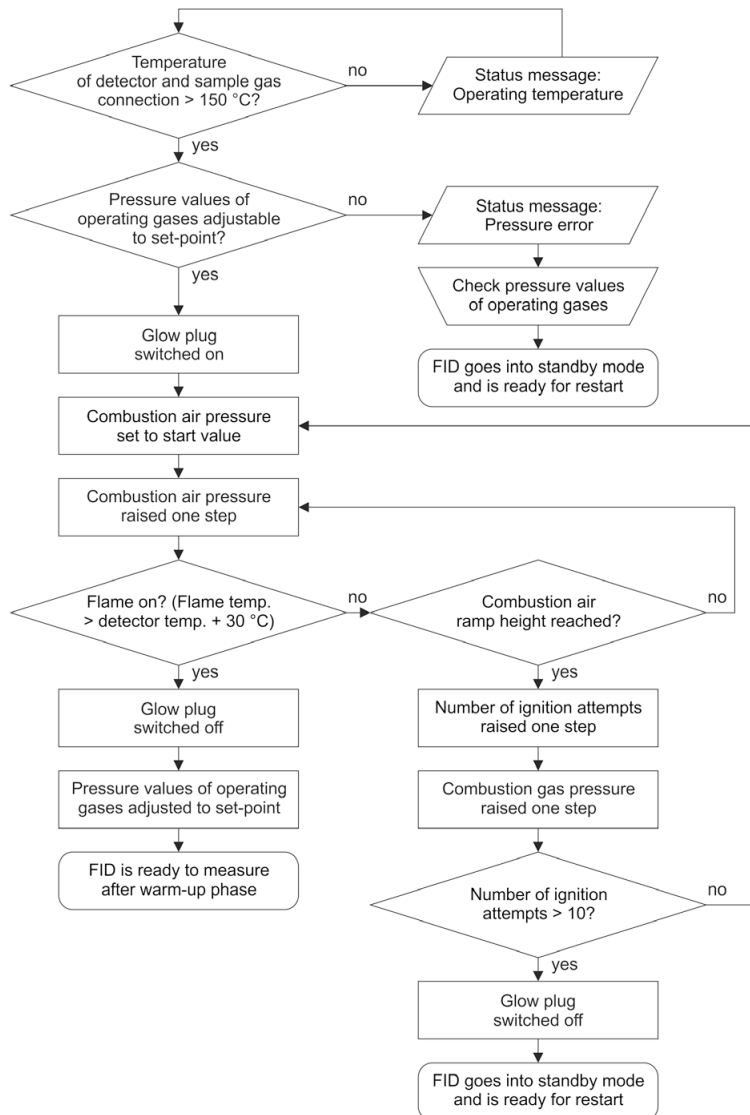
Heating-up phase, connect supply gases

- 1 Select the Controller measured values menu item:
MENU → Diagnosis/Information → Module-specific → Controller measured values
 In this menu item, the position values of the temperature controllers are displayed, among other things:
 T-Re.D Temperature of the ASP block
 T-Re.E Temperature of the FTIR cell
 T-Re.IP Temperature of the instrument air pre-heating
 TR.VV1 Temperature of the pre-amplifier
 The temperature values increase slowly after activating the power supply.
- 2 Connect instrument air, combustion air and combustion gas. Adjust the pressure to the value specified in the Analyzer Data Sheet with the corresponding external pressure regulator.
- 3 The controlled variables of the internal pressure regulator are also displayed in the Controller measured values menu item; the pressures of the supply gases are set by means of the controlled variables:
 SGI Pressure on the measured gas nozzle
 SG0 Pressure in the combustion chamber (output)
 C-air Combustion air
 C-gas Combustion gas
 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 analyzer system automatically reverts to the measurement mode to display measured values if the operator has not pressed a key in menu mode in the last five minutes.

- 4 During the heating phase, the following status messages are displayed:
"Operating 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 possibly of the FTIR cell (T-Re.E) is above 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 (input, output), combustion air (air) or combustion gas (H₂) is above or below the upper or lower limit value 1 (2).
- 5 As soon as the temperature of the detector reaches the threshold value (150°C), the corresponding solenoid valve in the FID automatically switches off the instrument air. The negative pressure regulation and the combustion air regulation attempt to adjust the pressures to the respective set point.
The sample gas begins to flow through the FID after the instrument air is connected.
- 6 After the pressures have been adjusted to the respective set point, the respective solenoid valve in the FID automatically connects the combustion gas. The combustion gas regulation attempts to adjust the pressure to the set point.

Flame ignition

7 Flame ignition is automatic.



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

On initial commissioning of the FID, 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 event, the ignition of the flame needs to be restarted in the Standby/Restart FID menu (see page 177).

The temperature of the flame is displayed in the Raw measurement values auxiliary values menu in the Flame parameter. 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.

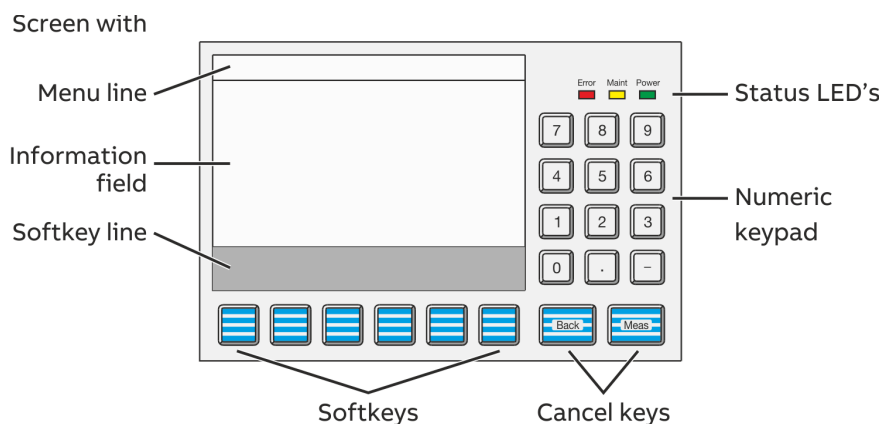
CAUTION!

The analyzer cabinet door must always kept closed during operation!

Operation

Display and operation unit

Overview



The display and operation unit consists of

- the display (see page 55) with
 - of the menu line,
 - the information field, and
 - the softkey line,
- the status LEDs (see page 58),
- the numeric keypad (see page 59),
- the cancellation keys (see page 60) and
- the softkeys (see page 61).

Operating modes of the display and operation unit

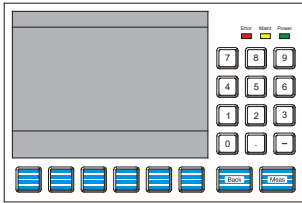
The operating modes of the display and operation unit are

- measuring mode and
- menu mode.

The operating modes of the display and operation unit have no impact on the measuring functions, i.e. in menu mode, the measuring functions of the analyzer system continue.

Display

The display



The backlit chart display has a resolution of 320 x 240 pixels.

The display is split into three areas:

- the menu line,
- the information field and
- the softkey line.

The menu line

The menu line appears only in menu mode. It is at the top edge of the display and is separated by a line from the information field. The menu line displays the current menu path and thereby offers the user orientation as to where they are in the menu tree. In addition, it displays the name of the analyzer being processed.

The information field in measuring mode

The information field displays in measuring mode the following information by standard for every measuring component:

- the measured value as figures and as a horizontal bar,
- the unit of the measured value,
- the designation of the measured component
- the bottom and top final value of the measuring range on the horizontal bar,
- the analyzer type and
- the analyzer name.

The measured value of up to six measured components can be displayed at the same time.

The user can configure

- what measured values are shown in the display and
- where the display of measured value is in the display.

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

- entering values directly in measuring mode (see page 156) or
- operating keys (see page 158).

NOTICE

Detailed information for display in measuring mode can be found in the "Configuration: Display functions" section (see page 144).

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 the "Softkeys" section (see page 61).

Message display

Message display functions

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

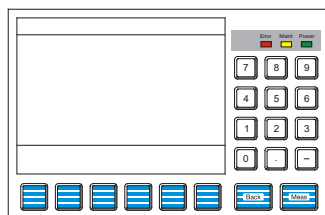
- It prompts for the STATUS MESSAGE key to be pressed whenever a status message is present
- It shows that a password is active.
- It shows that the analyzer system is being controlled from a remote HMI.
- It shows that an automatic calibration process is running in the analyzer system.

Display of status messages

When a status message is generated by the **Message Generator** function block, its short text is displayed on the message display as configured in the function block. The Technical Information "Function blocks – Descriptions and configuration" contains complete information on the individual function blocks.

Status LEDs

Status LEDs



Power



Maint




Error




The three LEDs next to the screen show the user the status of the analyzer system.

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 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.

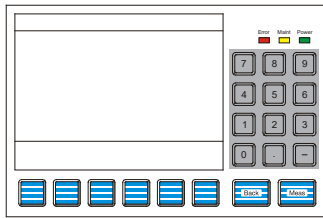
The softkey  appears on the screen at the same time.

NOTICE

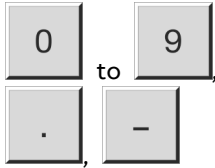
Chapter "Status messages, troubleshooting" (see page 198) contains detailed information on status messages and status signals.

Numeric keypad

Numeric keypad



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



With

- numeric keys "0" through "9"
- decimal point "." and
- minus sign "-".

the operator can enter values directly.

Examples:

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

NOTICE

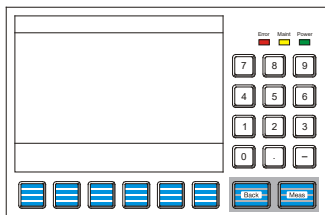
Any digits displayed cannot be overwritten directly. They must be deleted with the BACKSPACE or CLEAR key before new digits can be entered.

Entering text with the numeric keypad

The "Text entry" (see page 63) section explains how to enter information such as sample component or user names with the numeric keypad.

Cancel keys

Cancel keys



The "Back" and "Meas" keys located under the numeric keypad are designated as cancel keys.



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 key are stored; unconfirmed items are not accepted.

The "Back" key also allows the operator to clear analyzer system help text and messages.



The "Meas" key allows the operator to cancel a function or menu item and to return to the measured value display in measurement mode.

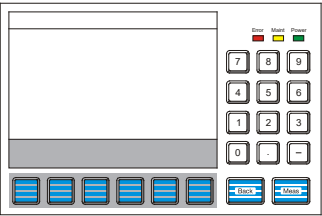
Only entries confirmed with the ENTER key are stored; unconfirmed items are not accepted.

NOTICE

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

Softkeys

Softkeys



The six keys 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 key 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 key assigned to the function; this process is illustrated by the quasi-three-dimensional softkey representation on the screen.

Softkeys are also called keys in this operating instruction.

The softkeys in measurement mode



In measurement mode, the softkey line contains the softkeys  and .

The softkey  also appears if an error occurs.

The **MENU** key is used to call up the main menu and switch to menu mode when in measurement mode.

The **>>** key allows the operator to scroll to the next display "page". This key only allows forward scrolling.

The "Back" key is used for backward scrolling.

The **STATUS MESSAGE** key appears in measurement mode if a "Failure" or "Maintenance request" condition arises.

This key 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.

NOTICE

The status messages are listed in the chapter "Status messages, troubleshooting" (see page 198).

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.



In menu mode the standard softkeys have the following functions: The operator uses these two arrow keys to move the selection cursor up or down, e.g. in menus or lists to choose vertically arranged (menu) items.

The menu item selected is reversed, i.e. appearing as bright characters on a dark background.



The operator uses these two arrow keys to move the selection cursor left or right, e.g. into or out of a submenu or to select (menu) items arranged adjacent to each other.

The menu item selected is reversed, i.e. appearing as bright characters on a dark background.



The operator can use the BACKSPACE key to delete characters to the left of the cursor (as on a PC keyboard).



The operator can use the CLEAR key to delete all characters in a selected field.



The operator can use the ENTER key to:

- Call up menu items for processing
- Start functions
- Confirm entries, e.g. parameter settings

The ENTER key is always at the right margin of the softkey line.



The operator can use the HELP key to access context-sensitive help. The screen will then show a help message explaining the menu item selected.

The operator can use the "Back" key to clear the help message.

Representation 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:	Adjust, Configure
Enter numbers:	1, 2, 3

Text entry

Entering text

When text, such as measurement components or user names, is to be entered an image 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 space
- Digits 0 to 9 . -

Each character is accessed using the key in the corresponding position on the numeric keypad. Examples:

Letters: A L t Blank or space character

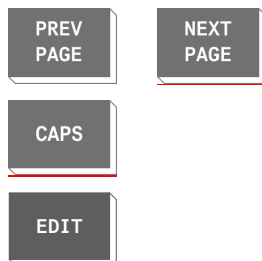
Key: 7 - 2 9

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

Softkeys in the input mode



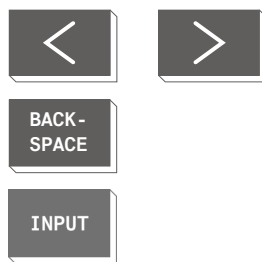
The softkeys in the input mode have the following functions:

The PREV PAGE and NEXT PAGE keys allow the operator to move to the previous or next keypad page.

The CAPS key allows the operator to switch between upper- and lowercase letters.

The EDIT key allows the operator to switch into the edit mode.

Softkeys in edit mode



The softkeys in the edit mode have the following functions:

The two arrow keys allow the operator to move the cursor left and right in the entry line.

The operator can use the BACKSPACE key to delete characters to the left of the cursor (as on a PC keyboard).

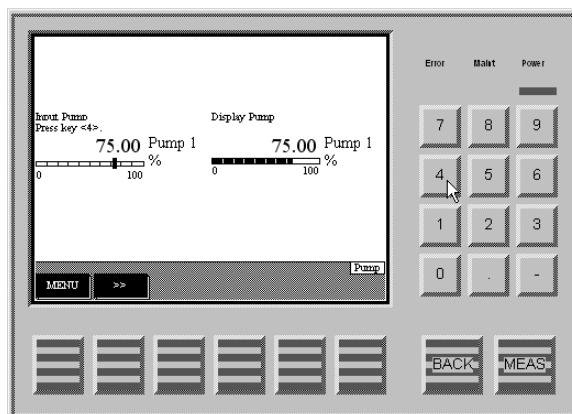
The INPUT key allows the operator to change the input mode.

Operating by value input

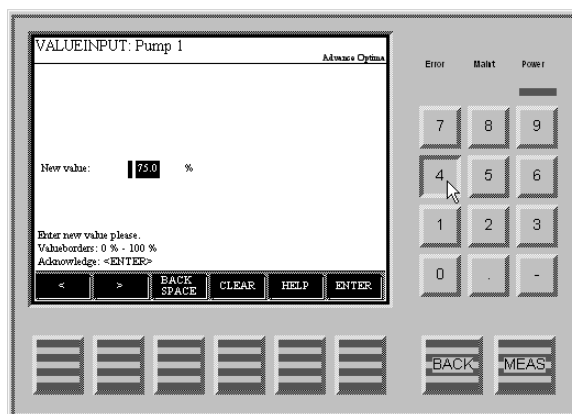
Value input

Values are entered during measurement by pressing the number key that corresponds to the position of the display element in the display and that is indicated above the display element.

In the example, this is key 4:



A field then appears for entering the value:



Description and configuration

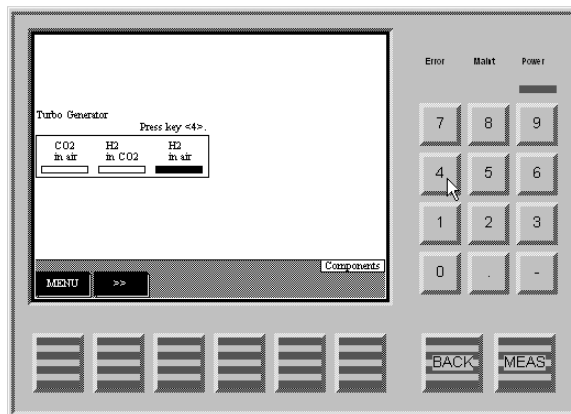
Further information about pressure correction can be found in sections "Value input (see page 156)" and "Configuring value input (see page 157)".

Operating by key entry

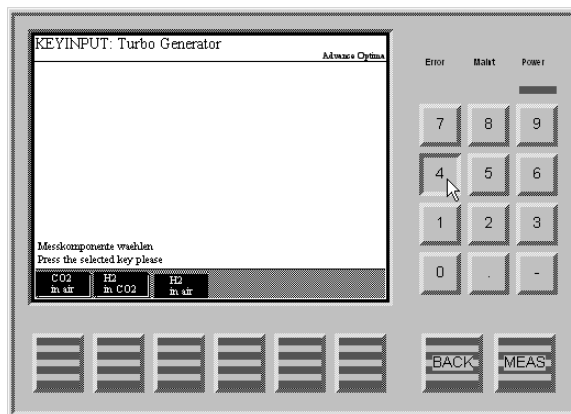
Key entry

Key entries are made in measurement mode by pressing the appropriate number key that corresponds to the position of the display element on the display and that is indicated over the display element.

In the example, this is key 4:



A softkey line then appears with the configured keys:



Description and configuration

Further information about pressure correction can be found in sections "Key entry" (see page 158) and "Configuring key entries" (see page 160).

Password protection

Elements of password protection

Password protection consists of three elements

- Password level,
- User group and
- Password.

Password level

Each menu item is assigned a password level. Password levels are numbered with 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. can make changes to the menu items at these levels.

Some user groups are set-up at the factory.

A user group can be made up of one or more users.

Password

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.

Passwords are pre-assigned for the factory-set user groups.

Factory setting

User group	Access to password levels	Password
Every user	0	No password
Maintenance team	0, 1	471100
Specialist team	0, 1, 2	081500
Function block specialist	0, 1, 2, 3	325465
Service specialist	All	737842

CAUTION!

After entering the password for password level 3, the user can access all of the function block applications. When configuring function blocks, existing applications with their configurations and links can be damaged or destroyed!

CAUTION!

The user can change all passwords. Therefore it is strongly recommended to document each password changing. Only ABB service is able to reset the passwords to the factory setting.

Viewing menu items

All users can view all menu items, regardless of password level, without entering a password.

Changing menu items

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

Password level 1, 2 and 3 menu items can only be changed if the user belongs to the group authorized for that level and after the user's password has been entered.

Entering the main menu and thus switching to the menu mode can be password protected (see the section "Blocking operation" (see page 131).

Change privilege

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

Duration of the change privilege

The change privilege remains in place until

- either the analyzer system automatically switches to measuring mode if the user does not actuate a key 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" reporting 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.

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

Change password

The changing of the password is described in the "Change password" (see page 130) section.

Blocking operation

Blocking operation using the function block configuration

Regardless of the preference of a user interface, it is possible to block access to the operation of the analyzer system of a certain human-machine interface (HMI) in full.

This block is brought about by the configuration of the **Access protection** function block. The Technical Information "Function blocks – Descriptions and configuration" contains complete information on the individual function blocks.

Access denied

If the user tries to operate the analyzer system from a blocked HMI, after pressing the MENU key on the display, the following text appears:

Access denied!
The operation of the analysis device
is currently blocked!
Back: <BACK>

Blocking operation using password protection

As an alternative to the above full blocking of the operation, the calling up of the main menu and the associated switching to menu mode can be protected with a password (see page 131).

Operating the analyzer system

The analyzer system is operated via the following:

- The display and control unit in the door of the analyzer cabinet (local HMI)
- A remote HMI
- A web page

Local HMI operation

All functions required for normal operation of the analyzer system can be accessed via the display and control unit in the door of the analyzer cabinet.

Remote HMI operation

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

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

Preference of an HMI

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 $n+1$ receives preference before an HMI with the password for level n . In deviation from this, the local HMI already receives with the password for level n preference before a remote HMI also with the password for level n .

1st user:	2nd 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 $n+1$	—

NOTICE

If a 2nd user with an HMI is given preference over another HMI, all entries not confirmed with ENTER of the 1st user are lost and ongoing procedures (e.g. an adjustment) are canceled.

Web page operation

Functions

Some functions are only accessible via a web page.

The user has access to the functions

- graphical procedure of the measured value for every measured component (see page 73),
- automatic cyclical adjustment check and the export of the QAL3 data (see page 88),
- Checking for automatic processes with scheduling conflicts (see page 100).

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 web page operation.

The web page is accessed using the analyzer system's IP address via port 8080. Example: If the analyzer system's IP address is 192.168.1.1, then `http://192.168.1.1:8080` must be entered in the address bar of the web browser.

Only those sub-menus are visible on the web page which can be accessed with the password entered previously (see page 66).

Note: Mozilla and Firefox are registered trademarks of the Mozilla Foundation.

Menu structure

Menu structure

Menu		
_ Adjust	_ Manual adjustment	0
	_ Automatic adjustment	0
_ Configure	_ Component specific	
	_ Measurement range	0
	_ Filter	1
	_ Pressure controller	2
	_ Autorange	1
	_ Active component	0
	_ Alarm values	1
	_ Corrections	2
	_ FTIR High Alarm	2
	_ Module text	2
_ Adjustment data	_ Manual adjustment	1
	_ Automatic Reference	2
	_ Automatic Just. Check	2
	_ Automatic Drift Check	2
	_ Automatic adjustment	1
	_ Ext. controlled adj.	1
	_ Output current response	1
_ Function blocks		
_ System	_ Date/Time	2
	_ Language	2
	_ Change password	
	_ Setup system modules	2
	_ Save configuration	1
	_ Status signals	2
	_ Network	2
	_ Display	2
_ Maintenance/Test		
_ System	_ Maintenance switch	2
	_ Emergency purge	2
	_ Manual gas path	2
	_ Atm. pressure	2
	_ Display test	0
	_ Keyboard test	0
_ Analyzer spec. adjustm.	_ Atm. press. anlz	2
	_ Adjustment reset	1
	_ Basic adjustment	2
	_ Cross sensitivity adjustm.	2
	_ Carrier gas adjustm.	2
	_ FTIR spectra	2
	_ Restart FID	1
_ Diagnostics/Information		
_ System overview		0
_ Module specific	_ Raw values	0
	_ Auxiliary raw values	0
	_ Status	0
	_ Controller values	0
_ Logbook		0

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

Password levels

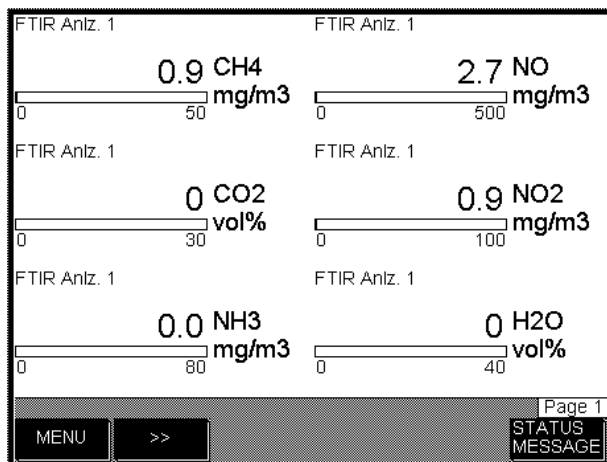
For every menu item, it is stated in the overview at what password level (0, 1, 2, 3) it can be found.

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

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

Display of measured value

HMI 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 key only allows forward scrolling. The "Back" key is used for backward scrolling.

Webpage display

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

The start page displays an overview of all measuring components with their current measured values and measuring range limits. Dry basis corrections or fixed O₂ concentrations are also displayed alongside the corresponding measured values, as long as these correction functions are configured (see page 125).

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 five seconds regardless of whether a new measured value is available.

Adjustment: Basics

NOTICE

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

Controlling the adjustment

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 the analyzer system detects implausible values during adjustment (e.g. if the end point value equals the zero point value), it cancels the adjustment and issues an error message. The values stored for the last adjustment remain in effect.

Status signal

The "Maintenance mode" status signal is set during adjustment.

Manual adjustment

Definition

Manual adjustment means: Zero and span are adjusted separately by pressing the analyzer system display and control unit keys.

Test gas infeed

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

Purging time test gas → measurement gas + 4 x T90 or

Purging time test gas → measurement gas + 1 x T90-1 + 3 x T90-2.

When different T90 times are specified for several sample components the largest T90 time is used for all sample components.

The waiting time is the same as that after the end of the automatic adjustment (see page 76).

Adjustment data

The setting of the adjustment data is described in section "Configuring manual adjustment" (see page 94).

Adjust analyzer system manually

Manual adjustment of the analyzer system is described in section "Carry out manual adjustment" (see page 111).

Automatic adjustment

Definition

Automatic adjustment means: The adjustment of the zero point and end point proceed automatically after starting.

Test gas infeed

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

Starting the automatic adjustment

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.

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 external starting of automatic adjustment:

Level Low 0 to 3 V → High 12 to 24 V edge. The Low → High transition may also be generated by an external contact. After the transition the High level must be present for at least 1 s.

Input Digital input DI1 on the digital I/O module (standard function block application "Status signals/Externally controlled adjustment")

Manual start

The automatic adjustment can be manually started on the display and control unit. It is effected

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

Manual start of an automatic adjustment of the analyzer system is described in the "Manual start of automatic adjustment" section (see page 112).

Automatic adjustment start and cancel

Start	Cancel
Controlled by interval:	
If "Activation" parameter is set to "on"	by appropriate configuration of the cancel management parameter or of the function block Automatic Adjustment
Externally controlled:	
with the "Start automatic adjustment" control signal	As per interval controlled start
Manually activated:	
with START	with STOP
NOTICE 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 Automatic 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

Purging time test gas → measurement gas + 4 x T90 or

Purging time test gas → measurement gas + 1 x T90-1 + 3 x T90-2.

When different T90 times are specified for several sample components the largest T90 time is used for all sample components.

Adjustment data

The setting of the adjustment data is described in the sections "Configuring automatic adjustment of the FID" (see page 95) and "Configuring automatic adjustment of the oxygen sensor" (see page 98). The setting of the T90 time constants is described in section "Configuring filter" (see page 120).

Adjustment methods

Adjustment method

In an analyzer module (detector) one or more (gas) components with one or more measuring ranges can be implemented.

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 measured component in every measuring range at the zero point and at the end point.

The single adjustment has no effect on the other measuring ranges of the same measured component and on the other measured 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 each at the zero point and at the end point for each measured component. The zero and end points of the other measuring ranges are then corrected electronically by the values established during this adjustment.

The common adjustment has no effect on the other measured components of the analyzer module.

In general, the zero point is adjusted in the smallest measuring range and the end point in that measuring range for which a 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 measured 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 the measured components at a zero point and at an end point. The zero and end points of the measuring ranges of all substitute gas and measured components are then corrected electronically by the values established during this adjustment.

NOTICE

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 measured components or in the substitute gas measuring ranges results in an erroneous adjustment of the analyzer module.

Overview

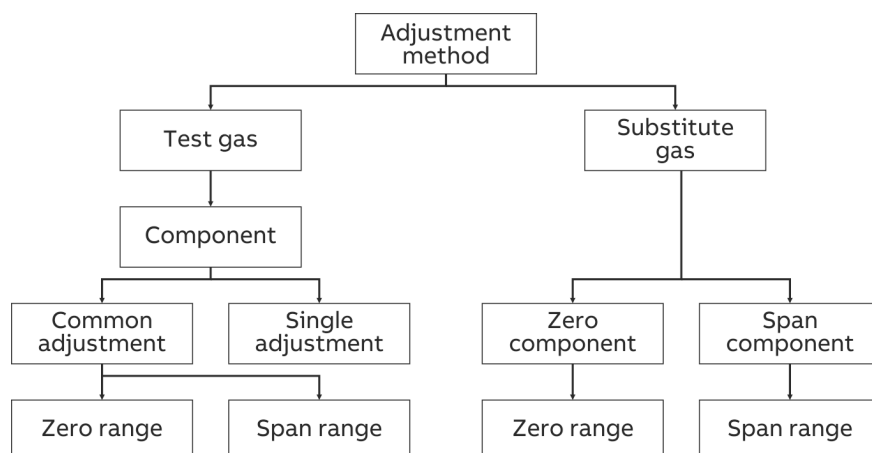
The following table presents the adjustment methods at a glance.

Qty. MC	Adjustment MR method	To be configured ...	To be adjusted ...	The adjustment affects ...
1	1 Test gas/Single		the zero point and the end point in every measuring range individually for every measured component	only on the relevant measuring range
≥ 1	> 1 Test gas/Common	the measuring ranges for zero point and end point adjustment	the zero point in a measuring range and the end point in another measuring range for every measured component	on all measuring ranges of the relevant measured 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

MC = measuring and substitute gas components

MR = measuring ranges per component

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.

FID: Conversion of concentration data

Various units for concentration details

When measuring organic carbon compounds (total C) the concentration is indicated in various units. The most important units are:

- mg C/m^3 (e.g. for measurements in accordance with 17. German Federal Regulation on Emissions)
- $\text{mg C}_n\text{H}_m/\text{m}^3$
- $\text{ppm C}_n\text{H}_m$ (e.g. or measurements in accordance with Federal German Regulations on Air Purity, details on test gas cylinders)
- ppm C1 (for TOC [total organic carbons] or methane CH_4)

Examples for the conversion of units and concentration details

Conversion ppm to $\text{mg C}_n\text{H}_m/\text{m}^3$

$$\text{mg C}_n\text{H}_m/\text{m}^3 = \text{ppm} \times \frac{\text{Molecular weight}}{V_m}$$

Conversion ppm to mg C/m^3

$$\text{mg C/m}^3 = \text{ppm} \times \frac{\text{Number of C atoms} \times 12.011}{V_m}$$

Conversion ppm to ppm C1

$$\text{ppm C1} = \text{ppm} \times \text{Number of C atoms}$$

Example 1

The analyzer module has a measuring range of 0 to 50 mg C/m^3 . 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/m^3 for the measuring range not to be exceeded?

$$c_{\text{C}_3\text{H}_8} [\text{ppm}] = \frac{\text{MR} \times V_m}{\text{Number of C atoms} \times M_C} = \frac{50 \times 22.414}{3 \times 12.011} = 31.102 \text{ ppm C}_3\text{H}_8$$

$$c_{\text{C}_3\text{H}_8} [\text{mg/m}^3] = \frac{c_{\text{C}_3\text{H}_8} [\text{ppm}] \times (\text{Number C atoms} \times M_C + \text{Number H atoms} \times M_H)}{V_m}$$

$$c_{\text{C}_3\text{H}_8} [\text{mg/m}^3] = \frac{31.102 \times (3 \times 12.011 + 8 \times 1.008)}{22.414} = 61.19 \text{ mg C}_3\text{H}_8/\text{m}^3$$

Example 2

If a test gas other than propane is used, its response factor must be taken into consideration.

What is the maximum test gas concentration in ppm or mg/m³ if methane (CH₄) is used?

$$c_{\text{CH}_4} [\text{ppm}] = \frac{\text{MB} \times V_m}{\text{Number C atoms} \times M_C} = \frac{50 \times 22.414}{1 \times 12.011} = 93.306 \text{ ppm CH}_4$$

$$c_{\text{CH}_4} [\text{mg/m}^3] = \frac{c_{\text{CH}_4} [\text{ppm}] \times (\text{Number C atoms} \times M_C + \text{Number H atoms} \times M_H)}{V_m}$$

$$c_{\text{CH}_4} [\text{mg/m}^3] = \frac{93.306 \times (1 \times 12.011 + 4 \times 1.008)}{22.414} = 66.785 \text{ mg CH}_4/\text{m}^3$$

The response factor for methane is $R_{f\text{CH}_4} = 1.13$; i.e. the display of measured value is too great by this factor. In order to determine the maximum test gas concentration to avoid exceeding the measuring range, the display of measured value must be divided by the response factor.

$$c_{\text{maxCH}_4} [\text{ppm}] = \frac{c_{\text{CH}_4} [\text{ppm}]}{R_{f\text{CH}_4}} = \frac{93.306}{1.13} = 82.572 \text{ ppm CH}_4$$

$$c_{\text{maxCH}_4} [\text{mg/m}^3] = \frac{c_{\text{CH}_4} [\text{mg/m}^3]}{R_{f\text{CH}_4}} = \frac{66.785}{1.13} = 59.102 \text{ mg CH}_4/\text{m}^3$$

A test gas cylinder with approx. 80 ppm CH₄ is ordered. The test gas concentration in the test gas cylinder is 81.2 ppm CH₄ according to the certificate.

This is equivalent to a concentration of

$$c_{\text{CH}_4} [\text{mg C/m}^3] = \frac{c_{\text{Bottle}} \times \text{Number of C atoms} \times M_C}{V_m}$$

$$c_{\text{CH}_4} [\text{mg C/m}^3] = \frac{81.2 \times 1 \times 12.011}{22.414} = 43.513 \text{ mg C/m}^3$$

Considering the response factor, the indication should be adjusted to

$$c_{\text{max CH}_4} [\text{mg C/m}^3] = c_{\text{CH}_4} \times R_{f\text{CH}_4} = 43.513 \times 1.13 = 49.1697 \text{ mg C/m}^3$$

Adjustment: Configuration

Configuring the automatic reference FTIR

Function

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

Menu path

Menu → Configure → Adjustment Data → Automatic Reference

Display

CONFIG: AUTOM. REFERENCE	
AO2000: FTIR - Anl. 1	
Enable:	off
Cycle time:	8 hour(s)
Next ref. date:	02/19/2016
Next ref. time:	13:45:00
Purge time: meas->zero gas:	300 sec.
Purge time: zero->meas gas:	30 sec.
Gas Path:	Local
Cancel management	>>>

Select parameter that should be configured!
Acknowledge: <ENTER>

▲ ▼ ENTER

The recommended settings are stated in the following table.

Procedure

Parameter	Explanation
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.
Next reference date/time	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, 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 T90 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. This setting also applies for the test gas release during the automatic adjustment of the FID (see page 95) and the O ₂ sensor (see page 98).
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 if the automatic reference recording is to be terminated when one of the three states occurs during the procedure: "System failure", "Analyzer failure" or "Analyzer maintenance request". 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 cancellation criterion is fulfilled.

Duration

Automatic recording of the reference takes about 18 minutes.

Automatic Adjustment Check (AAC): Configuring the time sequence

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 equipped with the AAC measurement media must be installed in the FTIR spectrometer and the "Automatic Adjustment 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 page (see page 88).

Menu path

Menu → Configure → Adjustment Data → Automatic Adj. Check

Display

The image displays two screenshots of the 'CONFIG: AAC' menu on a device. The top screenshot shows the 'Enable' option set to 'off'. The bottom screenshot shows the 'Enable' option set to 'on' and the 'Cancel management' option highlighted.

Parameter	Value
Enable:	off
AAC cycle runs	complete
Cycle time:	7 day(s)
Next AAC date:	09/26/2018
Next AAC time:	13:19:35
Purge time: Meas->zero gas:	300 sec.
Purge time: Zero->meas gas:	300 sec.
Gas Path:	Local

Select parameter that should be configured!
Acknowledge: <ENTER>

Buttons: ^, v, ENTER

The recommended settings are stated in the following table.

Procedure

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 runs step by step; the AAC step interval is waited for between the individual steps. Each step takes approx. 18 minutes – with the purge time set to 240 seconds. The cycle consists of a maximum of 6 steps – depending on the number of installed sample components: 1. FTIR reference recording and O ₂ span adjustment, 2. Measurement AAC measurement medium 1, and so on until 6. Measurement AAC measurement medium 5. Set values and actual values of the FTIR reference and the O ₂ span value are output after the first step. Set values and actual values of the FTIR span values are output after the last step.
complete	The AAC runs continuously without FTIR reference and O ₂ span adjustment. The complete sequence takes max. 45 minutes: Purging with zero gas, re-recording and validating of 10 measuring values (zero point validation), output of the measuring values, measuring AAC measurement medium 1, and so on until measuring AAC measurement medium 5, purging with sample gas, output of the set values and actual values of the FTIR span values (span validation).
complete & reference	The AAC runs continuously with FTIR reference and O ₂ span adjustment. The complete sequence takes max. 45 minutes: Purging with zero gas, FTIR reference recording and O ₂ span adjustment, output of set values and actual values, measuring AAC measurement medium 1, and so on until measuring AAC measurement medium 5, purging with sample gas, output of the set values and actual values of the FTIR span values.
Cycle time	The cycle time specifies the time intervals in which the AAC is completed. Recommended setting: 7 days.
Next AAC date/time	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 step-by-step AAC cycle: Set date and time so that no half-hourly average values are lost.
Number of AAC steps	Information display. The number of AAC steps depends on the number of components. The cycle is: zero point – validation cell 1 – validation cell 2 – validation cell 3 – validation cell 4 – validation cell 5
Next AAC step	Information display.
AAC step interval	The waiting time between two AAC steps must be set. Recommendation for step-by-step AAC cycle: Set interval so that no half-hourly average values are lost (min. 1 hour).
Purge time Meas->zero gas, Zero->meas. 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 T90 time of the entire analyzer system (typically 240 seconds).
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.

Parameter	Explanation
Cancel management	<p>The AAC is always canceled in the event of a system bus error and when setting the block input. You can configure if the AAC is to be terminated when one of the three states occurs during the procedure: "System failure", "Analyzer failure" or "Analyzer maintenance request".</p> <p>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.</p>

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 page.

Menu path

ACF5000 Settings → QAL3

Password

A level 2 password is required to access this submenu.

Display

Measurements Diagnostic Data Commissioning and Service ACF5000 Settings					
Measurements					
Component	Measurement value	Unit	Measurement Range		Def
			From	To	
O2	14.184	vol%	0	25	De
CH4	0.213	mg/m3	0	50	
CO2	-0.023	vol%	0	30	
NH3	-0.007	mg/m3	0	80	
NO	0.709	mg/m3	0	500	
NO2	-1.391	mg/m3	0	100	
H2O	0.092	vol%	0	40	
CO	1.255	mg/m3	0	2500	

Measurements

The results of the AAC can be displayed in the **Measurements** 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.

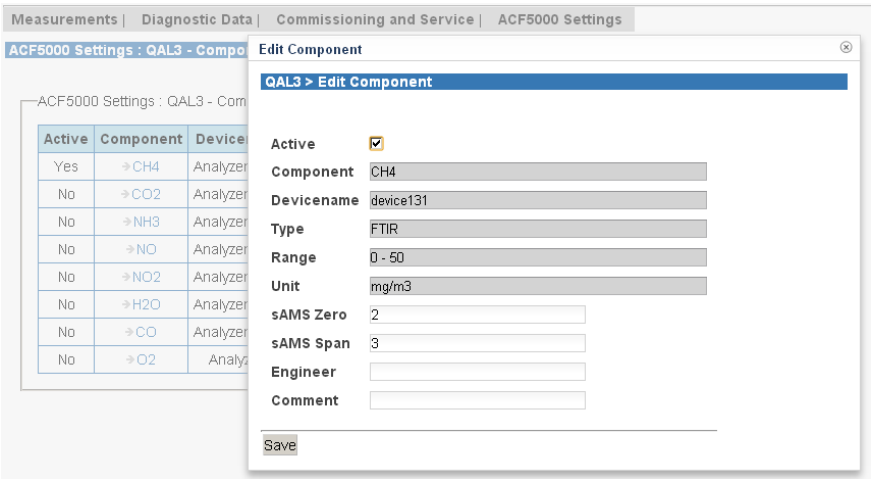
If the results table for the QAL3 measurements has extensive results, use the << 1 of 1 >>> keys to switch between the individual pages.

The AAC results for a measuring component can be printed or exported using the **Print**/**Export** keys.

Export components

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

Edit components



Measuring components that must be checked during the AAC can be activated and configured in the Edit 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. System conditions must be taken into account when using the performance test data. Minimum value = 3% of the measurement range.
sAMS Span	Enter the value of standard deviation from the reference point.	
Engineer	Enter name.	
Comment	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 **Measurements** 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 storage** 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	Explanation
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 are deleted with the Delete Data key. As this process cannot be undone, it is recommended that all results tables are exported before proceeding.	

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

Menu → Configure → Adjustment Data → Automatic Drift Check

Display

CONFIG: ADC AO2000: FTIR - Anlz. 1

Zero gas FTIR / Span gas O2
Zero gas Fidas24
Zero gas O2
Span gas Fidas24
Drift port 1
Drift port 2
Drift port 3
Span gas FTIR

Select port to configure.
Acknowledge: <ENTER>

Configuring 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.

CONFIG: ADC FTIR ZERO / O2 SPAN AO2000: FTIR - Anlz. 1

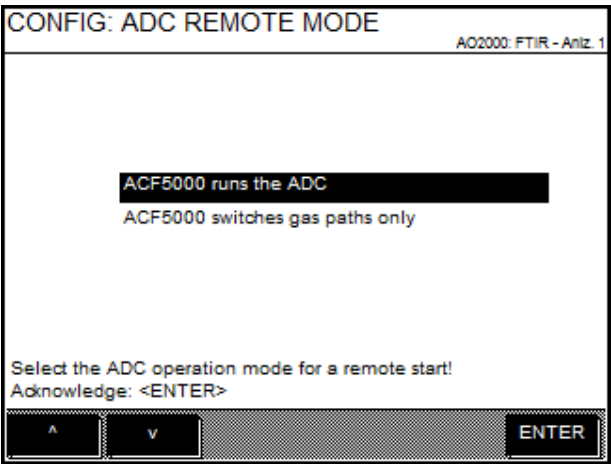
Enable:	off
Cycle time:	7 day(s)
Next ADC date:	10/15/2015
Next ADC time:	14:01:29
Duration:	20 sec.
Purge time: meas->probe gas:	20 sec.
Purge time: probe->meas gas:	20 sec.
Gas Path:	via Probe

Select parameter that should be configured!
Acknowledge: <ENTER>

Parameter	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/time	The analyzer system completes the next ADC at the time specified here. From this moment in time, the cycle period starts to run.
Measurement duration	Set up time during which the test gas is conducted through the analyzer system – after purge time measuring gas → Test gas.
Purge time meas. gas->test gas, test gas->meas. 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: Purging should last at least triple the T90 time of the entire analyzer system.
Gas path	The setting must be configured as to whether the test gas is emitted locally at the analyzer system or via sampling.

Configuring the ADC operating mode

Call up operating mode configuration in the ADC menu with **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 "Maintenance mode" status for the set test gas → measurement gas purge time plus 4 x T90 time.

Starting the gas port immediately

Start the required gas port immediately in the ADC menu with the **START PORT** key.

Configuring manual adjustment

NOTICE

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

Menu path

MENU → Configure → Adjustment Data → Manual Adj. → ...

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 (see page 78) is to be set for the manual adjustment.

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

NOTICE

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

Configuring automatic adjustment of the FID

Function

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

Menu path

Menu → Configure → Adjustment Data → Automatic Adj.

Display

CONFIG: AUTOM. ADJ AO2000: FIdas24 ACF - Anltz. 2

Enable:	off
Cycle time:	1 day(s)
Next adj. date:	10/09/2015
Next adj. time:	14:02:33
Working mode:	Adjustment
Test gas concentration	
Components for adjustment	
Cancel management	>>>

Select parameter that should be configured!
Acknowledge: <ENTER>

^ v ENTER

CONFIG: AUTOM. ADJ AO2000: FIdas24 ACF - Anltz. 2

Pump:	on during adj.
Purge time: meas->test gas:	181 sec
Purge time: zero<->span gas:	20 sec
Purge time: test->meas gas:	20 sec
Hold time for chart rec.:	0 sec
Gas Path:	via Probe
Pressure switch enabled for:	Disabled
Zero adjustment only:	Always

Select parameter that should be configured!
Acknowledge: <ENTER>

^ v ENTER

The recommended settings are stated in the following table.

Procedure

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
Date/time of next adjustment	The analyzer system completes the next automatic adjustment at the time specified here. From this moment in time, the cycle period starts to run.

Parameter	Explanation
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 Maintenance request 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 measured 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 measured 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 if the automatic adjustment is to be terminated when one of the three states occurs during the procedure: "System failure", "Analyzer failure" or "Analyzer maintenance request". 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. gas->test gas, zero gas->span gas, test gas->meas. gas	To be set (recommended settings in brackets) 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 end 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.
Waiting time for the trend recorder	The task time of the test gases after the purging time is to be set. Recommended setting: 0 seconds.
Gas path	To be set whether the test gases for automatic adjustment are connected at the separate test gas inlets or at the sampling probe.
Pressure switch activated 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 pressure switch can be activated for zero point gas, end point gas and zero point and end point gas.
Zero point adjustment individually	Whether zero adjustment will always or never be carried out individually, i.e. without subsequent end point adjustment, should be set.
End point adjustment individually	Whether end point adjustment will always or never be carried out individually, i.e. without prior zero point adjustment, should be set.
Zero point and end point adjustment jointly	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 measuring ranges for the start and end point adjustment for the common and substitute gas adjustment are selected in the Manual Adj. → Adjustment Method parameter.

Duration

Automatic adjustment takes about 18 minutes.

Configuring automatic adjustment of the oxygen sensor

Function

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

Menu path

Menu → Configure → Adjustment Data → Automatic Adj.

Display

CONFIG: AUTOM. ADJ AQ2000: ZrO2 - Aniz. 3

Enable:	off
Cycle time:	1 day(s)
Next adj. date:	10/09/2015
Next adj. time:	14:02:57
Working mode:	Adjustment
Test gas concentration	
Components for adjustment	
Cancel management	>>>

Select parameter that should be configured!
Acknowledge: <ENTER>

CONFIG: AUTOM. ADJ AQ2000: ZrO2 - Aniz. 3

Pump:	on during adj.
Purge time: meas->test gas:	20 sec
Purge time: zero<->span gas:	20 sec
Purge time: test->meas gas:	20 sec
Hold time for chart rec.:	0 sec
Gas Path:	via Probe
Zero adjustment only:	Always
Span adjustment only:	Never

Select parameter that should be configured!
Acknowledge: <ENTER>

The recommended settings are stated in the following table.

Procedure

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
Date/time of next adjustment	The analyzer system completes the next automatic adjustment at the time specified here. From this moment in time, the cycle period starts to run.

Parameter	Explanation
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 Maintenance request 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 measured 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 measured 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 if the automatic adjustment is to be terminated when one of the three states occurs during the procedure: "System failure", "Analyzer failure" or "Analyzer maintenance request". 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. gas->test gas, zero gas->span gas, test gas->meas. gas	To be set (recommended settings in brackets) how long after feeding in the test gas until the start of the adjustment (> 240 seconds), for joint zero point and end point adjustment after feeding in the end 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.
Waiting time for the trend recorder	The task time of the test gases after the purging time is to be set. Recommended setting: 0 seconds.
Gas path	To be set whether the test gases for automatic adjustment are connected at the separate test gas inlets or at the sampling probe.
Zero point adjustment individually	Whether zero adjustment will always or never be carried out individually, i.e. without subsequent end point adjustment, should be set.
End point adjustment individually	Whether end point adjustment will always or never be carried out individually, i.e. without prior zero point adjustment, should be set.
Zero point and end point adjustment jointly	Whether zero and end point adjustment will always or never be carried out jointly, or at every nth automatic adjustment, should be set.

Duration

Automatic adjustment takes about 18 minutes.

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 page 83),
- the automatic check of the adjustment (see page 85),
- the automatic drift check (see page 91) and
- the automatic adjustment of FID (see page 95) and oxygen sensor (see page 98).

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.

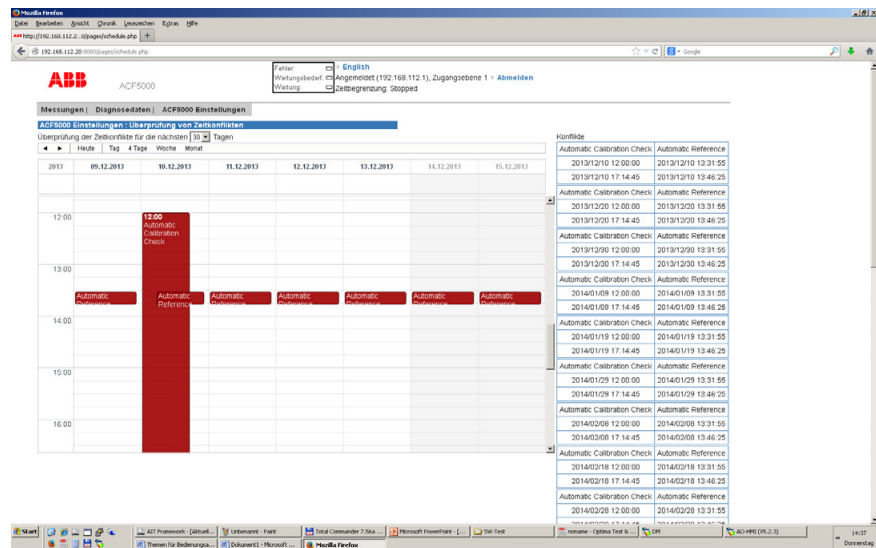
Menu path

ACF5000 Settings → Checking for scheduling conflicts

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** keys.

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

MENU → Configure → Adjustment Data →
Output current behavior → ...

Output current response

Signals at the current outputs (analog outputs)

- Are held at the last measured value prior to starting adjustment or
- Can follow measurement value changes during adjustment.

Adjustment: Operation

Carrying out manual reference

Creating manual reference

Function

A manual reference can be created for the FTIR spectrometer.

First, Menu → Service/Test → System → Manual gas path must be set to apply zero air either locally or via sampling (see page 172).

Menu path

Menu → Adjust → Manual Adjustment

Display

ADJ: MANUAL AO2000

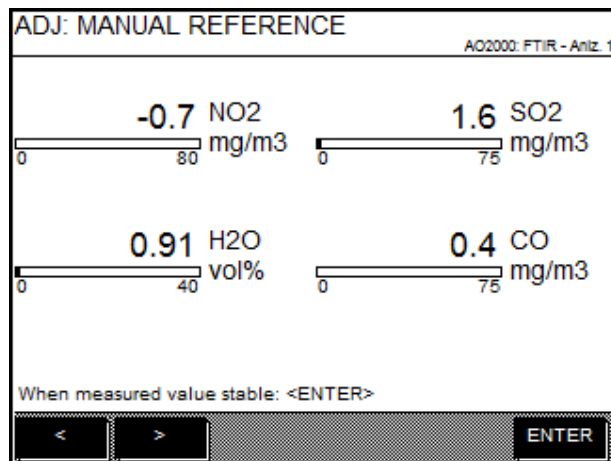
Analyzer type	Analyzer name	Components
FTIR	Anlz. 1	CH4,CO2,H2CO...
Fidas24 ACF	Anlz. 2	TOC
ZrO2	Anlz. 3	O2

Select analyzer! Acknowledge: <ENTER>

⬆ ⬇ ENTER

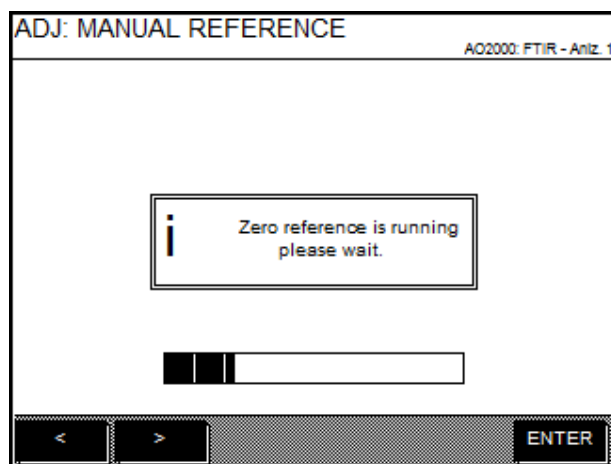
Procedure

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

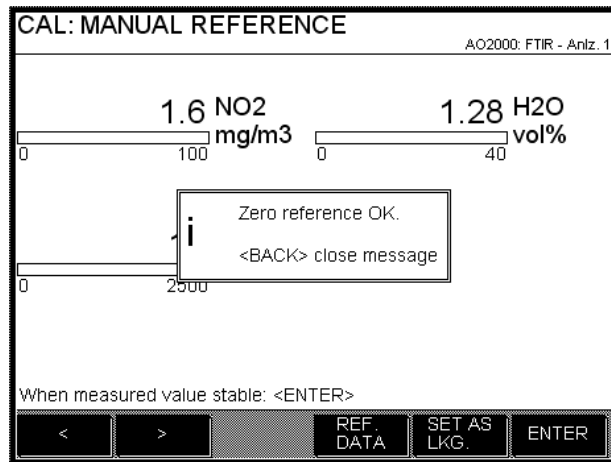


Switch between the various display pages using the < and > softkeys.

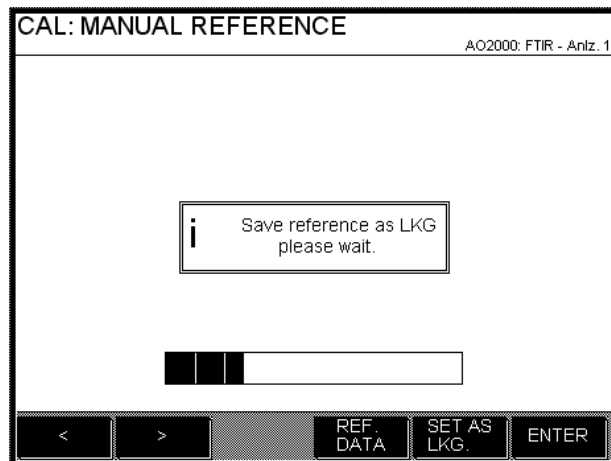
- 2 If the measured value is stable, start recording the manual reference by pressing **ENTER**.



- 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 as **SECURE AS LKG** (Last Known Good). It is then activated in the FTIR.



Displaying the status of the last reference

Menu path

Menu → Adjust → Manual Adjustment

Procedure

- 1 Select FTIR analyzer and press **ENTER** to select the Manual reference menu.
- 2 Display the last reference status by selecting **REF. DATA**.

ADJ: MANUAL REFERENCE		
AO2000: FTIR - Anlz. 1		
Parameter	Value	Ok
Remain. conc. CO2	231.295	-
Remain. conc. H2O	7.54913	*
Energy below cut-off	0.0179953	*
Region 1 [1/cm]	1000 - 1100	*
Intensity	0.0537164	*
Initial	0.0560071	*
Remaining [%]	95.91	*
Region 2 [1/cm]	2050 - 2150	*

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

The symbol in the OK column means:

- * Parameter OK
- Parameter not OK; the reference could not be recorded.

Displaying diagnosis 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 → Service/Test → Analyzer Spec. Adjustment → Basic Adjustment

Display

MAINT./TEST: BASIC ADJ. ACF5000 AO2000: FTIR - Anlz. 1

<SET LKG> set last reference as LKG reference.
 <SET INIT> set last reference as initial reference.
 <ANLZ. ADJ.> start an analyzer adjustment.
 Next automatic analyzer adjustment at:
 04/01/2016 14:52

SET LKG. SET INIT REF. DATA ANLZ. ADJ.

MAINT./TEST: BASIC ADJ. ACF5000 AO2000: FTIR - Anlz. 1

Parameter	Value	Ok
Remain. conc. CO2	231.295	-
Remain. conc. H2O	7.54913	*
Energy below cut-off	0.0179953	*
Region 1 [1/cm]	1000 - 1100	*
Intensity	0.0537164	*
Initial	0.0560071	*
Remaining [%]	95.91	*
Region 2 [1/cm]	2050 - 2150	*

^ v

Procedure

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

Saving the reference as an initial reference

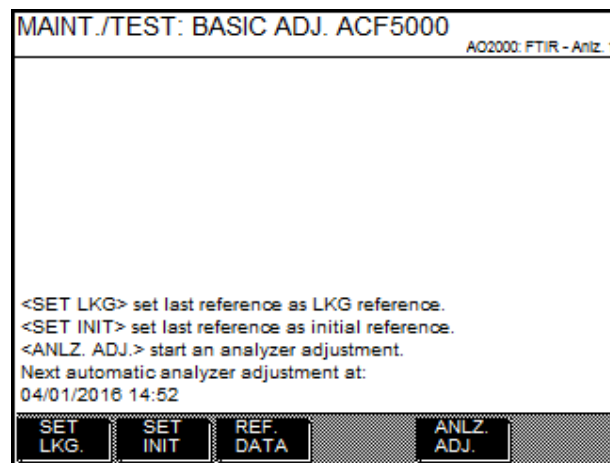
Function

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 → Service/Test → Analyzer Spec. Adjustment → Basic Adjustment

Display



Procedure

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

Start Automatic Adjustment Check (AAC) manually

Function

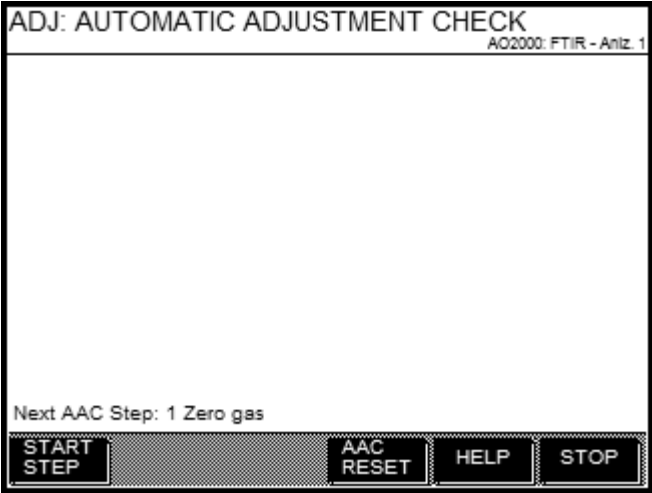
The automatic cyclic monitoring of the adjustment of the FTIR spectrometer (Automatic Adjustment Check – AAC) can be started manually. The handling depends upon configuration of the AAC cycle to “split” or “complete” or “complete & reference” (see page 85).

Menu path

Menu → Adjust → Automatic Adjustment → FTIR

AAC cycle "split"

Display

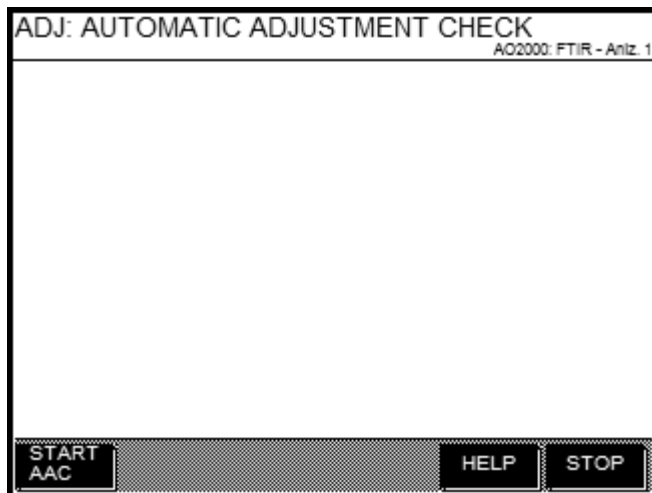


Operation

START STEP	Start the next step in AAC cycle (see display).
AAC RESET	Reset step counter to 1.
STOP	Abort the running AAC step. The analyzer system is purged with sample gas and returns to measuring mode. No set values and actual values for the FTIR span values are output. The AAC cannot be aborted during automatic reference recording.

AAC cycle “complete” or “complete & reference”

Display



Operation

START AAC	Start complete AAC.
STOP	Abort the running AAC. The analyzer system is purged with sample gas and returns to measuring mode. No set values and actual values for the FTIR span values are output. The AAC cannot be aborted during automatic reference recording.

Carry out manual adjustment

NOTICE

The descriptions in this section refer to the adjustment of the analyzer modules 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 Manual Adjustment menu:
MENU → Adjust → Manual Adjustment
- 2 For single adjustment: Select **Component** and **Measuring range**.
Zero point adjustment:
- 3 Select **Zero gas**.
- 4 Turn on the zero gas supply.
- 5 If necessary, change the test gas concentration shown¹, **ENTER**.
- 6 When the display of measured value stabilizes, initiate zero point adjustment with **ENTER**.
- 7 Carry out adjustment with **ENTER**
or **REPEAT**² adjustment (back to step 5)
or dismiss adjustment with **Back** (back to step 6)
or dismiss adjustment with **Meas** (back to display of measured value).
Span adjustment:
- 8 Select **Span gas**.
- 9 Turn on the span gas.
- 10 If necessary, change the test gas concentration shown, **ENTER**.
- 11 When the display of measured value stabilizes, initiate end point adjustment with **ENTER**.
- 12 Carry out adjustment with **ENTER**
or **REPEAT** adjustment (back to step 10)
or dismiss adjustment with **Back** (back to step 11)
or dismiss adjustment with **Meas** (back to display of measured value).
- 13 For single adjustment, repeat steps 2 to 12 for other components and measuring ranges.

¹ The parameterized test gas concentration is displayed. If the setpoint is altered here, the parameterized test gas concentration is overwritten.

² 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.

Manual start of automatic adjustment

NOTICE

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 carried out

- 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 Automatic Adjustment menu:
MENU → Adjust → Automatic Adjustment
- 2 Zero adjustment alone: **ZERO AUTOCAL**
Span adjustment alone: **SPAN AUTOCAL**
Zero and span adjustment jointly: **ZERO & SPAN AUTOCAL**

Cancel automatic adjustment manually

The user can cancel the automatic adjustment during the procedure 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.

Configuration: Component functions

Configuring measuring range

Switch measuring range

Menu path

MENU → Configure → Component-specific → Measuring Range (→ Select component) → ...

Selection

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

Procedure

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

NOTICE

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

Changing measuring range limits

NOTICE

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

Menu path

**MENU → Configure → Component-specific → Measuring Range
(→ Select component) → ...**

Selection

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

Procedure

Select measuring range with the arrow keys, press CHANGE LIMITS, select INITIAL VALUE or FINAL VALUE, change measuring range limit and confirm with ENTER.

NOTICE

For the automatic measuring range switching (see page 118) to work smoothly, the measuring ranges MB1, MB2, ... need to be configured in ascending order, i.e. $MB1 < MB2 < \dots$.

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

Measures after changing the measuring range limits

After changing the measuring range limits, the adjustment of the relevant measuring range needs to be verified. If the relationship of the old to the new measuring range is $\geq 1:10$, it is recommended to adjust the end point manually (see page 111).

After changing the measuring range limits, the parameters of the automatic measuring range switching (see page 118) should be verified.

Change number of decimal places

Menu path

MENU → Configure → Component-specific → Measuring Range
(→ Select component) → ...

Selection

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

Procedure

Select measuring range with the arrow keys, press DECIMAL PLACES, set the number of decimal places with the arrow keys and confirm with ENTER.

NOTICE

The setting only affects the display of the measured values in the display.

The number of decimal places cannot be increased.

The changed number of decimal places is displayed after switching in measuring mode in the display.

Number of decimal places

For the display of the measured value in physical units (e.g. ppm), the number of decimal places depends on how large the span of the measuring range is:

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

For the display of the measured value in % of the measuring range scope (%Span), two decimal places are always displayed.

The number of decimal places when setting the parameters is the same as in the display in measuring mode.

Add measuring range

NOTICE

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

Menu path

**MENU → Configure → Component-specific → Measuring Range
(→ Select component) → ...**

Selection

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

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

NOTICE

If the adding of measuring ranges for the configuration of the analyzer module was blocked with TCT, the "Free" entry does not appear, even if fewer than the 4 maximum measuring ranges possible are displayed.

Procedure

- 1 Press **NEW RANGE**.
- 2 Confirm the safety query by pressing **NEW RANGE**, where applicable, enter password (level 1).
Instead of the "Free" entry, a new measuring range is displayed in the list.
- 3 If necessary, by pressing **CHANGE LIMIT**, call up the menu for changing the measuring range limits (see page 114) and change the limits of the measuring range added.
- 4 If necessary, by pressing **DECIMAL PLACES**, call up the menu for changing the decimal places (see page 115) and change the number of decimal places of the measuring range added.

Delete measuring range

NOTICE

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

Menu path

**MENU → Configure → Component-specific → Measuring Range
(→ Select component) → ...**

Selection

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

If a measuring range can be deleted from the configuration of the measured components the **DEL. RANGE** softkey is displayed.

NOTICE

The deleting of measuring ranges can be locked when configuring the analyzer module using TCT.

The active measuring range (in which the measuring is currently being carried out) as well as the measuring ranges of the adjustment method currently active cannot be deleted.

Procedure

- 1 Press **DEL. RANGE** softkey.
- 2 Confirm the safety query by pressing **DEL. RANGE** softkey where applicable, enter password (level 1).
The "Free" entry is displayed in the list instead of the measuring range deleted.

Configuring automatic measuring range switching

Menu path

MENU → Configure → Component-specific → Autorange
→ Select Component → ...

NOTICE

The automatic measuring range switching works only perfectly if the measuring ranges MB1, MB2, ... were configured in ascending order, i.e. MB1 < MB2 < ... (see page 114).

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 system 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 system automatically switches to the next larger measuring range.

NOTICE

The values of the upper and lower thresholds need to be chosen such that the analyzer system does not permanently 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.

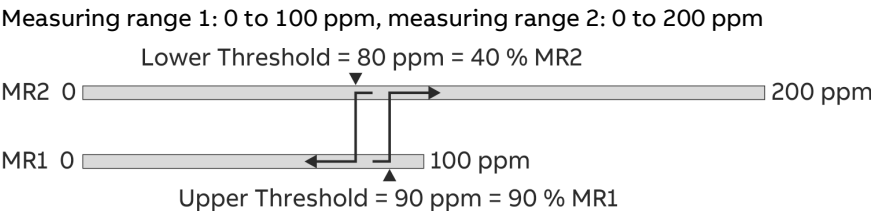
NOTICE

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

Status

Automatic measuring range switching can be activated or deactivated.

Example for auto-ranging



Procedure

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

Configuring 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. Range for FTIR sample components: 0 to 300 s FID and O ₂ sample components: 0 to 60 s	Set
T90-2	Low-pass time constant for measured value changes. Range: 0 to 60 s.	Set
Switching threshold	Switching threshold. When exceeding, T90-2 becomes effective.	Set

Non-linear filter

For the non-linear filter, it is practical to set $T90-2 \leq T90-1$.

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

Recommendations for FID:

T90-1 = 20 s, T90-2 = 1 s, switching threshold = 0.001%

Active component selection

Menu path

MENU → Configure → Component-specific → Active Component

Active component

With this FID analyzer module, several measured components can be configured however, only one measured component is measured and displayed.

Procedure

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

Subsequently, use the "Measuring range" menu item to select the range for the desired active component.

NOTICE

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

Configuring limit monitoring

Menu path

MENU → Configure → Component-specific → Limit Values →
Select 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
Threshold	in physical units	Set
Hysteresis	in physical units	Set

Standard configuration

As a rule, limit value monitoring for those components to be measured by the analyzer system 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** function blocks. The Technical Information "Function blocks – Descriptions and configuration" contains complete information on the individual function blocks.

Configuring FTIR limit monitoring

Function

The monitoring of the FTIR measured values with regard to exceeding limit values can be configured.

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

Menu path

Menu → Configure → Component-specific → FTIR High Alarm

Display

CONFIG: HIGH ALARM

AO2000

Parameter	Value
High Alarm Activ	No
Purge Time For Zero Gas (sec)	120
Flush Time For Span Gas (sec)	120
High Alarm Limits	→

Select item to configure. Acknowledge:<ENTER>

▲

▼

ENTER

CONFIG: HIGH ALARM

AO2000

Name	Limit	Unit
CH4	1000.00	mg/m3
CO2	40.00	vol%
H2CO	250.00	mg/m3
HCl	3000.00	mg/m3
HF	800.00	mg/m3
N2O	1500.00	mg/m3
NH3	300.00	mg/m3
NO	8000.00	mg/m3

Select item to configure. Acknowledge:<ENTER>

▲

▼

ENTER

Procedure

Parameter	Explanation
High alarm active	Activate ("yes") or deactivate ("no") limit monitoring.
Purge time for zero gas (sec)	Enter purging time for zero air in seconds.
Purge time for measuring gas (sec)	Enter purging time for measuring gas in seconds.
High alarm limit values	Enter the limit value for every measured component in the physical unit displayed.

Configuring dry base and O₂ reference

Correcting the measurement value

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 available only when this option has been ordered and configured ex-works in the analyzer system.

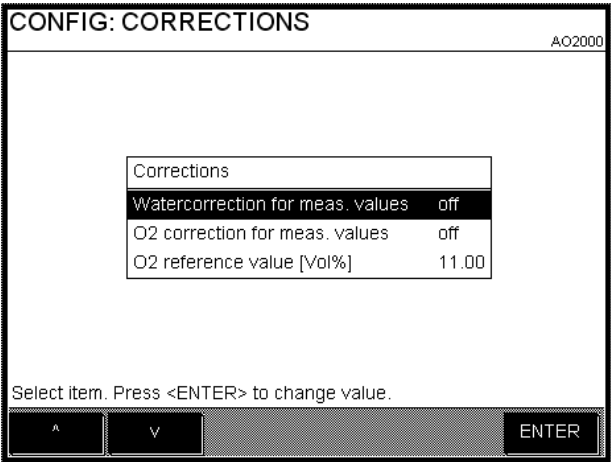
The correction functions are automatically shut off during adjustment when no sample gas is connected. As soon as the sample gas is connected again the correction functions are activated again (even when the adjustment is not yet finished).

The correction functions only affect those measured values that are determined after the function has been activated. Therefore, it can take up to 30 seconds for the FTIR spectrometer to display a corrected reading.

Menu path

Menu → Configure → Component-specific → Corrections

Display



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

Procedure

Parameter	Explanation
Water correction of measured values	Activates or deactivates the correction function.
O2 correction of measured values	Activates or deactivates the correction function.
O2 reference value [Vol%]	Enter the officially prescribed O ₂ reference value in vol%. The O ₂ reference value is limited to the range of ≥ 0 vol% to < 21.00 vol%.

Display of measured value

The measuring components marked with the * symbol in the display of measured values 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 or *O₂corr. or *Dry&O₂corr.

Changing module name

Menu path

MENU → Configure → Component-specific → Module Name

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 (see page 129) 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 two times 10 characters for a bilingual entry.

Entering the module name

When entering the module name, use the same procedure as entering text (see page 63).

NOTICE

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

If the module name appears next to or under the module type depends on the configured size for displaying the measured quantity (see page 144).

Configuration: System functions

Setting time zone, date and time

Menu path

MENU → Configure → System → Date/Time

Procedure

Parameter	Explanation
Time zone	The time zone can be selected either from the list of GMT values or from the list of continents/countries/cities.
Date	The date must be entered in the format Day.Month.Year, The year must have four digits.
Time	The time must be entered in the format hour:minute:second. The seconds must be entered.

Definitions

GMT = Greenwich Mean Time

CET = Central European Time = GMT + 1 hour

CEST = Central European Summer Time = GMT + 2 hours

Summer time

The analyzer system automatically switches to summer time.

Note: However, this applies only if the time zone is selected from one of the lists of continents/countries/cities and not from the list of GMT values.

Delivery status

The analyzer system is set at the plant to the time zone GMT+1.

Assuming the time settings

To assume the changed time settings, the SET CLOCK softkey must be pressed.

Selecting user interface language

Menu path

MENU → Configure → System → Language

Language selection

The user interface languages German and English are factory-set in the analyzer system as per order. It is possible to switch between these languages in the Language menu item.

Change password

Menu path

MENU → Configure → System → Changing Password

Password protection

Basic information on the subject of password protection can be found in the Password protection section (see page 66).

Factory setting

User group	Access to password levels	Password
Every user	0	None
Maintenance team	0, 1	471100
Specialist team	0, 1, 2	081500
Function block specialist	0, 1, 2, 3	325465
Service specialist	All	737842

Procedure

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

NOTICE

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

CAUTION!

After entering the password for password level 3, the user can access all of the function block applications. When configuring function blocks, existing applications with their configurations and links can be damaged or destroyed!

CAUTION!

The user can change all passwords. Therefore it is strongly recommended to document each password changing. Only ABB service is able to reset the passwords to the factory setting.

Blocking operation

Menu path

MENU → Configure → System → Changing Password

Blocking operation

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

After blocking, the operation of the analyzer system 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 Change password menu item, press the MENU ACCESS softkey and make the desired password protection settings.

Setting system modules

Menu path

MENU → Configure → System → Set System Modules

Function

If system modules are added to an analyzer system 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. For them to be identified by the analyzer system, 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 identified by the analyzer system if it is new or has already been added as a replacement for an already existing I/O module.

Serial number

The module's 14-digit serial number is stated in the Analyzer Data Sheet and on the 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:

014 Analyzer module

130 u-remote module

Unknown system module

If in the Set system module menu item, a system module has the status Unknown, there are several possible causes:

Cause: After activating the power supply of the analyzer system, the system module could not be found (status message no. 201).

Rectification: Restore system bus connection to the system module and press RESTART softkey.

Cause: The system bus connection to the system module is interrupted (status message no. 209).

Rectification: Restore system bus connection to the system module and press RESTART softkey.

Cause: The serial number of the system module was wrongly entered.

Rectification: Press CHANGE softkey and correct serial number.

NOTICE

While system modules are being set, the automatic adjustment is not possible.

Add system module

NOTICE

As long as no system module is configured in the analyzer system at all or an added system module is not yet configured, the **NEW** softkey appears in the display in measuring mode. By pressing this softkey, the user goes directly to the **Set 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 **Set system modules** menu item.
The list of the system modules available in the system is displayed.
- 2 Press **NEW** softkey.
- 3 Enter 14-digit serial number of the new system module.
- 4 The added system module appears in the list with the **New** status.
- 5 Save configuration change with **ENTER** or discard with **Back**.

Add a new I/O module

- 1 Select **Set system modules** menu item.
The list of the system modules available in the system is displayed.
- 2 Select the I/O module added, and automatically identified by the analyzer system, and press the **NEW** softkey.
- 3 When setting a digital I/O module:
Press **FB-APPL.** softkey and select function block applications.
- 4 The added system module appears in the list with the **New** status.
- 5 Save configuration change with **ENTER** or discard with **Back**.

NOTICE

If a Profibus module is refitted, it needs to be installed as the bottom I/O module, i.e. on the slot -X20/-X21.

Replace system module

Uninstallation and reinstallation of the same system module

If an existing system module is uninstalled and (e.g. after a repair) reinstalled, the setting of this system module is usually not necessary.

As soon as the system module is reconnected to the system bus, it is automatically identified and its configuration is saved automatically. The requirement for the automatic identification is that the analyzer system is in measuring mode.

CAUTION!

If an existing system module is replaced with another system module, the Remove function may be used to delete the old system module. In this process, the parameter settings and function block configuration of the old system module would also be irrevocably deleted.

To retain the parameter settings and the function block configuration of the old system module when replacing a system module, the Change function must be used.

NOTICE

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 identified by the analyzer system and does not need to be configured.

An existing system module (analyzer module or I/O device) is replaced by another system module

- 1 Select **Set system modules** menu item.
The list of the system modules available in the system is displayed.
- 2 Select system module (analyzer module or I/O device), which was replaced and is now to be reset.
This system module appears in the list either with the status of Unknown or Error.
- 3 Press **CHANGE** softkey.
By no means press the **REMOVE** softkey! This would delete irrevocably the parameter settings and the function block configuration of this system module.
- 4 Enter 14-digit serial number of the new system module.
- 5 In the list, the new system module now has the **Replaced** status.
- 6 Save configuration change with **ENTER** or discard with **Back**.

Delete system module

Sequence when removing system modules

When removing system modules from the analyzer system, the following sequence must always be applied:

- 1 Delete system module in the software (instructions see below).
- 2 Remove system module from the analyzer system.

Delete an existing system module without replacement

- 1 Select **Set 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 **REMOVE** softkey.
This deletes irrevocably the parameter settings and the function block configuration of this system module.
- 4 In the list, the system module now has the **Deleted** status.
- 5 Save configuration change with **ENTER** or discard with **Back**.

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 function 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 saving area and can be loaded when required, for instance in order to reset the analyzer system to a defined status.

NOTICE

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 on the DVD-ROM "Software tools and technical documentation", which is included in the scope of delivery of the analyzer system.

Configuring status signals

Menu path

MENU → Configure → System → Status Signals

Function

The configuration of the status signals is already defined when ordering the analyzer system and set at the plant.

As a rule, it is not necessary to change this configuration during operation.

Selection

The following are available

- Individual status signals, i.e. loss, maintenance request and maintenance mode, as well as
- Overall status signals.

NOTICE

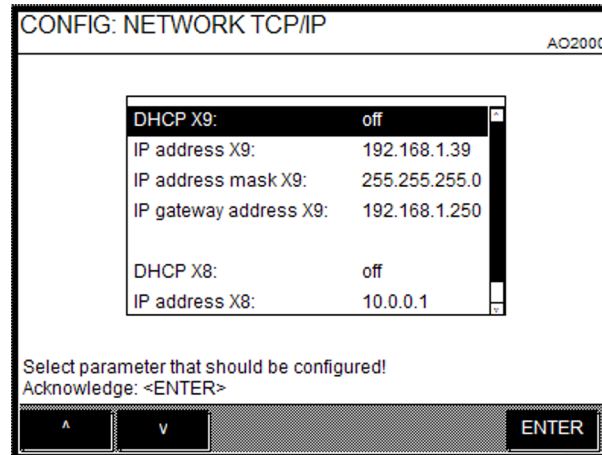
If the configuration of the status signals is changed from overall status signals to individual status signal, the digital outputs of DO2 and DO3 of the standard function block application status signals/externally controlled adjustment occupied with limit signals are potentially overwritten with individual status signals.

Further information on the status signals can be found in the "System status: Status signals" section (see page 203).

Configuring Ethernet connection

Menu path

MENU → Configure → System → Network → TCP/IP Network



Function

The analyzer system can be integrated via the Ethernet 10/100/1000BASE-T interface in an Ethernet network (with TCP/IP protocol).

Parameter

It depends on the DHCP settings what parameters need to be integrated:

DHCP on: network name (max. 20 characters, no empty and special characters),

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

Address

The IP address, IP address mask and IP gateway address need to be queried from the system administrator.

NOTICE

Addresses of the TCP/IP categories D and E are not supported.

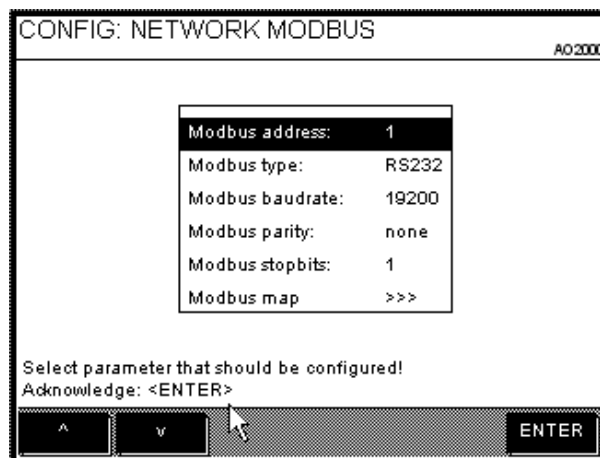
The address bits variable in the address mask may not all be set to 0 or 1 (broadcast addresses).

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

Configuring Modbus connection

Menu path

MENU → Configure → System → Network → Modbus



Function

The analyzer system 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.

NOTICE

The Modbus menu item is only displayed if the Modbus module is installed in the analyzer system.

Parameter

The analyzer system 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 only be set in the range 1 to 255.

As the Modbus type, the interface needs to be selected via which the analyzer system is connected to the Modbus network (RS232 or RS485).

The standard settings for the data transmission are displayed in the above image.

The Modbus image allows an overview of the address position of the Modbus register.

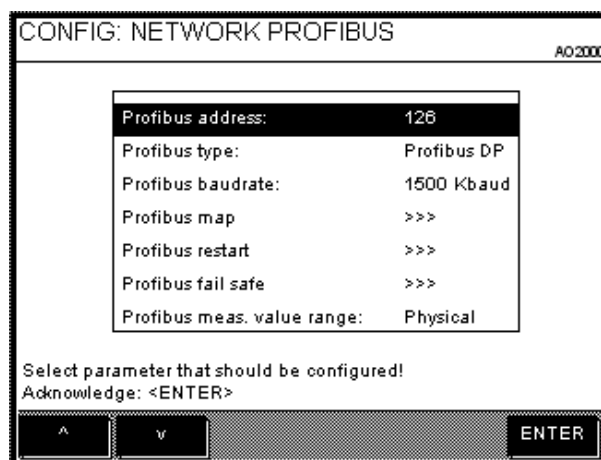
NOTICE

For additional information on "Modbus", refer to the Technical Information "AO2000 Modbus and AO-MDDE".

Configuring Profibus

Menu path

MENU → Configure → System → Network → Profibus



Parameter

Parameter	Selection	Explanation
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 AO2000 function block.
	Hold value	The Profibus function block holds the last output value. The display of the AO2000 function block may differ from this.
Profibus meas. value range	Physical	The Profibus-AI value is the physical measured value for AO2000.
	VDI 4201	The physical measured values of the AO2000 are scaled to the -10000 to 0 to +10000 range. Here, 0 is equal to physical 0 and 10000 equal to the final value of the display range (according to VDI 4201).

NOTICE: For additional information on "Profibus", refer to the Technical Information "AO2000 Profibus DP/PA interface".

Configuring Bus I/Os

Menu path

MENU → Configure → System → Network → BUS IO

CONFIG: BUS IO-CONFIG AO 0000

Bus IO	Quantity	Maximum.
Bus AI	8	50
Bus AO	8	50
Bus DI	8	50
Bus DO	8	50

Select parameter that should be configured!
Acknowledge: <ENTER>

Navigation buttons: ▲, ▼, ENTER

Number of Bus I/Os

Changing the number of Bus I/Os will affect the Modbus address range, Profibus map and Ethernet linking.

Reducing the number of Bus I/Os may cause transmission errors if the settings in the communication partners are not matched. This may also cause damage in the function block applications.

Parameter

Parameter	Function	Read	Write	Example
BUS AI	Bus analog inputs	x	x	for analog value input into the function block application
BUS AO	Bus analog outputs	x	–	for analog value output from the function block application
BUS DI	Bus digital inputs	x	x	for control of functionality such as automatic adjustment, measurement range control after function block configuration
BUS DO	Bus digital outputs	x	–	for display of functionalities linked by function block configuration, e.g. alarm signaling

Configuration: Display functions

Display features

The display can be configured

In measurement mode the analyzer system screen is freely configurable. A standard layout is configured on each delivered unit (see below).

Display elements

Display elements are:

- the default measured quantities in the analyzer system (sample components, auxiliary quantities, current outputs and current inputs), and
- freely configured displays of measured quantities as well as value inputs or key entries.

"Pages"

The screen is divided into "pages", i.e. the display elements are summarized on pages. Up to six measurement values can be displayed per page.

The pages brought up when scrolling with >> can be displayed.

A value can only be displayed on a single page.

System pages (standard layout)

The analyzer system normally displays its measured values in a fixed sequence on the various screen pages. This holds true for the measured quantities of system modules (see page 132), that were added by the user.

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

The user cannot delete system pages.

The following table shows the standard system page layout in a analyzer system 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	Measured values of the auxiliary variables (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 page 151).

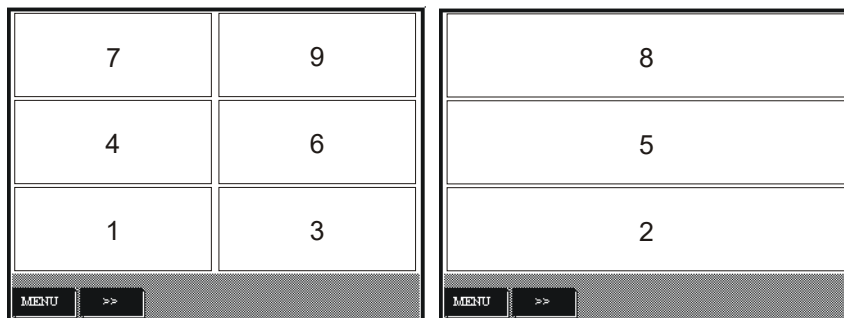
Function blocks as sources

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.

All sample components, auxiliary quantities, current outputs and current inputs exist as function blocks in the system, i.e., all of these measured quantities are displays of **function blocks** in the system. Technical Information "Function blocks – Descriptions and configuration" contains complete information on the "Function block" concept as well as detailed descriptions of the individual function blocks.

Display element positioning on the screen

The display elements can be represented in two sizes. A maximum of three large and six small display elements can be represented on a page. Large and small display elements can be mixed with each other. The positions are numbered as shown in the following figure. The numbering of the positions corresponds to the arrangement of the number keys next to the display.



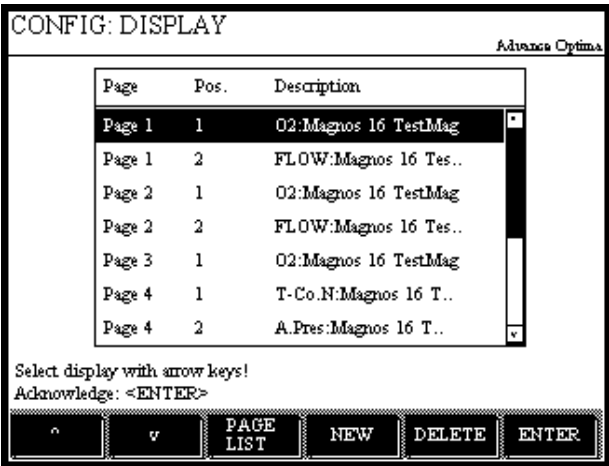
Views

The following views are available for screen configuration:

- the display overview (see page 147),
- the page overview (see page 148) and
- the parameter overview (see page 149)

Display overview

Display overview



Parameter

Parameter	Explanation
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:



With the PAGE LIST softkey, the user calls up the page overview (see page 148).



With the NEW softkey, the user starts the configuration of a new display element, e.g.

- Configuring the bar display or point display (see page 154),
- Value input (see page 157),
- Key entry (see page 160).



With the DELETE softkey, the user deletes the selected display element.



With the ENTER softkey, the user calls up the parameter overview (see page 149) of the selected display element.

Page overview

Page overview

CONFIG: DISPLAY PAGE LIST				Advance Optima
No.	Name	Usage	Typ	
1 On	Page 1	33%	System	
2 On	Page 2	33%	System	
3 On	Page 3	17%	System	
4 Off	Page 4	50%	System	
5 Off	Page 5	50%	System	
6 On	Page 6	33%	System	

Select page with arrow keys!
Acknowledge: <ENTER>

Parameter

Parameter	Explanation
No.	Page number and status ("On" or "Off")
Name	Name of the page
Assignment	Page assignment
Type	System: Pages configured by system with standard layout User: Page configured by the user

Page overview softkeys

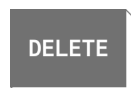
The page overview softkeys and keys have the following functions:



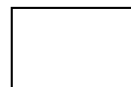
The operator toggles the selected screen page on or off with the PAGE ON/OFF softkey.



The NEW softkey starts the configuration of a new (user) page (see page 151).



The DELETE softkey deletes the page selected by the user. Only empty "user" pages can be deleted.



The ENTER softkey allows the user to input text to change the name of the selected page.



The **Back** key returns the user to the display overview (see page 147).

Parameter overview

Parameter overview

CONFIG: DISPLAY O2 Advance Optima

Parameter	Value
Name	O2:Magno 16 TestMag Vol%
Measpt.	Magno 16 TestMag
Source	O2
Page	Page 1
Position	1
Style	Bar
Range Low	0

Select parameter that should be configured!
Acknowledge: <ENTER>

Parameter

Parameter	Explanation
Name	The name of the display element set by the system cannot be changed.
Test point	The description entered for the Test point appears over the element display during measurement. 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 elements 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. The following display types exist bar display, point display, value input (see page 156) and key entry (see page 158). Examples of the different display styles are shown as soon as this parameter is selected.
Measuring Range Low, Measuring Range High	The Measuring Range Low and Measuring Range High parameters determine the measuring range span of the bar display and the point display. They cannot be changed for the display elements of the default assignment, i.e., the measured quantities.

Places	The Decimal Places parameter determines the number of decimal places (see page 115) for the digital display of the measured values. It cannot be changed for the display elements of the default assignment, i.e., the measured quantities.
--------	---

User page configuration

User page configuration

- 1 Select **Display** menu item.
- 2 Call up the page overview.
- 3 Start configuring a new page with **NEW**.
- 4 Either: Enter the page name. The page overview is displayed.
Or: Go directly to the page overview. In this case the system assigns the name "Page #" (# = page number).
- 5 The new page will appear in the page overview:
No.: Assigned by the system, status "on"
Name: As assigned in step 4
Allocation: 0% (no measurement value)
Type: User

Moving a display element from one page to another

Moving a display element from one page to another

- 1 Select **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 is also taken, the display element cannot be moved (display ----).
- 6 If the new page is a user page and other positions are free, the position of the display element can be changed.
Select the **Position** parameter.
The nine possible positions are graphically represented; free positions are identified by the position number.
Select the desired position with the corresponding number key.
- 7 Switch to measuring mode.
The display element is now shown on the new page.

Moving a display element within a page

Moving a display element within a page

- 1 Select **Display** menu item.
- 2 Select the display element in the display overview.
- 3 Select the **Position** parameter.
The nine possible positions are graphically represented.
- 4 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 softkey **Swap Display** is pressed), or it can be moved to a free position (the softkey **Swap Display** is not pressed).
Select the desired position with the corresponding number key.
- 5 Switch to measuring mode.
The display element is now displayed at the new position.

Configuring the bar display or point display

Configuring the bar display or point display

- 1 Select **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.
- 5 For the parameters **Name**, **Test point** and **Source**, system default values are displayed. The parameter **Name** cannot be changed.
- 6 Select the **Page** parameter.
The page overview is displayed.
- 7 Select the page on which the display element is to 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 page 153).
If the new page is a user page, the position must be configured.
- 8 Select the **Position** parameter.
The nine possible positions are graphically represented; free positions are identified by the position number.
- 9 Select the position with the corresponding number key.
- 10 Select the **Type** parameter.

- 11 Select display type: **Bar graph** (top of the image) or **Point graph** (bottom of the image).

Uras26 Anlz.1



Uras26 Anlz.1



- 12 Set the parameters **Range Low**, **Range High** and **Places**. If necessary, change the description of the display element in the parameter **Measuring Point**.
- 13 Switch to measuring mode.
- The newly configured display element is now shown in the display. The description of the display element is shown above the display. To the right of the display, the name and unit of the function block selected in step 4 are displayed. These two parameters can be changed with the function block configuration.

Value input

Configuring the value input

CONFIG: VALUE INPUT Pump 1 Advance Optima

Parameter	Value
Input low:	0
Input high:	100
Places	2
Helpline 1	
Helpline 2	
Pw. level	--

Select parameter that should be configured!
Acknowledge: <ENTER>

Navigation buttons: ^, v, HELP, ENTER

Description

The source of the display element **Value Input** is the function block **Constant** that is automatically generated during configuration. The output of this function block accepts the entered value.

For the value input to be effective, the generated function block must be linked using a function block application after the display is configured (see Technical Information "Function blocks – Descriptions and configuration" for detailed description).

Configuration

The following are to be configured for the display element **Value input** (see page 157)

- the start and end of the entry range,
- the number of decimal places in the display,
- two lines of text that are displayed when the display element is used, and
- the password level on which the entry value can be changed.

Procedure

Values are entered during measurement by pressing the number key that corresponds to the position of the display element in the display and is indicated above the display element. A field then appears for entering the value (see "Operating by value input" section, see page 64). The display element **Value input** accordingly represents feedback to the actual value input.

Configuring value input

Configuring value input

- 1 Select **Display** menu item.
- 2 Start configuration of the new display element with **NEW**.
- 3 Select the **Page** parameter.
The page overview is displayed.
- 4 Select the page on which the display element is to 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 page 153).
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 position with the corresponding number key.
- 7 Select the **Type** parameter.
- 8 Select **Entry** display type.
This creates a **Constant** function block; whose system-issued name, 'Value page-position', is displayed in the parameter **Source**. This name cannot be changed here; it can only be changed by configuring the function block (see step 11).
- 9 Select the **Config entry** parameter and configure the other parameters: entry range, decimal places, text and password level. The configuration of reverse entry ranges (e.g. 100 to 0 ppm) is possible.
- 10 The description of the display element is entered in the **Test point** parameter.
- 11 Select the function block created in step 8, enter the name and unit, and link the function block to an application via its Output 1 (see Technical Information "Function blocks – Descriptions and configuration" for detailed description).
- 12 Switch to measuring mode.
The newly configured display element is now shown in the display. The description of the display element is shown above the display. To the right of the display, the name and unit of the function block are displayed that were entered in step 11.

Key entry

Configuring key entries

CONFIG: KEY INPUT Advance Options

Parameter	Value
Number of keys	3
Key mode	Push buttons
Confkeys	>>>
Helpline 1	
Helpline 2	
Pwr. level	--

Select parameter that should be configured!
Acknowledge: <ENTER>

< > HELP ENTER

CONFIG: KEY1 Advance Options

Parameter	Value
Key mode	Push button
Key label 1	Key1
Key label 2	...
Value key up	0.0
Value key down	0.0

Select parameter that should be configured!
Acknowledge: <ENTER>

< > HELP ENTER

Description

The source of the display element **Key entry** is one or more **Constant** function blocks that is automatically generated during configuration. Upon "actuation", the output of this function block assumes the value that was established during configuration.

For the key entry to be effective, the generated function blocks must be linked using a function block application after the display is configured (see Technical Information "Function blocks – Descriptions and configuration" for detailed description).

Configuration

The following are to be configured for the display element `Key entry` (see page 160)

- the number of keys (1 to 6) – the keys are assigned to the softkeys,
- the key type
 - key or
 - switch or
 - option key,
- the parameters for each key
 - label,
 - value key released, and
 - value key pressed,
- two lines of text that are displayed when the display element is used, and
- the password level on which the keys can be used.

Procedure

Key entries are made in measurement mode by pressing the number key that corresponds to the position of the display element on the display and that is indicated over the display element. A softkey line then appears with the configured keys (see "Operating by key entry", see page 65). The display element `key entry` accordingly represents feedback to the actual key entry.

Configuring key entries


Configuring key entries

- 1 Select **Display** menu item.
- 2 Start configuration of the new display element with **NEW**.
- 3 Select the **Page** parameter.
The page overview is displayed.
- 4 Select the page on which the display element is to 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 page 153).
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 position with the corresponding number key.
- 7 Select the **Type** parameter.
- 8 Select the display type **Keys**.
This creates a single function block **Constant**, whose system default name 'Value page-position' is displayed in the parameter Source. This name does not appear in the display. If necessary, it can be changed by configuring the function block (see step 11).
- 9 Select the **Config keys** parameter and configure the other parameters: key number, key type, label, value released/pressed, text and password 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 **Test point** parameter.
- 11 Select each of the function blocks created in steps 8 and 9 and link to an application with its output 1 (see Technical Information "Function blocks – Descriptions and configuration" for detailed description).
- 12 Switch to measuring mode.
The newly configured display element is now shown in the display. The description of the display element is shown above the display.

Maintenance

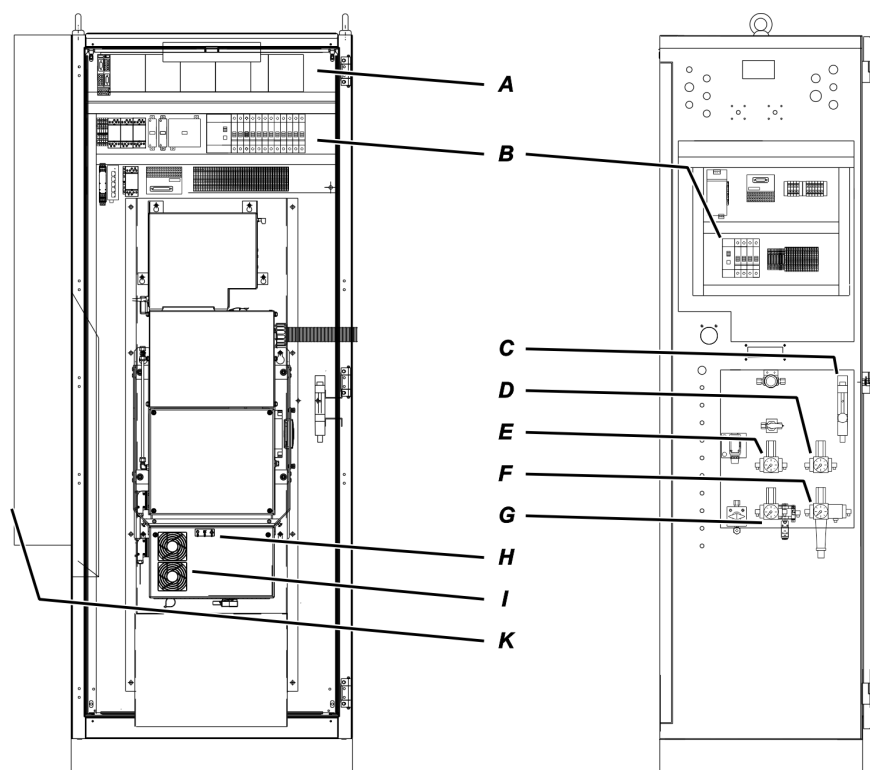
General notices

NOTICE	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.
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- | | |
|---|---|
| <div> WARNING</div> | <p>The following must be observed during all maintenance work:</p> <ul style="list-style-type: none">• The general safety instructions (see page 8),• The safety instructions for handling the analyzer system (see page 11),• The safety instructions for handling the analyzer system with integrated FID analyzer (see page 12),• The safety instructions for handling the FTIR spectrometer (see page 13),• The safety instructions for working with poisonous gases (see page 14). |
|---|---|
-

Visual inspection

Internal view of the analyzer cabinet



Visual inspection

External instrument air regulator		5.5 to 7 bar
External gas cylinder pressure reducers:		
Zero gas, O ₂ analyzer (3 vol. % O ₂ in N ₂)		1.5 ± 0.1 bar
Combustion gas, VOC analyzer (H ₂)		1.2 ± 0.1 bar
Zero gas, VOC analyzer (N ₂ or zero gas O ₂ analyzer)		1.5 ± 0.1 bar
Span gas, VOC analyzer (propane in N ₂)		1.5 ± 0.1 bar
A	Status LEDs of the analog and digital output modules	Green ¹⁾
B	Circuit breakers and ground fault circuit interrupters activated	ON
C	Purge gas flowmeter	125 l/h
D	Instrument air pressure regulator, combustion air, VOC analyzer (–J86)	1.2 ± 0.1 bar
E	Instrument air pressure regulator, purge air, spectrometer (–J88)	2.0 ± 0.1 bar
F	Instrument air regulator with filter (–J85)	5.5 bar
G	Instrument air pressure regulator, injector air (–J96)	4.5 ± 0.1 bar
H	Status LEDs on the cover of the FTIR E-Box	"Power" Green
		"Status" Green
		"Network" Orange/Green flashing
I	Filter mattes on the cover of the FTIR E-Box	White
K	Cooling unit display	Actual temperature value (target: 25°C)
Filter mattes in cabinet fan and exit filter		White

- 1) When not all channels are connected in an analog output or analog input module the status LED lights red also in normal operation.

Cleaning the analyzer cabinet

CAUTION!	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

CAUTION!

Do not use any leak search spray or similar leak search tools in the under-pressure area of the analyzer system. These media may result in damage to the analyzer system in the event of a leak.

Complete seal integrity test of the analyzer system

Complete seal integrity tests of the analyzer system are reserved for certified service personnel.

It should be carried out regularly during each maintenance work, at least every 12 months.

They must be performed after gas paths within the analyzer system have been opened and following a restart from cold.

Simplified seal integrity test of the sample gas path

NOTICE

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).

Simplified seal integrity test via FID

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 for a few seconds close to 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 for a few seconds close to the sample gas line connection at the ASP block.

CAUTION

The ASP block is hot (approx. 180°C)!

Wear suitable protective gloves and safety goggles!

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 great (> 90).
The position variables can be found in the menu under
Diagnosis/Information → Module-specific →
Controller measured values → FID.
- 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: Seal integrity and functional checks

CAUTION!

The seal integrity and functional checks 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, seal integrity and functional checks must be carried out by ABB service.

Seal integrity check of the combustion gas path

The seal integrity of the combustion gas line within the analyzer system must be checked regularly during each maintenance work and at least every 12 months using a hydrogen leak detector (leak rate $< 2 \times 10^{-4}$ hPa l /s). Do not use leak detector spray!

Seal integrity check of the combustion gas supply 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 from a bottle

- 1 Switch off the analyzer system power supply. Ensure that the shut-off valve in the combustion gas supply line is open.
- 2 Set the combustion gas pressure at approx. 1.4 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 combustion gas bottle and the combustion gas inlet valve of the analyzer system. In this case the following measures are to be taken:
 - 1 Check the pressure reducer and the combustion gas line between the bottle and analyzer system with a leak detection spray. A leak in this area must be remedied and another leak test must be performed before the analyzer system is put into operation again.
 - 2 If no leak is found at the pressure reducer and in the combustion gas line, that means the analyzer system combustion gas inlet valve is leaking. **In this case, the analyzer system may not be put into operation!** The combustion gas inlet valve must be replaced by ABB service.
- 6 After conclusion of the seal integrity test, set the combustion gas pressure to 1.2 bar.

Combustion gas supply from a central supply

- 1 Switch off the analyzer system power supply. Ensure that the shut-off fitting in the combustion gas supply line is open.
- 2 Set the combustion gas pressure at approx. 1.4 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 analyzer system. In this case the following measures are to be taken:
 - 1 Check the combustion gas line between the pressure reducer and analyzer system with a leak detection spray. A leak in this area must be remedied and another leak test must be performed before the analyzer system is put into operation again.
 - 2 If no leak is found in the combustion gas line, that means the analyzer system combustion gas inlet valve is leaking. **In this case, the analyzer system may not be put into operation!** The combustion gas inlet valve must be replaced by ABB service.
- 6 After conclusion of the seal integrity test, set the combustion gas pressure to 1.2 bar.

Function test of the H₂ safety valve

Part of the option "Hydrogen monitoring of the analyzer cabinet" (see page 19) 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 at 40 % LEL (H₂ safety valve).

The function of this H₂ safety valve must be checked with a sensitive hydrogen leak detector at every maintenance, but at least every 12 months.

Procedure

- 1 Switch off the power supply to the analyzer system.
- 2 Switch off the 24 V supply to the H₂ safety valve: The valve closes.
- 3 Shut off the hydrogen supply (from a central supply or from a bottle).
- 4 Disconnect the hydrogen supply line from the inlet of the H₂ safety 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 H₂ safety valve.
 - If the leak detector indicates a hydrogen leak, this is an indication that the H₂ safety valve is not closing reliably. **In this case, the analyzer system must not be put back into operation!** The H₂ safety valve must be replaced by ABB service.
 - If the leak detector does not indicate a hydrogen leak, the analyzer system can be put back into operation:
- 6 Connect the hydrogen supply line to the inlet of the H₂ safety valve.
- 7 Open the hydrogen supply.
- 8 Switch on the 24 V supply to the H₂ safety valve: The valve opens.
- 9 Switch on the power supply of the analyzer system and put the FID back into operation (see page 51).
- 10 After a few minutes, sniff out the screwed connection of the hydrogen supply line at the inlet of the H₂ safety valve with the leak detector again.

Maintenance switch

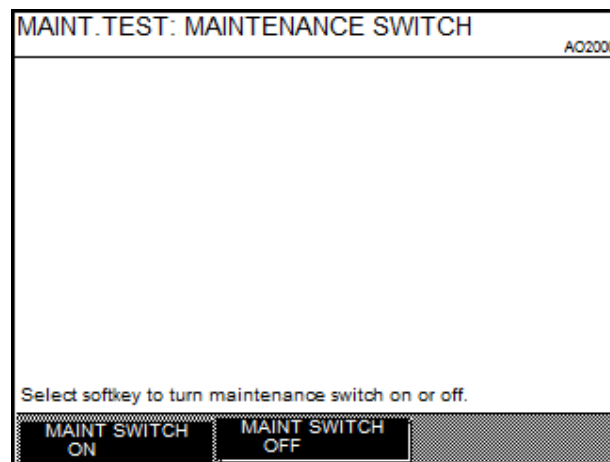
Function

The analyzer system can be set permanently to "Maintenance" status using the "Maintenance switch" function ("Maintenance mode" status signal).

Menu path

Menu → Service/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

If the maintenance switch is activated, this is displayed with a message (no. 121) on the measurement screen and in the status messages.

Emergency purging

Automatically switching to emergency purging

As soon as one of the temperatures in the analyzer box AU2 (except for the injector air heating) 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 → Service/Test → System → Emergency purging

Once all temperatures are above the threshold, emergency purging can be ended by pressing the **END EMERGENCY PURGING** 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 about 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 function block application ACF5000 cabinet status is set. This normally results in the deactivation of the air purifier; the valve for bypassing the air purifier is opened. An excessively high internal cabinet temperature also results in the triggering of the emergency purging (see page 170). 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 heaters need to be activated manually again in order to return to measuring mode. The internal cabinet temperature is reassessed every 30 seconds.

Menu path

MENU → Service/Test → System → Emergency Purging

Procedure

By pressing the **ACTIVATE HEATING** softkey, the heaters are reactivated.

As soon as all heaters have heated up to values of > 120°C again, the emergency purging (see page 170) can also be confirmed in the same menu.

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.

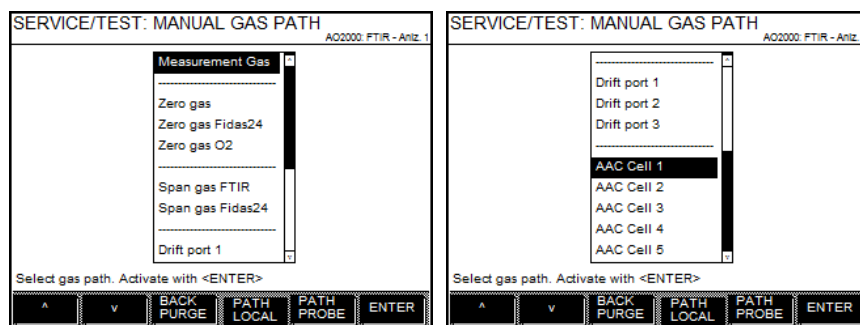
The menu can be exited without waiting for the purge times and any necessary changeover of the measuring model.

When a gas path is activated, the status signal "Maintenance mode" is set; the status signal is reset as soon as the purge time is completed after the sample gas has been switched on.

Menu path

Menu → Service/Test → System → Manual gas path

Display



Procedure

Gas path	Explanation
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 page 91).
AAC cell 1-5	<p>The gas paths are used to retract the validation cells for the "Automatic Adjustment Check" (AAC, see page 85).</p> <p>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). As this is a service menu, the menu does not wait for this activation.</p>
Function	Explanation
BACK PURGE	By pressing the softkey, a back-purging of the gas collection probe is started (see page 180).
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).

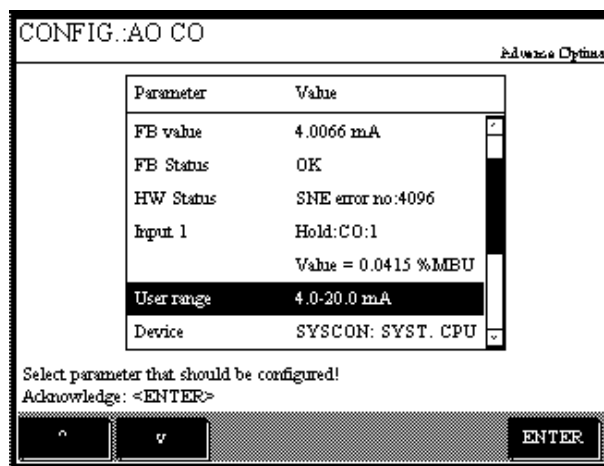
Changing analog output current range

Method

The current range of the individual analog outputs can be changed using the parameter setting of the corresponding function blocks **analog output**. The Technical Information "Function blocks – Descriptions and configuration" contains complete information on the individual function blocks.

Menu path

MENU → Configure → Function blocks → Outputs → Analog output



Changing current range

The current range is changed using the Output current range parameter.

Selection

The current range choices are 0 to 20 mA, 2 to 20 mA and 4 to 20 mA.

NOTICE

The output signal cannot be less than 0 mA and cannot be greater than 22 mA.

Current range limits

The output signal is limited to the range which is defined with the parameters Lower Limit and Upper Limit. These parameters are factory-set to 0 mA and 22 mA.

Adjustment reset

NOTICE

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

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 176)

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 → Diagnosis/Information. → Module-specific → Status**.

When should an adjustment reset be performed?

An adjustment reset 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.

Menu path

MENU → Service/Test → Analyzer Spec. Adjustment → Adjustment reset

NOTICE

The analyzer module should be adjusted after an adjustment reset.

Basic adjustment

NOTICE

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

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 and ensure

- That the analyzer system is in proper operating condition
- That the sample conditioning units are in proper operating condition
- That 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 measured component.

The basic adjustment can be carried out

- Individually at the zero point
- Individually at the end point, as well as
- Together (successively) at the zero and end points.

An adjustment reset (see page 175) is also performed in the case of common basic adjustment at the zero and end points.

Menu path

MENU → Service/Test → Analyzer Spec. Adjustment → Basic Adjustment

FID: Standby/Restart

Menu path

MENU → Service/Test → Analyzer Spec. Adjustment → Standby/Restart FID

Display of the operating condition of the FID

SERVICE/TEST: STANDBY/NEUSTART FID	
ACF5000: FID 24 - Anz. 1	
Parameter	Wert
Flamme 1	242.0 C
Zuendversuch	erfolgreich
Status	Messbetrieb
Luftd.	720.0 hPa
H2	1200.0 hPa
<STANDBY> um Standby-Modus zu aktivieren. <STANDBY & PURGE> Standby & Nullgas-Spuelung.	
<div> <div>A</div> <div>V</div> <div>STANDBY</div> <div>STANDBY SPUELEN</div> </div>	

The key operating data of the FID are displayed:

Flame 1	Flame temperature
Ignition attempt	The number of the ignition attempts is displayed until the ignition of the flame. The "successful" display means that the first ignition attempt was successful.
Status	Measuring mode
	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.	Combustion air pressure
H2	Combustion gas pressure

Definitions

Standby mode means: heater on, combustion gas valve closed, combustion air valve closed, instrument air valve closed, housing purging on, zero gas valve opened in standby mode with purging of the detector.

Fail-safe mode means: heater off, combustion gas valve closed, instrument air valve closed, housing purging on, emergency purge activated.

Putting the FID in standby mode

If in the Standby/Restart FID menu the STANDBY or STANDBY PURGING softkeys are displayed, the FID can be set to standby mode:

STANDBY	Standby mode is activated.
STANDBY PURGING	Standby mode with opening of the zero gas valve for purging the detector is activated (only when executing with test gas connection).

Setting FID back to measuring mode

If the FID is restarted from standby mode or after a flame error, the Standby/Restart FID mode display the RESTART softkey:

RESTART Restart is carried out.

After initiating the restart, the menu can be left via **Meas** or **Back**; 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 ignition of the flame has failed after 10 ignition attempts, for the Ignition attempt parameter, display 10 – failed is shown. By pressing the RESTART softkey, a restart can be initiated.

FID in fail-safe status

If a serious fault has occurred in the FID, it is put in fail safe status; in the menu Standby/Restart FID the indication Fail safe appears for the parameter Status.

Fail-safe means: heater off, combustion gas valve closed, instrument air valve closed, housing purging on, emergency purge activated.

The cause of the failure must be determined from the status messages (see page 207).

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.

Configuring saving of FTIR spectral data

Function

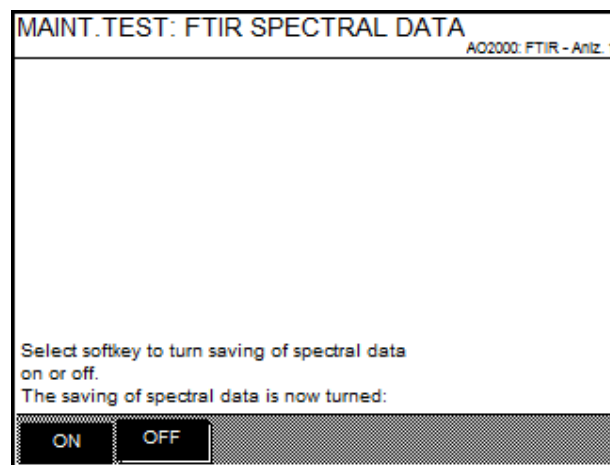
It can be configured whether the FTIR spectral data are saved in the analyzer system.

The spectral data saved can be loaded with the download tool or via web access from the analyzer system.

Menu path

Menu → Service/Test → Analyzer Spec. Adjustment → FTIR spectral data

Display

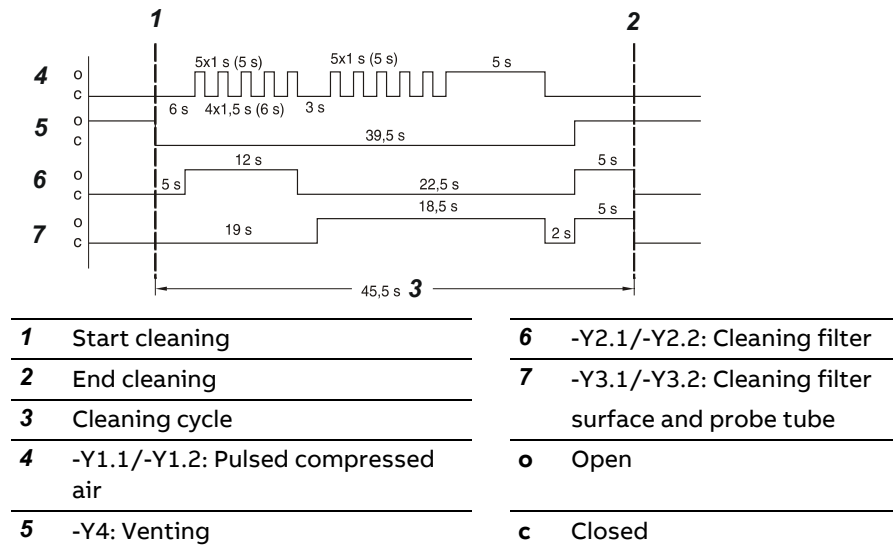


The appearance of the softkeys indicates the current status of the function. The image shows that the saving of FTIR spectral data is activated.

The saving of spectral data is ended automatically after two hours.

Configuring automatic back-purging of the gas extraction probe

Recommended program run 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 → Various → Time encoders

Procedure

- 1 In the Time encoder menu, select the Purge back SGI1 on/off function block.

CONFIG.:TIMER AQ2000

Timer
FLOW Limit1:491
Back purge MGE1-On/Off:916
Back purge MGE1-Clock:920
Add new

Select function block to configure!
Acknowledge: <ENTER>

▲
▼
DELETE
FB
ENTER

- 2 Set the cycle time and date and time of the next back purge.

CONFIG.:TIMER BACK PURGE MGE1-ON/OFF:916 AQ2000

Parameter	Value
I2:Reset	---
Output 1	Neg:Back purge MGE1-1:1 = off
Mode	Event
Cycle time	7 day(s)
Pulse width	4 second(s)
Next event date	04/07/2016
Next event time:	14:03:35

Select parameter that should be configured!
Acknowledge: <ENTER>

▲
▼
ENTER

- 3 Select the I1:Active parameter and press >> .

CONFIG.:TIMER BACK PURGE MGE1-ON/OFF:916 AO2000

Parameter	Value
FB Name	Back purge MGE1-On/Off:916
FB Enable	Enabled
FB Status	OK
I1:Enable	Const:Back purge MGE1-Cycle:1 = off
I2:Reset	---
Output 1	Neg:Back purge MGE1-1:1 = off
Mode	Event

Select parameter that should be configured!
Acknowledge: <ENTER>

^
v
DELETE LINK
>>
ENTER

- 4 Activate on the selected Constant function block the back purging:
 FB value = 0: back purging is deactivated.
 FB value = 1: back purging is activated.

CONFIG.:CONST BACK PURGE MGE1-CYCLE:916 AO2000

Parameter	Value
FB Name	Back purge MGE1-Cycle:916
FB Enable	Enabled
FB value	0.0000
FB Status	OK
Output 1	Timer:Back purge MGE1-On/Off:1
Unit	---

Select parameter that should be configured!
Acknowledge: <ENTER>

^
v
ENTER

Replacing wearing parts

⚠ CAUTION

Before executing maintenance work on the analyzer system, the maintenance control must be activated in the control display in order to set the maintenance mode 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.

⚠ CAUTION

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.

After completing the maintenance work, it must be waited until the temperature error is no longer active; where applicable, emergency purging needs to be deactivated.

Replacing wearing parts

Wearing parts	Replacement cycle
Filter on the gas sampling probe (see page 184)	At least every 12 months, depending on the dust content of the measuring gas
Sample gas filter in the ASP block (see page 187)	At least every 12 months, depending on the dust content of the measuring gas
Filter in the compressed air main controller (see page 190)	Every 12 months
Filter in the measuring gas pressure control (see page 192)	At least every 12 months, depending on the dust content in the ambient air
Filter cells in the air purifier (see page 193)	Approx. every 3 years
Filter pad in the fan (see page 195)	At least every 12 months, depending on the dust content in the ambient air
Battery on the system controller (see page 196)	Approx. every 4 years
Pressure equalization screws in the top of the cabinet (see page 197)	Every 12 months

Spare parts information

Information on spare parts can be found on the Internet in "ABB Business Online" at <https://online.abb.com/>.

NOTICE

Only genuine ABB spare parts and consumables may be used!

Replacing filter on the gas sampling probe

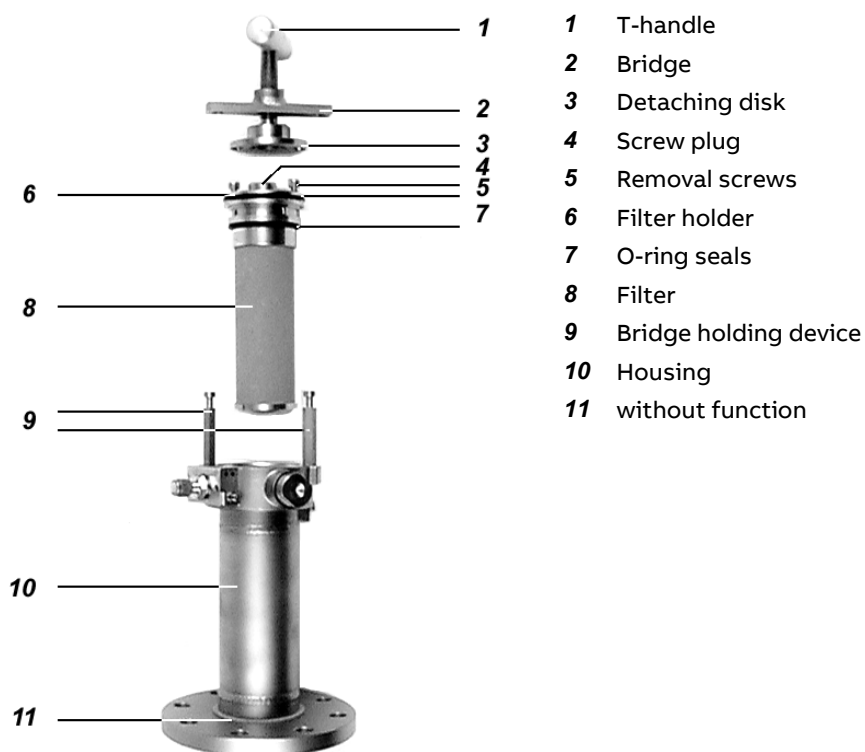
Wearing parts

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	

NOTICE

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

Filter unit



Cleaning or replacing filters

⚠ CAUTION

Parts of the sample gas sampling unit are hot (approx. 180°C)!
You might come into contact with the sample gas when carrying out the work described below.
Wear suitable protective gloves and safety goggles!

NOTICE

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 nitrile or latex disposable gloves from in order to prevent the filter coming into contact with your skin.

Preparing to remove the filter, interrupting measuring mode

- 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 holder **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**: blow adherent dirt off the surface using compressed air; allow the compressed air to act diagonal to the surface.

Or Replace filter 8:



- 1 Remove screw plug **4** with NW 22 flat spanner.
- 2 Undo hexagon screw **12** below 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 filter insert: Carry out steps 5 to 8 in the 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 page 164) 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 shut down 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

The ASP block is hot (approx. 180°C)!
Wear suitable protective gloves and safety goggles!

NOTICE

Hydrocarbons can – particularly on an analyzer system with integrated FID – falsify the measured values.

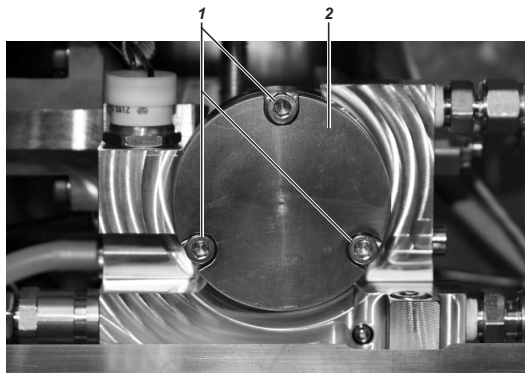
When fitting a new or cleaned filter, make sure that no hydrocarbons are introduced into the analyzer system. When handling a new or cleaned filter, wear disposable nitrile or latex gloves and use a degreased tool.

Preparing to remove the filter, interrupting measuring mode

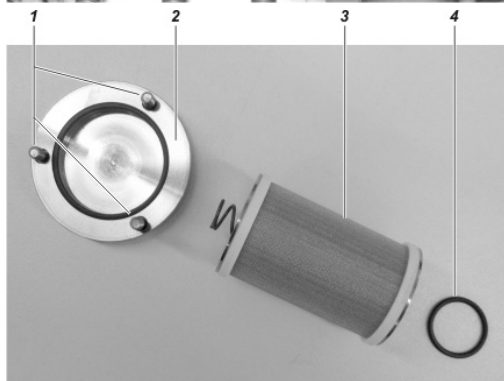
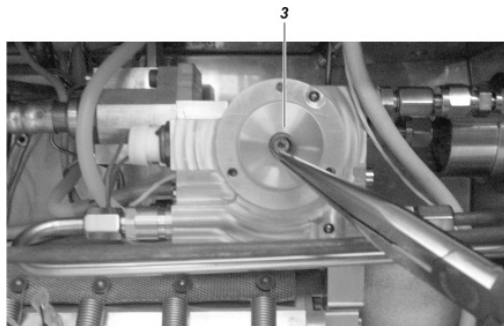
- 1 Prepare a grease-free and heat-resistant working surface/shelf.
- 2 Lay out the degreased gripping tool (tongs, coarse tweezers or similar).
- 3 Lay out new filter. Make sure that the O-ring is correctly located in the groove of the filter provided for this purpose.
- 4 Switch analyzer system to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

Removing the filter

- 6 Open analyzer box AU2.
- 7 Undo three fixing screws **1** (4 mm hexagonal spanner).



- 8 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.
- 9 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.



Fitting the filter

- 10** 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.
- 11** 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

- 12** Perform the simplified seal integrity test (see page 164).
- 13** Restore sample gas feed.

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

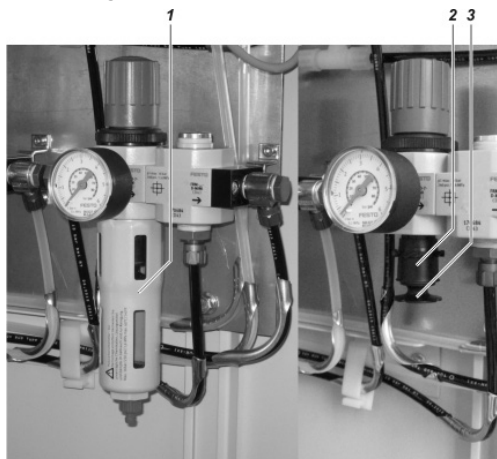
CAUTION

The compressed air main regulator is pressurized (5.5 to 7 bar)!

Preparing to replace the filter, interrupting 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 regulator -J85).

Replacing the filter element



- 6 Slowly screw on the filter housing **1** to relieve the residual pressure in the filter. If necessary, position a 22mm open-end wrench at the bottom end of the filter housing.
- 7 Unscrew filter housing and remove.
- 8 Undo the black closing piece **3** by hand; at the same time, fix the upper black cylinder **2** using your other hand.
- 9 Remove the used filter element and insert a new filter element.
- 10 Re-assemble the filter: carry out steps 6 to 8 in the reverse order. Screw on the filter housing only hand-tight.

Restoring measuring mode

- 11** Restart the instrument air supply
- 12** Remove blind fitting from the gas sampling probe and re-connect the sample gas line.
- 13** Restore sample gas feed.

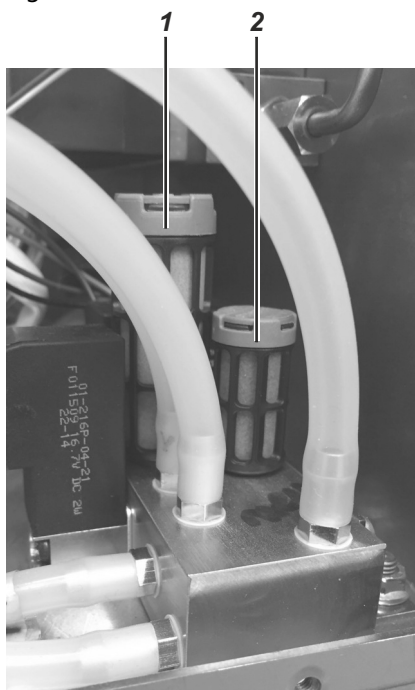
Replacing filters in the sample gas pressure regulator

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



- 2 Undo the used paper filter by hand and insert new filter.
1 large filter, item no. 4868313
2 small filter, item no. 4805885
- 3 Mount cover of the ACF5000 E-box and fasten using the screws.

NOTICE

Before replacement, the values of the controlled variables must be noted (for values > 85, the filters must be replaced) and compared with the values of the controlled 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.

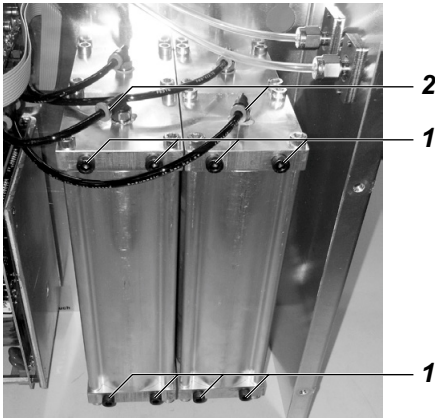
Replacing filter cells in air purifier AU5

Wearing parts

Wearing parts	Item no.	Replacements
2 PU+CA filter in air purifier (AU 5), mounted	8329425	Approx. every 3 years (depending on the instrument air quality)
CAUTION! Do not leave connections of the new filter cartridge open for too long to avoid the penetration of moisture.		

Replacing 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 AU5 by pulling the cold device plug on the AU5.
- 3 Slacken 4 screws and remove the cover of the air purifier AU5.



Only the two front filter cartridges must be replaced.

- 4 Slacken 4 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 with the 4 hexagonal screws.
- 9 Repeat steps 4 to 8 on the other filter cartridge.

- 10** Apply and fasten the cover of the air purifier AU5.
- 11** Restore instrument air supply to the air purifier AU5 by opening the pressure reducer -J85.
- 12** Restore the power supply of the air purifier AU5 by inserting the cold device plug on the AU5.
- 13** If an FID is installed in the analyzer system, the Flame error status message is released, because the instrument air supply was interrupted. Rectify this status by restarting the FID.

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 Using a screwdriver, prize out the fan grille of the inlet filter (at the right-hand cabinet wall, bottom) out of the frame at the two openings.



- 2 Replacing filter pad in the fan grille
- 3 Insert fan grille into the frame and push in until it engages.
- 4 Repeat steps 1 to 3 at the outlet filter (at the left-hand cabinet wall, top).

Replacing the battery on the system controller

Wearing parts

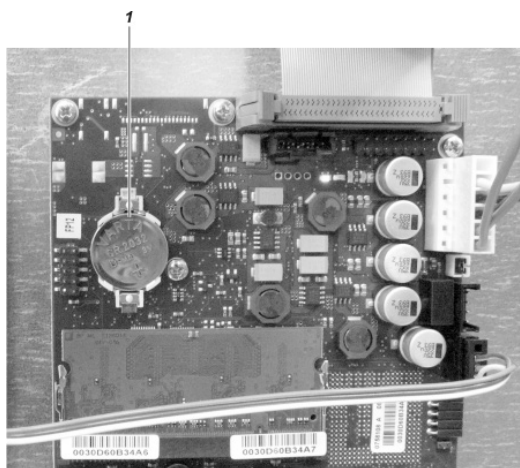
Wearing parts	Type	Replacements
Battery on the system controller	Varta CR3032 (type no. 6032) or Renata CR2032	Approx. every 4 years (as part of the maintenance work on the analyzer system)

CAUTION!

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



- 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.

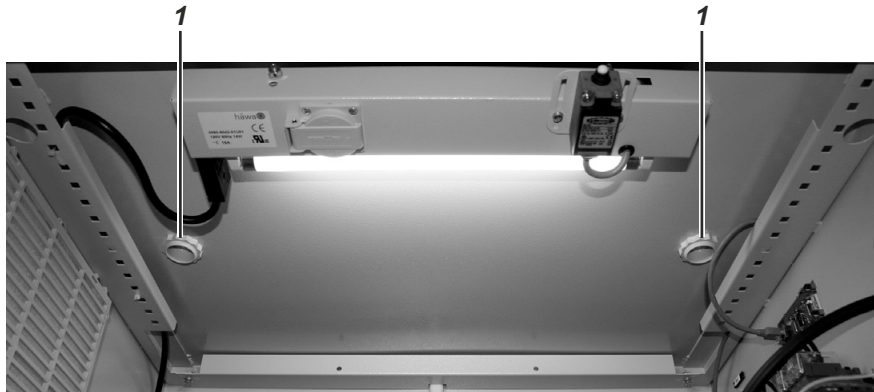
Replacing pressure equalization screws

Wearing parts

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

Replacing pressure equalization screws

- 1 Slacken counter nut **1** in the top of the cabinet and remove the screw upwards.



- 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.

Status messages, troubleshooting

CAUTION!

The tasks described in this chapter for reacting to status messages and troubleshooting require special training and under some circumstances involve working with the analyzer system open and powered up. Therefore, they should only be performed by qualified and specially trained personnel.

Dynamic QR code

Application

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

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

Static data for device identification are among other data:

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

Dynamic data for error diagnosis are among other data:

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

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

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

Handling

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

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

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

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

Select QR code

Menu path

Menu → **Diagnosis/Info.** → **QR Code Display**

Procedure

- 1 Select system overview or specific analyzer module.
- 2 Select QR code with **ENTER**.
- 3 Scan QR code.
- 4 Return to selection with **Back**.

The diagnosis menu can be selected directly from the status messages overview.

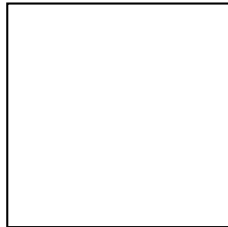
The QR code can also be selected in Remote HMI and scanned from the computer screen.

Recommended QR code scanner applications

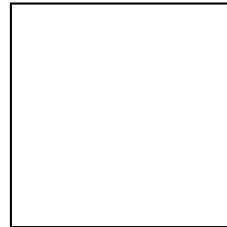
ABB recommends the use of the following QR code scanner applications (available free of charge for iOS and Android):

"my Installed Base" by ABB

Download in App Store:

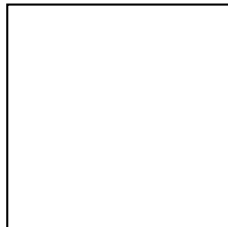


Download in Google Play:

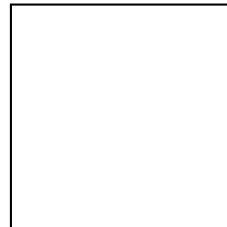


"QR Scanner" by Kaspersky

Download in App Store:



Download in Google Play:



Process status

Definitions

The **Process status** (see below) provides information on measured values and the process being monitored by the analyzer system.

The **System status** (see page 201) provides information on the status of the analyzer system itself.

Process status

The term "process status" includes

- Transgression of measuring range limits
 - Transgression of limit values
- by the measured values.

Transgression of measuring range limits

If the measured value of a component is $> +130\%$ or $< -100\%$ of the span, the measured value for the component flashes in the display. A status message is also generated in each case; these messages will not be entered into the logbook.

The thresholds established cannot be changed.

Transgression of limit values

If a measured value is above or below a limit value, this status is output as a binary signal at one of the digital outputs.

Two prerequisites must be met to this effect:

- The limit value must be assigned to a digital output by means of function block configuration.
- The limit value monitoring parameters (direction of action, threshold value, hysteresis) must be set (see page 122).

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

System status: Status messages

Where are status messages generated?

Status messages are generated

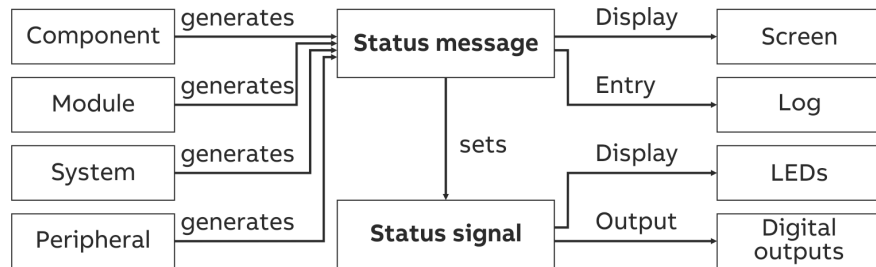
- By the analyzer system, i.e.
 - The system controller (signal processing, adjustment, system bus)
 - The analyzer modules
 - The temperature and pressure regulators
 - The I/O modules and external I/O devices
- By peripherals, for example
 - The sample gas handling modules.

User-configured status messages

Status messages are generated by the analyzer system and by peripherals.

In addition, it is possible with the use of the **Message Generator** function block to integrate status messages for both the analyzer system and from the periphery assemblies in the status message processing. The Technical Information "Function blocks – Descriptions and configuration" contains complete information on the individual function blocks.

Status message processing



- Status messages are shown on the screen and recorded in the log.
- Status messages set a corresponding status signal (overall status or individual status).
- Status signals are indicated using status LEDs and output via the system controller digital outputs.

Status message display

The Status message softkey appears as soon as a status message is generated. By pressing the softkey the user can recall the status message summary and view status message details.

Entry of the status messages in the logbook

The status messages are entered in the logbook.

Messages concerning a transient analyzer system state with no direct effect on measured values are not logged. Such messages include

- "A password is active!"
- "This system is currently under remote control!"
- "Automatic calibration in progress."

System status: Status signals

Overall or individual status

The status signal is factory-configured (see page 138) to output as an overall or individual status.

Overall status

If the analyzer system is configured to output overall status, status messages are issued as overall status indications.

Individual status

If the analyzer system is configured to output individual status, status messages are issued as the "Failure" or "Maintenance request" or "Maintenance mode" 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 system is in a state that requires immediate user intervention.	The measured value is invalid.
Maintenance request	The analyzer system is in a state that requires user intervention shortly.	The measured value is valid.
Maintenance mode	The analyzer system is adjusted or operated.	The measured value is not a process measured value and is to be discarded.

Individual status by analyzer module or sample component



As a rule, the individual status signals refer to the entire analyzer system.

However, by configuring the **Message input** function block, individual status messages for each analyzer module or for each sample component can be output separately via digital outputs. The Technical Information "Function blocks – Descriptions and configuration" contains complete information on the individual function blocks.

I/O module status messages are only reported as system status signals.

Status indication

Analyzer system status is indicated by means of status LEDs.

LED	Status
Error 	Overall status or individual "Error" status
Maint 	Individual "Maintenance request" status

Status message categories

Status message categories

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

- Status messages not requiring acknowledgement
- Status messages requiring acknowledgement
- Status messages requiring acknowledgement and troubleshooting

Status messages not requiring acknowledgement

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

Example: Temperature error during the warm-up phase.

Status messages requiring acknowledgment

The instrument operates normally after the analyzer system 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 analyzer system.

Example: No new measured values from the analog/digital converter.

Status messages requiring acknowledgment and intervention

The analyzer system 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.

Summary

The following table shows

- the time sequence of the three status message categories
- The identifier used to identify the status messages in the summary (q, Q and I).

Status messages not requiring acknowledgement

Status begins	Status ends
LED lights up	LED goes out
Status signal set	Status signal reset
Status message appears	Status message canceled

Status messages requiring acknowledgment

Status begins	Status ends	Acknowledge
LED lights up	LED goes out	
Status signal set	Status signal reset	
Status message appears	q Status message remains	I Status message canceled
Status begins	Acknowledge	Status ends
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 begins	Status ends	Acknowledge, correct
LED lights up		LED goes out
Status signal set		Status signal reset
Status message appears	q Status message remains	I Status message canceled
Status begins	Acknowledge, correct	Status ends
LED lights up		LED goes out
Status signal set		Status signal reset
Status message appears	q Status message remains	Q Status message canceled

Status message system

List layout

The status message list contains the following information:

No.	The status message number appears in the menu line display
Text	Full text of the status message is shown in the detailed display
S	x = Status message sets the overall status
A	x = Status message sets the "Error" individual status
W	x = Status message sets the "Maintenance request" individual status
F	x = Status message sets the "Maintenance mode" individual status
Reaction/ Comment	Explanations and corrective measures in case of status messages

Status messages

No.	Text	S	A	W	F	Reaction/Comment
Runtime error						
1 to 21	Runtime error 1 to Runtime error 21					When the same status message occurs repeatedly, notify 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> key in the display of measured values.					Information on password protection, see page 66; not in the logbook
110	The system starts up.					not in the logbook
111	This system is currently under remote control!					not in the logbook

No.	Text	S	A	W	F	Reaction/Comment
112	The display and operating unit synchronizes with the analyzer. Please wait.					not in the logbook
113	The system time was changed from -> to:					not in the logbook
114	Changed parameters are saved. Please wait.					
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 re-started.					
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 the backup configuration. Or load a configuration with the use of SMT.	x	x			see message text
120	All passwords are reset to the system defaults. Please save the configuration, power off the system and remove the jumper. Then repower the system.					see message text
121	The maintenance switch is ON.			x		for information
122	The system disk has been re-initialized! This system contains no configuration now! Please use SMT to reinstall your configuration.			x		see message text

No.	Text	S	A	W	F	Reaction/Comment
QAL3						
126	The QAL3 historien buffer is full. Please read-out QAL3 data.			x		see message text
127	The calibration drift exceed the QAL3 limits.			x		
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 → Diagnosis/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 data-base.	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 is 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 → Diagnosis/Information → System overview
214	The system is currently being maintained with Optima SMT.					
215	The analyzer module has an internal communication error!	x	x			Notify service.
216	The analyzer module has an internal program error!	x	x			Notify service.
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.

No.	Text	S	A	W	F	Reaction/Comment
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 measuring range installed. 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		Adjust detector displayed manually at the zero point and end 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. Adjust detector displayed manually at the zero point (no. 306) or at the end point (no. 307). Permissible range: 15% of the smallest measuring range installed; 6% of the smallest measuring range for measurements on plants and systems requiring approval of 27 and 30 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
310	The temperature correction for this component was deactivated because the temperature measured value is invalid.			x		see status message of the relevant temperature
311	The pressure regulator works erroneously.	x	x			see status message of the relevant pressure detector
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

No.	Text	S	A	W	F	Reaction/Comment
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 fuse and replace, if necessary.
322	The flame is off.	x	x			Status message during the warm-up phase. If the status message occurs after the warm-up phase: check supply gases, check glow plug.
323	The analyzer is in fail-safe mode.	x	x			Causes: flame temperature > Detector set point + 220°C, hardware errors, Pt100 line break or short-circuit. Switch power supply off and back on after ≥ 3 seconds. If the status message recurs, notify service. Note: Fail-safe means: heater off, combustion gas valve closed, instrument air valve closed, housing purging on, zero gas valve open.
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 status messages occur after the warm-up phase: check whether the permissible ambient temperature range (see page 221) is observed.
325	The temperature exceeds or falls below the top or bottom limit value 2.			x		FID: 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		FID: Check supply gas pressures: Output = instrument air, Air = combustion air, H2 = 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 area.	x	x			FID: 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/O type that is not yet available is configured.	x	x			Correct configuration with test and adjustment software.
334	No new measured values from the analog/digital converter.	x	x			The I/O card is faulty. Replace card.
335	The measured value exceeds the value range of the analog/digital converter.	x	x			Check signals on the analog inputs. If OK, check configuration and 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 and analog output.	x	x			Check lines in analog output.
338	Line break in digital input (humidity sensor).	x	x			Check humidity sensor in the system cooler.
339	Line break or short-circuit in the analog input.	x	x			Check temperature of the system cooler.
340	The value of the analog input exceeds or falls below the top or bottom limit value 1.			x		Check temperature of the system cooler.
341	The value of the analog input exceeds or falls below the top or bottom limit value 2.			x		Check temperature of the system cooler.

No.	Text	S	A	W	F	Reaction/Comment
Flow monitor						
342	The flow rate undershoots limit value 1			x		Check sample preparation. Alarm value 1 = 25 % of MRS.
343	Flow rate undershoots limit value 2.	x	x			Check sample preparation. Alarm value 2 = 10 % of MRS. Automatic calibration is interrupted and disabled
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 concentration. Check push connections in the analyzer system 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.

No.	Text	S	A	W	F	Reaction/Comment
FID						
411	The analyzer is in standby. Re-activation in the menu: Service/Test..Standby/Restart FID	x			x	Restart FID.
412	Ignition failed. The analyzer needs to be reactivated manually. Reactivation in the menu: Service/Test..Standby/Restart FID	x	x			Check operating gases. Restart FID.
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 FID, 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. End point gas concentration too low – check.
507	A combination of the following errors has occurred: drift half, drift, amplification of the delta drift.					Adjust detector displayed manually at the zero point and end 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

No.	Text	S	A	W	F	Reaction/Comment
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	Pre-amplifier overrun 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 may be imprecise. 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 adjustment was manual.					for information
529	The adjustment was canceled, as no raw measured values can be entered.	x		x		
530	The adjustment was canceled, as the pressure switch did not detect adjustment gas.	x		x		
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:					

No.	Text	S	A	W	F	Reaction/Comment
536	Automatic validation outside the limit for:					
537	Automatic validation outside the limit for:			x		
User-configured messages						
800	An external error occurred during:	x	x			Standard texts for the Message Generator function block are supplemented by the long text defined when configuring the function block
801	A user-defined error occurred during:	x	x			
802	A user-defined maintenance request occurred during			x		
803	A user-defined maintenance mode event occurred during:				x	
Various messages						
1000	This function block has an error:	x	x			is supplemented by the reference to the function block type

Status messages FTIR

List layout

The status message list contains the following information:

No.	The status message number appears in the menu line display
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
S	x = Status message sets the overall status
Text	Short and long text of the status message
Reaction/Comment	Explanations and corrective measures in case of status messages

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

Status messages

No.	A	W	F	S	Short and long text	Reaction/Comment
424	x			x	Temperature Problem The temperature value of the controller and the redundant temperature measurement differ.	Check temperatures of the measuring gas collection components: Menu → Diagnosis/Information → Module-specific → Raw measured values auxiliary values → SGIn Where applicable, notify service.
425	x			x	Excess temperature The temperature value of the controller exceeds the maximum limit value.	Check temperatures: Menu → Diagnosis/Information → Module-specific → Controller measured values Notify service in the event of constant or increasing values.
426		x		x	Emergency stop The temperature controller was deactivated due to a malfunction. To activate, rectify fault and confirm this message.	Check temperatures: Menu → Diagnosis/Information → Module-specific → Controller measured values After cooling down to $T < 190^{\circ}\text{C}$, confirm message to reactivate the heating. Notify service if this occurs again.
2001		x			WARNINGLOW Alarm state: WARNINGLOW	Check measuring gas concentration. Notify service.
2002		x			WARNINGHIGH Alarm state: WARNINGHIGH	Check measuring gas concentration. Notify service.
2003					WARNING Alarm state: WARNING	Check measuring gas concentration. Notify service.
2004	x				OFFLINE Alarm state: OFFLINE	Check measuring gas concentration. Notify service.
2005		x			MAINTENANCE Alarm state: MAINTENANCE	Check measuring gas concentration. Notify service.

No.	A	W	F	S	Short and long text	Reaction/Comment
2006	x				ALARMLOW Alarm state: ALARMLOW	Check measuring gas concentration. Notify service.
2007	x				ALARMHIGH Alarm state: ALARMHIGH	Check measuring gas concentration. Notify service.
2008	x				ALARM Alarm state: ALARM	Check measuring gas concentration. Notify service.
2009	x				FAULT Alarm state: FAULT	Check measuring 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		x			Ref. Temp. >> The analyzer temperature is outside the defined range for the last zero point reference.	With a deactivated automatic reaction to temperature violation, enter manual reference. With 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			x		Auto ref. In progress Automatic zero point reference in progress.	For information
2505		x			Auto ref. Errors Automatic zero point reference failed.	Enter manual reference Notify service if this occurs again.
2506	x			x	High alarm High alarm triggered by the components:	For information
2507					AAC start Automatic Adjustment Check started.	For information

No.	A	W	F	S	Short and long text	Reaction/Comment
2508					AAC end Automatic Adjustment Check end.	For information
2509					AAC cancelation Automatic Adjustment Check externally canceled.	For information
2510			x		AAC in progress Automatic Adjustment Check in progress.	For information
2511					ADC start Automatic Drift Check started.	For information
2512					ADC end Automatic Drift Check ended.	For information
2513					ADC cancelation Automatic Drift Check externally canceled.	For information
2514			x		ADC in progress Automatic Drift Check in progress.	For information
2515			x		Zero point gas Zero point gas was activated manually.	For information
2516			x		End point gas End point gas was activated manually.	For information
2517			x		Gas port 1 active Gas port 1 activated manually.	For information
2518			x		Gas port 2 active Gas port 2 activated manually.	For information
2519			x		Gas port 3 active Gas port 3 activated manually.	For information
2520			x		AAC cell 1 active Validation cell 1 activated manually.	For information
2521			x		AAC cell 2 active Validation cell 2 activated manually.	For information
2522			x		AAC cell 3 active Validation cell 3 activated manually.	For information
2523			x		AAC cell 4 active Validation cell 4 activated manually.	For information
2524			x		AAC cell 5 active Validation cell 5 activated manually.	For information
2525			x		Back purging Back purging of the probe in progress.	For information
2526			x		FTIR adjust. FTIR analyzer adjustment in progress,	For information
2527	x			x	Emergency purging Temperature error on the emergency purging is active. To end the emergency purging, please select the menu: Service/Test Emergency Purging	See message text
2528					Ext. purging External temperature error emergency purging is activated.	For information
2529		x			Ambient temp. > The ambient temperature exceeds limit value 1.	For information

No.	A	W	F	S	Short and long text	Reaction/Comment
2530	x			x	Ambient temp. >> The ambient temperature exceeds limit value 2.	For information
2531		x			FTIR purging << The flow rate of FTIR purging falls below the limit value.	Check settings of the pressure and flow controller.
2534	x			x	Cabinet temp. >> The internal cabinet temperature is too high. The analyzer heaters were deactivated. To activate the heaters, please select the menu: Service/Test Emergency Purging	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

Analyzer system: Troubleshooting

Display of measured value flashes

Measured signal exceeds measuring range limits

Note: Measured value > +130% MRS or measured value < -100% MRS. In addition, the status messages 344 or 345 are generated.

Display of measured value flashes alternating with --E--

Error in measured signal processing

- View status messages.
- Search and rectify fault cause.

Only mA display flashes alternating with --E--

Fault in the output current circuit

- Search and rectify fault cause (e.g. line break).

Flow error

External gas lines or filters soiled, blocked or leaking

- Disconnect analyzer system from the gas processing system.
- Blow gas lines with compressed air or penetrate them mechanically.
- Replace filter inserts and fillings.
- Check gas lines for leakproofness:

Gas paths in analyzer system kinked or leaking

- Disconnect analyzer system from the gas processing 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:

Ambient temperature for storage and transport	-25 to +65°C
Ambient temperature during operation	
with built-in fan (option)	+5 to +30°C
With built-in air conditioner (option)	+5 to +45°C
Relative humidity during operation	
Annual average	max. 75%
briefly	max. 95%

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

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.
- Inspect power supply of the heater.

Unstable display of measured value

Vibrations

- Reduce vibration at the installation site of the analyzer system.

Sample gas path leaking

- Check gas path in the analyzer module and in the sampling modules for seal integrity.

Loss of sensitivity

- Notify service.

Sample gas outlet pressure too high

- Check air discharge line; it must have a large internal diameter.
- Notify service: Have the air jet injector checked for blocks. Have the instrument air pressure checked.

Combustion air contaminated

- Notify service: Have the combustion gas supply and the air purifier checked.

Fluctuating process gas pressures

- Check the supply of instrument air and combustion gas

Outgassing of hydrocarbons in the H₂ safety valve (option "Hydrogen monitoring of the analyzer cabinet")

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

Pressure regulator fault

Unstable pressure values or pressure regulator output variables not equal to set points

- Check the inlet pressure of the supply gases.
- Notify service.

Zero point drift

Sample gas line contaminated

- Clean sample gas line.

Air purifier is not operating adequately

- Reduce hydrocarbon content.
- Exchange catalyst.

Combustion gas line contaminated

- Clean combustion gas line.

Flame does not ignite

Air in the combustion gas line

When connecting or replacing the combustion gas bottle make sure that no air penetrates into the combustion gas supply line. Air which has penetrated the gas supply line results in the flame in the analyzer going out.

The analyzer module 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 module switches to operating condition "Wait for restart". In this case, ignition of the flame must be re-started:

Menu → Service/Test → Analyzer Spec. Adjustment → Standby/Restart FID

Note: The Wait for restart operating condition means: heating on, combustion gas valve closed, instrument air valve open, housing purging on.

FID in fail-safe status

If a serious fault has occurred in the FID, it is put in fail safe status; in the menu Standby/Restart FID the indication Fail safe appears for the parameter Status.

Fail-safe mode means: heater off, combustion gas valve closed, instrument air valve closed, housing purging on, emergency purge activated.

The cause of the failure must be determined from the status messages (see page 207)

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

ABB Service,

Telephone: +49-(0)180-5-222 580, Fax: +49-(0)621-381 931 29031,

E-mail: automation.service@de.abb.com

Before you notify service...

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

When you notify service...

When you notify service because of a malfunction or a status message, have the following information available:

- the production number (F-No.) of the analyzer system, you can find it on the type plate and in the Analyzer Data Sheet,
- The system controller and system module software versions are found in the menu item
MENU → Diagnosis/Information → System overview,
- An exact description of the problem or status as well as the status message text or number.

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

Have the Analyzer Data Sheet ready – it contains important information that will help the service personnel to find the cause of the malfunction.

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

CAUTION!

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

Decommissioning

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 measured gas supply.
- 2 Wait until all measured values match the values of the cleaned zero air from the air treatment station.
- 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 (option): Shut off the combustion gas feed.
- 6 Switch off the power supply to the individual assemblies and finally turn off the main switch on the right-hand side of the cabinet wall; with UPS, turn off the two main switches.
- 7 Shut off the instrument air supply to the analyzer system.

Packing the analyzer cabinet

Packing the analyzer cabinet

- 1 Vacuum-pack the analyzer cabinet in film.
- 2 Lay out desiccant in the transport crate. Use an amount of desiccant that is appropriate for the packing volume and the expected transport time (min. 3 months).
- 3 Place the analyzer cabinet into the transport crate on snubbers and chock.
- 4 Mark the transport crate as specified (in particular as "Fragile product").

NOTICE

- Moisture that could freeze at low storage and transportation temperatures must not remain in the analyzer system.
 - The analyzer cabinet and/or the FTIR spectrometer must be packed at a dry and heated location, preferably at the installation site.
 - Having the analyzer cabinet transported by a specialist company is highly recommended.
 - The analyzer cabinet must be transported on its rear in the horizontal position.
 - Ambient conditions during transport and storage:
Temperature -25 to +65°C, humidity ≤ 75%.
-

Disposal

Notes for disposal

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



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

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

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

Index

A

- Active component selection • 121
- Add measuring range • 116
- Add system module • 134
- Adjustment
 - Basics • 74
 - Configuration • 83
 - Operation • 103
- Adjustment methods • 78, 94
- Adjustment reset • 175, 176
- Analyzer system
 - Troubleshooting • 211, 221
- Application and function of the analyzer system • 15
- Automatic adjustment • 75, 76
- Automatic Adjustment Check (AAC)
 - Configuring the duration • 100, 173
 - Configuring the time sequence • 85
 - Settings and export of the QAL3 data • 71, 85, 88

B

- Basic adjustment • 175, 176
- Blocking operation • 67, 69, 131

C

- Cancel keys • 54, 60
- Carry out manual adjustment • 75, 111, 114
- Carrying out manual reference • 103
- Change number of decimal places • 115, 116, 150
- Change password • 68, 130
- Changing analog output current range • 174
- Changing measuring range limits • 114, 116, 118
- Changing module name • 127
- Check time conflicts of the automatic processes • 71, 100
- Cleaning the analyzer cabinet • 163
- Commissioning • 50
- Components of the analyzer system • 17
- Configuration
 - Component functions • 113
 - Display functions • 55, 144
 - System functions • 128
- Configuring automatic adjustment of the FID • 77, 84, 95, 100
- Configuring automatic adjustment of the oxygen sensor • 77, 84, 98, 100
- Configuring automatic back-purging of the gas extraction probe • 46, 173, 180
- Configuring automatic measuring range switching • 114, 118
- Configuring Bus I/Os • 143
- Configuring dry base and O₂ reference • 73, 125
- Configuring Ethernet connection • 139
- Configuring filter • 77, 120
- Configuring FTIR limit monitoring • 123

- Configuring key entries • 65, 147, 159, 160
- Configuring limit monitoring • 122, 200
- Configuring manual adjustment • 75, 94
- Configuring measuring range • 113
- Configuring Modbus connection • 140
- Configuring Profibus • 141
- Configuring saving of FTIR spectral data • 179
- Configuring status signals • 138, 203
- Configuring the Automatic Drift Check (ADC) • 91, 100, 173
- Configuring the automatic reference FTIR • 83, 100
- Configuring the bar display or point display • 147, 154
- Configuring value input • 64, 147, 156, 157
- Connecting gas paths and inserting validation cells • 103, 172
- Connecting the electrical leads • 47
- Controlling the adjustment • 74
- Creating manual reference • 103

D

- Decommissioning • 227
- Delete measuring range • 117
- Delete system module • 136
- Description of the analyzer system • 15
- Dimensions, weights and noise level • 31
- Display • 54, 55
- Display and operation unit • 54
- Display features • 127, 144
- Display of measured value • 71, 73
- Display overview • 146, 147, 148
- Displaying diagnosis values of the reference measurement • 107
- Displaying the status of the last reference • 106
- Disposal • 228
- Dynamic QR code • 198

E

- Emergency purging • 46, 170, 171

F

- FID
 - Conversion of concentration data • 27, 81
 - Seal integrity and functional checks • 166
 - Standby/Restart • 53, 177
 - Troubleshooting • 223

H

- Hydrogen monitoring of the analyzer cabinet • 19

I

- Installation • 35
- Installing the analyzer cabinet • 36
- Installing the gas sampling probe and filter unit • 39
- Installing the operating gases • 44
- Installing the sample gas line • 38, 42
- Intended use • 8

K

Key entry • 55, 65, 149, 158

M

Maintenance • 161
Maintenance switch • 169
Manual adjustment • 75
Manual start of automatic adjustment • 76, 112
Material required for the installation (not supplied) • 33, 37, 44, 48
Menu structure • 72
Message display • 57
Monitoring the internal cabinet temperature • 171
Moving a display element from one page to another • 152
Moving a display element within a page • 153, 154, 157, 160

N

Notify service • 226
Numeric keypad • 54, 59

O

Operating by key entry • 65, 159
Operating by value input • 64, 156
Operating gases and test gases • 26, 44, 50
Operating the analyzer system • 70
Operation • 54
Output current response • 102

P

Packing the analyzer cabinet • 227
Page overview • 146, 147, 148
Parameter overview • 146, 147, 149
Password protection • 66, 71, 130
Power supply • 29, 49
Preface • 6
Preparation for installation • 21
Process status • 200

R

Recommissioning • 50
Replace system module • 135
Replacing filter cells in air purifier AU5 • 183, 193
Replacing filter in the compressed air main regulator (-J85) • 183, 190
Replacing filter on the gas sampling probe • 183, 184
Replacing filter pad in the fan • 183, 195
Replacing filters in the sample gas pressure regulator • 183, 192
Replacing pressure equalization screws • 183, 197
Replacing sample gas filter in the ASP block • 183, 187
Replacing the battery on the system controller • 183, 196

Replacing wearing parts • 183
Requirements for the installation site of the analyzer cabinet • 23, 36, 37

S

Safety instructions • 8, 161
Safety instructions for handling the analyzer system • 11, 161
Safety instructions for handling the analyzer system with integrated FID • 11, 12, 45, 161
Safety instructions for handling the FTIR spectrometer • 11, 13, 161
Safety instructions for working with poisonous gases • 11, 14, 161
Sample gas inlet conditions • 25
Save configuration • 137
Saving the reference as an initial reference • 108
Scope of supply and delivery • 32, 35
Seal integrity test • 164, 186, 189
Selecting user interface language • 127, 129
Selection of the sampling point, installation of the wall tube • 21
Setting system modules • 132, 144
Setting time zone, date and time • 128
Shutting down the analyzer system • 227
Softkeys • 54, 56, 61
Start Automatic Adjustment Check (AAC) manually • 109
Status LEDs • 54, 58
Status message categories • 205
Status message system • 178, 207, 225
Status messages FTIR • 217
Status messages, troubleshooting • 58, 61, 198
Switch measuring range • 113
System status
 Status messages • 200, 201
 Status signals • 138, 203

T

Text entry • 59, 63, 127

U

User page configuration • 145, 148, 151

V

Value input • 55, 64, 149, 156
Visual inspection • 162

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