ACX

Advanced CGA Solutions

Analyzer System for Emission Monitoring, Cement Applications and Process Measurement

Measurement made easy

Introduction

ACX is a complete system solution for continuous gas analysis.

The ACX system includes everything from probe, heated lines, sample conditioning to reliable and time-tested analyzers of the Advance Optima series. It can be operated from the outside.

The system is available in various variants tailored to your measuring tasks - emission monitoring, cement applications and process gas measurements.
It is especially designed for easy service and maintenance.

Additional Information

Additional documentation on ACX is available for download free of charge at www.abb.com/analytical. Alternatively simply scan this code:

Advanced CGA Solutions

ACX

Analyzer System for Emission Monitoring, Cement Applications and Process Measurement

Commissioning Instruction

Publication No. CI/ACX-EN
Revision D
Edition: February 2020

This operator's manual is protected by copyright. The translation, duplication and distribution in any form, even in a revised edition or in extracts, in particular as a reprint, by photomechanical or electronic reproduction or in the form of storage in data processing systems or data networks are prohibited without the consent of the copyright holder and will be prosecuted under civil and criminal law.

Table of Contents

Foreword

The Content of this Operator's Manual

This operator's manual contains all the information you will need to safely and efficiently install, operate and maintain the ACX Analyzer System.

This operator's manual contains information on all the functional units in the analyzer system. Your analyzer system as delivered may differ from the version described in this operator's manual.

System documentation

The system documentation includes the following:

- Device Data Sheet
- Instructions in brief for installation, commissioning and operation
- Certificates
- Project-relevant CD-ROM with
  - Set of drawings (arrangement diagram, piping diagram, interface diagram) as well as
  - Information on function block configuration as needed
- System CD-ROM 'Continuous Gas Analysis – Software Tools and Technical Documentation'
- CD-ROM 'Spare Parts Catalog for Analyzer Technology'

Information on the Internet

Information on ABB Analytical products and services is available on the Internet at "http://www.abb.com/analytical".

Service Contact

If the information in this manual does not cover a particular situation, ABB Service is prepared to supply additional information as needed.

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

ABB Service
Telephone: +49-(0)1805-222580, Telefax: +49-(0)621-38193129031,
E-mail: automation.service@de.abb.com

Symbols and Type Format in this Operator's Manual

indicates safety information to be heeded during analyzer system operation in order to avoid risks to the user.

identifies specific information on operation of the analyzer system as well as on the use of this manual.

1, ***2***, ***3***, … identifies reference numbers in figures.

`Display` identifies a message in the display.

`Input` identifies a user entry
- either by pressing a soft key
- or by selecting a menu item
- or via the numeric keypad.

Safety Information

Important Safety Information

Intended Conditions of Use

The analyzer system is designed for continuous measurement of concentrations of specific components in gases or vapor. Any other application is not compliant with the specified use. Observation of this manual is also part of the specified use.

The analyzer system must not be used to measure flammable gases or combustible gas/air or gas/oxygen mixtures. The analyzer system must not be installed in hazardous locations.

The analyzer system interior remains free of explosive atmosphere during normal operation. Therefore, the integration of explosion protection measures inside the analyzer system is not required.

Requirements for Safe Operation

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

Personnel Qualifications

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

Special Information and Precautions

These include

- The content of this manual,
- The safety labels affixed to the analyzer system,
- The applicable safety precautions for installing and operating electrical devices,
- Safety precautions for working with gases, acids, condensates, etc.

Safety Labels Affixed to the Analyzer System

Observe the safety labels affixed to the analyzer system or to the individual components:

Consult Documentation!

Hot Surface! (Temperature > 60 °C)

Corrosive Material!

Risk of Electric Shock!

National Regulations

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

Analyzer System Safety and Safe Operation

The analyzer system is designed and tested in accordance with EN 61010 Part 1/ IEC 1010-1, "Safety Provisions for Electrical Measuring, Control, Regulation and Laboratory Instruments" and has been shipped ready for safe operation.

To maintain this condition and to assure safe operation, read and follow the safety information identified with the safety symbols in this manual. Failure to do so can put persons at risk and can damage the analyzer system as well as other systems and instruments.

Safety Tips for Handling Electronic Measurement Devices

Protective Lead Connection	The protective lead should be attached to the protective lead connector before any other connection is made.
Risks of a Disconnected Protective Lead	The analyzer system can be hazardous if the protective lead is interrupted inside or outside the analyzer cabinet or if the protective lead is disconnected.
Correct Operating Voltage	Be sure the analyzer system voltage setting matches the line voltage before connecting the power supply.
Risks Involved in Opening the Covers	Current-bearing components can be exposed when covers or parts are removed, even if this can be done without tools. Current can be present at some connection points.
Risks Involved in Working with an Open Analyzer System	The analyzer system must be disconnected from all power sources before being opened for any work. All work on an analyzer system that is open and connected to power should only be performed by trained personnel who are familiar with the risks involved.
Charged Capacitors	The capacitors in the analyzer system can retain their charge even when it is disconnected from all power sources.
Use of Proper Fuses	Only fuses of the specified type and rated current should be used as replacements. Never use patched fuses. Do not short-circuit the fuse holder contacts.
When safe operation can no longer be assured ...	If it is apparent that safe operation is no longer possible, the analyzer system should be taken out of operation and secured against unauthorized use. The possibility of safe operation is excluded: • if the analyzer system is visibly damaged, • if the analyzer system no longer operates, • after prolonged storage under adverse conditions, • after severe transport stresses.

Safety Tips for Handling the Analyzer System

CAUTION!

Do not open any gas paths in the analyzer system or in the integrated analyzers. Doing so will damage gas path seal integrity.

If system-internal gas paths are opened, a seal integrity check must be performed with a leak detector (thermal conductivity) when the device is reassembled.

Additional Safety Tips for Handling the Analyzer System with Integrated VOC Analyzer

CAUTION!

The combustion gas path in the analyzer system and especially in the integrated VOC analyzer must not be opened! The combustion gas feed path can become leaky as a result!

If the system-internal combustion gas path is opened, a seal integrity check must be performed with a leak detector (thermal conductivity) when the device is reassembled.

The bulkhead connector with integrated flow limiter for connection of the combustion gas line is a safety relevant part. It must not be removed, modified or replaced!

It is recommended to check regularly the seal integrity of the combustion gas line outside the analyzer system.

WARNING!

Combustion gas flowing out of leaks in the gas paths can cause fire and explosions (even outside the analyzer system itself).

A shut-off valve must be installed in the combustion gas supply line to increase safety in the following operating conditions:

- During shutdown of the gas analyzer,
- In the event of failure of the instrument air supply,
- Leakage in the combustion gas feed path inside the gas analyzer.

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

Safety Tips for Handling Corrosive and Acidic Substances

CAUTION!

When working with corrosive reagents note the hazard information and safety precautions contained in the applicable material safety data sheets.

Condensates are often acidic. Neutralize condensates and follow the prescribed measures for disposal.

Safety Tips for Handling Harmful Gases

CAUTION!

Some of the gases measured with the analyzer system are harmful to health.

Therefore, the sample gas must not escape from the gas path during normal operation and maintenance works.

A seal integrity check of the analyzer system has to be performed at regular intervals.

The diluted exhaust gas must be drained out of the installation room of the analyzer cabinet.

Notes on data safety

Obligations of the owner

This product is designed to be connected to a network interface and to communicate information and data via this network interface.

It is the operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).

The operator shall establish and maintain any suited measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and / or theft of data or information.

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

Digital communication

The ABB guidelines prevent communication through unsecured communication protocols, provided that the operator does not explicitly allow this.

These communication protocols are blocked by default.

The device software has been supplemented with menu items through which the operator can explicitly release communication.

The communication protocols are blocked again after software updates and must be released once again.

Services and ports on the Ethernet interface

Port	Description
22/tcp	Used only for software updates. No direct access to the device.
8001/tcp	Binary proprietary protocol for: • Remote HMI for operation • AnalyzeIT program for continuous monitoring • OPC Server, external OPC Server for ACX systems
501/tcp	Used for Modbus/TCP. The device allows connection to any Modbus client.

Installation Preparation

"Hydrogen Monitoring of the Analyzer Cabinet" option

Function

If an FID (VOC Analyzer) is installed, the analyzer system can be supplied with the 'Hydrogen monitoring of the analyzer cabinet' option as an additional safety measure. If a leak occurs in the hydrogen path inside the analyzer cabinet and hydrogen accumulates inside the cabinet, both the hydrogen supply and the power supply are shut off before the explosion limit is reached – at 40 % LEL. This prevents formation of an ignitable mixture.

Scope of delivery

Installed in the analyzer cabinet:

- in the upper area, an ATEX-certified gas sensor with connection socket,
- on the exterior on the right-hand side wall, a solenoid valve, connected with the combustion gas input of the analyzer cabinet, which cuts off hydrogen supply in the event of a failure of the power supply, or at 40 % LEL (H_2safety 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 electric wiring of the gas sensor and the gas warning center to shut down the power supply in the event of a fault is not installed in the analyzer system in the factory-delivered condition.

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 (H_2) as well as the coils of the contactors and relays for disconnecting the power supply and UPS (if present) must be connected to a fault-signalling contact in the gas warning center. The fault-signalling 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.

The measurement and status signals supplied potential-free as well as bus connections must not be activated separately in the event of a gas alarm. If however a non potential-free external signal is fed in, the operator should make sure that if a gas alarm is triggered, it is activated via a cut-off relay, for example.

- The gas sensor installed in the analyzer cabinet is not factory calibrated; it is inoperable without calibration. Calibration of the gas sensor is the responsibility of the operator.
- Installation, commissioning, parameterization, operation, signal evaluation and maintenance of the supplied gas warning 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.

Operation of this safety device should be checked during commissioning and at regular intervals (min. 1 time a year).

Installing the Analyzer System

- We recommend having the analyzer system installed by ABB.
- When installing the analyzer system, in addition to this manual, comply with the information contained in the drawings set.
- If there is shipping damage which points to improper handling file a damage claim with the shipper (railway, mail or freight carrier) within seven days.
- Make sure the enclosed accessories are not lost (see the “Items Delivered” section, page 23).
- Keep the packaging material for future shipping needs.

Installation – Overview

Step	Action	Page
1	Prepare the gas sampling probe installation site.	15
2	Prepare the analyzer cabinet installation site.	16
3	Install the gas sampling probe and filter unit.	25
4	Install the sample gas line.	35
5	Install the back-purging unit (if applicable).	39
6	Install the analyzer cabinet.	47
7	Install the instrument air and test gas supply (if applicable).	49
8	Connect the gas lines to the analyzer cabinet.	51
9	Connect the electrical leads to the analyzer cabinet.	52

Choosing the Extraction Point, Wall Tube Installation

Choosing the Extraction Point

The extraction point must be suitable for extracting a representative specimen flow.

In the case of emission monitoring systems the extraction point is specified by the responsible technical inspection authority.

Wall Tube Installation

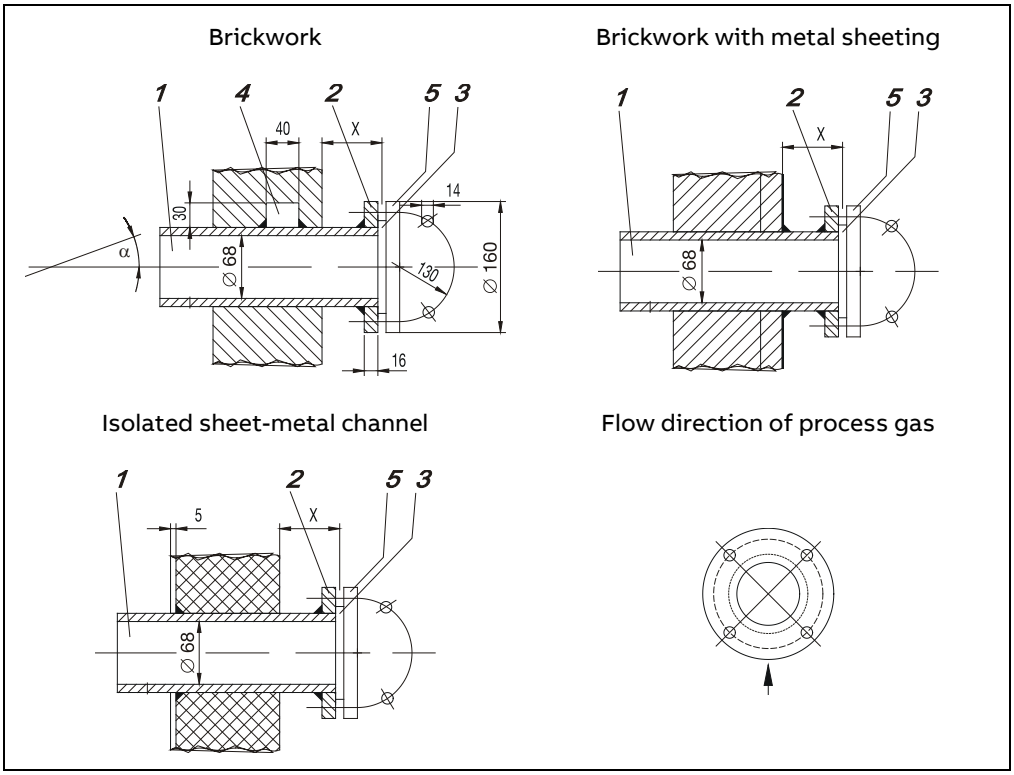
- Install the wall tube with mounting flange (DN 65, PN 6, type A according to DIN EN 1092-1; not supplied) at the extraction point in such a way that the sampling probe tube can be easily installed and removed (see Figure 1).
- The sampling probe tube must be easily accessible to allow maintenance work to be performed.
- Align the boreholes of the mounting flange in relation to the flow direction of the process gas (see Figure 1).

Observe the separate instructions for installation of probe tube type 40W on page 27!

Figure 1

Wall Tube Installation

(Dimensions in mm)



Wall tube
Wall tube mounting flange DN 65, PN 6, Form A to DIN EN 1092-1
Gasket
Welded-on rectangular block
Sampling probe tube flange

Minimum distance x_{min} of the mounting flange (wall tube flange) from the wall depending on mounting angle α:

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

Analyzer System Installation Site Requirements

CAUTION!

The analyzer system must not be installed in hazardous locations.

Short Gas Paths

The analyzer cabinet should be installed as close as possible to the sampling site. A short sample gas line results in brief lead times.

The sample gas line length is limited to 60 meters with 230 VAC power supply and to 40 meters with 115 VAC power supply on account of pressure drop build-up in the line and the required electrical fusing.

For fast measurement at preheater / CO monitoring of ESP, the sample gas line length is limited to 10 meters.

The test gas cylinders should be installed as close as possible to the analyzer system.

Protection from Adverse Conditions

Protect the analyzer cabinet against

- Water spray
- Contact with chemicals
- Strong sunlight and heat radiation
- Strong air currents
- Heavy dust load
- Corrosive atmospheres
- Vibration

Installation Indoors or Outdoors

The sheet steel cabinet and the mounting plate are only suitable for installation indoors. An air-conditioned room is recommended.

The GRP cabinet is suitable for installation indoors and outdoors. A weather protection roof must be provided.

Ambient Temperature

Operation:	Mounting plate		0 to +35 °C
	Sheet steel cabinet	with ventilation fan	0 to +35 °C
		with cooling unit	0 to +45 °C
	GRP cabinet	with ventilation fan	–20 to +35 °C
		with cooling unit	–20 to +45 °C
Storage and transport:			+2 to +60 °C
	after draining and drying parts in contact with condensate		–25 to +60 °C

Relative Humidity

Year-round average max. 75 %, short-term max. 95 %, occasional slight condensation is permitted

Installation Site Altitude

The maximum installation altitude is 2000 m above sea level.

Continued on next page

Dimensions and Space Requirement

Refer to the “Layout Plan” in the drawings set.

Installation Site Stability

The installation site floor must be plane and capable of supporting the cabinets weight (see page 22).

The installation site wall must be capable of supporting the weight of the mounting plate and the separate electrical distribution cabinet (see page 22).

Sample Gas Inlet Conditions (at the Extraction Point)

CAUTION!

The analyzer system must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures!

In the case of toxic gases, the threshold limit value (TLV) must be complied with.

Application	Temperature	Pressure p_{abs}		Flow
Emission Monitoring	max. 500 °C	850 to 1100 hPa	(0.85 to 1.1 bar)	max. 250 l/h
Kiln or Calciner Outlet (T > 900 °C)	max. 1300 °C	850 to 1100 hPa	(0.85 to 1.1 bar) [1)]	max. 100 l/h
Calciner	max. 900 °C	850 to 1100 hPa	(0.85 to 1.1 bar)	max. 125 l/h
Wet Kiln Gas Outlet	max. 300 °C	850 to 1100 hPa	(0.85 to 1.1 bar)	max. 250 l/h [2)]
Preheater / CO Monitoring of ESP	max. 450 °C	850 to 1100 hPa	(0.85 to 1.1 bar)	max. 250 l/h [3)]
Coal Bunker, Coal Mill	max. 500 °C	850 to 1100 hPa	(0.85 to 1.1 bar)	max. 250 l/h
Process Measurement	max. 500 °C	850 to 1100 hPa	(0.85 to 1.1 bar)	max. 250 l/h

1) at the sample gas inlet of the analyzer system

2) max. 60 l/h with SO_2 measurement

3) max. 300 l/h with probe F

Test Gas Connection at the Gas Sampling Probe or upstream of the Sample Gas Cooler: Test Gas Inlet Conditions

CAUTION!

When handling test gases, the lower explosion limit (LEL)as well as the threshold limit value (TLV) must be complied with.

	Specification	Pressure p_e	Flow
Test gases 1, 2, 3	Sample component or substitute gas component in N_2 or air	1000 ± 100 hPa (1.0 ± 0.1 bar)	130 to 250 l/h

AO2000-Magnos27: Test Gas Inlet Conditions

	Characteristic	Pressure p_e	Flow
Zero Gas	N_2	500 ± 50 hPa (= 0.5 ± 0.05 bar)	130 to 250 l/h
Span Gas	Air		

AO2000-Fidas24: Supply Gas and Test Gas Inlet Conditions

	Characteristic	Pressure p_e	Flow
Instrument Air [1)]	Based on ISO 8573-1 Class 2 (particle size max. 1 µm, particle density max. 1 mg/m³, oil content max. 0.1 mg/m³, pressure dew point at least 10 °C below the lowest expected ambient temperature)	4000 ± 500 hPa (4.0 ± 0.5 bar)	approx. 1500 l/h
Combustion Air [2)]	Synthetic air or catalytically cleaned air with an org. C content of < 1% of the span	1200 ± 100 hPa (1.2 ± 0.1 bar)	max. 40 l/h
Combustion Gas [3)]	H_2 (quality 5.0)	1200 ± 100 hPa (1.2 ± 0.1 bar)	approx. 3 l/h
Zero Gas	N_2 (quality 5.0) or synthetic air or catalytically cleaned air	1000 ± 100 hPa (1.0 ± 0.1 bar)	130 to 250 l/h
Span Gas [4)]	Sample component or substitute gas component in N_2 or air	1000 ± 100 hPa (1.0 ± 0.1 bar)	130 to 250 l/h

1) Provide a shutoff valve with a p_e = 4.5 to 7 bar pressure gauge.
   Instrument air is used as
   - drive air for the air injector (if installed),
   - combustion air,
   - emergency purge air.
2) Separate combustion air supply is required if the analyzer system is not equipped with a combustion air conditioning module (catalyst).
3) Recommendation: Provide two 40 l cylinders and a switchover station.
   Note: For safety reasons, a flow limiter is integrated in the bulkhead connector provided for connection of the combustion gas line to limit the combustion gas flow to 10 l/h.
4) As the VOC analyzer only measures the number of carbons the concentration of the span gas has to be calculated from ppm or mg/m³ C_nH_m to ppm or mg/m³ C.

- Perform regular inspections of the external combustion gas line.
- Install a pressure relief valve in the combustion gas line outside of the analyzer cabinet
- Set the pressure relief valve to < 2 bar to securely limit the maximum supply pressure.

Definition

$p_e = p_{abs} - p_{amb}$
with p_e = positive pressure, p_{abs} = absolute pressure, p_{amb} = atmospheric pressure

Back-Purging Unit: Installation Site and Air Supply Requirements

Design of the Back-Purging Unit

The back-purging unit consists of a protective cabinet with shut-off valve, 6 bar pressure reduction valve, solenoid valves for back-purging, pressure regulator and 5 l compressed air receiver for effective pressure pulses also with lower airflow rate.

Distance to Sampling Probe

The distance between the back-purging unit and the sampling probe must not exceed 5 m (length of the steel-braided compressed-air hoses = 6 m).

Protection from Adverse Conditions

Protect the back-purging unit against

- Water spray
- Contact with chemicals
- Strong sunlight and heat radiation
- Strong air currents
- Heavy dust load
- Corrosive atmospheres
- Vibration

Pressurized air supply requirements

- dry (dew point < 3 °C), oil- and dust-free
- max. 6 bar for back-purging
- approx. 4 bar as control air (needed for 2-stage back-purging with Type PFE2 filter unit and AO2000-Fidas24 VOC analyzer)
- Required air capacity approx. 100 m3/h
- Instrument air following ISO 8573-1 Class 2 (particle size max. 1 µm, particle density max. 1 mg/m3, oil content max. 0.1 mg/m3, pressure dew point max. –20 °C)

CAUTION!

If the compressed air is not dry and clean, this will result in damage to the sample conditioning components (valves, filters, sample gas cooler, sample gas feed unit) as well as to the gas analyzer.

Power Supply Requirements

Operating Voltage

230 / 400 V AC or 120 / 208 V AC, ± 10 %, 48 to 62 Hz; 3~, L1, L2, L3, N, PE.

Non-floating PEN conductor is forbidden.

Power Consumption

Basic version		1000 W
Cooling unit		+ 940 W
Analyzer module AO2000-Fidas24		+ 285 W
NO_2 / NO converter		+ 350 W
Probe tube type 40W, partially heated (24 V AC)		+ 120 W
Probe tube type 42, heated		+ 800 W
Filter unit type PFE2 or PFE3, heated		+ 250 W
Probe 2, partially heated		+ 255 W
Probe F, partially heated		+ 400 W
Back-purging unit		+ 150 W
Sample gas line type TBL01-S, TBL01-C, heated	regulated 180 °C	+ 90 W/m
	self-regulating 100 °C	+ 35 W/m
	self-regulating 30 °C	+ 15 W/m

Uninterruptible Power Supply

Prepared for Uninterruptible Power Supply (UPS), 400 W.

230 V AC or 120 V AC, ± 10 %, 48…62 Hz; L, N, PE.

Non-floating PEN conductor is forbidden.

Service Socket

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

The service socket is located
- in the cabinet light or
- mounted on a top hat rail in the separate electrical distribution cabinet.

Continued on next page

Fuses

-F10	Power supply / leakage current indicator (option)	25 A / 30 mA
-F20	Power supply UPS / leakage current indicator (option)	25 A / 30 mA
-F01	Lighting, service socket, ventilation fan or cooling unit	6 A or 16 A
-F02	Heated probe tube, heated filter unit, back-purging unit, test gas connection valves	10 A or 16 A or 6 A
-F03	Heated sample gas line	16 A
-F04	NO_2 / NO converter	6 A
-F05	AO2000-Fidas24, air catalyst	6 A
-F06	Sample gas cooler, sample gas feed unit	6 A
-F07	AO2000 central unit, power supply	6 A
-F11	Temperature controller	T 2 A
-F12	Temperature controller	T 2 A
-F13	Temperature controller	T 2 A
-F14	Emergency purging AO2000-Fidas24	T 0.5 A
-F17	Test gas valve 1	T 0,5 A
-F18	Test gas valve 2	T 0,5 A
-F19	Test gas valve 3	T 0,5 A
-F22	Filter unit 2nd sampling point	10 A or 16 A
-F23	Heated sample gas line 2nd sampling point	16 A

Weight, Sound Level

Weight of the Individual System Components

Sheet steel cabinet		max. 430 kg
GRP cabinet		max. 370 kg
Mounting plate		max. 170 kg
Separate electrical distribution cabinet		max. 65 kg
Probe tube type 40, unheated	500 mm	1 kg
	1000 mm	2 kg
	1500 mm	3 kg
Probe tube type 40W, partially heated	3500 mm	13 kg
	4000 mm	15 kg
	4500 mm	17 kg
Probe tube type 42, heated	1000 mm	8 kg
	1500 mm	10 kg
	2000 mm	12 kg
Probe 2 with protective case	1200 mm	17 kg
Probe F	1200 mm	10 kg
Filter unit type PFE2, heated, with protective case		20 kg
Filter unit type PFE3, heated, with protective case		17 kg
Back-purging unit		70 kg
Sample gas line type TBL01-S or TBL01-C, heated		1 kg/m

Sound Level

Ventilation fan	50 Hz	59 dB(A)
	60 Hz	61 dB(A)
Cooling unit		< 64 dB(A)

Items Delivered

Standard Equipment

Quantity	Description
1	Analyzer cabinet or Mounting plate with separate electrical distribution cabinet
	System documentation (provided in a ring binder, see page 6)

Additional Items Delivered Per Order

Quantity	Description
1	Gas sampling probe tube Type 40 (unheated) or Type 40W (partially heated) or Type 42 (heated) or Gas sampling probe Type 2 optionally with separate protective case or Type F
1	Filter unit type PFE2 or PFE3 with ring heater or heating sleeve
1	Sample gas line type TBL01-S or TBL01-C (heated)
1	Back-purging unit 1-stage or 2-stage with compressed-air hoses
1	Hydrogen switch-over station with cylinder pressure reducers on mounting plate (for AO2000-Fidas24)
1	Reagent supply bottle
1	Condensate collection bottle
1	Wear parts set

'Hydrogen monitoring of the analyzer cabinet' option

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

The gas sensor and the H_2 safety valve are securely installed in or on the analyzer cabinet.

Materials Needed for Installation (not supplied)

Gas Sampling

- Wall tube with mounting flange (DN 65, PN 6, Type A to DIN EN 1092-1, see Figure 1, page 15)

Gas Lines

• Sample gas (unheated line)	PTFE pipe 4 / 6x1 mm
• Sample gas outlet	PTFE pipe 4 / 6x1 mm
• Test gas N_2	PTFE pipe 4 / 6x1 mm
• Test gases 1, 2, 3	PTFE pipe 4 / 6x1 mm
• Instrument air	Stainless steel pipe, 8 mm O.D., or compressed-air hose (plus pressure gauge and shut-off valve)
• Fidas24 combustion air	PTFE pipe 4 / 6x1 mm
• Fidas24 combustion gas	Purified stainless steel pipe (SS316), 6 mm O.D.
• Fidas24 zero gas	PTFE pipe 4 / 6x1 mm
• Fidas24 span gas	PTFE pipe 4 / 6x1 mm
• Fidas24 exhaust gas	Stainless steel pipe, 12 mm O.D.
• Condensate collecting bottle	PVC tube 4 / 6x1 mm

Input Wiring

- Input wiring
  - 5 x 6 mm^2 (5 x AWG 8)
  - If applicable, uninterruptible power supply wiring 3 x 2.5 mm^2 (3 x AWG 14)
- Cables to connect the heated gas sampling probe, filter and sample gas line to the analyzer cabinet (if applicable, in a heat-resistant version; note the power requirements of these components, page 20)
- Grounding cable with cross section ≥10 mm^2 (≥ AWG 8)

Signal Leads

- Shielded cable for analog outputs (current outputs)
- Cable for digital outputs
- Cable for data lines (Modbus, Profibus, Ethernet)
- Cable for the Pt100 resistance thermometers of the heated components

When selecting conductor materials, follow all applicable national safety regulations for the installation and operation of electrical devices.

Mounting

- Screws and nuts to secure the analyzer cabinet to the floor
  or
- Screws and nuts (stud bolts if applicable) to secure the mounting plate and the electrical distribution cabinet to the wall

For details regarding the size of the screws and nuts see the “Layout Plan” in the drawings set.

Sampling System Installation

Type 40 Probe Tube and Filter Unit Installation

CAUTION!

The weight of the probe tube with filter unit amounts to approx. 18–20 kg! Two persons are needed for transportation and mounting!

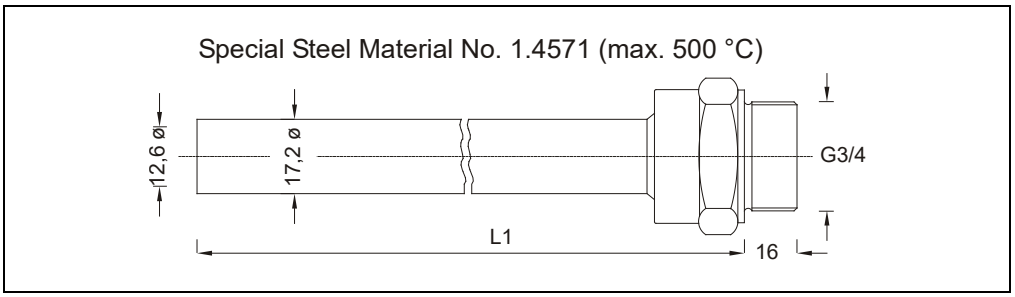
Before the Installation

- Observe the “Piping Plan” in the drawings set.
- Make sure that the wall tube is installed at the extraction point (see page 15).

Figure 1

Type 40 Probe Tube

L1=500/1000/1500 mm
(Dimensions in mm)



Type 40 Probe Tube and Filter Unit Installation

Step	Action
1	Screw the probe tube into the internal thread of the filter unit.
2	Insert the pre-assembled probe tube with filter unit in the wall tube and screw the flange of the filter unit to the flange of the wall tube. Use the green seal from the accessories pack to seal the space between the flanges of wall tube and filter unit.
3	Mount the heating sleeve or the ring heater on the filter unit.
4	If applicable, install the compressed-air hoses between the filter unit and the back-purging unit (see page 39).

Type 42 Probe Tube and Filter Unit Installation

CAUTION!

The weight of the probe tube with filter unit amounts to approx. 28–32 kg! Two persons are needed for transportation and mounting!

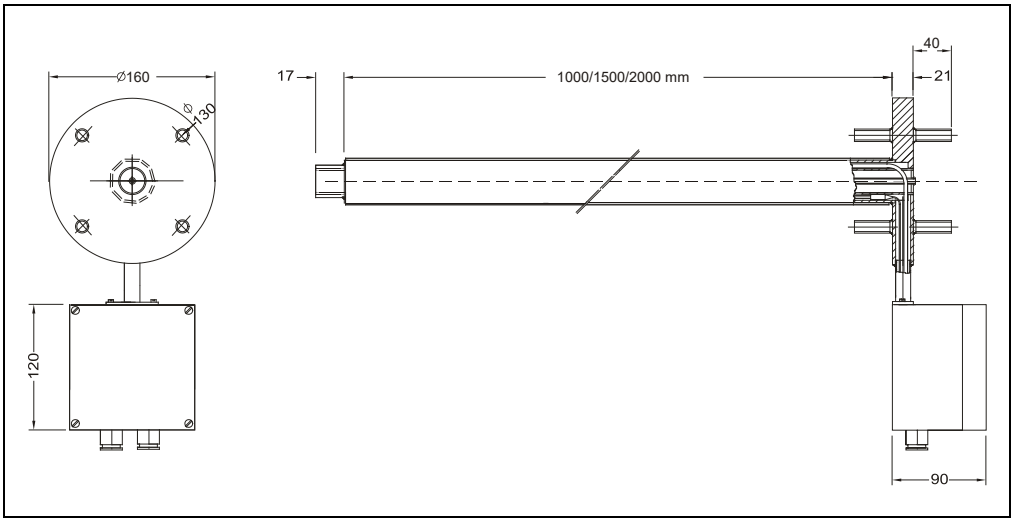
Before the Installation

- Observe the “Piping Plan” in the drawings set.
- Make sure that the wall tube is installed at the extraction point (see page 15).

Figure 2

Type 42 Probe Tube

(Dimensions in mm)



Type 42 Probe Tube and Filter Unit Installation

Step	Action
1	Insert the probe tube in the wall tube and screw the probe tube flange to the wall tube flange. Use the green seal from the accessories pack to seal the space between the flanges.
2	Screw the filter unit to the flange of the probe tube. Use the green seal from the accessories pack to seal the space between the flanges of probe tube and filter unit.
3	Mount the heating sleeve on the filter unit.
4	If applicable, install the compressed-air hoses between the filter unit and the back-purging unit (see page 39).

Type 40W Probe Tube and Filter Unit Installation

CAUTION!

The weight of the probe tube with filter unit amounts to approx. 50 kg!
Two persons are needed for transportation and mounting!

Before the Installation

Observe the “Piping Plan” in the drawings set.

Vertical Installation

The type 40W probe tube must be installed in the smoke chamber almost in vertical orientation (see Figure 3, page 28).

Protection Pipe for Type 40W Probe Tube

The probe tube must be installed in a protection pipe with the following characteristics:

Material:	Mild steel
Length:	3.0 m (for protection of the heated part of the probe tube)
Inner diameter:	50 mm or 100 mm for probe tube without or with prefilter
Flange:	for connection to the flange of probe tube, location min. 300 mm above the roof of the smoke chamber or its platform

Due to the probe tube’s length (normally 3.5 m, 4.0 m or 4.5 m), it can be necessary to make a hole in the roof above the smoke chamber in order to install the probe tube as well as the protection pipe.

Installation of the protection pipe is preferably carried out during a shut down of the kiln. The opening should be closed with a blind flange until the installation of the probe tube takes place.

Type 40W Probe Tube and Filter Unit Installation

Step	Action
1	Remove the blind flange from the protection pipe and lay on a flange seal on the protection pipe flange.
2	Insert the probe tube from above in the protection pipe. Do not damage the electrical connection (porcelain terminals) of the probe tube heating at the probe tube flange!
3	Lay on the supplied flange seal on the probe tube flange and mount the filter unit.
4	Interconnect the 3 flanges with bolts and nuts.
5	Mount the heating sleeve on the filter unit.
6	Connect the cable of the heating sleeve to the terminals in the terminal box of the filter unit.
7	Connect the cable of the probe tube heating (2 x 2.5 mm^2) to the 26 VDC connection of the transformer in the back-purging unit.

Continued on next page

Figure 3

Type 40W Probe Tube Installation in the Smoke Chamber

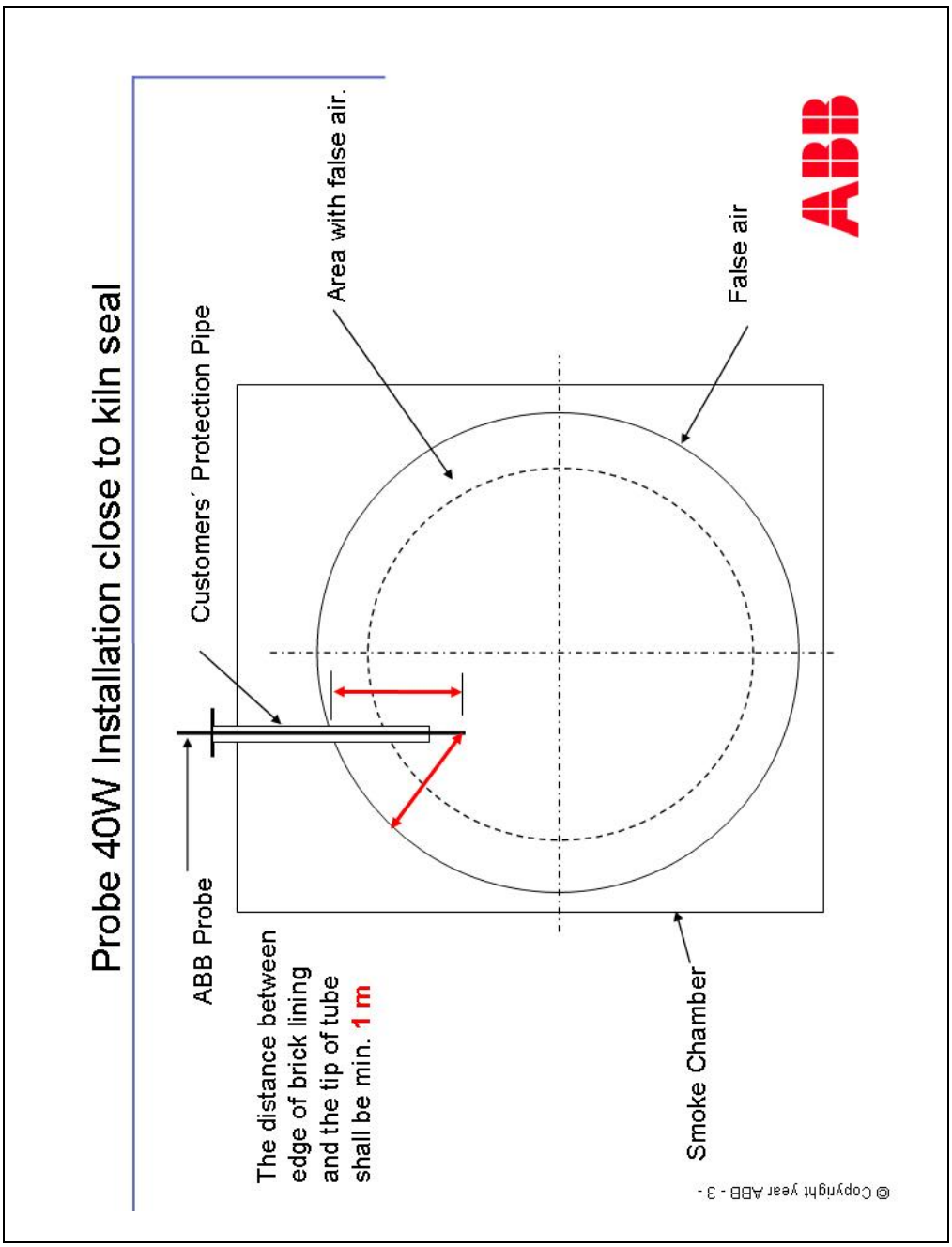
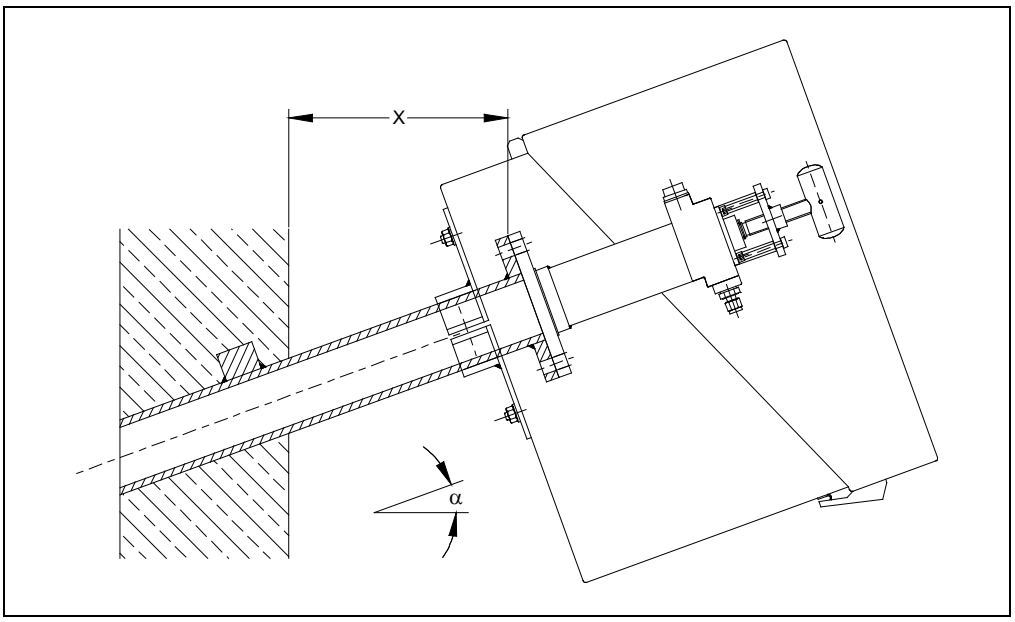


Figure 4

PFE2 Filter Unit: Mounting of Probe Protective Case



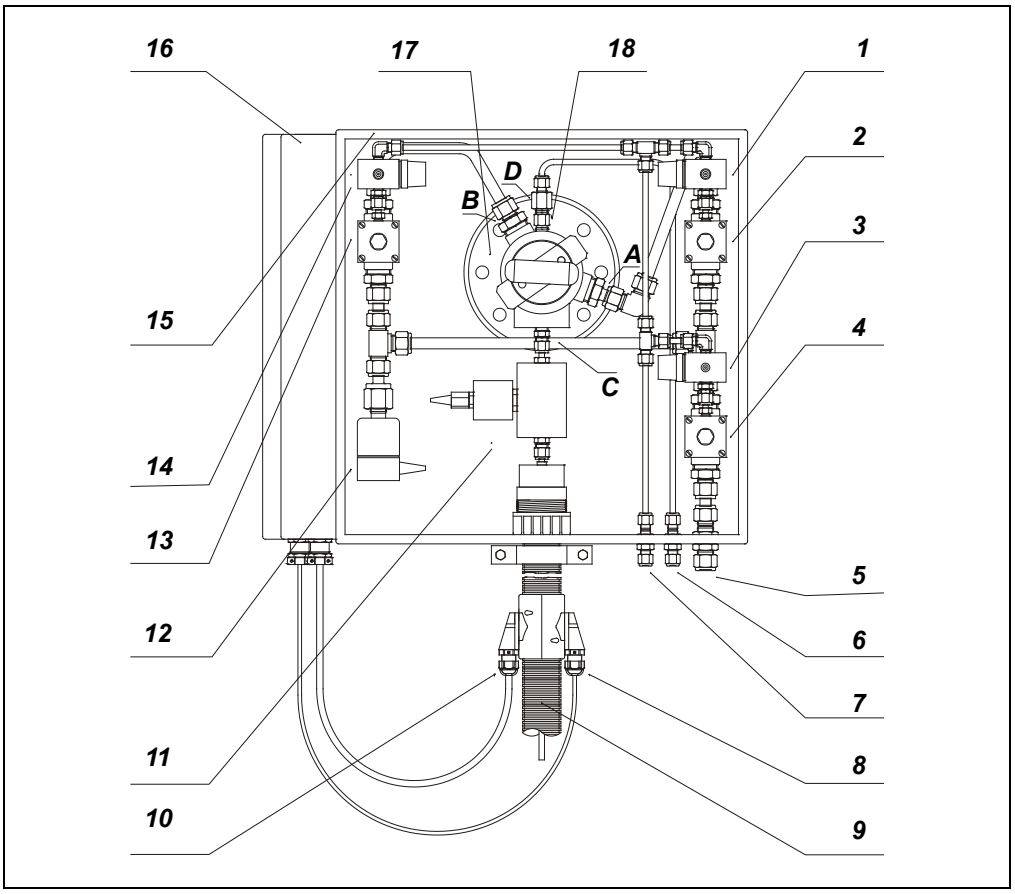
Minimum distance x_{min} of the mounting flange (wall tube flange) from the wall depending on mounting angle α:

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

PFE2 Filter Unit: Gas Connection

Figure 5

PFE2 Filter Unit: Gas Connections (with Back-Purging)

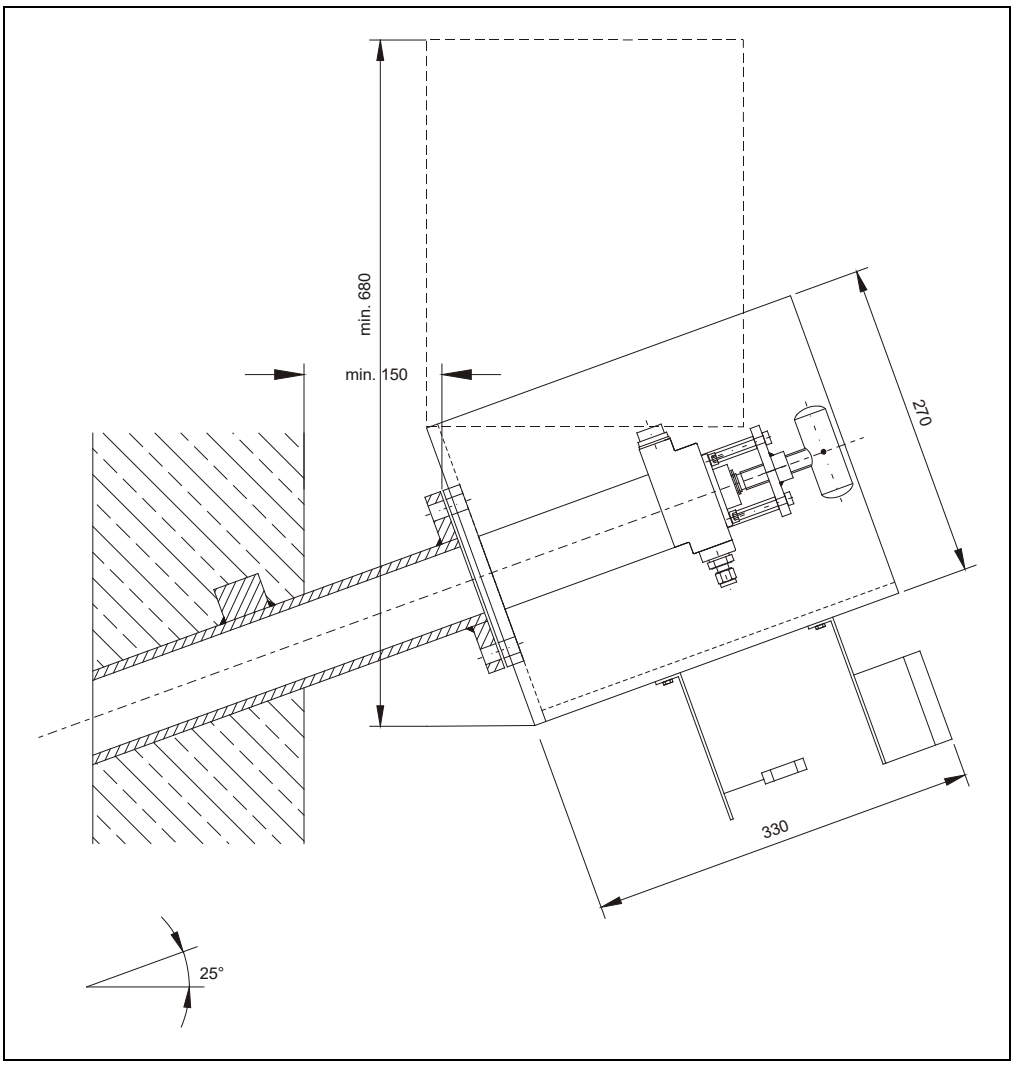


1 Pilot Operation Valve Cleaning Filter -Y2.1
2 Diaphragm Valve Cleaning Filter -Y2.2
3 Pilot Operation Valve Pulsed Instrument Air -Y1.1
4 Diaphragm Valve Pulsed Instrument Air -Y1.2
5 Instrument Air Inlet Bulk Head Union 12 mm
6 Test Gas Inlet Bulk Head Union 6 mm
7 Control Air Inlet Bulk Head Union 6 mm
8 Pt100 Connection
9 Heated Sample Gas Line -E13
10 Power Supply
11 Heated Check Valve -Y5
12 Solenoid Valve Aeration -Y4
13 Diaphragm Valve Cleaning Filter Surface and Probe Tube -Y3.2
14 Pilot Operation Valve Cleaning Filter Surface and Probe Tube -Y3.1
15 Protection Box
16 Terminal Box
17 Filter Unit
18 Check Valve
A Back Purging Filter Inlet G 1/2″
B Back Purging Filter Surface / Probe Tube Inlet G 1/2″
C Sample Gas Outlet G 1/4″
D Test Gas Inlet G 1/4″

Figure 6

PFE3 Filter Unit: Mounting of Probe Protective Case

(Dimensions in mm)



Minimum distance x_{min} of the mounting flange (wall tube flange) from the wall depending on mounting angle α:

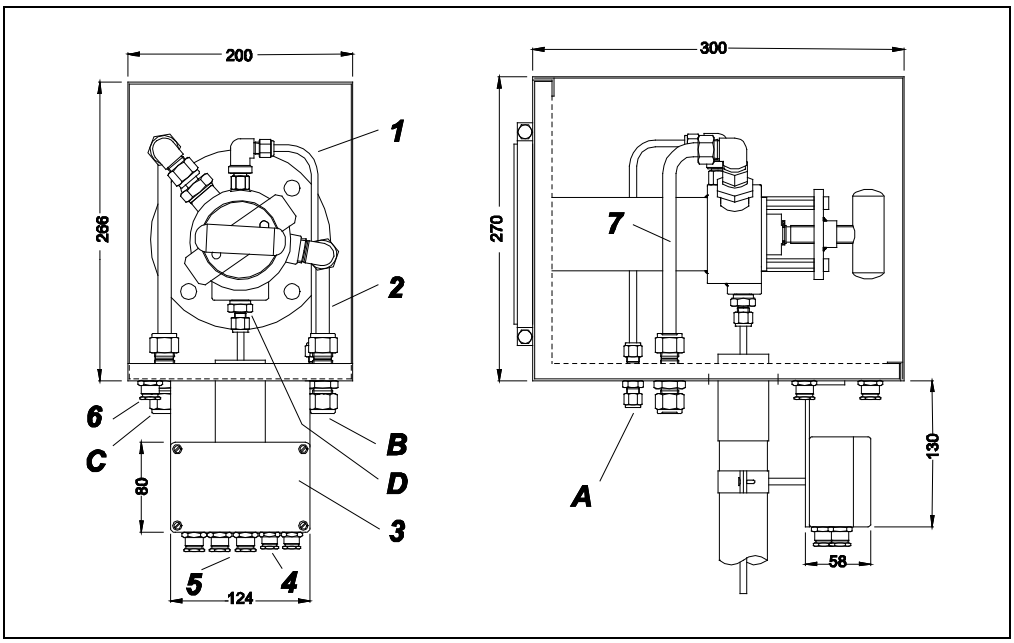
α	10°	15°	20°	25°	30°	35°
x_{min} / mm	229	248	268	287	307	324

PFE3 Filter Unit: Gas Connection

Figure 7

PFE3 Filter Unit: Gas Connections (with Back-Purging)

(Dimensions in mm)



1 Tube Test Gas, VA 1.4571, 6x1 mm
2 Tube Compressed Air, CU, 15x1 mm
3 Terminal Box -X1 IP66
4 2 x M12x1.5 Cable Connectors
5 3 x M20x1.5 Cable Connectors
6 2 x M20x1.5 Cable Connectors
7 Tube Compressed Air, CU, 15x1 mm
A Test Gas Connection with Check Valve, Bulkhead Fitting 6 mm
B Back-purging of Filter (max. 6 bar), Bulkhead Fitting 18 mm
C Back-purging of Filter Surface / Probe Tube (max. 6 bar), Bulkhead Fitting 18 mm
D Sample gas connection, male fitting 6 mm

Probe 2 Installation

Probe 2 Delivery Form

Probe 2 is supplied in various partially pre-assembled component parts:

- Gas sampling probe with flange and internal heating rod
- Ceramic inlet filter (inner filter)
- Installation set for mounting the ceramic inlet filter (4 bolts M12 x 70 with nuts, spring washers and washers)
- Harting connector, degree of protection IP55
- Protective box (option), degree of protection IP54

CAUTION!

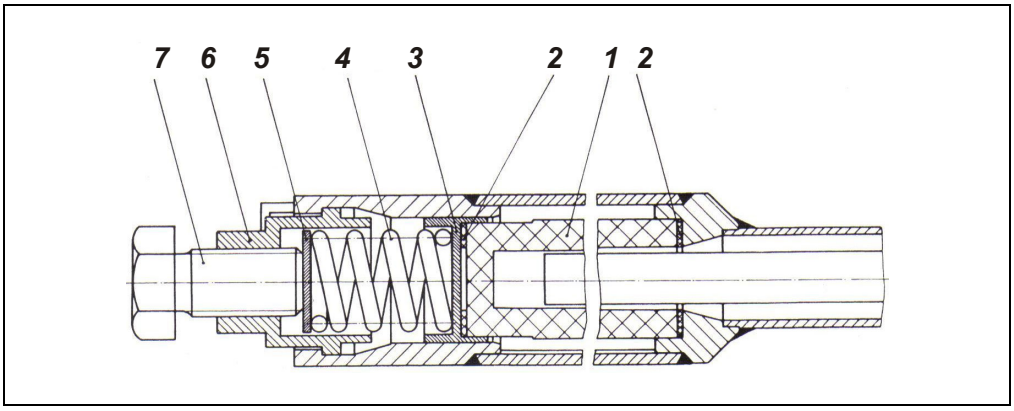
Danger of breakage! The ceramic inlet filter of probe 2 is fragile.

Assembly of the Ceramic Inlet Filter

First of all, assemble the ceramic inlet filter as shown in Figure 8. Please note that the compression spring ***4*** has to be compressed by approx. 15 mm.

Figure 8

Probe 2: Ceramic Inlet Filter



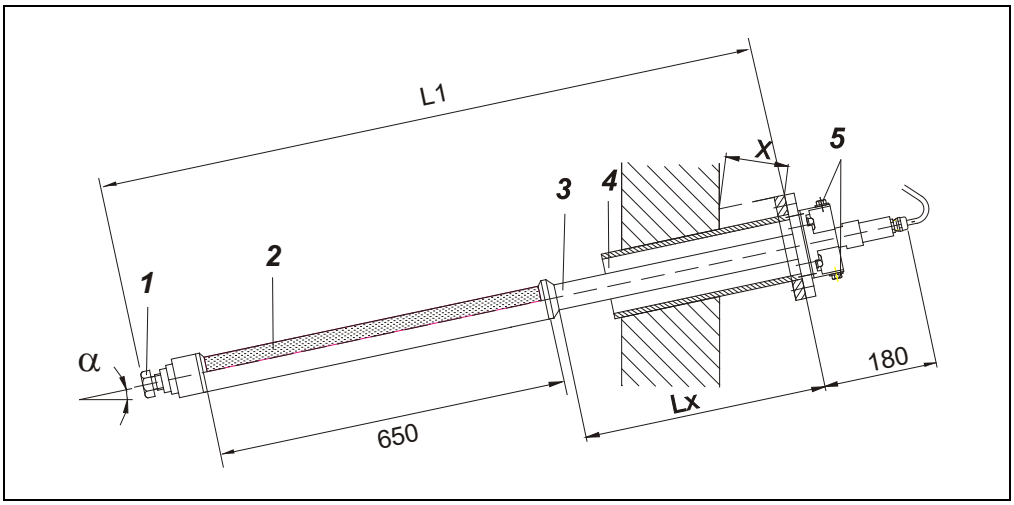
1 Filter Element
2 Sealing Gasket
3 Bush
4 Compression Spring
5 Pressure Disk
6 Bush
7 Screw

Continued on next page

Figure 9

Probe 2 Installation

(Dimensions in mm)



1 Mounting for the Ceramic Inlet Filter
2 Inlet Filter (Inner Filter) with Internal Heating Rod
3 Gas Sampling Tube
4 Wall Tube with Inlet Flange
5 Sample Gas Outlet and Test Gas / Purge Air Inlet G 1/4
L1 Fitting Length
Lx Length of the Gas Sampling Tube (approx. 400 mm)

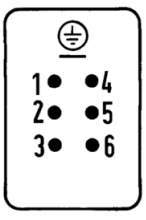
Minimum distance x_{min} of the mounting flange (wall tube flange) from the wall depending on mounting angle α:

α	10°	15°	20°	25°	30°	35°
x_{min} / mm	133	138	143	147	151	153

Probe 2 Installation

Step	Action
1	Align the probe so that the protection shield is directed towards the process gas flow.
2	Insert the probe in the wall tube and screw it to the wall tube flange with the enclosed screws M12 x 70.
3	Connect the sample gas line to one of the two gas ports ***5*** by means of a clamp ring screw fitting.
4	If 1-stage probe back-purging is available, connect the compressed-air hose to the other of the two gas ports ***5***. Please note the maximum permissible air pressure of 6 bar.

Probe 2 Electrical Connection

Step	Action		
1	Connect the cables of the current lead to the connector as shown in the connector pin assignment.		⏚ PE 1 N 2 L1 3–6 not assigned
2	Connect the connector to the power supply.		

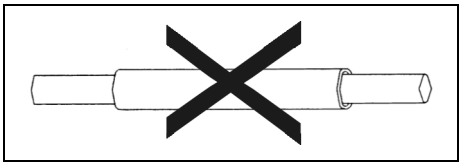
Sample Gas Line Installation

Installing the Sample Gas Line

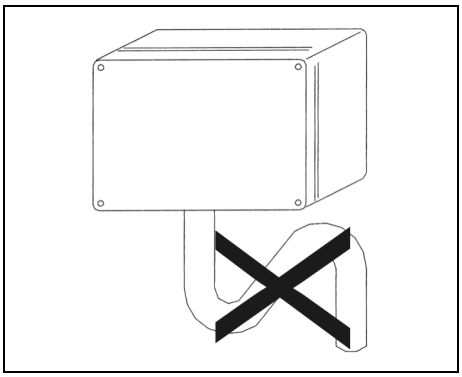
- Observe the “Piping Plan” in the drawings set.
- Connect the sample gas line to the filter unit / gas sampling probe.
- Route the sample gas line through the opening provided in the right wall of the cabinet.

When a VOC analyzer is installed in the analyzer system no fat or grease should be used when installing the sample gas line (see page 51). Otherwise the measurement values would drift for a prolonged period of time.

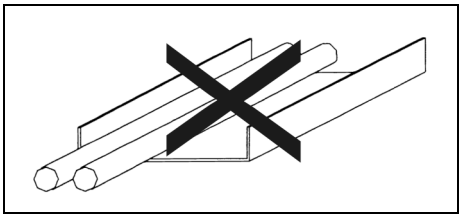
Fundamentals for Laying the Sample Gas Line



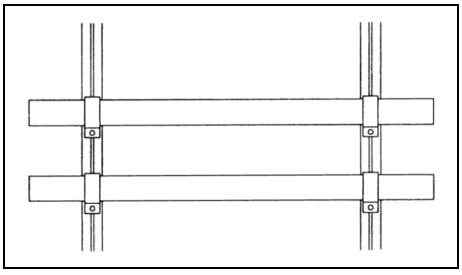
Do not lay the heated sample gas line in a thermowell.



When laying the sample gas line, avoid the formation of water locks, particularly at the sampling points.



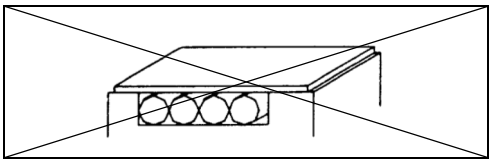
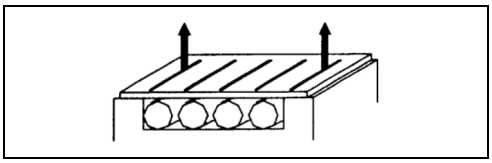
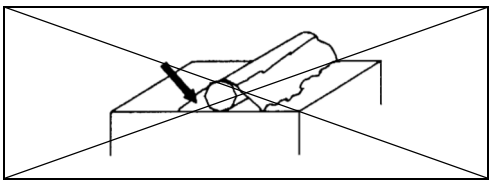
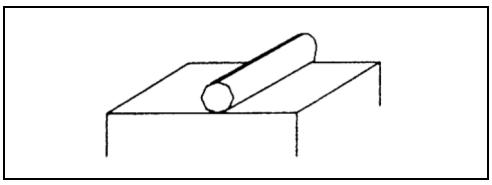
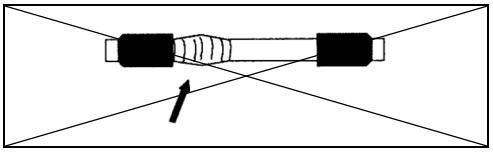
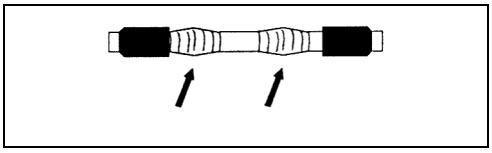
Do not lay the heated sample gas line in a cable tray together with other electrical or pneumatic lines, especially not in an enclosed cable tray.



When laying the heated sample gas lines on exposed C-profiles with BBS cable clips:
Do not overtighten the cable clips, in order to prevent damage to the sample gas line through crushing.

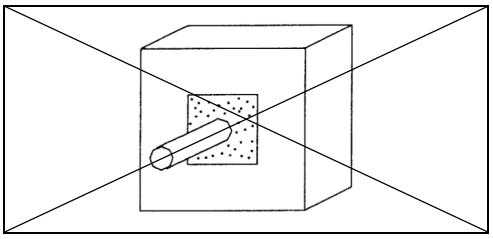
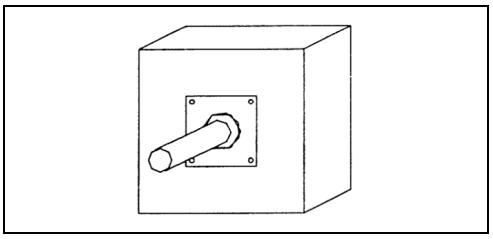
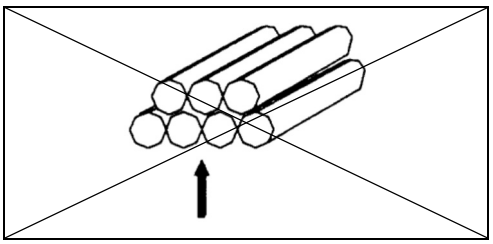
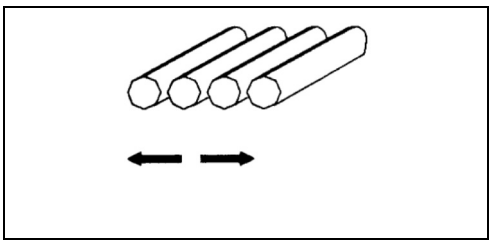
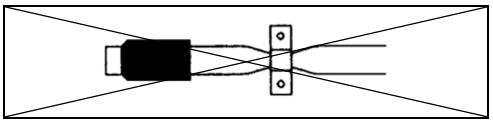
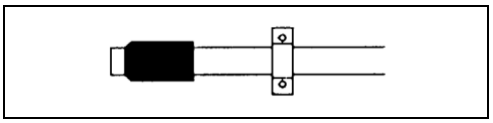
Continued on next page

Procedures for Laying the Sample Gas Line

Incorrect	Correct
	
Do not lay the heated sample gas lines directly side-by-side in an enclosed duct or shaft. This results in heat accumulation.	Ensure that the hoses do not touch. Maintain a distance of 25 mm. Provide adequate ventilation. Heat can be conducted away as a result.
	
Prevent powdery substances, adhesives or other thermally insulating materials from soiling the heated sample gas line. Otherwise, overheating will occur at these points.	If soiling occurs, clean the materials and remedy the cause. Heat can be conducted away again as a result.
	
Avoid heat accumulation through wrapping the heated sample gas line with other materials, otherwise the sample gas line will overheat at these points. Do not cover the area near the temperature sensor, otherwise the rest of the sample gas line will cool down.	Do not wrap the sample gas line. Ensure that the area near the temperature sensor is exposed. This results in error-free temperature measurement.

Continued on next page

Procedures for Laying the Sample Gas Line (continued)

Incorrect	Correct
	
Do not lay the heated sample gas line in wall break-throughs which are subsequently sealed with a sealing compound under any circumstances. The sample gas line will be destroyed by overheating in this case!	When laying the heated sample gas line through a wall break-through, use bulkhead plates with conduit thread cable glands, in order to provide adequate cooling of the sample gas line.
	
Avoid bundling or laying several heated sample gas lines, so that they touch each other. This results in overheating at the contact points.	Lay several heated sample gas lines separately with a distance of at least 2.5 cm and provide adequate ventilation. Heat can be conducted away as a result.
	
Do not squeeze the heat insulation in mounting brackets tightly together, so that the outer braiding is pressed on to the heat conductor. If you disregard this, damage to the protective braiding and the heated sample gas line may occur.	Tighten the BBS cable clips sufficiently but not excessively, in order to prevent damage to the protective braiding and the heated sample gas line.

Continued on next page

Permissible Values for Laying the Sample Gas Line

Characteristic	Permissible value
Maximum line length	see table below
	65 m for version with anti-frost heater
Minimum bending radius	300 mm
Maximum clip distance	1.2 m with horizontal laying
	3.5 m with vertical laying
Lowest laying temperature	–10 °C
Temperature of the sheathing	max. 60 °C

Application	Ambient Temperature	Sample Components	Type of Sample Gas Line	Length of Sample Gas Line
Emission Monitoring			heated, Type TBL01-S, regulated heating, 200 °C, heating power approx. 90 W/m	230 / 400 V AC [1]: 3-phase max. 60 m 1-phase max. 35 m
				120 / 208 V AC [1]: 3-phase max. 40 m 1-phase max. 15 m
Kiln or Calciner Outlet, Calciner	> 0 °C	w/o SO_2, NO	unheated (PTFE)	max. 20 m (recommended)
		with SO_2, NO	heated, Type TBL01-C, self-regulating, 100 °C	
	< 0 °C			
Wet Kiln Gas Outlet	> 0 °C	w/o SO_2, NO	unheated (PTFE)	max. 10 m (recommended)
		with SO_2, NO	heated, Type TBL01-C, self-regulating, 120 °C	
	< 0 °C			
Preheater / CO Monitoring of ESP	> 0 °C	w/o SO_2, NO	unheated (PTFE)	max. 10 m (must not be exceeded!)
		with SO_2, NO	heated, Type TBL01-C, self-regulating, 120 °C	
	< 0 °C			
Coal Bunker, Coal Mill	> 0 °C		unheated (PTFE)	max. 20 m (recommended)
	< 0 °C		heated, Type TBL01-C, self-regulating, 100 °C	
Process Measurement			heated, Type TBL01-S, regulated heating, 200 °C, heating power approx. 90 W/m	230 / 400 V AC [1]: 3-phase max. 60 m 1-phase max. 35 m
				120 / 208 V AC [1]: 3-phase max. 40 m 1-phase max. 15 m
			heated, Type TBL01-S, self-regulating heating, 100 °C, heating power approx. 30 W/m	max. 60 m
			unheated (PTFE)	max. 25 m

1) with “measuring point switch-over” option (2 measuring points):
230 / 400 V AC, only 1-phase allowed, length max. 35 m per measuring point
120 / 208 V AC, only 1-phase allowed, length max. 15 m per measuring point

Back-Purging Unit Installation

Before the Installation

Observe the “Piping Plan” in the drawings set.

Installation Site

The distance between the back-purging unit and the sampling probe must not exceed 5 m (length of the steel-braided compressed-air hoses = 6 m).

Connecting the Compressed-air Hoses to PFE2 Filter Unit

Connect the compressed-air hoses for purge air and control air to the respective ports at the PFE2 filter unit (see Figure 5, page 30).

Connecting the Compressed-air Hoses to PFE3 Filter Unit

Connect the compressed-air hoses for purge air (filter and filter / probe tube) to the respective ports at the PFE3 filter unit (see Figure 7, page 32).

Connecting the Compressed-air Hose to Probe 2

Connect the compressed-air hose for purge air to one of the two gas ports at Probe 2 (see Figure 9, page 34).

Gas Sampling with Automatic Back-Purging

In General

Filter Plugging

During operation of the ACX analyzer system the dust which is contained in the sample gas will accumulate in the probe filter of the gas sampling system. This is uncritical if dust concentration is low and only requires a cleaning of the filter periodically in longer time intervals.

But if the dust concentration is high, the dust accumulation in the filter will cause an increasing pressure loss, and the gas feed of the sample gas pump decreases and also the sample gas flow, and finally the filter is blocked in an extreme case.

Pump Suction Increase

At first this effect can be compensated by occasional adjustment of the sample gas flow, which increases the suction of the sample gas pump.

The pump is strong enough, but if the fouling continues, the needed suction for keeping up the required gas flow will increase to such a high value, that several unfavorable effects will emerge and can finally be accepted no longer.

Filter Cleaning

If the suction exceeds a limit of about 300 mbar (accordingly the absolute pressure falls below 700 mbar), the sampling system filter has to be cleaned. The PFE2 and PFE3 filter units can be cleaned automatically by a back-purging procedure with compressed air. To control this procedure a function block program is used.

Components for Automatic Back-Purging Procedure

Components for Automatic Back-Purging Procedure

To carry out the automatic back-purging of the filter unit, components are integrated in the ACX analyzer system as follows:

- the PFE2 filter unit with valves combination for back-purging or
- the PFE3 filter unit and separate back-purging unit with integrated compressed-air conditioning components and
- the control program.

Control of the Automatic Back-Purging Procedure

The back-purging procedure is integrated into the main control program of the ACX analyzer system. The manual handling is carried out with softkeys on the system's display and control unit.

Start of the Back-Purging Procedure

Start of the Back-Purging Procedure

The start of the back-purging procedure can be carried out
- Controlled by time
- Controlled by event
- Manually controlled.

Start Controlled by Time

After a cycle time has run down, the back-purging procedure will start automatically. The cycle time can be adjusted individually (see section “Adjustment of Cycle Time and Post-Purge Time”, page 46). A cycle time of 4 hours is factory-set.

Start Controlled by Event

A flow fault during normal measuring operation will start the automatic back-purging procedure. After back-purging was started by event, the procedure will run only once. If the procedure is finished (waiting time 30 sec) and the starting event (flow fault) is still active, the back-purging procedure will not start again, even not controlled by time, and a status message “Probe or line is plugged” will be generated. However, the back-purging procedure can be started manually.

Manually Controlled Start

The manual start of back-purging procedure can be executed locally by softkey “Start Purge” on the system’s display and control unit (see section “Control Panel Screen”, page 70) or remote-controlled via Modbus-DI or Profibus-DI.

Program Sequence

PFE2		Digital output:	-D08 DO2	-D08 DO3	-D08 DO1	-D08 DO4	-D08 DO5	-E05 MV1	Display	Status signal
		Valve:	-Y1.1	-Y2.1	-Y3.1	-Y4	-Y5 [6]	-Y01	Message “Purge back active“	
Step	Duration	Function	Impulse Compr. Air	Filter Back-purging	Tube Back-purging	Venting	Sample Gas Valve	Position Calibr. Valve [5]		Maint. Mode
0	4 hrs [1]	Measure	closed	closed	closed	open	open	Measure	off	off
1	10 sec [8]	Back-purging probe filter	Impulse	open	closed	closed	closed	Calibrate	on	on
2	14 sec [9]	Back-purging probe tube	Impulse	closed	open	closed	closed	Calibrate	on	on
3	6 sec	Venting	closed	open	closed	open	closed	Calibrate	on	on
4	150 sec [2]	Post-purging	closed	closed	closed	open	open	Measure	on	on
0	4 hrs [1]	Measure	closed	closed	closed	open	open	Measure	off	off

PFE3, Probe 2, Probe F, Probe Tube 40W		Digital output:		-A01 DO1	-A01 DO2	-A01 DO3		-E05 MV1	Display	Status signal
		Valve:		-Y12 [7]	-Y11	-Y07		-Y01	Message “Purge back active“	
Step	Duration	Function		Filter Back-purging	Tube Back-purging	Venting		Position Calibr. Valve [5]		Maint. Mode
0	4 hrs [1]	Measure		closed	closed	closed		Measure	off	off
1	2 sec	Switch over		closed	closed	closed		Calibrate	on	on
2	4 sec [3]	Back-purging probe filter		open	closed	closed		Calibrate	on	on
3	8 sec [4]	Back-purging probe tube		closed	open	closed		Calibrate	on	on
4	6 sec	Venting		closed	closed	open		Calibrate	on	on
5	150 sec [2]	Post-purging		closed	closed	closed		Measure	on	on
0	4 hrs [1]	Measure		closed	closed	closed		Measure	off	off

1) Cycle time factory-set to 4 hours
2) Post-purging time factory-set to 150 sec. For an analyzer system with Probe F, this period must be as short as possible (to be determined during start-up)
3) 1x pressure impulse 2 sec, 1x interrupt 2 sec
4) 1x pressure impulse 2 sec, 1x interrupt 2 sec, 1x pressure impulse 4 sec
5) Calibration valve on = “Measure”, calibration valve off = “Calibrate”
6) Only in version with VOC analyzer AO2000-Fidas24: open = sample gas path open, closed = relaxation against atmosphere
7) not in a system with Probe 2, Probe F
8) 3x interrupt 2 sec, 2x pressure impulse 2 sec
9) 3x interrupt 2 sec, 2x pressure impulse 2 sec, 1x pressure impulse 4 sec

Continued on next page

Switch Over

At first the calibration valve -Y01 [1)] is switched over to position “Calibrate”. This separates the sample gas conditioning system and the analyzer system from the sampling system and protects it against the back-purging pressure. At the same time the status “Maintenance mode” is activated and all analog outputs and limits are set on hold. The display reports “Purge Back is active”.

Back-Purging Probe Filter

The back-purging procedure continues with the back-purging of the probe filter. To increase the cleaning effect, the compressed air is applied not continuously but by two 2 sec pressure impulses alternating with a 2 sec interval each.

Back-Purging Probe Tube

After this the probe tube is purged back in the same way with two pressure impulses. A single pressure impulse of 4 sec is followed, to blow out the remaining dust from the tube.

Venting and Switch Over

Next the pneumatic system is vented for 6 sec and finally the calibration valve -Y01 [1)] is switched back from position “Calibrate” to position “Measure”. This venting time removes an internal remaining pressure which might be still present in the pneumatic system and so avoids a damage of the analyzer’s measuring cell.

Post-Purging Period

The calibration valve switch back to position “Measure” will not finish the back-purging procedure, because first the actual sample gas must flow through the pneumatic system to purge it, and the analyzer must adjust to the new actual measuring value. This post-purge time must be adjusted individually according to the given conditions (see section “Adjustment of Cycle Time and Post-Purge Time”, page 46). A purge time of 150 sec is factory-set.

End of the Back-Purging Procedure

The back-purging procedure is not finished until the purge time has expired. Now the analog outputs and limits are set free again and they will take over the actual values. The message “Purge back active” in the display as well as the status signal “Maintenance Mode” will vanish.

1) In system version with VOC analyzer AO2000-Fidas24, the sample gas path is blocked and unblocked with the valve -Y5 which is built-in in the PFE2 filter unit.

Cycle Time

Cycle Time Duration

The cycle time is given as the time interval between two automatic starts of the back-purging procedure. The higher the dust concentration in the sample gas and the higher the sample gas flow, the shorter this time interval must be set, to avoid a blocking of the gas sampling probe filter.

Cycle Time Factory Setting

The parameter “Cycle time” is factory-set to 4 hours.

The parameter “Next event time” is factory-set to 08:00 / 12:00 / 16:00 / 20:00 / 00:00 / 04:00 o’clock.

Optimum Cycle Time Setting

The cycle time should not be adjusted shorter than needed, because during the back-purging procedure (approx. ca. 28 sec) and especially during the post-purge time (factory-set to 150 sec) no measurement can be made. The optimum time will have to be found out by operational experience.

Cycle Time Minimum Value

The cycle time should not be below a lower limit. The back-purging procedure with cold compressed air causes a cooling of the heated probe filter, and the filter temperature regulation needs some time to correct this temperature decrease. As the filter heating regulation is a rather slow control loop, this time will be relatively long. Therefore the cycle time should not fall below approx. 60 min.

Event-controlled Start of the Back-purging Procedure by Filter Plugging

Should despite the time controlled back-purging a probe filter blocking occur caused by temporary larger amounts of dust, with the result of a sample gas flow decrease beneath the admissible limit, an additional back-purging procedure is started as a result, and the probe filter is purged free in between.

Post-Purge Time

Post-Purge Time Duration

The post-purge time at the end of the back-purging procedure must be such, that the complete pneumatic system is flushed with the actual sample gas and the analyzer gets time to take over the actual measuring value again. The needed post-purge time depends on the respective layout of the system (i.e. the length of the sample gas line) and will have to be adjusted individually. A post-purge time of 150 sec is factory-set.

Guide for the Post-Purge Time

A guide for the needed post-purge time is given in the table below. Please add the times for the pneumatic system, the analyzer and the sample gas line.

	Response time (3 x T_{90}, approx.) for sample gas flow		
	60 l/h	100 l/h	200 l/h (Bypass)
Pneumatic system without sample gas line	45 sec	27 sec	20 sec
plus analyzer Uras26	23 sec	20 sec	23 sec
plus for each 10 m sample gas line I.D. = 4 mm	8 sec	5 sec	2.5 sec
plus PFE2 / PFE3 with probe tube 40, length = 1 m	75 sec	45 sec	23 sec

Example

For an ACX analyzer system with filter unit PFE2 / PFE3 and 15 m sample gas line at 60 l/h sample gas flow the post-purge time is calculated as follows:

Post-purge time = 45 sec + 23 sec + 1.5x 8 sec + 75 sec = 155 sec

Adjustment of Cycle Time and Post-Purge Time

Adjustment of Cycle Time and Post-Purge Time

To adjust the cycle time or post-purge time you must change the parameters of function blocks.

WARNING!

Only changes as described below may executed! Changes of function block parameters inappropriately executed may affect the complete function of the function blocks program!

Procedure

Step	Action
1	Push Softkey **MENU**. The window MAIN MENU is shown.
2	Select menu **Configure**. The window CONFIG: is displayed.
3	Select menu **Functions blocks**. The window CONFIG: FUNCTION BLOCK is displayed.
4	Select menu **Miscellaneous** and after this menu **Timer**. The window CONFIG.: TIMER is displayed.
	To adjust the cycle time:
5	Select timer **Zycl.**. The window CONFIG: TIMER CYCL. is shown with the parameters of this function block.
6	Select the parameter **Low time**. The window PASSWORD ENTRY is shown, if the password is not already active.
7	Enter the password, using the numeric keys. The factory-set password is 325465. The window CONFIG: TIMER CYCL. with indication of the parameter Cycle time is shown.
8	Change the shown value (factory-set = 4 hrs) to the new value required.
9	Return to normal measuring operation using the key **MEAS**.
	To adjust the post-purge time:
5	Select timer **DELAY**. The window CONFIG: TIMER DELAY is shown with the parameters of this function block.
6	Select the parameter **Low time**. The window PASSWORD ENTRY is shown, if the password is not already active.
7	Enter the password, using the numeric keys. The factory-set password is 325465. The window CONFIG: TIMER DELAY with indication of the parameter Low time is shown.
8	Change the shown value (factory-set = 150 sec) to the new value required.
9	Return to normal measuring operation using the key **MEAS**.

Analyzer Cabinet Installation

Installing the Analyzer Cabinet

Installing the Foundation

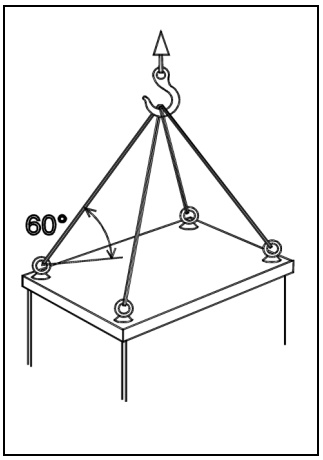
- Observe the installation site requirements, see page 12
- Observe the “Layout Plan” in the drawings set.

CAUTION!

The analyzer cabinet weighs approx. 370 to 430 kg.
A suitable lifting device (crane, block and tackle, lifting truck, etc.) is required for transport, setting upright and installation!

Use the handling lugs provided to connect any lift cables to the analyzer cabinet.

The lift cable must be long enough to have an angle of at least 60° relative to the top of the cabinet when under tension (see the illustration).
If this is not done the handling lugs can be bent or the analyzer cabinet can be warped.



It is strongly recommended that the analyzer cabinet is
- transported by a specialist firm
- transported in a horizontal position as far as possible and
- not set upright until immediately before the installation!

Unpacking the Analyzer Cabinet

- Lift out the analyzer cabinet from the shipping box.
  Do not remove the plastic sheet in which the analyzer cabinet is wrapped. Unpacking a cold analyzer cabinet can lead to condensation.
- Do not remove the plastic film until just before the analyzer cabinet will be connected and it has reached room temperature. This takes at least 24 hours.

Setting Up the Analyzer Cabinet

- Installation site requirements, see page 12
- Material required, see page 24
- Follow the “Layout Plan” in the drawings set.
- Ground by means of the central grounding screw, route the grounding cable (≥10 mm^2 / AWG 6) through the M16 cable gland.

Mounting Plate and Electrical Distribution Cabinet: Installation

Preparing the Installation Site

- Observe the installation site requirements, see page 12
- Observe the “Layout Plan” in the drawings set.
- Mounting on a rack or wall. The loading capacity must be high enough to bear the weight of the mounting plate and electrical distribution cabinet (see page 22).
- Attachment with M8 bolts or studs.

ATTENTION!

The mounting plate weighs approx. 170 kg! The electrical distribution cabinet weighs approx. 65 kg! A suitable lifting device (crane, block and tackle, lifting truck, etc.) is required for transport, setting upright and installation!

It is strongly recommended that the mounting plate and the electrical distribution cabinet are

- transported by a specialist firm
- transported in a horizontal position as far as possible and
- not set upright until immediately before the installation!

Unpacking the System Components (Mounting Plate and Electrical Distribution Cabinet)

- The system components are shipped in two separate transport crates.
- Open the transport crates and lift out the system components.

  Do not remove the plastic foil in which the system components are shrink-wrapped! Unpacking cold system components could cause condensation.
- Do not remove the plastic foil until the system components have reached room temperature. This takes at least 24 hours.

Installing the System Components

- Installation site requirements, see page 12
- Material required, see page 24
- Follow the “Layout Plan” in the drawings set.
- Hang the electrical distribution cabinet on the left of the mounting plate.
  The distance is predetermined by the length of the prepared cables which are connected to the modules on the mounting plate. The cables are tied together in bundles for transport.
- Connect the ground lead (green-yellow, $\geq$10 mm^2 / AWG 6) to the central ground-terminal screw of the mounting plate and pass it through the provided M16 screwed cable gland to the ground-terminal screw in the electrical distribution cabinet.
- Connect the prepared cables to the electrical distribution cabinet:
  - Open the sliding cable entry plate on the underside of the cabinet (knurled screws)
  - Insert the ready-made cables
  - Attach the cable connectors to the appropriate terminal strip as per the wiring diagram and
  - Close the cable entry plate

Analyzer System with Integrated VOC Analyzer: Installing the Supply Gases and Test Gases

- Gas inlet conditions, see page 18
- Material required, see page 24
- Observe the “Piping Plan” in the drawings set.
- Pay special attention to complete cleanliness when connecting the gas lines. Gas inlets, outlets, fittings, tubes and pipes must be free of dust and grease. Contaminants can enter the gas analyzer and damage it or lead to false measurement results.
- Follow the fitting manufacturer’s instructions. Be sure to use a backup wrench when tightening gas line bulkhead connections (gas ports).
- Heat the gas lines if there is a danger of frost.

CAUTION!

The pertinent safety regulations for handling combustible gases must be followed.

Installing the Instrument Air Supply

- Connect the instrument air line to the bulkhead connector provided for this purpose on the right wall of the cabinet.
- Install a shutoff valve with a p_e = 4.5 to 7 bar pressure gauge in the instrument air supply system.

Installing the Combustion Gas Supply

- Clean the combustion gas line: Pump cleaning agent (alkaline cleaner, solvent, stainless steel pickling fluid) through the tube. Purge tube thoroughly with distilled water. Purge tube for several hours at a temperature above 100 °C with synthetic air or nitrogen (10 to 20 l/h). Close off tube ends.
- Connect the combustion gas line: Connect two-stage pressure-reducing valve (for ultra-pure gases) with flow limiter to the combustion gas cylinder. Connect the combustion gas line to the bulkhead connector provided for this purpose on the right wall of the cabinet.
  Note: For safety reasons, a flow limiter is integrated in this bulkhead connector to limit the combustion gas flow to 10 l/h.
- Check combustion gas line seal integrity: Adjust the high-pressure stage of the pressure-reducing valve of the combustion gas cylinder to p_e = 1200 ± 100 hPa (1.2 ± 0.1 bar) and purge the combustion gas line. Check seal integrity of the combustion gas line with a leak detector (measuring principle: thermal conductivity). Close combustion gas cylinder.

Continued on next page

Analyzer System with Integrated VOC Analyzer: Installing the Supply Gases and Test Gases, *cont'd*

Setting Up the Test Gas Cylinders

- Comply with permissible ambient temperatures and the warning labels on the pressure reducers.
- Fit the test gas cylinders with pressure reducers and place them near the analyzer cabinet. Short test gas lines result in short lag times.
- Connect the test gas lines to the bulkhead connectors provided for this purpose on the right wall of the cabinet.

Installing the Exhaust Gas Line

- Connect the exhaust gas line to the bulkhead connector provided for this purpose on the right wall of the cabinet (using the shortest possible line with an I.D. $\geq$ 8 mm). Allow the exhaust air to pass freely and do not install reduction sections or shutoff valves. The diameter of the exhaust gas line should be widened at the shortest possible distance outside the cabinet to prevent any backpressure due to long line length.

AO2000-Fidas24: Connecting the Sample Gas Line

CAUTION!

Before start-up of the gas analyzer it is imperative to remove any plastic sealing stopper inserted in the sample gas inlet at the factory.

Sample Gas Line Connection

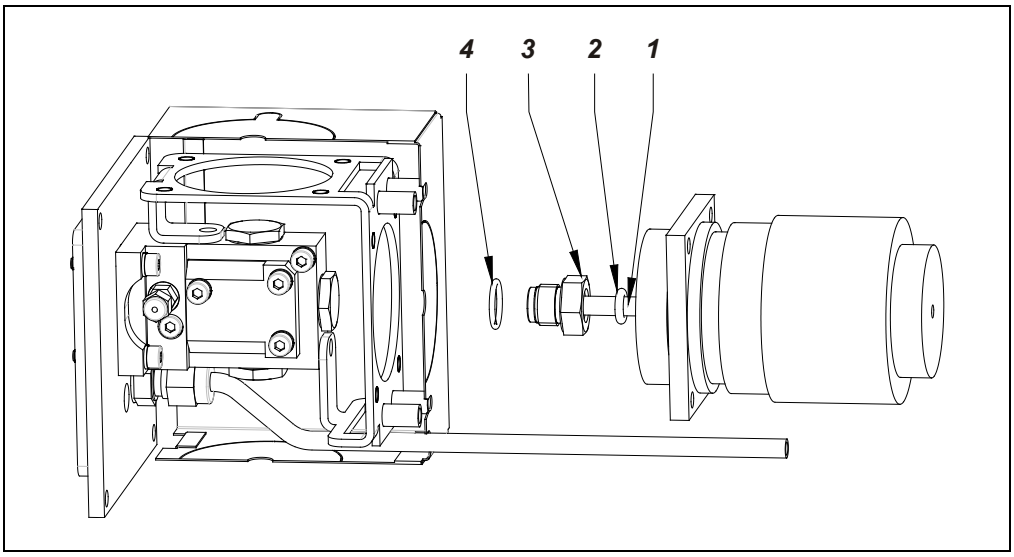
Connect the heated sample gas line directly to the sample gas inlet of the AO2000-Fidas24 VOC analyzer (see Figure 10). Make sure that the O-rings are properly seated and the sample gas line is fully inserted in the sample gas port.

Fittings and O-Rings

The required fittings and O-rings are supplied in the accessory kit.

Figure 10

Sample Gas Line Connection on AO2000-Fidas24 Heated Sample Gas Port



1 Heated Sample Gas Line (tube with 4/6-mm ID/OD)

2 O-Ring 6.02 x 2.62

3 Fitting

4 O-Ring 12.42 x 1.78

Analyzer Cabinet: Connecting the Electrical Leads

Connecting the Electrical Leads

- Material required, see page 24
- Observe the “Interface Plan” in the drawings set.
- When routing the electrical lines, follow all applicable national safety regulations for the installation and operation of electrical devices.

Connecting the Signal Leads

- Route the signal leads separately from the power supply lines.
- Locate the analog and digital signal lines separately from each other.
- Carefully plan the arrangement of signal leads in the cables as well as the use of openings for cable connectors.
- Connect the signal leads to the terminal strips.
- Cable shielding should be connected according to local regulations. Differences in potential and signal interference must be taken into consideration.

Connecting the Input Wiring

- Power supply requirements, see page 20
- Before connecting the power supply, make sure the analyzer system operating voltage is set to match the line voltage.
- The protective lead connector and protective lead should be connected before any other connection is made. The analyzer system can be hazardous if the protective lead is interrupted inside or outside the system or if the protective lead is disconnected.
- Connect
  - the input wiring of the analyzer cabinet
  - the input wiring of the heated sample components (temperature-resistant as needed)
  - the Pt100 resistance thermometer leads
  - the input wiring of the back-purging unit (solenoid valves)

  to the terminal strips.

Analyzer System Start-Up

Initial startup of the analyzer system should be performed by trained personnel of the manufacturer or the supplier.

Prior to Analyzer System Start-Up

WARNING!

The analyzer system must stand in its operating position for about 24 hours prior to start-up.

Purge the Combustion Gas Line

Purge the combustion gas line before analyzer system start-up. This should ensure that the combustion gas line is free of impurities – especially containing hydrocarbons – that could lead to erroneous measurement values. Purge the combustion gas line for approx. 20 seconds with a nitrogen flow of approx. 100 l/h.

Transportation Restraints Release

see “Transportation Restraints Release” section, page 54

Reagent Fill

see “Reagent Fill” section, page 55

Check Analyzer System Seal Integrity

see “Analyzer System: Seal Integrity Check” section, page 85

Transportation Restraints Release

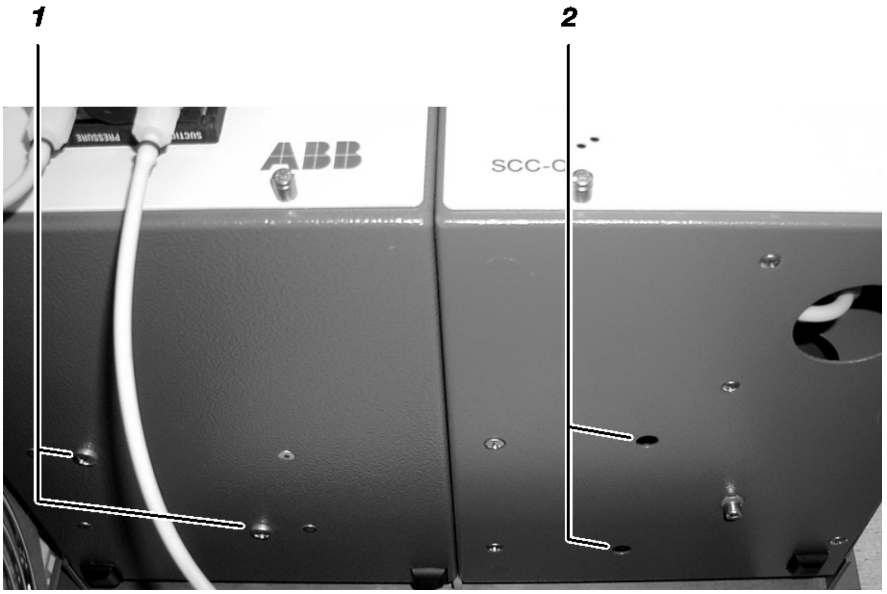
Transportation Restraints Release

(see Figure 11)

Step	Action
Sample Gas Feed Unit SCC-F: Diaphragm Pumps Transportation Restraints:	
1	Using a Ph2 crosshead screwdriver, loosen the two M6x25 screws ***1*** in the base plate. Retain the screws in case the unit needs to be transported again in the future.
Sample Gas Cooler SCC-C: Compressor Transportation Restraints:	
2	Using a Ph2 crosshead screwdriver, turn the two screws counterclockwise through the holes ***2*** in the base plate to the point at which resistance can be felt.
	In case that the “Zero Air Generator” (catalyst for combustion air conditioning) is mounted underneath the sample gas cooler use an offset screwdriver to release the transportation restraints. If no offset screwdriver is at hand the “Zero Air Generator” must be dismounted according to the following instructions.
	1 Loosen the nuts of the hose fittings on the left and right side of the “Zero Air Generator” and pull the hoses out of the fittings.
	2 Loosen the mounting screws (2 above, 1 below) and lay the “Zero Air Generator” on the cabinet floor.
	3 Release the transportation restraints as described above.
	4 Mount the “Zero Air Generator” to the cabinet rear wall.
	5 Insert the hoses into the hose fittings as far as they will go and hand-tighten the nuts. Perform this step carefully in order to ensure leak-tightness of the hose connections.

Figure 11

Transportation Restraints
left: **SCC-F Sample Gas Feed Unit**
right: **SCC-C Sample Gas Cooler**



Reagent Fill

CAUTION!

When working with corrosive reagents note the hazard information and safety precautions contained in the applicable material safety data sheets.

Reagents should be purchased from a local chemical distributor in order to keep the route of transport as short as possible!

Reagents

Depending on the measurement task involved, reagents can be used to eliminate interfering gas components or to stabilize the desired sample components.

Reagent Fill

Fill the reagent supply bottle (optional) with the reagent needed for the measurement task.

Mixture Ratio

Reagents (concentrate) are used in the following mixture ratios:

	Phosphoric Acid (H_3PO_4)	**Hydrogen Peroxide (H_2O_2)**
Concentration	85 %	30 %
Mixture ratio (in 10-liter bottle)	½ liter phosphoric acid 9½ liters water [1)]	1 liter hydrogen peroxide 9 liters water [1)]
Solution sufficient for	2 fills	1 fill

1) e.g. distilled water or water from an ion exchanger

CAUTION!

Before activating the power supply check once again that the analyzer system operating voltage is set to match the line voltage.

Power Supply Activation

Step	Action	
1	Make sure that all fuse switches are deactivated.	
2	Turn on the analyzer system power supply with main switch ***-Q10*** and ***-Q20*** if applicable.	
3	Activate the ground fault circuit interrupters ***-F10*** or ***-F20*** if applicable.	
4	Activate the fuse switches of the individual modules one after the other:	
	-F01	Lighting, service socket, fan or cooling unit
	-F02	Heated probe tube, heated filter unit, back-purging unit, test gas connection valves
	-F03	Heated sample gas line
	-F04	NO_2 / NO converter
	-F05	AO2000-Fidas24, air catalyst
	-F06	Sample gas cooler, sample gas feed unit
	-F07	AO2000 central unit, power supply

Function Check

The following events will occur after the power supply is turned on:

Phase	Description
1	The three “Power”, “Maint” and “Error” LEDs light up.
2	The different booting phases are displayed on the screen. Also the software version is displayed.
3	After a brief time the screen switches to measurement mode.
4	The STATUS MESSAGE softkey appears on the screen. This indicates the possibility of a temperature or flow problem during the warm-up phase (see page 61). By pressing the softkey the user can recall the status message summary and view status message details.

Date and Time Check

A correct date and time setting is required for proper operation of functions such as automatic calibration and time / date logging of error messages.

Step	Action
1	Select the Date/time menu item: **MENU → Configure → System → Date/Time**
2	Check and, if necessary, correct the date and time (for more information see “Setting the Time Zone, Date and Time”, page 74).

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

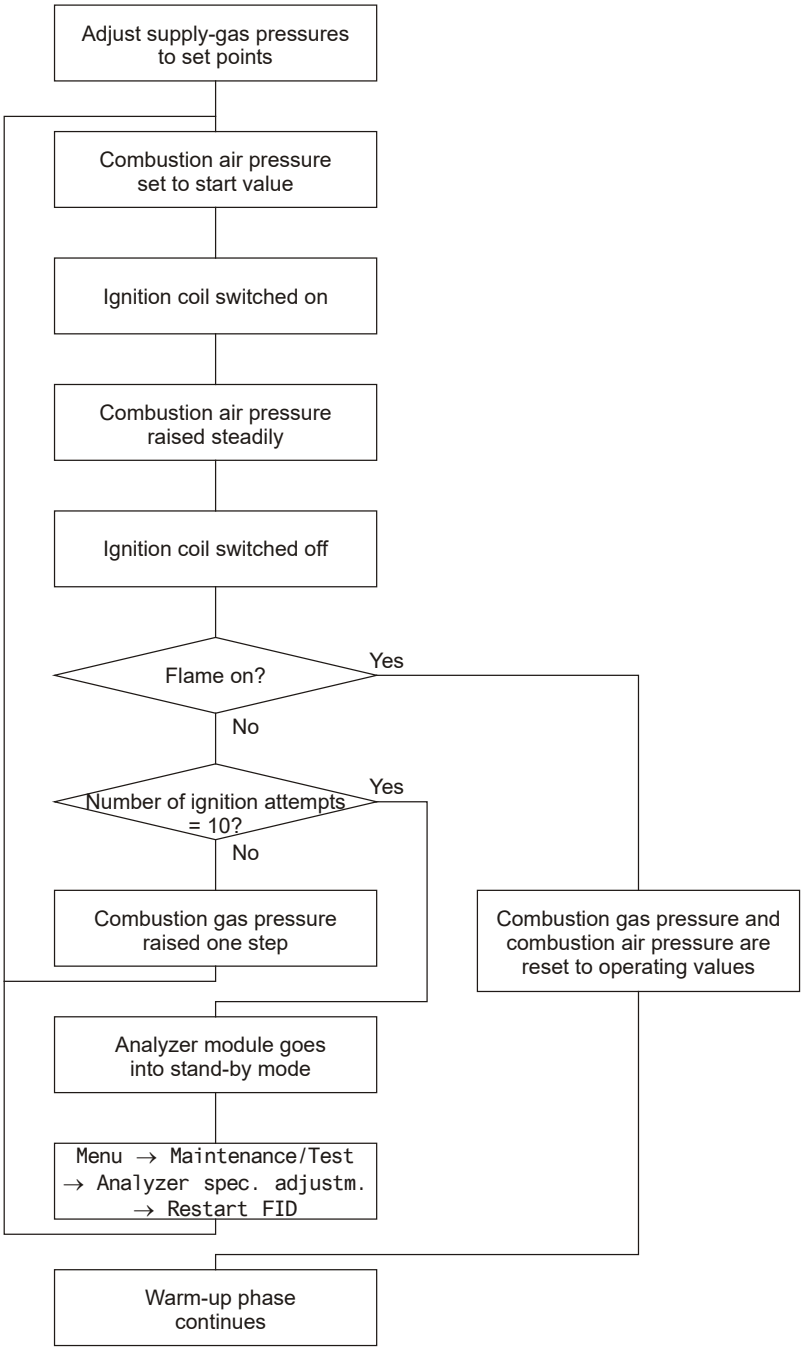
VOC Analyzer Start-Up Procedure

Step	Action
Turn on supply gases	
1	Select the `Controller values` menu item: **MENU → Diagnostic/Information → Module specific → Controller values** The variables for the temperature regulators are indicated under this menu item: `T-Re.D` Detector temperature `T-Re.E` Heated sample gas port temperature The temperature values will rise slowly after the power supply is activated.
2	Turn on instrument air, combustion air and combustion gas (H_2). Using the appropriate external pressure regulator, adjust the initial pressure to the value specified in the analyzer data sheet. The pressure values shown on the gas port labels and in the "Supply Gas and Test Gas Inlet Conditions" section (see page 18) are only typical values. Only the factory-determined values shown in the analyzer data sheet of the analyzer module are applicable for safe operation.
3	In the `Controller values` menu item also the variables for the internal pressure regulators are indicated; set the supply gas pressures by means of the variables: `Input` Instrument air at combustion-chamber inlet `Output` Instrument air at combustion-chamber outlet `Air` Combustion air `H2` Combustion gas (H_2) Random values may be displayed at first for the variables. The values are updated for the first time approx. 30 seconds. after selection of the menu item and thereafter approx. every 30 seconds. Pressure control continues to run in the background. Depending on the pilot pressure setting, pressure setting times can be long. If the operator does not press any key for more than five minutes while in menu operation, the analyzer switches automatically to measuring operation to display of sample values ("time out").
4	As soon as the temperature of the detector has reached the threshold value (150 °C) the appropriate solenoid valve in the analyzer module automatically connects the instrument air. The vacuum and combustion air controllers work to keep pressures at the applicable set points. Sample gas begins to flow through the analyzer as soon as the instrument air is connected.
5	After the pressures are at the applicable set points, the associated solenoid valve in the analyzer module automatically starts the combustion gas supply. The combustion gas controller attempts to establish the set point pressure value.

Continued on next page

Step	Action
Adjust the variables for the internal pressure regulators	
	Steps 6 to 8 should only be performed if the analyzer module does not automatically start operation at the pressure values indicated on the analyzer data sheet. If the internal pressure controller values do not match these values, the pilot pressures must be changed.
6	Instrument air: Use the external pressure regulator to set the `Output` variable to approx. 60 % (max. 70 %). Variable too large ⇒ reduce pressure. Variable too small ⇒ raise pressure. (The `Input` variable depends on the sample gas flow rate.)
7	Combustion air: Use the external pressure regulator to set the `Air` variable to approx. 50 % (max. 60 %). Variable too large ⇒ raise pressure. Variable too small ⇒ reduce pressure.
8	Combustion gas: Use the external pressure regulator to set the `H2` variable to approx. 35 % (max. 40 %). Variable too large ⇒ raise pressure. Variable too small ⇒ reduce pressure.

Continued on next page

Step	Action
Flame ignition (automatic)	
9	

Flame ignition may take up to 10 minutes, depending on the number of ignition attempts.
The flame temperature is displayed in the `Flame` parameter under the `Auxiliary raw values` menu item; it must be at least 30 °C higher than the detector temperature.
Actual start-up of the analyzer is complete when the flame ignites.

Continued on next page

Initial Heating Phase

The initial heating phase covers the period after the power supply has been turned on until the detector temperature reaches the threshold value (150 °C).

Status Messages

The following status messages are present during the initial heating phase:

Short Text	Description
Working temperature	The detector temperature has not yet reached the threshold value.
Flame fault	The flame is not yet lit.
Temperature limit value 1, 2	The temperature of the detector (T-Re.D) and possibly of the heated sample gas port (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).

Reading

The reading and ––E–– flash alternately, signaling that the displayed measurement value is not valid.

CAUTION!

Never pull the 115 / 230 VAC power supply plug connectors for the detector heater and the heated sample gas port while the power is on.

CAUTION!

The heated sample gas port cover is hot during operation. Its temperature is higher than 70 °C.

Warm-Up Phase

Warm-Up Phase

The warm-up time is approx. 2 to 4 hours.

The warm-up phase can take longer if the analyzer system was not brought to room temperature before the power supply was activated.

During the warm-up phase measurement values can be outside the ranges specified in the data sheet.

End of the Warm-Up Phase

The warm-up phase is over when the temperature and flow status messages are gone and the measured value drift is acceptable. The latter depends on the size of the measurement range.

Readiness, Sample Gas Supply

At the end of the warm-up phase the analyzer system is ready for operation and automatically activates the sample gas supply.

Calibration

Calibration should only be started after the warm-up phase (see “Analyzer System Calibration” chapter, page 80).

Analyzer System: Seal Integrity Check

CAUTION!

Prior to performing any maintenance works on the analyzer system be sure to activate the “Maintenance Mode” on the “Control Panel” screen (see page 70) thus setting the “Maintenance Mode” status signal.

Be sure to reset this setting after finishing the maintenance work.

When is the seal integrity check needed?

The seal integrity check must be performed regularly. It must be performed in any event when the respective status message is displayed.

The seal integrity check methods differ depending on whether a VOC analyzer (AO2000-Fidas24) is installed in the analyzer system.

Seal Integrity Check of Analyzer System without VOC Analyzer

The seal integrity check should be performed according to the pressure-drop method using a U-tube manometer when no VOC analyzer is installed in the analyzer system.

Step	Action
1	Interrupt the sample gas supply.
2	Close the sample gas outlet.
3	Disconnect the sample gas line from the sample gas inlet and connect a tee fitted with a shut-off valve.
4	Connect a U-tube manometer half filled with water to the free end of the tee.
5	Blow air or nitrogen through the shutoff valve to a gauge pressure of $p_e \approx$ 100 hPa (= 1000 mm water column).
6	Close the shut-off valve. The pressure should not change measurably in 1 minute (pressure drop $\leq$ 1 hPa). A sharp pressure drop is a sign of a leak.

Seal Integrity Check of Analyzer System with VOC Analyzer

When a VOC analyzer is installed in the analyzer system,

- disconnect the sample gas line which runs to the other gas analyzers from the AO2000-Multi-FID14 sample gas connection and
- perform the seal integrity check for the analyzer system without the AO2000-Fidas24 according to the pressure-drop method described above.

The sample gas path in the AO2000-Fidas24 cannot be checked for seal integrity.

Continued on next page

Seal Integrity Check of Combustion Gas Path in an Analyzer System with VOC Analyzer

Check seal integrity of the combustion gas line in the analyzer system with a leak detector (measuring principle: thermal conductivity). Leak rate < 2×10^{-4} hPa l/s. Do not use leak detection spray!

It is recommended to check regularly the seal integrity of the combustion gas line outside the analyzer system.

The combustion gas path inside the VOC analyzer is checked for leaks at the factory. No seal integrity testing is required during normal operation.

Seal Integrity Check of Back-Purging Unit

Step	Action
1	Close the water precipitator outlet (part of the pressure regulator combination).
2	Connect instrument air with operating pressure = 6 bar to the back-purging unit inlet.
3	Spray the complete compressed-air path with leak detection spray.

AO2000: Air Pressure Correction

Air Pressure Effect

A specific amount of change in air pressure will result in a specific change in a measurement value, depending on the measurement principle employed by the analyzer module.

Measures to Minimize Air Pressure Effect

Air pressure effect can be minimized by:

- Installing a pressure sensor in the analyzer module (this can only be done at the factory) or
- Entering the current atmospheric pressure as a correction value.

In which analyzer modules is a pressure sensor installed?

Analyzer module	Pressure sensor
Uras26, Limas21, Magnos206, Magnos28	installed ex works
Magnos27, Fidas24	cannot be installed

Use the `MENU → Diagnostic/Information → System overview` menu item and select the appropriate analyzer module to determine if a pressure sensor is installed.

Air Pressure Values

Operating Altitude meters above mean sea level	Mean Air Pressure hPa (mbar)	psi	mm Hg (Torr)	in Hg
–200	1037	15.04	778	30.63
–100	1025	14.87	769	30.28
±0	1013	14.69	760	29.92
+100	1001	14.52	751	29.57
200	989	14.34	742	29.21
300	977	14.17	733	28.86
400	965	14.00	724	28.50
500	955	13.85	716	28.19
600	943	13.68	707	27.84
700	932	13.52	699	27.52
800	921	13.36	691	27.21
900	909	13.18	682	26.85
1000	899	13.04	674	26.54
1100	888	12.88	666	26.22
1200	877	12.72	658	25.91
1300	867	12.57	650	25.59
1400	856	12.42	642	25.28
1500	845	12.26	634	24.96
1600	835	12.11	626	24.65
1700	825	11.97	619	24.37
1800	815	11.82	611	24.06
1900	804	11.66	603	23.74
2000	793	11.50	595	23.43

AO2000: Air Pressure Value Correction

An incorrect air pressure value will produce erroneous measurement values.

When should the air pressure value be set?

The air pressure value must be checked and readjusted as required in the following cases:

- If the analyzer system's operating site altitude has changed since the last calibration
- If the air pressure effect on the measured value is too high.

Limas21 and Uras26 with Integral Pressure Sensor and Calibration Cells

A pressure sensor is installed as standard equipment in the Limas21 and Uras26 analyzer modules. The pressure sensor is calibrated to 1013 hPa. This is the reference pressure for the test gas concentration when measuring the calibration cells.

If the air pressure value needs to be changed, the following items are also required

- Calibrate the sample components with test gases and then
- Measure the calibration cells

Air Pressure Value Correction

The current atmospheric pressure can be entered as a correction value for each analyzer module or for all analyzer modules as a group.

Menu Path

For one analyzer module:

MENU → Maintenance/Test → Analyzer spec. adjustm. → Atm. press. anlz → …

For all analyzer modules as a group:

MENU → Maintenance/Test → System → Atm. pressure

If the pressure sensor is connected to the sample gas output line, the sample gas flow must be interrupted while calibrating the pressure sensor so that the sample gas pressure does not distort the measured pressure.

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 analyz-er 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 ser-vice representative.

Select QR code

Menu path

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

Vorgehensweise

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

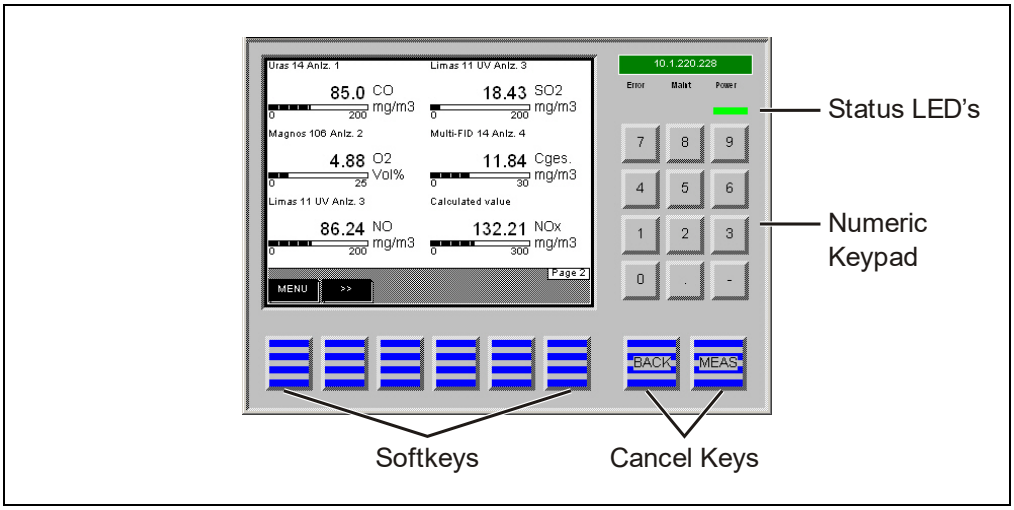
Download in App Store:

Download in Google Play:

Display/Control Unit

Figure 12

Display/Control Unit



Status LED's

Power — Green LED: The power supply is on.

Maint — Yellow LED: The "Maintenance Request" status signal is on. The measured value is valid.

Error — Red LED: The "Error" status signal is on. The measured value is no longer valid.

Cancel Keys

Back — Allows the operator to cancel a function or menu item and to return to the previous menu level.

Meas — 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 ENTER are stored; unconfirmed items are not accepted.

Softkeys

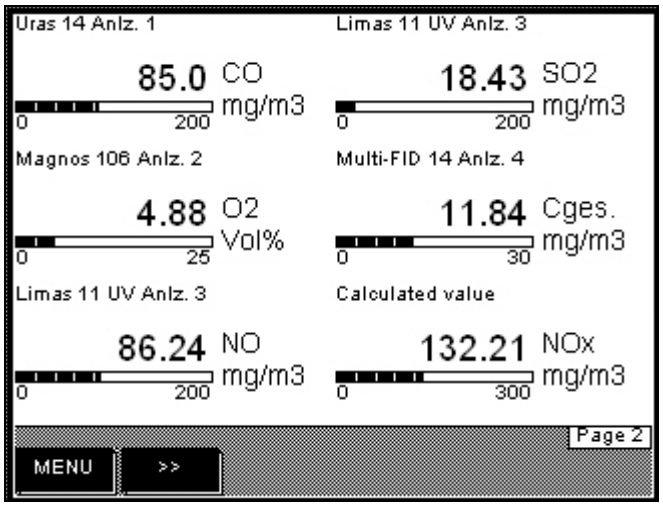
>> — Allows the operator to scroll to the next display "page". This key only allows forward scrolling.

STATUS MESSAGE — Appears in measurement mode if an "Error" or "Maintenance request" condition arises. This key allows the operator to call up the status message log and view the status messages. The operator can also call up a detailed display for any message in the log.

“Measured Values” Screen

Figure 13

“Measured Values” Screen



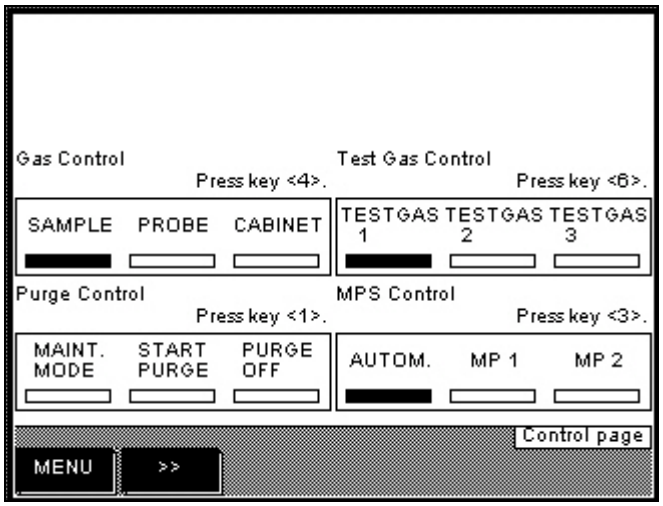
Indication

Values measured by the analyzer system are displayed on the “Measured Values” screen. Up to six measured values are displayed on one page. The actual number of pages depends on the number of measurement components configured in the analyzer system.

“Control Panel” Screen

Figure 14

“Control Panel” Screen



Indication

The “Control Panel” screen offers controls for various functions of the analyzer system.

Functions activated manually are indicated by means of a filled rectangle below the function’s name (see the following example).

“Maintenance Mode” deactivated (off)

“Maintenance Mode” activated (on)

Operation

The controls are operated in the following manner:

Press the number key that corresponds to the position of the control and is indicated above the control. In the following screen, press the corresponding function key. Thereby, the system switches back to the control panel screen, and the function just activated is indicated by means of a filled rectangle.

Password Protection

All control panel functions except the “Maintenance control” are password protected.

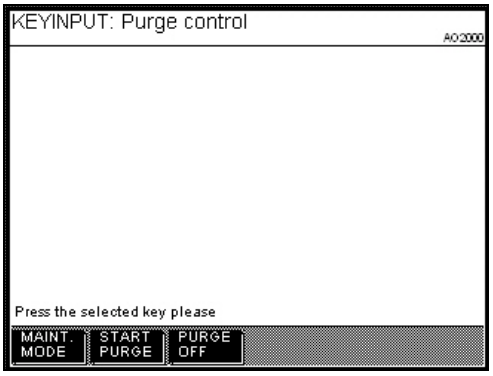
Changing the password is described on page 76.

Continued on next page

“Control Panel” Screen, *continued*

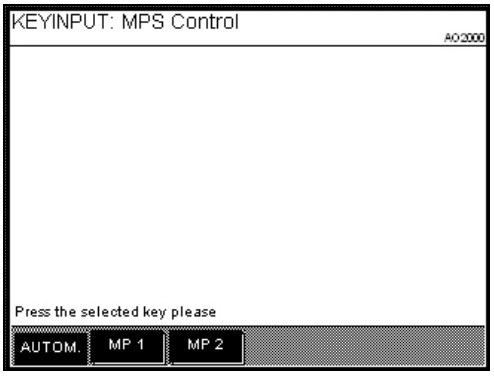
Purge Control

MAINT. MODE	Operate this key before starting and after finishing maintenance work (“Maintenance Key Switch”)
START PURGE	Start back-purging manually
PURGE OFF	Disable back-purging



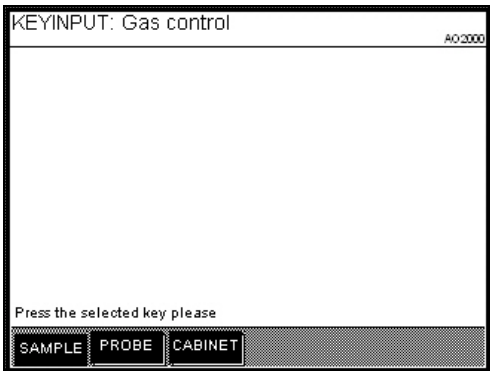
MPS Control (Measuring Point Switchover)

AUTOM.	Automatic measuring point switchover
MP 1	Select measuring point 1 manually
MP 2	Select measuring point 2 manually



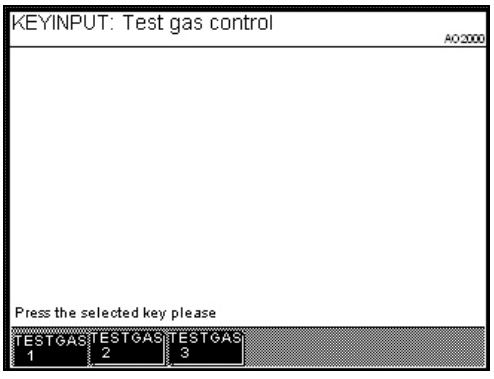
Gas Control

SAMPLE	Sample gas supply (normal operation)
PROBE	Test gas supply at the probe
CABINET	Test gas supply at the analysis cabinet



Test Gas Control

TESTGAS 1	Select test gas 1
TESTGAS 2	Select test gas 2
TESTGAS 3	Select test gas 3



Menu Tree

Menu Tree

The following table summarizes the analyzer system menu tree.

For reasons of brevity only the top level parameters and functions are shown; the menu branches more extensively at most menu items, e.g. into the various measurement components or into the selection and adjustment of values.

Some menu items are analyzer-specific, i.e. they only appear when particular analyzer modules are integrated into the analyzer system.

Password Levels

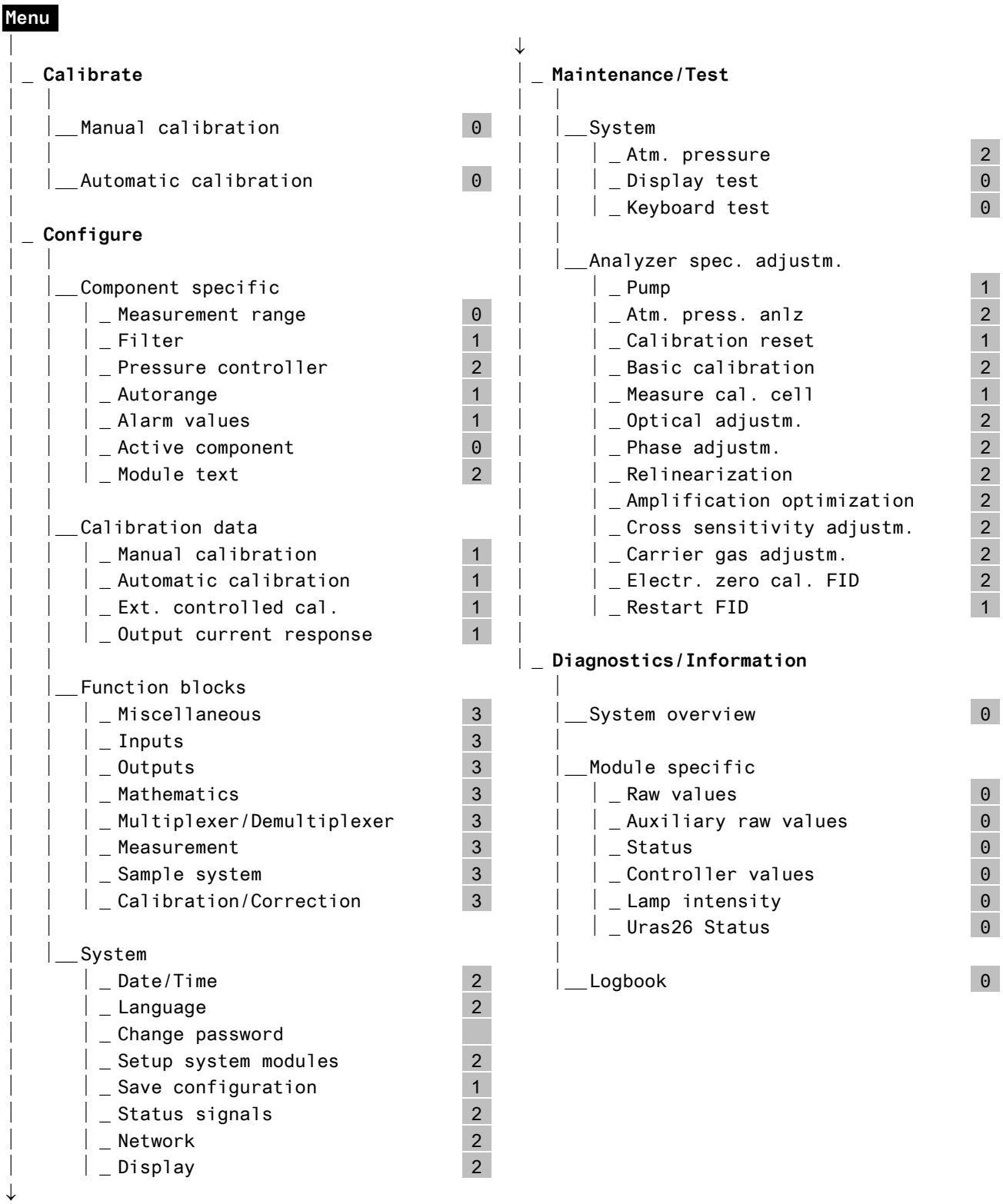
For each menu item its password level (0, 1, 2, 3) is shown in the table.

For some menu items, individual sub-menu items are on a higher password level. These applies especially to those sub-menu items which allow access to function block applications.

Note: The “Change password” menu item is not assigned to a specific password level. To change a password the old password of the respective level must be entered (see “Changing the Password” section, page 76).

Continued on next page

Menu Tree, *continued*



Setting the 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 GMT (Greenwich Mean Time) values or from the continent / country / city list.
Date	Date must be entered in month/day/year format. Enter year with 4 digits.
Time	Time must be entered in hour:minute:second format. Enter seconds, too.

Daylight Savings Time

The analyzer system is automatically set to daylight savings time.

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

Factory Setting

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

Accept the Time Settings

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

Selecting User Interface Language

Menu Path MENU → Configure → System → Language

Language Selection The user interface languages English and German are factory-configured (per order) in the analyzer system. In the menu item Language the user can switch between these two languages.

Changing the Password

Menu Path MENU → Configure → System → Change password

Password Protection See page 77 for basic information on “Password Protection”.

We strongly recommend to change all passwords from their default value.

Factory Setting

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

Procedure Select the Change password menu item, select the user group, enter the old password, enter the new password (6 digits), re-enter the new password, leave the menu item with **Back**.

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

CAUTION!

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

Password Protection

Elements of Password Protection

Password protection consists of three elements:

- Password level
- User group
- Password

Password Level

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

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

User Group

The members of a user group are authorized to access a specific password level, i.e. to change the menu items at that level.

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	None
Maintenance team	0, 1	471100
Specialist team	0, 1, 2	081500
Function block specialist	0, 1, 2, 3	325465

CAUTION!

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

Technical Bulletin “AO2000 Function Blocks – Descriptions and Configuration” (publication no. 30/24-200 EN) contains complete information on the “Function Block” concept as well as detailed descriptions of the individual function blocks.

Continued on next page

Viewing Menu Items

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

Changing Menu Items

All users can execute all 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.

Note

Entering the main menu and thus switching to the menu mode can be password protected (see the "Inhibit Operation" section, page 79).

Change Privilege

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

Duration of the Change Privilege

The change privilege remains in effect until:

- The analyzer automatically switches to measurement mode if the user has not pressed a key for more than about 5 minutes (time out).
- Or the user presses the "Meas" key twice in succession.

The change privilege remains in effect if the user presses the "Meas" key only once to return to measurement mode. This is indicated by the "Password active" status message.

In this manner the user does not have to re-enter a password to change a menu item if he or she returns to the menu mode within approximately 5 minutes.

Note

The change privilege thus refers to a temporary authorization to change menu items. In contrast, the access privilege refers to a fundamental and configurable authorization to change menu items at certain password levels.

Inhibit Operation

Menu Path

MENU → Configure → System → Change password

Inhibit Operation

Operation of the analyzer system, i.e. entering the main menu and thus switching to the menu mode, can be password protected.

After inhibition the analyzer system can only be operated when the level 1 password has been entered.

The level 3 password must be entered to configure the password protection.

Procedure

Press the MENU ACCESS softkey in the “Change password” menu item and set the password protection.

Release of communication via port 8001/tcp

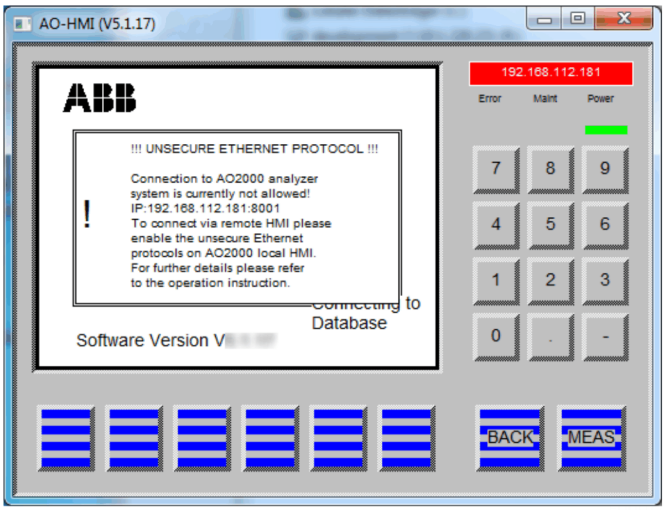
In ACX, a proprietary protocol has been implemented on port 8001 for communication with remote clients:

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

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

Image 1

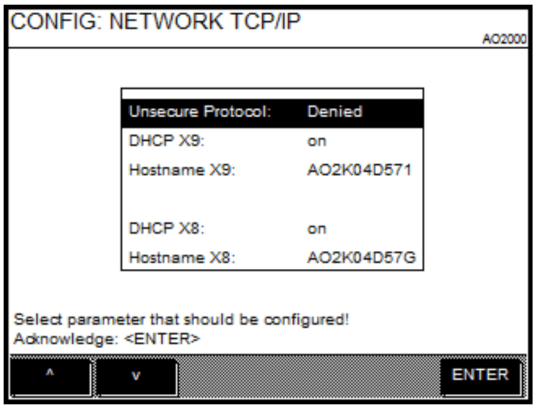
Message on the Remote HMI (example)



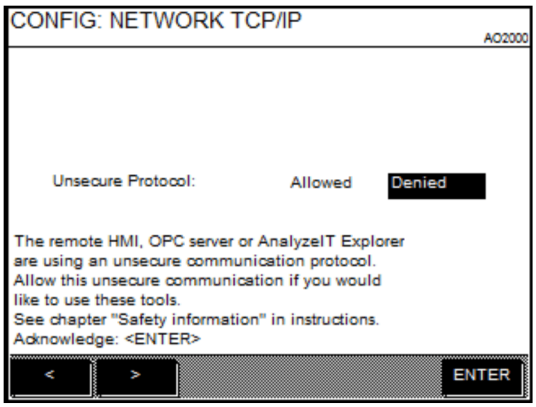
Release communication via the proprietary protocol

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

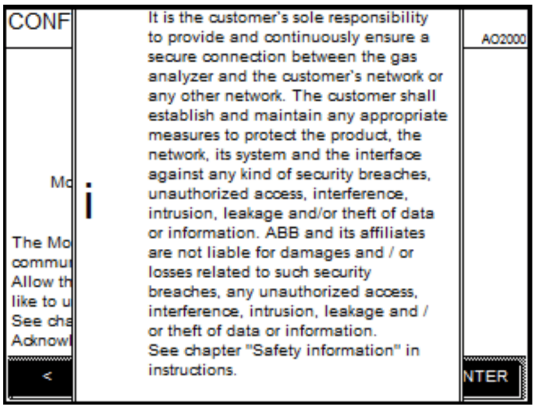
1. Select the '…\Configure\Network\TCP/IP Network' menu.
2. Select the 'Unsecured protocol' menu item



3. Select the ‘Unsecured protocol’ menu item and set the parameter to ‘Permit’.



4. Confirm the information field by selecting <BACK>.



- Communication via the proprietary protocol has now been released.

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

Release of communication via Modbus® TCP/IP

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

Release communication via Modbus® TCP/IP

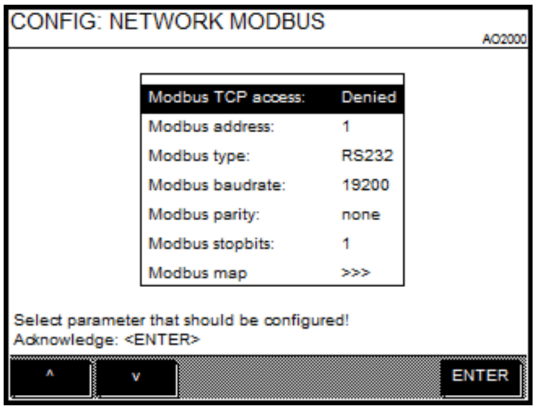
Implement the following steps to release communication via Modbus® TCP/IP:

1. With the Modbus card installed, select the '…\Configure\Network\Modbus' menu.

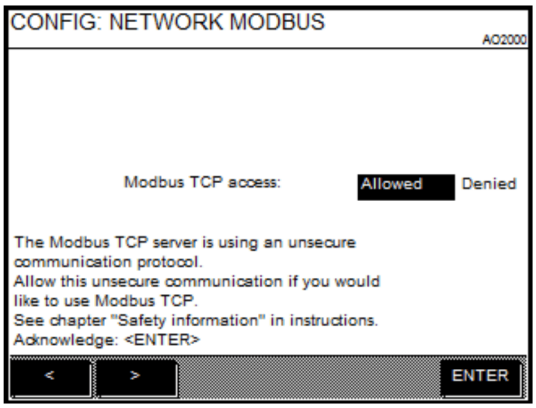
or

The '…\Configure\Network\Modbus' menu is **not** available if the Modbus card is not installed. In this case, the Release menu is called up directly via 'Modbus TCP'.

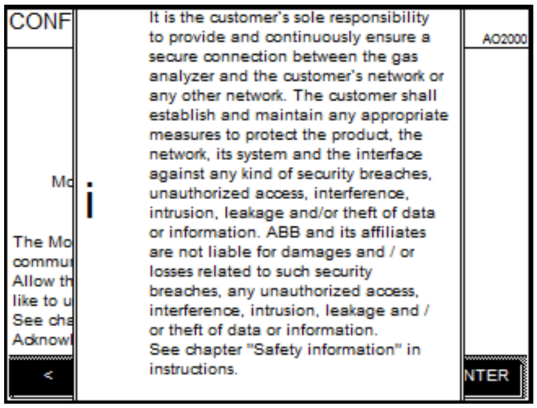
2. Select the 'Modbus TCP Access' menu item and confirm by selecting <ENTER>.



3. Select the 'Modbus TCP Access' menu item and set the parameter to 'Permit'.



4. Confirm the information field by selecting <BACK>.



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

The Modbus® protocol is an unsecured protocol (in the meaning of IT security or cybersecurity), as such the intended application should be assessed before implementation to make sure that the protocol is suited.

Inspection and Maintenance

Safety Information

CAUTION!

Only persons familiar with the maintenance of comparable analyzer systems and certified as being capable of such work should work on the system.

Safety Labels Affixed to the Analyzer System

CAUTION!

Observe the safety labels affixed to the analyzer system or to the individual components:

Consult Documentation!

Hot Surface! (Temperature > 60 °C)

Corrosive Material!

Risk of Electric Shock!

Harmful Substances

CAUTION!

When working with corrosive reagents note the hazard information and safety precautions contained in the applicable material safety data sheets.

Condensates are often acidic. Neutralize condensates and follow the prescribed measures for disposal.

Harmful Gases

CAUTION!

Some of the gases measured with the analyzer system are harmful to health.

Therefore, the sample gas must not escape from the gas path during normal operation and maintenance works.

A seal integrity check of the analyzer system has to be performed at regular intervals.

The diluted exhaust gas must be drained out of the installation room of the analyzer cabinet.

For detailed information on the maintenance of the device, consult the associated operating instructions (OI)!

Analyzer System Shut-Down

CAUTION!

Before being shut down the analyzer system should be purged in order to prevent condensation and condensate deposits in the individual units.

CAUTION!

When working with corrosive reagents note the hazard information and safety precautions contained in the applicable material safety data sheets.

Condensates are often acidic. Neutralize condensates and follow the prescribed measures for disposal.

Shutting Down the Analyzer System

Step	Action
1	Flush the sampling probe, filter and sample gas line, e. g. by drawing outside air from the sampling probe.
2	Purge the gas paths of the analyzer system for 30 minutes.
3	Turn off the analyzer system with main switch ***-Q10***.

Disposing of Reagents

Empty the (optional) reagent supply bottle and dispose of reagents according to applicable regulations.

Emptying the Condensate Collecting Bottle

Empty the condensate collecting bottle and dispose of condensates according to applicable regulations.

Make sure the analyzer system is free of residual moisture that can freeze if low temperatures are encountered during shipping and storage.

Transportation Restraints Activation

Step	Action
Sample Gas Feed Unit SCC-F: Diaphragm Pumps Transportation Restraints:	
1	Using a Ph2 crosshead screwdriver, screw two M6x25 screws through the holes in the base plate into the diaphragm pumps base plate and tighten them.
Sample Gas Cooler SCC-C: Compressor Transportation Restraints:	
2	Using an offset Ph2 crosshead screwdriver, turn the two screws clockwise through the holes in the base plate to the point at which the compressor housing is in contact with the base plate (noticeable resistance).

Ambient Temperature

During storage and transport:	+2 to +60 °C
After draining and drying parts in contact with condensate:	–25 to +60 °C

Packing the Analyzer Cabinet or System Components

Packing

Step	Action
	It is strongly recommended that the analyzer cabinet / mounting plate / electrical distribution cabinet are • transported by a specialist firm and • transported in a horizontal position
1	Vacuum-pack the analyzer cabinet / mounting plate / electrical distribution cabinet in foil.
2	Put desiccating agent in the transport crate. The amount of desiccating agent should be sufficient for the package volume and the expected shipping duration (at least 3 months).
3	Place the analyzer cabinet / mounting plate / electrical distribution cabinet on vibration dampers in the transport crate and fix with wedges.
4	Mark the transport crate according to the regulations (in particular, “Fragile Goods”).

Ambient Temperature

During storage and transport:	+2 to +60 °C
After draining and drying parts in contact with condensate:	–25 to +60 °C

ABB Automation GmbH
Measurement & Analytics
Stierstädter Str. 5
60488 Frankfurt am Main
Germany
Tel: +49 69 7930-4666
Email: cga@de.abb.com

abb.com/analytical

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB.

© ABB 2020

3KXG141002R4401

CI/ACX-EN Rev. D 02.2020