Instruction Manual
HASXEE-IM-HS
05/2017

XSTREAM®

Gas Analyzers

X-STREAM Enhanced Series

Instruction Manual

ROSEMOUNT™

EMERSON™

ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Emerson Process Management (Rosemount Analytical) designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using and maintaining Emerson Process Management (Rosemount Analytical) products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Emerson Process Management (Rosemount Analytical) representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product**.
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes**. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson Process Management (Rosemount Analytical). Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY**. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury**.

The information contained in this document is subject to change without notice.

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Emerson Process Management GmbH & Co. OHG
Rosemount Analytical
Process Gas Analyzer Center of Excellence
Industriestrasse 1
63594 Hasselroth
Germany
T +49 6055 884 0
F +49 6055 884 209

Cert. Reg. No. 254969 QM08

SHORT FORM GUIDE FOR THIS MANUAL

To find information about **see chapter**

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INTRODUCTION

The instruction manual contains information about the component assembly, function, installation, operation and maintenance of the X-STREAM® *Enhanced* series gas analyzers.

The manual covers several X-STREAM analyzer models and so may contain information about configurations and/or options not applicable to your analyzer.

The installation and operation of units for use in explosive (hazardous) environments is not covered in this manual.
Analyzers intended to be used in such environments are supplied with further instruction manuals, which should be consulted in addition to this.

DEFINITIONS

The following definitions apply to the terms WARNING, CAUTION and NOTE, and the symbol ☞, as used in this manual.

⚠ WARNING

Indicates an operational or maintenance procedure, a process, a condition, an instruction, etc.
Failure to comply may result in injury, death or permanent health risk.

⚠ CAUTION

Indicates an operational or maintenance procedure, a process, a condition, an instruction, etc.
Failure to comply may result in damage to or destruction of the instrument, or impaired performance.

NOTE!
Indicates an imperative operational procedure, an important condition or instruction.

The symbol ☞ , together with a page number (☞ 6-5) or chapter headline (☞ Startup) refers to more information, provided on the indicated page or chapter.

TERMS USED IN THIS INSTRUCTION MANUAL

Explosive Gas(es)

Flammable Gases and gas mixtures in a mixture with air within the explosive limits.

Flammable Gas(es)

Gases and gas mixtures are assigned to be flammable if they might become ignitable when in a mixture with air.

Infallible Containment

This term is derived from the standards of explosion protection especially from the requirements for pressurized housings: thus an infallible containment can be characterized by no intended leakage out of the gas paths enabling gas to enter the inner compartment of the analyzer housing.

Lower Explosion Limit (LEL)

Volume ratio of flammable gas in air below which an explosive gas atmosphere will not be formed: the mixture of gas and air lacks sufficient fuel (gas) to burn.

NAMUR

NAMUR is an international user association of automation technology in process industries. This organisation has issued experience reports and working documents, called recommendations (NE) and worksheets (NA).

Protection Class IP66 / NEMA 4X

Both terms are used to specify conditions for equipment to be installed outdoor.

IP stands for Ingress Protection, the first number specifies protection against solid objects (**6. = dust tight**) while the second number specifies the degree of protection against liquids (**.6 = heavy seas**).

NEMA stands for National Electrical Manufacturers Association. **4X** specifies a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water; and that will be undamaged by the external formation of ice on the enclosure

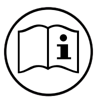
Upper Explosion Limit (UEL)

Volume ratio of flammable gas in air above which an explosive gas atmosphere will not be formed: the mixture of gas and air is too rich in fuel (deficient in oxygen) to burn.

SYMBOLS USED ON AND INSIDE THE UNIT

Wherever one or more of the following symbols appear on or inside the instrument, be careful and read the instructions given in the accompanying manuals!

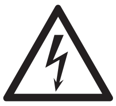
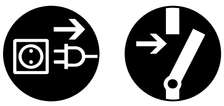
Strictly observe the given warnings, instructions and information to minimize hazards!

This symbol at the instrument ...	... means
	**dangerous voltages** may be accessible. Removing covers is permitted only, if the instrument is disconnected from power - and even in this case by qualified personnel only!
	**hot surfaces** may be accessible. Removing covers by qualified personnel is permitted only, if the instrument is disconnected from power. Nevertheless several surfaces may remain hot for a limited time.
	**more detailled information available:** see instruction manual before proceeding!
	**more detailled information available:** see instruction manual before proceeding!

SYMBOLS USED IN THIS MANUAL

Where one or more of the following symbols appear within this manual, carefully read the related information and instructions!

Strictly observe the given warnings, instructions and information to minimize hazards!

This symbol used in the manual ...	... means
	**dangerous voltages** may be exposed
	**hot surfaces** may be exposed
	possible **danger of explosion**
	**toxic substances** may be present
	**substances harmful to health** may be present
	indicates notes relating to **heavy instruments**
	electrical components may be destroyed by **electrostatic discharges**
	units must be **disconnected from the power source**
	refers to conditions or information on operating at **low temperatures**
	indicates basic conditions or procedures are being described. This symbol may also indicate information important for achieving accurate measurements.

SAFETY INSTRUCTIONS

INTENDED USE STATEMENT

X-STREAM XE series gas analyzers are intended to be used as analyzers for industrial purposes. They must not be used in medical, diagnostic or life support applications nor as safety devices.

Using X-STREAM XE analyzers as safety devices, requiring redundant design or SIL classification, is also not permitted. They must not be used to measure explosive gas mixture.

No independent agency certifications or approvals are to be implied as covering such applications!

GENERAL SAFETY NOTICE / RESIDUAL RISK

If this equipment is used in a manner not specified in these instructions, protective systems may be impaired.

Despite of incoming goods inspections, production control, routine tests and application of state-of-the-art measuring and test methods, an element of risk remains when operating a gas analyzer!

Even when operated as intended and observing all applicable safety instructions some residual risks remain, including, but not limited to, the following:

- **An interruption of the protective earth line, e.g. in an extension cable, may result in risk to the user.**
- **Live parts are accessible when operating the instrument with doors open or covers removed.**
- **The emission of gases hazardous to health may even be possible when all gas connections have been correctly made.**

Avoid exposure to the dangers of these residual risks by taking particular care when installing, operating, maintaining and servicing the analyzer.

ADDITIONAL LITERATURE

This manual covers aspects important for installation and startup of X-STREAM XE gas analyzers.

For comprehensive information on operating and maintain/service the instrument in a safe manner it is MANDATORY to read all additional instruction manuals! If not provided as printed version, check the accompanying USB stick for an electronic version (PDF)!

The following additional instruction manuals are available or referenced within this manual:

- **HASICx-IM-H Infallible containment instruction manual**
- **Separate manuals for Hazardous Area applications**

Contact your local service center or sales office when missing documents.

SAVE ALL INSTRUCTIONS FOR FUTURE USE!

AUTHORIZED PERSONNEL

In-depth specialist knowledge is an absolutely necessary condition for working with and on the analyzer.

Authorized personnel for installing, operating, servicing and maintaining the analyzer are instructed and trained qualified personnel of the operating company and the manufacturer.

It is the responsibility of the operating company to

- **train staff,**
- **observe safety regulations,**
- **follow the instruction manual.**

Operators must

- **have been trained,**
- **have read and understood all relevant sections of the instruction manual before commencing work,**
- **know the safety mechanisms and regulations.**

To avoid personal injury and loss of property, do not install, operate, maintain or service this instrument before reading and understanding this instruction manual and receiving appropriate training.

NOTES ON BATTERIES

- **This instrument contains a Li battery (button cell) of type CR 2032.**
- **The battery is soldered and usually does not need to be replaced during the instrument´s lifetime.**
- **At the end of lifetime, the instrument must be disposed in compliance with the wast regulations. The disposal specialist then has to disassemble the instrument and dispose the battery in compliance with the regulations.**
- **Batteries may leak, overheat or explode if not handled properly.**
- **Do not open or try to charge a battery.**
- **Do not expose batteries to heat or fire.**

INSTALLING AND CONNECTING THE UNIT

The following notices should be carefollowed to ensure compliance with the **low voltage directive (Europe) and other applicable regulations**.

1. Suitable grounding connections should be made at all connectors provided for this purpose.
2. All safety covers and grounding connections must be properly reinstated after maintenance work or troubleshooting.
3. A fuse should be provided at the installation site which will completely disconnect the unit in case of failure. Installing an isolating switch may also be beneficial. In either case, these components must be constructed to conform to recognised norms.

OPERATING AND MAINTAINING THIS UNIT

On leaving our factory, this instrument conformed to all applicable safety directives.

In order to preserve this state of affairs, the operator must take care to follow all the instructions and notes given in this manual and on the unit.

Before switching on the unit, ensure that the local nominal mains voltage corresponds to the factory-set operational voltage of this unit.

Any interruption of the protective earth connections, whether inside or outside of the unit, may result in exposure to the risk of electricity. Deliberately disconnected the protective earth is therefore strictly forbidden.

Removing covers may expose components conducting electric current. Connectors may also be energised. The unit should therefore be disconnected from the power supply before any kind of maintenance, repair or calibration work requiring access to the inside of the unit.

Only trained personnel who are aware of the risk involved may work on an open and energized unit.

Fuses may only be replaced by fuses of an identical type and with identical ratings. It is forbidden to use repair fuses or to bypass fuses.

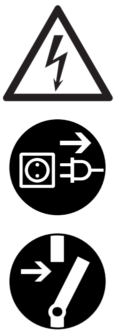
Take note of all applicable regulations when using this unit with an autotransformer or a variable transformer.

Substances hazardous to health may escape from the unit's gas outlet. This may require additional steps to be taken to guarantee the safety of operating staff.

⚠ WARNING

EXPLOSION HAZARD

The units described in this manual may not be used in explosive atmospheres without additional safety measures.



⚠ WARNING

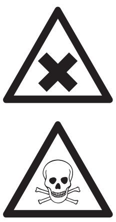
ELECTRICAL SHOCK HAZARD

Do not operate without covers secure.

Do not open while energized.

Installation requires access to live parts which can cause death or serious injury.

For safety and proper performace this instrument must be connected to a properly grounded three-wire source of power.



⚠ WARNING

TOXIC GASES

This unit's exhaust may contain toxic gases such as (but not limited to) e.g. sulfur dioxide. These gases can cause serious injuries.
Avoid inhaling exhaust gases.

Connect the exhaust pipe to a suitable flue and inspect the pipes regularly for leaks.

All connections must be airtight to avoid leaks; ☞ 7-4 for instructions on performing a leak test.

⚠ CAUTION

HEAVY INSTRUMENT

The models intended for outside and wall mounted use (X-STREAM XEXF and XEFD) weigh between 26 kg (57 lb) and 63 kg (139 lb) depending on options installed.

Two people and/or lifting equipment is required to lift and carry these units.

Take care to use anchors and bolts specified to be used for the weight of the units!

Take care the wall or stand the unit is intended to be installed at is solid and stable to support the weight!

⚠ CAUTION

CRUSHING HAZARD

Take care of crushing hazard when closing the front door of analyzer field housings!

Keep out of the closing area between enclosure cover and base!

⚠ CAUTION

OPERATION AT LOW TEMPERATURES

When operating an instrument at temperatures below 0 °C (32 °F), do NOT apply gas nor operate the internal pump before the warmup time has elapsed!

Violation may result in condensation inside the gas paths or damaged pump diaphragm!

⚠ CAUTION

HIGH TEMPERATURES

Hot parts may be exposed when working on photometers and/or heated components in the unit.

GASES AND PREPARATION OF GASES


WARNING

GASES HAZARDOUS TO HEALTH

Follow the safety precautions for all gases (sample and span gases) and gas cylinders.

Before opening the gas lines, they must be purged with air or neutral gas (N2) to avoid danger from escaping toxic, flammable, exposive or hazardous gases.

WARNING

FLAMMABLE OR EXPLOSIVE GASES

The analyzers are not suitable to measure explosive gases.

When supplying flammable gases with concentrations of more than 25 % of the lower explosion limit, we RECOMMEND implementing one or more additional safety measures:

- **purging the unit with inert gas**
- **stainless steel internal pipes**
- **flame arrestors on gas inlets and outlets**
- **infallible measuring cells.**

POWER SUPPLY

⚠ WARNING

CONNECTING UNITS FOR PERMANENT INSTALLATION

Only qualified personnel following all applicable and legal regulations may install the unit and connect it to power and signal cables. Failure to comply may invalidate the unit's warranty and cause exposure to the risk of damage, injury or death.

This unit may only be installed by qualified personnel familiar with the possible risks.

Working on units equipped with screw-type terminals for electrical connections may require the exposure of energized components.

Wall-mounted units have no power switch and are operational when connected to a power supply. The operating company is therefore required to have a power switch or circuit breaker (as per IEC 60947-1/-3) available on the premises. This must be installed near the unit, easily accessible to operators and labelled as a power cut-off for the analyzer.

⚠ CAUTION

HAZARD FROM WRONG SUPPLY VOLTAGE

Ensure that the local power voltage where the unit is to be installed, corresponds to the unit's nominal voltage as given on the name plate label.

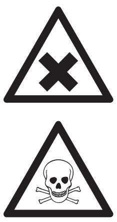
⚠ CAUTION

ADDITIONAL NOTES FOR UNITS WITH SCREW-TYPE TERMINALS

Cables for external data processing must be double-insulated against mains power.

If this is not possible, cables must be laid in such a way as to guarantee a clearance of at least 5 mm from power cables. This clearance must be permanently secured (e.g. with cable ties).

GENERAL OPERATING NOTES



WARNING

EXPLOSION HAZARD

Exhaust gases may contain hydrocarbons and other toxic gases such as carbon monoxide. Carbon monoxide is toxic.

Faulty gas connections may lead to explosion and death.

Ensure that all gas connections are connected as labelled and airtight.

- The unit must be installed in a clean and dry area protected from strong vibrations and frost.
- The unit must not be exposed to direct sunlight and sources of heat. Admissable ambient temperatures (see technical details) must be adhered to.
- Gas inlets and outlets must not be interchanged.All gases must be supplied to the unit already processed. When using this unit with corrosive sample gases, ensure that these gases do not contain components harmful to the gas lines.
- Admissable gas pressure for sample and test gases is 1500 hPa.
- Exhaust lines must be laid inclined downwards, depressurized, protected from frost and according to applicable regulations.
- If it is necessary to disconnect the gas lines, the unit's gas connectors must be sealed with PVC caps to avoid polluting the internal gas lines with condensate, dust, etc.
- To ensure electromagnetic compatibility (EMC), only shielded cables (supplied by us on request, or of equivalent standard) may be used and the enclosure has to be connected to earth. The customer must ensure that the shielding is correctly fitted. Shielding and terminal housing must be electrically connected; submin-D plugs and sockets must be screwed to the unit.
- When using optional external adapters (submin-D to screw-type terminal), protection from electromagnetic interference can no longer be guaranteed (CE compliance pursuant to EMC guidelines). In this case the customer or operating company functions as a system builder and must therefore ensure and declare compliance with EMC guidelines.

Chapter 1
Technical Description

The following are the main features of the new Emerson Process Management X-STREAM *Enhanced* (hereinafter also referred to as "X-STREAM XE") gas analyzers in brief:

- compact design with easily accessible internal components
- customizable for a wide range of applications: different housings are available while internal construction remains largely identical
- a highly integrated mainboard contains all interfaces and basic functions for the operation of the unit
- multilingual microprocessor-controlled user interface with liquid crystal display (LCD) to indicate measurement values and status messages
- units for outdoor use are supplied with an impact tested front panel
- widerange power supply unit for worldwide use without modification (½ 19in units with internal or external PSUs)

X-STREAM XE gas analyzers can measure up to five different gas components by multiple combinations of the following analyzing techniques (restrictions apply to ½19in units, and to parallel tubing):

IR = non-dispersive infrared analysis

UV = ultraviolet analysis

pO_2 = paramagnetic oxygen analysis

eO_2 = electrochemical oxygen analysis

tO_2 = electrochemical trace oxygen analysis

TC = thermal conductivity analysis

tH_2O = trace moisture measurement

Modified resistant measuring cells are available for use with corrosive gases and/or gases containing solvents.

Special configurations for the analysis of combustible gases are also available. The analyzers are not suitable for measuriung explosive gases.

☞ Chapter 3 gives a detailed description of the various measuring techniques.

Standard applications

Different housings allow X-STREAM analyzers to be tailored to the many different applications:

- Tabletop units in ½19in modular design, with IP 20 protection class
- Tabletop and rack mountable units in 19in modular design, with IP 20 protection class
- Stainless steel wall mountable field housing with IP 66 / NEMA 4X protection class for outdoor use (operating temperature -20°C to +50°C).
- Cast aluminium wall mountable field housing (flameproof Ex d) with IP 66 / NEMA 4X protection class for outdoor use in hazardous areas.

The various analyzer types are described in more detail beginning with ☞ page 1-14.

Installation in hazardous areas

X-STREAM XEXF field housing analyzers, when featuring various protection methods, can also be installed and operated in hazardous areas. Available options are:

- Non-incendive assembly (Ex nA nC) for installation in Zone 2 and Division 2 for the measurement of non-flammable gases.

1 Technical Description

The cast aluminium field housing is designed to withstand an explosion and intended to be used in hazardous areas of Zone 1.

More information about analyzers for hazardous areas can be obtained from your Emerson Process Management sales office.

Note!

These instructions do not detail the installation nor operation of X-STREAM analyzers in hazardous areas. ***If you intend to use your analyzer for such purposes, pay attention to the separate instruction manuals supplied with analyzers to be used in hazardous areas.***

Further features (in parts options):

- Configurable measurement display
  - gas values and/or secondary measurements (e. g. flow)
  - single or dual pages
- Configurable measurement units
  - supports conversion factors from ppm to several other, even user specific units
- 3 independent software access levels
  - protection against unauthorized changing of configurations
  - password protected
  - to be separately activated
- Unattended zero and span calibrations
  - calibrations without user interaction
- Communication via serial and Ethernet interface
  - remotely control the analyzer
- Web browser interface
  - remote control and monitoring via standard web browser
- Realtime clock
  - Synchronizing with internet time server
  - enables time controlled calibration
- Data logger with individually configurable parameters
  - measuring values protocols, e.g. for quality or process monitoring and control
- Event protocol with configurable events list
  - remote analyzer status monitoring
- Logfile sizes only limited by available space on an internal SD card
  - up to 2 GB enable logging periods up to 1 year
  - SD card replacable *(not by operator, due to internal use by the analyzer firmware)*

- Log file export via USB, Ethernet and web browser
  - text format
  - enables external data analysis
- Backup and restore analyzer configurations to/from protected internal memory or USB stick
  - protection against changes, store for reference,
  - restore a working configuration in case of faults or faulty configuration changes
- Calculator
  - working with measurement values
  - setup a virtual calculated channel on basis of real measurement values (e. g. calculate NO and NO_2 to NO_x)
  - text file programming via web browser or external computer
  - up-/download via USB or web browser
- Integral programmable logic control (PLC)
  - control valves, pumps,.and more.
  - text file programming via web browser or external computer
  - up-/download via USB or web browser

More detailed information is provided by the related sections of this manual, or by documentation, separately available.

1.1 Overview

All X-STREAM *Enhanced* gas analyzers feature an easy-to-use graphical user interface, which displays measurement values, status and error messages, and menus for the input of parameters.

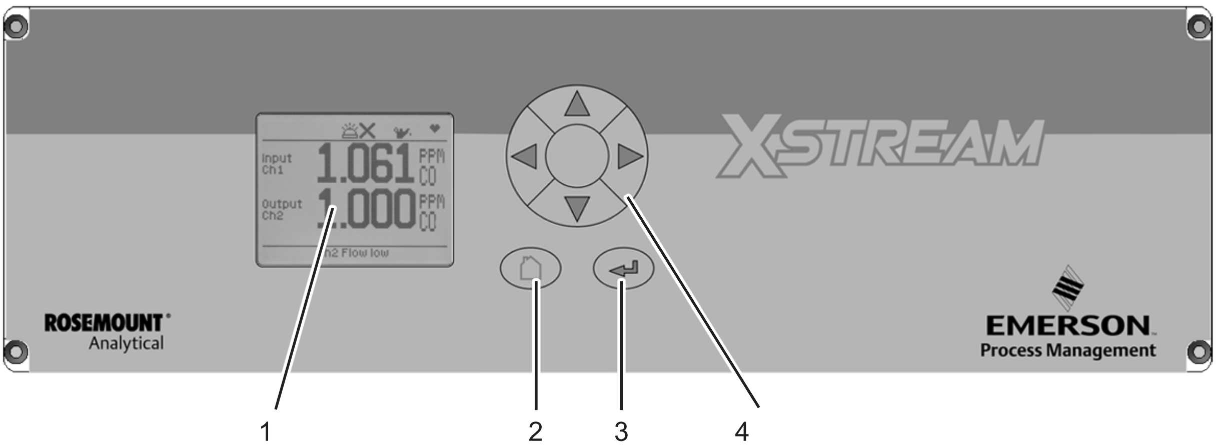
For ease of use, the operator at any time can select one of the following languages for the display: English, French, German, Spanish, Portuguese and Polish; Italian is under preparation and may be available at time of publishing this document.

1.1.1 The Front Panel

The graphic LCD shows measurement and status information with plain text and symbols.

The symbols are designed to indicate the different status 'Failure', 'Function check', 'Out of specification' and 'Maintenance request' as specified by the NE 107 standard. For further information, ☞ Chapter 8.

The analyzer software is operated by means of only six keys.
The displays of outdoor versions are protected with an impact tested glass panel, to withstand even harsher conditions and to provide a higher IP protection class of IP66 / NEMA Type 4X.



1 Graphic display
2 “Home“ key
3 “Enter” key
4 4 keys for settings and menu navigation

Fig. 1-1: *X-STREAM Enhanced Front Panel (here X-STREAM XEGP)*

1.2 Configuration of Gas Lines

1.2.1 Materials Used

Various materials are available to allow the analyzer to be customized to your needs. The materials used are selected based on the characteristics of the sample gas, e.g. diffusion rate, corrosiveness, temperature and pressure. Among those available are Viton®, PFA and stainless steel.

1.2.2 Safety Filter

The analyzers are generally fitted with an internal stainless-steel filter. This filter is not a replacement for any dust filter in the preparation of the gas, but represents a last line of defence.

1.2.3 Gas Inlets and Outlets

Rackmounted and tabletop devices are fitted with PVDF inlets and outlets (ø 6/4 mm) as standard. Alternatively, Swagelok™ or stainless steel fittings (ø 6/4 mm or ¼ in).

Wall-mounted field housings are supplied with Swagelok™ or stainless steel fittings (ø 6/4 mm or ¼ in).

Other materials available on request.

X-STREAM XEFD units are always supplied with flame arrestors and stainless steel fittings (ø 6/4 mm or ¼ in).

Fieldhousings and 19 in analyzers provide up to 8 gas fittings, so if featuring five channels, this requires at least two channels in serial tubing.

1.2.4 Tubing

Unless otherwise specified, the analyzers are supplied with Viton® or PVDF piping (ø 6/4 mm or ¼ in). Other materials (e.g. stainless steel) can be used, depending on the application.

1.2.5 Infallible Containments

Infallible containments are gas lines which, due to their design, can be regarded as permanently technically tight. This is achieved by, for example, welded joints, or metallically sealing joints (e.g. tap connectors and binders), providing they are seldom disconnected. Gas lines configured in this manner can be used for measuring noxious or flammable gases. At the time of going to press, infallible containments are available for thermal conductivity analysis (TC) only. Further information about infallible containments can be found in the separate instruction manual supplied with these units.

Infallible containments do not render it unnecessary to regularly test for leaks, e.g. following lengthy breaks in service, substantial alterations, repairs and modifications.

Read the separate instruction manual giving detailed instructions on the configuration, operation and maintenance of units fitted with infallible containments.

1.2.6 Optional Components for Gas Lines

The analyzers can, as an option, be fitted with further components. Not all components are available for all analyzer types:

- internal sample gas pump
- internal valve block
- internal flow sensors
- internal flow monitor switch
- internal barometric pressure sensor
- internal temperature sensors.

1.2.6.1 Internal Sample Gas Pump

An internal sample gas pump is used when the sample gas is under insufficient pressure. It ensures a constant flow of sample gas (max. 2.5 l/min through the analyzer).

When in internal pump is fitted, the relevant parameter in the software setup dialog is set to **Yes** (☞ 6-88). The pump can be controlled either manually through a software menu or optionally by a digital input.

Note!
Gas pressure is limited to atmospheric, if an internal pump is used!

1.2.6.2 Internal Valve Block

An internal valve block allows all necessary gas lines (zero gas, span gas, sample gas) to remain permanently connected to the analyzer. Valves are then activated automatically when required (e.g. during automatic calibration).

When an internal valve block is fitted, this is shown in the relevant software setup dialog as either **Internal** or **Int+Ext** (☞ 6-105). The valves are controlled by either a software menu, optionally by digital input, or automatically during autocalibration.

Depending on the model, up to two valve bocks can be fitted.

1.2.6.3 Internal Flow Sensor

Up to two internal flow sensors can measure the flow of gas and, compared to the flow monitor switch can provide a flow reading. They also can activate an alarm signal in the event of a failure.

The alarm level for flow sensors is operator adjustable to up to 2000 ml/min. Depending on the model, up to two sensors can be fitted and evaluated separately.

When a sensor is fitted, the relevant parameter in the software setup dialog is set to **Yes** (☞ 6-107).

If the current flow rate is too low, a status message is displayed and the parameter under CHECK REQUESTS.. is set to **Yes** (☞ Chapter 8 'Troubleshooting').

1.2.6.4 Internal Flow Monitor Switch

An internal flow switch monitors the gas flow and activates an alarm signal in case it is not sufficient. Compared to the flow sensore it does not provide a flow reading, but only indicates if the flow is sufficient, or not.

The alarm level for the internal flow switch is fixed and not operator adjustable. Additional external switches may be used and connected via digital inputs. All fitted flow switches are evaluated to share a common alarm.

When an internal flow switch is fitted, the relevant parameter in the software setup dialog is set to **Yes** (☞ 6-105).

If the current flow rate is too low, a status message is displayed and the parameter under CHECK REQUESTS.. is set to **Yes** (☞ Chapter 8 'Troubleshooting').

1.2.6.6 Internal Barometric Pressure Sensor

Varying atmospheric pressure has an influence also on the density of the gases applied to the measuring system: Higher density correlates with more molecules per volume and thus influences the measuring results.

To compensate such influences. an internal barometric pressure sensor can be installed. It´s reading is used to electronically compensate the atmospheric pressure variation (☞ measurement specification, page 3-21).

If such a sensor is installed in the unit, the related menu shows the entry **Internal** (☞ 6-105).

1.2.6.5 Internal Temperature Sensors

In the same way as pressure variations, varying temperatures influence the measuring results: Higher temperature results in lower gas density and thus in less molecules per volume. To compensate temperature influence, internal temperature sensors can be installed to electronically compensate temperature variations (☞ page 3-21 ,measurement specification).

Depending on the configuration of the unit or the demands of the application, temperature sensors can measure the unit's internal temperature or selected measurement channel components.

If such sensors are installed in the unit, this is indicated in the installed options menu (☞ 6-105).

1.2.6.7 Optional Heated Area

The physical components can be optionally separated from the electrical components by means of a special box (not an option for ½ 19 in units). This can be done for one or both of the following purposes:

Firstly, the box allows the physical components to be regulated to a temperature of approx. 60 °C, avoiding condensation of gases or minimizing the influence of varying environmental temperatures.

Secondly, the box can be purged with, for example, inert gas (enclosure purge). The purge gas is first fed through a separate fitting, purges the electronic components, then floods the box and leaves the instrument via another fitting.

Purging in this manner can be useful when measuring very low concentrations (e.g. of CO or CO_2): the expulsion of ambient air avoids adulterant outside influences.

Alternatively, enclosure purging can be used to secure enhanced protection for electronic parts and operators from corrosive or toxic gases: any leaking gas is expelled from the housing and does not escape into the vicinity of the unit or come into contact with any electronic components located outside the box.

In either case, the purge gas outlet should be connected to an exhaust gas line.

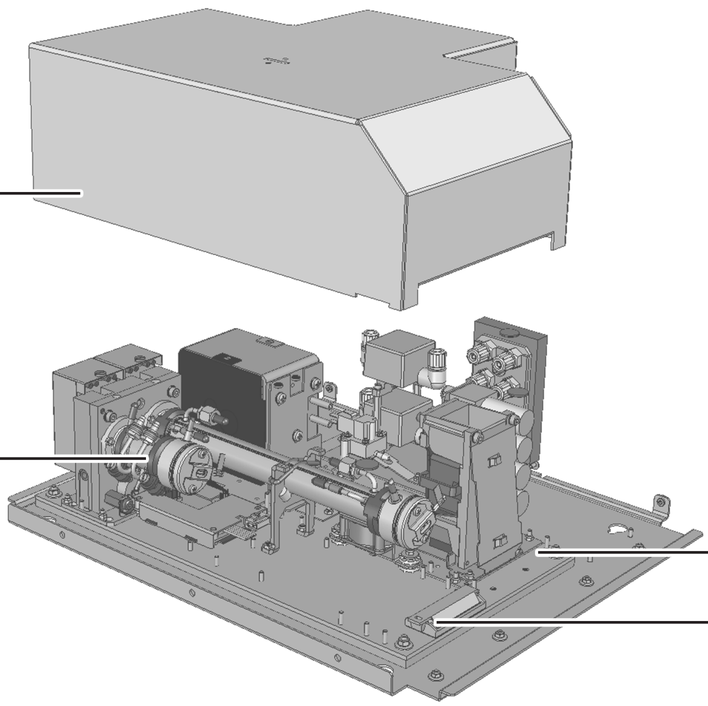


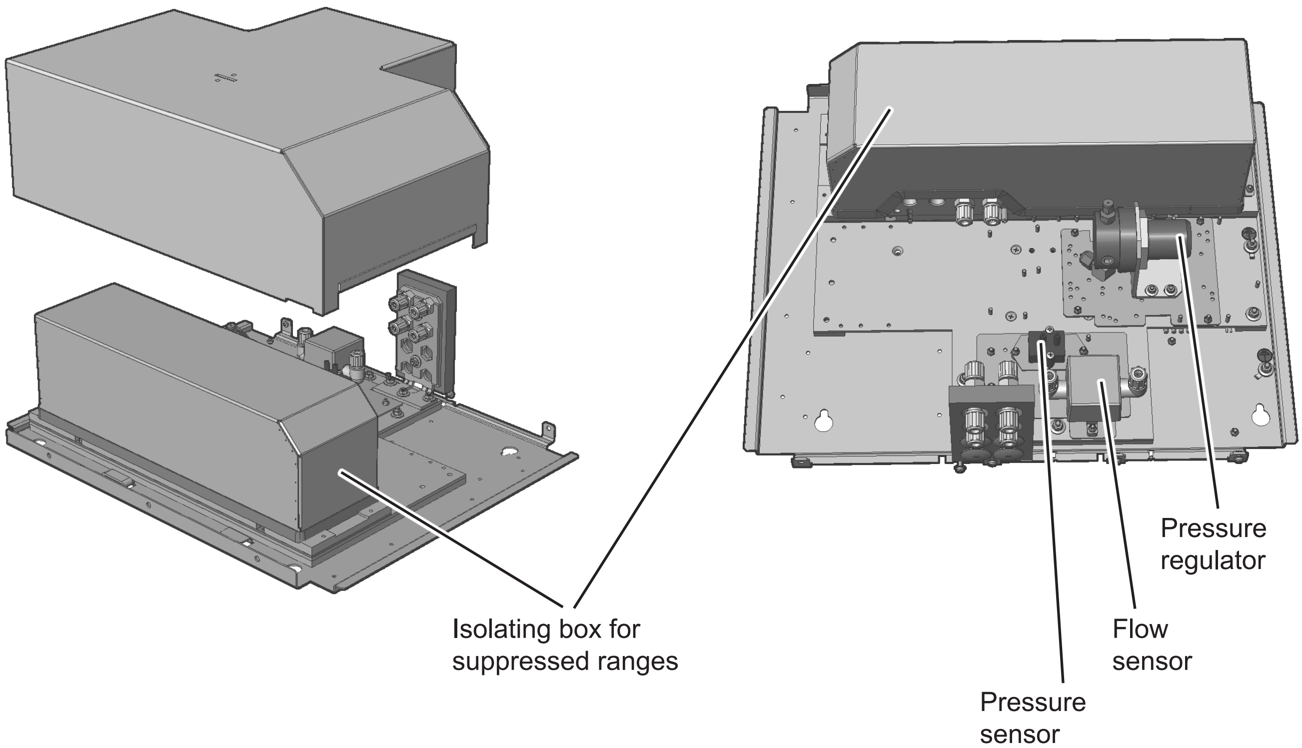
Fig. 1-2: *Optional Heated Area*

1.2.6.8 Suppressed Ranges

Suppressed ranges require additional components (some optional, or depending on measurement):

- internal isolating box covering measuring cells, detectors and sources only
- pressure regulator
- flow sensor
- pressure sensor.

Restrictions apply to ambient operating temperature ranges for suppressed ranges.



Note!
Images show optional components.
Content of Images is reduced to essential.

Fig. 1-3: *Suppressed Ranges Options*

1.2 Configuration of Gas Lines

1.2.7 Configurations

Depending on the application and the selected analyzer options, several gas line configurations are available, exemplified in the following diagram of a dual-channel analyzer:

Note!
X-STREAM gas analyzers feature at maximum eight gas connectors. So, parallel tubing is not possible for five channel configurations (at least two out of five channels need to be serial tubed)!

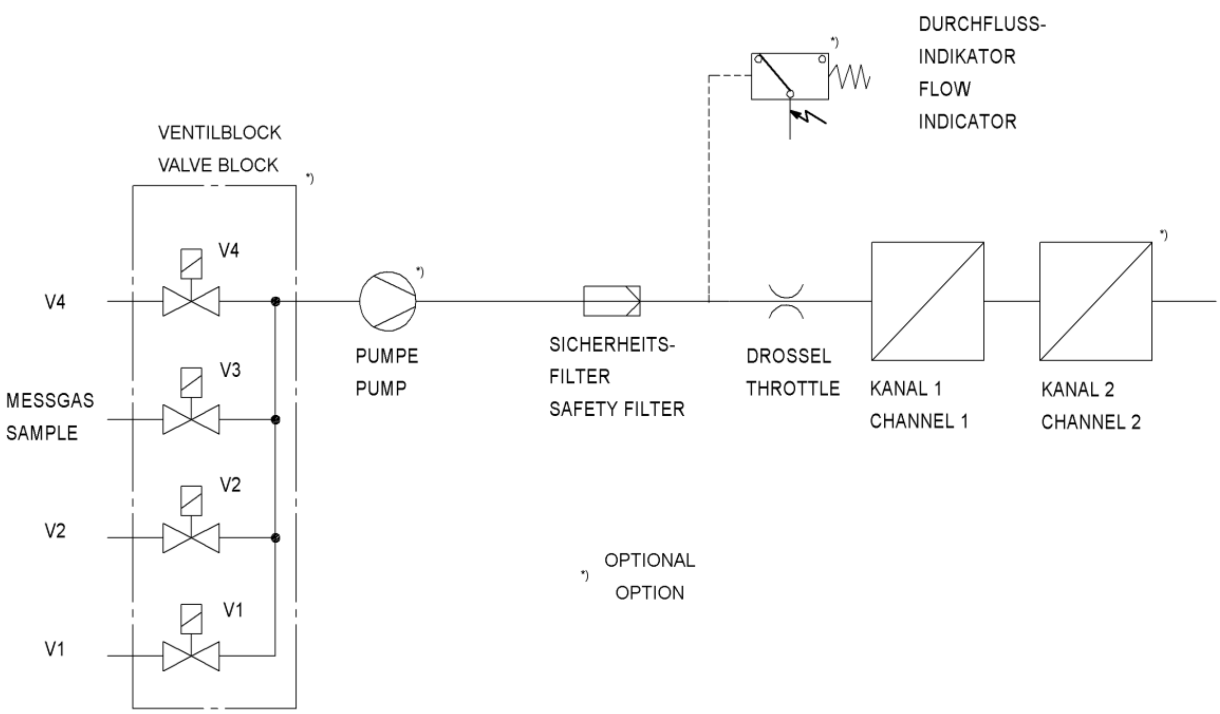


Fig. 1-4: *Gas Flow Diagram**: Single Channel Or in Series***

1.3 Interfaces

All analyzer types are fitted with one analog electrical output for each channel, four status relays, 2 Ethernet interfaces and a serial service interface as standard.

As an option, further interfaces can be added.

Depending on the unit configuration, all interfaces are accessible via either SubminD connectors or screw terminals.

1.3.1 Analog Outputs

By default each X-STREAM analyzer is fitted with one output per channel, which can transmit data on concentration levels to an external data acquisition system. Up to five analog outputs can be installed.

The analog outputs support several operation modes, such as 4-20 mA, 0-20 mA, as well as the NAMUR NE 43 specifications (incl. Live Zero). Operation modes can be set in a software menu (☞ 6-76).

The factory setting for analog outputs is 4-20 mA.

X-STREAM analyzers support up to five analog outputs, which, however, do not always need to be assigned to measurement channels which are physically present: If a unit features less than five channels, the remaining analog outputs can be used to transmit concentration levels with a different resolution; for example, a single-channel analyzer could be set up as follows:

Output 1: 0 … 100 % CO_2 = 4 … 20 mA
Output 2: 0 … 25 % CO_2 = 4 … 20 mA

1.3.2 Status Relays

By default each analyzer provides four relays outputs, preconfigured to signal the current status of the unit according to the NAMUR NE 44 specification ('Failure', "Maintenance request", 'Out of specification' and 'Function check'). However, the operator can assign different functions to the relays via software menus. For a comprehensive list of available functions, ☞ 6-82.

Note!
Any NE 44 status is also indicated by symbols appearing in the display´s 1st line. These symbols remain conformant to NE 44 even when the status relays are software assigned different functions.

Electrical details:

maximum load of 30 V / 1 A / 30 W,

can be operated as normally open (NO) or normally closed (NC).

Further information on the status relays is provided in the section 'Technical Data' ☞ 2-2.

1.3.3 Modbus Interface, Ethernet

The Ethernet Modbus interface offers the same form of communication with a data acquisition system as does a serial interface. Furthermore this interface enables to connect the analyzer to a network, providing web-browser access.

This interface is electrically isolated from the unit’s electronic components and enables the construction of a network of several analyzers.

Information about web-browser access is provided in ☞ Chapter 7.

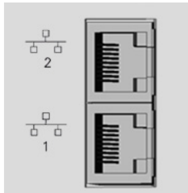


Fig. 1-5: *Ethernet Interface Marking*

Note!
All analyzers provide 2 Ethernet connectors

1.3.4 Serial Interface

A serial interface with the Modbus protocol allows communication with external data acquisition systems. The interface enables the exchange and modification of measurement and analyzer signals, analyzer status monitoring as well as remote activation of procedures.

The serial interface is electrically isolated from the unit’s electronic components. RS 485 facilitates the construction of a network of several analyzers. RS 232 interface only supports communication between two end devices.

A table nearby the connector shows the interface configuration (here: MODBUS)

X2	
▬▬▬	
CAN	
FF	
MODBUS	X
RS 232	
RS 485 2W	
RS 485 4W	

Fig. 1-6: *Serial Interface Marking*

1.3.5 USB Interfaces

Two USB connectors enable connecting

- storage devices to the bigger port for external data and analyzer configuration storage
- external computers to the smaller Mini USB port.

☞ Chapter 7 provides more information on how to use USB ports.

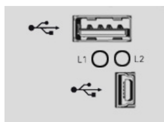


Fig. 1-7: *USB Interfaces*

1.3.6 Optional Interfaces

1.3.6.1 Analog Inputs

Two d. c. analog inputs enable connection to external devices. Their signals can be used for e.g.

- cross compensation
- pressure compensation, or
- handled as a separate measurement channels.

Electrical details:

0–1 (10) V , R_{in} = 100 kΩ

or

0–20 mA, R_{in} = 50 Ω

The inputs are protected against overload up to ± 15 V or ± 20 mA.

1.3.6.2 Digital Outputs

In addition to the 4 default digital outputs, analyzers can optionally be upgraded with 9 or 18 more digital outputs, to be used for various purposes, e.g.:

- Triggering concentration alarms: Process control systems can detect when limits are exceeded and trigger appropriate actions.
- Switching external components: For example, during automatic calibration, the necessary valves can be activated directly by the analyzer.

The different functions can be assigned via software menus. For a comprehensive list of available functions, ☞ 6-82.

Electrical details:

maximum load of 30 V / 1 A / 30 W,

can be operated as normally open (NO) or normally closed (NC).

1.3.6.3 Digital Inputs

Digital inputs can be integrated into the units in groups of 7 or 14.

Digital inputs can be used to:

- trigger calibration procedures, for example by a process control system
- remotely control valves and the optional sample gas pump (in concert with correctly configured digital outputs).

The different functions can be assigned via software menus. For a comprehensive list of available functions, ☞ 6-86 .

Electrical details:

DC inputs

LOW: U_{in} ≤ 1,5 V

HIGH: U_{in} ≥ 4,5 V

R_{in}: 57.5 kΩ

Common ground for all outputs (“IN-GND”)

The inputs are protected against excess voltages of up to approx. 40 V. An open (not wired) input has LOW potential.

1.4 Comparison of the Various X-STREAM *Enhanced* Analyzer Models

X-STREAM XEGK	X-STREAM XEGP
	
½ 19 in housing, table-top or rackmountable, *optional with carrying handle* protection type: IP 20	1/1 19 in housing, table-top or rackmountable, protection type: IP 20
Internal wide range power supply, **or** 24V input with external power supply unit	Internal wide range power supply unit
Max. 3 channels in many combinations max. 8 gas connections, *including 1 optional purge gas connection*	Max. 5 channels in many combinations max. 8 gas connections, *1 optional extra connection for purge gas*
Options for gas lines: Flow sensor, pressure sensor, infallible gas lines. With restrictions on measurement channel combinations: sample gas pump, 1 valve block	*Options for gas lines: Flow sensor, pressure sensor, heating for physical components, sample gas pump, 1 or 2 valve blocks, infallible gas lines*
1–5 analog outputs, 4 relay outputs, 2 Modbus Ethernet interfaces, 2 USB connectors *optional:* *1 interface card with 7 digital inputs and 9 digital outputs* *1 interface card with analog inputs* electrical interfaces accessible via sockets on back of unit	1–5 analog outputs, 4 relay outputs, 2 Modbus Ethernet interfaces, 2 USB connectors *optional:* *1 or 2 interface cards, each with 7 digital inputs and 9 digital outputs* *1 interface card with analog inputs* electrical interfaces accessible via sockets on back of unit, *optionally: screw-type terminal adapters (except for Ethernet & USB)*
LCD	LCD
Max. operating ambient temperature*): 0 °C to +50 °C (32 °F to 122 °F)	Max. operating ambient temperature*): 0 °C to +50 °C (32 °F to 122 °F)
Size: (DxHxW): max. ca. 460x128.7x213 mm Weight: ca. 8–12 kg (17.6 - 26.5 lb)	Size: (DxHxW): max. ca. 411x133x482 mm Weight: ca. 11–16 kg (24.3–35.3 lb)
For more detailed information: 1-16	For more detailed information: 1-18

*): *Limitations apply to selected measurement principles and ranges,*
Measurement Specifications!

1.4 Comparison of Analyzer Models

X-STREAM XEXF	X-STREAM XEFD
	
Stainless steel wallmountable field housing, protection type: IP66 / NEMA 4X Single (XEF) or dual (XDF) compartment design	Cast aluminum wallmountable field housing, protection type: IP66 / NEMA 4X
Internal wide range power supply unit	Internal wide range power supply unit
Max. 5 channels in many combinations max. 8 gas connections, *1 optional extra connection for purge gas*	Max. 5 channels in many combinations max. 8 gas connections, *including 2 optional purge gas connection*
Options for gas lines: Flow sensor, pressure sensor, heating for physical components, sample gas pump, 1 or 2 valve blocks, infallible gas lines	*Options for gas lines: Flow sensor, pressure sensor, heating for physical components, sample gas pump, 1 or 2 valve blocks, infallible gas lines*
1–5 analog outputs, 4 relay outputs, 2 Modbus Ethernet interfaces, 2 USB connectors *optional:* *1 or 2 interface cards, each with 7 digital inputs and 9 digital outputs* *1 interface card with analog inputs* electrical interfaces on internal screw-type terminal adapters (except for Ethernet & USB)	1–5 analog outputs, 4 relay outputs, 2 Modbus Ethernet interfaces, 2 USB connectors *optional:* *1 or 2 interface cards, each with 7 digital inputs and 9 digital outputs* *1 interface card with analog inputs* electrical interfaces on internal screw-type terminal adapters (except for Ethernet & USB)
LCD, impact tested front panel	LCD, impact tested front panel
Max. operating ambient temperature*) : -20 °C to +50 °C (-4 °F to 122 °F)	Max. operating ambient temperature*) : -20 °C to +50 °C (-4 °F to 122 °F)
Models available for use in hazardous areas (explosive environments)	Flameproof enclosure: approved for use in hazardous areas (explosive environments)
Size: (DxHxW): ca. 265x400 (815)x550 mm Weight: max. ca. 25 (45) kg / 55.1 (99.2) lb	Size: (DxHxW): max. ca. 222x512x578 mm Weight: max. ca. 63 kg (138.9 lb)
For more detailed information: ☞ 1-20	For more detailed information: ☞ 1-25

1.5 X-STREAM XEGK: ½19 Inch Table-Top Unit

This compact model for general purposes can be fitted with up to three measurement channels in various combinations. Power is supplied by an internal wide range power supply or a separate external power supply unit.

By default the units are configured for tabletop use. A carrying handle is optional available which makes it easy to take the instrument to varying sampling points. For rack mounting a XEGK is fixed by screws located at the front panel.

Connection to power supply

AC is supplied by an IEC chassis plug with power switch and fuse holders. The internal wide range power supply unit enables the analyzers to be used worldwide. DC 24 V power is supplied via a 3-pin socket at the rear of the unit.

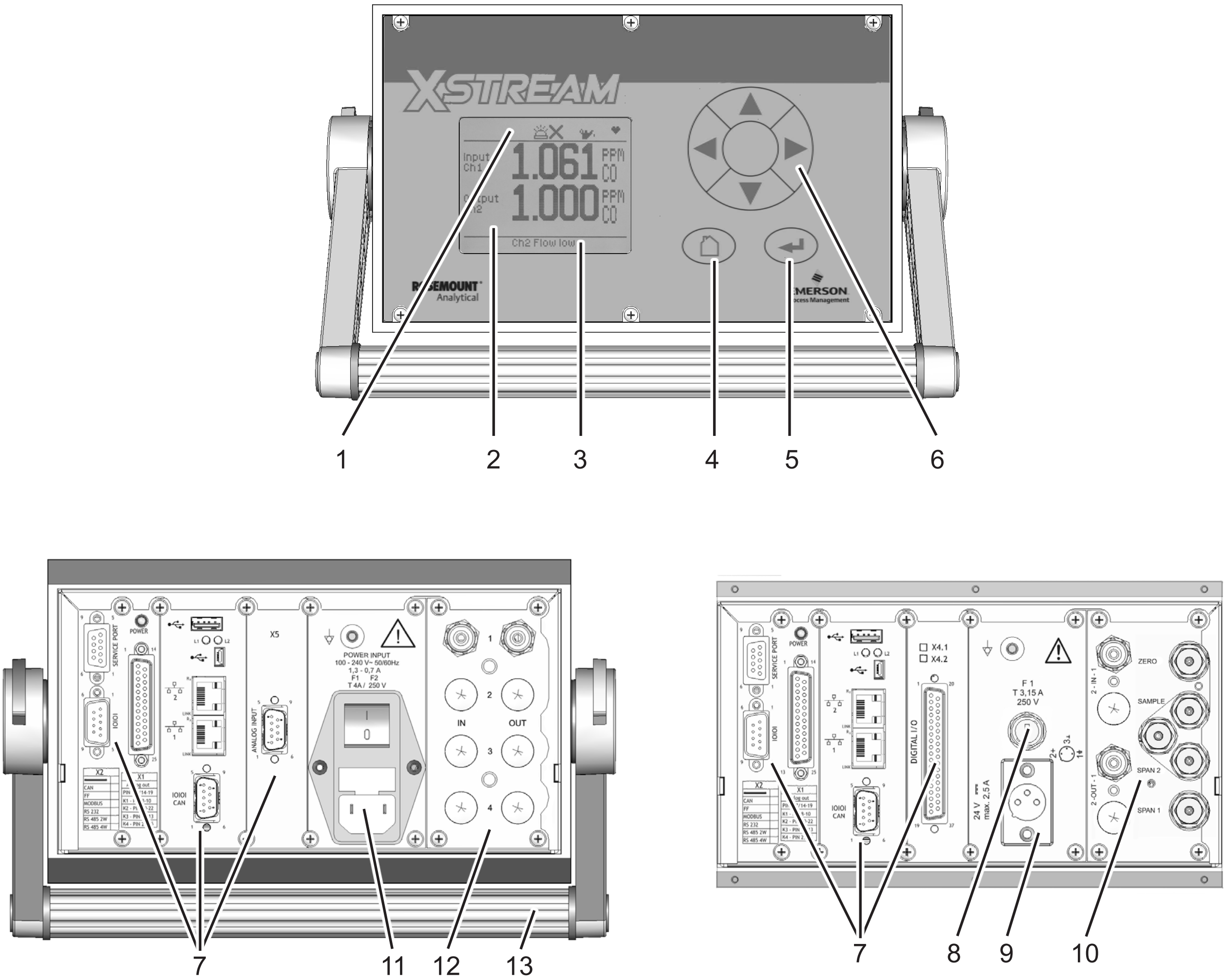
Interfaces

Electrical connections for interface signals are provided via submin-D connectors, Ethernet and USB connectors mounted on the rear panel of the device ((☞ Fig. 1-8).
Detailed technical details on the various interfaces can be found at ☞ 2-2. The configuration of the connectors are described in ☞ Chapter 4 'Installation' and the software settings in ☞ Chapter 6 'User interface and software menus'.

Gas connections

Depending on the configuration of the unit (number of measurement channels and serial or parallel connection), sample and calibration gases are fed into the unit via up to 8 tube fittings mounted on the rear panel. Any free tube fittings can be used for purging the device to minimize interference from the ambient atmosphere, or when measuring corrosive and/ or flammable gases.

1.5 X-STREAM XEGK



Note!
Figures show optional components!

1 Status line
2 Graphic display
3 Messages line
4 *HOME* key
5 *ENTER* key
6 4 keys for adjustment and menu selection
7 Signal connectors (some optional)
8 DC power input fuse
9 DC power input
10 Gas fittings and valve block
11 AC power input with switch and fuses
12 Standard gas in- and outlets
13 Carrying handle

Fig. 1-8: *X-STREAM XEGK - Views*

1.6 X-STREAM XEGP: 19 Inch Table-Top or Rackmount Design

This model can be fitted with up to five measurement channels in various combinations. The physical components can optionally be encased in a cover. This area can be held at a specific temperature of up to 60 °C to minimize interference from changes in external temperature.

Units configured for rack mounting can be converted for tabletop use by removing the lateral mounting brackets and attaching the four feet supplied as accessories.

Connection to power supply

Main power is supplied via the IEC chassis plug mounted on the rear panel, with integrated power switch and fuse holders. The internal wide range power supply unit enables the analyzers to be used worldwide.

Interfaces

Electrical connections for interface signals are provided via submin-D connectors mounted on the rear panel of the device (fig 1-8).

For applications where screw-type terminals are preferred, optional adapters are available, which are mounted directly onto the submin-D connectors.

Detailed technical details on the various interfaces can be found at ☞ 2-2. The configuration of the connectors and the optional screw-type terminal adapters are described in ☞ Chapter 4 'Installation' and the software settings in ☞ Chapter 6 'User interface and software menus'.

Up to two digital I/O cards may be installed, where the first digital I/O card is marked "X4.1" while the second is "X4.2" on the rear panel, right above the connector (☞ Fig. 1-9, rear view).

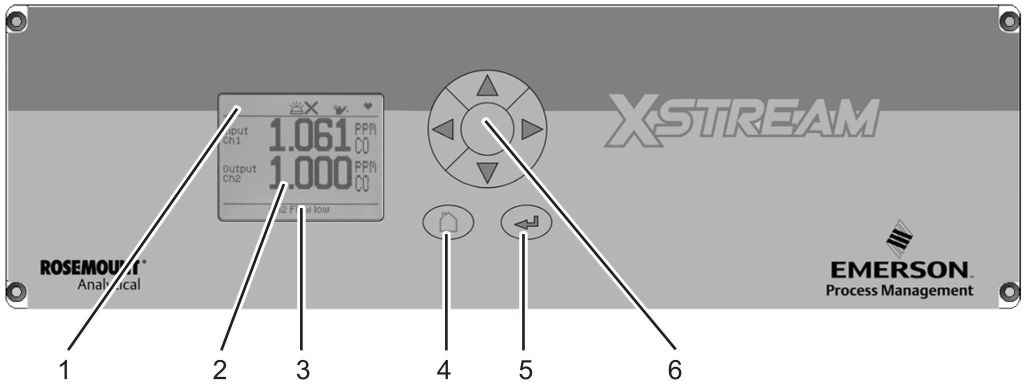
Gas connections

Depending on the configuration of the unit (number of measurement channels and serial or parallel connection), sample and calibration gases are fed into the unit via up to 8 threaded connectors mounted on the rear panel. The configuration of the connectors is indicated on an adhesive label located near the connectors.

A further optional tube fitting enables the housing to be purged to minimize interference

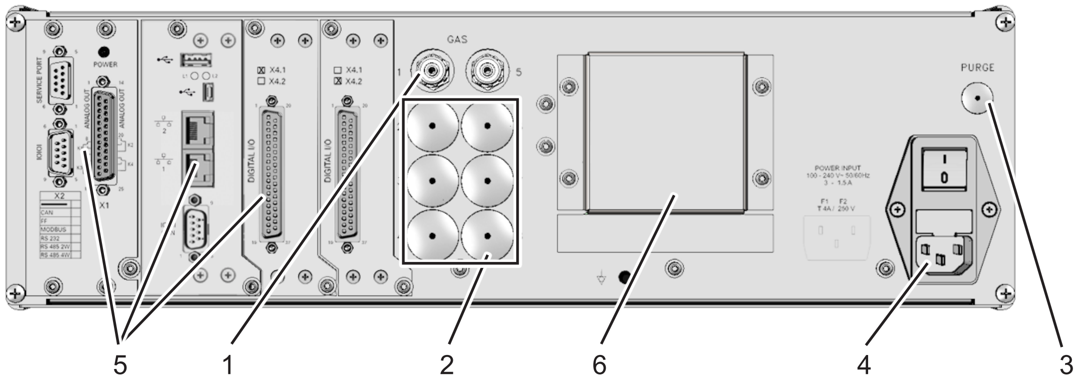
1.6 X-STREAM XEGP

Front view



1 Status line
2 Graphic display
3 Messages line
4 *HOME* key
5 *ENTER* key
6 4 keys for adjustment and menu selection

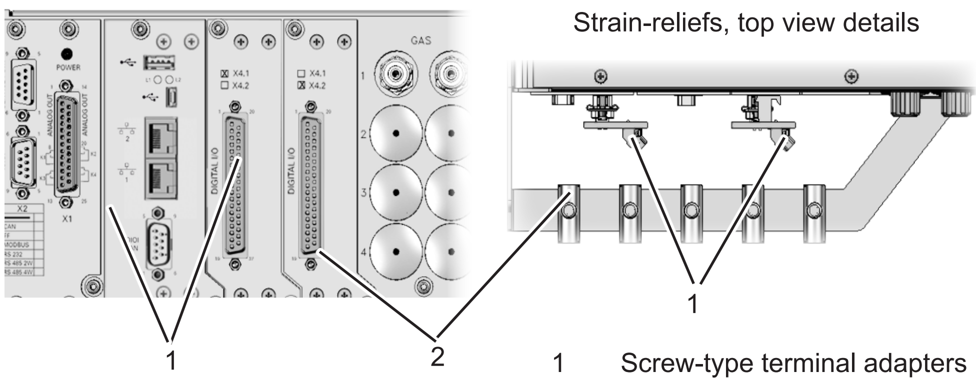
Rear view



1 Gas connector fittings
2 Space for additional fittings
3 Optional purge gas inlet
4 Power inlet with filter, fuses & switch
5 Signal input/output connectors (some optional)
6 Cover for eO_2 or tO_2 sensor

Optional screw-type terminal adapter

Strain-reliefs, top view details



1 Screw-type terminal adapters
2 Strain-reliefs

Fig. 1-9: *X-STREAM XEGP - Details*

1.7 X-STREAM XEXF: Field Housing With (XEF) Single or (XDF) Dual Compartment

Field housing are conceived for outdoor use and wall-mounting. The coated stainless steel housing has a protection class rated IP66 / NEMA Type 4X, offering protection against water and dust entering the device:

*IPx**6**: In case of occasional flooding, e.g. heavy seas, water shall not enter in harmful quantities*

*IP**6**x: Protection against penetration by dust. Live or internal moving parts are completely protected.*

An X-STREAM field housing can be fitted with up to five measurement channels in various combinations. The physical components can optionally be encased in a cover. This separate volume can be held at a specific temperature of up to 60 °C to minimize interference from changes in external temperature.

Front panel

The analyzer's display is covered by an impact tested glass for enhanced protection against breakage in harsh environments.

Electrical connections

Electrical connections are provided via internal tube fittings, the cables being fed through cable glands at the right side of the unit (☞ Fig. 1-11). The front cover of the housing swings open to the left once the fasteners have been released.

Connection to power supply

Mains power is supplied via screw-type terminals with integrated fuse holders at the right side of the housing, near the front. The wide range power supply unit mounted internally enables the analyzers to be used worldwide.

Interface signals

Up to two digital I/O cards may be installed. If so, on a label nearby, they are labeled "X4.1" for the first I/O board, and "X4.2" for the second.

Detailed technical details on the various interfaces can be found at ☞ 2-2. The configuration of the screw-type terminal adapters are described in ☞ Chapter 4 'Installation'and the software settings in ☞ Chapter 6 'User interface and software menus'.

Gas connections

Depending on the configuration of the unit (number of channels, series or parallel piping), up to eight tube fittings are provided for the supply of sample and calibration gases. The assignments of the fittings is given on an adhesive label situated near the fittings.

A further optional tube fitting enables the housing to be purged to minimize interference from the ambient atmosphere, or when measuring corrosive and/or flammable gases.

For further information, see ☞ 1-5.

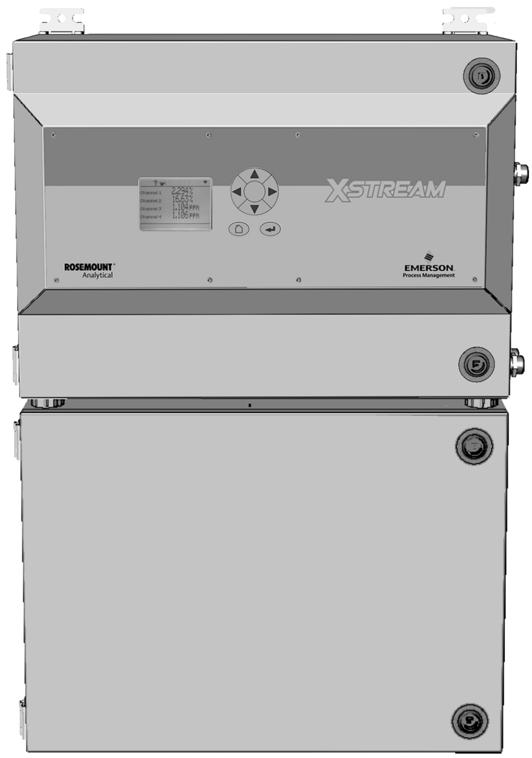
Dual compartment variation XDF

The dual compartment variation XDF supports separating electronics and physics, e.g. for measurement of corrosive or solvent gases. For such applications the electronics are installed in the upper compartment, while measurement physics are in the lower compartment. This separation is also available as gastight version.

XDF also provides more space e.g. for installation of optional signal converter elements for system integrators.

1.7 X-STREAM XEXF Field Housings

XEF



XDF

Fig. 1-10: X-STREAM XEXF Field Housings- Front Views

CAUTION

HEAVY INSTRUMENT

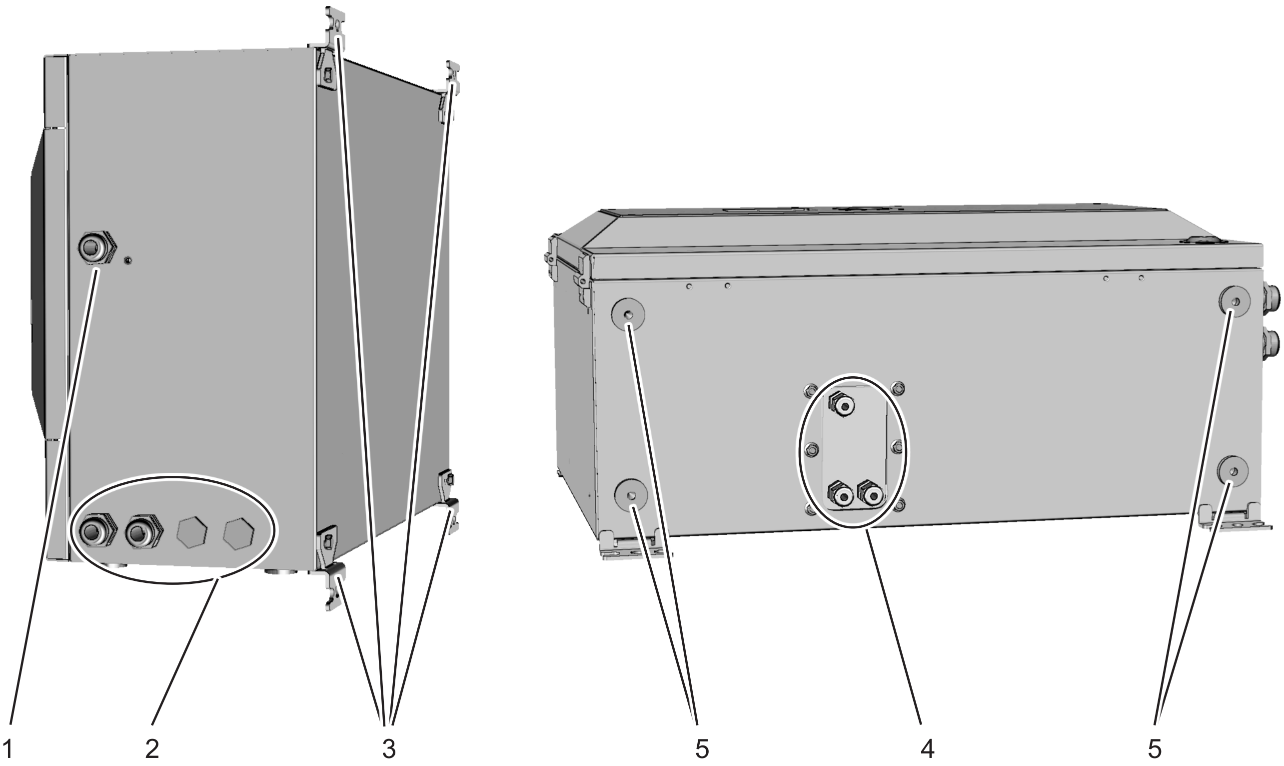
X-STREAM field housings, intended for outside and wall mounted use, weigh approx. (XEF) 26 kg (57 lb) or (XDF) 45 kg (99 lb), depending on options installed.

Two people and/or lifting equipment is required to lift and carry these units.

Take care to use anchors and bolts specified to be used for the weight of the units!

Take care the wall or stand the unit is intended to be installed at is solid and stable to support the weight!

1.7 X-STREAM XEXF Field Housings

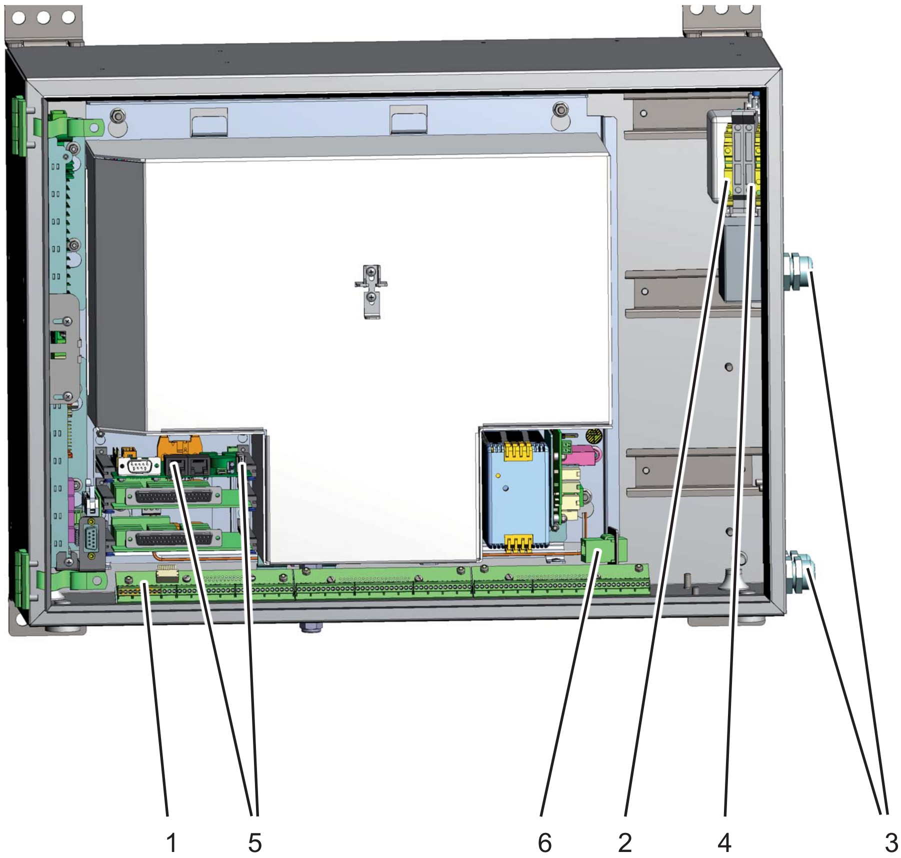


1 Cable gland for power cable
2 Cable glands for signal cables
3 4 brackets for wall-mounting
4 Gas in- & outlets (max. 8)
5 Cutouts, to combine 2 housings (here closed)

Note!
In case of XDF, the cable glands are located at the upper compartment, while the gas in- & outlets are at the bottom side of the lower compartment.
Also only 2 brackets are at each compartment.

Fig. 1-11: *X-STREAM XEF - Right Side and Bottom View*

1.7 X-STREAM XEXF Field Housings



1 Screw-type terminals for signal cables
2 Power line filter
3 Cable glands
4 Power supply terminals with integrated fuses
5 Ethernet Service Port and USB connection
6 Ethernet network conncetion

Note!
In case of XDF, the terminals and connectors are located at the upper compartment, while physical components and gas fittings are in the lower compartment.

Fig. 1-12: *X-STREAM XEF - Power Supply and Signal Terminals*

1.7 XEXF Field Housings in Hazardous Areas

1.7.1 Field Housings XEXF for Installation in Hazardous Areas (Ex-Zones & Divisions)

WARNING

EXPLOSION HAZARD

X-STREAM XEXF field housings CAN NOT be used in explosive environments (hazardous areas) without additional safety features.

This instruction manual does NOT describe the special conditions necessary to operate gas analyzers in hazardous areas.

Please refer to the separate instruction manual supplied with units for use in hazardous areas.

Special X-STREAM field housing analyzer models can be used in Ex-zones 2 or Division 2:

X-STREAM XEFN/XDFN:

Analyzer with non-sparking protection for measuring non-flammable gases in European Ex-zone 2 and North-American Division 2 areas: the customized configuration of this instrument ensures that, when used correctly, no sparks, hot surfaces etc. which could ignite an explosive ambient atmosphere are generated. No further measures, such as a supply of protective gas, are necessary.

Please contact your local EMERSON Process Management office if you require analyzers for use in hazardous areas.

1.8 X-STREAM XEFD: Cast Aluminum Flameproof Housing

The most obvious X-STREAM XEFD analyzer feature is its flameproof housing (☞ Fig. 1-13). This enables its use in Ex-zone 1 hazardous environments. With a protection type of IP66/NEMA Type 4X and sturdy cast aluminum housing designed for wall-mounting, it can also be used in other tough environments.

*IPx**6**: In case of occasional flooding, e.g. heavy seas, water shall not enter in harmful quantities*

*IP**6**x: Protection against penetration by dust. Live or internal moving parts are completely protected.*

Up to five measuring channels in various combinations can be installed in the X-STREAM XEFD. The physical components can optionally be encased in a cover. This separate volume can be held at a specific temperature of up to 60 °C to minimize interference from changes in external temperature.

Front panel

The analyzer’s display is protected by an impact tested glass for enhanced protection against breakage in harsh environments.

Electrical connections

Electrical connections are made via internal screw-type terminals; the corresponding cables are fed through cable inlets on the underside of the unit into the housing (☞ Fig. 1-14). The front of the unit opens downwards once the screws located on the surrounding flange are removed.

Connection to power supply

Mains power is connected via screw-type terminals with integrated fuses, located in the front right-hand area of the housing. The internally mounted wide range power supply unit ensures, the analyzers can be used worldwide.

Interface signals

Up to two digital I/O cards may be installed, where terminal strip for the first digital I/O card is marked "X4.1" while the second is "X4.2" on a label near the terminals.

Detailed technical details on the various interfaces can be found at ☞ 2-2. The configuration of the screw-type terminal adapters are described in ☞ Chapter 4 'Installation'and the software settings in ☞ Chapter 6 'User interface and software menus'.

Gas connections

Depending on the configuration of the unit (number of channels, series or parallel piping), up to eight flame arresters are provided for the supply of sample and calibration

WARNING

EXPLOSION HAZARD

The special conditions for installing and operating analyzers in hazardous areas are not covered by this manual!

Read the separate instruction manuals shipped together with instruments intended to be installed in hazardous areas!

gases. The assignments of the connectors is given on an adhesive label situated near the connectors.

Optional two of the fittings may be used to purge the housing to minimize interference from the ambient atmosphere, or when measuring corrosive and/or flammable gases. In this situation special conditions apply for operation in hazardous areas, described in the separate manual addendum for hazardous areas.

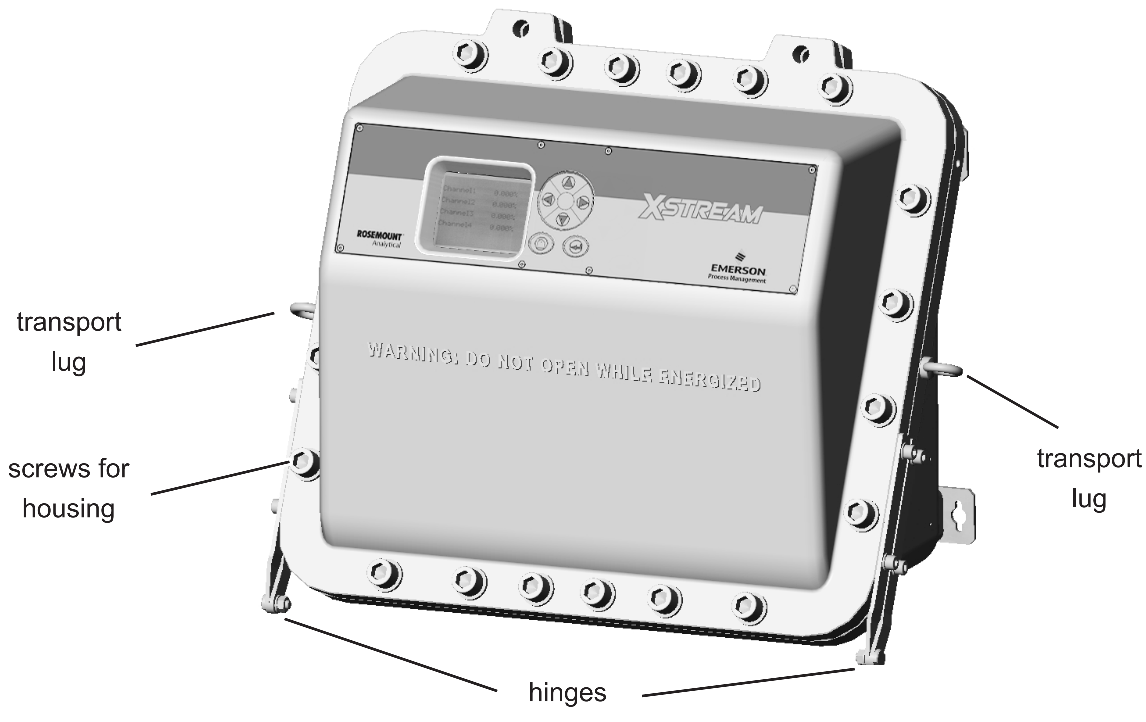
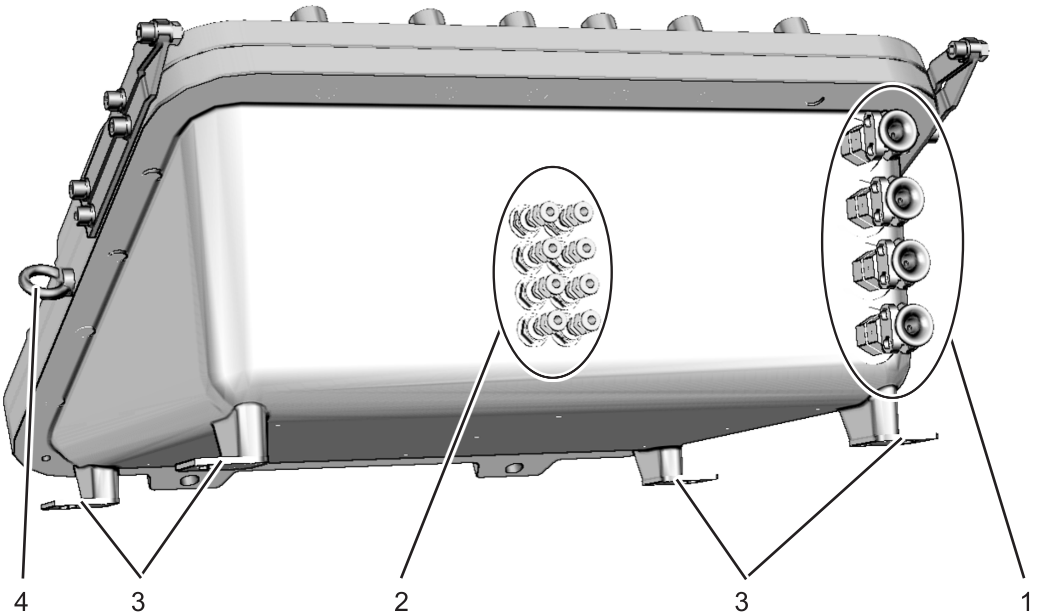


Fig. 1-13: *X-STREAM XEFD - Front View*

1.8 X-STREAM XEFD



1 Cable inlets for power and signal cables
2 Gas tube fittings, protected by flame arrestors
3 4 brackets for wall mounting
4 Transport lug

Fig. 1-14: *X-STREAM XEFD - Bottom View*

CAUTION

HEAVY INSTRUMENT

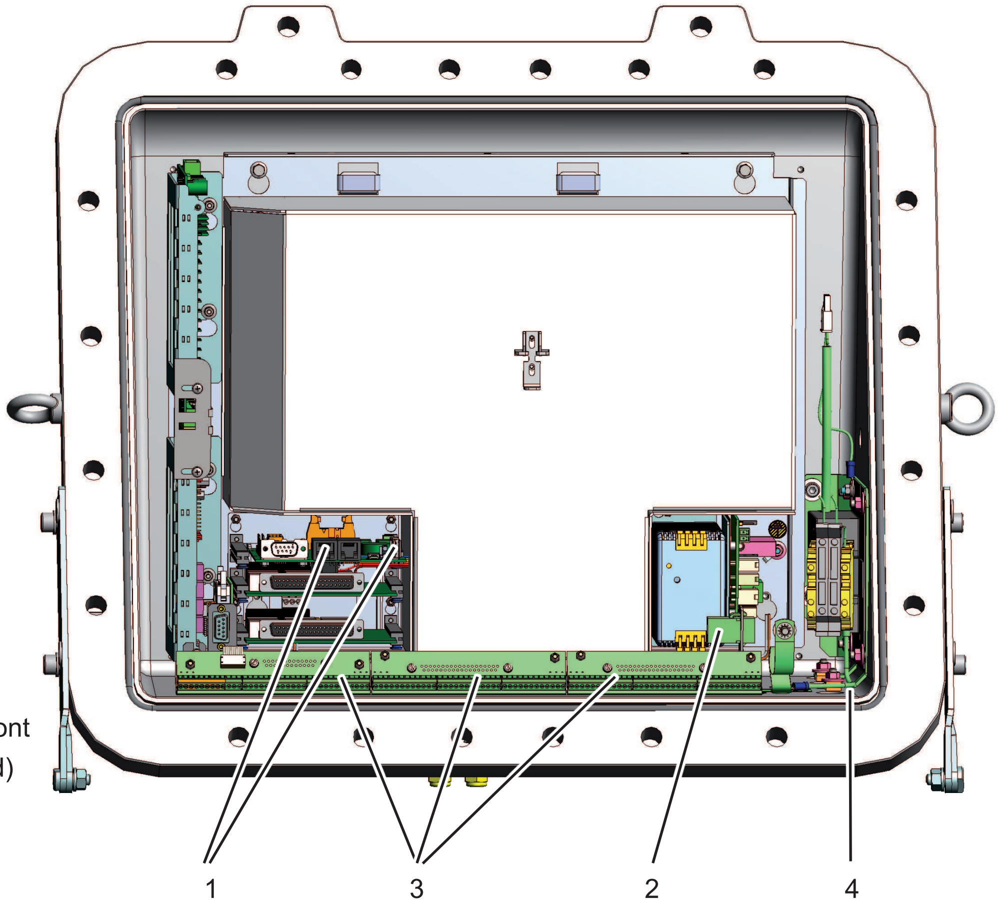
The model X-STREAM XEFD, intended for outside and wall mounted use, weighs approx. 63 kg (139 lb), depending on options installed.

Two people and/or lifting equipment is required to lift and carry these units. Use the transport lugs located on the sides of the instrument.

Take care to use anchors and bolts specified to be used for the weight of the units!

Take care the wall or stand the unit is intended to be installed at is solid and stable to support the weight!

1.8 X-STREAM XEFD



(shown with front panel removed)

1 Ethernet Service port & USB
2 Ethernet for network connection
3 Analog & digital I/O terminal strips
4 Max. 3 signal cables entries sdd

Fig. 1-15: *X-STREAM XEFD - Terminals*

Chapter 2
Technical Data

This chapter contains all the technical details of the analyzers, divided into common and model-specific data.

2.1 Common Technical Data

Site of installation	
Humidity (non-condensing)	< 90 % RH at +20 °C (68 °F) < 70 % RH at +40 °C (104 °F)
Degree of pollution	2
Installation category	II
Elevation	0 to 2000 m (6560 ft) above sea level
Ambient atmosphere	Units may not be operated in corrosive, flammable or explosive environments (except flameproof XEFD) without additional safety measures.
Certification	
Electrical safety	
CAN / USA (C US 185562)	CSA-C/US, based on CAN/CSA-C22.2 No. 61010-1-04 / UL 61010-1, 2nd edition
Europe CE	CE, based on EN 61010-1
Electromagnetic compatibility	
Europe	CE, based on EN 61326
Australia	C-Tick

Gas parameters

☞ **Chapter 3 “Measuring principles” or “4.3 Gas conditioning” on page 4-3**

2.1 Common Technical Data

Interfaces, signal inputs and outputs

Interface signals are accessed in different ways depending on the analyzer model:

X-STREAM XEGK, XEGP:	standard:	subminD plugs and sockets
	optional:	screw-type terminal adapters (XEGP only)
X-STREAM XEXF, XEFD:		internal screw-type terminals

All versions provide 2 RJ45 plugs for Ethernet connections as well as 1 USB and 1 mini USB connector (field housings internally only).

All models are supplied with		
up to 5 analog outputs (standard: 1 analog output per channel)	electrical specification	4 (0)–20 mA ($R_B \leq 500\ \Omega$) optically isolated from each other and from analyzer electronics
	function	user-configurable activation and deactivation of concentration levels support for NAMUR NE 43 operation modes, configurable via keypad and Modbus
4 relay outputs	electrical specification	Dry relay change-over contacts, to be used as NO or NC max. load. 30 V; 1 A; 30 W resistive
	function	Each output can be configured to provide any of the functions listed by ☞ Tab. 6-1 at page 6-77. These functions include, but are not limited to NAMUR NE 107 status signals 'Failure', 'Maintenance request', 'Out of specification', 'Function check' (these signals are automatically configured Fail Safe), concentration alarms (can manually be configured Fail Safe), control signals for external valves or pumps, and many more
2 Modbus interfaces		Ethernet (RJ45 sockets)
2 USB ports	specification	USB 1.0
	function	1 USB connector type A, for connecting external storage devices 1 USB connector type mini AB, for connecting external computers

2.1 Common Technical Data

Optional interfaces for all models		
Digital I/O board		
7 or 14 digital inputs (X-STREAM XEGK: max. 7 inputs)	electrical specification	max. 30 V, internally limited to 2.3 mA HIGH: min. 4 V; LOW: max. 3 V common GND
	function	Each input can be configured to any of the functions listed by ☞ Tab. 6-4 at page 6-87, e. g. Open valve Activate sample gas pump Zero calibrate all channels Span calibrate all channels Zero and span calibrate all channels Abort calibration
9 or 18 additional relay outputs (X-STREAM XEGK: max. 9 add. outputs)	electrical specification	Dry relay change-over contacts can be used as NO or NC max. load. 30 V; 1 A; 30 W resistive
	function	Each output can be configured to provide any of the functions listed by ☞ Tab. 6-3 at page 6-83 . These functions include, but are not limited to NAMUR NE 107 status signals 'Failure', 'Maintenance request', 'Out of specification', 'Function check' (these signals are automatically configured Fail Safe), concentration alarms (can manually be configured Fail Safe), control signals for external valves or pumps, and many more

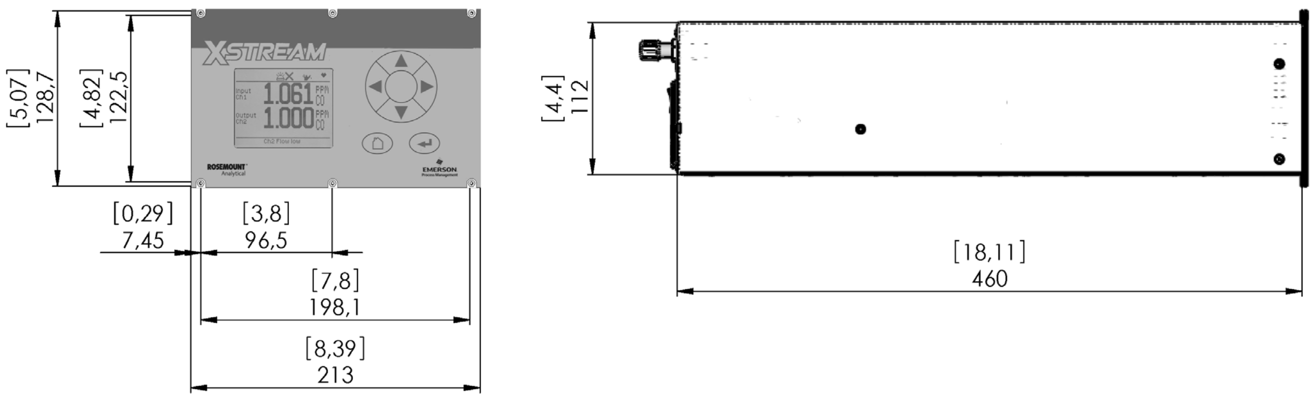
2.1 Common Technical Data

Optional interfaces for all models		
Analog I/O board		
2 Analog inputs	electrical specification	0–1 V, 0–10 V (software selectable) R_{in} = 100 kΩ optional (requires to fit wire bridges, ☞ Chapter 4 Installation): 0–20 mA ; R_{in} = 50 Ω optically isolated from analyzer GND protected against overload up to ± 15 V or ± 20 mA
	function	Input analog signals from external devices, such as e.g. pressure transmitters, flow sensors, analyzers, etc. for compensation or other purposes
Serial Interface		
1 Interface	electrical specification	9-pin,optically isolated from analyzer electronics
	function	RS232E, RS485 or Modbus

Special Interface		
Service Interface		
1 Serial	electrical specification	RS232E, **NOT optically isolated from analyzer electronics**
	function	**Only for special trained service personnel!**

2.2 Model-Specific Technical Data

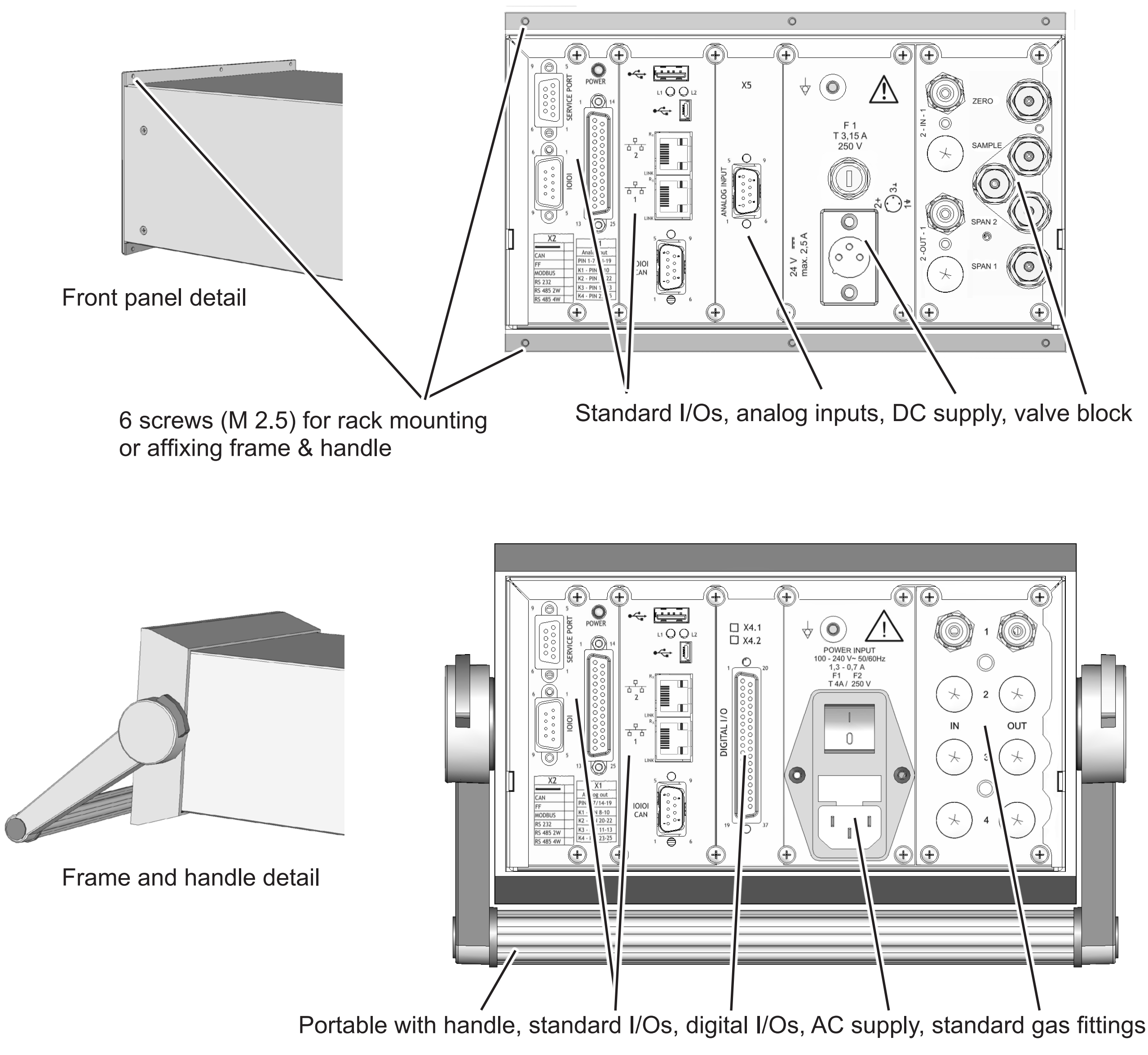
2.2.1 X-STREAM XEGK: ½19 Inch Tabletop Unit



All dimensions in mm [in]

Fig. 2-1: *X-STREAM XEGK - Dimensions*

2.2.1 Model-Specific Technical Data: X-STREAM XEGK



Note!
The shown rear panel options are interchangable!

Fig. 2-2: *X-STREAM XEGK - Rear Panel and Handle Variations*

2.2.1 Model-Specific Technical Data: X-STREAM XEGK

Temperatures		
operational, max.*)	0 … +50 °C / 32 … 122 °F	
storage	-20 … +70 °C / -4 … -158 °F	
Weight, max	8 … 12 kg / 17.6 … 26.5 lb	
IP or Type rating	IP 20 for indoor use, protected against dripping water and direct sun light	
Measurement channels, max.	3	
Gas connections		
max number	8	
max for purging (incl. / separate)	2 incl.	
material	PVDF; stainless steel (opt.)	
sizes	6/4 mm; ¼"	
Power supply unit	external; alternatively: internal wide range P/S	
Power supply	Mains supply voltage fluctuations are not to exceed ± 10 percent of the nominal voltage	
nominal voltage	DC 24 V	100–240 V∿ 50 / 60 Hz
voltage range	DC 10–30 V	85–264 V∿ 47–63 Hz
nominal input current, max	2.5 A	1.3–0.7 A
Power input fuses	AC 230 V / T 3.15 A 5x20 mm (1 pcs)	AC 230 V / T 4 A 5x20 mm (2 pcs)
Electrical in- and outputs		
power	3-pin XLR connector	IEC connector with integrated power switch & fuse holders
signals	signal cables are connected using submin-D plugs or sockets on the unit's rear panel	
special	Ethernet: RJ45 socket; USB connectors	

*): *Limitations apply to selected measurement principles and ranges,*
☞ *Measurement Specifications!*

2.2.1 Model-Specific Technical Data: X-STREAM XEGK

2.2.1.1 Data for Optional External Power Supply Units

Model UPS 01 T

This PSU can be ordered as an option for supplying power to one tabletop unit.

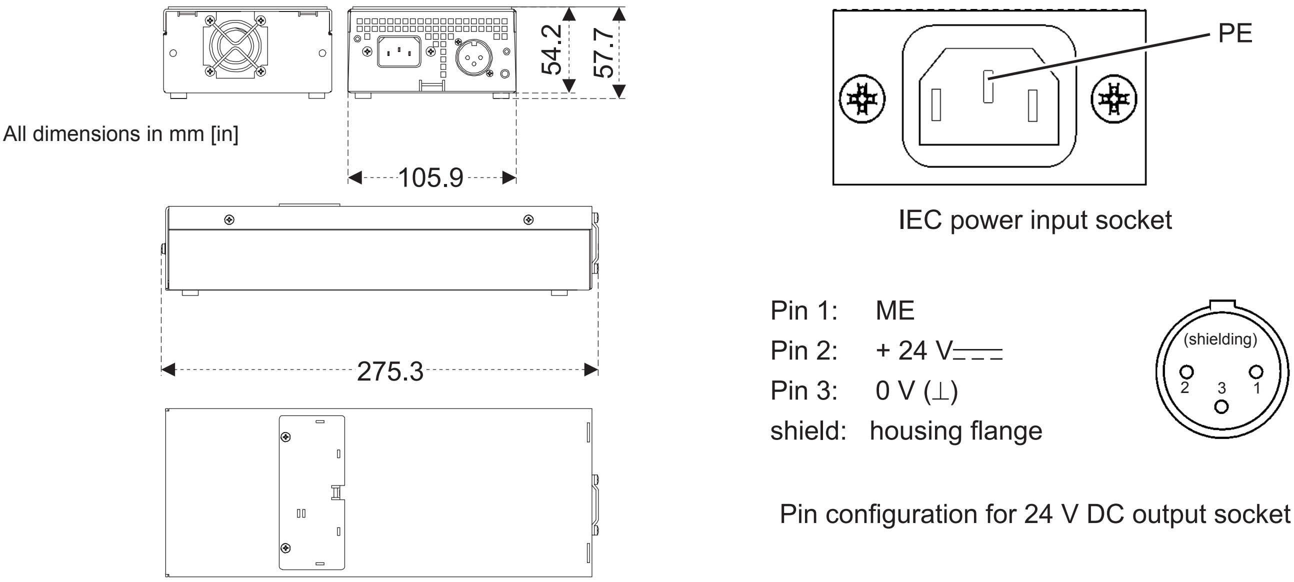


Fig. 2-3: *UPS 01 Tabletop Power Supply Unit*

Nominal input voltage	120 / 230 V∼ 50/60 Hz
Input voltage range	95–138 V∼ / 187–264 V∼, 47–63 Hz
Power consumption	max. 240 VA
Input	via rubber connector (IEC plug; ☞ Fig. 2-3).
Power input fuses	The PSU does not include user-replaceable fuses.
Nominal output voltage	24 V⎓ (± 5 %)
Nominal output current	5 A
Surge protection	current limiting typ. 110 % I_{nom}, straight response curve, short-circuit-proof
Excess temperature protection	reduction of output voltage to disconnection. Resets after cooling.
Output	3-pin XLR socket
Weight	approx. 2.5 kg (4.8 lb)
Certification	
Safety	EN 60950, UL1950, CSA22.2 NO 950-95
EMC	EN 50081-1 (emitted interference) EN 50082-2 (interference resistance), et al

2.2.1 Model-Specific Technical Data: X-STREAM XEGK

This PSU can optionally be ordered for rack installation.
Two variations are available:

- with blind front panel, connectors at the rear side
- with rear panel, connectors to the front.

Both variations are fixed to the rack by means of screws at the panels.

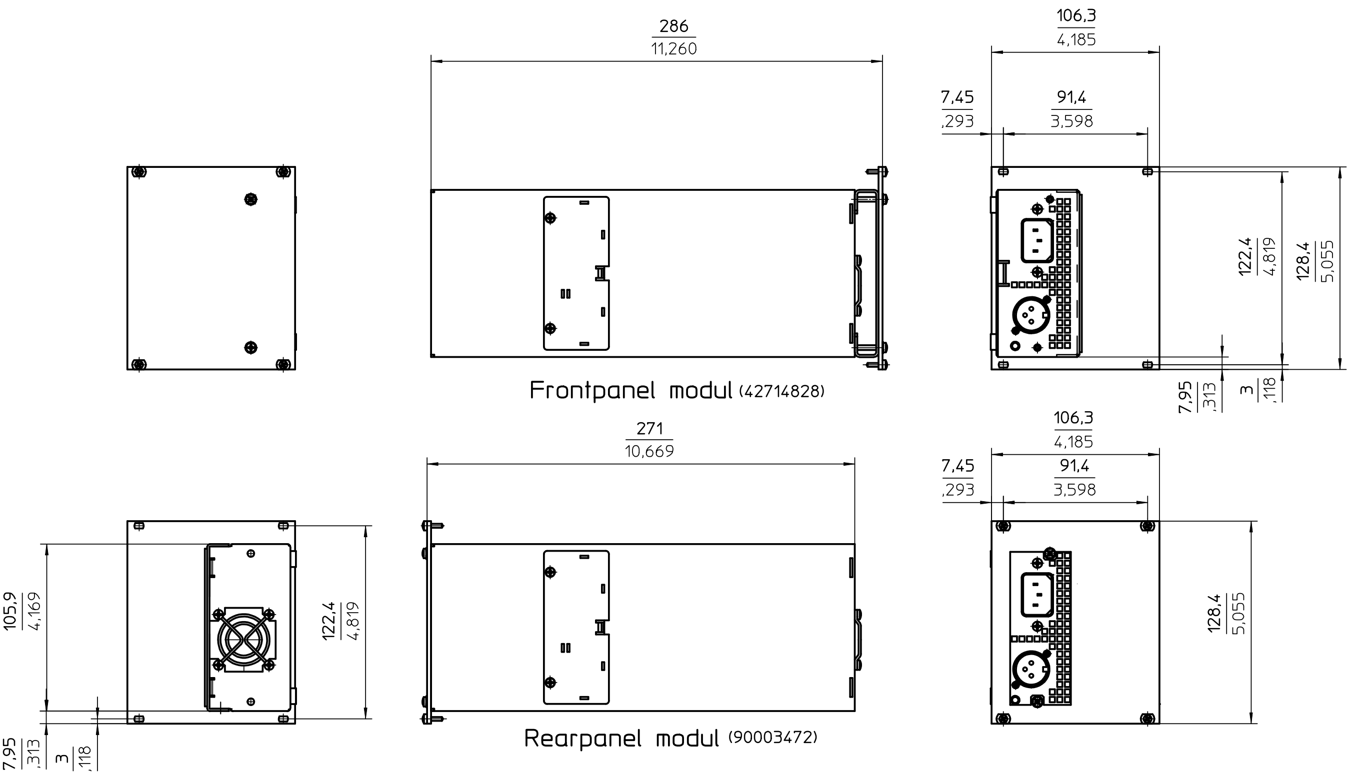


Fig. 2-4: *UPS 01 Power Supply Unit for Rack Installation*

2.2.1 Model-Specific Technical Data: X-STREAM XEGK

2.2.2 X-STREAM XEGP: 19 Inch Tabletop and Rack-Mount Models

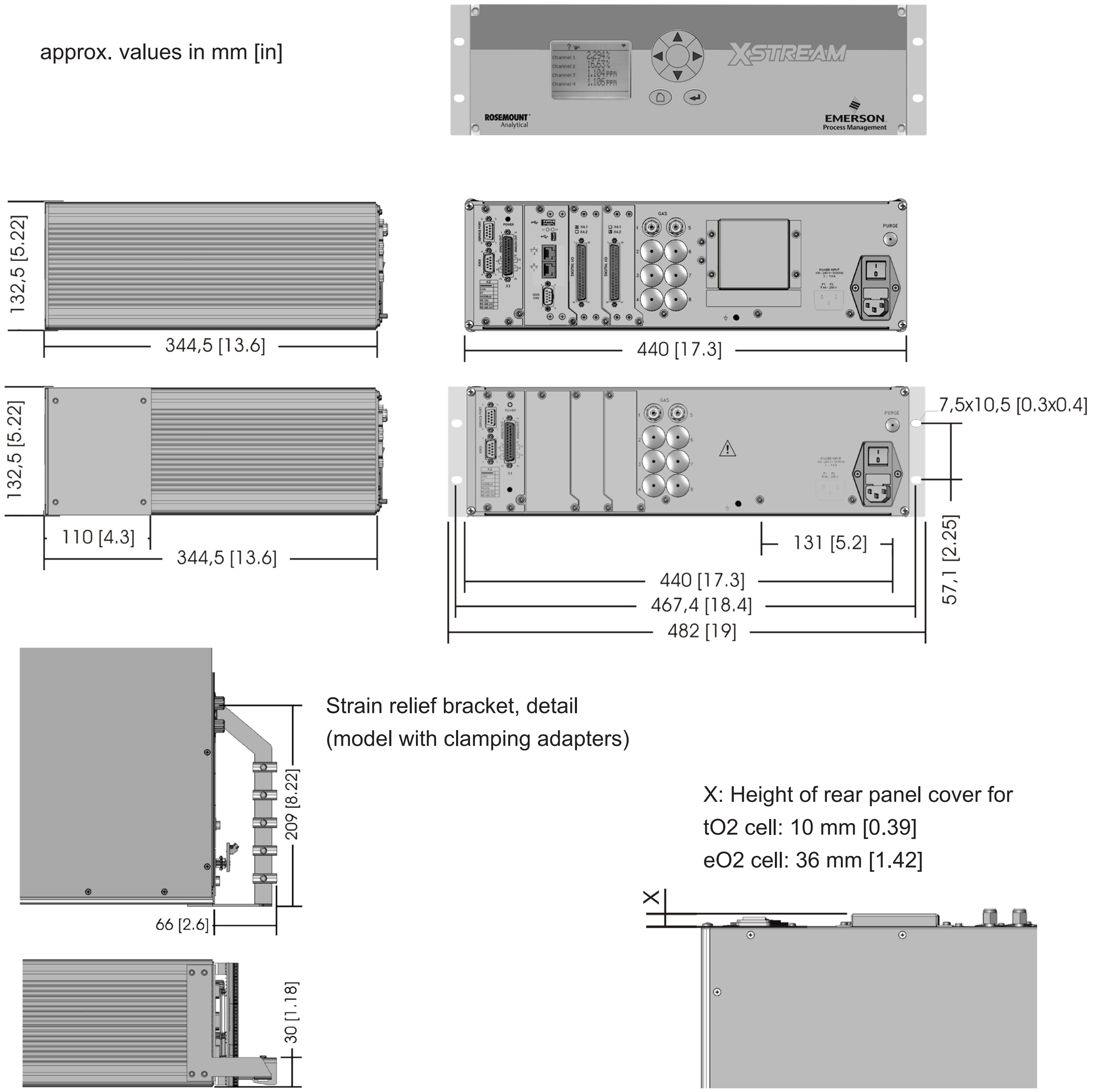


Fig. 2-5: *X-STREAM XEGP - Dimensions*

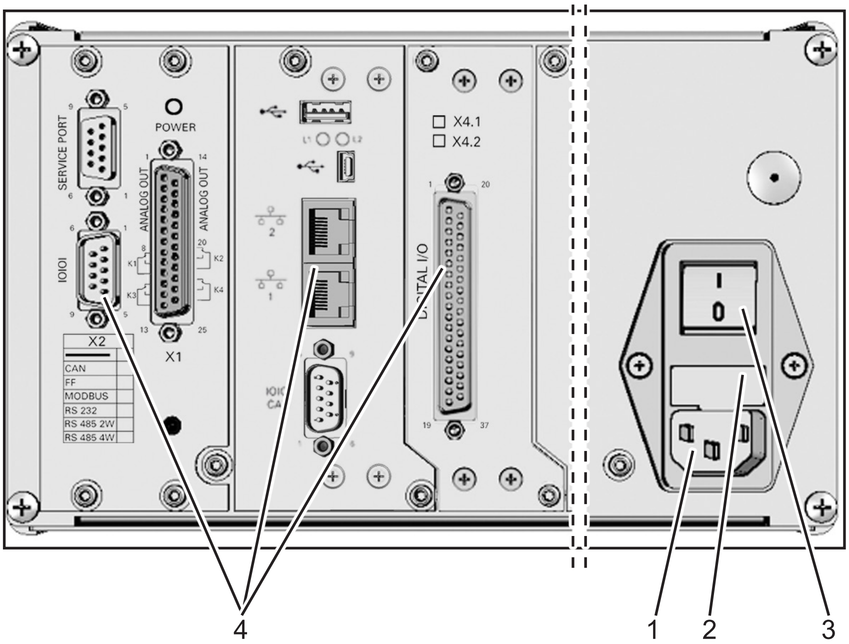
2.2.2 Model-Specific Technical Data: X-STREAM XEGP

Temperatures	
operational, max.*)	0 … +50 °C / 32 … 122 °F
storage	-20 … +70 °C / -4 … -158 °F
Weight, max	12 … 16 kg / 26.5 … 35.3 lb
IP or Type rating	IP 20 for indoor use, protected against dripping water and direct sun light
Measurement channels, max.	5
Gas connections	
max number	8
max for purging (incl. / separate)	1 separate.
material	PVDF; stainless steel (opt.)
sizes	6/4 mm; ¼"
Power supply unit	wide range, internal
Power supply	Mains supply voltage fluctuations are not to exceed ± 10 percent of the nominal voltage
nominal voltage	100–240 V∿ 50 / 60 Hz
voltage range	85–264 V∿ 47–63 Hz
nominal input current, max	
standard, max	1.3–0.7 A
w/ temperature control, max	3–1.5 A
Power input fuses	AC 230 V / T 4 A / 5x20 mm
Electrical in- and outputs	
power	IEC connector with integrated power switch & fuse holders
signals	signal cables are connected using submin-D plugs or sockets on the unit's rear panel
optional	terminals adaptors, to be installed onto the submin-D connectors
special	Ethernet: RJ45 socket; USB connectors

*): *Limitations apply to selected measurement principles and ranges,*
☞ *Measurement Specifications!*

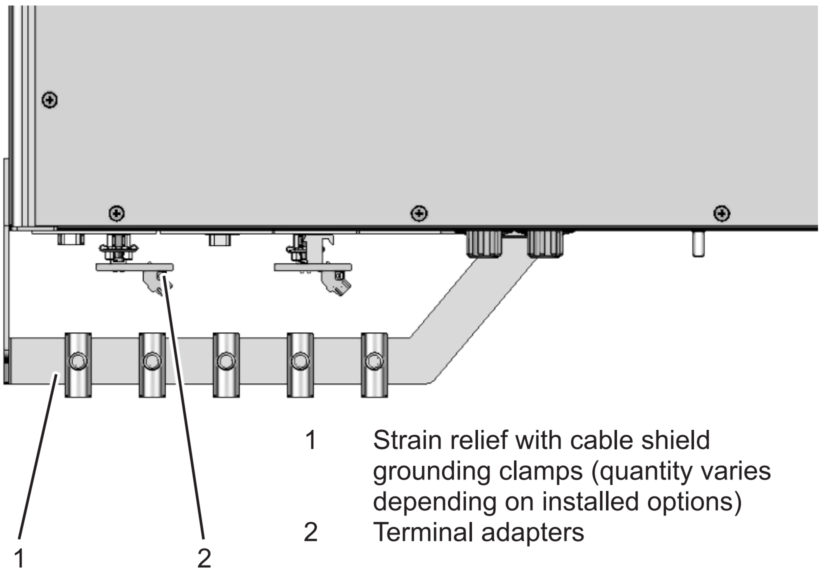
Technical Data
2

2.2.2 Model-Specific Technical Data: X-STREAM XEGP

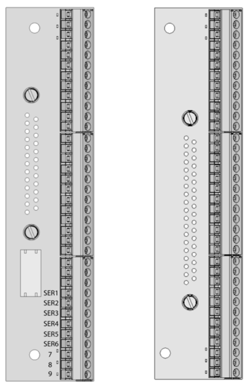


1	Power connector	3	Power switch
2	Fuse holder	4	Signal connectors (some optional)

Fig. 2-6: *X-STREAM XEGP - Power Supply and Signal Connections*



1 Strain relief with cable shield grounding clamps (quantity varies depending on installed options)
2 Terminal adapters



Terminal adapters (detail)

Fig. 2-7: *X-STREAM XEGP - Signal Connections With Screw-Type Terminal Adapters (Top View)*

2.2.3 X-STREAM XEXF: Field Housing With (XEF) Single or (XDF) Dual Compartment

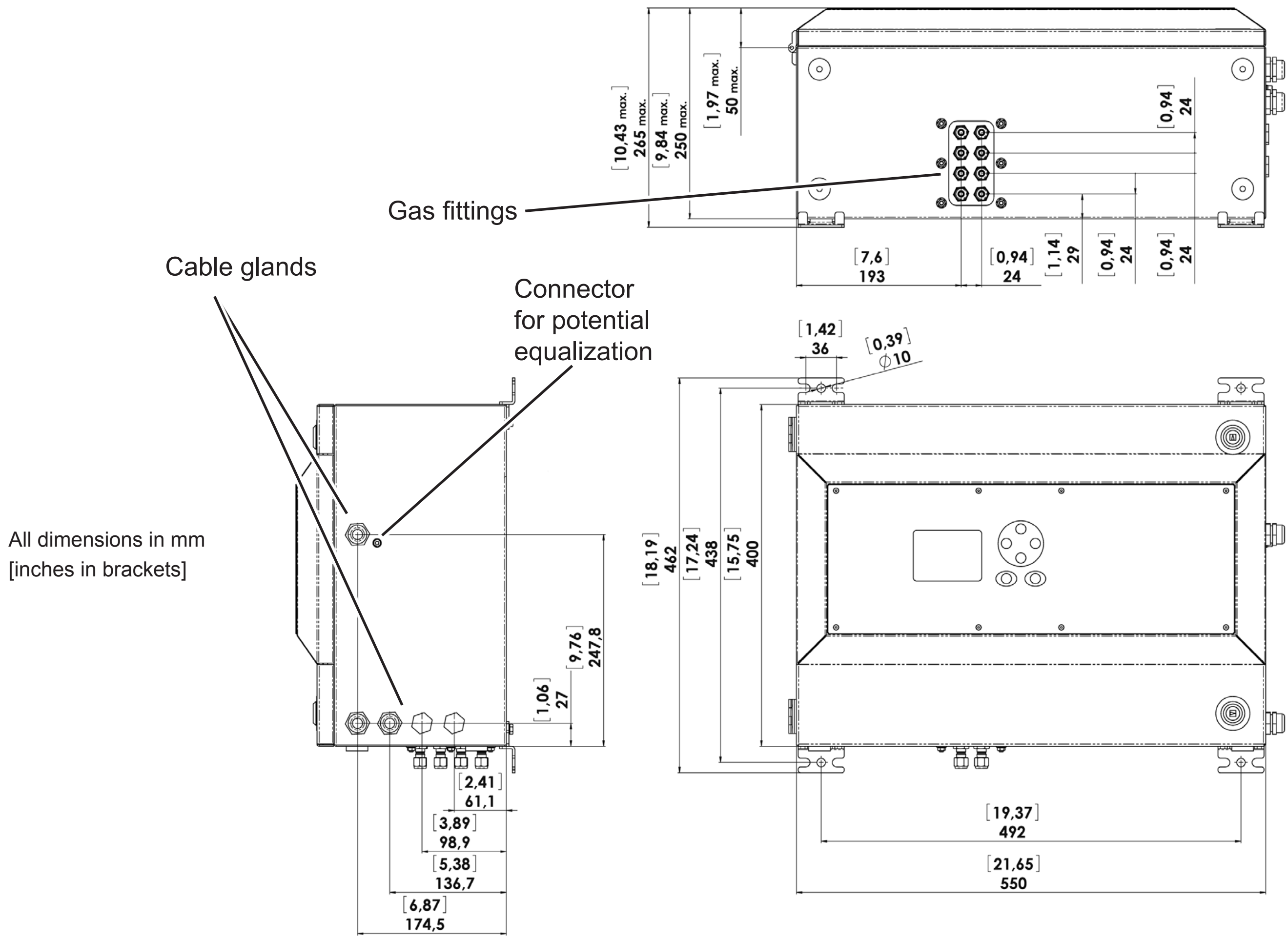


Fig. 2-8: X-STREAM XEF - Dimensions

2.2.3 Model-Specific Technical Data: X-STREAM XEXF Field Housings

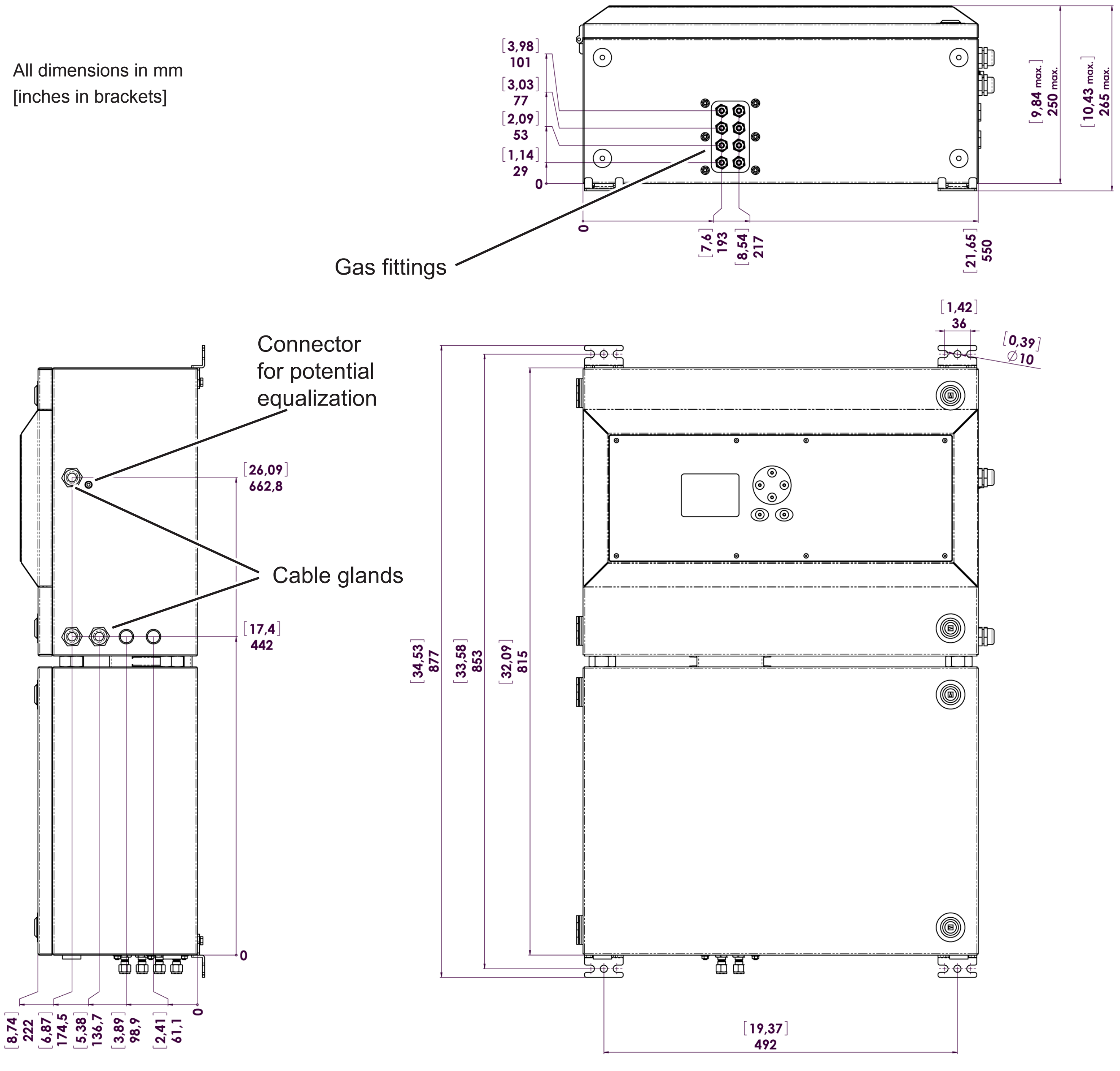


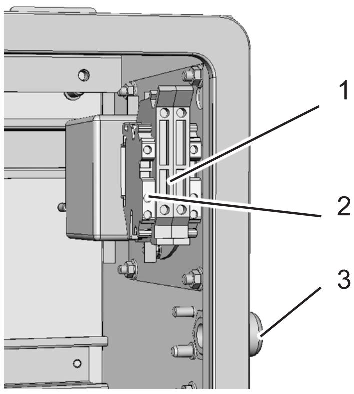
Fig. 2-9: *X-STREAM XDF - Dimensions*

2.2.3 Model-Specific Technical Data: X-STREAM XEXF Field Housings

Temperatures	
operational, max.*)	0 (-20) … +50 °C / 32 (-4) … 122 °F
storage	-20 … +70 °C / -4 … -158 °F
Weight, max	
XEF (single)	up to approx. 25 kg / 55.1 lb
XDF (dual)	up to approx. 45 kg / 99.2 lb
IP or Type rating	IP 66, Type 4X for outdoor use, protected against direct sun light
Measurement channels, max.	5
Gas connections	
max number	8
max for purging (incl. / separate)	1 separate.
material	stainless steel
sizes	6/4 mm; ¼"
Power supply unit	wide range, internal
Power supply	Mains supply voltage fluctuations are not to exceed ± 10 percent of the nominal voltage
nominal voltage	100–240 V∿ 50 / 60 Hz
voltage range	85–264 V∿ 47–63 Hz
nominal input current, max	
XEF	
standard, max	1.3–0.7 A
w/ temperature control, max	3–1.5 A
XDF	
standard, max	1.5–0.8 A
w/ temperature control, max	5.5–3 A
Power input fuses	AC 230 V / T 6.3 A / 5x20 mm
Electrical in- and outputs	
power	screw terminals with integrated fuse holders, max. 4 mm² / 11 AWG
signals	screw terminals, max. 1.5 mm² / 15 AWG
special	Ethernet: RJ45 socket; USB connectors
Cable entries	Cable glands, IP 68
permissible cable outer dia	7 … 12 mm / 0.27" … 0.47"

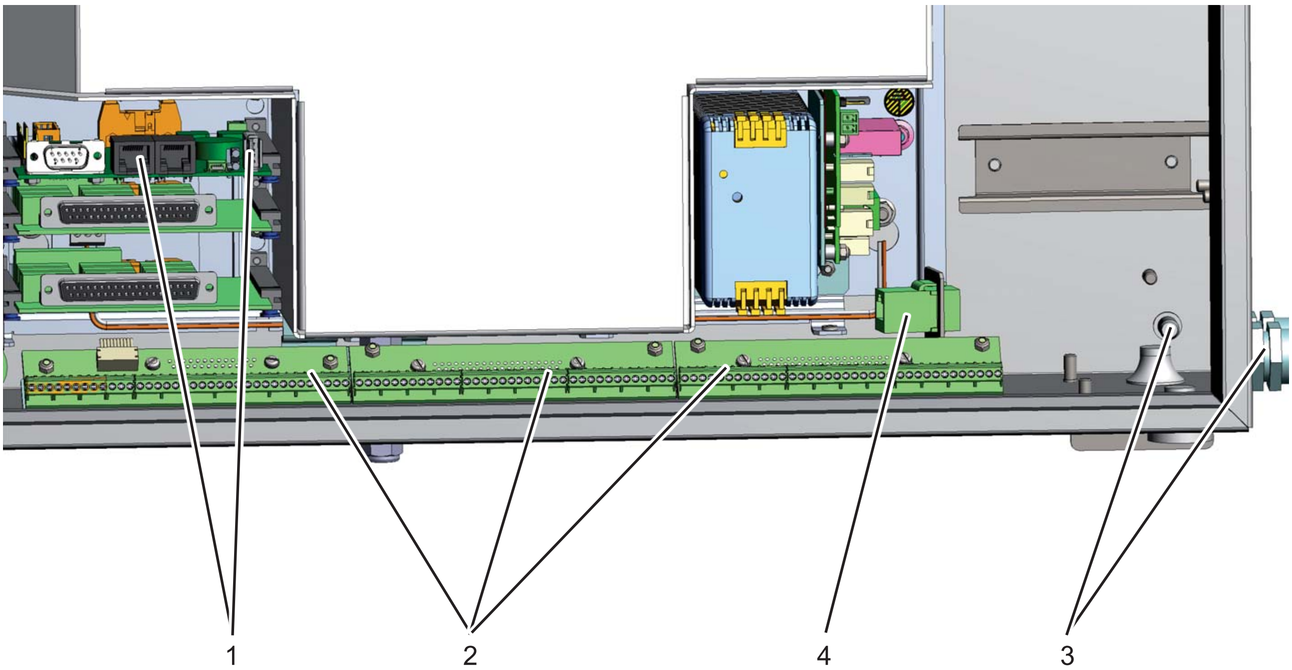
*): *Limitations apply to selected measurement principles and ranges,*
☞ *Measurement Specifications!*

2.2.3 Model-Specific Technical Data: X-STREAM XEXF Field Housings



1 Power supply terminals with fuse holders
2 Grounded conductor clamp (PE)
3 Power supply cable entry

Fig. 2-10: *X-STREAM XEXF Field Housings - Power Supply Terminals / Fuse Holders*



1 Ethernet Service Port & USB connection
2 Analog & digital I/O terminal strips
3 Max. 4 signal cables entries
4 Ethernet network connection

Note!
Depending on the actual analyzer configuration not all shown terminal strips may be installed!

Fig. 2-11: *X-STREAM XEXF Field Housings - Signal Terminals*

2.2.4 X-STREAM XEFD: Flameproof Housing

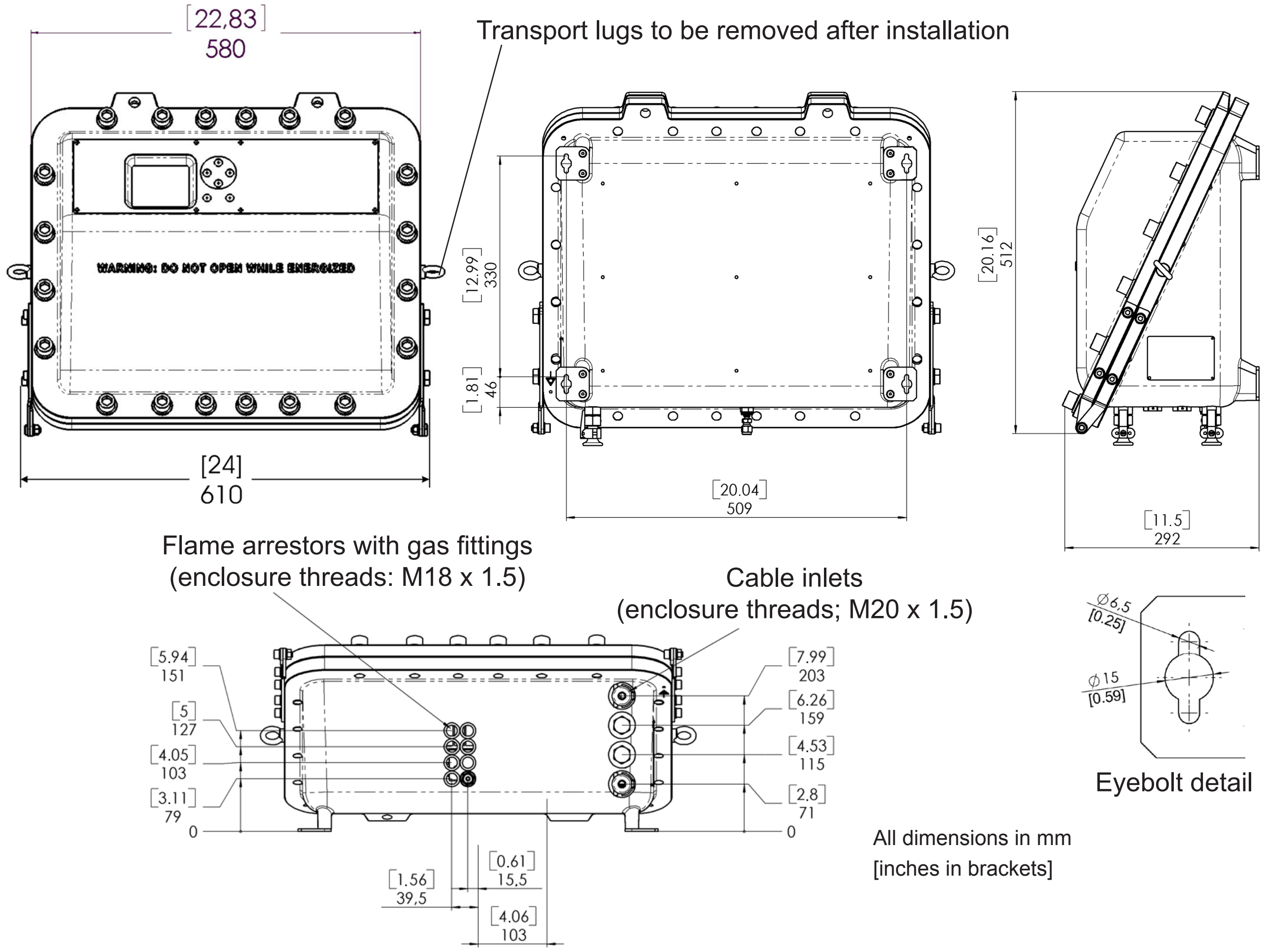


Fig. 2-12: X-STREAM XEFD - Dimensions

2.2.4 Model-Specific Technical Data: X-STREAM XEFD

Temperatures	
operational, max.*)	0 (-20) … +50 °C / 32 (-4) … 122 °F
storage	-20 … +70 °C / -4 … -158 °F
Weight, max	up to approx. 63 kg / 138.6 lb
IP or Type rating	IP 66, Type 4X for outdoor use, protected against direct sun light
Measurement channels, max.	5
Gas connections	
max number	8
max for purging (incl. / separate)	2 incl..
material	stainless steel
sizes	6/4 mm; ¼"
Power supply unit	wide range, internal
Power supply	Mains supply voltage fluctuations are not to exceed ± 10 percent of the nominal voltage
nominal voltage	100–240 V∿ 50 / 60 Hz
voltage range	85–264 V∿ 47–63 Hz
nominal input current, max	
standard, max	1.3–0.7 A
w/ temperature control, max	3–1.5 A
Power input fuses	AC 230 V / T 4 A / 5x20 mm
Electrical in- and outputs	
power	screw terminals with integrated fuse holders, max. 4 mm² / 11 AWG
analog and digital I/O signals	screw terminals, max. 1.5 mm² / 15 AWG
special	Ethernet: RJ45 socket; USB connectors
Cable entries	to be supplied by customer, see separate insturction manual for flameproof analyzers

*): *Limitations apply to selected measurement principles and ranges,*
☞ *Measurement Specifications!*

2.2.4 Model-Specific Technical Data: X-STREAM XEFD

1 Power terminals with integrated fuse holders
2 Protective earth terminal (PE)
3 Power cable entry
4 EMI power supply filter

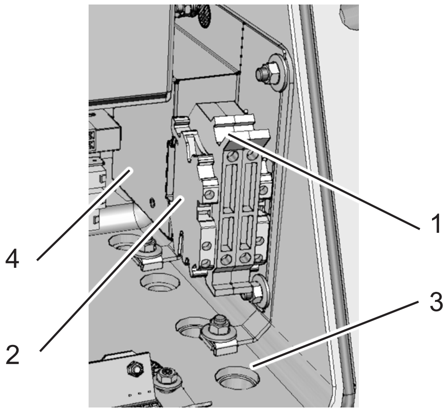
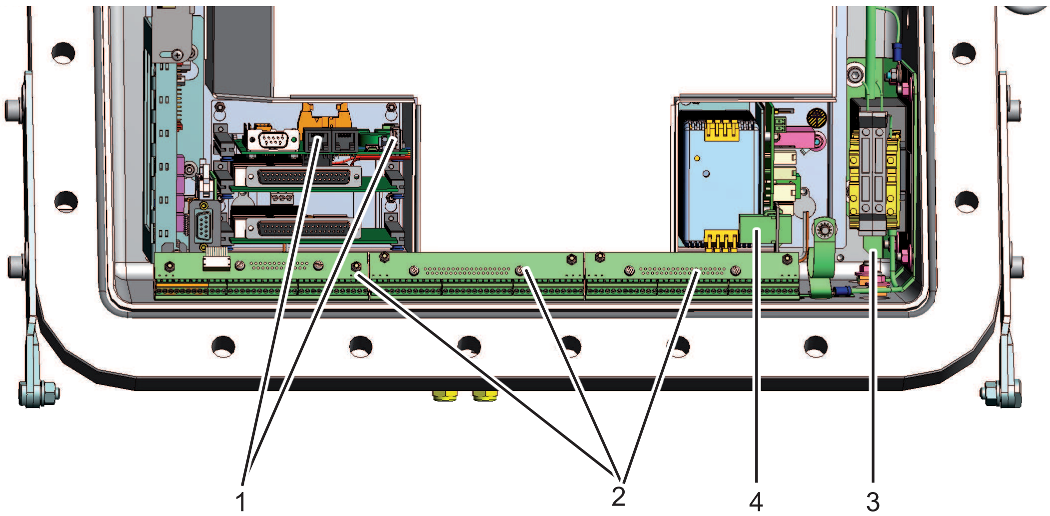


Fig. 2-13: *X-STREAM XEFD - Power Supply Terminals / Fuse Holders*



1 Ethernet Service Port and USB connectors
2 Analog & digital I/O terminal strips
3 4 cable entries for power and signal cables
4 Ethernet network connection

Note!
Depending on the actual analyzer configuration not all shown terminal strips may be installed!

Fig. 2-14: *X-STREAM XEFD - Signal Terminals*

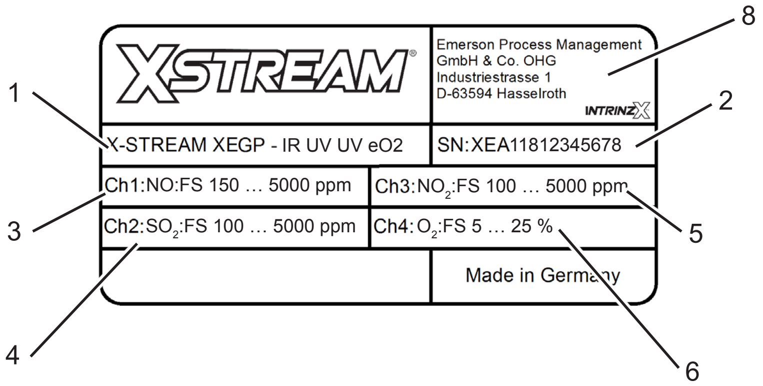
2.3 Information on Name Plate

The name plate provides details on the configuration of the unit, installed measuring techniques, sample gases and measuring ranges. It also indicates the unit's serial number.

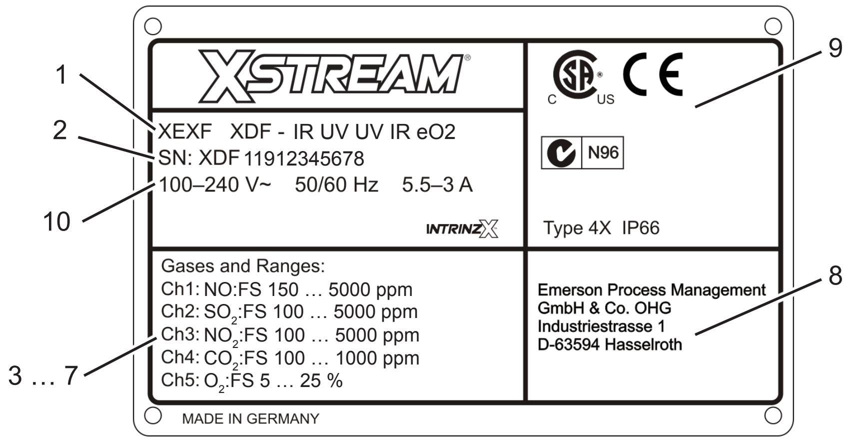
The plate is located on either the side or the rear of the unit.

Note!
Analyzers configured to be installed in hazardous areas have special name plates, described in the associated manuals.

XEGK, XEGP
Note!
XEGK max. 3 channels!



Field housings



1 Model and installed measuring techniques (here: 1x resp. 2x IR & 2x UV & electrochemical O_2)
2 Serial number
3 Channel 1: Gas and full scale ranges (here: NO, 150 to 5000 ppm)
4 Channel 2: Gas and full scale ranges (here:SO_2, 100 to 5000 ppm)
5 Channel 3: Gas and full scale ranges (here: NO_2, 100 to 5000 ppm)
6 Channel 4: Gas and full scale ranges (here:CO_2, 100 to 1000 ppm)
7 Channel 5: Gas and full scale ranges (here:O_2, 5 to 25 %)
8 Manufacturer´s address
9 Certification marks (XEGK, XEGP: on a separate label)
10 Electrical data (XEGK, XEGP: on rear panel)

Fig. 2-15: *Analyzer Name Plate (examples)*

Chapter 3
Measuring Principles

X-STREAM series analyzers support several measuring principles depending on the gas component of interest. This provides best possible results, as the measurement can be chosen to optimally fit the characteristics of the gas to be measured with respect to the application. The following sections introduce the available measuring principles highlighting their specific characteristics.

3.1 Infrared Measurement (IR) Ultraviolet Measurement (UV)

The non-dispersive measurement methods described in this section utilize gas specific light absorption in order to discriminate between different gases. This is possible, as any gas possesses distinct absorption characteristics. The selective measurement of these absorption lines can be used to identify gas components. The amount of light absorbed by the absorption lines is a direct measure of the gas concentration.

One can distinguish between two different types of non-dispersive measurements differing how wavelength selectivity is accomplished. It is essential for gas specific concentration measurements, to selectively detect only light of the absorption line wavelengths of the gas of interest. Typically a gas selective detector is used for NDIR measurements. For NDUV the selectivity is achieved by an additional optical filter, as the detector itself is not wavelength selective. In some applications, a pyrodetector is used for NDIR measurements. This type of detectors is not wavelength selective, hence these setups also use an optical filter to narrow their wavelength response function.

The assembly of a NDIR and NDUV channel is shown in Fig. 3-3. For NDIR a broad-band IR light source is used to generate the light, while NDUV measurements utilize a narrowband UV fluorescence source, already adopted for the absorption lines of the gas of interest. Part of this adoption is done by a specially selected optical filter in the adaptor cell.

The diameter of the light beam emitted from the sources is adjusted to completely fill the opening of the split analysis cell. After traversing the analysis cell, the light passes through a filter cell which adjusts the beam diameter to the chopper opening and the diameter of the active detector area. The chopper wheel used is designed to allow an intrinsically referenced measurement. The details of this new patent pending method are described in section 3.1.1.

Which measurement (UV / IR) to use for a specific application depends on the gas component to be measured and the required measurement performance.

3.1.1 IntrinzX Technology

The IntrinzX technology is an enhancement of the well established “proof peak” technology with automatic sensitivity control, known from the MLT gas analyzer series. While the “proof peak” provided only one reference measurement per chopper wheel revolution, the IntrinzX technology provides four reference measurements per revolution. The patent pending IntrinzX technology has been introduced into the market with the launch of the X-STREAM X2 gas analyzers.

Using the new IntrinzX chopper wheel, the reference and the measurement signal are modulated with 4 and 5 times the basic revolution frequency, respectively. As a result, the proof peak process is integrated into the measurement information, in contrast to being artificially inserted in the measurement signal.

Frequency filtering separates the sum signal into measurement and reference signal (Fig. 3-1). This results in a permanently referenced signal by dividing the integrated reference level by the integrated measurement level for each revolution.

Therefore the IntrinzX technology provides many outstanding features:

- High dynamic measurement ranges (e.g. 0-200 to 50,000 ppm CO), which cannot be obtained with standard photometric technologies
- Reduced temperature dependency
- High sensitivity for lowest measuring ranges

This leads to cost saving effects for the customer:

- Fewer number of benches & cells
- Easier field repair and replacement of parts
- Easy adjustment of low measuring ranges in the field
- Reduced maintenance
- Extended span calibration intervals
- Minimized demand for test gases

Due to the inherent correlation between reference and measurement side, span calibration can often be achieved by zero calibration.

The above listed IntrinzX features offer a high degree of flexibility with regards to applications:

- One bench enables measurements of low & high ranges
- Low & high concentration in raw and clean gases
- Small and large ranges before and after scrubbers
- Measurement of carbon bed breakthrough / catalyst efficiency
- Mobile measurements at different sampling points / locations
- Easy adaption to different applications (universities, laboratories)
- Supports automotive engine testing
- Benches to be used in TOC applications for measurements of low and high carbon content

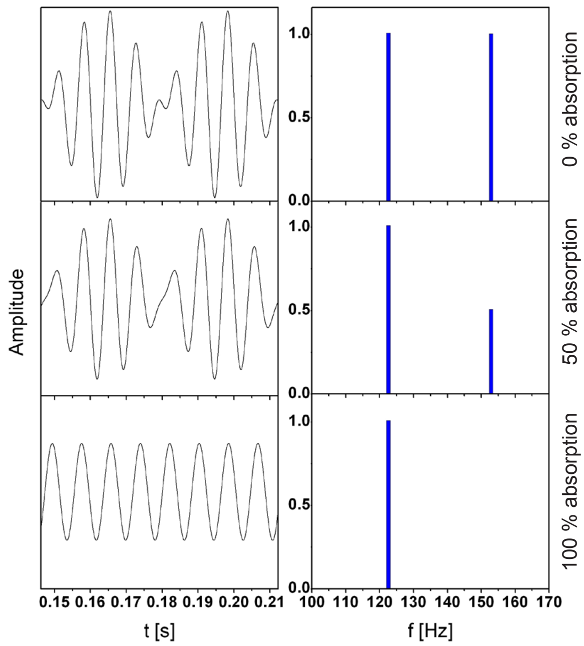


Fig. 3-1: *IntrinzX Signal Forms*

3.1.2 NDIR Detector

The standard detector used for NDIR measurements is an opto pneumatic detector. It consists of two chambers, filled with gas and connected via a small channel (Fig. 3-2). The gas filling is chosen to provide maximum overlap with the gas to be measured. Usually the gas to be measured itself is used.

A micro flow sensor, placed in the connecting channel, measures the flow between both chambers. As light is absorbed by the gas in the absorption chamber the gas temperature changes resulting in an increase of volume of the heated gas. The gas expands and flows towards the compensation chamber. When the chopper closes, no light is absorbed and thus temperature and volume of the gas in the absorption chamber decrease. Gas flows back from the (now) hotter compensation chamber into the absorption chamber. The absolute flow, detected by the micro flow sensor, in both cases is therefore a measure for the light absorbed while the chopper is open. This directly correlates to the amount of light not absorbed in the analysis cell and therefore to the concentration of the measurement gas inside the analysis cell.

Using the divided analysis cell and the IntrinzX chopper wheel enables simultaneous detection of measurement and reference signal.

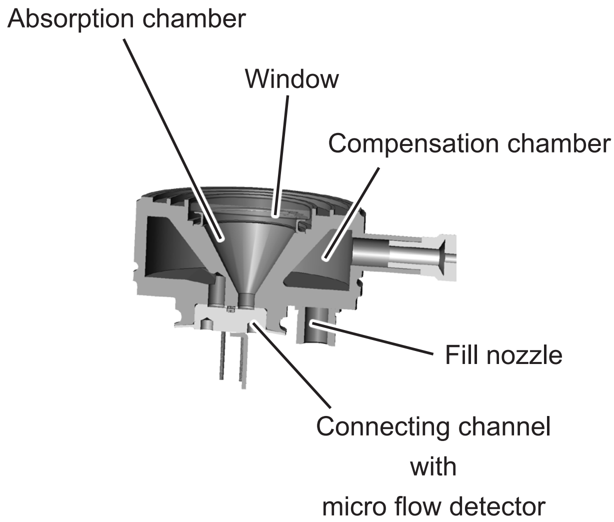
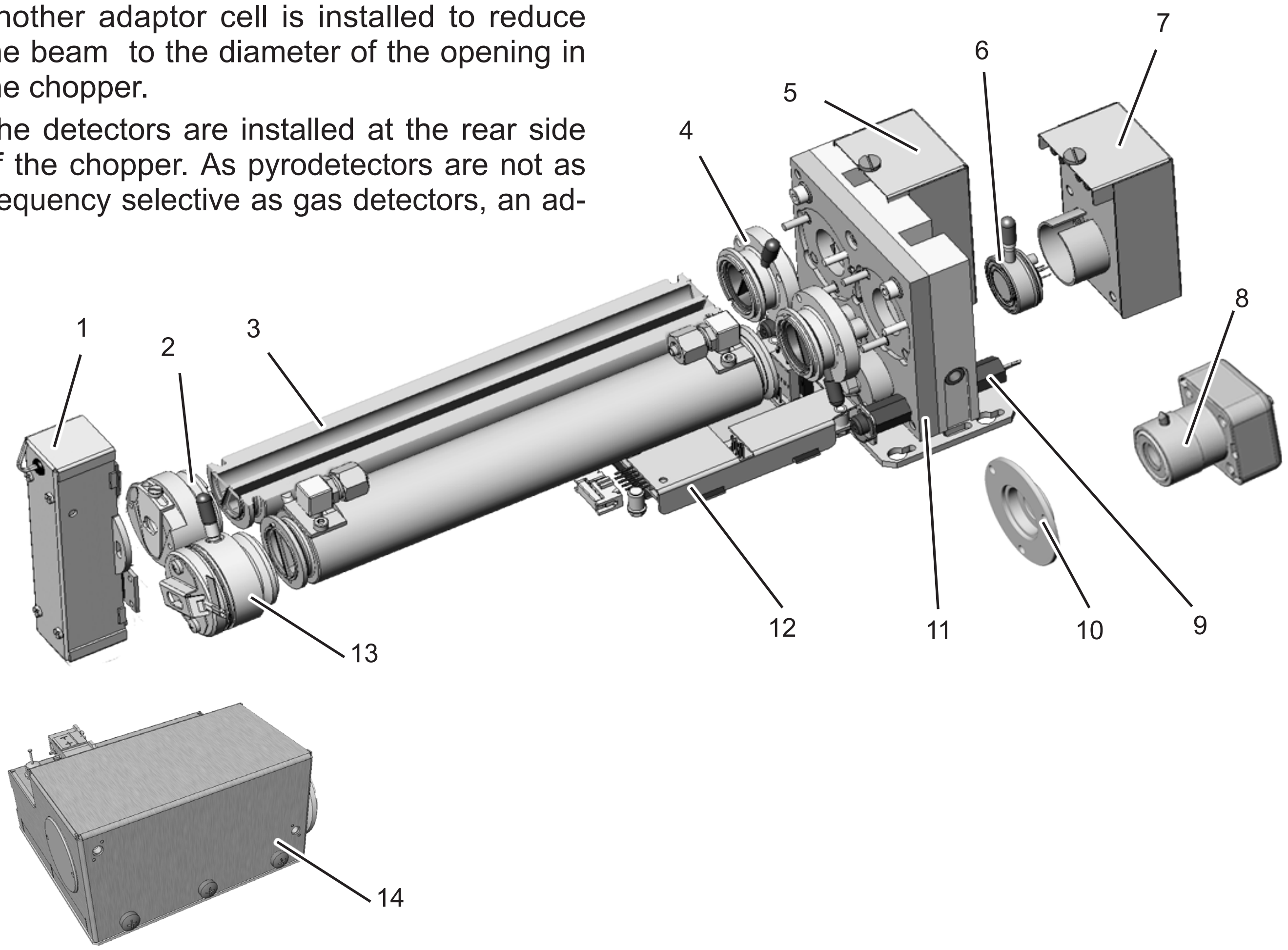


Fig. 3-2: *Gas Detector Design Principle*

3.1.3 Technical Implementation

The radiation emitted by an IR or UV/EDL source passes an adaptor cell, widening the beam to completely fill out the analysis cell´s diameter. At the opposite side of the cell, another adaptor cell is installed to reduce the beam to the diameter of the opening in the chopper.

The detectors are installed at the rear side of the chopper. As pyrodetectors are not as frequency selective as gas detectors, an additional filter has to be installed when using pyrodetectors, limiting the bandwidth of radiation passing the chopper.



1 UV source
2 Adaptor cell
3 Analysis cell (internal view)
4 Filter cell
5 UV detector
6 Gas detector
7 IR detector electronics
8 Pyro detector (alternatively)
9 Temperature sensor
10 Filter for pyro detector assembly
11 Chopper
12 Chopper electronics
13 IR source
14 EDL

Fig. 3-3: *Photometer Assembly Principle*

3.2 Oxygen Measurement

Three different principles are used for measuring oxygen concentrations. The principle used in your specific instrument is given by the channel code (sample gas designator) on the nameplate label (☞ figure on page 2-22):

pO_2 = paramagnetic sensor
eO_2 = electrochemical sensor
tO_2 = trace oxygen sensor

3.2.1 Paramagnetic Measurement

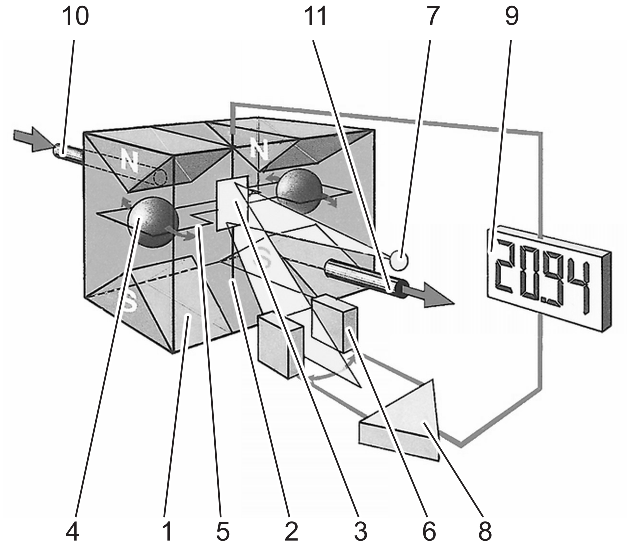
This oxygen measurement principle is based on the paramagnetic characteristic of oxygen molecules:

Two cavernous glass spheres filled with nitrogen are arranged in a dumb¬bell configuration. This dumbbell with a platinum wire is mounted rotatable inside a strong inhomogeneous magnetic field. A small mirror is fixed on the front side of the dumbbell, which reflects light from a light source towards two photo detectors (Fig. 3-4). The dumbbell is surrounded by another platinum wire, which is bent like a coil around each glass sphere. It generates a magnetic field when supplied by an electric current to control the dumpbell´s deflection.

Oxygen molecules within the sample gas are attracted be the magnetic field due to their paramagnetic characteristic and will be concentrated into the area of the highest field strength in the inhomogeneous field. In doing so they displace the nitrogen filled glass spheres. This generates a torque on the dumbbell which depends on the oxygen concentration in the sample gas. The dumbbell starts to rotate and the light reflected by the mirror on the dumbbell generates a signal on one of the two photo detectors. Initiated by the photo detector signal a preamplifier drives a current through the platinum wire surrounding the dumbbell. This generates a compensating magnetic field and rotates the dumbbell back into its zero position. The compensating current gives a direct and linear measure for the oxygen concentration within the sample gas.

The paramagnetic oxygen detector also con¬tains a temperature sensor for compensation and a heating ele¬ment to keep the detector at approx. 55 °C.

Several variations are available including corrosion resistant and/or solvent resistant versions.



1	Permanent magnet	6	Photodetector
2	Platinum wire	7	Light source
3	Mirror	8	Preamplifier
4	Glass ball	9	Display
5	Loop	10	Gas inlet
		11	Gas outlet

Fig. 3-4: *Paramagnetic Oxygen Sensor - Assembly Principle*

3.2.1.1 Cross Interferences by Accompanying Gases

The Table below by selected gases shows, how accompanying gases interfere the paramagnetic oxygen measurement. A comprehensive list of gases and their cross interferences is given in the standard IEC 61207-3.

If the concentration of such gases is already given at time of enquiry, this interference may be taken into account during factory startup and thus minimized (option).

100 % Gas		Zero-level effect % O_2
Acetylene	C_2H_2	-0.29
Ammonia	NH_3	-0.20
Argon	Ar	-0.25
Bromine	Br_2	-2.02
1.2-Butadiene	C_4H_6	-0.49
1.3-Butadiene	C_4H_6	-0.49
n-Butane	C_4H_{10}	-1.26
i-Butene	C_4H_8	-1.30
cis 2-Butene	C_4H_8	-0.89
trans 2-Butene	C_4H_8	-0.92
Carbon dioxide	CO_2	-0.30
Carbon monoxide	CO	+0.07
Chlorine	Cl_2	-0.94
Cyclohexane	C_6H_{12}	-1.84
Ethane	C_2H_6	-0.49
Ethylene	C_2H_4	-0.22
Helium	He	+0.33
n-Heptane	C_7H_{16}	-2.40
n-Hexane	C_6H_{14}	-2.02
Hydrogen	H_2	+0.26
Hydrogen bromide	HBr	-0.76

100 % Gas		Zero-level effect % O_2
Hydrogen chloride	HCl	-0.35
Hydrogen flouride	HF	+0.10
Hydrogen iodide	HI	-1.19
Hydrogen sulphide	H_2S	-0.44
Iodine	I	-2.40
Isobutane	C_4H_{10}	-1.30
Krypton	Kr	-0.55
Laughing gas	N_2O	-0.23
Methane	CH_4	-0.18
Neon	Ne	+0.17
Nitric acid	HNO_3	+0.43
Nitrogen	N_2	±0.00
Nitrogen dioxide	NO_2	+20.00
Nitrous oxide	NO	+42.94
n-Octane	C_8H_{18}	-2.78
n-Pentane	C_5H_{12}	-1.68
Oxygen	O_2	100
Propane	C_3H_8	-0.87
Propylene	C_3H_6	-0.64
Vinyl chloride	C_2H_3Cl	-0.77
Water	H_2O	-0.03
Xenon	Xe	-1.05

Note!
This data is based on a temperature of 60 °C (140 °F).

Tab. 3-1: *Paramagnetic Sensor - Cross Interferences (Examples)*

3.2.1.2 Applications With Corrosive or Solvent Components

Special paramagnetic oxygen sensors are available to measure gases, containing corrosive or solvent components.

See below Tables for further information on approved solvents, and medium affected materials.

Approved solvents (inclusive accompanying disturbing components)	
Acetic acid	Heptane
Acetone	Hexane
Acrolein	Isopropanol
Aromatics	Methanol
Butadiene	Methyl acetate
Butadiene-1	Methylethylketone
Butadiene-2	Methylmercaptane
C2H2	Propadiene
C4H8	Propene
C5	Propylen oxide
C6H12	Propylene
CH3COOH	Toluene
Cyclohexane	Vinyl acetate
Cyclohexanon	Vinyl acetylene
Dimethyl sulfide	Xylene
Ethanol	i-Butyr acid
Ethene	i-Butyr aldehyd
Ethylene	i-Propylformiat
Ethylene oxid	n-Butane

Conditions

- Single or summarized concentrations **do not exceed 20 %**
- Gas passes gas cooler prior to entering the analyzer
- Gas dew point at max. 5 °C

Solvent resistant sensors have limited lifetime and are consumables!

Tab. 3-2: Solvent Resistant Paramagnetic Sensor - Approved Solvents

Component	**Measuring cell type**	
	Solvent resistant	**Corrosion resistant (Chlorine, dry)**
Case	SS 1.4571	
Pole nucleus	Tantalum	
Mirror	Glass, Rhodium	
Tension band	Platinum alloy	
Loop wire	Platinum alloy	
Supporting wire	Platinum alloy	
Cylinder	Glass	
Cylinder bushing	Ceramics	
Dumbbell	Glass	
Taring	Epoxy	Epoxy
Compound material	Plumb bob, Epoxy	Epoxy
Seals	Kalrez	Kalrez

Tab. 3-3: Paramagnetic Sensor - Medium Affected Materials

Another variation of measuring cell has the following materials in contact with the sample:

A316 stainless steel, viton ‘O’ ring, borosilicate glass, electroless nickel, platinum, platinum/iridium alloy.

For the solvent resistant version of this cell, the ‘O’ ring made of viton is replaced by a chemraz® model.

3.2.2 Electrochemical Measurement

This sensor utilizes the principle of galvanic cells, Fig. 3-5 shows the design.

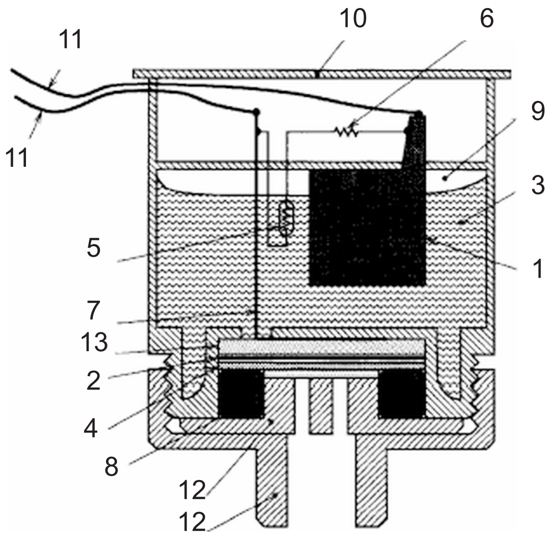
For storage and handling instructions, and safety data ☞ Chapter 7 “Maintenance”.

The electrochemical oxygen (eO_2) sensor‘s key components are a lead anode (1) and a gold cathode (2) surrounded by a special acid electrolyte (3).

The gold electrode is integrated solid with the membrane,which is a non-porous fluororesin membrane. Oxygen which barely diffuses through the membrane is electrochemically reduced on the gold electrode.

The temperature compensating thermistor and adjusting resistance are connected between the cathode and anode. The current generated by oxygen reduction is converted into a voltage by these resistances.

The value of the current flowing to the thermistor and resistance varies in proportion to the oxygen concentration of the measuring gases which contact the membrane. Therefore, the voltage at the terminal of the resistances is used for the sensor output to measure the oxygen concentration.



1 Anode (lead)
2 Cathode (Gold)
3 Electrolyte solution
4 Membrane
5 Thermistor
6 Resistance
7 Titanum wire
8 O-Ring
9 Pressure compensating volumes
10 Lid
11 Electrical connections
12 Lids
13 Current collector

Fig. 3-5: *Electrochemical O_2 Sensor - Design Principle*

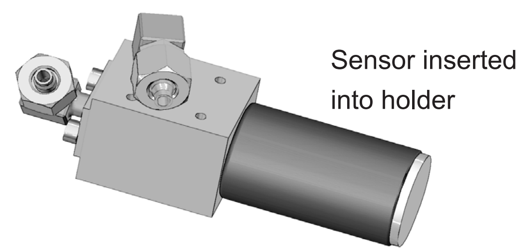


Fig. 3-6: *Electrochemical O_2 Sensor - Assembly*

3.2 Oxygen Measurement

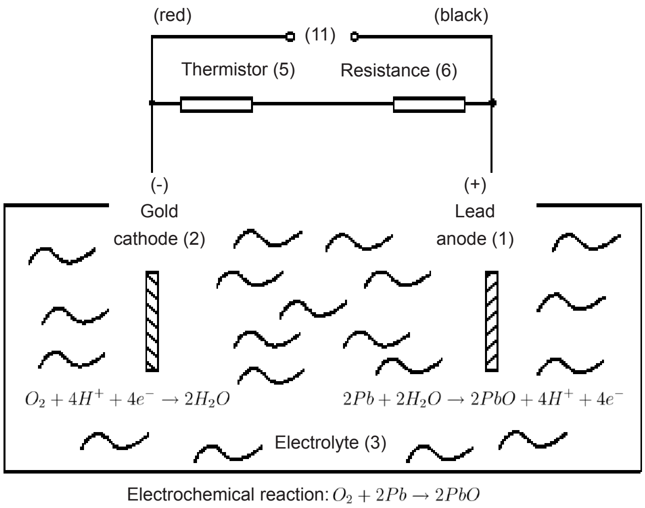


Fig. 3-7: *Electrochemical Reaction of Oxygen Sensor*

In consequence of its design the sensor‘s lifetime is limited and depends on theoretical designed life and oxygen concentration. The sensor output can be taken as a rough criterion for end of lifetime: The sensor is weared when the output in atmosphere is below 70 % of the initial output. The period till this can be calculated by

$$\textit{Lifetime} = \frac{\textit{designed life (\% hours)}}{O_2 \textit{ concentration (\%)}}$$

The sensor‘s designed lifetime under constant conditions of ambient temperature 20 °C is approx. **900,000 % hrs.**

The lifetime at 21 % oxygen is then calculated to approx. **42,857 hrs, corresponding to approx. 5 years.**

An indicator for end of lifetime is a reduced output signal. In this case the sensor must be replaced to ensure accurate measurements (☞ Chapter 7 “Maintenance”).

Note!

The given values are for reference only! The expected lifetime is greatly affected by the temperature of the environment in which the sensor is used or stored (operation at 40 °C halves lifetime).

Increases or decreases in atmospheric pressure have the same effect as increasing or decreasing oxygen concentrations.

3.2.2.1 Special Hints

Due to the measuring principle the electrochemical oxygen cell requires a minimum internal consumption of oxygen (residual humidity avoids drying of the cell). Supplying cells continuously with dry sample gas of low grade oxygen concentration or with sample gas free of oxygen could result in a reversible detuning of O_2 sensitivity. The output signal will become unstable, but response time remains constant.

For correct measurement the cell needs continuously to be supplied with concentrations of at least 0.1 Vol.-% O_2 . We recommend to use the cells if need be in alternating mode, means to purge cells with conditioned (not dried, but dust removed) ambient air when measurement pauses.

If it is necessary to interrupt the oxygen supply for several hours or days, the cell has to regenerate (supply cell for about one day with ambient air). Temporarily flushing with nitrogen (N_2) for less than 1 h (e.g. for analyzer zeroing purpose) has no influence on measuring characteristics.

This sensor is not suitable for

- **anorganic gases containing chlorene or flourene!**
- **sample gases containing**
  - **FCHCs**
  - **ozone,**
  - **H_2S (> 100 ppm)**
  - **NH_3 (> 20 ppm).**

For a number of other interfering gases ☞ Tab. 3-4.

Gas		Concen-tration	Interference Level
Carbon monoxide	CO	0-100 %	no effect
Carbon dioxide	CO_2	0-100 %	no effect
Nitric monoxide	NO	0-1 %	no effect
Nitrogen dioxide	NO_2	0-1 %	no effect
Sulfur dioxide	SO_2	0-3 %	3 %
Hydrogen sulfide	H_2S	0-3 %	no effect
Ammonia	NH_3	0-3 %	1 %
Hydrogen	H_2	0-100 %	no effect
Hydrogen chloride	HCl	0-3 %	1 %
Benzene	C_6H_6	0-100ppm	1 %
Methane	CH_4	0-100 %	no effect

Tab. 3-4: *Electrochemical Oxygen Measurement - Cross Interference by Accompanying Gases*

Note for XEGP analyzers!
If the XEGP analyzer features thermostate control, the eO2 sensor block is installed at the XEGP rear panel.

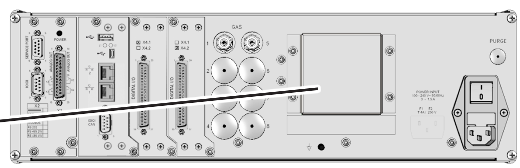


Fig. 3-8: *Cover for EO2 Sensor Block At Rear Panel*

3.2.3 Electrochemical Trace Oxygen Measurement

For trace oxygen measurements (tO_2)another electrochemical sensor technology is used, see Fig. 3-9. The sensor is a self contained disposable unit which requires no maintenance. The sensor utilizes the principle of electrochemical reaction to generate a signal proportional to the oxygen concentration in the sample.

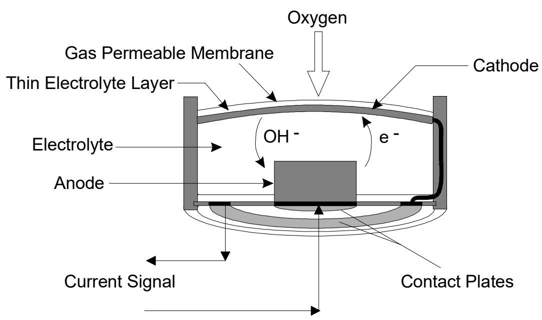


Fig. 3-9: *Trace Oxygen Sensor Design Principle*

The sensor consists of a cathode and anode which are in contact via a suitable electrolyte. The sensor has a gas permeable membrane which covers the cathode allowing gas to pass into the sensor while preventing liquid electrolyte from leaking out.

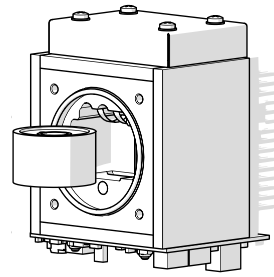
As the sample diffuses into the sensor, any oxygen present will dissolve in the electrolyte solution and migrate to the surface of the cathode. The oxygen is reduced at the cathode. Simultaneously, an oxidation reaction is occurring at the anode generating four electrons. These electrons flow to the cathode to reduce the oxygen.

The representative half cell reactions are:

anode: $4OH^- + 2Pb \rightarrow 2PbO + 2H_2O + 4e^-$

cathode: $4e^- + 2H_2O + O_2 \rightarrow 4OH^-$

in total: $2Pb + O_2 \rightarrow 2PbO$



This flow of electrons constitutes an electric current which is directly proportional to the concentration of oxygen present in the sample. In the absence of oxygen, no oxidation/reduction reaction occurs and therefore no current is generated. This allows the sensor to have an absolute zero.

3.2.3.1 Special Hints

This sensor is a consumable and requires replacement periodically. (To determine if the sensor requires replacement, see the troubleshooting section of this manual)

Remaining lifetime counts down when the sensor is in contact with oxygen.

For above reasons, the analyzer is shipped with the sensor as extra item in a sealed bag!

The sensor must be installed before analyzer startup, according the instructions shipped with the sensor!

Always consult the separate instructions, shipped with the sensor, before intending to start calibrations! Violation may result in a damaged sensor!

Prolonged exposure of the sensor to air can cause extended start up time, reduction of

3.2 Oxygen Measurement

performance or damage to the sensor. Do not remove the sealing caps until all associated sample handling components are installed and the instrument is fully ready for installation.

After replacement purge gas paths with inert gas (nitrogen (N_2) or sample gas as soon as possible to avoid prolonged exposure of the sensor to high concentrations of oxygen. The longer the sensor is exposed to air, the longer it will take for the sensor to recover to low ppm levels. When installing a new sensor or starting the instrument for the first time, it may take as long as eight hours for the analyzer to purge down to the lowest operating range.

After initial startup or startup following a prolonged shutdown, the analyzer may require extended time to recover to the range of measurement. Commonly, this is caused by the introduction of ambient air into the sample and/or vent lines to the sensor. The presence of higher than normal levels of oxygen at the sensor will cause the sensor electrolyte to become saturated with dissolved oxygen. When the instrument is placed in operation, the sensor must now consume all excess dissolved oxygen above the desired measuring level.

All analyzers with electrochemical tO_2 cell have to be purged with inert gas (Nitrogen, N_2) prior to disconnecting the gas lines! Then the gas line fittings have to be closed for transport or depositing the analyzer.

While handling the sensor, always consider the documentation provided together with the sensor, especially the information on the included material (safety data) in the attachment of the documentation!

Note for XEGP analyzers!
If the XEGP analyzer features a thermostate control, the tO2 sensor block is installed at the XEGP rear panel.

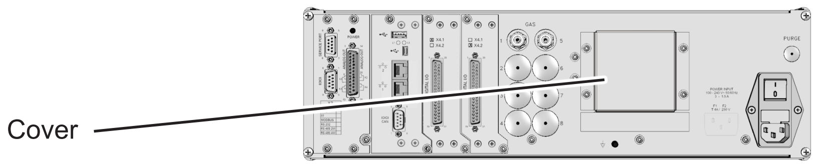


Fig. 3-10: *Cover for TO2 Sensor Block At Rear Panel*

3.3 Thermal Conductivity Measurement

Thermal conductivity is the property of a material that indicates its ability to conduct heat.

Thermal conductivity measurement primarily is used for measuring concentrations of hydrogen (H_2) and helium (He). These gases are characterized by a specific thermal conducitivity, differing clearly from that of other gases (☞ Tab. 3-5).

Gas		λ in mW / cm K
		50 °C
Air	N_2/O_2	276
Ammonia	NH_3	270
Argon	Ar	189
Butane	C_4H_{10}	102
Carbon Dioxide	CO_2	184
Carbon Monoxide	CO	267
Chlorine	Cl_2	371
Helium	He	1580
Hydrochloric Acid	HCl	151
Hydrogen	H_2	1910
Krypton	Kr	185
Methane	CH_4	96,8
Neon	Ne	516
Nitrogen	N_2	277
Oxygen	O_2	283
Radon	Rn	26
Sulfur Dioxide	SO_2	113
Xenon	Xe	60

Tab. 3-5: Examples of Specific Thermal Conductivities

3.3.1 Principle of Operation

A Wheatstone bridge, made of 4 temperature sensitive resistors (PT 100 sensors), is surrounded by gas in a way, that each 2 sensors are located in the sample gas stream (R_S) and in a reference gas stream (R_R), ☞ Fig. 3-11.

The bridge output signal (U_{Br}) is adjusted to zero when in rest position (no gas flow). By default the reference gas path is closed (not flown through by gas). When sample gas is supplied, the sensors in the sample gas path are cooled due to the thermal conductivity effect: The gas absorbs heat and carries it away from the sensors. This tunes the Wheatstone bridge and generates a signal proportional to the thermal conductivity.

Additional electronics linearizes and conditions this signal to provide usefull measuring values.Depending on application, it is possible to supply a reference gas to the bridge‘s reference side. The output signal in this case is proportional to the difference of the thermal conductivities of sample and reference gas.

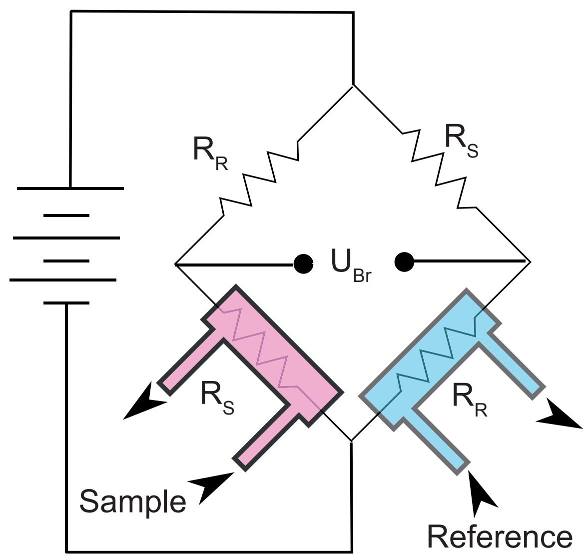
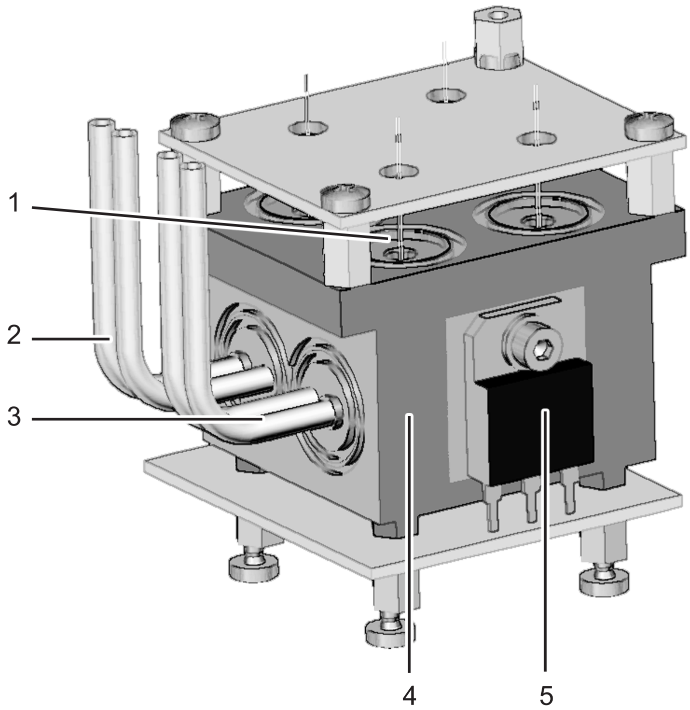


Fig. 3-11: Wheatstone Bridge

3.3.2 Technical Implementation

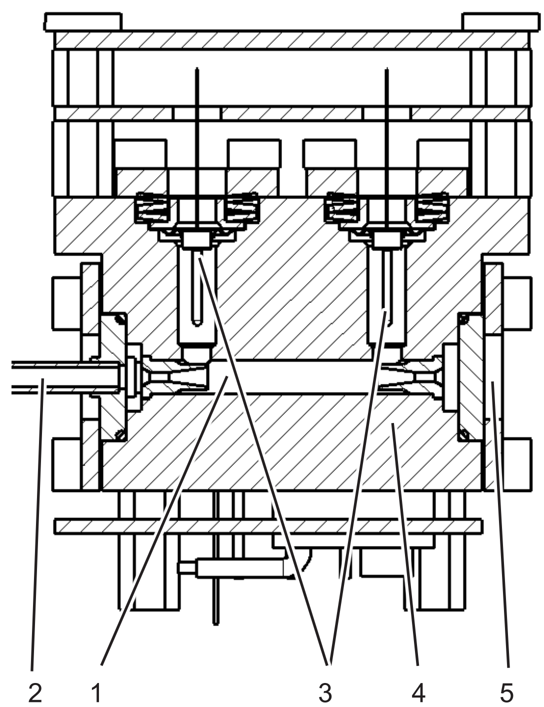
A block made of stainless steel contains two gas paths. Both, the volume of the block and the mass of the sensors have been minimized in order to obtain short response times. To suppress influences by changing ambient temperature the block is thermostatted and isolated against ambience.

The sensors are fully glass packaged to withstand aggressive gases.



1 Sensor
2 Sample gas inlet and outlet
3 Reference side inlet and outlet
4 Metal block
5 Heater for thermostatting

Fig. 3-12: *TC Cell, Exterior View, Thermal Isolation Removed*



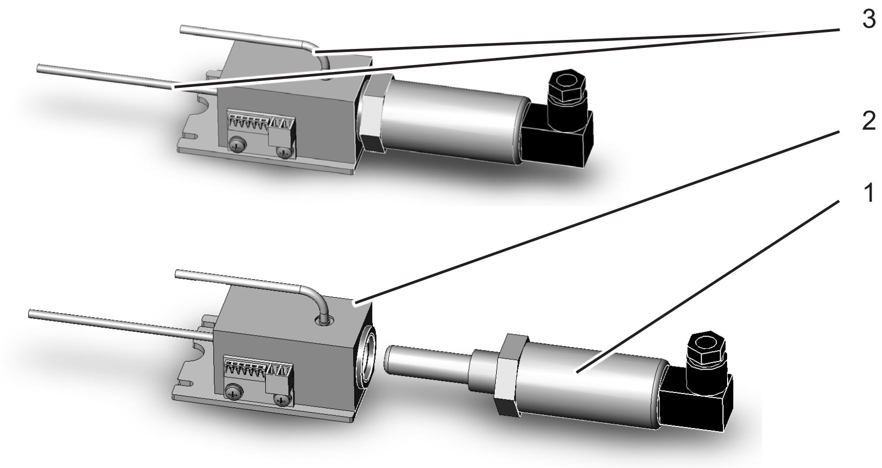
1 Internal gas path
2 Sample gas inlet and outlet
3 PT 100 sensors
4 Metal block
5 Lid

Fig. 3-13: *TC Cell, Sectional View*

3.4 Trace Moisture Measurement

The Trace Moisture sensor is a robust 2-wire-transmitter, using dew point impedance measurement for continuous moisture measurements in gases and gas mixtures. It makes dew point measurement as accessible as temperature and pressure.

This type of sensor is used, if dew point measurements are required.



1 Sensor
2 Sensor block
3 Gas connections

Fig. 3-14: *Trace Moisture Sensor Assembly*

Some definitions:

The **dew point** is the temperature in Deg C to which a given parcel of humid air must be cooled, at constant barometric pressure, for water vapor to condense into water. The condensed water is called dew. The dew point is the saturation temperature.

The dew point is associated with **relative humidity.** A high relative humidity indicates that the dew point is closer to the current air temperature. Relative humidity of 100 % indicates the dew point is equal to the current temperature and the air is maximally saturated with water. If the dew point remains constant and temperature increases, relative humidity will decrease.

Humidity is the amount of water vapor in the air. Relative humidity is defined as the ratio of the partial pressure of water vapor (in a gaseous mixture of air and water vapor) to the saturated vapor pressure of water at a given temperature.

3.4 Trace Moisture Measurement

How does dew point measurement connect with trace moisture measurement?

The lower the dew point of a gas, the less is the content of moisture within that gas.

dp / °C	Water / ppm	dp / °C	Water / ppm
-100	0.025	-44	121
-98	0.038	-42	150
-96	0.057	-40	185
-94	0.084	-38	228
-92	0.123	-36	279
-90	0.179	-34	340
-88	0.258	-32	413
-86	0.368	-30	501
-84	0.520	-28	604
-82	0.729	-26	726
-80	1.01	-24	870
-78	1.40	-22	1039
-76	1.91	-20	1237
-74	2.59	-18	1468
-72	3.49	-16	1737
-70	4.68	-14	2048
-68	6.22	-12	2409
-66	8.22	-10	2826
-64	10.8	-8	3306
-62	14.1	-6	3856
-60	18.3	-4	4487
-58	23.5	-2	5208
-56	30.2	0	6030
-54	38.5	2	6964
-52	48.9	4	8025
-50	61.8	6	9226
-48	77.6	8	10 583
-46	97.1	10	12 113

Tab. 3-6: *Dew Points and Water Content (at 1013 hPa)*

3.4.1 Special Operating Conditions

The sensor is completely calibrated with all calibration data stored in its flash memory and does not require recalibration:

- If the sensor is included into a calibration procedure, it might end up with a wrong calibration and unusable sensor. Therefore the analyzer's trace moisture measurement channel is configured to be excluded from autocalibration procedures, by default calibrating all channels. This exclusion is done by factory setup and cannot be changed.
- For proper measurement results we recommend to exchange the sensor regularly after 12 months of operation.

3.4.2 Accompanying Gases

Several gases may affect the sensor, so consider the following limits:

Component		Maximum Permitted Concentration / ppm	Maximum Permitted Dew-point / °C
Acetylene (Ethyne)	C_2H_2	[1]	-20
Ammonia	NH_3	1000	-20
Aromatic alcohols		no limit	no limit
Benzene	C_6H_6	no limit	no limit
Bromine	Br_2	no limit	-20
Carbon dioxide	CO_2	no limit	no limit
Carbon disulphide	CS_2	no limit	no limit
Carbon monoxide	CO	no limit	no limit
Carbon tetrachloride	CCl_4	no limit	no limit
Carbon tetrafluoride	CF_4	no limit	-20
Chlorine	Cl_2	**not permitted**	
Dichlorodifluoromethane	CCl_2F_2	no limit	-20
Ethane	C_2H_6	no limit	no limit
Ethylene (Ethene)	C_2H_4	no limit	no limit
Ethylene oxide	CH_4O	**not permitted**	
Exhaust gases		no limit	no limit
Fluorine	F_2	10	-20
Glycol (Ethane-1,2-diol)	$HOCH_2CH_2OH$	no limit	no limit
Halogenated hydrocarbons		Consult with Emerson	
Hydrobromic acid	HBr	**not permitted**	
Hydrochloric acid	HCl	**not permitted** [2]	
Hydrofluoric acid	HF	500	-20
Hydrogen peroxide	H_2O_2	**not permitted**	
Hydrogen sulphide	H_2S	no limit [3]	no limit
Mercury	Hg	**not permitted** [4]	
Methane	CH_4	no limit	no limit
Methanoic acid	HCOOH	**not permitted**	
Methanol	CH_3OH	[5]	no limit
Methylethyl glycol	$C_4H_{11}O$	no limit	no limit
Natural gas		no limit	no limit
Nitric acid	HNO_3	10	-20
Nitrogen dioxide	NO_2	no limit	-20
Nitrous oxide	N_2O	no limit	-20

Tab. 3-7: *Limitations on Gases (I)*

3.4 Trace Moisture Measurement

Component		Maximum Permitted Concentration / ppm	Maximum Permitted Dew-point / °C
Oxygen	O_2	no limit	no limit
Ozone	O_3	**not permitted**	
Perchloric acid	$HClO_4$	**not permitted**	
Phosgene	$COCl_2$	no limit	-20
Propane	C_3H_8	no limit	no limit
Sodium hydroxide	NaOH	**not permitted**	
Sulphur dioxide	SO_2	no limit [6]	no limit
Sulphur hexafluoride	SF_6	no limit	no limit
Sulphur trioxide	SO_3	no limit	-20
Sulphuric acid	H_2SO_4	10	-20
Toluene	$C_6H_5CH_3$	no limit	no limit
Xylene	C_8H_{10}	no limit	no limit

1 Recommended sensor exchange after 6 months.

2 For refinery catalytic reformer applications, consult with EMERSON.

3 Consult with EMERSON for extremely sour natural gas, >1 % H_2S

4 Consider sacrificial gold filter to remove mercury vapour – Consult with EMERSON.

5 Consult with EMERSON - for impedance type sensors, recommended concentration limit of Methanol <10% of moisture concentration to be measured to ensure negligible interference effects.

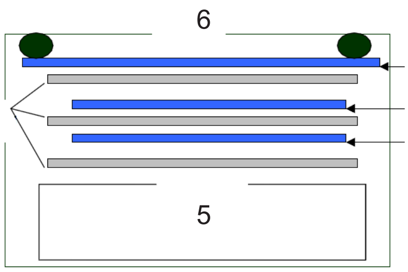
6 At temperatures exceeding 50 °C (122 °F), the maximum concentration is 50 ppm.

The sensor should also be resistant to most organic acids, alcohols, ketones, aldehydes, esters and halogenated hydrocarbons, but will not be resistant to very strong alkalis. If in doubt, consult with EMERSON.

Tab. 3-7: *Limitation on Gases (II)*

3.5 Hydrogen Sulfide (H_2S) Measurement

H_2S sensors are electrochemical cells that operate in the amperometric mode. That is, they generate a current that is linearly proportional to the content of H_2S in the sample gas.



1 Working electrode
2 Reference electrode
3 Counter electrode
4 Wetting filters
5 Electrolyte reservoir
6 Gas diffusion barrier

Working electrode: $H_2S + 4H_2O \rightarrow H_2SO_4 + 8H^+ + 8e^-$

Counter electrode: $2O_2 + 8H^+ + 8e^- \rightarrow 4H_2O$

Overall cell reaction: $H_2S + 2O_2 \rightarrow H_2SO_4$

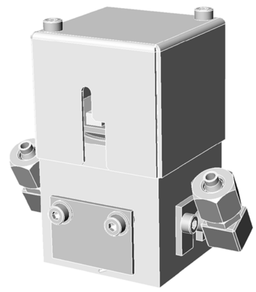
Fig. 3-15: *H_2S Sensor Schematic and Reaction Formulas*

The working electrode (also called the sensing electrode) is designed to optimize the oxidation of Hydrogen Sulfide. This electrode allows the gas to come in contact with both electro catalyst and electrolyte to create a threephase interface of gas, liquid and solid.

The other two electrodes in the cell, the counter electrode and the reference electrode usually have a similar chemical composition to the working electrode.

All three electrodes are stacked parallel to each other, as illustrated in Fig. 3-15. Three metal strips connect each electrode to the three pins outside of the sensor body.

The cell electrolyte provides ionic electrical contact between the electrodes, usually with the aid of hydrophilic separators (labelled “wetting filters” in Fig. 3-15) to allow capillary



transport of the electrolyte which is usually sulfuric acid between 3 and 7 molarity.

A potentiostatic circuit maintains the potential of the working electrode at a fixed value with respect to the reference electrode potential.

The working electrode is the surface where the electrochemical oxidation of H_2S occurs. A high surface area catalyst is used to optimize the sensor performance, resulting in a high sensor capacitance: typically 50 mF to 200 mF.

The counter electrode balances the reaction of the working electrode – if the working electrode oxidises the gas, then the counter electrode must reduce some other molecule to generate an equivalent current, in the opposite sense.

The reference electrode anchors the working electrode potential to ensure that it is always working in the correct region of the current-voltage curve. It is important that the reference electrode has a stable potential, keeping the working electrode at the right electrochemical potential to maintain a constant sensitivity, good linearity and minimum sensitivity to interfering gases.

The potentiostatic circuit ensures that the counter electrode is provided with as much current as it needs, also maintaining the working electrode at a fixed potential, irrespective of how hard it is working.

3.5 Hydrogen Sulfide (H_2S) Measurement

Moisture and oxygen are needed in the sample gas for the electrochemical reactions to take place. If concentrations of above components are too low, the sensor's sensitivity decreases. Therefore a purge cycle with ambient air can be implemented by programming the internal PLC.

If this option has not been ordered, the customer is responsible to take care of regularly purging the sensor. See the separate documentation provided together with every sensor for information on how to properly setup such a procedure.

3.5.1 Cross Interferences by Accompanying Gases

Interfering Gas	**ppm applied**	**% Interference related to full scale (f. s.)**		
		Measurement range H_2S		
		0 to 50 ppm	0 to 200 ppm	0 to 2000 ppm
CO	400	4	4	1
H_2	400	0.2	1	0.25
SO_2	20	20	18	10
NO_2	10	-25	-30	-30
NO	50	10	2	3
Cl_2	10	-12	-25	-25
C_2H_4	400	0.25	0.8	0.1
NH_3	20	0.1	0.1	0.1

Tab. 3-8: *Electrochemical H_2S Measurement - Cross Interference by Accompanying Gases*

3.6 Measurement Specifications

Sample gas components and measuring ranges (standard configurations)

In total, more than 60 gases are detectable, so the following table gives an overview only. Consult with Emerson for gases / configurations not listed.
Not all data is applicable to all analyzer variations. The sample gas(es) and measuring ranges for your specific analyzer are given by the order acknowledgement and on the analyzer's name plate label.

Gas component		Principle	Special Specs or Conditions	Standard Specs (see Tab. 3-10 – 3-13)	Enhanced Specs (see Tab. 3-10 & 3-13)	
			Lowest Range	Lowest Range	Lowest Range	Highest Range
Acetone [1]	CH_3COCH_3	UV		0–400 ppm	0–800 ppm	0–3 %
Acetone [1]	CH_3COCH_3	IR		0–500 ppm	0–1000 ppm	0–3 %
Acetylene	C_2H_2	IR		0–3 %	0–6 %	0–100 %
Ammonia	NH_3	IR		0–100 ppm	0–200 ppm	0–100 %
Argon	Ar	TCD		0–50 %	0–100 %	0–100 %
Carbon dioxide	CO_2	IR	0–5 ppm [5]	0–50 ppm	0–100 ppm	0–100 %
Carbon monoxide	CO	IR	0–10 ppm [5]	0–50 ppm	0–100 ppm	0–100 %
Chlorine	Cl_2	UV		0–300 ppm	0–600 ppm	0–100 %
Ethane	C_2H_6	IR		0–1000 ppm	0–2000 ppm	0–100 %
Ethanol [1]	C_2H_5OH	IR		0–1000 ppm	0–2000 ppm	0–10 %
Ethylene	C_2H_4	IR		0–400 ppm	0–800 ppm	0–100 %
Helium	He	TCD		0–10 %	0–20 %	0–100 %
Hexane [1]	C_6H_{14}	IR		0–100 ppm	0–200 ppm	0–10 %
Hydrogen [4]	H_2	TCD		0–1 %	0–2 %	0–100 %
Hydrogen Sulfide	H_2S	UV		0–2 %	0–4 %	0–10 %
Hydrogen Sulfide	H_2S	IR		0–10 %	0–20 %	0–100 %
Hydrogen Sulfide	H_2S	electrochem.		0–50 ppm	–	0–2000 ppm [6]
Methane	CH_4	IR		0–100 ppm	0–200 ppm	0–100 %
Methanol [1]	CH_3OH	IR		0–1000 ppm	0–2000 ppm	0–10 %
n–Butane	C_4H_{10}	IR		0–800 ppm	0–1600 ppm	0–100 %
Nitrogen dioxide [1]	NO_2	UV	0–25 ppm [3]	0–50 ppm	0–100 ppm	0–10 %
Nitrogen monoxide	NO	IR		0–100 ppm	0–200 ppm	0–100 %
Nitrous oxide	N_2O	IR		0–100 ppm	0–200 ppm	0–100 %
Oxygen	O_2	.		0–5 %	–	0–25 % [2,6]
Oxygen	O_2	paramagn.		0–1 %	0–2 %	0–100 %
Oxygen, Trace	O_2	electrochem.		0–10 ppm	–	0–10 000 ppm [6]
Propane	C_3H_8	IR		0–1000 ppm	0–2000 ppm	0–100 %
Propylene	C_3H_6	IR		0–400 ppm	0–800 ppm	0–100 %
Sulfur dioxide	SO_2	UV	0–25 ppm [3]	0–50 ppm	0–130 ppm	0–1 %
Sulfur dioxide	SO_2	IR		0–1 %	0–2 %	0–100 %
Sulfur hexafluoride	SF_6	IR	0–5 ppm [3]	0–20 ppm	0–50 ppm	0–2 %
Toluene [1]	C_7H_8	UV		0–300 ppm	0–600 ppm	0–5 %
Vinyl chloride	C_2H_3Cl	IR		0–1000 ppm	0–2000 ppm	0–2 %
Water vapor [1]	H_2O	IR		0–1000 ppm	0–2000 ppm	0–8 %
Water vapor, Trace [1]	H_2O	capacitive		0–100 ppm	–	0–3000 ppm [6]

[1] Dew point below ambient temperature
[2] Higher concentrations decrease sensor lifetime
[3] Daily zero calibration required for ranges below lowest standard specs range
[4] Special "refinery" application with 0–1% H_2 in N_2 available
[5] see Tab. 3-12
[6] standard specs only

Tab. 3-9: *Gas Components and Measuring Ranges, Examples*

3.6 Measurement Specifications

Standard and Enhanced Performance Specifications

	NDIR/UV/VIS		Thermal Conductivity (TCD)	
	Standard Spec	**Enhanced Spec**	**Standard Spec**	**Enhanced Spec**
Detection limit (4 σ) [1, 4]	≤ 1 %	≤ 0.5 %	≤ 1 %	≤ 0.5 %
Linearity [1, 4]	≤ 1 %		≤ 1 %	
Zero-point drift [1, 4]	≤ 2 % per week	≤ 1 % per week	≤ 2 % per week	≤ 1 % per week
Span (sensitivity) drift [1, 4]	≤ 0.5 % per week	≤ 1 % per month	≤ 1 % per week	
Repeatability [1, 4]	≤ 0.5 %		≤ 0.5 %	
Response time (t_{90}) [3]	4 s ≤ t_{90} ≤ 7 s [5]		15 s ≤ t_{90} ≤ 30 s [6]	
Permissible gas flow	0.2–1.5 l/min.		0.2–1.5 l/min. (± 0.1 l/min)	
Influence of gas flow [1, 4]	≤ 0.5 %		≤ 1 % [11]	
Maximum gas pressure [8, 14]	≤ 1500 hPa abs. (≤ 7 psig)		≤ 1500 hPa abs. (≤ 7 psig)	
Influence of pressure [2]				
– At constant temperature	≤ 0.10 % per hPa		≤ 0.10 % per hPa	
– With pressure compensation [7]	≤ 0.01 % per hPa		≤ 0.01 % per hPa	
Permissible ambient temperature [9]	0 (-20) to +50 °C (32 (-4) to 122 °F)		0 (-20) to +50 °C (32 (-4) to 122 °F)	
Influence of temperature [1, 13] (at constant pressure)				
– On zero point	≤ 1 % per 10 K	≤ 0.5 % per 10 K	≤ 1 % per 10 K	≤ 0.5 % per 10 K
– On span (sensitivity)	≤ 5 % (0 to +50 °C / 32 to 122 °F)		≤ 1 % per 10 K	
Thermostat control [6, 12]	none / 60 °C (140 °F) [5]		none / 60 °C (140 °F) [10]	
Warm-up time [6]	15 to 50 minutes [5]		approx. 50 minutes	

***Note!** 1 psi = 68.95 hPa*

1 Related to full scale
2 Related to measuring value
3 From gas analyzer inlet at gas flow of 1.0 l/min (electronic damping = 0 s)
4 Constant pressure and temperature
5 Dependent on integrated photometer bench
6 Depending on measuring range
7 Pressure sensor is required
8 Limited to atmospheric if internal sample pump
9 Temperatures below 0 °C (-4 °F) with thermostat control only
10 Thermost. controlled sensor: 75 °C (167 °F)
11 Flow variation within ± 0.1 l/min
12 Optional thermostatically controlled box with temperature 60 °C (140 °F), not XEGK
13 Temperature variation: ≤ 10 K per hour
14 Special conditions apply to model XEFD

***Tab. 3-10:** IR, UV, VIS, TCD - Standard and Enhanced Measurement Performance Specifications*

Trace Moisture (tH_2O)	
Measurement range	-100 to -10 °C dew point (0–100…3000 ppm)
Measurement accuracy	±2 °C dew point
Repeatability	0.5 °C dew point
Response time (t_{95})	5 min (dry to wet)
Operating humidity	0 to 100 % r.h.
Sensor operating temperature	-40 to +60 °C
Temperature coefficient	Temperature compensated across operating temperature range
Operating pressure	Depending on sequential measurement system, see analyzer specification [1] max. 1500 hPa abs / 7 psig [2]
Flow rate	Depending on sequential measurement system, see analyzer specification [1] 0.2 to 1.5 Nl/min

***Note!** 1 psi = 68.95 hPa*

1 If installed in series to another measurement system, e. g. IR channel
2 Special conditions apply to model XEFD

Note! Do not calibrate, see special calibration notes in the measurement description!

***Tab. 3-11:** Trace Moisture - Standard Measurement Performance Specifications*

3.6 Measurement Specifications

	Oxygen Sensors			
	Paramagnetic (pO_2)		Electrochemical (eO_2)	Trace (tO_2)
	Standard Spec	Enhanced Spec		
Detection limit (4 σ) [1, 4]	≤ 1 %	≤ 0.5 %	≤ 1 %	≤ 1 %
Linearity [1, 4]	≤ 1 %		≤ 1 %	≤ 1 %
Zero-point drift [1, 4]	≤ 2 % per week	≤ 1 % per week	≤ 2 % per week	≤ 1 % per week
Span (sensitivity) drift [1, 4]	≤ 1 % per week	≤ 0.5 % per week	≤ 1 % per week	≤ 1 % per week
Repeatability [1, 4]	≤ 0.5 %		≤ 1 %	≤ 1 %
Response time (t_{90}) [3]	< 5 s		approx. 12 s	20 to 80 s
Permissible gas flow	0.2–1.5 l/min		0.2–1.5 l/min.	0.2–1.5 l/min.
Influence of gas flow [1, 4]	≤ 2 % [10]		≤ 2 %	≤ 2 %
Maximum gas pressure [7, 14]	≤ 1500 hPa abs. (≤ 7 psig) [13]		≤ 1500 hPa abs. (≤ 7 psig)	≤ 1500 hPa abs. (≤ 7 psig)
Influence of pressure [2]				
– At constant temperature	≤ 0.10 % per hPa		≤ 0.10 % per hPa	≤ 0.10 % per hPa
– With pressure compensation [6]	≤ 0.01 % per hPa		≤ 0.01 % per hPa	≤ 0.01 % per hPa
Permissible ambient temperature [8]	0(-20) to +50 °C (32 (4) to 122 °F)		5 to +45 °C (41 to 113 °F)	5 to +45 °C (41 to 113 °F)
Influence of temperature [1, 12] (at constant pressure)				
– On zero point	≤ 1 % per 10 K	≤ 0.5 % per 10 K	≤ 1 % per 10 K	≤ 1 % per 10 K [5]
– On span (sensitivity)	≤ 1 % per 10 K		≤ 1 % per 10 K	≤ 1 % per 10 K [5]
Thermostat control	60 °C (140 °F) [11]		none	none [9]
Warm-up time	Approx. 50 minutes		-	Approx. 50 minutes

Note! *1 psi = 68.95 hPa*

1 Related to full scale
2 Related to measuring value
3 From gas analyzer inlet at gas flow of 1.0 l/min (electronic damping = 0 s)
4 Constant pressure and temperature
5 Range 0–10…200 ppm: ≤ 5 % (5 to 45 °C / 41 to 113 °F)
6 Pressure sensor is required
7 Limited to atmospheric if internal sample pump
8 Temperatures below 0 °C (-4 °F) with thermostat control only
9 Thermost. controlled sensor: 35 °C (95 °F)
10 For ranges 0–5…100 % **and** flow 0.5…1.5 l/min
11 Optional thermostatically controlled sensor with temperature 60 °C (140 °F)
12 Temperature variation: ≤ 10 K per hour
13 No sudden pressure surge allowed
14 Special conditions apply to model XEFD

Note! Take care of the tO_2 sensor‘s documentation, providing important calibration instructions!

Tab. 3-12: *Oxygen - Standard and Enhanced Measurement Performance Specifications*

	Hydrogen Sulfide (H_2S)		
Measurement range (sensor dependent)	0 to 50 ppm	0 to 200 ppm	0 to 2000 ppm
Overgas limit	200 ppm	500 ppm	10,000 ppm
Detection limit [1]	< 0.2 %		
Repeatability [1]	< 2 %		
Drift [1]	< 1 % per month		
Response time (t_{90})	< 35 s		
Operating life	> 24 months		
Sensor operating temperature	-30 to 50 °C		
Gas pressure range	800 to 1200 hPa (-3.1 to 2.7 psig)		
Gas humidity range (rel. humidity)	15 to 90 %		
Thermostat control	none		

1 Related to full scale

Note! These sensors require oxygen and moisture to work properly within given specifications! Take care of the separate documentation accompanying the sensors!

Tab. 3-13: *H_2S - Standard Measurement Performance Specifications*

3.6 Measurement Specifications

Special Performance Specifications for Gas Purity Measurements (ULCO & ULCO$_2$)

	0–10…< 50 ppm CO 0–5…< 50 ppm CO_2	
Detection limit (4 σ) [1,2]	< 2 %	
Linearity [1,2]	< 1 %	
Zero-point drift [1,2,3]	< 2 % *resp. < 0.2 ppm* [9]	
Span (sensitivity) drift [1,2,4]	< 2 % *resp. < 0.2 ppm* [9]	
Repeatability [1,2]	< 2 % *resp. < 0.2 ppm* [9]	
Response time (t_{90}) [7]	< 10 s	
Permissible gas flow	0.2–1.5 l/min.	
Influence of gas flow [1,2]	< 2%	
Maximum gas pressure [10,11]	≤ 1500 hPa abs. (≤ 7 psig)	
Influence of pressure [5]		
– At constant temperature	≤ 0.1 % per hPa	
– With pressure compensation [8]	≤ 0.01 % per hPa	
Permissible ambient temperature	+15 to +35 °C (59 to 95 °F)	+5 to +40 °C (41 to 104 °F)
Influence of temperature [6] (at constant pressure)		
– On zero point	< 2 % per 10 K *resp. < 0.2 ppm per 10 K* [9]	
– On span (sensitivity)	< 2 % per 10 K *resp. < 0.2 ppm per 10 K* [9]	
Thermostat control	none	60 °C (140 °F)

Note! *1 psi = 68.95 hPa*

[1] Related to full scale
[2] Constant pressure and temperature
[3] Within 24 h; daily zero calibration requested
[4] Within 24 h; daily span calibration recommended
[5] Related to measuring value
[6] Temperature variation: ≤ 10 K per hour
[7] From gas analyzer inlet at gas flow of 1.0 l/min
[8] Barometric pressure sensor is required
[9] Whichever value is higher
[10] Limited to atmospheric if internal sample pump
[11] Special conditions apply to model XEFD

Tab. 3-14: *Special Performance Specifications for Gas Purity Measurements (Low Ranges)*

3.6 Measurement Specifications

Special Performance Specifications for Gas Purity Measurements (Suppressed Ranges)

	98–100 % CO_2
Detection limit (4 σ) [1, 2]	≤ 2 %
Linearity [1, 2]	≤ 1 %
Zero-point drift [1, 2, 3]	≤ 2 % per day
Span (sensitivity) drift [1, 2, 3]	≤ 2 % per day
Repeatability [1, 2]	≤ 2 %
Response time (t_{90}) [4]	≤ 30 s
Permissible gas flow	defined by constant pressure at inlet
Permissible gas pressure	1300 hPa (4.4 psig) – 1700 hPa (10.1 psig)
Permissible gas pressure variation	± 70 hPa (1 psig)
Influence of ambient pressure change from 800 to 1100 hPa at constant temperature with pressure compensation [1, 5]	≤ 2 %
Permissible ambient temperature	+15 to +35 °C (59 to 95 °F)
Influence of temperature [1, 6] (at constant pressure)	
– On zero point	≤ 0.5 % per 10 K
– On span (sensitivity) [7]	≤ 2 %
Thermostat control	60 °C (140 °F)
Warm-up time	approx. 50 minutes
Purge gas (N_2) flow	approx. 0.1–0.2 l/min

Note! *1 psi = 68.95 hPa*

[1] Related to suppressed range (98–100 %)
[2] Constant pressure and temperature
[3] Daily zero and span calibration requested
[4] Switching from absolute to suppressed range requires purge time of > 240 s
[5] Sample gas pressure sensor mandatory
[6] Temperature variation: ≤ 10 K per hour
[7] Related to permissible ambient temp. range

Tab. 3-15: *Special Performance Specifications for Gas Purity Measurements (Suppressed Ranges)*

3.6 Measurement Specifications

Note 1!

Not all data listed are applicable to all analyzer versions (e.g. 60 °C thermostatically controlled box is not available for electrochemical and trace oxygen, nor for ½19 in instruments).

Note 2!

For NDIR/UV/VIS measurements, take into account that

- *sample gas may diffuse or be released by leakages into the analyzer enclosure*
- *if existent in the analyzer surroundings, the component to be measured may enter the enclosure.*

Concentrations then may increase inside the enclosure. High concentrations of the component to be measured inside the enclosure may influence the measurement by unintended absorption, which could cause drift of the measurement.

A remedy for this issue is to purge the housing with gas not containing the component of interest.

All performance data are verified during the manufacturing process for each unit by the following tests:

- Linearization and sensitivity test
- Long term drift stability test
- Climate chamber test
- Cross interference test (if applicable)

Chapter 4
Installation

This chapter describes the correct installation procedure for the various X-STREAM analyzer versions.

On receipt, check the packaging and its contents thoroughly for damage.

Inform the carrier immediately of any damage to packaging or contents, and keep damaged parts until clarification.

Store the instrument at a dry and clean place, considering the acceptable environmental conditions. We recommend to keep the packaging available for future transportation, because only the original packaging ensures proper protection!

4.1 Scope of Supply

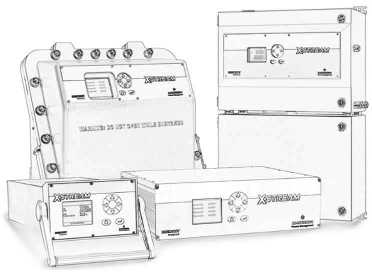
WARNING

HAZARDS FROM MISSING INFORMATION

Compare the contents of your package with the pictures below.

Analyzers for hazardous areas need additional parts, described in the accompanying documentation refering to hazardous area installations.

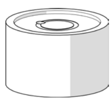
Call your local sales office if something is missing, and DO NOT continue to install your analyzer, until all parts are at hand!



Analyzer

USB
stick

external power supply unit with DC power cable
(XEGK, option)



Trace oxygen cell
(if applicable)

Manuals, some of which either as paper or electronic version on USB stick:
- short form manual for general purpose instruments
- X-STREAM *Enhanced* series manual

If applicable to your instrument
- special addendum manual for hazardous area installations
- infallible containment instruction manual

Fig. 4-1: *X-STREAM* Enhanced *Analyzers - Scope of Supply*

4.2 Introduction

WARNING

ELECTRICAL SHOCK HAZARD

Before connecting the analyzer to mains power, please read the chapter on safety warnings and the following instructions carefully.

The place of installation must be clean, dry and protected against strong vibrations and frost. Please observe the admissable operating temperatures given in the technical data.

Units must not be subjected to direct sunlight or sources of heat.

For outdoor installation it is recommended to install the unit in a cabinet. It should at least be protected against rainfall.

In order to comply with regulations on electromagnetic compatibility, it is recommended to use only shielded cables which can be supplied by Emerson Process Management. The customer must ensure that the shielding is correctly connected to the signal cable plug housing. Submin-d plugs and sockets must be screwed to the analyzer.

The use of external submin-d to screw-type terminal adapters affects electromagnetic compatibility. In such a case the customer must take appropriate measures to comply with the regulations, and must declare conformity if this is legally required (e.g. European EMC guidelines).

4.3 Gas Conditioning

In order to ensure trouble-free operation, special attention must be paid to the preparation of the gases:

All gases must be conditioned before supplying to the analyzer, to ensure they are

- **dry,**
- **free of dust and**
- **free of any aggressive components which may damage the gas lines (e.g. by corrosion or solvents) .**

Flammable gases must not be supplied without suitable protective measures.

Pressure and gas flow must remain within the values given in the ☞ "Measurement Specifications" section within this manual.

If moisture cannot be avoided, it is necessary to ensure that the dew point of the gases is at least 10 °C (18 °F) below the ambient temperature to avoid condensate in the gas lines.

The X-STREAM field housings can optionally be fitted with heated piping to enable the use of gases with a maximum dew point of 25 °C (77 °F) - consult factory.

Hints for selected gases

- **Calibration gases for CO and NO** need to be moistured by supplying them via a cooler.

Enclosure purge option

The purge medium (e.g. to minimize CO_2 interference or for enhanced safety while measuring corrosive or poisonous gases)

- **must be dry, clean and free of corrosives or components containing solvents.**
- **has to be free of components to be measured, to minimize cross interferences.**

Its temperature must correspond to the ambient temperature of the analyzer, but be at least within the range 20…35 °C (68…95 °F).

Set purge gas flow ≥ 0.2 NL/min at maximum inlet pressure of 0.1 barg (1.45 psig).

We recomment to always purge the analyzer enclosure, if gases are supplied, which may harm analyzer components, if due to a leak released into the analyzer enclosure!

Open reference option

In some cases, the measuring cell has an open reference side, to be supplied with nitrogen.

This nitrogen

- **at least should be of quality 5.0, which means nitrogen of purity ≥ 99.999 %.**

If such gas is not available, the substitute

- **must be dry, clean and free of corrosives or components containing solvents.**
- **has to be free of components to be measured, to minimize cross interferences.**

In any case, the gas temperature must correspond to the ambient temperature of the analyzer, but at least be within the range 20…35 °C (68…95 °F).

Pressure and gas flow must remain within the values given in the ☞ "Measurement Specifications" section within this manual.

Perform a calibration each time the source of this gas (e. g. bottle) has changed!

4.4 Gas Connections

WARNING

TOXIC GAS HAZARDS

Take care that all external gas pipes are connected in the described way and that they are gastight to avoid leakages!

Faulty connected gas pipes lead to explosion hazard or even to mortal danger!

Don‘t take a breath of the emissions! Emissions may contain hydrocarbons or other toxic components (e.g. carbon monoxide)! Carbon monoxide may cause headache, sickness, unconsciousness and death.

CAUTION

Do not confuse gas inlets and outlets. All gases must be conditioned before supplying to the analyzer. When supplying aggressive gases, ensure that the gas lines are not damaged.

Max. admissable pressure: 150 kPa / 7 psi*g*; atmospheric with internal pump!

Exhaust lines must be installed to incline downwards and be unpressurized and protected against frost, and conform to legal requirements.

TRACE OXYGEN MEASUREMENTS

The sensor for trace oxygen measurements is a consumable.
Remaining lifetime counts down when the sensor is in contact with oxygen.

For above reasons, the analyzer is shipped with the sensor as extra item in a sealed bag! The sensor must be installed before analyzer startup, according the instructions shipped with the sensor!

Do not use plastic tubing for trace oxygen measurements as it can permeate oxygen from the ambient air and cause higher than expected oxygen readings.

4.4 Installation - Gas Connections

The number of gas connections and their configuration varies according to analyzer version and installed options. Stainless steel fittings are compression fittings.

All gas connectors are labelled and can be found on the

- analyzer's rear panel (X-STREAM XEGP, X-STREAM XEGK)
- underside of the analyzer (X-STREAM field housings)

Should it be necessary to open the gas lines, the gas connectors should be sealed with PVC caps to prevent pollution by moisture, dust, etc.

	IN	OUT
1	SAMPLE	SAMPLE
2		
3		
4		PURGE GAS

Fig. 4-2: *Labelling of Gas Connectors (example)*

The analyzer should be mounted close to the sample gas source to minimize transport time. A sample gas pump can be used to reduce the reaction time; this requires that the analyzer be operated in bypass mode or fitted with a pressure control valve to protect against excessive gas flow and pressure (Fig. 4-3).

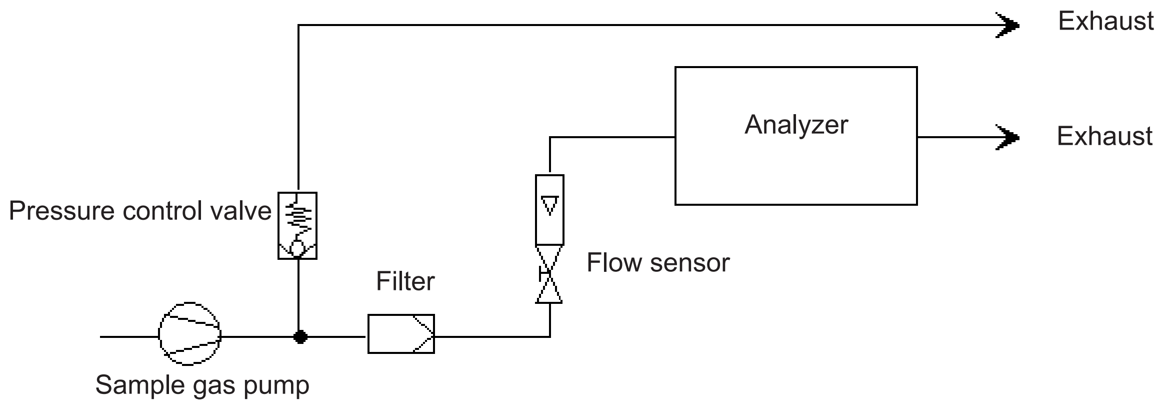
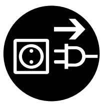


Fig. 4-3: *Installation in Bypass Mode*

4.5 Electrical Connections

WARNING

ELECTRICAL SHOCK HAZARD



Only qualified personnel, observing all applicable technical and legal requirements, may install these devices and connect power and signal cables.

Failure to comply may render the guarantee void and cause exposure to risk of damage, injury or death.

The devices may only be installed by personnel who are aware of the possible risks. Working on units with screw-type terminals for electrical connections may require exposure to energized components.

Wall-mountable X-STREAM analyzers are not fitted with power switches and are operational as soon as they are connected to a power supply. For these analyzers a switch or circuit breaker (IEC 60947-1/-3) must be installed on the premises. The switch or breaker must be located near the analyzer, easily accessible and labelled as a power supply cut-off for the analyzer.

Units with screw-type terminals must be de-energized by unplugging it or operating the separate cut-off switch or circuit breaker when working on the power connections.

To avoid the risk of electrical shock, all units must be earthed. For this reason, the power cable with a protective earth wire must be used.

Any break in the earth wire inside or outside the unit may cause exposure to the risk of electrocution and is therefore prohibited.

4.6 Analyzer Specific Instructions for Installation

Important note for X-STREAM XEFD!

*Due to the special conditions which must be observed when installing units in EX zones, the installation of the flameproof **X-STREAM XEFD** version is described in a separate **instruction manual HASXEDE-IM-EX**.*

Even if you do not install your X-STREAM XEFD in an EX zone, please install the unit according to the instructions in the separate manual.

Installation instructions:	X-STREAM XEGK & XEGP	☞ page 4-8
	X-STREAM XEXF field housings	☞ page 4-19
Notes for wiring signal inputs and outputs		☞ page 4-31

4.6.1 X-STREAM XEGK, X-STREAM XEGP

Plugs and sockets required for the electrical connections are on the rear panel of the units (Fig. 4-4 & 4-5).

X-STREAM XEGP analyzers provide an internal wide range power supply for worldwide use.

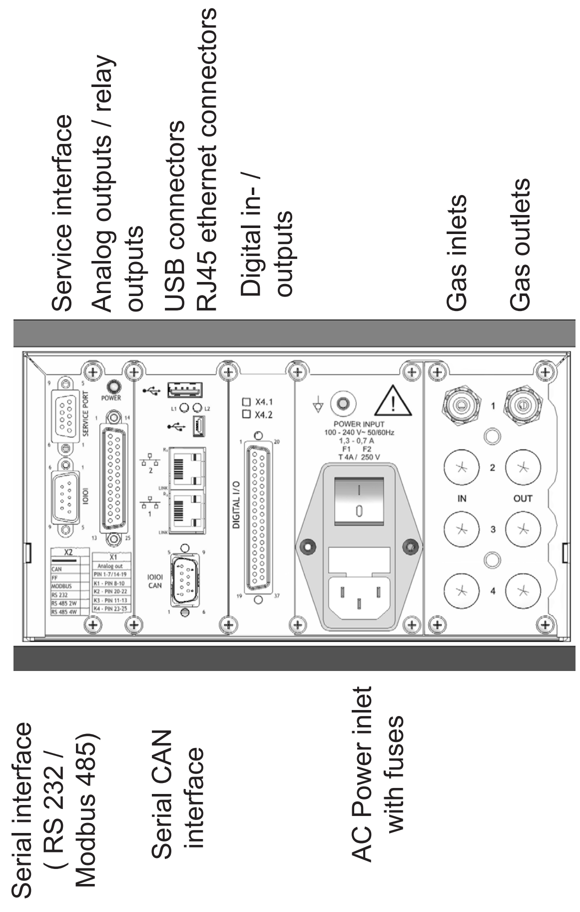
X-STREAM XEGK analyzers are powered by an internal wide range power supply for worldwide use, or by an external DC 24 V power supply unit, optionally supplied with the unit. If an external PSU is not included in delivery, another unit can be used instead, provided it conforms to the specifications on ☞ 2-9.

X-STREAM XEGK / XEGP analyzers should be operated in a horizontal position.

Six screws at the front panel enable to install XEGK models into a rack. The external PSU is optionally available for rack mounting, too.

XEGP can be installed into a rack by adding two optional brackets to the left and right hand side of the instrument.

⚠	⚠ **CAUTION**
	HAZARD BY RACK INSTALLATION
	The front panel and its screws are not designed to carry the weight of the instrument!
	Support the instrument, when installed into a rack!
	Disregarding may cause personal injury and damaged equipment.



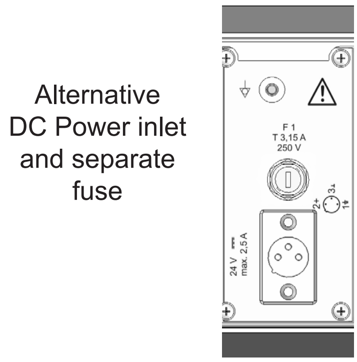


Fig. 4-4: X-STREAM XEGK - Rack Mount Version Rear Panel

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

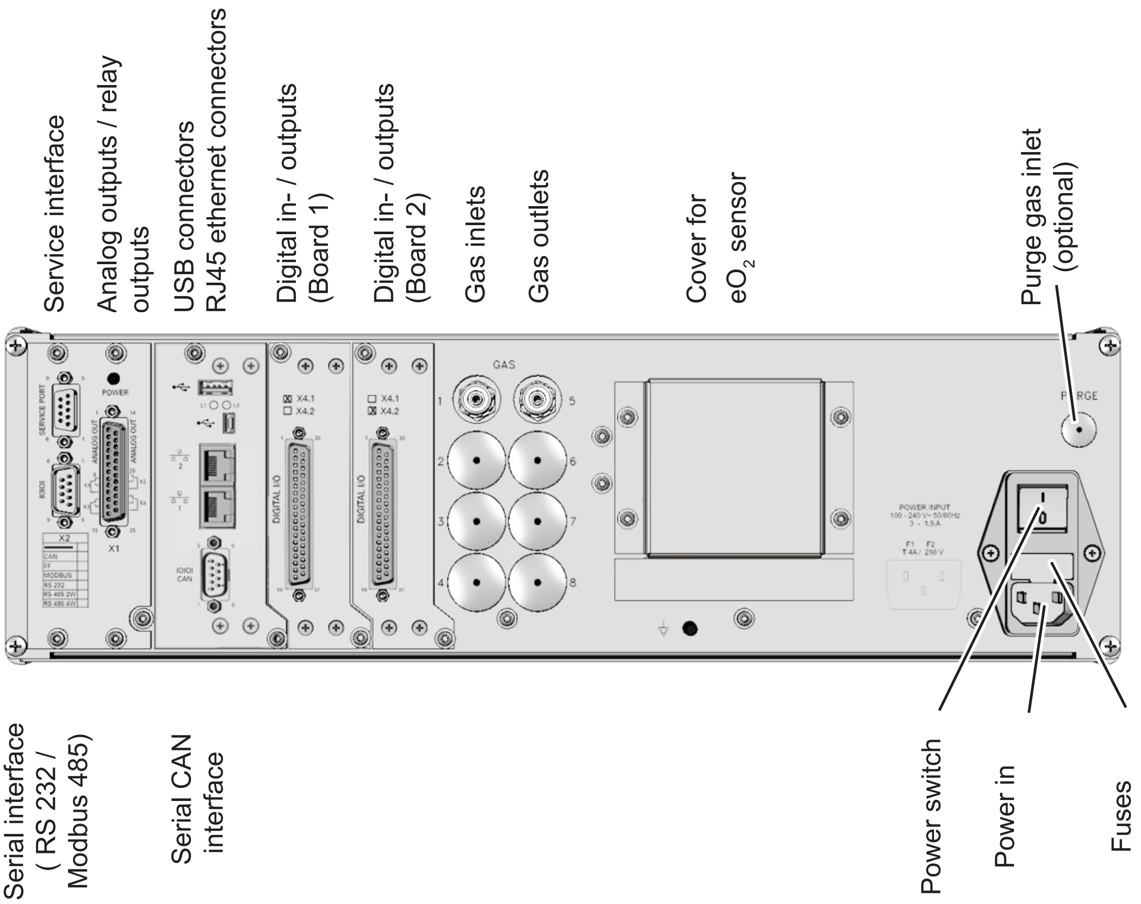


Fig. 4-5: X-STREAM XEGP - Table Top Version Rear Panel

The number and configuration of the gas inlets and outlets vary from model to model and are indicated on the notice on the rear of the instrument.

To simplify installation, we recommend labelling the gas lines as in the figures above (1, 2, 3, …). This avoids confusion in case the analyzer ever has to be disconnected.

	XEGK	XEGP
Gas connections		
Max number	8	8
Max for purging (incl. / separate)	2 incl.	1 incl. & 1 separate
Material	PVDF; stainless steel (opt.)	
Sizes	6/4 mm; ¼"	

4.6.1 Installation - X-STREAM XEGP

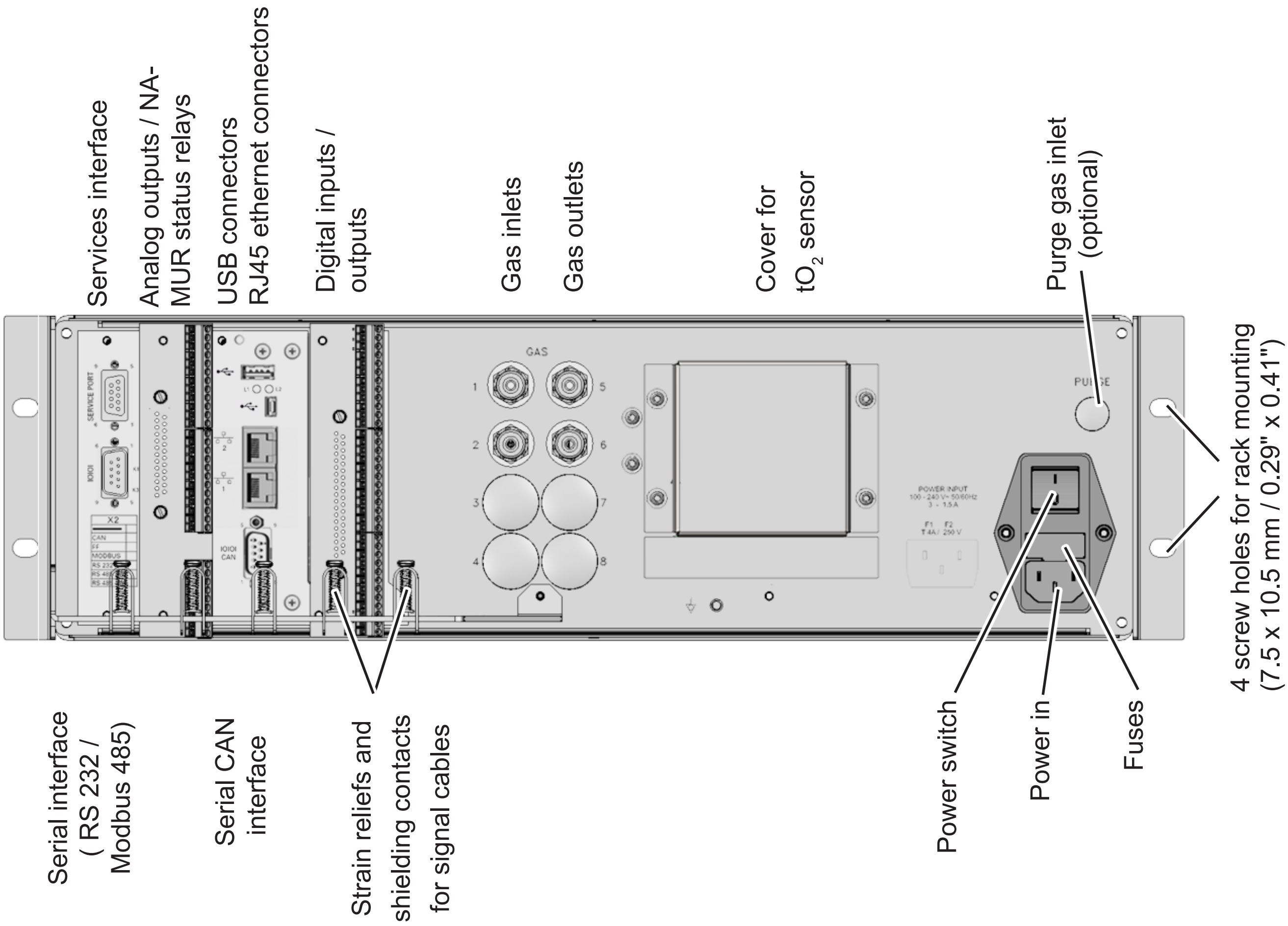


Fig. 4-6: *X-STREAM XEGP - Rear Panel, Model With Terminal Adapters and Front Side Brackets for Rack Mounting*

The brackets on either side of the front panel enable to install the unit into a rack; this is accomplished by means of four screws (Fig. 4-6).

> **⚠ CAUTION**
>
> **HAZARD BY INSTALLATION**
>
> **The brackets are not designed to carry the weight of the instrument!**
>
> **Support the instrument, when rack mounting!**
>
> **Disregarding may cause personal injury and damaged equipment.**

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

Signal inputs and outputs

The number of signal outputs actually available varies according to the unit's configuration.

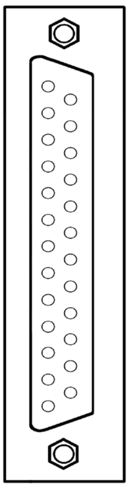
Analog signals
Relay outputs

Analog signals and relay outputs are located on a shared 25-pin submin socket (X1; Fig. 4-7), or on an optional terminals adaptor XSTA (☞ 4-13).

Specification of analog signal outputs:	4 (0)–20 mA; burden: $R_B \leq 500\ \Omega$
Specification of relay outputs 1–4:	max. 30 VDC, 1 A, 30 W
Note	Dry relay change-over contacts can be used as NO or NC.

Note!
Consider the installation notes in section 4.6.

	Signal	Pin
Analog outputs	Channel 1, (+) 4 (0)–20 mA	1
	Channel 2, (+) 4 (0)–20 mA	2
	Channel 3, (+) 4 (0)–20 mA	3
	Channel 4, (+) 4 (0)–20 mA	4
	Channel 5, (+) 4 (0)–20 mA	5
	unused	6
	unused	7
Relay contacts (Status signals)	Output1 (Failure) NC	8
	Output1 (Failure) NO	9
	Output1 (Failure) COM	10
	Output3 (Off spec) NC	11
	Output3 (Off spec) NO	12
	Output3 (Off spec) COM	13



Pin	Signal	
14	Channel 1, GND	Analog outputs
15	Channel 2, GND	
16	Channel 3, GND	
17	Channel 4, GND	
18	Channel 5, GND	
19	*unused*	
20	Output2 (Maintenance request) NC	Relay contacts (Status signals)
21	Output2 (Maintenance request) NO	
22	Output2 (Maintenance request) COM	
23	Output4 (Function check) NC	
24	Output4 (Function check) NO	
25	Output4 (Function check) COM	

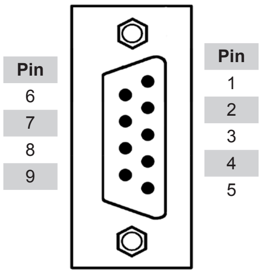
Note!
Configuration of relay contacts as per standard factory setting (NAMUR status signals)

Fig. 4-7: *Socket X1 - Analog & Digital Outputs 1–4*

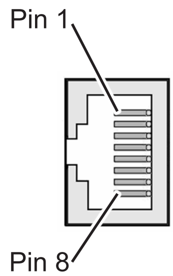
4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

Serial interface

For specifications and notes on control, see
☞ chapter 7



Pin no.	MOD 485/ 2 wire	MOD 485/ 4 wire	RS 232
1	Common	Common	Common
2	*not used*	*not used*	RXD
3	*not used*	*not used*	TXD
4	*not used*	RXD1(+)	*not used*
5	D1(+)	TXD1(+)	Common
6	*not used*	*not used*	*not used*
7	*not used*	*not used*	*not used*
8	*not used*	RXD0(-)	*not used*
9	D0(-)	TXD0(-)	*not used*



Pin no.	Signal
1	TX+
2	TX-
3	RX+
6	RX-
other	*not used*

Ethernet connector

Fig. 4-8: *Plug X2 - Serial Interface*

Notes!

Consider the installation notes in section 4.6.

When terminal adapters are used, the Modbus interface terminals are located on the same adapter as those for the ***analog*** *signal outputs (☞ Fig. 4-9, page 4-13).*

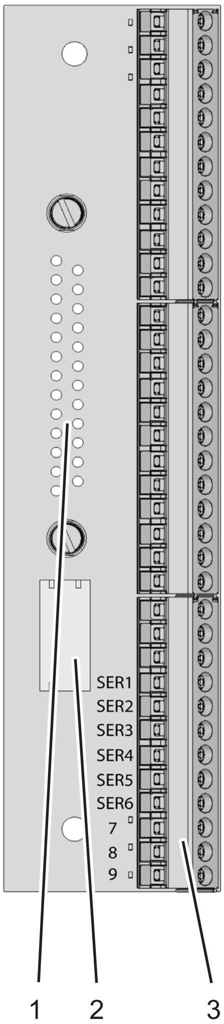
Then a flat flexible cable attached to the terminal adapter is used for connecting to the illustrated 9-pole plug.

X-STREAM analyzers are classified DTE (Data Terminal Equipment).

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

The XSTA adapter can optionally be used (not XEGK) to connect signal cables to screw-type terminals instead of submin-D plugs and sockets: it is plugged onto the X1 Submin-D connector on the unit.

To connect any serial interface, the adapter is equipped with a flat flexible cable ending in a 9-pin submin-D plug, which should be plugged onto the unit's X2 connector.



Pin	Signal	
P2.1	Channel 1, (+) 4 (0)–20 mA	Analog Outputs
P2.2	Channel 1, GND	Analog Outputs
P2.3	Channel 2, (+) 4 (0)–20 mA	Analog Outputs
P2.4	Channel 2, GND	Analog Outputs
P2.5	Channel 3, (+) 4 (0)–20 mA	Analog Outputs
P2.6	Channel 3, GND	Analog Outputs
P2.7	Channel 4, (+) 4 (0)–20 mA	Analog Outputs
P2.8	Channel 4, GND	Analog Outputs
P2.9	Channel 5, (+) 4 (0)–20 mA	Analog Outputs
P2.10	Channel 5, GND	Analog Outputs
P2.11	*not used*	
P2.12	*not used*	
P3.1	*not used*	
P3.2	*not used*	
P3.3	Output 1 (Failure), NC	Relay Outputs**)
P3.4	Output 1 (Failure), NO	Relay Outputs**)
P3.5	Output 1 (Failure), COM	Relay Outputs**)
P3.6	Output 2 (Maintenance Request), NC	Relay Outputs**)
P3.7	Output 2 (Maintenance Request), NO	Relay Outputs**)
P3.8	Output 2 (Maintenance Request), COM	Relay Outputs**)
P3.9	Output 3 (Out of Spec), NC	Relay Outputs**)
P3.10	Output 3 (Out of Spec), NO	Relay Outputs**)
P3.11	Output 3 (Out of Spec), COM	Relay Outputs**)
P3.12	Output 4 (Function check), NC	Relay Outputs**)
P4.1	Output 4 (Function check), NO	Relay Outputs**)
P4.2	Output 4 (Function check), COM	Relay Outputs**)
P4.3	*not used*	
P4.4		Serial Interface*)
P4.5		Serial Interface*)
P4.6		Serial Interface*)
P4.7		Serial Interface*)
P4.8		Serial Interface*)
P4.9		Serial Interface*)
P4.10		Serial Interface*)
P4.11		Serial Interface*)
P4.12		Serial Interface*)

1 Connector for plug X1 (on reverse side)
2 Connection for flat cable to plug X2 (cable not illustrated)
3 Screw-type terminals

Fig. 4-9: *Configuration of XSTA Terminal Adapter*

Recommended wire gauge:	0.14…1.5 mm² (AWG 26…AWG 16) end sleeves not required
Skinning length:	5 mm (0.2")
Thread:	M2
Min. tightening torque:	0.25 Nm (2.21 in.lb)

*) See table below

**) Configuration of relay output terminals as per standard factory setting (NAMUR status signals)

Assignment of serial interface terminals

Terminal		MOD 485/ 2 wire	MOD 485/ 4 wire	RS 232
P4.4	*SER1*	Common	Common	Common
P4.5	*SER2*	*not used*	*not used*	RXD
P4.6	*SER3*	*not used*	*not used*	TXD
P4.7	*SER4*	*not used*	RXD1(+)	*not used*
P4.8	*SER5*	D1(+)	TXD1(+)	Common
P4.9	*SER6*	*not used*	*not used*	*not used*
P4.10	*7*	*not used*	*not used*	*not used*
P4.11	*8*	*not used*	RXD0(-)	*not used*
P4.12	*9*	D0(-)	TXD0(-)	*not used*

Note!

Consider the installation notes in ☞ section 4.7

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

Digital inputs & outputs

7 or 14 digital inputs (X-STREAM XEGK: max. 7 inputs)	electrical specification	max. 30 V, internally limited to 2.3 mA HIGH: min. 4 V; LOW: max. 3 V common GND
9 or 18 additional relay outputs (X-STREAM XEGK: max. 9 add. outputs)	electrical specification	Dry relay change-over contacts can be used as NO or NC max. load. 30 V; 1 A; 30 W resistive

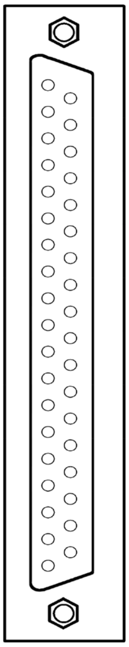
Digital in- & outputs are located on shared 37-pin submin sockets (X4.1 or X4.2; Fig. 4-10), or on optional terminals adaptor XSTD (XEGP only; ☛ next page)

Notes!
Depending on model and configuration, an analyzer may be fitted with up to 2 of these sockets (the unit is thus equipped with 14 digital inputs and 18 digital outputs).

To aid identification, the sockets are labelled X4.1 and X4.2.

Consider the installation notes in ☛ section 4.7

	Signal	Pin
Digital inputs	Input 1	1
	Input 2	2
	Input 3	3
	Input 4	4
	GND for all digital inputs	5
	unused	6
	unused	7
Digital outputs	Output 5 NC	8
	Output 5 NO	9
	Output 5 COM	10
	Output 6, NC	11
	Output 6, NO	12
	Output 6, COM	13
	Output 7, NC	14
	Output 7, NO	15
	Output 7, COM	16
	Output 8, NC	17
	Output 8, NO	18
	Output 8, COM	19



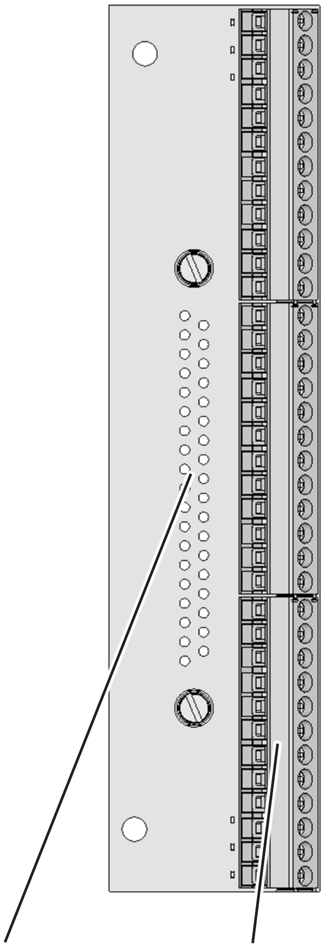
Pin	Signal	
20	Input 5	Digital inputs
21	Input 6	
22	Input 7	
23	Output 9, NC	Digital outputs
24	Output 9, NO	
25	Output 9, COM	
26	Output 10, NC	
27	Output 10, NO	
28	Output 10, COM	
29	Output 11, NC	
30	Output 11, NO	
31	Output 11, COM	
32	Output 12, NC	
33	Output 12, NO	
34	Output 12, COM	
35	Output 13, NC	
36	Output 13, NO	
37	Output 13, COM	

Note!
The configuration illustrated here is that of the first socket, labelled X4.1.
Inputs 8–14 and outputs 14–22 are on the second socket (X4.2), if installed.

Fig. 4-10: *Sockets X4.1 and X4.2 - Pin Configuration*

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

An XSTD adapter can optionally be used (XEGP only) to connect digital I/O cables to screw-type terminals instead of Submin-D plugs and sockets: it is plugged onto the X4.1 and X4.2 (if fitted) Submin-D connectors on the unit.



Pin	Signal	
P3.1	Input 1	Digital inputs
P3.2	Input 2	
P3.3	Input 3	
P3.4	Input 4	
P3.5	Input 5	
P3.6	Input 6	
P3.7	Input 7	
P3.8	GND for inputs 1-7	
P3.9	*unused*	
P3.10	Output 5, NC	Digital outputs
P3.11	Output 5, NO	
P3.12	Output 5, COM	
P4.1	Output 6, NC	
P4.2	Output 6, NO	
P4.3	Output 6, COM	
P4.4	Output 7, NC	
P4.5	Output 7, NO	
P4.6	Output 7, COM	
P4.7	Output 8, NC	
P4.8	Output 8, NO	
P4.9	Output 8, COM	
P4.10	Output 9, NC	
P4.11	Output 9, NO	
P4.12	Output 9, COM	
P2.1	Output 10, NC	
P2.2	Output 10, NO	
P2.3	Output 10, COM	
P2.4	Output 11, NC	
P2.5	Output 11, NO	
P2.6	Output 11, COM	
P2.7	Output 12, NC	
P2.8	Output 12, NO	
P2.9	Output 12, COM	
P2.10	Output 13, NC	
P2.11	Output 13, NO	
P2.12	Output 13, COM	

Recommended wire gauge:	0.14…1.5 mm² (AWG 26…AWG 16) end sleeves not required
Skinning length:	5 mm (0.2")
Thread:	M2
Min. tightening torque:	0.25 Nm (2.21 in.lb)

Note!
The configuration illustrated here is that of the first adapter (on socket X4.1).
Inputs 8–14 and outputs 14–22 are on the second adapter (on socket X4.2), if installed.

1 Connector for socket X4.1 / X4.2 (on reverse side)
2 Screw-type terminals

Note!
Consider the installation notes in ☞ section 4.7

Fig. 4-11: *Configuration of XSTD Terminal Adapter*

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

Analog inputs

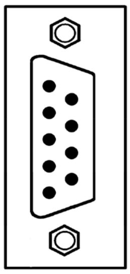
Analog inputs are located on a 9-pole submin-D-connector (plug X5; Fig. 4-12) or on an optional terminals adaptor XSTI (Fig. 4-13).

2 analog inputs	electrical specification	0–1 (10) V, software selectable; R_{in} = 100 kΩ optional (requires to fit wire bridges, see figures): 0–20 mA ; R_{in} = 50 Ω optically isolated from analyzer GND protected against overload up to ± 15 V or ± 20 mA

Note!

Consider the installation notes in ☞ section 4.7

Signal	Pin
BR 2 { fit a wire bridge here to apply analog }	5
BR 2 { signal in current mode to input 2 **) }	4
unused	3
BR 1 { fit a wire bridge here to apply analog }	2
BR 1 { signal in current mode to input 1 *) }	1



Pin	Signal
9	Input 2 high (+)
8	Input 2 low (-)
7	Input 1 low (-)
6	Input 1 high (+)

*) alternatively set jumper P2 on electronics board XASI

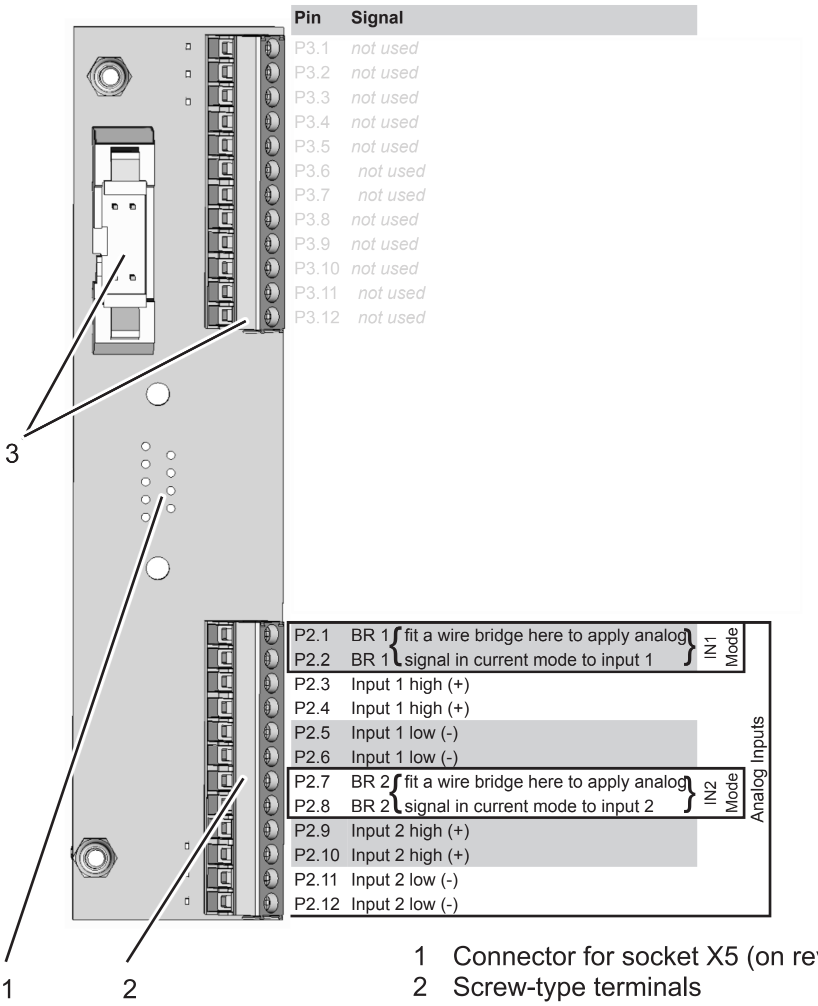
**) alternatively set jumper P1 on electronics board XASI

Fig. 4-12: *Plug X5 - Analog Inputs*

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

A XSTI adapter can optionally be used (XEGP only) to connect analog IN cables to screw-type terminals instead of a submin-D plugs and sockets. The adapter is plugged onto the unit´s submin-D connector X5.

Recommended wire gauge:	0.14…1.5 mm^2 (AWG 26…AWG 16) end sleeves not required
Skinning length:	5 mm (0.2")
Thread:	M2
Min. tightening torque:	0.25 Nm (2.21 in.lb)



1 Connector for socket X5 (on reverse side)
2 Screw-type terminals
3 Reserved for future use

Fig. 4-13: *Configuration of XSTI Terminal Adapter*

4.6.1 Installation - X-STREAM XEGK, X-STREAM XEGP

Power supply

X-STREAM XEGK and XEGP

AC power is supplied to the unit by means of a three-pin IEC connector on the rear panel of the instrument.

Optional DC Supply for X-STREAM XEGK

24 VDC is supplied to the unit by means of a three-pin XLR connector on the rear panel of the instrument.

Depending on the order, the following is supplied as an accessory: either

- an external power supply unit which can be connected directly to the analyzer using the supplied cable

or

- a connector which can be used with a cable and PSU as specified by the customer.

Note the configuration of the connector´s pins (☞ Fig. 4-14).

Details of any PSUs supplied with the unit are given on ☞ 2-9.

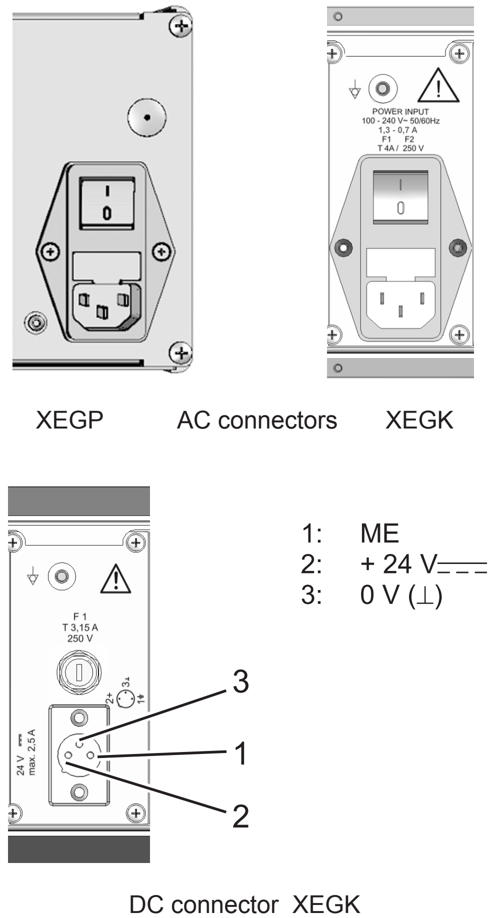


Fig. 4-14: *Power Supply Connectors*

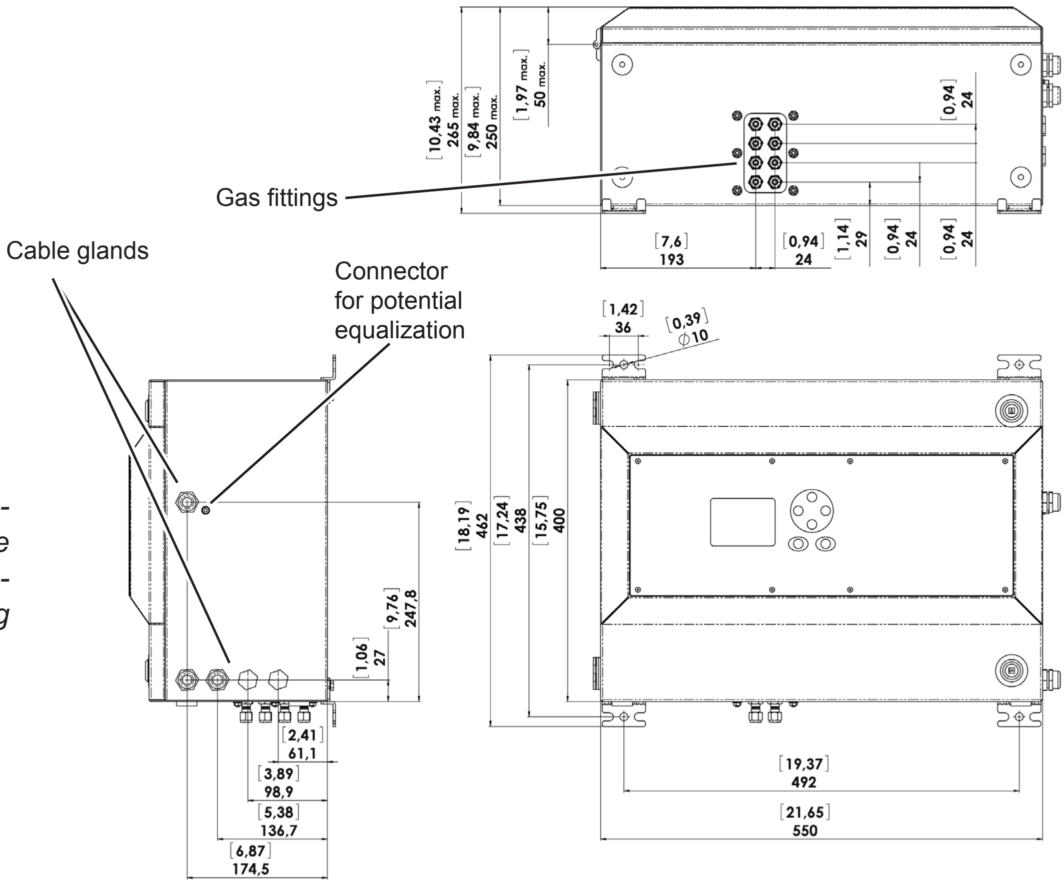
Completing the installation process

To achieve best and proper measuring results you must ensure the gas path system does not have leaks.

For this reason we recommend to carry out a leak test, as it is described within ☞ “Chapter 7 Maintenance and Other Procedures”.

4.6.2 X-STREAM XEXF (Single XEF; Dual XDF)

Fitted with four eyebolts and featuring IP66/ Type 4X protection, the X-STREAM XEXF field housings can be mounted in the open air on a wall or frame with no extra work.



Note!

Take care to reserve space at the right side of the instrument for laying the cables!

All dimensions in mm
[inches in brackets]

***Fig. 4-15:** X-STREAM XEF - Dimensions for Installation*

CAUTION

HEAVY INSTRUMENT

X-STREAM XEF / XDF analyzers, intended to be wall mounted and/or outdoor installed, weigh up to 45 kg (99 lbs), depending on the chosen options!

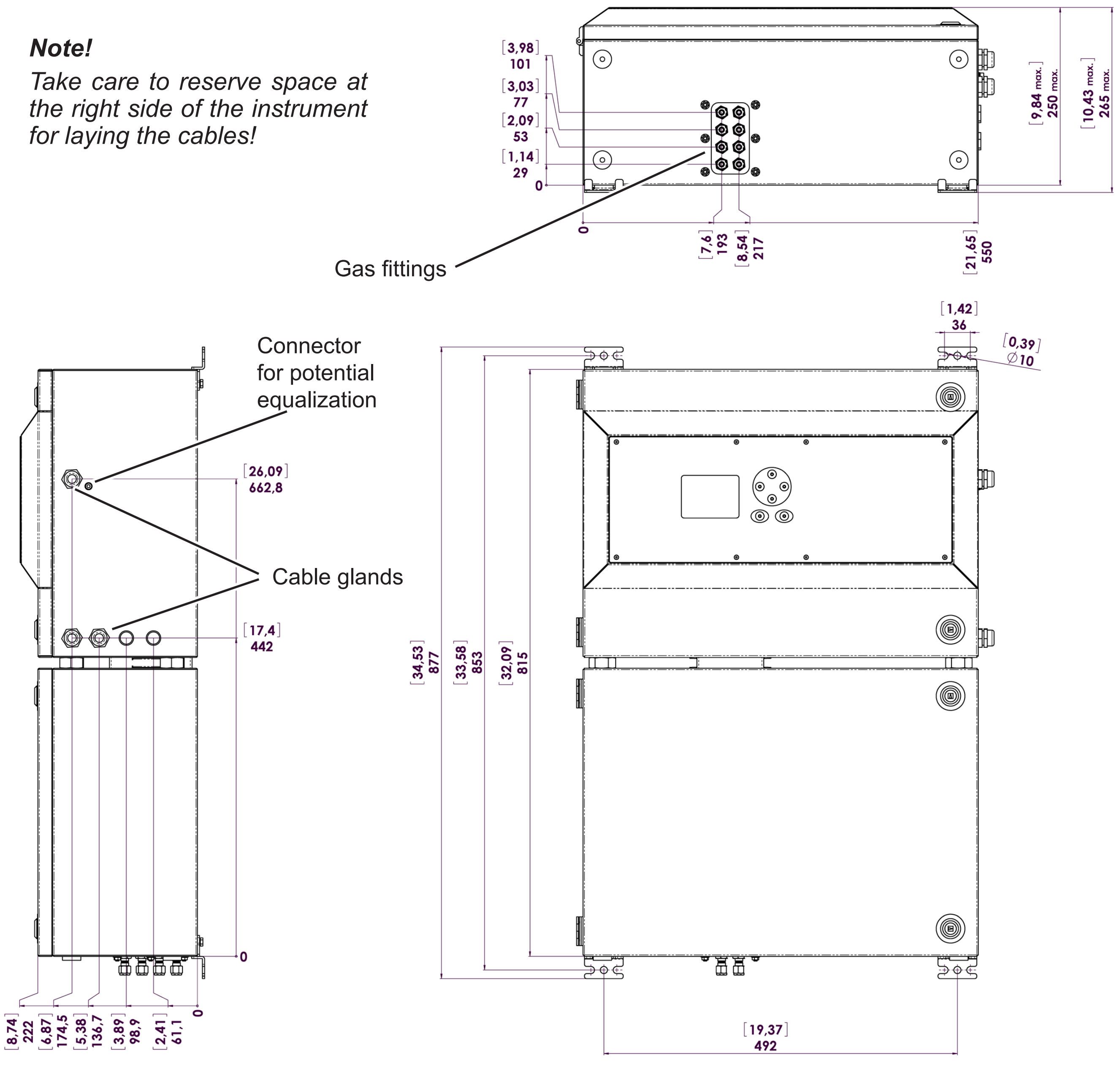
Use two persons and/or suitable tools for transportation and lifting these instruments!

Take care to use anchors and bolts specified to be used for the weight of the instruments!

Assure that the wall / device for installation is sufficiently attached and stable to carry the instrument!

4.6.2 Installation - X-STREAM XEXF Field Housings

Note!
Take care to reserve space at the right side of the instrument for laying the cables!



All dimensions in mm
[inches in brackets]

Fig. 4-16: *X-STREAM XDF - Dimensions for Installation*

Installation
4

4.6.2 Installation - X-STREAM XEXF Field Housings

Power and signal cables are connected using internal screw-type terminals. This requires opening the unit by releasing the fasteners on the housing.

Gas connectors are accessible from the underside of the instrument.

The number and configuration of the gas inlets and outlets depends on the analytical application, and is noted on a sticker on the underside of the instrument next to the connectors.

Note on XDF!

In case of the dual compartment version XDF, the electrical connections are established in the upper compartment, and the gas connections to fittings at the lower compartment.

Besides this, the design and layout of terminals and fittings are the same as with the single compartment version XEF.

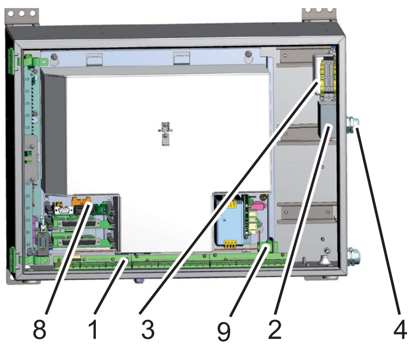
To simplify installation, we recommend labelling the gas lines in accordance with these markings. This avoids confusion should the analyzer need to be disconnected for maintenance.

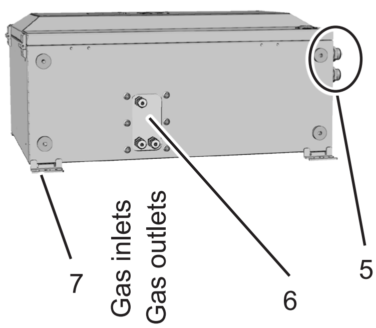
⚠ CAUTION

GASKETS AT LOW TEMPERATURES

Consider that enclosure gaskets may be frozen if the instrument is installed outdoors. Carefully open the enclosure at temperatures below -10 °C / 14 °F to not damage the gaskets.

Damaged gaskets void the ingress protection, possibly causing property damage, personal injury or death.





1 Terminals for signal cables
2 Mains filter
3 Power connections with integrated fuses
4 Glands for power cable
5 Glands for signal cables
6 Gas inlets and outlets
7 Plugs for openings to connect housings
8 Ethernet Service Port and USB connection (optional)
9 Ethernet network connection

Fig. 4-17: *X-STREAM XEXF Field Housings - Terminals, Cable Glands and Gas Fittings*

4.6.2 Installation - X-STREAM XEXF Field Housings

Gas connections

Gas connections	
Max number	8
Max for purging (incl. / separate)	2 incl.
Material	PVDF; stainless steel (opt.)
Sizes	6/4 mm; ¼"

Signal in- and outputs

Preparation of signal cables

All signal cables are connected to screw-type terminals located inside the housing. Access to the internal components is gained by releasing the two fasteners at the top of the unit and opening the front panel downwards.

All cables must be fed through cable glands and secured with a gland nut.

Properly installed, the glands act as a strain relief and guarantee EMC (electromagnetic compatibility):

Installing cable glands with shielded cables

1. Strip the cable
2. Expose braided shield

3. Feed cable through dome nut and clamping insert
4. Fold braided shield over clamping insert
5. Make sure that braided shield overlaps the O-ring by 3⁄32" (2 mm)

6. Push clamping insert into body and tighten dome nut
7. Assemble into housing and you´re done!

4.6.2 Installation - X-STREAM XEXF Field Housings

WARNING

ELECTRICAL SHOCK HAZARD

Verify the power supply at installation site meets the specification given on the analyzer´s nameplate label, before installing the instrument!

Verify power cables are disconnected and/or instrument is de-energized prior to working at the terminals!

Verify the power cord is layed with a distance of at least 1 cm (0.4 in) to any signal cable to ensure proper insulation from signal circuits!

The number of actually available signal outputs, and also the number of built-in modules with screw-type terminals, varies according to the configuration of the unit.

A maximum of three modules with 36 terminals each can be fitted.

The terminals can be accessed by opening the front panel of the instrument.

Characteristics of terminals:

Accepted wire gauge:	0.14…1.5 mm^2 (AWG 26…AWG 16), end sleeves not required
Skinning length:	5 mm (0.2")
Thread:	M2
Min. tightening torque:	0.25 Nm (2.21 in.lb)

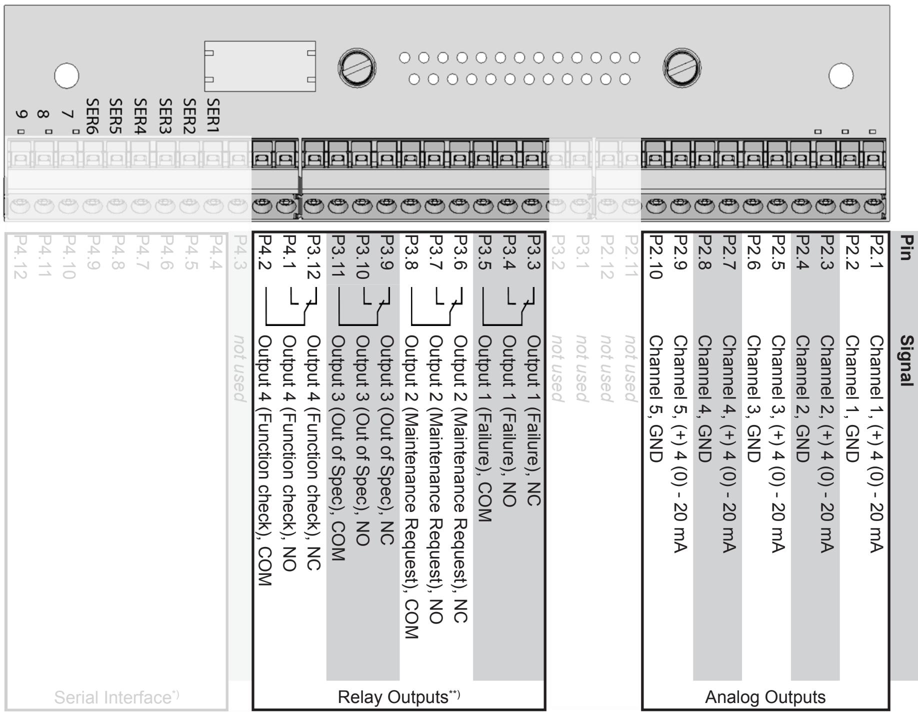
Analog signals
Relay outputs 1-4

Terminals for analog signals and relay outputs 1 - 4 are located on the outer left module (terminal block X1; Fig. 4-18).

Specification of analog signal outputs:	4(0)–20 mA; burden: $R_B \leq 500\ \Omega$
Specification of relay outputs 1-4:	max. 30 VDC, 1 A, 30 W
Note	Dry relay change-over contacts, can be used as NO or NC.

Note!

Consider the installation notes in ☞ section 4.7and the notes on installing cable glands on page 4-22.



**) Configuration of relay output terminals as per standard factory setting (NAMUR status signals)

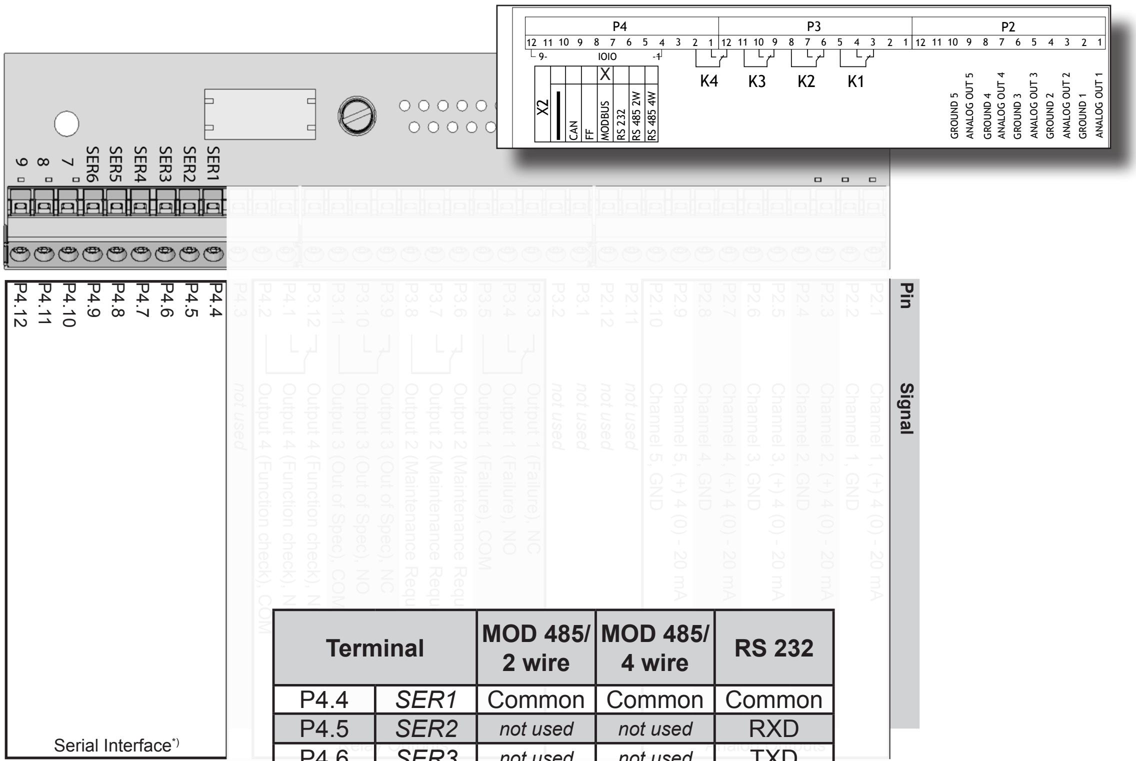
Fig. 4-18: *Terminal Block X1 - Analog Signals and Relay Outputs 1-4*

4.6.2 Installation - X-STREAM XEXF Field Housings

Serial interface

Specification and interface control:

The 9 terminals on the left (28 - 36) of the right most strip carry the serial interface signals.



*) See table

Terminal		MOD 485/ 2 wire	MOD 485/ 4 wire	RS 232
P4.4	*SER1*	Common	Common	Common
P4.5	*SER2*	*not used*	*not used*	RXD
P4.6	*SER3*	*not used*	*not used*	TXD
P4.7	*SER4*	*not used*	RXD1(+)	*not used*
P4.8	*SER5*	D1(+)	TXD1(+)	Common
P4.9	*SER6*	*not used*	*not used*	*not used*
P4.10	*7*	*not used*	*not used*	*not used*
P4.11	*8*	*not used*	RXD0(-)	*not used*
P4.12	*9*	D0(-)	TXD0(-)	*not used*

Notes!

Consider the installation notes in ☞ section 4.7 and the notes on installing cable glands on page 4-22.

X-STREAM analyzers are classified DTE (Data Terminal Equipment).

Your analyzer´s type of serial interface is marked on a label nearby the terminals (see sample above)

Fig. 4-19: *Terminal Block X1 - Serial Interface*

4.6.2 Installation - X-STREAM XEXF Field Housings

RJ45 Ethernet connection

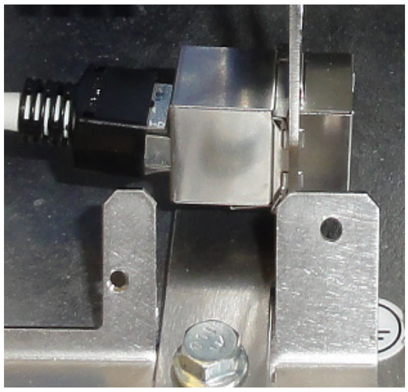
The RJ45 connectors are located on an electronics board in the card cage section of the unit (Fig. 4-17, pg. 4-22). For connecting the analyzer into a network for analysis purposes, use the RJ45 transfer element on the lower right side of the housing (Fig. 4-20).

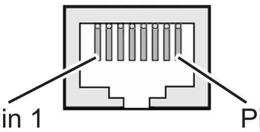
The RJ45 transfer element secures the connection of the RJ45 cable shielding with the housing. Do not directly connect the RJ45 cable from outside the analyzer to the electronic board. Do not remove the RJ45 transfer element.

To install this connection, a cable must be fed through the cable entry **without** a connector.

The connector can be wired when the free end has been fed into the instrument:

We recommend the VARIOSUB RJ45 QUICK-ON connector (PHOENIX CONTACT), which is supplied with the unit and requires no special tools. Wiring instructions can be found in the separate manual supplied with the connector.





Pin no.	Signal
1	TX+
2	TX-
3	RX+
6	RX-
other	*not used*

Fig. 4-20: *Ethernet Connector*

4.6.2 Installation - X-STREAM XEXF Field Housings

Digital inputs and relay outputs (option)

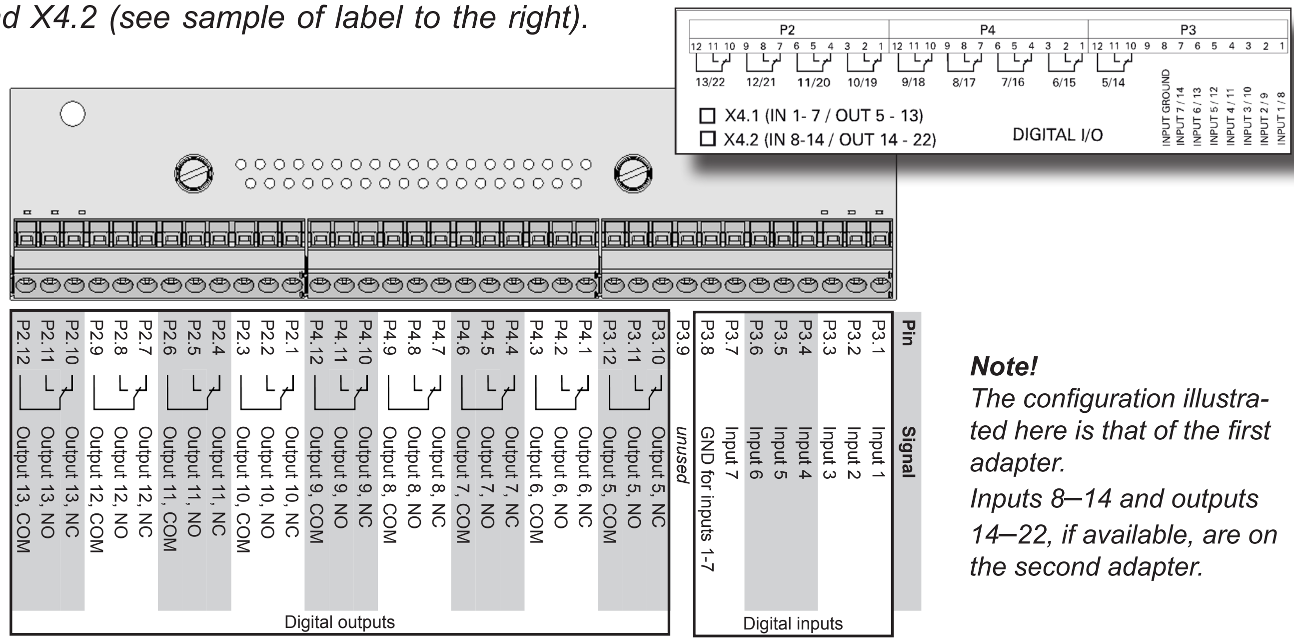
Terminals for these signals are located on the terminals board XSTD (terminal block X4; Fig. 4-21).

7 or 14 digital inputs	max. 30 V, internally limited to 2.3 mA HIGH: min. 4 V; LOW: max. 3 V common GND
9 or 18 additional relay outputs	max. load. 30 V; 1 A; 30 W resistive
Note	Dry relay change-over contacts, can be used as NO or NC

Notes!

Depending on configuration, an analyzer can be fitted with up to two of these terminal blocks (the unit will then feature 14 digital inputs and 18 digital outputs). To aid identification, the sockets are labelled X4.1 and X4.2 (see sample of label to the right).

Consider the installation notes in ☞ section 4.7 and the notes on installing cable glands on page 4-22.



Note!

The configuration illustrated here is that of the first adapter.

Inputs 8–14 and outputs 14–22, if available, are on the second adapter.

Fig. 4-21:** X4: **Terminal Blocks for Digital Inputs and Outputs

4.6.2 Installation - X-STREAM XEXF Field Housings

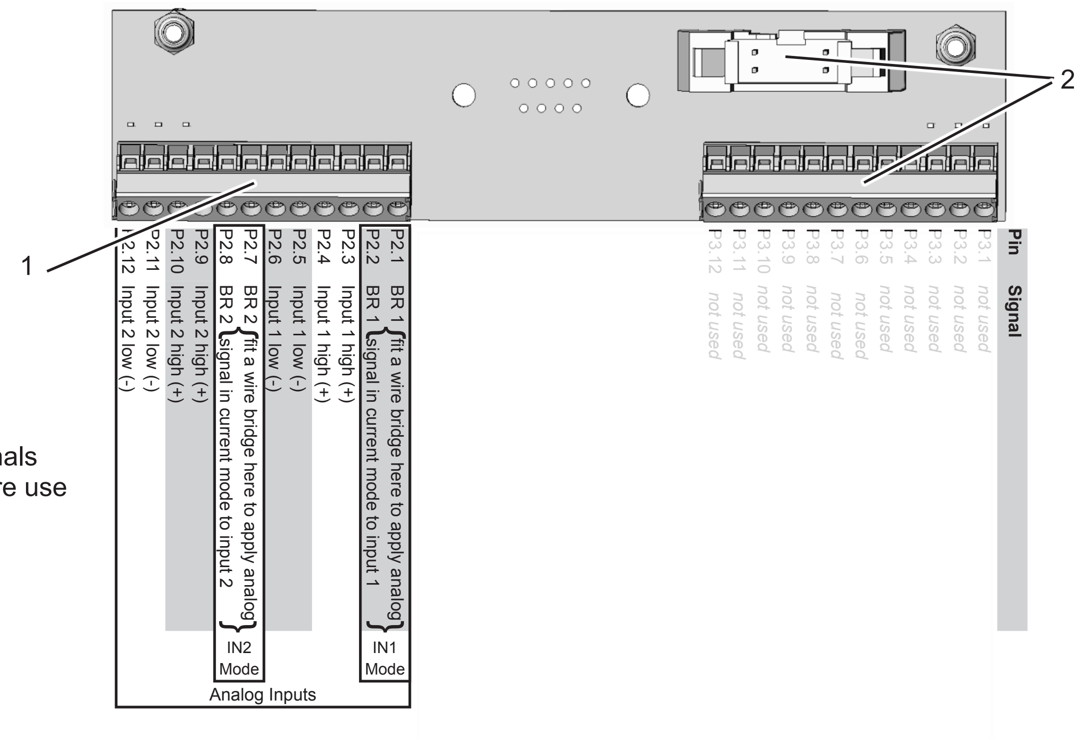
Analog inputs (option)

Terminals for analog input signals are located on the terminals board XSTI (terminal block X5; Fig. 4-22).

2 analog inputs	0–1 V, 0–10 V (software selectable) R_{in} = 100 kΩ optional (requires to fit wire bridges, see figure): 0–20 mA ; R_{in} = 50 Ω optically isolated from analyzer GND protected against overload up to ±15 V or ±20 mA

Note!

Consider the installation notes in ☞ section 4.7 and the notes on installing cable glands on page 4-22.



1 Screw-type terminals
2 Reserved for future use

Fig. 4-22: *Terminal Block X5 - Analog Input Signals*

4.6.2 Installation - X-STREAM XEXF Field Housings

Connecting the power cord

The power cord is connected to screw-type terminals located inside the housing.

Accepted wire gauge:	0.2…4 mm² (AWG 24…AWG 12)
Recommended wire gauge	min. 1.5 mm² (AWG 15), end sleeves not required
Skinning length:	8 mm (0.315")
Thread:	M3
Min. tightening torque:	0.5 Nm (4.4 in.lb)

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Verify the power supply at installation site meets the specification given on the analyzer´s nameplate label, before installing the instrument!

Verify power cables are disconnected and/or instrument is de-energized prior to working at the terminals!

Verify the power cord is layed with a distance of at least 1 cm (0.5“) to any signal cable to ensure proper insulation from signal circuits!

Feed the power cable through the cable gland at the instrument´s right side and strip the outer insulation. Strip the individual wires and connect to the terminals (a label is located next to the terminals on the mains filter housing).

Finally, tighten the outer dome nut to secure the power cable.

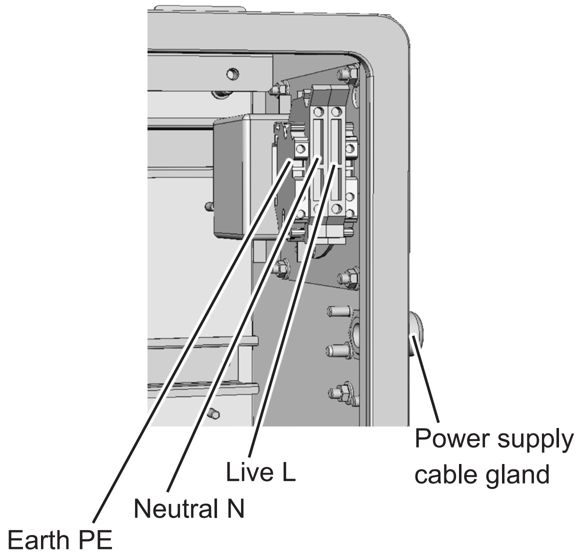


Fig. 4-23: *Power Supply Connections*

4.6.2 Installation - X-STREAM XEXF Field Housings

WARNING

ELECTRICAL SHOCK HAZARD BY MISSING EARTHING CONDUCTOR

Before completing the electrical connection of the instrument, verify cables are inserted and connected in correct manner!

Ensure the earthing conductor (protective earth; PE) is connected!

Completing the installation process

After all connections are correctly made and checked,

- close the front panel and secure with the two fasteners.

To achieve best and proper measuring results you must ensure the gas path system does not have leaks.

For this reason we recommend to carry out a leak test, as it is described within ☞ "Chapter 7 Maintenance and Other Procedures".

4.7 Notes On Wiring Signal Inputs and Outputs

Emerson Process Managament has made every effort during the development process, to ensure that the X-STREAM analyzer series ensures electromagnetic compatibility (EMC) with respect to emission and interference resistance, as confirmed by EMC measurements.

However, EMC is not wholly influenced by the design of the instrument, but to a large degree by the on-site installation process. Please observe the following sections and precautions to guarantee the safe and problem-free operation of this analyzer.

We recommend the operation of our analyzers in TN-s or TT power supply systems which are favorable regarding EMC effects.

4.7.1 Electrical Shielding of Cables

In order to minimise ambient electromagnetic interference, it is necessary to take care making all electrical connections between the analyzer and any other devices:

- We recommend using only shielded signal cables. For TN-S and TT systems the shielding must be connected at both ends to the housing (Fig. 4-24).

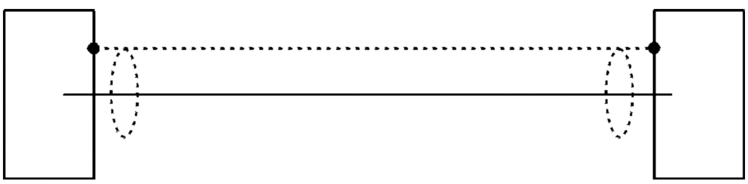


Fig. 4-24: *Shielded Signal Cable, Shielding Connected At Both Ends.*

4.7 Installation - Notes on Wiring

On-site conditions often differ from test environments and may require special precautions. Such a case arises when strong electromagnetic fields are present which could induce an interference current in the shielding. This type of current creates a potential difference between the connected housings.

Two possible methods of eliminating this e.g. in TN-C or TN-C-S systems are described here. Fitters familiar with EMC problems must decide which method should be emplyed.

- The shielding is connected only at one end (connecting to the analyzer is recommended): this gives better protection against external interference, and interference currents are prevented because the ground loop is interrupted.

This is the preferred method for connecting cable shields in hazardous area installations, to prevent interference currents between connected enclosures.

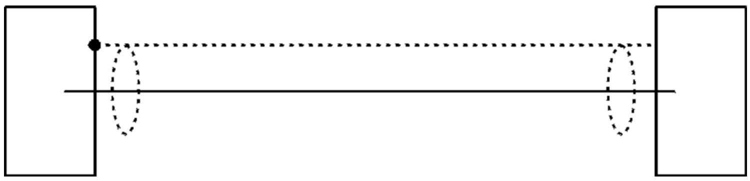


Fig. 4-25: *Shielded Signal Cable, Shielding Connected At One end.*

- Cables with double shielding: in this case, one shielding is connected to the analyzer housing, the other shielding to the external device. This is advantageous when both units are supplied from different grids (e.g. when installed in different buildings). Other precautions for connections between buildings are the use of fiber optic cable.

  This method is more expensive, but gives the best protection against external interference and against interference currents.

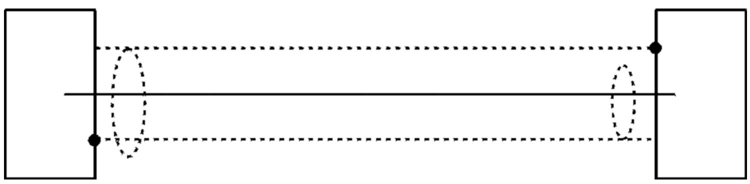


Fig. 4-26: *Signal Cable With Double Shielding, Shieldings Connected At Alternate Ends.*

X-STREAM XEGP with screw-type terminal adapters

In order to avoid measured values being influenced by external interference signals when terminal adapters are in use, the signal cable shieldings must be connected to the analyzer housing by means of shield connector terminals:

- Strip the signal cable to a length of 20 cm (8"). Take care to not damage the braided shield!
- Pull up the contact part of the shield connector terminal,
- feed through the cable as illustrated in Fig. 4-27, and
- release the contact part down onto the braided shield.

The result is a secure contact with the cable shield, improving the unit's immunity against interference from other electronic devices.

Finally connect the individual wires as described in section 4.6.1.

Fig. 4-27: *Shield Connector Terminal With Cable*

The shield connector must be ordered to fit the cable diameter, and can be retrofitted:

Ø 1.5…6.5 mm (0.06"…0.25")	part # ETC02019
Ø 5…11 mm (0.2"…0.43")	part # ETC02020
Ø 10…17 mm (0.4"…0.66")	part # ETC02021
Ø 16…24 mm (0.63"…0.94")	part # ETC02022

4.7 Installation - Notes on Wiring

4.7.2 Wiring Inductive Loads

Switching inductive loads creates electromagnetic interference:

When an inductive load (e.g. relay, valve) is switched off, the magnetic field resists the change in current; this induces a high voltage across the coil contacts (several hundred volts). This impulse propogates through the connected cables and can influence any electrical devices nearby or destroy signal inputs and outputs. This can be avoided with a simple precaution:

- A silicon diode is connected in parallel to the load's contacts. The induced impulse is thus short-circuited at its source. The cathode must be connected to the positive end of the coil, the anode to the negative end (Fig. 4-28).

Compatible filter components for standard valves are available on request.

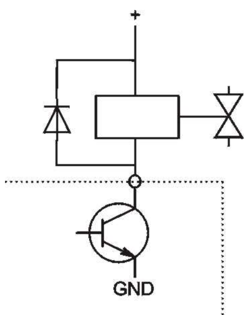


Fig. 4-28: *Suppressor Diode for Inductive Loads.*

4.7.3 Driving High-Current Loads

Loads which draw a current in excess of the specifications for X-STREAM series analyzer outputs (>30 mA / >1 A) may not be directly driven from digital or relay outputs.

Such loads require external relays serving as de-coupling modules: the X-STREAM output drives the external relay, which in turn drives the load.

In order to avoid interference, we recommend supplying the analyzer and the high-current loads from different sources (Fig. 4-29).

As previously described, the use of suppressor diodes for inductive loads is highly recommended.

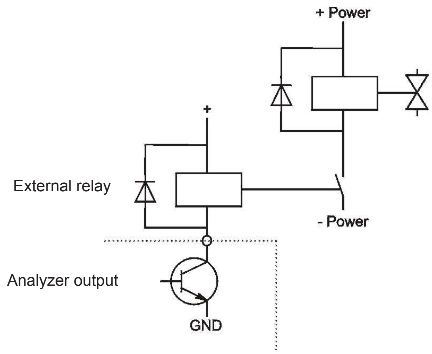


Fig. 4-29: *Driving High-Current Loads*

4.7.4 Driving Multiple Loads

Frequently, several loads in one system are controlled by several analyzer outputs, whereby the power for the loads derives from a common source.

Special care is needed when wiring the loads to minimize interference from switching these loads:

- **avoid** connecting the loads to their power supply by a common line:

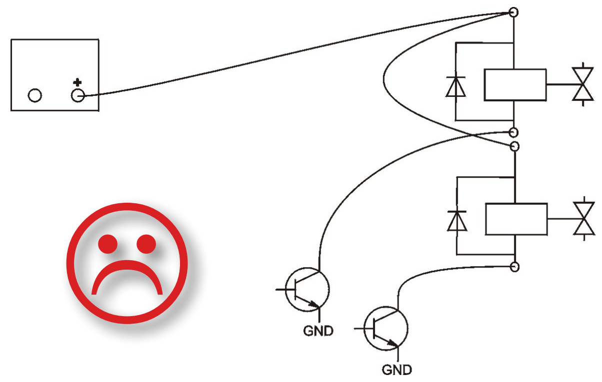


Fig. 4-30: *Common Line*

- **It is recommended** the loads to be wired separately, and each load connected separately to the power supply. Beginning at the distribution point, both the + and the - wires for each load are laid together to the load (Fig. 4-31). Interference is further reduced if a twisted multi-core cable is used.

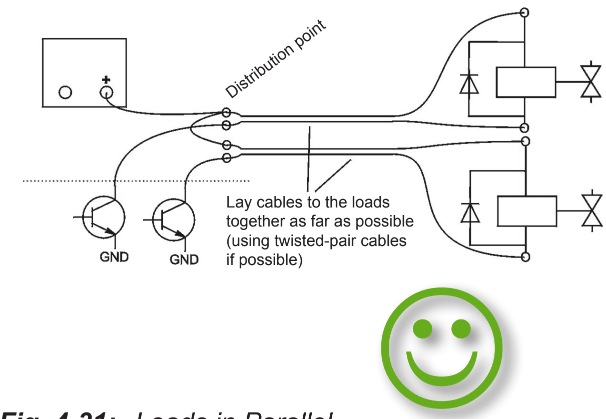


Fig. 4-31: *Loads in Parallel*

Chapter 5
Startup

5.1 Introduction

Once the unit has been unpacked and installed, it is recommended to first check the settings, and if necessary adjust them to the user's needs. e.g:

- What hardware is installed?
- Is the unit configured to your needs (alarms, inputs, outputs, etc.)

In order for the information in this chapter to be of any relevence, the unit must have been installed according to the instructions in chapter 4.

The following pages describe how to navigate through the menus and what is to be observed when configuring the unit. For the first startup after installation, follow the step-by-step instructions for navigating the menus, allowing you to familiarise yourself with the unit and its software, and if necessary adjust the settings to your own requirements.

⚠ CAUTION

OPERATION AT LOW TEMPERATURES

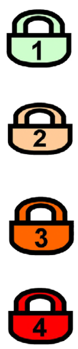
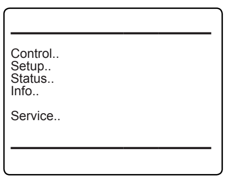
When operating an instrument at temperatures below 0 °C (32 °F), do NOT apply gas nor operate the internal pump before the warmup time has elapsed!

Violation may result in condensation inside the gas paths or damaged pump diaphragm!

Before starting to follow the steps described on the next pages, we recommend to carry out a leak test for the gas paths (containment system), to ensure the instrument is in proper condition. For instructions on how to carry out a leak test: ☞ "Performing a Leak Test" on page 7-4.

5.2 Symbols and Typographical Conventions

In the following sections, the symbols and typographical conventions explained below are used to describe the software menus and navigation.

Symbol	Description
Within Process Descriptions	
Setup..	Menu title
Setup.. Analog outputs..	Parent (SETUP) and current menu (ANALOG OUTPUTS)
Analog outputs.. Output*1...5*	As an example, the menu for Output1 is shown; the menus for outputs 2 to 5 look identical
Setup.. In-/Outputs.. Analog outputs.. 3 Output*1...5*	To access the current menu, access level code 3 has to be entered somewhere in the menu history
	Access levels: Access level 1 *(user)* Access level 2 *(expert)* Access level 3 *(administrator)* Access level 4 *(service level)*
	Screen shot (here: MAIN MENU) Menu lines shaded in gray are optional variants or functions

Convention	Description
Within Text	
(MENU TITLE) 6-12	For a detailed description of *MENU*, see page 6-12.
CONTROL	Identifies the CONTROL menu, e.g. "press ENTER to open CONTROL"
CONTROL - RANGES	From within the CONTROL menu, select the RANGES menu.
"*Valves*" "*Control..*"	Parameter or menu line name
Never, 1 min	Values to be selected
0…2000	Value to be entered
ENTER	press key (here: *ENTER* key)

5.3 Front Panel Elements

All X-STREAM XE gas analyzers feature an easy-to-use graphical user interface, which displays measurement values, status and error messages, and menus for the input of parameters.

For ease of use, the operator can select one of three languages for the display: By default any analyzer is configured with English and German language sets, while a third can optionally be added. Currently available or under preparation: French, Italian, Portuguese and Spanish.

The units are operated by six keys on the front panel.

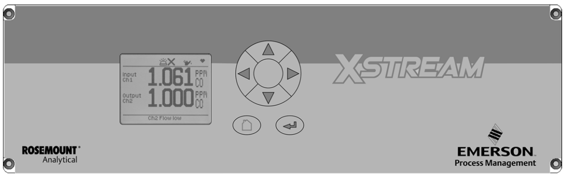
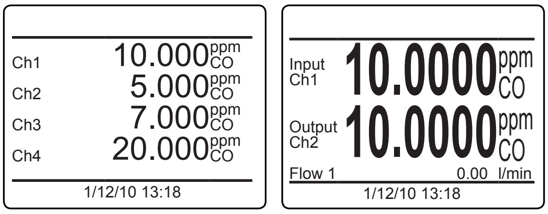


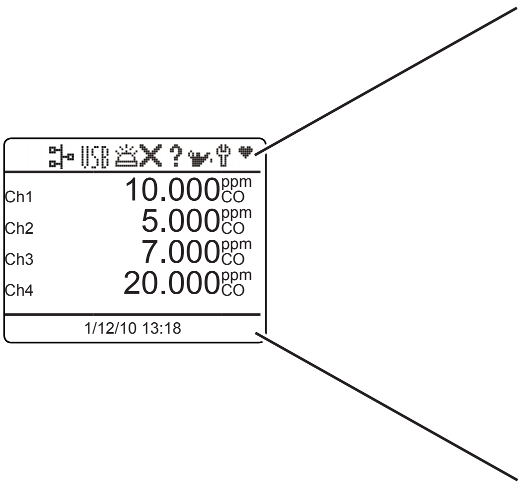
Fig. 5-1: *X-STREAM* Enhanced *Front Panel*

5.3.1 Display



The measurement display can be configured to various layouts. The figure to the left examplarly shows a 4 channel layout and a 2 channel layout with additional Information and differing letter sizes.

5.3.2 Status Line and Text Message Line



Status information is provided by different icons in the display´s first line:

Network = analyzer is remotely accessed

USB = USB device is attached

Bell = 'Alarm'

Cross = 'Failure'

Question mark = 'Off spec'

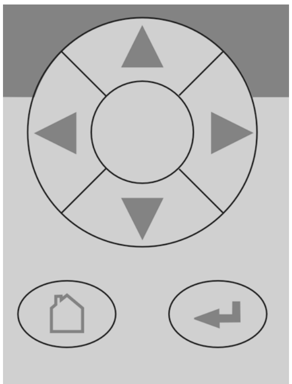
Oil can = 'Maintenance request'

Tool = 'Function check'

Heart = the analyzer´s 'heart beat', indicating the instrument is operating.

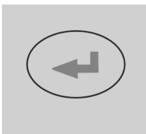
Clear text messages appear in the bottom line, replaced by current analyzer date & time if no messages are to be displayed.

5.3.3 Keys



Six keys enable the use of the menu system. Depending on the operational mode (measuring, browsing menus, editing) they have the following functions:

ENTER key:

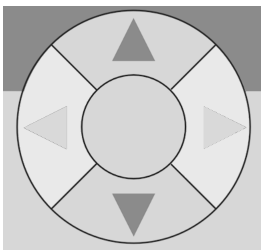


Mode	*Function*
Measuring	Enter main menu
Browsing	Open submenu (..) or execute command (!)
Editing	Confirm new entry

HOME key:

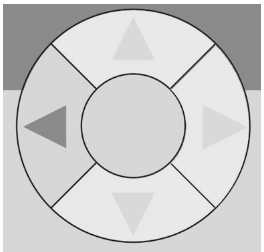
Mode	*Function*
Measuring	*(no function)*
Browsing	Return to measurement display
Editing	Abort entry

UP / DOWN keys:



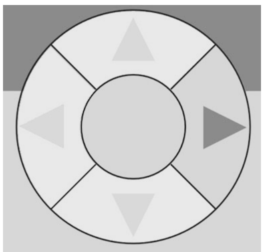
Mode	*Function*
Measuring	Enter main menu
Browsing	Highlight next menu line
	Open the previous/next page, when currently a line beginning with ▲/▼ is highlighted
Editing	Change current parameter

5.3 Front Panel Elements



LEFT key:

Mode	Function
Measuring	Enter main menu or open 2nd measurement display page (if configured)
Browsing	Go up 1 level or page in menu system
Editing	Move cursor 1 char to the left
	Leave channel selection
	Cancel editing of given parameter
	Go to previous menu page, if ▲ shows in first menu line



RIGHT key:

Mode	Function
Measuring	Enter main menu or open 2nd measurement display page (if configured)
Browsing	Open submenu (..)
Editing	Go to next menu page, when ▼ shows in last menu line
	Move cursor 1 char to the right

5.4 Software

The analyzer software displays measurement results and status messages, allows parameters to be set and edited, and maintenance functions (e.g. calibration or validation) to be carried out.

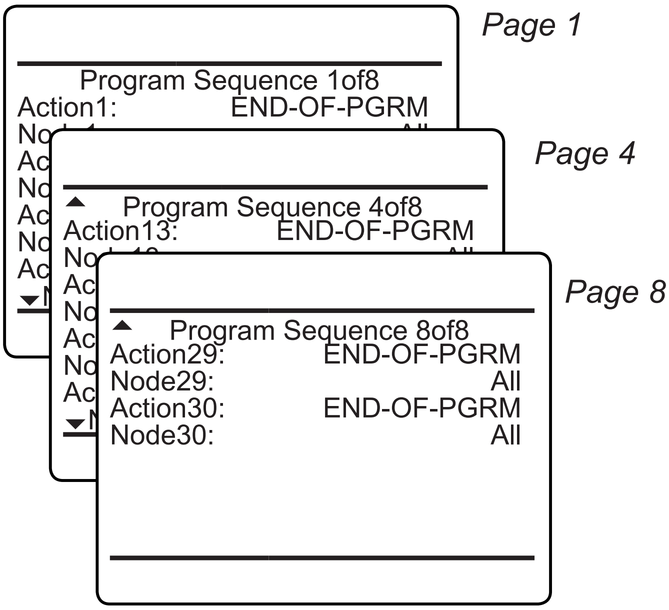
The software is organised hierarchically: The topmost level is called MEASUREMENT DISPLAY, followed by a MAIN MENU; all other menus and submenus are arranged below (☞ Fig. 6-1 at page 6-2).

Function	Description
Text	Simple text (not selectable with cursor)
Editable variables / parameters	A variable description shows a colon; the line can be made up of up to 3 elements: 1. description 2. value (number or text) 3. unit (optional) *Examples:* Span gas: 2000 ppm Tol.Check: Off Pressing *ENTER* in an editable variable line highlights the value to be changed. The optional unit can only be changed utilizing a setup menu. Variables shown without a colon cannot be edited, they are for information only.

Menu lines can perform different functions, to be distinguished by the following characteristics:

Function	Description
Executable command	A command line text ends in an exclamation mark; pressing *ENTER* with such a line highlighted, the command is executed, e.g. a calibration procedure. *Example:* Start calibration !
Selectable submenu	A menu line text ends in two dots. Press *ENTER* with a menu line highlighted to open the submenu. *Example:* Setup..

Browsing



Some menus have more entries than can be displayed at once. In these menus, an indicator in the last (▼) and/or first (▲) line indicates the direction the menu continues in.

In the example to the left

- page 1 continues downwards
- page 4 continues upwards and downwards
- page 8 continues upwards.

To show the next page (indicator ▼)

- place the cursor in the last accessible line and press *DOWN* or
- press *RIGHT,* irrespective of where the cursor is located.

To show the previous page (indicator ▲)

- place the cursor in the first accessible line and press *UP* or
- press *LEFT,* irrespective of where the cursor is located.

Editing

The editing mode enables changing parameters. It is initiated by pressing *ENTER*.

If the selection is a **parameter list**, the current entry is highlighted and may be changed by *UP* and *DOWN*.

If the selection is a **value**, the cursor is placed over the last character. Use *UP* and *DOWN* to change it.

Use *LEFT* and *RIGHT* to select another character.

The type of available characters depends on the position of the cursor:

- It is not possible to select the minus sign or decimal point as the last character.
- It is not possible to select the decimal point in integer values.
- For decimal numbers, the decimal point can be placed anywhere within certain limits.

There are two ways to exit the data entry mode:

ENTER: the entry is verified. If it is accepted, it is saved and the new value displayed; if not, an error message is displayed.

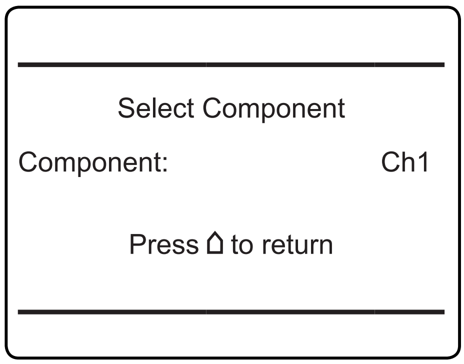
HOME: Cancel: all settings and changes are reset to their former values.

Component selection menu

Within the analyzer software, one can distinguish between analyzer related and component related menus: While the first contain entries, relevant for the analyzer (e.g. time setting), the second contain entries relevant for a specific component (channel) only (e.g. calibrating a channel).

For single channel analyzers, editing any channel specific parameter will only effect this one channel.

Different for multi-channel analyzers: Such instruments require selecting a channel prior to changing channel related parameters. When a channel related menu entry is selected, automatically a SELECT COMPONENT menu shows up, to select the component of interest, or to cancel the current action.



Select the component / channel you want to work with, and press *ENTER*.

This menu does not show on single-channel units.

Within menu descriptions, the following points out, that for multi-channel instruments a selection is required:

Multi-channel unit:
In SELECT COMPONENT select the channel to be ...

5.4 Software

5.4.1 Access Levels & Codes

Access levels can be used to prevent changes to parameters by unauthorized personnel. The X-STREAM menu system supports **four prioritized** access levels, which can be activated and deactivated separately, and should be supplied with their own access codes.

Level four has the highest priority and is used for factory settings — only qualified EMERSON service personnel have access to this level.

Level three gives access to system admin parameters, e.g. for configuring data acquisition systems communication.

Level two covers the expert settings, e.g. basic settings for calibrations and measurements.

Level one is the user level and includes

- parameters which should be set by trained personnel only.
- functions, not to be started by any person (e.g. start calibrations).

All menus not assigned to one of these levels are not editable or of minor relevance.

Within this manual, the descriptions of the menus and procedures also indicate, which level the menus are assigned. These assignments cannot be changed.

Access codes for levels 1 to 3 can be defined, activated and deactivated by the client. The analyzer is delivered with the following settings:

Level	Access code	Status
1	00000001	Off
2	00000002	Off
3	00000003	Off

⚠ **We recommend to set new access codes, if you want to use this option (☞ 6-44)!**

Notes!

*If a low level is **locked** (status **On**), all higher levels will also be **locked.***

*If a high level is **unlocked** (status **Off**, or code entered when requested), automatically all lower levels will also be **unlocked**.*

For above reasons, it is always possible to enter a higher code than requested, to gain access to a menu (e.g. if access code 1 is requested, you may also enter access code 2).

Entering access codes

If an access code is required for a menu, a message like the following appears:

Access Code 1
Code 00000000

Press ⌂ to return

To enter the code, press

- UP/DOWN to change the currently selected digit,
- LEFT/RIGHT to select a different digit,
- ENTER to submit the code

or

- HOME to exit the edit mode and return to the previous display.

5.4.2 Special Messages

Depending on the last action performed by the user, one of the following messages may be displayed to assist or inform the user.

Information on incorrect entry:

The value entered by the user is outside valid limits. The display indicates what limits apply.

Press ↵ to return to the previous screen to enter an acceptable value.

```
          Wrong input
Range                 0.1…50

        Press ↵ to return
```

Confirmation of execution of function:

Confirms that a function or procedure (e.g. calibration) has been started, or cancelled. The message automatically dissapears after a few seconds.

```
       Function executing


        Press ↵ to return
```

5.5 Powering Up

5.5.1 Boot Sequence

When the unit is powered up, a series of internal tests is automatically performed. During this time the front panel keys are disabled, while the remaining time counts down in the display.

5.5.2 Measurement Display

The measurement display is shown

- automatically on completion of the boot sequence
- when HOME is pressed
- automatically after a set period of time of inactivity (i.e. with no keys being pressed).

The information, to be provided in each of the four lines of the measurement display, can be configured by an expert (access level 2):

- Sample gas components, measuring results and measuring units for each channel
- secondary measurements, e.g. pressure, gas flow, temperature
- nothing (empty line)

The factory settings are as follows:

Line 1: measured value of channel 1
Line 2: measured value of channel 2
Line 3: measured value of channel 3
Line 4: measured value of channel 4

Note!

If less than four channels are installed in the unit, only the measureands for these channels are available for selection.

5.5 Powering Up

The setup menu enables several additional configurations, e.g.

- 2 pages measurement display
- different font sizes

☛ 6-41.

The very first display line shows

- a flashing heart, showing the instrument is operating
- one or more icons to indicate the analyzer status. Some of these are explained by a text message in the last line (see below)
- a channel indicator, if the current menu page is related to a specific channel only.

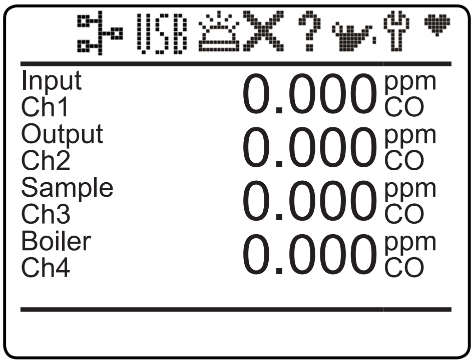
The display´s bottom line shows plain text status information (errors, maintenance requests, function checks or off-spec performance).

Active messages are stored in an internal buffer. If there is more than one message in the buffer, the display will cycle through.

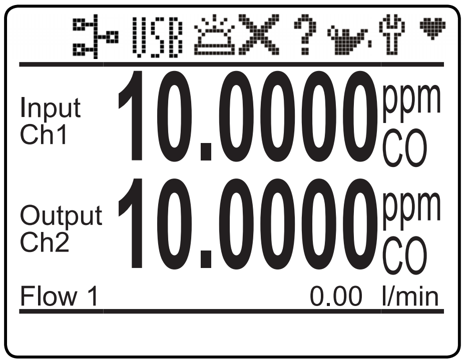
Most messages also activate a NAMUR relay (if a relay has been assigned to that NAMUR function; ☛ 6-82).

Note!

There are also functions, that do activate a relay, but are not shown on the display. In such cases, check the STATUS menu for more information.



4 lines display

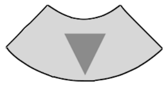


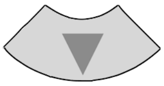
2 lines display with additional secondary measurement line

MEASUREMENT DISPLAY

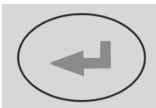
5.6 Selecting the Language

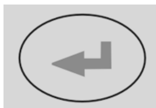
If the analyzer is operational and it becomes clear that the incorrect language has been set, which is unintelligible to the operator, the following sequence of keypresses (starting at the measurement display) can be used to set the language.



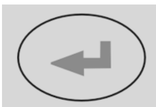


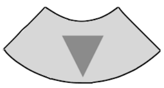
If the system has been set up accordingly, the code for access level 1 must be entered at this point to enable access to the following menu.





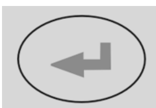
Note!
The factory setting for this unit is "no code required". For ease of operation, it is recommended to use the factory settings for access codes while setting up the unit for the first time. In the following sections, therefore, no more reference will be made to any need for entering a code.

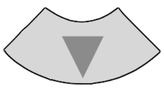


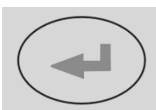


Note!
Pressing ENTER the 3rd time in the main sequence highlights the "Language" line.

- *DOWN* changes the language.
- *ENTER* sets this language and the display is updated accordingly.
- If the selected language is not the intended, repeate the last three steps until the intended language is set.







5.7 Checking the Settings

The following sections are structured so that the user can work through them one by one after powering up the unit. After completing these steps, the unit will be configured to the user's needs and properly functioning.

()

Starting with the measurement display (☞ 5-11), pressing any key except *HOME* will access the MAIN MENU; from here, follow these steps:

(If the display is showing anything other than the measurement display, press *HOME* to return to the measurement display first).

```
            Setup 1of2
Display..
Calibration/Validation...
Measurement..
In-/Outputs..
Communication..
Limit Alarms..
Installed Options..
▼Save-Load..
```

Note!

If you are unfamiliar with the language set: ☞ 5-12 shows the sequence of keys to set a different language.

If the system has been set up accordingly, the code for access level 1 must be entered at this point to enable access to the following menu.

Note!

The factory setting for this unit is "no code required". For ease of operation, it is recommended to use the factory settings for access codes while setting up the unit for the first time. In the following sections, therefore, no more reference will be made to any need for entering a code.

```
             Display

Contrast..
Language:                English
Phrase Version             1_6_0
Measurements..
Measurement Display..
Menu Access..
Auto Home:                10 Min
```

Set the preferred language for the software.

5.7 Checking the Settings

5.7.1 Installed Options

All X-STREAM gas analyzers can be fitted with a variety of optional components: follow these steps to see which options are installed on your analyzer.

Press *LEFT* to return to SETUP, highlight “*Installed options”* and press *ENTER*.

Do not edit any entries in these menus without special knowledge.

Incorrect entries may result in incorrect results or impair the performance of the unit.

Initial access to this menu should be to gain information on the configuration of the unit.

```
      Installed Options 1of2
Licenses..

Valves:                    None
Pumps:                     None
DIO#1 Installed:             No
DIO#2 Installed:             No
Anal. Outputs:                4
▼AIN Installed:              No
```

This 2 pages menu indicates, which of the possible optional components are installed in the unit. The values displayed on your unit may differ from those illustrated here.

Note!
Multichannel instruments require to select a component (channel) to enter the second menu page.

```
▲     Installed Options 2of2

Flow..
Pressure..
```

```
            Licenses

Key 1:                        0
Key 2:                        0
Key 3:                        0

Package                    None
Trial Days
```

“Licenses..” opens another menu where you can check or enter license codes to unlock optional software features.

5.7.2 Configuring the Display

Press *LEFT* to return to SETUP.

Check the settings for the measurement display, temperature and pressure units, and for menu access: press *ENTER* to open DISPLAY.., select "*Measurement display..*" and press *ENTER*.

If a setting does not meet your requirements, access that menu and adjust the parameter.

```
Display 1 assignments

Line 1:          Comp1
Line 2:          Comp2
Line 3:          Comp3
Line 4:          Comp4
Line 5:          Blank

▼Labels..
```

Select the value to be displayed in each line of the measurement display. The following options are available:

Comp1…Comp5,
Temp1…Temp5,
Press1…Press5,
Flow1…Flow5
Blank (nothing)

Note!
*X-STREAM currently supports one pressure sensor only. Values **Press1** to **Press5** thus refer to the same sensor.*

```
Display 1 labels

Line 1:
Line 2:
Line 3:
Line 4:
Line 5:
```

When entering LABELS.., you may change the channel´s label, that is the first text phrase in a line showing a measurement value: If here nothing is entered, the default phrases (Ch1…Ch4) are used.

Note!
Notice the headlines of the menus showing a "1": This indicates that you can setup more than 1 measurement display page.

5.7.3 Calibration/Validation Setup

Setup..
Calibration/Validation..

Component ?

```
              Gases

Zero Gas:                0.0 ppm
Span Gas:             2000.0 ppm
Range Gases..

Current Range:           Range 1
```

```
           Tolerances 1of2

ZeroValidTol:              10.0%
SpanValidTol:              10.0%

CalibDeviat Tolrance:        Off
ZeroCalTol:.               20.0%
SpanCalTol:.               20.0%
▼ AfterCalCheck:             Off
```

Once the display settings have been checked, press *LEFT* to return to SETUP and open CALIBRATION/VALIDATION to check the calibration and validation settings.

Multi-channel unit:
Select the component to be set in the gas component selection menu.

Note!
For more detailed information on calibration procedures, ☞ 7-5.

In CALIBRATION/VALIDATION - GASES, enter the values for zero and span gas:

- See gas supplier´s certificate for correct values.
- Values must be correctly set for results to be accurate.
- Multi-channel units: the values for each channel must be entered separately.

Press *LEFT* to return to CALIBRATION/VALIDATION, and enter TOLERANCES .

By default the 'CalibDeviat Tolerance' check′ option is set inactive (**Off**).

With 'CalibDeviat Tolerance' set to **On**,

- during calibration the analyzer checks whether the values set for zero and span gas conform to the concentration of the gas currently being supplied.
- If the concentrations differ more than the percentage of range entered in the following lines, the calibration is aborted.This prevents calibration from being performed when the incorrect gas is supplied (e.g. span gas calibration using zero gas), which would result in an incorrectly configured unit.

5.7 Checking the Settings

If “AfterCalCheck” is enabled (**On**), the calibration procedure adds an additional phase where it measures and stores the concentration value shortly after the calibration.

Ch2	
Tolerances 2 of 2	
ZeroTolRef:	2000.0ppm
ZeroValidTol+-	200.0ppm
ZeroCalTol+-	400.0ppm
SpanTolRef:	2000.0ppm
SpanValidTol+-	200.0ppm
SpanCalTol+-:	400.0ppm

This menu shows the explicit concentration reference and limit values for the calibration and validation procedures for zero and span gas. They are calculated using the configured zero respective span gas values and their according percentage tolerance.

Press LEFT several times to return to SETUP and open MEASUREMENT.

5.7 Checking the Settings

Setup..
Measurement..

```
Ch1
            Measurement 1of2

Ranges..
Damping..
Linearization..
Cross Interference..
Average..
Delay..
▼
```

Signal damping (set in DAMPING) allows smoothing the output signal, but also affects the response time of outputs and display:

- The factory setting is 0 seconds.
- The maximum possible t_{90} time is limited by the size of the internal sampling buffer and the sampling rates of the installed measuring principles/sensors.
- Multi-channel units: the value for each channel must be entered separately.

```
Ch1
▲           Measurement 2of2

Cut-off:                     None
Pressure Compensation ..
```

The second page´s last line (Pressure Compensation) enables the user

- to enter the current ambient pressure manually, if no pressure sensor is installed,

or

- to view the current pressure, if a sensor is installed (☞ 5-14).

5.7 Checking the Settings

Ch1

Pressure compensation

Manual Pressure:	1013 hPa
Pressure	1013 hPa
Pressure Status	Good

If no pressure sensor is installed, enter the current ambient pressure here and adjust it, when significant changes take place: this improves the accuracy of the instrument.

5.7.4 Setting the Analog Outputs

Press *LEFT* to return to SETUP, and then open IN/OUTPUTS, and from there ANALOG OUTPUTS.

Setup..
In/Outputs..
Analog Outputs..

Analog Outputs

Output1..
Output2..
Output3..
Output4..
Output5..

Select the analog output you like to check.

Note!
The following section only in brief describes the entries currently of interest!
☞ Chapter 7 for a more detailed description.

5.7 Checking the Settings

```
Signal:              Comp1
OutRange:          0-20 mA
Low Scale:            0.00
High Scale:         100.00
AutoScale:             Yes
FailMode:            Track
0/4 mA:               0.00
20 mA:              100.00
Hold:                   No
```

"*Signal*" specifies the value associated with the selected output. The following options (partly dependent on the number of measuring channels and sensors installed) are available:

Signal*)	**Description**
None	The analog output is deactivated
0 / 4 mA	Either a 0 mA or 4 mA signal is generated, for example to be used to test the processing in a subsequent system. The actual type of generated signal is setup in the "*Out range*" line (☞ next page).
20 mA	A 20 mA signal is generated, e.g. to test the signal processing in a subsequent system.
Comp1…5	Gas concentration
Temp1…5	Temperature
Press1…5	Pressure
Flow1…5	Flow
Calc A…D	Result of calculator
RawVal1…5	Raw value
RangeID1…5	ID of selected range

***)** *Numbers 1 to 5 refer to components [channels] 1 to 5: In case of secondary measurements, this means, the selected value is that of the sensor assigned to the given component (Press2 is the pressure value of the sensor assigned to component 2).*

In contrast, capital letters A to D imply that these calculator results are component [channel] independent (Calc C is the result of calculator C).

5.7 Checking the Settings

Signal:	Comp1
OutRange:	0-20 mA
Low Scale:	0.00
Max Scale:	100.00
AutoScale:	Yes
FailMode:	High +10%
0/4 mA:	0.00
20 mA:	100.00
▼Hold:	No

Next, select the output range:

- **0-20 mA** (dead zero) generates a 20 mA signal, if a concentration is measured at the upper limit of the signal range. A 0 mA signal is generated if the sample gas concentration equals the value specified with "*LowScale*".
- **4-20 mA** (life zero): A 4 mA signal is generated if the concentration equals the value specified with "*LowScale*", thus enabling to detect e.g. a broken cable.

Enter a concentration, to equal the low output limit (0 or 4 mA)

Enter a concentration, to equal the high output limit (20 mA)

Enable (**Yes**) or disable (**No**) output autoscaling.

"*FailMode*" selects the output´s behaviour under failure conditions, considering or not, the NAMUR recommendation NE 43. NE 43 defines output signals enabling to detect different types of failures/status (☞ Tab. 5-1): The related information is transmitted as a current signal, but outside the (0)4-20 mA measurement signal range.

Available options:

Track: NE 43 not considered.

HIGH +10%: NE 43 failure signal level: "above".

LOW -10%: NE 43 failure signal level: "below".

Note!
The related outputs signals can be finetuned on a second menu page, if "FailMode" *is set to other than* ***Track*** *(☞ next section).*

Note!
*Factory setting is "*Outrange:" ***4-20 mA*** *and "*FailMode:" ***LOW - 10%****, unless ordered otherwise.*

Operational modes conforming to NAMUR 43 recommendations (NE 43)

The common modes for analog outputs do not support the detection of a failure in the measurement system. In such a case, the behaviour of the output signal is undefined: either the last value is held, or a random value is sent. System failures cannot be detected by an external data capture system.

NE43 includes recommendations for such cases, but also for the configuration of analog outputs to detect other measurement states. X-STREAM analyzers incorporate these recommendations as follows:

Setting "*FailMode*" to **HIGH + 10%** or **LOW - 10%** defines specific analog output signals in case of a failure. Since these values are not output under normal operation conditions, a data acquisition system is enabled to distinguish between the following situations:

- valid measured value (signal within range as per Tab. 5-1)
- signal out of range (signal slowly rises or falls towards the limits given in Tab. 5-1, and holds that value until the concentration returns to within the measuring range).
- failure (signal out of range as per Tab. 5-1, but not 0)
- severed cable (no signal [0 mA]),

Table 5-1 provides a summary of all available operational modes.

			Output signal, if				
"OutRange"	**"FailMode"**	**Failure signal level acc. NE 43**	**Measured value is valid**	**Measured value is below lower limit ("Low scale")**	**Measured value is above upper limit ("High scale")**	**An internal failure occured**	**Cable is severed**
0-20 mA	Track	-	0…20 mA	< -19 mA	> 21.7 mA	undefined	0 mA
4-20 mA	Track	-	4…20 mA	< -19 mA	> 21.7 mA	undefined	0 mA
0-20 mA	LOW - 10 %	below	0…20 mA	-0.20 mA* (-1.80…-0.01 mA)**	20.50 mA* (20.01…21.50 mA)**	-2 mA	0 mA
4-20 mA	LOW - 10 %	below	4…20 mA	3.80 mA* (2.20…3.99 mA)**	20.50 mA* (20.01…21.50 mA)**	2 mA	0 mA
0-20 mA	HIGH + 10 %	above	0…20 mA	-0.20 mA* (-1.80…-0.01 mA)**	20.50 mA* (20.01…21.50 mA)**	> 21.7 mA	0 mA
4-20 mA	HIGH + 10 %	above	4…20 mA	3.80 mA* (2.20…3.99 mA)**	20.50 mA* (20.01…21.50 mA)**	> 21.7 mA	0 mA

Note!
*The application of values marked * or ** depends on the setting of "Cut Mode" (Analog outputs setup menu, page 6-76).*

Tab. 5-1: *Analog Output Signals Settings and Operation Modes*

5.7 Checking the Settings

Signal:	Comp1
OutRange:	0-20 mA
Low Scale:	0.00
Max Scale:	100.00
AutoScale:	Yes
FailMode:	Track
0/4 mA:	0.00
20 mA:	100.00
▼Hold:	No

"*0/4 mA*" enables to finetune the analog output: Set "*Signal*" to **0 mA** and, while measuring the output current, adjust it to the expected value.

Accepted range: **-10,000** … **+10,000**

"*20 mA*" enables to finetune the analog output: Set "*Signal*" to **20 mA** and while measuring the output current, adjust it to the expected value.

Accepted range: **-10,000** … **+10,000**

"*Hold*" selects the output´s behaviour during calibrations.

If set to **Yes**,

- the analog output is fixed to the last measured value;
- concentration alarms, which may otherwise be triggered by the concentrations of the calibration gases, are supressed.

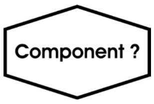
If set to **No**,

- the analog output signal always corresponds to the actual measured value during calibration; this may trigger alarms if limits are exceeded.
  Note!
  This behaviour may be undesireable if e.g. the unit is connected to a data acquisition system.

5.7.5 Setting Concentration Alarms

Note!
If concentration alarms are not being used, continue with ☞ 5-25.

Press *LEFT* until SETUP is displayed, then open LIMIT ALARMS - CONCENTRATION



Multi-channel unit:
Select the channel to be calibrated in the SELECT COMPONENT menu.

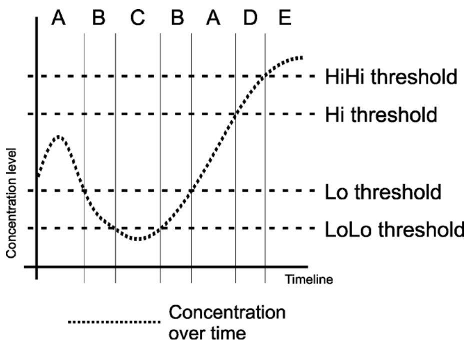
Ch1	
Concentration	
Alarm Monitor:	On
LoLo Level:	50.000 ppm
Lo Level:	100.000 ppm
Hi Level:	400.000 ppm
HiHi Level:	600.000 ppm
Hysteresis:	10.000 ppm
States..	

Four concentration limits can be set for each channel:

- *"Lo"* and "*Hi*" enframe the expected gas concentration,
- *"LoLo"* equals or is below "*Lo*",
- *"HiHi"* equals or is above "*Hi*".

See the figure to the left for an explanation.

If you enter values for any threshold, the above given order has to be considered. A message is displayed, if an entered value does no comply with this condition.



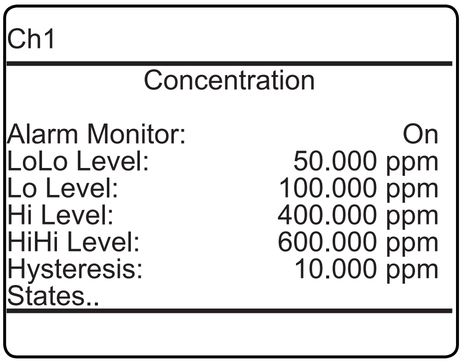
Note!
HiHi und LoLo are main alarms,
Hi and Lo are pre-alarms.

Fig. 5-2: *Arrangement of Concentration Thresholds*

Should the measured concentration go beyond one of the threshold levels (areas B, C, D & E in the figure), a message is displayed in the message line of the measurement display, the NAMUR pictogram appears (bell) and a corresponding digital output is activated, if assigned.

A hysteresis avoids oscillating alarms in case the concentration is fluctuating around a threshold.

5.7 Checking the Settings



You may turn the alarm function **On** or **Off** separately for each channel (“*Alarm Monitor*”).

It´s also possible to use some of the thresholds only. In this case, set the not used to a level outside the range limits (for this, “*Lo*” and “*LoLo*” support entering negative values).

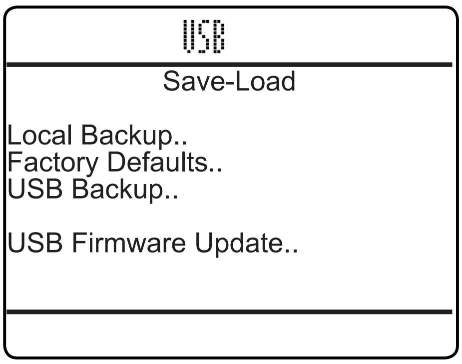
In case of an alarm, you may like to enter the STATES submenu, to check which one is triggered.

5.7.6 Backup the Settings

The most important settings have now been checked and the unit is configured to suite your needs.

A backup copy of these configuration data can now be saved.

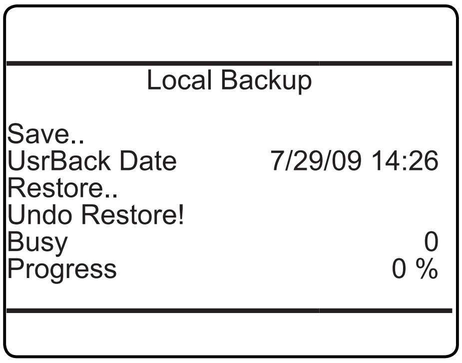
Press *LEFT* until SETUP and then open SAVE-LOAD.



This menu gives you the choice, to either

- make a local backup to a protected memory area
- restore the factory default settings, or
- make a backup to an external USB device.

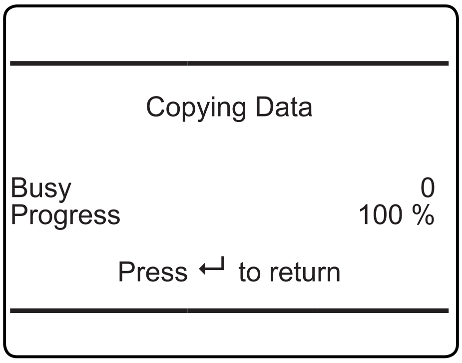
5.7 Checking the Settings



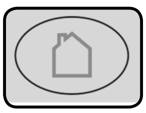
For now, make a local backup:

Enter LOCAL BACKUP and then select "*Save..*".

Confirm the operation (select "*Yes!*").



Wait until "*Progress*" shows **100 %**, then press *ENTER* to return to LOCAL BACKUP.



You have now completed checking the unit's settings:

- **Press *HOME* to return to the MEASUREMENT DISPLAY**.

5.8 Perform a Calibration

We recommend to perform at least a zero calibration, after startup of the instrument, to ensure proper measuring results.

Refer to ☞ Chapter 7 for a comprehensive description of calibration procedures.

Chapter 6
User Interface and Software Menus

This chapter describes the structure and content of the X-STREAM Enhanced gas analyzer software menus.

While this chapter describes all software menus in hierarchical order, Chapters 5 & 7 explain by practical examples, how to navigate through the menus to perform certain basic setup operations, or maintenance functions.

6.1 Symbols and Typographical Conventions

In the following sections, the symbols and typographical conventions described below are used to describe the software menus and navigation.

Symbol	Description
Within Process Descriptions	
Setup..	Menu title
Setup.. Analog outputs..	Parent (SETUP) and current menu (ANALOG OUTPUTS)
Analog outputs.. Output*1...5*	As an example, the menu for Output1 is shown; the menus for outputs 2 to 5 look similiar
Setup.. In-/Outputs.. Analog outputs.. 3 Output*1...5*	To access the current menu, access level code 3 has to be entered somewhere in the menu history
	Access levels:
	Access level 1 *(user)*
	Access level 2 *(expert)*
	Access level 3 *(administrator)*
	Access level 4 *(service level)*

Symbol	Description
Within Process Descriptions	
Control.. Setup.. Status.. Info.. Service..	Screen shot (here: MAIN MENU) MENU LINES SHADED IN GRAY ARE OPTIONAL VARIANTS OR FUNCTIONS

Convention	Description
Within Text	
(MENU TITLE) ☞ 6-12	For a detailed description of *MENU*, see page 6-12.
CONTROL	Identifies the CONTROL menu, e.g. "press ENTER to open CONTROL"
CONTROL - RANGES	From within the CONTROL menu, select the RANGES menu.
"*Valves*" "*Control..*"	Parameter or menu line name
Never, 1 min	Values to be selected
0 ... 2000	Value to be entered
ENTER	press key (here: *ENTER* key)

6.2 Menu System

Note!

This overview does only show menu branches up to the 3rd menu level, not functions nor parameter lines! E.g. the lines "Pump" or "Lock menus" of the menu CONTROL are not shown.

The analyzer's menu system has a dynamic behavior in that it does not show entries not supported by the current analyzer configuration. Therefore this overview might show entries hidden in your specific instrument!

Notes!
This figure applies to software revision 1.6.x and later.

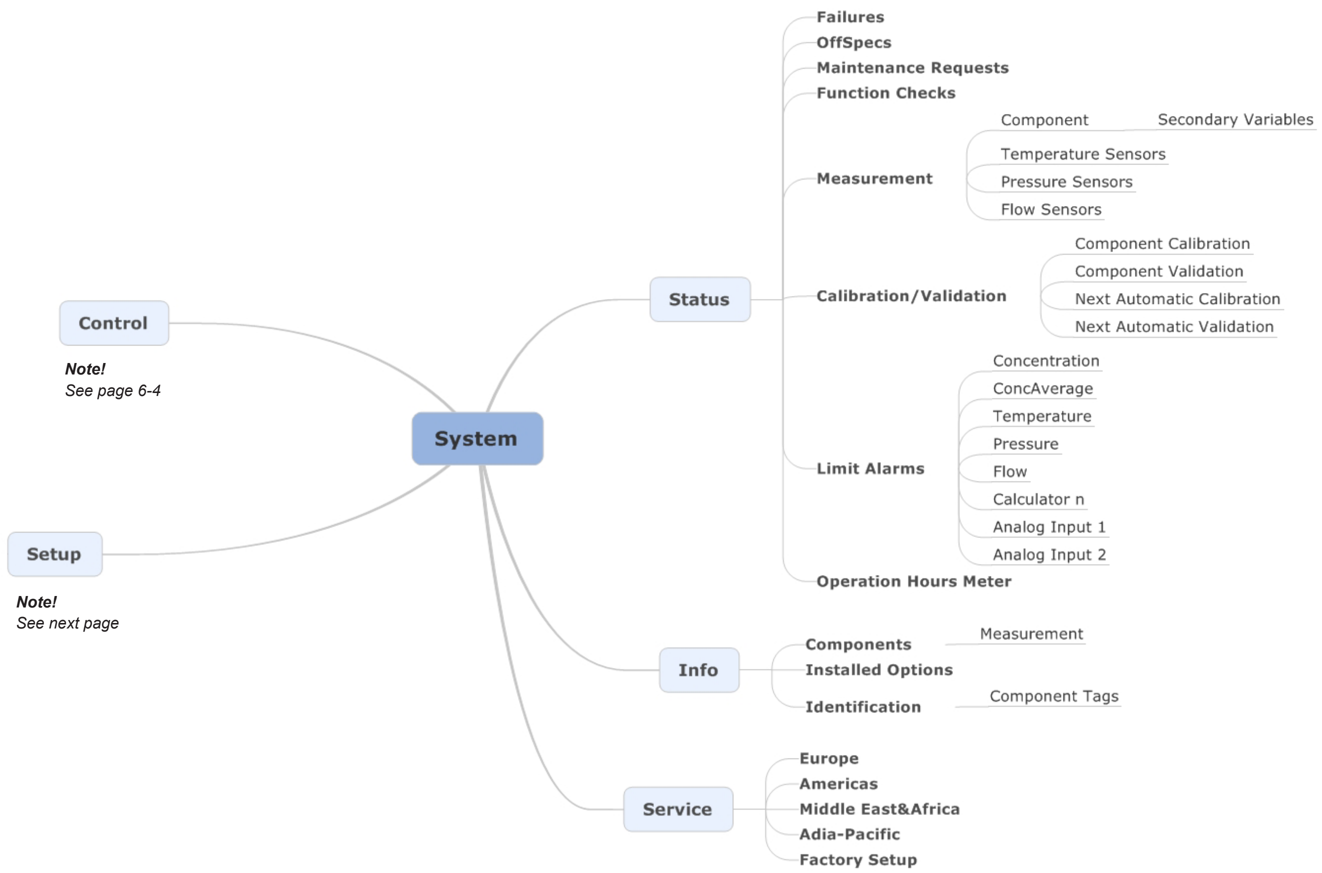


Fig. 6-1: *X-STREAM* Enhanced *Software Menu Structure*

6.2 Menu System

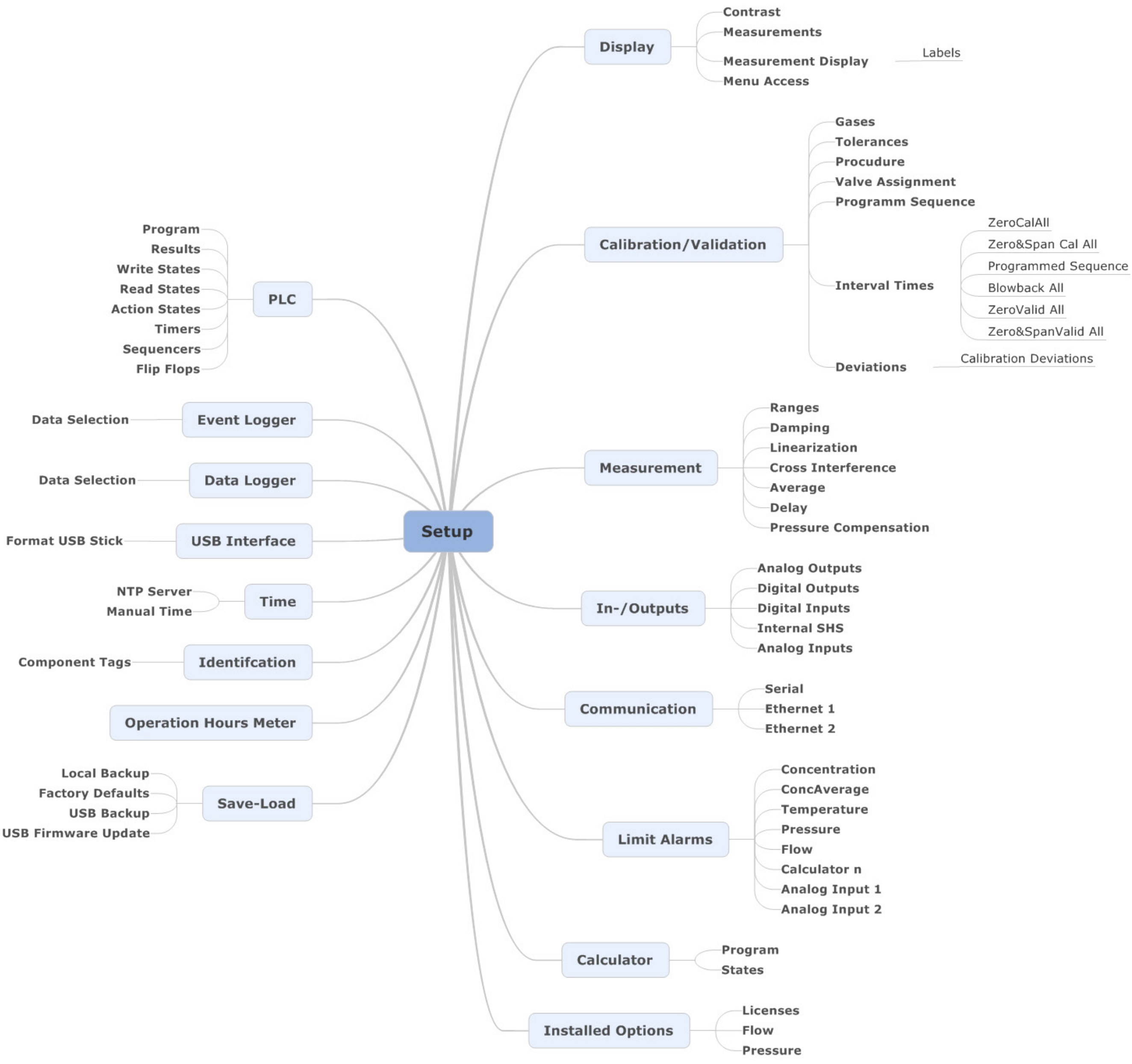


Fig. 6-1: *X-STREAM* Enhanced *Software menu structure (continued)*

6.2 Menu System

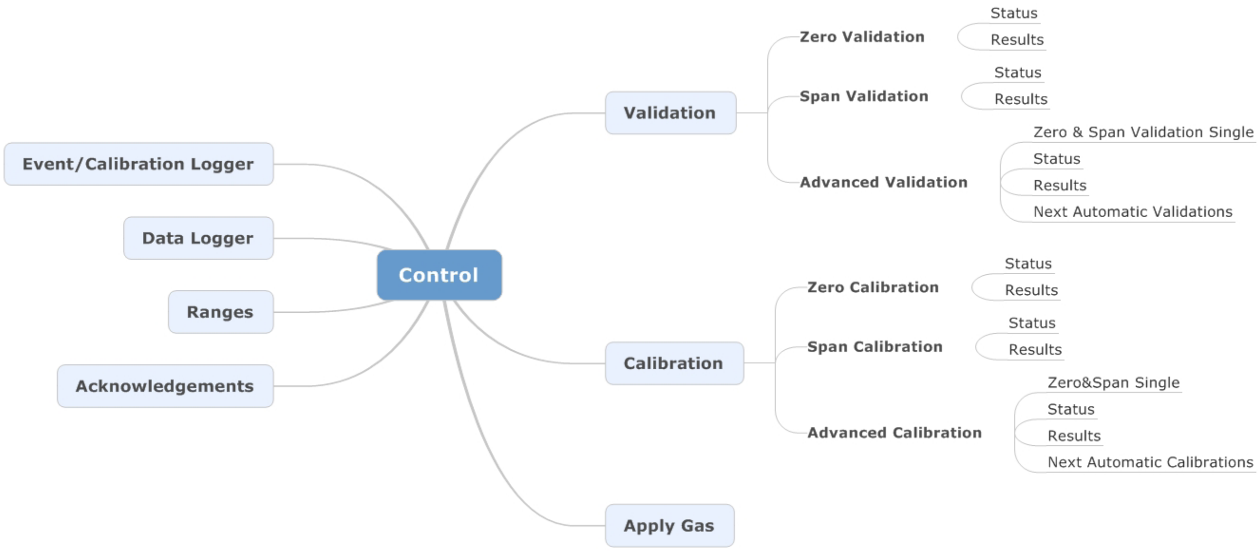
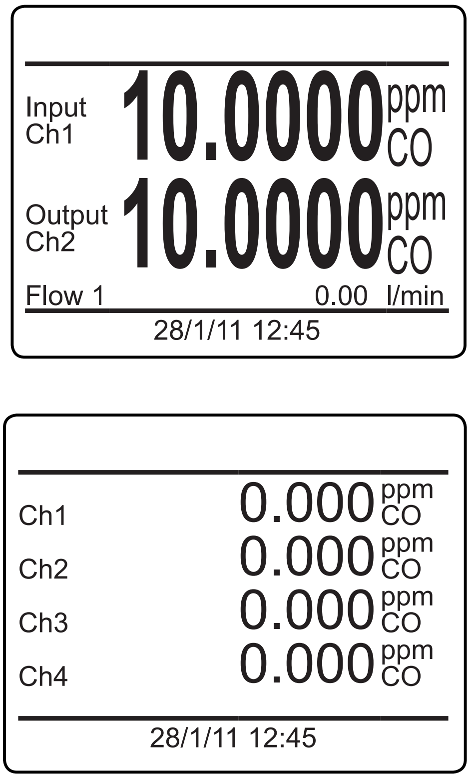


Fig. 6-1: *X-STREAM* Enhanced *Software menu structure (continued)*

6.2 Menu System

6.2.1 Switching On



MEASUREMENT DISPLAY

When the unit is powered up, a self-test (POST) is initiated, after which the unit shows the **MEASUREMENT DISPLAY**.

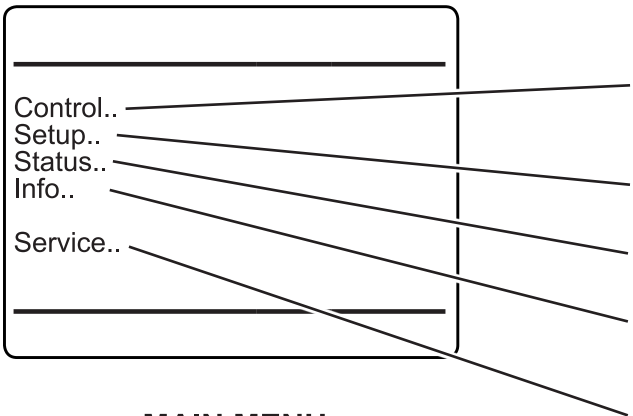
Note!
Two different measurement display layouts are available and user selectable. To change the display of the MEASUREMENT DISPLAY ☞ DISPLAY SETUP, 6-34.

Depending on the setup, either a 2-channel layout or a 4-channel layout is used.

Clear text messages appear in the bottom line, replaced by current analyzer date & time if no messages are to be displayed.

Note!
Figures within this manual do not always consider displaying date&time or messages.

Press *LEFT* or *RIGHT* to switch to the MAIN MENU and select one of the main submenus:



Start functions or perform actions ☞ 6-6.

Setup the instrument ☞ 6-33.

Get status information ☞ 6-125.

Some analyzer information ☞ 6-141.

Get service information ☞ 6-145.

MAIN MENU

6.2.2 Control Menu

Control..

Validation...
Calibration..
Apply Gas.....
Lock Menus!
Acknowledgements
Pump 1 On
Pump 2 Off
▼Ranges...

Select the validation menu ☞ 6-7.

Select the calibration menu ☞ 6-17.

Optional: Apply gases ☞ 6-28.

Press *ENTER* in this line to lock all menus, for which *"Code"* in MENU ACCESS has been set to **On** (☞ 6-44).

Acknowledge messages ☞ 6-29.

Available if the related internal pump is installed:
Switch internal pump 1 / 2 **On** or **Off**.
Note!
These lines do not appear if digital inputs are used to control the pumps (☞ 6-86), or if no internal pump is available.

Set ranges ☞ 6-30.

▲
Data Logger..
Event/Calibration Logger..

Handle data logger data ☞ 6-31.

Optional: Handle event/calibration and validation logger data ☞ 6-32.

6.2.2 Control Menu

6.2.2.1 Validation Menu

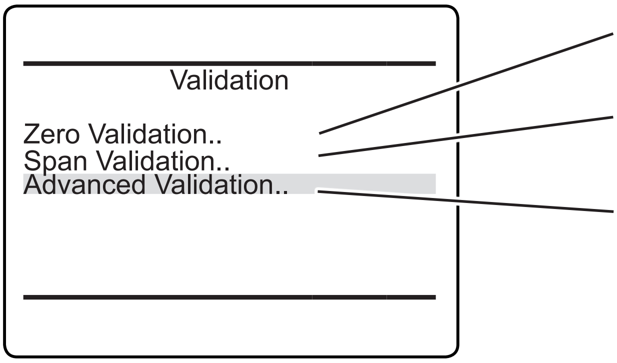
Control..
Validation.

This menu allows to select a validation procedure.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be validated.



Perform a zero validation ☞ 6-7.

Perform span validation ☞ 6-10.

Optional: Perform advanced validation ☞ 6-11.

6.2.2.1.1 Zero Validation Menu

Control..
Validation..
Zero Validation..

This menu allows to start and control a validation procedure for the zero gas.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

6.2.2 Control Menu

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be validated.

```
Zero Validation
Cancel!
Start!
Zero Gas             0.0 ppm
Zero Valid Tol+-     200.0 ppm
Concentration        2000.0 ppm
Flow                 0.0 l/min
Status..
Reults..
```

Press ENTER in this line to cancel any ongoing validation.

Press ENTER in this line to start a zero validation.

Nominal zero gas concentration (setup see ☞ 6-46)

Tolerances for the nominal zero gas concentration (setup see ☞ 6-47)

Currently measured gas concentration.

Currently measured gas flow, if a flow sensor is installed.

Open a submenu to see validation status information, ☞ 6-8.

Open a submenu to see validation results information ☞ 6-9.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to validate another channel.

6.2.2.1.2 Validation Status Single

Control..
..
..
Validation Status Single..

This menu gives a channel specific status overview.

Note!

This menu can be opened from several higher-level menus, dependent on which it now may be necessary to select a component:

6.2.2 Control Menu

1

Component ?

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.

Validation Status Single

Validation Status	Ready
Remaining Time	0 s
Concentration	2000.0 ppm
Zero Gas	0.0 ppm
Span Gas	2000.0 ppm
Current Range	Range 1
Applied Gas	Span gas

Indicates the currently ongoing procedure (***Purging**, **Zeroing**, **Spanning**, **Ready*****)

Shows the remaining time for the current procedure

Currently measured gas concentration.

Current channel's validation gases setup

Range under validation.

Currently applied gas type.

6.2.2.1.3 Validation Results Single

Control..
..
..
Validation Results Single..

This menu gives a channel specific summary of results.

Note!
This menu can be opened from several higher-level menus, dependent on which it now may be necessary to select a component:

1

Component ?

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.

6.2.2 Control Menu

Validation Results Single	
Zero Result	Limit Exceeded
Zero Date	----
Span Result	Canceled
Span Date	----
ZeroValidDev	0.0 ppm
SpanValidDev	0.0 ppm

Result type of last zero validation.
(*Success, Cancelled, Timeout, Limit Exceeded, Bad Stability, OutOfLinRange, Not Allowed, Awaiting Span Cal, Sampling-Fail***)**

Date of last zero validation.

Result type of last span validation.
(*Success, Cancelled, Timeout, Limit Exceeded, Bad Stability, OutOfLinRange, Undefined Spangas, Awaiting SpanCal, Not Allowed, SamplingFail***)**

Date of last span validation.

Deviation determined by last luccessful zero validation.

Deviation determined by last luccessful span validation.

Multi-channel unit:

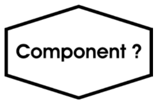
Press LEFT to enter SELECT COMPONENT, to view another channel's results.

6.2.2.1.4 Span Validation Menu

Control..
Validation..
Span Validation..

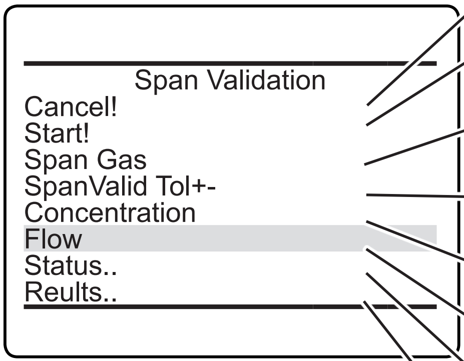
This menu allows to start and control a validation procedure for the span gas.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be validated.

6.2.2 Control Menu



Press *ENTER* in this line to cancel any ongoing validation.

Press *ENTER* in this line to start a zero validation.

Nominal span gas concentration (setup see ☞ 6-46).

Tolerances for the nominal span gas concentration (setup see ☞ 6-47).

Currently measured gas concentration.

Currently measured gas flow, if a flowsensor is installed.

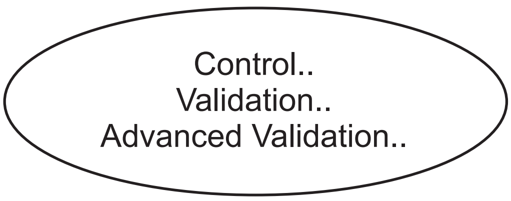
Open a submenu to see validation status information ☞ 6-8.

Open a submenu to see validation results information ☞ 6-14

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to validate another channel.

6.2.2.1.5 Advanced Validation



This menu allows to start and control valve supported validation procedures.

6.2.2 Control Menu

Note!
*This menu is only available if "Valves" in SETUP - INSTALLED OPTIONS is set to a value other than **none**.*

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Advanced Validation
Cancel!
Zero&Span Validation Single..
Zero Validation All!
Span Validation All!
Zero&Span Validation All!
Status..
Results..
Next Automatic Validations..

Press ENTER in this line to cancel any ongoing validation.

Open a submenu to carry out a zero and span validation for a single channel ☞ 6-7.

Highlight any of the next 3 lines and press ENTER to start the related validation procedure:
- zero all channels
- span all channels
- zero and span all channels

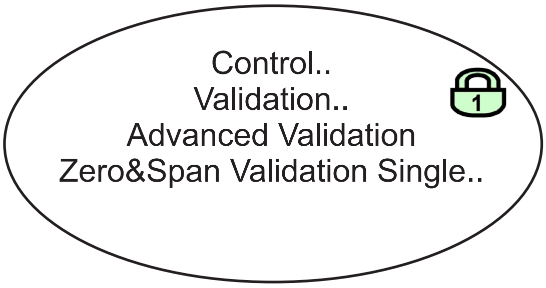
Press ENTER in this line to start a programmed validation sequence; ☞ 6-49 for information on how to program a sequence.

Open a submenu to see validation status summary for all channels ☞ 6-14.

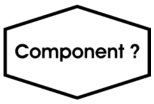
Open a submenu to see validation results summary for all channels ☞ 6-15.

Open a submenu to view the scheduled dates for next automatically performed validation ☞ 6-16.

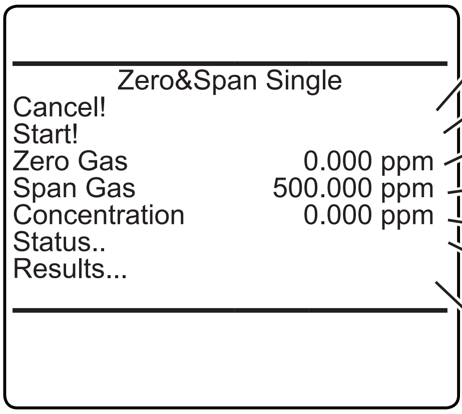
6.2.2.1.6 Zero & Span Validation Single



This menu allows to start and control a valve supported validation procedure for zero **and** span for a single channel only.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be validated.



Press ENTER in this line to cancel any ongoing validation.

Press ENTER in this line to start a zero & span validation procedure.

Nominal zero gas concentration (can be set in ☞ 6-46)

Nominal span gas concentration (can be set in ☞ 6-46)

Currently measured gas concentration.

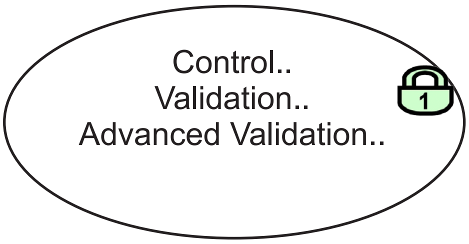
Open a submenu to see validation status summary for the selected channel ☞ 6-14

Open a submenu to see validation results summary for the selected channel ☞ 6-15

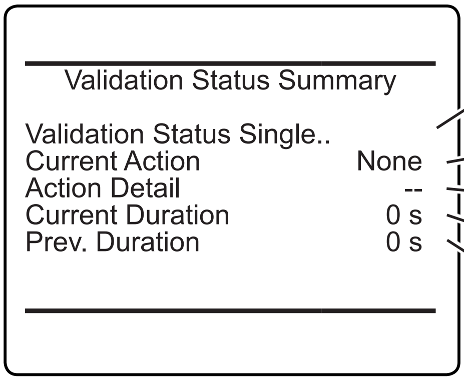
Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to select another channel.

6.2.2.1.7 Validation Status Summary



This menu gives an overview on the validation status.



Open a submenu to see detailed validation status information for a specific component (to be selected in a next step) ☞ 6-136.

Indicates the currently ongoing procedure (***Purging**, **Zeroing**, **Spanning**, **Ready, None*****)**

Shows the current procedure, or **Off**

Shows the remaining time for the current procedure.

Shows the duration for the previous procedure.

6.2.2.1.8 Validation Results Summary

Control..
Validation..
Advanced Validation
Results..

This menu shows detailed, channel specific information on validation results.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Validation Results Summary	
Execution	Performed
Any ZeroValidFail	Yes
Any SpanValidFail	No
Validation Results Single..	

Information about whether the validation procedure has been performed.

Information about failures during the validation procedures carried out in several components.

Open the submenu VALIDATION RESULTS SINGLE ☞ 6-136

6.2.2.1.9 Next Automatic Validation

Control..
Validation..
Advanced Validation..
Next Automatic Validation..

This menu shows the date and hour for the next validation, that will be carried out automatically.

Note!
This menu is only available if "Valves" in SETUP - INSTALLED OPTIONS is set to a value other than ***none****.*

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Validation Results Summary	
Execution	Performed
Any ZeroValidFail	Yes
Any SpanValidFail	No
Validation Results Single..	

Information about wheter the validation procedure has been performed.

Information about failures during the validation procedures carried out in several components.

Open the submenu VALIDATION RESULTS SINGLE ☞ 6-136

6.2.2.2 Calibration Menu

Control..
Calibration..

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be calibrated.

Calibration

Zero Calibration.
Span Calibration..
Advanced Calibration..

Open a submenu to perform a zero calibration ☞ 6-18

Open a submenu to perform a span calibration ☞ 6-19

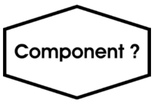
Optional: Open a submenu to perform an advanced calibration ☞ 6-20

6.2.2.3 Zero Calibration Menu

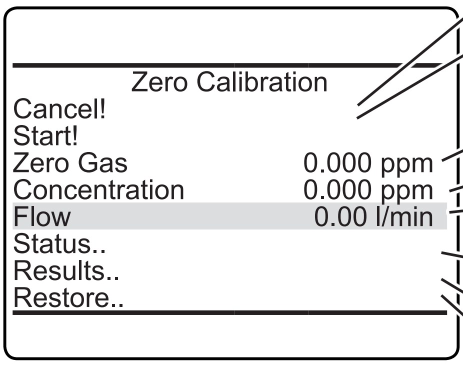
Control..
Calibration..
Zero Calibration

This menu allows to start and control a calibration procedure for the zero gas.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be calibrated.



Press ENTER in this line to cancel any ongoing calibration

Press ENTER in this line to start a zero calibration

Nominal zero gas concentration (can be set in SETUP ☞ 6-46)

Currently measured gas concentration.

Currently measured gas flow, if a flow sensor is installed.

Open a submenu to see calibration status information ☞ 6-24

Open a submenu to see calibration results information ☞ 6-26

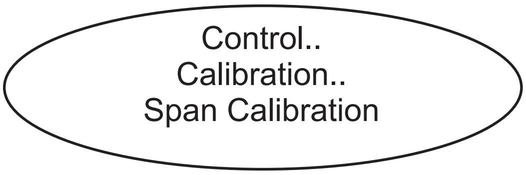
Press ENTER in this line to restore calibration data to the last known good data set.

A confirmation screen appears, before the function is executed.

Multi-channel unit:

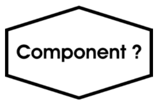
Press LEFT to enter SELECT COMPONENT, to calibrate another channel.

6.2.2.4 Span Calibration Menu

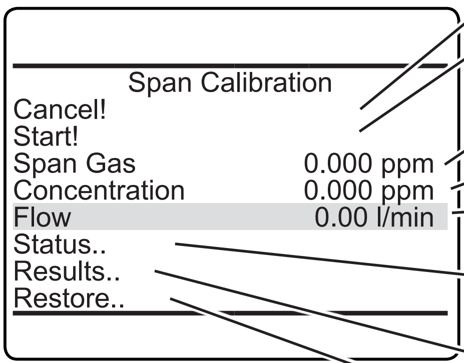


This menu allows to start and control a calibration procedure for the span gas.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be calibrated.



Press ENTER in this line to cancel any ongoing calibration.

Press ENTER in this line to start a span calibration.

Nominal span gas concentration (can be set in SETUP ☞ 6-36)

Currently measured gas concentration.

Currently measured gas flow, if a flow sensor is installed.

Open a submenu to see calibration status information ☞ 6-24

Open a submenu to see calibration results information ☞ 6-26

Press ENTER in this line to restore calibration data to the last known good data set.

A confirmation screen appears, before the function is executed.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to calibrate another channel.

6.2.2 Control Menu

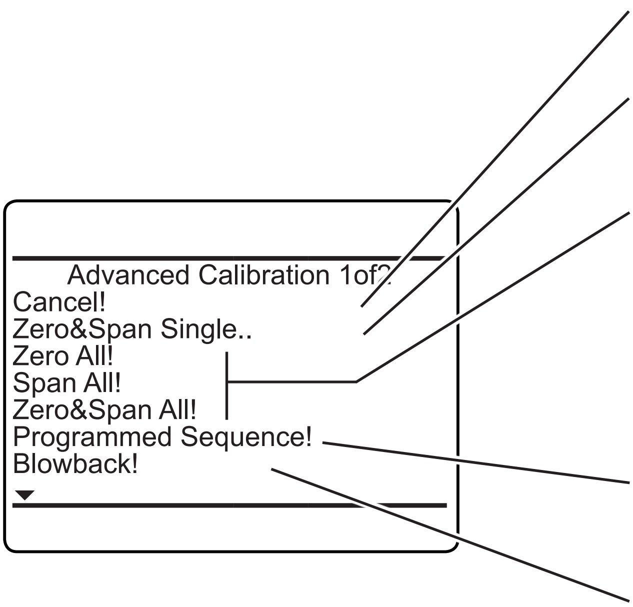
6.2.2.5 Advanced Calibration Menu

Control..
Calibration
Advanced calibration..

This menu allows to start and control valve supported calibration procedures.

Note!
*This menu is only available if "Valves" in SETUP - INSTALLED OPTIONS is set to a value other than **none**.*

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Press *ENTER* in this line to cancel any ongoing calibration.

Zero & span a single channel ☞ 6-22

Highlight any of the next 3 lines and press *ENTER* to start the related calibration procedure:

- zero all channels
- span all channels
- zero and span all channels

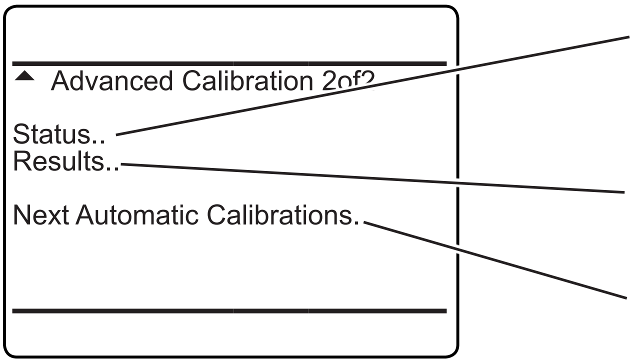
Press *ENTER* in this line to start a programmed calibration sequence; ☞ 6-52 for information on how to program a sequence.

Press *ENTER* in this line to start a blowback procedure for all channels.

Note!
This menu is also available in single-channel units.

*In this case, the 3rd and 4th lines will start a zero **or** span calibration, while the 5th line starts the same procedure as the 2nd.*

6.2.2 Control Menu



Open a submenu to see calibration status summary for all channels ☞ 6-23

Open a submenu to see calibration results summary for all channels ☞ 6-25

Open a submenu to view the scheduled dates for next automatically performed calibrations ☞ 6-137

6.2.2.5.1 Zero & Span Single Menu

Control..
Advanced Calibration..
Zero&Span Single..

This menu allows to start and control a valve supported calibration procedure for zero **and** span for a single channel only.

1

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be calibrated.

Zero&Span Single	
Cancel!	
Start!	
Zero Gas	0.000 ppm
Span Gas	500.000 ppm
Blowback!	
Concentration	0.000 ppm
Status..	
Results..	

Press ENTER in this line to cancel any ongoing calibration

Press ENTER in this line to start a zero & span calibration procedure

Nominal zero gas concentration (can be set in SETUP ☞ 6-46)

Nominal span gas concentration (can be set in SETUP ☞ 6-46)

Immediately start a blowback procedure

Currently measured gas concentration.

Open a submenu to see calibration status summary for all channels ☞ 6-23

Open a submenu to see calibration results summary for all channels ☞ 6-25

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to select another channel.

6.2.2.5.2 Calibration Status Summary

Control..
Advanced Calibration..
Status..

This menu gives an overview on the ongoing calibration procedure.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Calibration Status Summary	
Calibration Status Single..	
Current Action	Ready
Action Detail	Off
Current Duration	0 s
Prev. Duration	0 s
Current Step	0

Calibration Status Single..: Open a submenu to see detailed calibration status information for a specific component (to be selected in a next step) ☞ 6-24.

Current Action: Indicates the currently ongoing procedure (**Purging**, **Zeroing**, **Spanning**, **Ready)** .

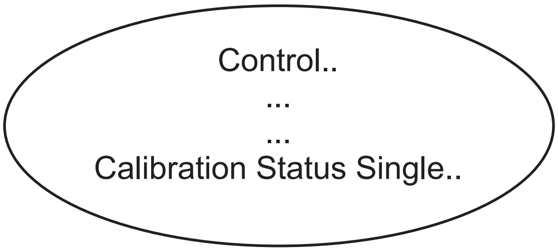
Action Detail: Shows the current procedure, or **Off.**

Current Duration: Shows the remaining time for the current procedure.

Prev. Duration: Shows the time for the previous procedure.

Current Step: Information about the step currently carried out.

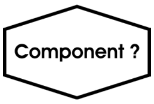
6.2.2.5.3 Calibration Status Single



This menu gives a channel specific status overview.

Note!
This menu can be opened from several higher-level menus, dependent on which it now may be necessary to select a component:

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.

Calibration Status Single	
Cancel!	
CalibrStatus	Ready
Remaining Time	0 s
Concentration	0.000 ppm
Zero Gas	0.000 ppm
Span Gas	5000.000 ppm
Current Range	Range 1
Applied Gas	Sample gas

Press ENTER in the first line to cancel any ongoing calibration

Indicates the currently ongoing procedure (**Purging**, **Zeroing**, **Spanning**, **Ready)**

Shows the remaining time for the current procedure

Currently measured gas concentration.

Current channel's calibration gases setup.

Range under calibration.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to view the status for another channel.

6.2.2.5.4 Calibration Results

Control..
Advanced Calibration..
Results..

This menu gives an overall calibration results summary.

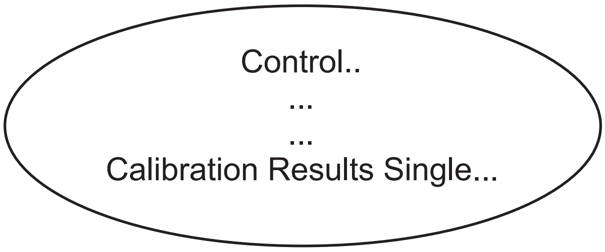
If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Calibration Results Summary	
Execution	Performed
Any ZeroFail	No
Any SpanFail	No
Calibration Results Single..	

Open a submenu to see detailed, channel specific calibration results information ☞ 6-26.

6.2.2 Control Menu

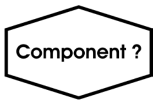
6.2.2.6 Calibration Results Single



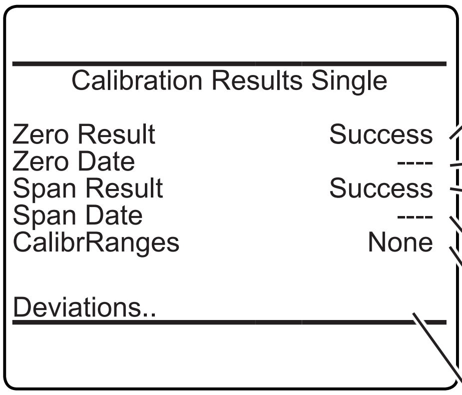
This menu gives a channel specific summary of results.

Note!
This menu can be opened from several higher-level menus, dependent on which it now may be necessary to select a component:

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.



Result type of last zero calibration.
(*Success, Canceled, Timeout, Limit Exceeded, Bad Stability, OutOfLinRange, Not Allwoed, Awaiting SpanCal, Sampling Fail***)**

Date of last zero calibration.

Result type of last span calibration.
(*Success, Canceled, Timeout, Limit Exceeded, Bad Stability, OutOfLinRange, Undefined Spangas, Awaiting SpanCal, Not Allowed, Sambling Fail***)**

Date of last span calibration.

None, 1, 2, 3, 4, 1+2, 1+3, 1+4, 2+3, 2+4, 3+4, 1+2+3, 1+2+4, 1+3+4, 2+3+4, 1+2+3+4.

Open a submenu to view calibration results deviations information ☞ next page.

Multi-channel unit:
Press LEFT to enter SELECT COMPONENT, to view another channel's results.

6.2.2.6.1 Calibration Deviations

Control..
...
Calibration Results Single..
Deviations..

This menu gives a channel specific summary of deviations of calibration results.

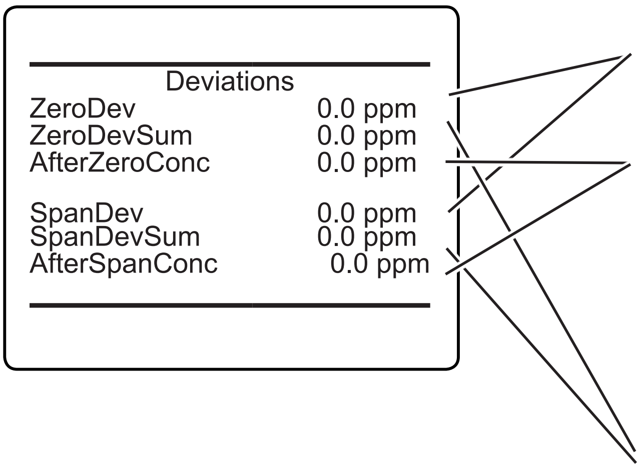
Note!
This menu is a submenu of CALIBRATION RESULTS SINGLE, which can be opened from several higher-level menu.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Example:
A measuring channel shows zero drift of 10 ppm per week. It is calibrated once a week.
After the 3rd zero calibration, DEVIATIONS shows:

ZeroDev:	*10 ppm* (=last calibr.)
ZeroDevSum:	*30 ppm* (=summary of 3 calibrations carried out within 3 weeks)

In the context of this menu, deviation means the value, a calibration corrected the zero or respectively the span calibration value.



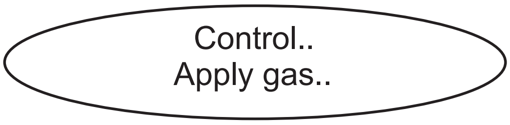
"ZeroDev." or *"SpanDev."* in concentration units give the correction of the last corresponding calibration.

A short time after the calibration procedure has been performed, the calibration quality is tested. *"AfterZeroConc"* and *"AfterSpanConc"* show the deviations from the nominal value.

"ZeroDevSum" or *"SpanDevSum"* in concentration units give the total (sum of) corrections of the corresponding calibrations since the last time, deviations have been reset (SETUP - CALIBRATION/VALIDATION - DEVIATIONS; ☞ 6-56)

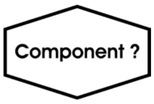
6.2.2 Control Menu

6.2.2.7 Apply Gas Menu

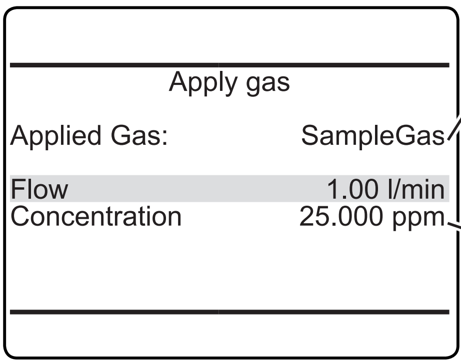


If the instrument features internal, or is connected to external valves, this menu allows to apply a specific gas to the analyzer, e.g. for maintenance purposes.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT, select the channel for the gas to be applied.



Select the gas to be applied.
Available options:

- **SampleGas**
- **ZeroGas**
- **SpanGas1**
- **SpanGas2**
- **SpanGas3**
- **SpanGas4**
- **Blowback**
- **All Closed**

Currently measured gas concentration.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to change the settings for another channel.

6.2.2.8 Acknowledgements Menu

Control..
Acknowledgements..

This submenu provides function lines to acknowledge status messages and alarms, separately (lines 1 to 5) or simultaneously (last line).

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Acknowledgements

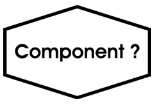
Failures!
Off-Specs!
Maintenance Requests!
Function Checks!
Alarms!
All States!

To acknowledge status messages, highlight the relevant line and press ENTER.

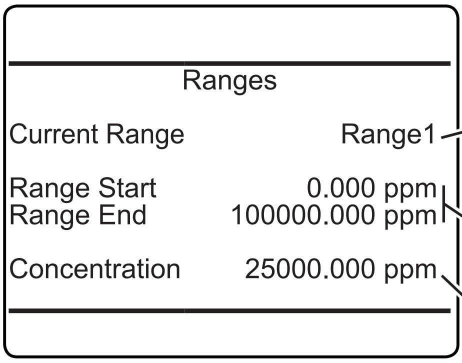
6.2.2.9 Ranges Menu

This menu allows to check the measuring range.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be configured.



Select the measuring range to be used.
Available options:

- **Range1**
- **Range2**
- **Range3**
- **Range4**

Lines 2 & 3 show the corresponding range limits.

Line 4 shows the currently measured value.

Note!
To change range limits ☞ 6-59

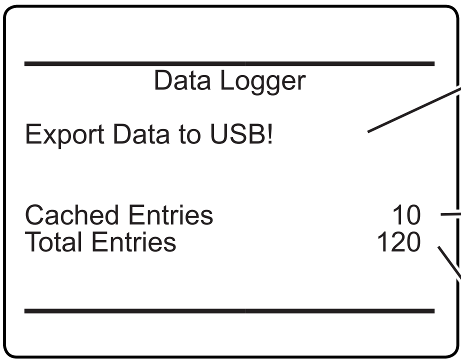
Multi-channel unit:
Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

6.2.2.10 Data Logger

Control..
Data logger..

This menu allows to export data logger data to an external device for further processing.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Export logged data (=total entries) to an USB device.

Notes!
Make sure, there's a memory device connected!

*Before the data is exported, all "*Cached entries*" are copied to the "*Total entries*" file.*

Number of entries currently in RAM, not yet saved to the internal data logger (total entries) file.

Note!
*Data is written to the internal file every 30 min, or the moment "*Logging*" is turned* ***Off*** *(SETUP - DATA LOGGER; ☞ 6-122)*

Total number of entries in the internal data logger file.

6.2.2.11 Event/Calibration Logger

Control..
Event/Calibration Logger..

This menu allows to export event, calibration logger data and validation logger data as well to an external device for further processing.

Note!
This menu is available only, if an optional software features license code has been purchased and installed; ☞ *6-106*

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.

Event/Calibration Logger

Export Event Data to USB!
Total Entries 1

Export Calib Data to USB!
Total Entries 5

Export logged event data to an USB device.

Note!
Make sure, there's a memory device connected!

Total number of entries of the internal event logger file.

Export logged calibration data to an USB device.

Note!
Make sure, there's a memory device connected!

Total number of entries of the internal calibration logger file. The calibration logger file includes calibration and validation entries.

6.2.3 Setup Menu

Setup..

This menu allows to change basic analyzer settings.

Setup 1of2
Display..
Calibration/Validation..
Measurement..
In-/Outputs..
Communication..
Limit Alarms..
Installed Options..
▼Save-Load..

Setup display layout, language and more ☞ 6-34 1

Setup calibration and validation parameters ☞ 6-45 2

Setup channel specific parameters ☞ 6-58 2

Configure In- and Outputs ☞ 6-75 2

Setup communication parameters ☞ 6-92

Configure concentration alarms ☞ 6-95 3

Configure installed options, enter licence codes for software options ☞ 6-105 3

Backup and restore analyzer configurations ☞ 6-109 3

Setup 2of2
Operation Hours Meter..
Identification..
Time..
USB Interface..
Data Logger..
Event Logger..
PLC..
Calculator..

Operation hours meter ☞ 6-114

System identification ☞ 6-115 3

Setup date/time ☞ 6-117 3

USB interface setup ☞ 6-120 3

Optional: Data logger setup ☞ 6-122 3

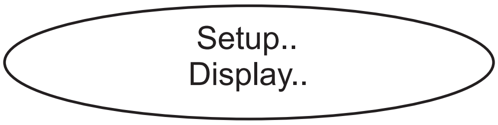
Optional: Event logger setup ☞ 6-124 3

Optional: PLC setup ☞ 6-124 3

Optional: Calculator setup ☞ 6-124 3

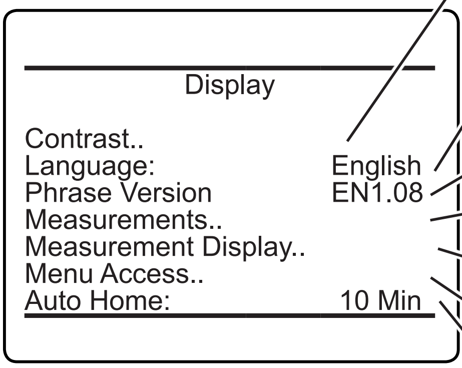
6.2.3 Setup Menu

6.2.3.1 Display Setup Menu



From within this menu you can setup how measuring results show up, control menu access, and more.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Adjust the display's contrast ☞ 6-35

Selects the preferred language for the analyzer software. Available options vary according to the analyzer configuration.

Currently available:

English, French, German, Italian, Polish, Portuguese, Spanish

Phrases file version

Configure how measurement results are displayed ☞ 6-36 

Setup the measurement display ☞ 6-41

Configure menu access authorizations ☞ 6-44

This parameter determines the time period without user activity, before returning to the measurement display from any submenu.

Available options:

Never, 1 min, 10 min

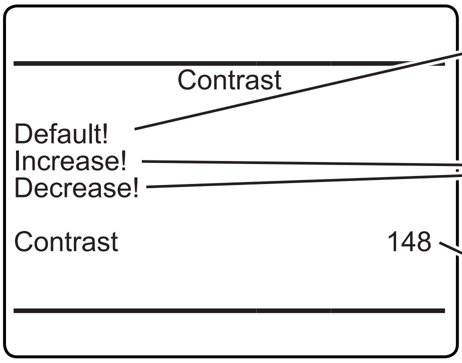
6.2.3 Setup Menu

6.2.3.1.1 Display Contrast Setup Menu

Setup..
Display..
Contrast

This menu allows to set up the contrast of the diplay.

If the system is setup accordingly, the access code for level 1 must be entered to gain access to this menu.



Press *ENTER* to reset to the default value (148).

Increase / decrease contrast by a value of **3**, each time *ENTER* is pressed in either of these lines.

Limits: **82 ... 208**

Shows the currently used contrast value and is updated each time, *ENTER* is pressed in one of the above menu lines.

Notes!

If by mistake characters are not visible any longer, reset the contrast to the default value.

The display's contrast is temperature dependent. If need be, re-adjust.

The default value gives an acceptable result for the analyzer's permitted operating temperature range.

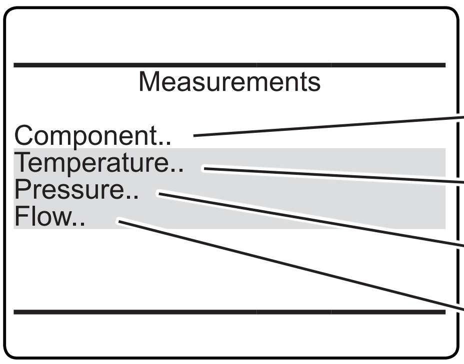
6.2.3 Setup Menu

6.2.3.1.2 Display Measurements Setup Menu

Setup..
Display..
Measurements..

This menu allows to setup measurement tags, units, precision and more for primary and secondary measurements. This specifies how the measured values are displayed.

If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu.



Configure the parameters for

Gas measurement ☞ 6-37

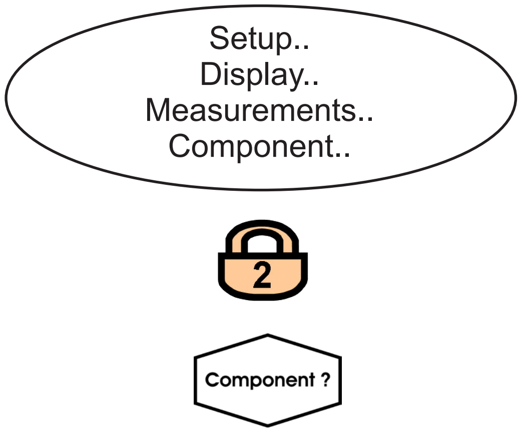
Optional: Temperature measurement ☞ 6-39

Optional: Pressure measurement ☞ 6-39

Optional: Flow measurement ☞ 6-40

Note!
Temperature, pressure and flow are referred to as 'secondary measurements'.

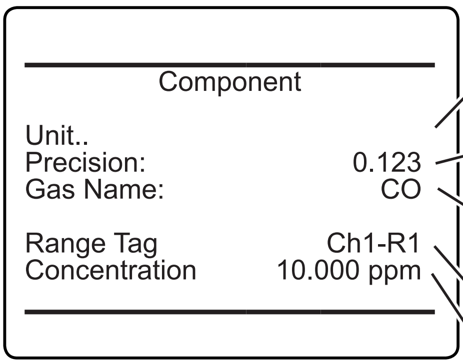
6.2.3.1.2.1 Display Component Setup Menu



This menu allows to specify how the measured gas concentration values are displayed.

If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu.

Multi-channel unit:
In SELECT COMPONENT, select the channel to be configured.



Configure the component's measuring unit ☞ 6-38

Configure the precision of the displayed measured value for this component.

Selectable options:

0. 0.1 0.12 0.123 0.1234

(means, the fraction part can be setup between none and four digits).

Specify the gas name for this component, to show up on the measurement display.

Maximum length: **12 characters**

Shows the current range tag

The last line shows the current settings for the selected channel, depending on the settings above, and is updated if settings are changed.

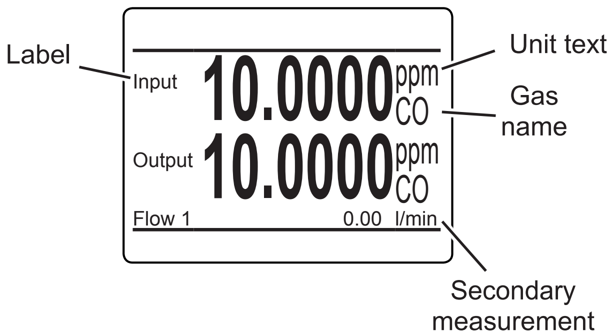


Fig. 6-2: *Measurement Display Elements*

Multi-channel unit:
Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

6.2.3.1.2.1.1 Component Unit Setup Menu

Setup..
Display..
Measurements..
Component..
Unit..

This menu allows to configure the component's unit to be used for measurement results.

Ch1	
Component Unit	
Unit:	ppm
Unit Text:	ppm
Span Gas Unit:	ppm
Span Unit Text:	ppm
Custom Factor:	1.000000
Custom Offset:	0.000000
Span Gas	50000.000 ppm
Concentration	0.000 ppm

Select the measuring unit for the component.
Available options: **ppm, ppb, Vol%, Custom**

Set the text for the measuring unit of the component, to be shown in the measuring screen: each character must be set separately.[1)]

Select the measuring unit for the span gas.
Available options: **ppm, ppb, Vol%, Custom**

Note!
Zero gas unit and zero gas unit text are always as configured for the component (first 2 menu lines)!

Set the text for the measuring unit of the span gas: each character must be set separately.[1)]

Gas concentrations are internally calculated as ppm. To use other units, the corresponding factor must always be specified, e.g. 0.0001 to calculate from ppm to %.[2)]

If necessary, enter an offset here, to be added to the measured value.[2)]

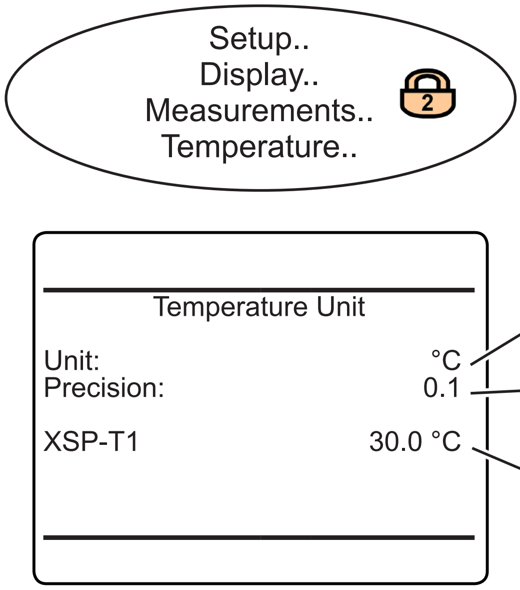
The last 2 lines show how the settings affect the display of measurements.

[1)] Configuring individual text strings is permitted only, if "*Unit*" or "*Span gas unit*" is set to **Custom**.

[2)] "*Custom factor*" and "*Custom offset*" are visible and editable only, if "*Unit*" or "*Span gas unit*" is set to **Custom**. For all other options, conversion factors and offsets are pre-defined.

Note!
Texts for units, and values for "Custom Factor" *and* "Custom Offset" *are not checked for plausibility. Any arbitrary value can be set.*

6.2.3.1.2.2 Display Temperature Setup Menu



This menu allows to set up the unit of the temperature.

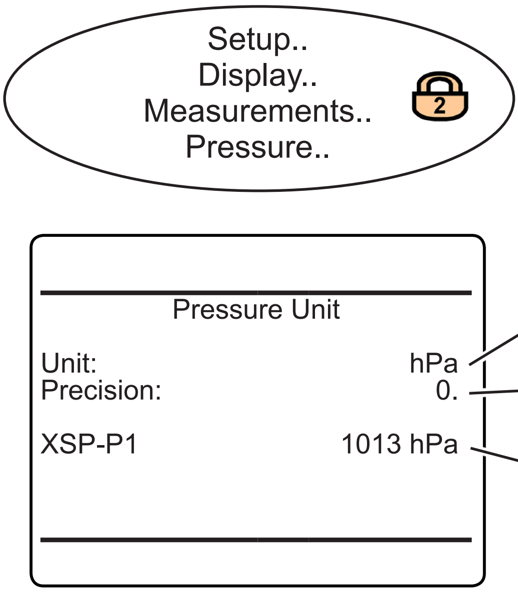
Select the temperature unit to be used for all measurements.
Available options: **°C, °F, K**

Configure the precision of temperature displays
Accepted values: **0., 0.1, 0.12**

Example for the current settings.

Note!
Conversion factors for the different units are pre-defined.

6.2.3.1.2.3 Display Pressure Setup Menu



This menu allows to set up the unit of the pressure.

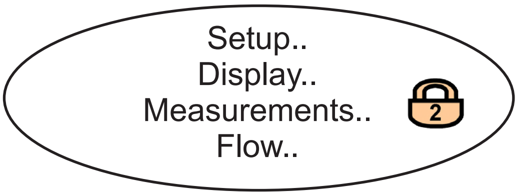
Select the pressure unit to be used for all measurements.
Available options: **hPa, mbar, bar, psig, Pa**

Configure the precision of pressure displays
Accepted values: **0., 0.1, 0.12**

Example for the current settings.

Note!
Conversion factors for the different units are pre-defined.

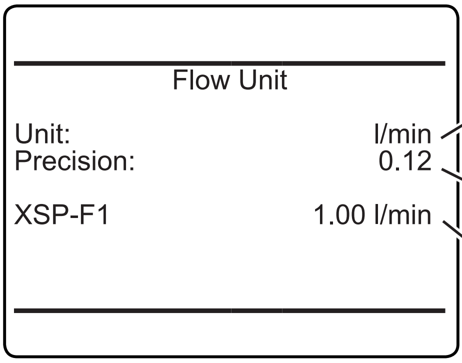
6.2.3.1.2.4 Display Flow Setup Menu



This menu allows to set up the unit of the flow.

Note!
This menu is available only if at least one flow sensor is installed (☞ 6-105).

Select the flow unit to be used for all measurements.



Available options:
l/min, l/h, ml/min, gal/min

Note!
1 gal = 1 US.liq.gal. = 3.7853 l

Configure the precision of flow displays
Accepted values: **0., 0.1, 0.12**

Example for the current settings.

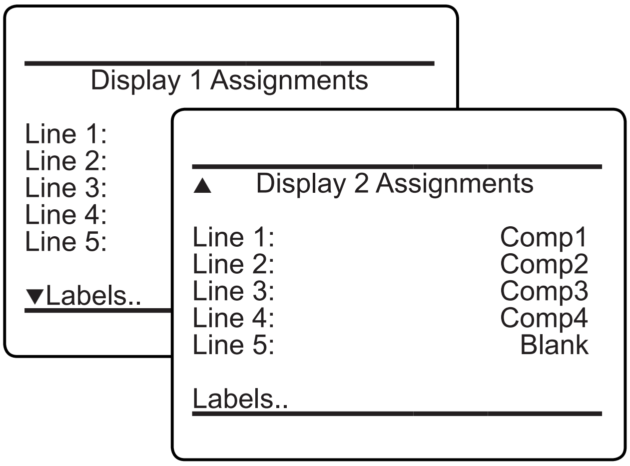
Note!
Conversion factors for the different units are pre-defined.

6.2.3.1.3 Measurement Display Setup Menu

Setup..
Display..
Measurement Display..

This menu allows to configure the measurement display.

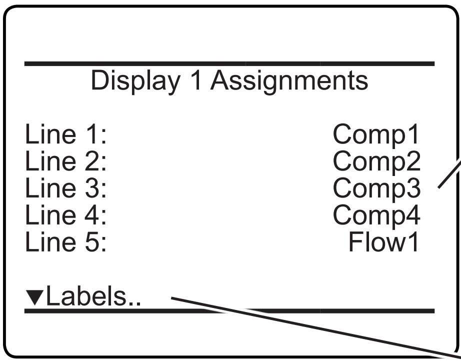
If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu.



The MEASUREMENT DISPLAY may be configured as a single or dual page version, where the content of each page can be configured separately by a related page within this setup menu.

The first setup menu page ('Display 1 ...') configures the first MEASUREMENT DISPLAY page. You may specify up to 5 measurements to be shown on the page. If only up to two primary and one secondary measurements are configured, the display will use the 2 lines layout with bigger characters. Enter the second menu page ('Display 2 assignments') to setup a second MEASUREMENT DISPLAY page.

Note!
Primary measurements are gas measurements. Secondary measurements are pressure, flow, temperature; these are always displayed with the smaller font.



On either setup menu page, highlight the line to be configured, press *ENTER* and then select the parameter to be displayed in the related line by means of *UP* / *DOWN*.

Available options:

Comp1 ... Comp5
Temp1 ... Temp5
Flow1 ... Flow5
Press1 ... Press5
CalcA ... CalcD
Blank

Configure the labels ☞ 6-42.

6.2.3.1.3.1 Setup Measurement Display Labels

Setup..
Display..
Measurement Display..
Labels..

For each MEASUREMENT DISPLAY line you may enter an individual text, called “label”.

Specifications:

- free alphanumeric text
- maximum length: 8 characters.

Labels

- show up on the MEASUREMENT DISPLAY only,
- may be setup for primary and secondary measurements, as they refer to the MEASUREMENT DISPLAY **line**, and not to the parameter.

Display 1 Labels

Line 1:	Input
Line 2:	Output
Line 3:	
Line 4:	
Line 5:	Flow1

Within this menu, to configure a label, enter the related menu line and enter the text.

Display 2 Labels

Line 1:	Press1
Line 2:	Press2
Line 3:	Flow2
Line 4:	
Line 5:	

Differing from labels, tags are used to identify a measurement (primary or secondary), and for this reason

- are transmitted via network
- show up on menu head lines with channel related data
- show up on the MEASUREMENT DISPLAY, too.

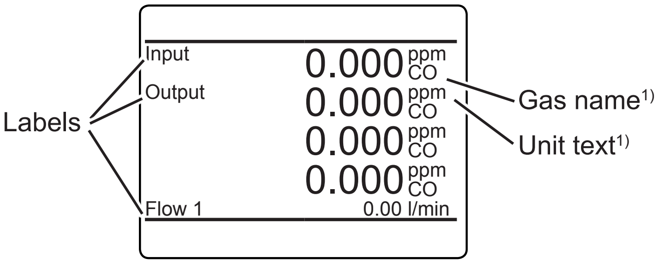
Note!
There are separate DISPLAY LABELS menus for each MEASUREMENT DISPLAY.

Due to their importance for measurement identification within a network, the menu to setup tags can be found at ☞ SETUP - IDENTIFICATION, page 6-115.

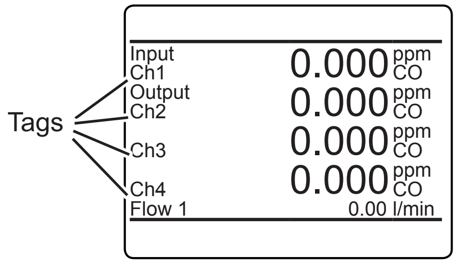
6.2.3 Setup Menu

Examples:

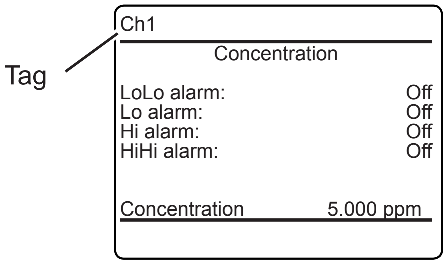
MEASUREMENT DISPLAY, if besides gas names and units, only labels are setup:



MEASUREMENT DISPLAY, if also tags are setup:

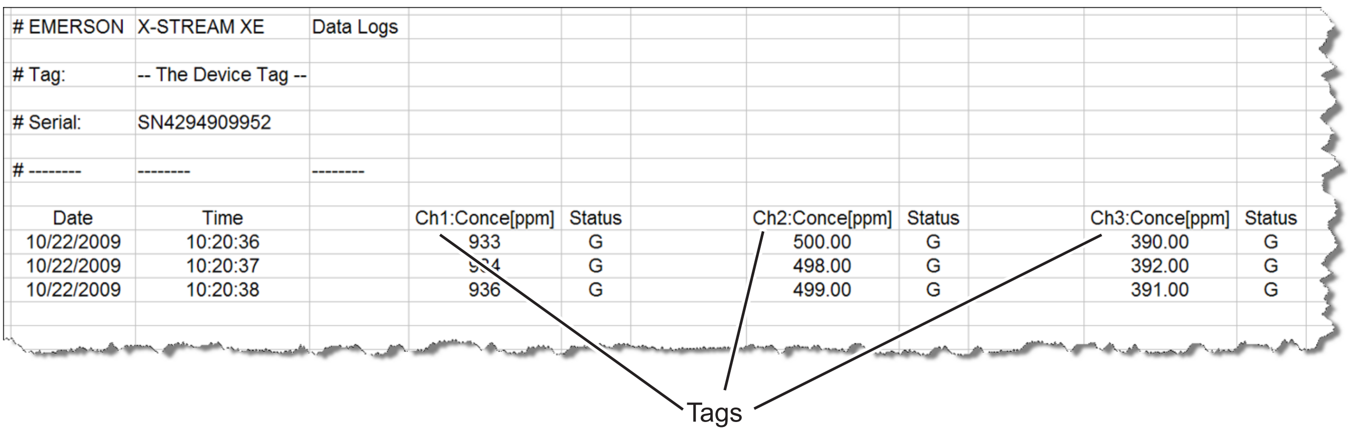


Identification of component specific menu pages:



[1] *To configure gas names and units:* ☞ *SETUP - DISPLAY - MEASUREMENTS, page 6-37.*

Identification of components in log files:



# EMERSON	X-STREAM XE	Data Logs								
# Tag:	-- The Device Tag --									
# Serial:	SN4294909952									
# --------	--------	--------								
Date	Time		Ch1:Conce[ppm]	Status		Ch2:Conce[ppm]	Status		Ch3:Conce[ppm]	Status
10/22/2009	10:20:36		933	G		500.00	G		390.00	G
10/22/2009	10:20:37		934	G		498.00	G		392.00	G
10/22/2009	10:20:38		936	G		499.00	G		391.00	G

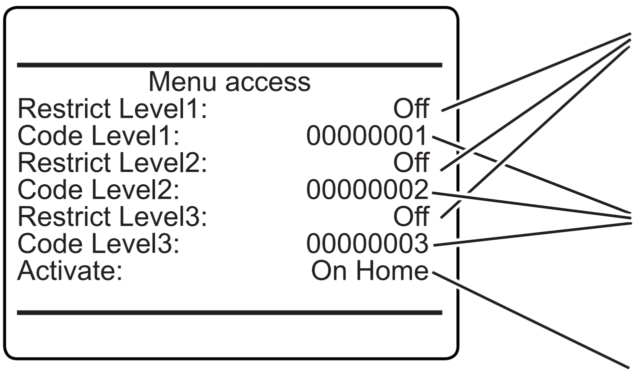
Fig. 6-3: *Usage of Labels and Tags*

6.2.3.1.4 Menu Access Setup

Setup..
Display..
Menu access..

This menu enables to configure acces level codes.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.



Enter these lines to activate or de-activate the access restrictions for the related menu level.

Avaliable options: **On**, **Off**

Setup the access codes:

Up to 8 alphanumeric characters may be entered for each code.

Determines how unlocked menus are re-locked to restore security settings.
Available options:

On Home: all levels with active acess code are locked on return to the MEASUREMENT DISPLAY

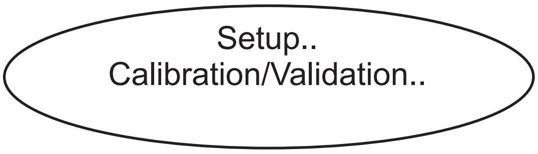
1 min: Levels are locked after 1 minute of inactivity.

Never: Menus remain unlocked

When using access codes, we recommend NOT using the factory-set codes.

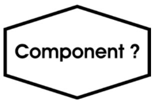
Note!
Executing “Lock menus!” in CONTROL (☞ 6-6), immediately sets all activated locks.

6.2.3.2 Calibration and Validation Setup Menu



This menu shows the specific options that must be set up for calibration and validations procedures.

If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu.

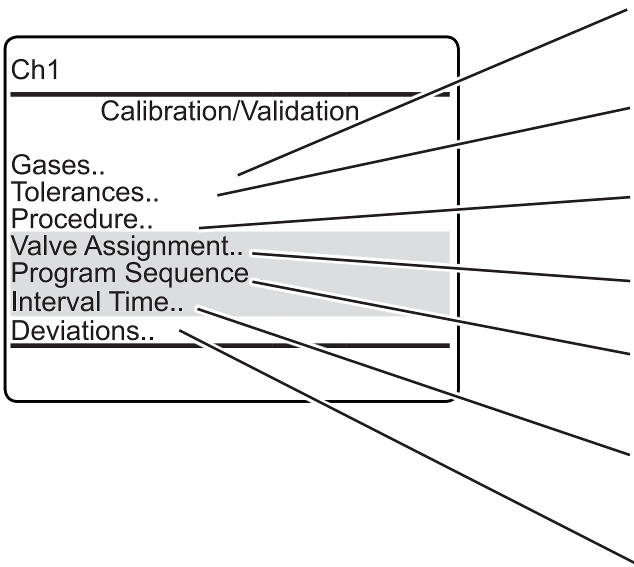


Note!

Multi-channel unit:

Some of the following submenus require to select the component to be configured:

In SELECT COMPONENT, select which channel's calibration to be configured.



Submenu to specify the calibration gases for the selected channel; ☞ 6-46.

Setup calibration tolerances; ☞ 6-47.

Setup details for the channel's calibration procedure; ☞ 6-49.

Optional: Assign calibration valves; ☞ 6-51.

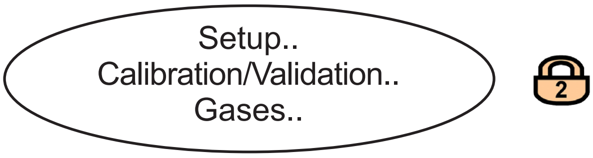
Optional: Program a detailled calibration sequence; ☞ 6-52.

Optional: Specify interval times for automatic calibrations; ☞ 6-54.

See (and reset) calibrations deviations information ☞ 6-56.

6.2.3 Setup Menu

6.2.3.2.1 Setup Calibration and Validation Gases



This menu allows to set up the concentration for gases.

Ch1	
Gases	
Zero Gas:	0.000 ppm
Span Gas:	50000.000 ppm
Range Gases..	
Current Range:	Range 1

Zero Gas: Enter this line to setup the zero gas concentration.

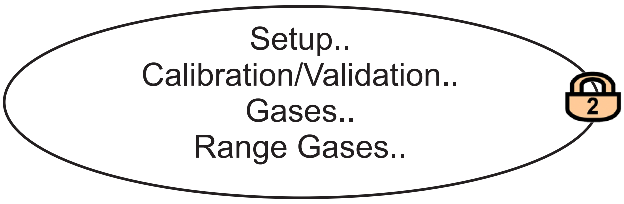
Span Gas: Enter this line to setup the span gas concentration.

Range Gases..: Submenu to specify different calibration and validation gases for several ranges (if instrument is setup to use different ranges); ☞ below.

Current Range: Information about currently used range.

Note!
The calibration gases units are as setup for the currently selected channel; ☞ 6-38.

6.2.3.2.1.1 Setup Range Gases

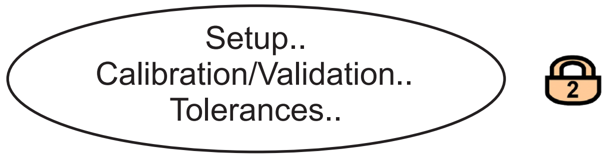


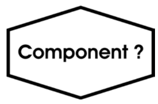
Ch1	
Range Gases	
Zero Gas1:	0.000 ppm
Zero Gas2:	0.000 ppm
Zero Gas3:	0.000 ppm
Zero Gas4:	0.000 ppm
Span Gas1:	500.000 ppm
Span Gas2:	5000.000 ppm
Span Gas3:	25000.000 ppm
Span Gas4:	50000.000 ppm

This menu enables to specify separate zero and span calibration gas concentrations for each range of the selected channel.

Note!
The calibration gases units are as setup for the currently selected channel; ☞ 6-38.

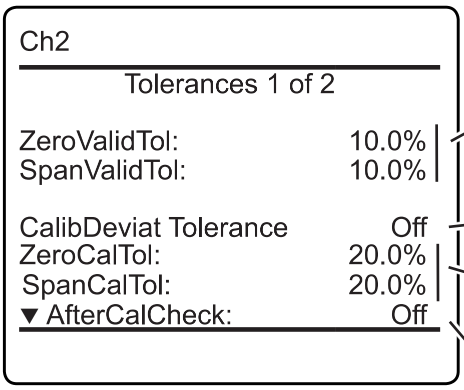
6.2.3.2.2 Setup Calibration and Validation Tolerances





Multi-channel unit:
In SELECT COMPONENT, select the channel to be configured.

During the validation procedure it is checked, if the current concentration signal is within +/- n % of the ***calibration gas value. If not, the validation is declared as failed.



Setup the validation limits for zero and span gas individually.
Accepted values: **0 ... 100 %**
(of the channel's full range resp. span gas value)

This parameter determines whether the tolerance check is active during calibration (**On**), or not (**Off**).

If tolerance check is enabled (**On**), setup the limits for zero and span gas individually.
Accepted values: **0 ... 100 %**
(of the channel's full range resp. span gas value)

If "AfterCalCheck" is enabled (**On**), the calibration procedure adds an additional phase where it measures and stores the concentration value shortly after the calibration.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to change the settings for another channel.

6.2.3 Setup Menu

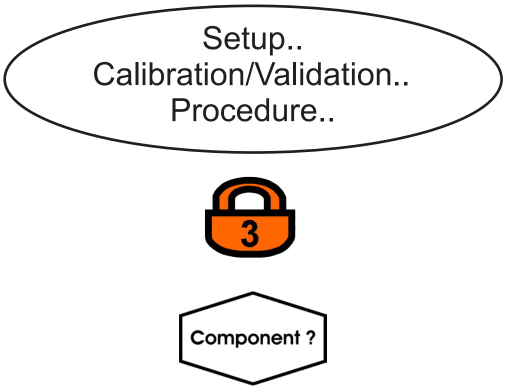
Ch2

Tolerances 2 of 2

ZeroTolRef:	2000.0ppm
ZeroValidTol+-	200.0ppm
ZeroCalTol+-	400.0ppm
SpanTolRef:	2000.0ppm
SpanValidTol+-	200.0ppm
SpanCalTol+-:	400.0ppm

This menu shows the explicit concentration reference and limit values for the calibration and validation procedures for zero and span gas. They are calculated using the configured zero respective span gas values and their according percentage tolerance.

6.2.3.2.3 Setup Calibration and Validation Procedure



Ch2	
Procedure	
CalProcMode:	AdvCal
Purge Time:	10 s
Time Max:	120 s
Zero Ranges:	Together
Span Ranges	Separately
Zero Method:	Stability
Span Method:	Instant
Test Mode:	No

Note!
Marked lines are available only if "Valves" in INSTALLED OPTIONS is set to a value other than ***none****.*

This menu allows to set up a defined procedure for calibration and validation.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

Multi-channel unit:
In SELECT COMPONENT, select the channel to be configured.
This menu line enables to select how the current channel is to be considered for calibration:

- Selected measuring principles are permitted to be calibrated considering special conditions only, or are not permitted to be calibrated at all.
- Your process may require special handling of measuring channels with regard to calibration.

Available options:

AdvCal: This channel is permitted to be included into advanced calibration procedures. **Requires valves to be assigned!**

SingleAuto: This channel is permitted to be calibrated by a single zero or span calibration only. **Requires valves to be assigned!**

Manual: This channel is permitted to be manually calibrated only.

Disabled: This channel is not allowed to be calibrated.

Notes!
Depending on your analyzer and selected channel, not all options may be available. E. g. for trace moisture sensors, calibration is not permitted (☞ page 3-15).

AdvCal *also enables* ***SingleAuto*** *and* ***Manual*** *calibrations.*

SingleAuto *also enables* ***Manual*** *calibrations!*

6.2.3 Setup Menu

```
Ch2
            Procedure
CalProcMode:            AdvCal
Purge Time:               10 s
Max. Time:               120 s
Zero Ranges:          Together
Span Ranges         Separately
Zero Method:         Stability
Span Method:           Instant
Test Mode:                  No
```

The “CalProcMode” does not influence any validation. Validations are always possible, irrespective of the selection under “CalProc-Mode”.

The time required to completely fill the gas line with the related gas, when switching to zero or span gas[1]. Adjust according your system.

Accepted values:

0 ... [*max. time*, *see next menu line*]

The maximum time to complete a calibration /validation procedure, if calibrated/validated with stability method. If not already regular finished, a calibration/validation will be terminated after this time.

Accepted values: **0 ... 600 seconds**

Specify how to calibrate/validate multiple ranges of a channel.

Available options: **Together, separately**

Specify the calibration/validation methods for zero and span calibrations/validations.

Available options: **Stability, Instant**

Set to **Yes**, to simply check, if the calibration/validation is still valid**:** now the instrument performs calibration/validation procedures, without correcting the calibration/validation parameters (simulation of calibrations/validations).

Note!
*Marked lines are available only if “Valves” in INSTALLED OPTIONS is set to a value other than **none**.*

[1] see note on page 6-51

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to change the settings for another channel.

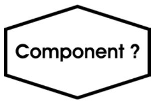
6.2.3.2.4 Setup Calibration and Validation Valves

Setup..
Calibration/Validation..
Valve Assignment..

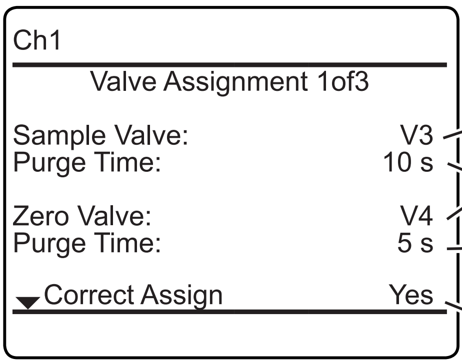
This menu allow to configure valve assignments.

Note!
*This menu is available only if “Valves” in INSTALLED OPTIONS is set to a value other than **none**. (☞ 6-105).*

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be configured.



For the selected channel:

- assign the valves to be used for the different functions, (available options: **None, V1 ... V20**)

and

- specify the purge time for each valve (accepted values: **0 ... 10,000** s)

If there is no conflict in valve assignment, this line shows **Yes**, otherwise check if, e.g. one valve has been assigned different functions for the same channel.

Note!
The purge time depends on the gas line design and length, and is the time it takes for the gas stream to completely fill the measuring cell, after the related valve has been opened.

Take care to set the purge time correctly, otherwise the measured concentrations may result faulty. If purge times are too short, the measuring cell is filled with improper gas.

6.2.3 Setup Menu

Ch1	
Valve Assignment 2of3	
Span1 Valve:	V1
Purge Time:	1 s
Span2 Valve:	None
Purge Time:	0 s
Span3 Valve:	None
Purge Time:	0 s
Span4 Valve:	None
Purge Time:	0 s

On the 2nd menu page, assign the span valves, and specify their purge times for the different ranges of the selected channel.

Ch1	
Valve Assignment 3of3	
Blowback Valve:	None
Purge Time:	0 s

The 3rd menu page enables to assign a blow-back valve, and specify its purge time for the selected channel.

Multi-channel unit:

Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

6.2.3.2.5 Setup Calibration and Validation Program Sequence

Setup..
Calibration/Validation..
Program Sequence..
2

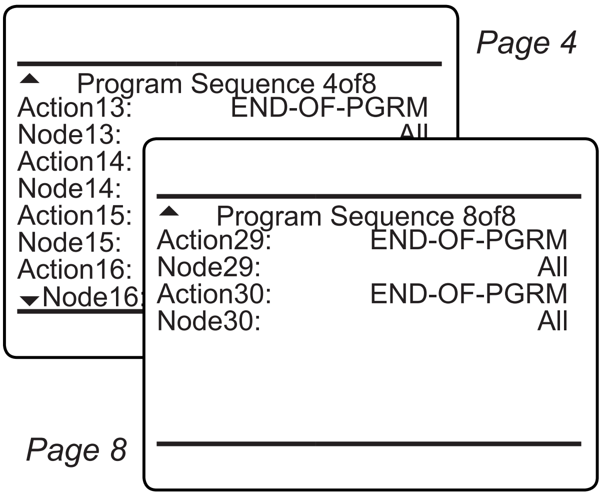
Note!
This line is available only if "Valves" in INSTALLED OPTIONS is set to a value other than ***none*** *(☞ 6-105).*

Program Sequence 1of8	
Action1:	Zero-Cal
Node1:	All
Action2:	Rg1SpanCal
Node2:	Ch1
Action3:	Rg2SpanCal
Node3:	Ch3
Action4:	END-OF-PGRM
Node4:	All

Page 1

This menu with 8 pages allows to setup a sequences of up to 30 actions (steps), to carry out individual calibration or validation procedures.

6.2.3 Setup Menu



Example:

The sequence in the first figure to the left (page 1of8) starts with

- a zero calibration for all channels, followed by

- a span calibration of range 1 of channel 1

- a span calibration of range 2 of channel 3.

Each step consists of an action and a related node.

Available actions are:

Action name	*What to happen*
Rg1SpanCal ... **Rg4SpanCal**	span calibrate range1 ... range4
ZSpanCal	zero & span calibrate
SpanCal	span calibrate
ZeroCal	zero calibrate
NoOp	no action
ZSpanValid	zero & span validate
SpanValid	span validate
ZeroValid	zero validate
Blowback	start blowback
END-OF-PGRM	end of programmed sequence

Available nodes are (depending on number of channels installed within your analyzer):

Node name	*Selected action is carried out for*
All	all installed channels
Ch1 ... Ch5 (depending on the analyzer set-up, an assigned component tag may show here instead; 6-116)	the selected channel only

Software Menus

6

6.2.3.2.6 Setup Calibration and Validaton Interval Time

Setup..
Calibration/Validation..
Interval Times..

Note 1!
This line is available only if “Valves” in INSTALLED OPTIONS is set to a value other than ***none*** *(☞ 6-105).*

Interval Times

ZeroCal All..
Zero&SpanCal All..
Programmed Sequence..
Blowback All..
ZeroValid All..
Zero&SpanValid All..

This menu allows to select the procedure(s) you want to configure to be carried out on a regular (interval time) basis.

Note 2!
All lines in this menu link to submenus of a similiar design, exemplified in the following section.

6.2.3.2.6.1 Setup an Interval Time

Note!
Consider above given Note 1.

...	
Enable:	Disabled
Interval:	24 h
Start Time..	
Next:	--
Time	3/22/11 15:33

Depending on the procedure selected on the previous menu page, the title shows ‘*ZeroCal All*’, ‘*Zero&SpanCal All*’, ‘*Programmed Sequence*’ , ‘*Blowback All*’, ‘*ZeroValid All*’ or ‘*Zero&SpanValid All*’.

Enable or **Disable** interval times for the selected procedure

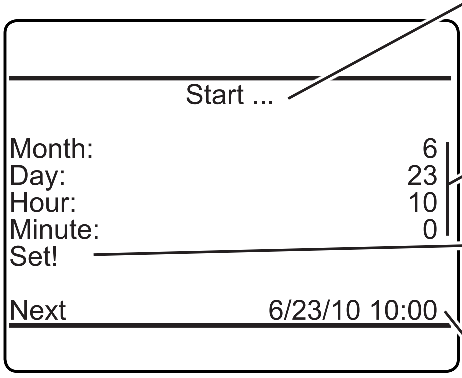
Specify the interval between two procedures.
Accepted values: **1 ... 10,000 h**

Specify the date to start the countdown for the next interval (☞ next page).

Shows the time for the next start of procedure, based on the current settings.

Current time.

6.2.3 Setup Menu



In '...' the title is replaced by *'ZeroCal All', 'Zero&SpanCal All', 'Programmed Sequence'* , *'Blowback All'*, *'ZeroValidAll'* or *'Zero&SpanValid All'* depending on the selected procedure.

In lines 1 ... 4, specify date and time for the next countdown to start.

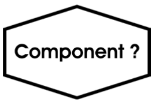
Set start date and time: The next calibration or validation time is calculated, considering the entries in above lines and the interval time given on the previous page.

Note!
This procedure also updates the four lines above, to show the next calibration or validation date as start time.

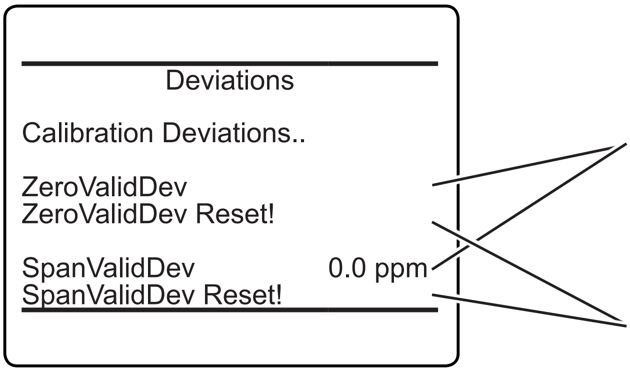
Shows the time for the next start of procedure, based on the current settings.

6.2.3.2.7 Setup Calibration and Validation Deviations

This menu shows deviation values from nominal values and allows to reset them.



Multi-channel unit:
In SELECT COMPONENT select the channel to be setup.



"ZeroValidDev" and *"SpanValidDev"* show the values in concentration units, that means how far they deviate from the nominal values for zero resp. span gas setup in SETUP - CALIBRATION/VALIDATION - GASES determined by the last successful validation procedure.

Reset all zero or span deviations.

Note!
These functions are carried out immediately, and there's no undo!

6.2.3.2.7.1 Setup Calibration Deviations

Setup..
Calibration/Validation..
Deviations..
Calibration Deviations

In the context of this menu, deviation means the value, the current zero or span calibration value is corrected by subsequent calibrations.

Ch2	
Calibration Deviations	
ZeroDev	0.0 ppm
ZeroDevSum	5.000 ppm
AfterZeroConc	7.000 ppm
Zero Deviation Reset!	
SpanDev	0.0 ppm
SpanDevSum	100.000 ppm
AfterSpanConc	0.0 ppm
Span Deviation Reset!	

"*ZeroDev*" or "*SpanDev*" in concentration units give the correction by the last performed calibration.

A short time after the calibration procedure has been performed, the calibration quality is tested. *"AfterZeroConc"* and *"AfterSpanConc"* show the deviations from the nominal value.

"*ZeroDevSum*" or "*SpanDevSum*" in concentration units give the total (sum of) corrections of all the referred calibrations since the last time, deviations have been reset.

Reset all zero or span deviations.

Note!
These functions are carried out immediately, and there's no undo!

Example:

A measuring channel shows zero drift of 10 ppm per week. It is calibrated once a week.

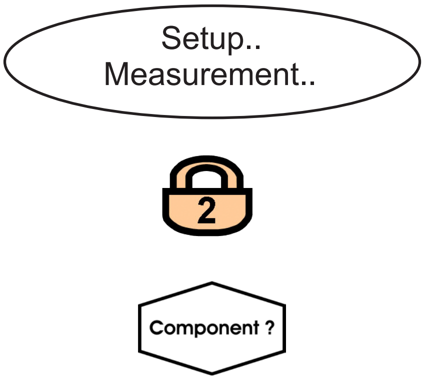
After 3 weeks of operation, DEVIATIONS would show:

ZeroDev:	*10 ppm (= last calibr.)*
ZeroDev Total:	*30 ppm (= summary of 3 calibrations, carried out within 3 weeks)*

Multi-channel unit:
Press LEFT *to enter SELECT COMPONENT, to change the settings for a different channel.*

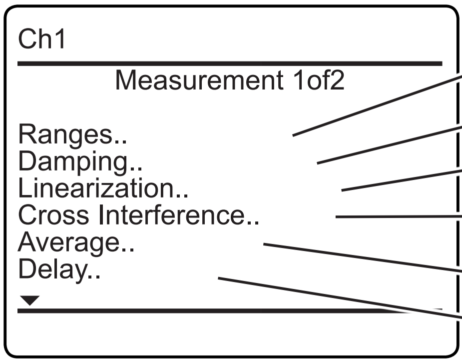
6.2.3 Setup Menu

6.2.3.3 Setup Measurement



If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu and all submenus.

Multi-channel unit:
In SELECT COMPONENT, select the channel to be configured.



Submenu to configure up to four ranges per channel; ☞ 6-59.

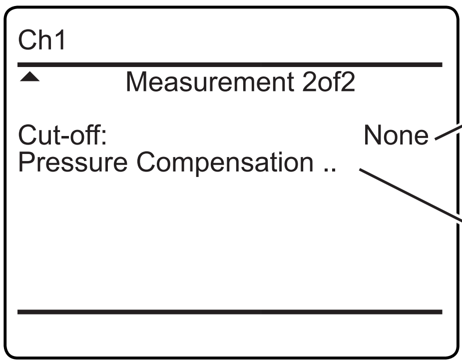
Setup t_{90} times; ☞ 6-62.

Setup and activate linearization; ☞ 6-68.

Setup and activate cross interference compensation; ☞ 6-69.

Setup and activate averaging; ☞ 6-72.

Setup delay time; ☞ 6-73.



Cut-off mode: Output values are limited, in case they exceed the configured range limits, or are becoming negative.
Available options:
None: cut-off mode is disabled
RngLimits: values are limited to range limits
NonNegat.: negative values are output as ‘0’

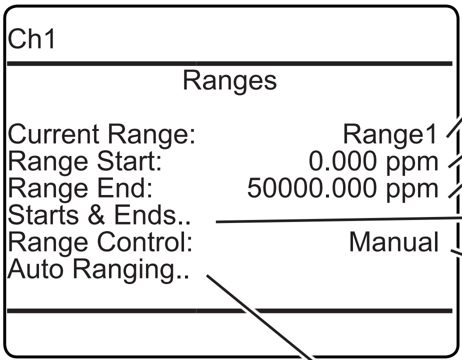
Setup ambient pressure for compensation; ☞ 6-74

Note!
Cut-off always is disabled during calibrations!

Multi-channel unit:
Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

6.2.3.3.1 Setup Measurement Ranges

This menu allows to configure up to four ranges per channel.



Select the range to be configured.
Available options: **Range1 ... Range4**

For the current range, specify start and end concentration limits.

Specify the limits for up to four ranges per channel in one single menu, making it easier to adjust several limits at a glance; ☞ 6-60.

For the current range, specify how range switching is done.
Available options:
Manual, Remote, Automatic

Note!
*Selecting **Remote** or **Automatic** range control is not possible, if identical ranges end values are specified (☞ 6-60)!*

Specify the switchover levels for up to four ranges per channel; ☞ 6-60.

6.2.3.3.1.1 Measurement Ranges Starts & Ends

Setup..
Measurement..
Ranges..
Starts & Ends..

This menu allows to define a start and an end concentration for all four ranges at once.

```
Ch1
           Starts & Ends
Range1 Start:          0.000 ppm
Range1 End:          500.000 ppm
Range2 Start:          0.000 ppm
Range2 End:         1000.000 ppm
Range3 Start:          0.000 ppm
Range3 End:         5000.000 ppm
Range4 Start:          0.000 ppm
Range4 End:        10000.000 ppm
```

Select the range to be configured, and set start and end concentrations.

Note!
For automatic or remote range control, all ranges end values need to be different!

6.2.3.3.1.2 Measurement Autoranging

Setup..
Measurement..
Ranges..
Autoranging..

This menu allows to switch on or off the autoranging function for each range

```
Ch1
           Auto Ranging

Range1:                  Yes
Range2:                  Yes
Range3:                  Yes
Hysteresis:             10 %
Switchover Levels..
```

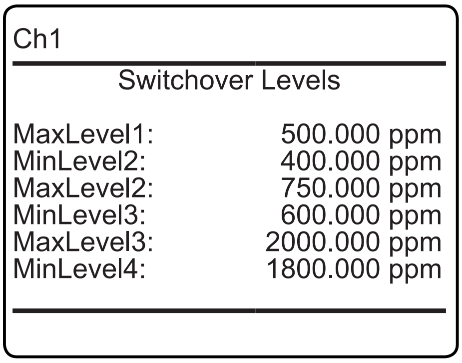
For each range select separately, if autoranging is to be used (**Yes**) or not (**No**)

Specify the hysteresis for autoranging.
Accepted range: **1 ... 50 %**

Alternatively specify switchover limits for each range separately; ☞ 6-61.

6.2.3.3.1.2.1 Autoranging Switchover Levels

This menu allows to specify individual switchover levels, instead of using one single hysteresis value for all ranges.



Max. level gives the switchover limit for rising concentrations: If this level is exceeded, the analyzer activates the next higher range.

Min. level gives the switchover limit for decreasing concentrations: If this level is underrun, the analyzer activates the next lower range.

Note!
*As given in the figures to the left, specifying the '*Min.level*' of a level to be lower than the '*Max.level*' of the level right below, defines a switching hysteresis.*

6.2.3.3.2 Setup Damping

Setup..
Measurement..
Damping..

Any measuring system applies a damping on its output signal, compared to the change of the 'real' measurand, due to delays caused by

- electronic signal processing,
- sensors with finite response time,
- gas flow, and more.

This damping is called 'system damping'.

This menu enables to setup an additional electronic damping (t90 time), that is added to the system damping. The reason to do so, is to e.g. have a smoother output signal.

Ch1

Damping

t90 Range1:	2.0 s
t90 Range2:	2.0 s
t90 Range3:	2.0 s
t90 Range4:	2.0 s
t90 Current	2.0 s
Current Range	Ch1-R1
t90 Time Max	76.9 s

Specify t_{90} times for each range of the selected channel.

Gives the current t_{90} time, specified for the currently selected range.

Shows the current measuring range.

Gives the maximum possible t_{90} time, which is limited by the size of the internal sampling buffer and the sampling rates of the installed measuring principles/sensors.

6.2.3.3.3 Setup Linearization

Setup..
Measurement..
Linearization..

This menu allows to correct unlinear measurements behaviors by enabling a linearization algorithm.

If the system is set up accordingly, the access code for level 3 must be entered to gain access to this menu and all submenus.

Ch1	
Linearization	
Linearizer:	Off
LinearMethod:	Splines
Calculate!	
Setpoints (X)..	
Actuals (Y)..	
Linearizer Min	20.000 ppm
Linearizer Max	110.000 ppm
▾Status	Normal

Switch **On** or **Off** the linearizer.

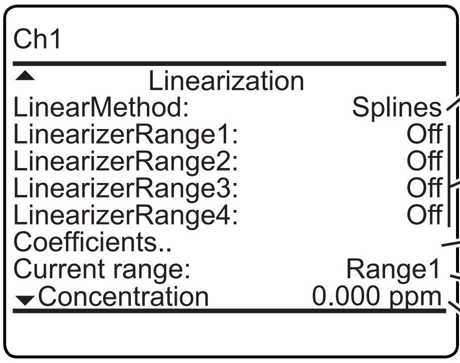
Specify the linearization methode to be used. Available options: **Splines**, **Polynom**.

Select this line to let the analyzer calculate the new linearization curve.

First enter SETPOINTS (X) to enter the new setpoint values (☞ 6-65).
When done, enter ACTUALS (Y) to enter the corresponding actuals (☞ 6-66).

The linearization status.
Possible values: **Normal, Underflow, Overflow, Undefined**

6.2.3 Setup Menu



Specify the linearization methode to be used.

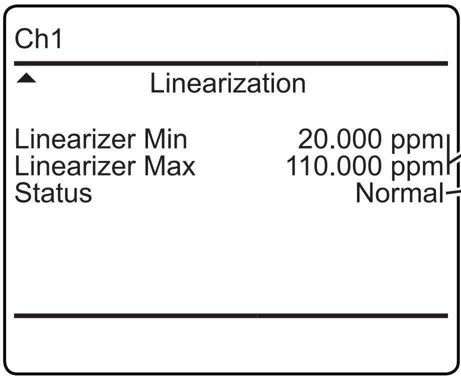
Available options: **Splines**, **Polynom**.

Separately switch **On** or **Off** the Linearization for each range of the selected channel.

Submenu to enter coefficients (☞ 6-67).

Select the currently to be used range.

Currently measured gas concentration



Measuring range, covered by the linearization settings.

Linearization status.

Possible values: **Normal, Underflow, Overflow, Undefined**

6.2.3 Setup Menu

6.2.3.3.3.1 Setup Linearization Setpoints (X)

Setup..
Measurement..
Linearization..
Setpoints (X)..

3

```
Ch1
        Setpoints (X) 1of4
Lin X1:              0.000 ppm
Lin X2:              0.000 ppm
Lin X3:              0.000 ppm
Lin X4:              0.000 ppm
Lin X5:              0.000 ppm
Lin X6:              0.000 ppm
Lin X7:              0.000 ppm
▼Lin X8:             0.000 ppm
```

To modify a linearization curve, within this menu enter up to 32 setpoint values (x values) for the new parameter sets.

When done, return to the previous menu, enter ACTUALS (Y) and enter the corresponding (y) values.

```
Ch1
▲       Setpoints (X) 2of4
Lin X9:              0.000 ppm
Lin X1
Lin X1
Lin X1
Lin X1
Lin X1
Lin X1
▼Lin X
```

```
Ch1
▲       Setpoints (X) 3of4
Lin X17:             0.000 ppm
Lin X1
Lin X1
Lin X2
Lin X2
Lin X2
Lin X2
▼Lin X
```

```
Ch1
▲       Setpoints (X) 4of4
Lin X25:             0.000 ppm
Lin X26:             0.000 ppm
Lin X27:             0.000 ppm
Lin X28:             0.000 ppm
Lin X29:             0.000 ppm
Lin X30:             0.000 ppm
Lin X31:             0.000 ppm
Lin X32:             0.000 ppm
```

Software Menus
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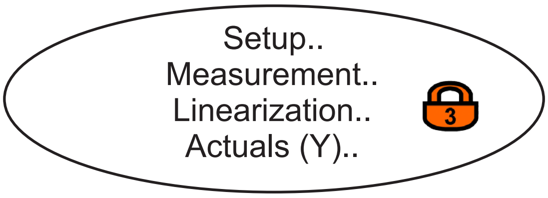
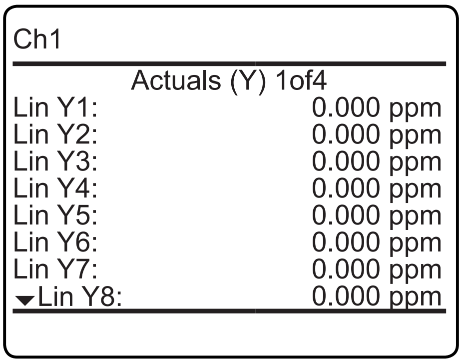
6.2.3.3.3.2 Setup Linearization Actuals (Y)

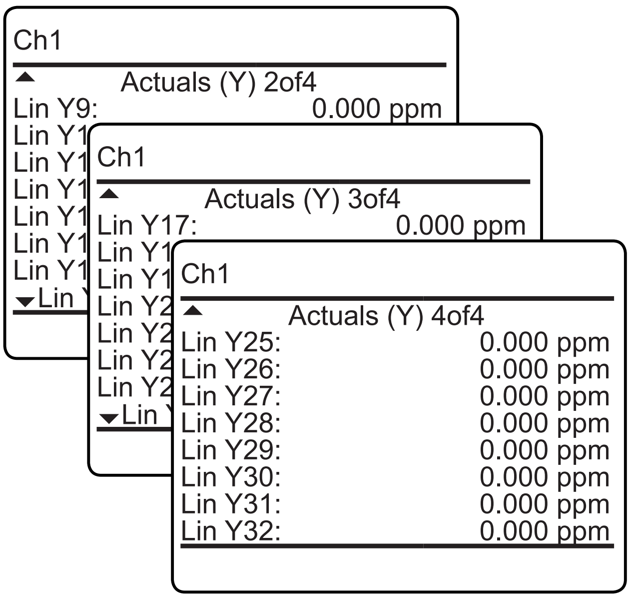




To modify a linearization curve, after having entered the setpoint values (x values) for the new parameter sets, within this menu enter the new actuals (y) values.

4 menu pages enable to enter up to 32 values.

Note!
Take care to enter the same number of actuals as setpoints!



6.2.3.3.3.3 Polynomials Coefficients

Setup..
Measurement..
Linearization..
Coefficients..

Range1 Uses:	Poly1
Range2 Uses:	Poly3
Range3 Uses:	Poly3
Range4 Uses:	Poly4
Coeffs Poly1..	
Coeffs Poly2..	
Coeffs Poly3..	
Coeffs Poly4..	
Calculation..	

Assign polynomials to each range of the current channel. Multiple assignments are supported.

Submenus to enter polynomials coefficients; ☞ see below .

Submenu to calculate the polynomials; ☞ 6-68.

6.2.3.3.3.3.1 Enter Polynomials Coefficients

Overflow:	10.0 %
Underflow:	5.0 %
a0:	
a1:	
a2:	
a3:	
a4:	
RefValue	100000 ppm
State Poly1	No coeffs

Enter the coefficients here for a 4th order polynomial:

$$a4 * x^4 + a3 * x^3 + a2 * x^2 + a1 * x + a0$$

6.2.3.3.3.3.2 Calculate Polynomials

```
Ch1
   Linearization setpoint

CalcPolySet:          All Poly
Calculate!
Cancel!
State Poly1          No Coeffs
State Poly2          No Coeffs
State Poly3          No Coeffs
State Poly4
▼Merit
```

Submenu for linearization setpoints (☞ below)

Start calculation of polynomials.

```
Ch1
▲      Approximation setup

MaxItera:                  100
Cut-off:                 0.001
```

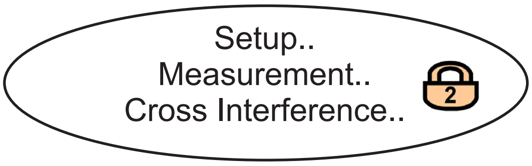
6.2.3.3.3.3.2.1 Linearization Setpoints

```
Ch1
       Linearization setpoints

Setpoints (X)..
Actuals (Y)..
RefPoly1:           10000 ppm
RefPoly2:           10000 ppm
RefPoly3:           10000 ppm
RefPoly4:           10000 ppm
Clear all points!
```

Submenu to enter setpoints (☞ 6-65).
Submenu to enter actuals (☞ 6-66).

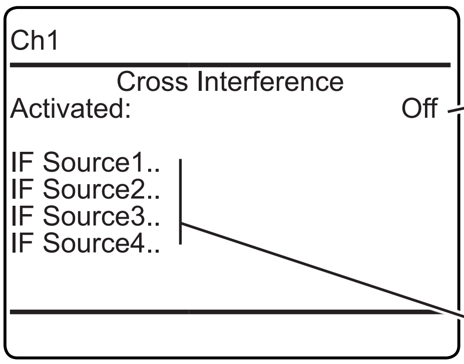
Clear all entered setpoints.

6.2.3.3.4 Setup Cross Interference



This menu allows to configure up to four sources (internal or external) for cross interference compensation.

☞ 7-59 for more information about this menu.



Enable (**On**) or disable (**Off**) cross interference compensation for the selected channel.

If the 3rd parameter **CalibOff** is selected, cross interference compensation is activated, but disabled during calibrations.

Up to four sources of concentration values can be configured for compensation. These submenus are exemplified on ☞ 6-70.

6.2.3.3.4.1 Setup Cross Interference Source *n*

Setup..
Measurement..
Cross Interference..
IF Source*1 ... 4*

This menu allows to configure the source and effect of interference of the component, interfering the currently selected channel.

Ch1	
IF Source1	
Source:	None
Value	0
Status	Good
Interference Factor:	1
Apply IF Factor!	
Linearization Curve..	

Source: Select the source of measuring values to be used for cross compensating the selected channel.

Available options:

None: source is disabled for cross compensation

Conc1…Conc5: Measurement values of internal channels 1…5

*(**Note!***
The currently selected channel, here Ch1, cannot be setup as a source!)

AIN1, AIN2: Analog input 1 or 2

Calc A ... Calc D: Result of Calc A to Calc D

Value: Shows the interfering components value, currently applied.

Status: Shows the interfering components status.

Available options: **Absent, Good**.

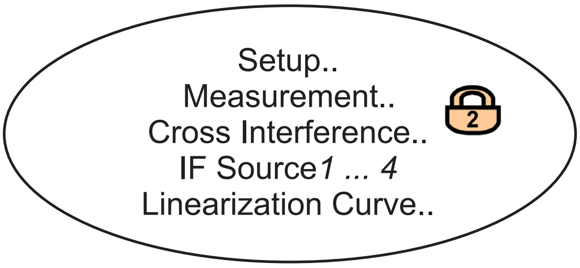
Interference Factor: Specify the influence of the selected source on the selected channel to be compensated.

Accepted range: **$-1x10^9$ ... $+1x10^9$**

Apply IF Factor!: Apply the configured settings.

Linearization Curve..: If the source signal is not linear, enter this submenu to configure a fourth-order polynomial, ☞ 6-71.

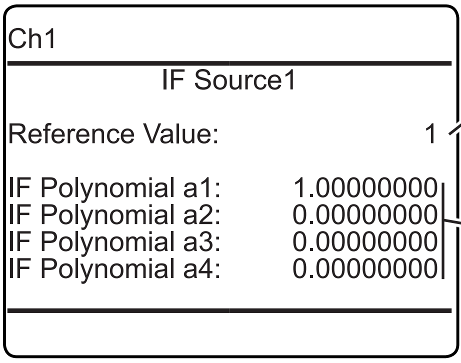
6.2.3.3.4.1.1 Setup Cross Interference Linearization Curve



This menu allows to define an algorithm for unlinear source signals for the selected IF-source.

Note!
The menu figure to the left shows the default setup for the polynomials, which relates to a straight line.

So, if your IF source signal is linear, no further actions or changes in this menu are required.



Reference value to normalize the linearization curve.

Accepted range: **-1E+9 ... +1E+9**

Enter up to four polynomial factors to linearize the interfering component's input signal with a fourth-order polynomial of the form

Polynomial equation:

$P(x) = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4$

6.2.3.3.5 Setup Measurement Average

Setup..
Measurement..
Average..

Some applications, like e.g. CEMS (Continuous Emissions Monitoring System), require to calculate and monitor concentration averages. Enter this menu to setup averaging.

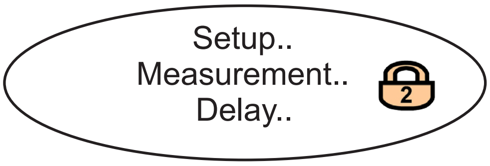
```
Ch1
              Average
Method:                    Sliding
Interval Time                2 min
Sliding Time                10 min
StartStopMethod:            Manual
Reset Averaging!

Next Average in                0 s
Last Average            2000.0 ppm
```

In this line specify the averaging time.
Accepted values: **0 ... 120** min

Elapsed time for the next average.

Last average result.

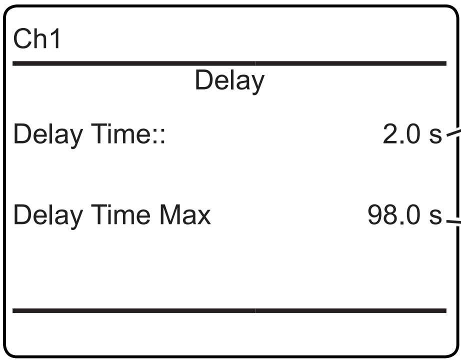
6.2.3.3.6 Setup Measurement Delay



This menu option allows to delay a measurement output (on all display, analog outputs, network, etc.).

Use this option to compensate signal delays within multichannel instruments, if you need very synchronous results.

Reasons for unsynchronous behaviour may be e.g. serial tubing of multiple channels, where the first channel already gives a valid reading, while the last one is still waiting for the gas.

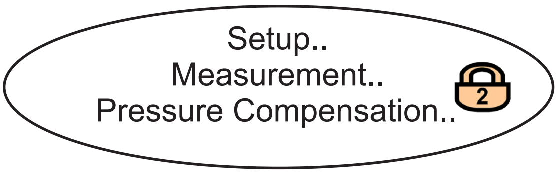


Setup the output delay time.

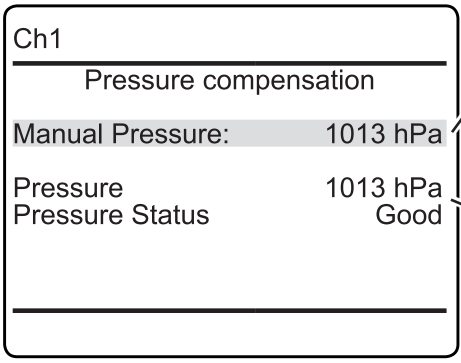
Accepted range: **0.0 s ... "*Max. Delay time*"**

The acceptable maximum delay time is internally calculated, depending on the installed measuring options, and cannot be changed.

6.2.3.3.7 Setup Pressure Compensation



This menu allows to enter the ambient pressure, if no pressure sensor is installed.



Manually enter the current ambient pressure for pressure compensation.

Note!

If a pressure sensor is installed, this line is hidden!

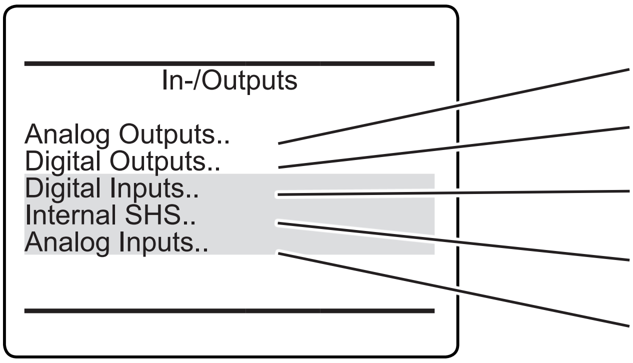
These lines show the pressure, currently used for pressure compensation and the status.

6.2.3.4 Setup In-/Outputs

Setup..
In-/Outputs..

If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu.

Enter the submenu for the in- or outputs you want to configure:



Analog outputs: ☞ 6-76

Digital outputs: ☞ 6-82

Optional: Digital inputs: ☞ 6-86

Optional: Internal sample handling system: ☞ 6-88

Optional: Analog inputs: ☞ 6-89

6.2.3.4.1 Setup Analog Outputs

Setup..
In-/Outputs..
Analog Outputs..

Configure your analyzer's analog outputs.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

Analog Outputs

Output1..
Output2..
Output3..
Output4..
Output5..

Enter the submenu for the output you want to configure.

Note!
All submenus for the analog outputs settings are of an identical design.

6.2.3.4.1.1 Setup Analog Output *n*

Setup..
In-/Outputs..
Analog outputs..
Output*1...5*..

Signal:	Comp1
OutRange:	0-20 mA
Low Scale:	0.00
High Scale:	100.00
AutoScale:	Yes
FailMode:	Track
0/4 mA:	0.00
20 mA:	100.00
▾Hold:	No

"*Signal*" specifies the value associated with the selected output. The following options (partly dependent on the number of measuring channels and sensors installed) are available:

Signal*)	Description
None	The analog output is deactivated
0 mA	A 0 or 4 mA signal is generated, e.g. to check the signal processing in an external system. Whether a 0 or 4 mA signal is generated, is set by the "*Out range*" line (☞ next page).
20 mA	A 20 mA signal is generated, e.g. to check the signal processing in an external system.
Comp1 ... 5	Gas concentration
Temp1 ... 5	Temperature
Press1 ... 5	Pressure
Flow1 ... 5	Flow
Calc A ... D	Result of calculator
RawVal1 ... 5	Raw value
RangeID1 ... 5	ID of selected range

**) Numbers 1 to 5 refer to components [channels] 1 to 5: In case of secondary measurements, this means, the selected value is that of the sensor assigned to the given component (Press2 is the pressure value of the sensor assigned to component 2).*

In contrast, capital letters A to D imply that these calculator results are component [channel] independent (Calc C is the result of calculator C).

Tab. 6-1: *Analog Output Signals*

6.2.3 Setup Menu

Signal:	Comp1
OutRange:	0-20 mA
Low Scale:	0.00
High Scale:	100.00
AutoScale:	Yes
FailMode:	Track
0/4 mA:	0.00
20 mA:	100.00
▼Hold:	No

“*Out(put) range*”:

- **0-20 mA** (dead zero) generates a 20 mA signal, if a concentration is measured at the upper limit of the signal range. A 0 mA signal is generated if the sample gas concentration equals the value specified with “*LowScale*”.
- **4-20 mA** (life zero): A 4 mA signal is generated if the concentration equals the value specified with “*LowScale*”, thus enabling to detect e.g. a broken cable.

Enter a concentration, to equal the low output limit (0 or 4 mA)

Enter a concentration, to equal the high output limit (20 mA)

Enable (**Yes**) or disable (**No**) output autoscaling.

“*Fail mode*” selects the output’s behaviour under failure conditions, considering or not, the NAMUR recommendation NE 43. NE 43 defines output signals enabling to detect different types of failures/status (see Tab. 6-1): The related information is transmitted as a current signal, but outside the (0)4-20 mA measurement signal range.

Available options:

Track: NE 43 not considered.

HIGH + 10%: NE 43 failure signal level: “above”.

LOW - 10%: NE 43 failure signal level: “below”.

Note!
*Factory settings are OutRange: **4-20 mA** and FailMode: **LOW - 10%**, if not changed at time of order.*

6.2.3.4.1.1.1 Operation Modes Acc. NAMUR NE 43

If "*OutRange*" is set to **0-20 mA**, a 20 mA signal is generated, if the measured concentration equals "*Max Scale*". A 0 mA signal is generated if the sample gas concentration is 0 (dead zero).

However, a severed cable also results in a signal value of 0. An external data acquisition system thus cannot detect such an failure and accepts a gas concentration of 0.

The commonly used method of detecting a severed cable is to apply an offset: a concentration corresponding to the lower range value is assigned an analog signal of 4 mA, enabling to detect a severed or disconnected cable.

This live zero mode is activated by setting "*Out Range*" to **4-20 mA**.

Operation Modes Conforming to NAMUR 43 (NE 43) Recommendations

The operation modes described above do not generate a signal which enables detection of a failure in the measurement system. In such cases the behaviour of the output signal is undefined: either the last value is held, or a random value is sent. System failures thus cannot be detected by an external data acquisition system.

NE 43 gives recommendations for setting analog outputs in order to avoid these situations. They are implemented by X-STREAM analyzers as follows:

Setting "*FailMode*" to **HIGH +10%** or **LOW -10%** defines specific analog output signals for failures. Since these values are not output under normal operation conditions, a data acquisition system is enabled to distinguish between the following situations (Tab. 6-1):

- Valid signal (signal within valid range; column *C*)
- Signal out of range (signal rises or falls slowly to the limits given in columns *D* or *E* and holds this value until the concentration returns to a valid level).
- Failure (signal out of range; column *F*)
- Severed cable (no signal; column *G*)

			Output signal, if				
Column	*A*	*B*	*C*	*D*	*E*	*F*	*G*
"OutRange"	**"FailMode"**	**Failure signal level acc. NE 43**	**Measured value is valid**	**Measured value is below lower limit ("Low scale")**	**Measured value is above upper limit ("High scale")**	**An internal failure occured**	**Cable is severed**
0-20 mA	Track	-	0 ... 20 mA	< -19 mA	> 21.7 mA	undefined	0 mA
4-20 mA	Track	-	4 ... 20 mA	< -19 mA	> 21.7 mA	undefined	0 mA
0-20 mA	LOW - 10 %	below	0 ... 20 mA	-0.20 mA* (-1.80 … -0.01 mA)**	20.50 mA* (20.01 ... 21.50 mA)**	-2 mA	0 mA
4-20 mA	LOW - 10 %	below	4 ... 20 mA	3.80 mA* (2.20 ...3.99 mA)**	20.50 mA* (20.01 ... 21.50 mA)**	2 mA	0 mA
0-20 mA	HIGH + 10 %	above	0 ... 20 mA	-0.20 mA* (-1.80 … -0.01 mA)**	20.50 mA* (20.01 ... 21.50 mA)**	> 21.7 mA	0 mA
4-20 mA	HIGH + 10 %	above	4 ... 20 mA	3.80 mA* (2.20 ...3.99 mA)**	20.50 mA* (20.01 ... 21.50 mA)**	> 21.7 mA	0 mA

Tab. 6-2: *Analog Output Failure Modes*

Note!
*The application of values marked * or ** depends on the setting of "Cut Mode" (☞ page 6-81).*

6.2.3 Setup Menu

Signal:	Comp1
OutRange:	4-20 mA
Low Scale:	0.00
Max Scale:	100.00
AutoScale:	Yes
FailMode:	LOW - 10%
0/4 mA:	0.00
20 mA:	100.00
▼Hold:	No

"*0/4 mA*" enables to finetune the analog output: Set "*Signal*" to **0 mA** and, while measuring the output current, in this line adjust it to the expected value.

Accepted range: **-10,000** ... **+10,000**

"*20 mA*" enables to finetune the analog output: Set "*Signal*" to **20 mA** and while measuring the output current, in this line adjust it to the expected value.

Accepted range: **-10,000** ... **+10,000**

"*Hold*" selects the output's behaviour during calibrations.

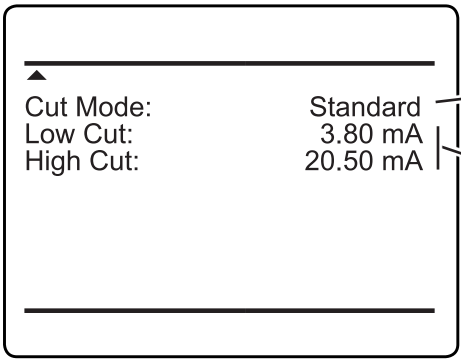
If set to **Yes**,

- the analog output is fixed to the last measured value;
- concentration alarms, which may otherwise be triggered by the concentrations of the calibration gases, are supressed.

If set to **No**,

- the analog output signal always corresponds to the actual measured value during calibration; this may trigger alarms if limits are exceeded.
  Note!
  This behaviour may be undesireable if e.g. the unit is connected to a data acquisition system.

6.2.3 Setup Menu



Note!
This second menu page appears only, if "FailMode" *is set to other than* ***Track****! It enables to specify the output's behaviour in case the measured value exceeds the range* **(** ☞ *Tab. 6-2 on page 6-79).*

"Low Cut" is output if the measured value is below the lower range limit, *"High Cut"* is output if it exceeds the upper range limit.

"*Cut Mode*" specifies if **Standard** values or **Config**urable values are used for output:

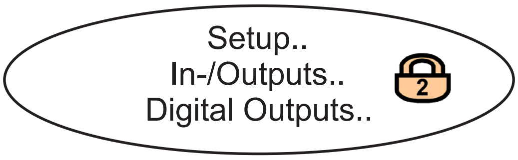
If *"Cut Mode"* is set to **Standard**, these lines show the standard settings. For *"Low Cut"* they depend on the setting of *"OutRange"*:

OutRange	**0-20 mA**	**4-20 mA**
Low Cut	-0.20 mA	3.80 mA
High Cut	20.50 mA	

If *"Cut Mode"* is set to **Config**, use these lines to adjust the related output signals. The accepted values for *"Low Cut"* again depend on the setting of *"OutRange"*:

OutRange	**0-20 mA**	**4-20 mA**
Low Cut	-1.80…-0.01 mA	2.20…3.99 mA
High Cut	20.01…21.50 mA	

6.2.3.4.2 Setup Digital Outputs



This first menu page enables to configure digital outputs 1 ... 4, which are the basic outputs, available with every X-STREAM *Enhanced* analyzer ('X1' in the menu title refers to the instrument's I/O connector X1).

```
        Digital Outputs (X1)
Output1 Node:             System
Output1 Signal:              Off
Output2 Node:                Ch1
Output2 Signal:              Off
Output3 Node:                Ch2
Output3 Signal:              Off
Output4 Node:                Ch3
▼Output4 Signal:             Off
```

For each output 1 .. 4 specify within the "*Node*" line the signal source.

Available options: **System**, **Ch1…Ch5** (depending on the number of channels installed).

If any one of **Ch1…Ch5** is selected, only signals, valid for the selected channel are considered.

If **System** is selected, analyzer specific signals are selectable.

Once the "*Node*" is specified, for each output

- 1…4 select within the "Signal" line, what to output. Depending on the node, the list of available signals varies; ☞ next page.

6.2.3 Setup Menu

Node: **System** *(related to analyzer)*

Option	Description
Off	Switched off
On	Switched on
Heartbeat	Status changes every second (test mode)
Any Failure	Any failure, off-spec, maintenance request or function check status is set [1]
Any OffSpec	
Any MaintRequ	
Any FctCheck	
Any Calibrating	Any calibration, zero or span calibration is ongoing
Any Zeroing	
Any Spanning	
Any ZeroCal Failed	A zero or span calibration failed
Any SpanCal Failed	
Any Range Low	Any measured value exceeds a current range
Any Range High	
Any ConcAlarm	Any channel triggered an alarm of the selected type [2]
Any AvgAlarm	
Any TempAlarm	
Any PressAlarm	
Any FlowAlarm	
Reserved	Currently without function (storage place reserved for new functions)
V1…V20	Drive an external valve
Pump1…2	Drive an external pump
Ext Status1…8	An alarm is triggered
PLC Result1…20	Status of related PLC result
CalcA Rslt LoLo	The result of calculatorA exceeds the selected limit [2]
CalcA Rslt Lo	
CalcA Rslt Hi	
CalcA Rslt HiHi	
CalcB Rslt LoLo .... CalcD Rslt HiHi	Similar to CalcA, but for calculatorsB…D [2]
Ain1.. ..LoLo, ..Lo, ..Hi, ..HiHi	An alarm of the selected type is triggered by Analog Input 1 or 2 [2]
Ain2.. ..LoLo, ..Lo, ..Hi, ..HiHi	

Tab. 6-3: *Digital Output Signals*

Option	Description
AnyValidation	Any validation is ongoing
AnyZeroValid	Any zero or span validation is ongoing
Any SpanValid	
Any ZeroValid Fail	A zero or span validation failed
Any SpanValid Fail	

1) If assigned, the output is automatically configured Failsafe

2) Parameter *"Alarms Output Failsafe"* can be used to manually configure Failsafe all outputs assigned to the same type of option (indexed with [2]). ☞ 6-95

6.2.3 Setup Menu

Node: **Ch1…Ch5** *(related to channel)*

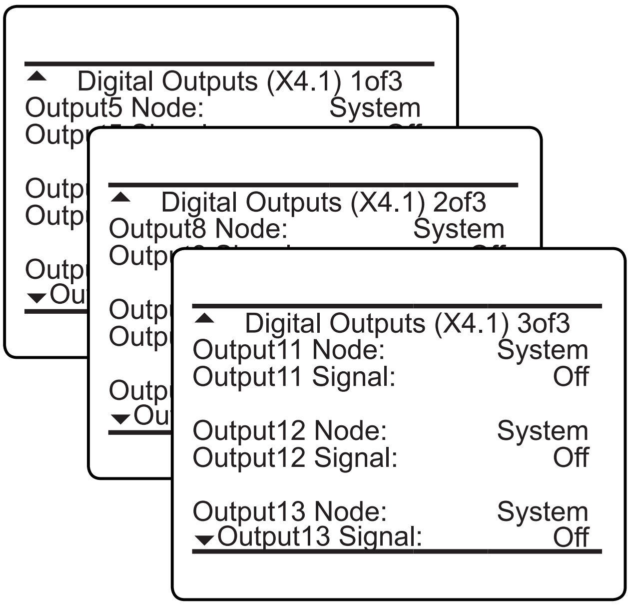
Option	Description
Off	Switched off
On	Switched on
Heartbeat	Status changes every second (test mode)
Failure Off-Spec MaintRequ FctCheck	A channel specific failure, off-spec, maintenance request or function check status is set [1]
Calibrating Zeroing Spanning	The channel is calibrating, zeroing or spanning
Zero CalFailed Span CalFailed	A channel specific zero or span calibration failed
Range Underflow Range Overflow	Measured value exceeds current range
Range 1…4	The selected range is active
Conc LoLo Conc Lo Conc Hi Conc HiHi	A concentration alarm of the selected type is triggered [2]
Average.. ..LoLo, ..Lo, ..Hi, ..HiHi	A concentration average alarm of the selected type is triggered [2]
Temperature.. ..LoLo, ..Lo, ..Hi, ..HiH	A temperature alarm of the selected type is triggered [2]
Pressure.. ..LoLo, ..Lo, ..Hi, ..HiH	A pressure alarm of the selected type is triggered [2]
Flow.. ..LoLo, ..Lo, ..Hi, ..HiH	A flow alarm of the selected type is triggered [2]
Validating	A channel specific validation is ongoing
ZeroValid SpanValid	A channel specific zero or span validation is ongoing
ZeroValidFail SpanValidFail	A channel specific zero or span validation failed

[1] If assigned, the output is automatically configured Failsafe

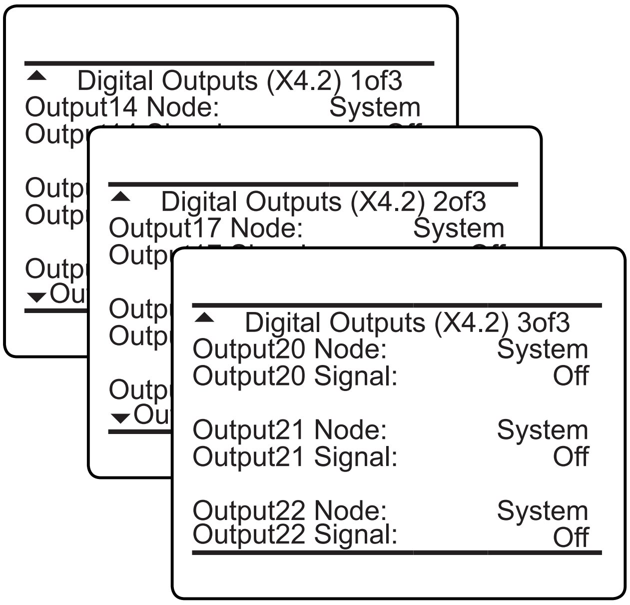
[2] Parameter *“Alarms Output Failsafe”* can be used to manually configure Failsafe all outputs assigned to the same type of option (indexed with [2]). ☞ 6-95

6.2.3 Setup Menu

If your instrument features optional digital I/O boards, similiar menu pages for the additional digital outputs are unlocked. The options for each output are as described before.:

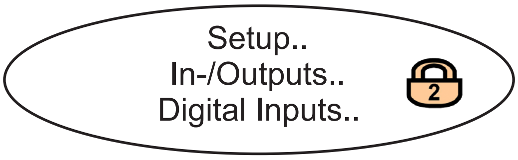


Menu pages 4 ... 6 (titled ‘Digital outputs (X4.1)’) enable to configure outputs 5 ... 13 on the first expansion board (‘X4.1’ in the menu title refers to the instrument’s I/O connector X4.1).



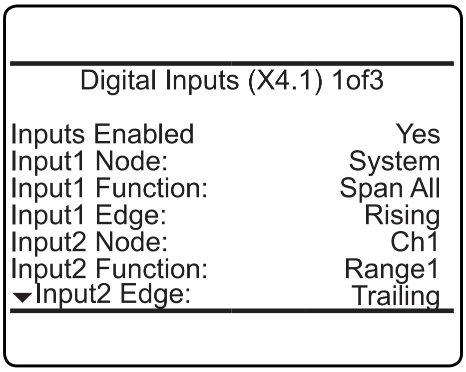
Menu pages 7 ... 9 (titled ‘Digital outputs (X4.2)’) enable to configure outputs 14 ... 22 on the second expansion board (‘X4.2’ in the menu title refers to the instrument’s I/O connector X4.2).

6.2.3.4.3 Setup Digital Inputs



If your instrument features optional digital I/O boards, this menu appears, enabling to configure the digital inputs.

Menu pages 1...3 (titled “Digital inputs (X4.1)”) enable to configure inputs 1...7 on the first expansion board (‘X4.1’ in the menu title refers to the instrument’s I/O connector X4.1).

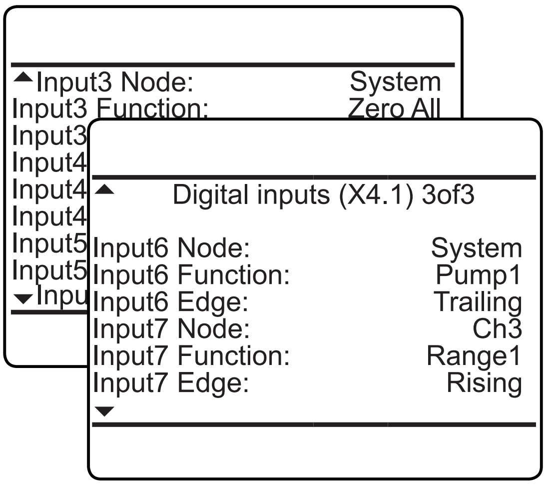


For each input 1...7 specify within the “*Node*” line the signal source.

Available options: **System**, **Ch1 ... Ch5** (depending on the number of channels installed).

If any one of **Ch1 ... Ch5** is selected, only signals, valid for the selected channel are selectable.

If **System** is selected, any system signal is selectable.



Once the “*Node*” is specified, for each input

- select the “*Function*” of that input (depending on the node, the list of available signals varies; ☞ next page)
- select, how the input is to be triggered: by **Rising** edge, or **Trailing** edge.

6.2.3 Setup Menu

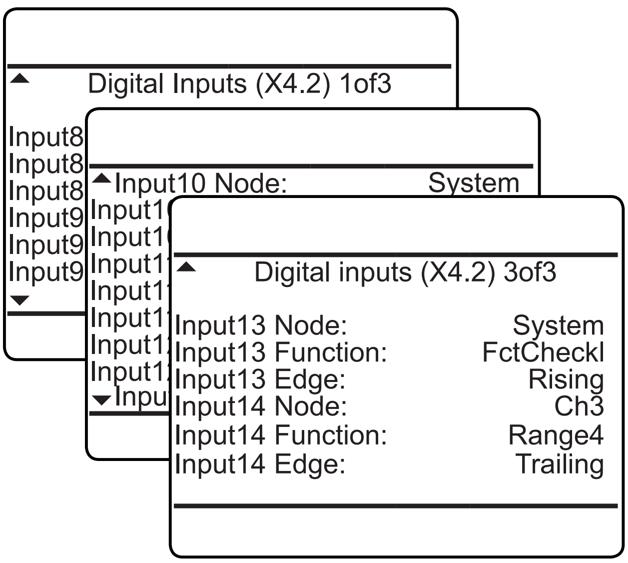
Node: **System**

Input*n* Function	
Option	**Description**
None	Not used
Zero All	Carry out the selected calibration procedure, or cancel any ongoing calibration
Span All	
Zero&Span All	
Cancel All	
ProgSequ	Perform calibration sequ.
Blowback	Activate blowback
CalCheckMod	Perform calibration check
Reserved	Currently without function
Failure	The input signal activates the related analyzer NAMUR status
OffSpec	
MaintRequ	
FctCheck	
Pump1…2	Activate related pump
ExtStatus1…8	Input signal is assigned the selected alarm signal
Datalogger	Start data logger
Hold AO1...AO5	Put Analog Output 1...5 into hold mode
ZeroValid All	Carry out the selected validation procedure
SpanValid All	
Zero & SpanValid All	
FlowAlm	Trigger a flow alarm

Node: **Ch1…Ch5**

Input*n* Function	
Option	**Description**
None	Not used
ZeroCal	Carry out the selected calibration procedure, or cancel any ongoing calibration
SpanCal	
ZeroSpanCal	
Cancel	
Range1…4	Activate the selected range
Failure	The input signal activates the related channel NAMUR status
OffSpec	
MaintRequ	
FctCheck	
SampleGas	Open related valve
ZeroGas	
SpanGas1…4	
AllClosed	Close all valves
Blowback	Activate blowback
ConcAlaOff	Switch off concentration alarms monitoring
ConcAlaOn	Switch on concentration alarms monitoring
ZeroValid	Carry out the selected validation procedure
SpanValid	
Zero&SpanValid	
FlowAlm	Trigger a flow alarm

Tab. 6-4: *Digital Input Signals*



Menu pages 4 ... 6 (titled 'Digital inputs (X4.2)') enable to configure inputs 8 ... 14 on a second expansion board ('X4.2' in the menu title refers to the instrument's I/O connector X4.2).

6.2.3.4.4 Setup Internal SHS

Setup..
In-/Outputs..
Internal SHS..

Internal SHS (1of2)	
Gas1 Signal:	V2
Gas2 Signal:	V3
Gas3 Signal:	V18
Gas4 Signal:	Off
Gas5 Signal:	Off
Gas6 Signal:	Off
Gas7 Signal:	Off
▾Gas8 Signal:	Off

▴ Internal SHS (2of2)	
Pump1 Signal:	Off
Pump2 Signal:	Off

This menu enables to configure the optional internal components for routing gas (valves and pumps) to be used in autocalibration procedures.

Note!

This menu appears only if your analyzer features internal valves or pumps.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

Note

Ensure that valves are assigned (☞ 6-51)

Each assigned valve has its label (*"Gas1… Gas8"*). The current menu enables to assign these valves (and pumps too) a signal to control it. (If the components were installed in the factory, the basic settings will already have been set).

All signals applicable to digital outputs can be used (☞ *Tab. 6-3 on page 6-83)*

Example 1:

Gas1 Signal: Any span failed

--> The valve connected to gas inlet 1 is activated when a span calibration failure occures.

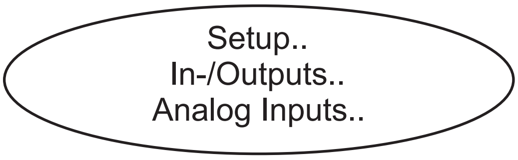
Example 2:

Gas2 Signal: V2

Pump1 Signal: V2

--> The internal signal "V2" activates the valve connected to gas inlet 2 and pump 1.

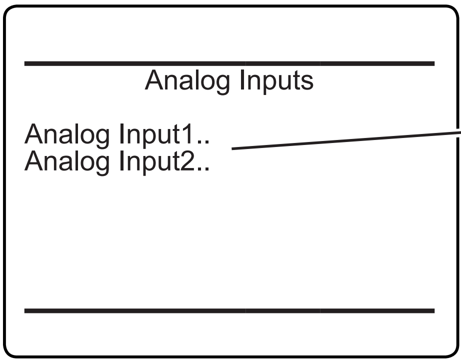
6.2.3.4.5 Setup Analog Inputs



Enter this menu to configure the optional analog inputs.

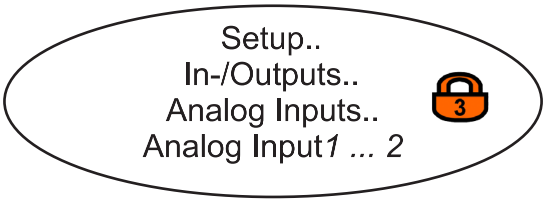
Note!
If your instrument does not feature analog inputs, this menu is not available.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.



Select the analog input you want to configure (☞6-90).

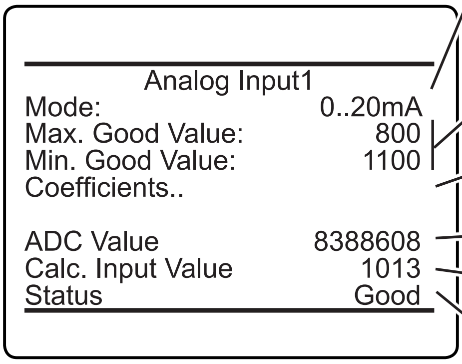
6.2.3.4.5.1 Setup Analog Input *n*



This menu allows to select the type of signal, provided by the external source.

Available options:

Option	Description
Test	The instrument internally generates a step-like signal for testing purposes.
Off	Input is switched off.
0..10V	Voltage or current signal is applied.
0..1V	
0..20mAc	



With this two lines specify the range for the input value to be accepted as 'good'. The (not shown) unit for these entries is the measurement unit of the external source, such as e.g. pressure sensor: hPa, flow sensor: l/min, ...

Opens the submenu COEFFICIENTS ☞ next page.

Shows the internal ADC output (informative)

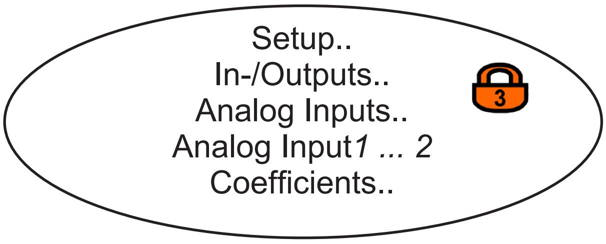
Shows the calculated input value, based on the conversion coefficients a0..a4, as specified in the submenu.

Input value status.

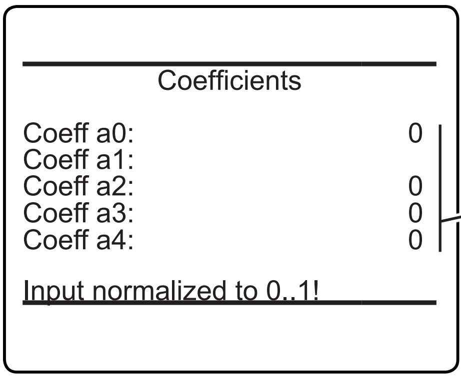
Possible entries:

Absent, Failure, Good, Simulated (e.g. when in test mode)

6.2.3.4.5.1.1 Setup Coefficients



If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.



Enter the coefficients for your input signal here, considering

- it is for a polynomial equation.
- it is normalized to 0...1 (see note in menu)

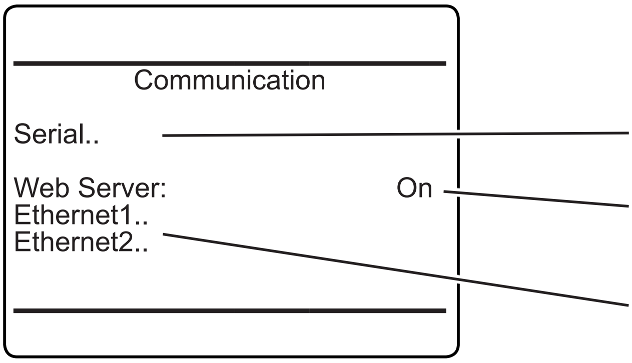
Polynomial equation:

$P(x) = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4$

6.2.3.5 Setup Communication

This menu allows to setup the interface parameters to meet the configuration of your host system.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

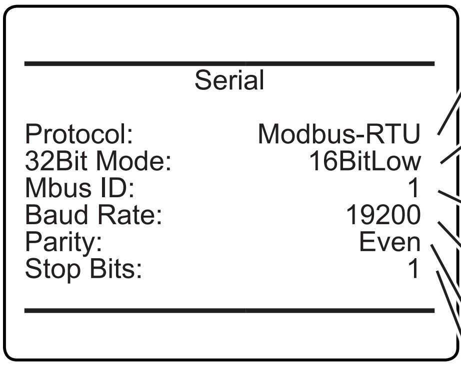


Configure the serial interface (☞ 6-93)

Specify, if (**On**) or not (**No**) a web server connection is used.

Configure "*Ethernet1*" or "*Ethernet2*" communication (☞ 6-94)

6.2.3.5.1 Setup Communication Serial



Select the Modbus protocol.
Available options:
MODB-RTU, None

Modbus mode of operation.
Available options:
32Bit (=Daniel mode),
16BitLow (=Modicon mode, LOW word first)
16BitHigh (=Modicon mode, HIGH word first)

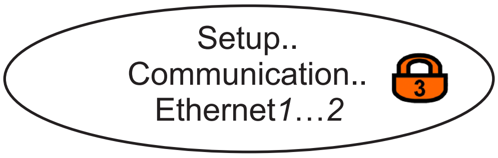
Enter instrument ID for network.
Accepted values: **1 .. 254**

Select baud rate for the serial interface.
Available options:
2400, **4800**, **9600**, **19200**

Set whether a parity bit is used.
Available options:
None, **Even**, **Odd**

Number of Stop Bits:
Available options:
1, 2

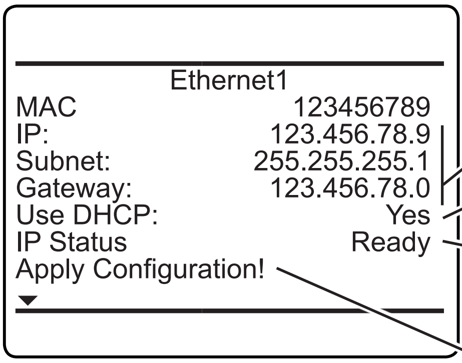
6.2.3.5.2 Setup Communication Ethernet *n*



Within these menus, configure the Ethernet communication for connector 1 or 2.

Most entries are standard, to be setup to meet your local network configuration.

Enter the second menu page to configure the Modbus parameters.

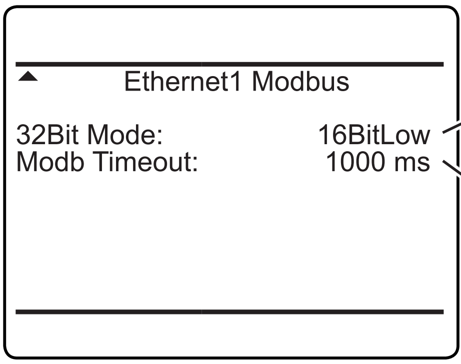


If your network does not feature a DHCP server, enter these lines to configure the network settings manually.

If your network does not feature a DHCP server, select **No** to enter the network settings manually.

If your network features a DHCP server, "*IP status*" turns to **Ready**, if a valid IP address has been assigned.

To apply any changes made on this first menu page, press enter in this line.



Modbus mode of operation.

Available options:
32Bit (=Daniel mode),
16BitLow (=Modicon mode, LOW word first)
16BitHigh (=Modicon mode, HIGH word first)

Modbus timeout.

Accepted values: **500 ... 10,000** ms

Note!
*At maximum 2 hosts at a time can connect to the analyzer. "*MBus timeout*" specifies the time interval to elapse, before a host without activity is disconnected.*

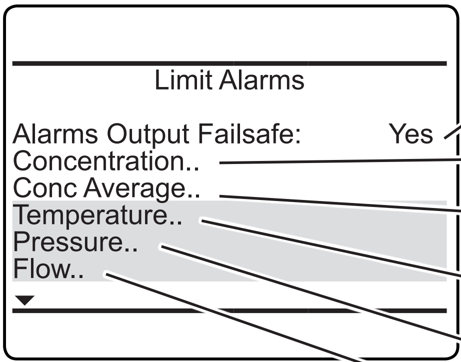
6.2.3.6 Setup Limit Alarms

Setup..
Limit Alarms..

This menu and its submenus enable to configure a couple of alarm conditions.

In case an alarm goes off, a status is set and the related pictogram shows in the display. Also digital outputs may be configured to be activated (☞ 6-82).

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.



Select if the alarms outputs are failsafe (**Yes**) or not (**No**): Failsafe means, relay output coils are powered during normal operation.

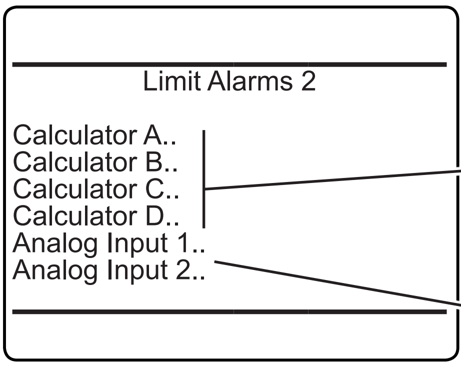
Configure concentration alarms (☞ 6-96)

Configure alarms for concentration averages (☞ 6-98)

Optional: Configure temperature alarms (☞ 6-100)

Optional: Configure pressure alarms (☞ 6-100)

Optional: Configure flow alarms (☞ 6-100)



X-STREAM XE analyzers can be upgraded with optional software packages, to provide four calculators (A ... D).

Their results can be monitored to activate alarms (☞ 6-101).

Open the submenu ANALOG INPUT (☞ 6-103)

6.2.3.6.1 Setup Limit Alarm Concentration

Setup..
Limit Alarms..
Concentration..

Note!
To configure concentration alarm levels for averaging measurements, ☛ 6-98!

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be setup.

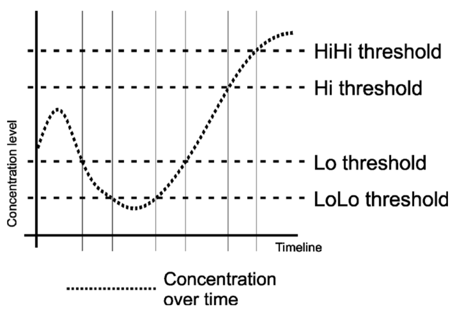
```
Ch1
            Concentration

Alarm Monitor:                 On
LoLo Level:            50.000 ppm
Lo Level:             100.000 ppm
Hi Level:             400.000 ppm
HiHi Level:           600.000 ppm
Hysteresis:            10.000 ppm
States..
```

Switch **On** or **Off** the alarm monitor for the current channel.

Specify up to four concentration (threshold) levels:
"*LoLo*" and "*Lo*" levels are to be setup below the expected concentration.
"*HiHi*"and "*Hi*" levels are to be setup above the expected concentration.
See the figure to the left for details.

Specify the hysteresis to be considered around the concentration levels, to avoid oscillating alarms.

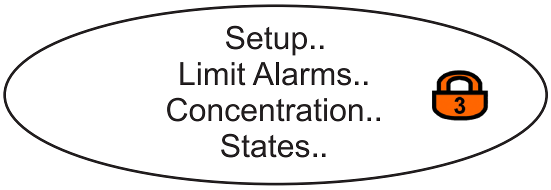
To view the current alarm states; ☛ 6-97

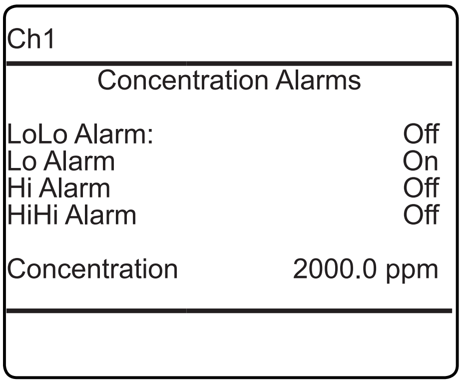


Note!
HiHi und LoLo are main alarms,
Hi and Lo are pre-alarms.

Multi-channel unit:
Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

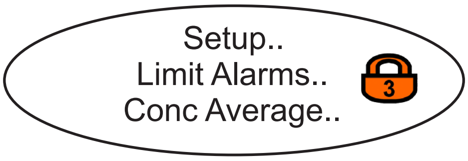
6.2.3.6.1.1 View Concentration Alarms States





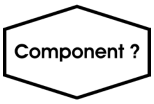
This menu gives an overview of activated alarms, based on the currently measured "*Concentration*".

6.2.3.6.2 Setup Concentration Average Alarms

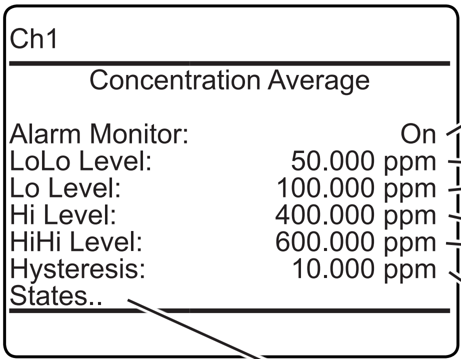


Note!
To configure concentration alarm levels for non-averaging measurements, ☞ 6-96!

If concentration averaging (☞ 6-72) is active, specify concentration alarms within this menu. In this case, an alarm goes off only, if an average value exceeds one of the given levels.



Multi-channel unit:
In SELECT COMPONENT, select the channel to be setup.



Switch **On** or **Off** the alarm monitor for the current channel.

Specify up to four concentration (threshold) levels:

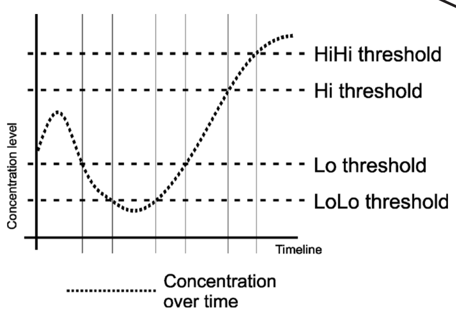
"*LoLo*" and "*Lo*" levels are to be setup below the expected concentration.

"*HiHi*"and "*Hi*" levels are to be setup above the expected concentration.

See the figure to the left for details.

Specify the hysteresis to be considered around the concentration levels, to avoid oscillating alarms.

To view the current alarm states; ☞ 6-99

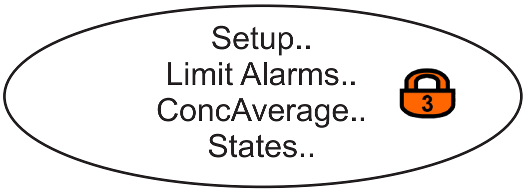


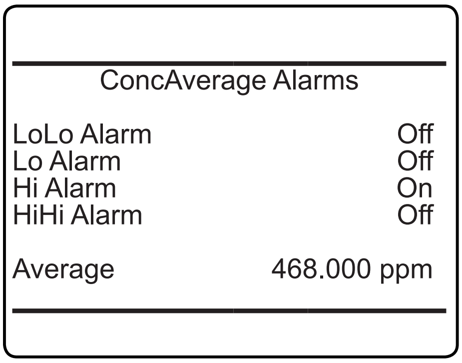
Note!
HiHi und LoLo are main alarms,
Hi and Lo are pre-alarms.

Multi-channel unit:

Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

6.2.3.6.2.1 Setup Alarms Conc Average States





This menu gives an overview of activated alarms, based on the currently measured “*Average*” of concentration.

6.2.3.6.3 Setup Temperature Alarms

Setup..
Limit Alarms..
Temperature..

Configuring temperature alarms is similiar to the procedure for concentration alarms; ☞ 6-96.

6.2.3.6.4 Setup Pressure Alarms

Setup..
Limit Alarms..
Pressure..

Configuring pressure alarms is similiar to the procedure for concentration alarms; ☞ 6-96.

6.2.3.6.5 Setup Flow Alarms

Setup..
Limit Alarms..
Flow..

Configuring flow alarms is similiar to the procedure for concentration alarms; ☞ 6-96.

Note!
Reasonable values for flow alarms are between 0.4 and 2.0 l/min.

6.2.3.6.6 Setup Alarms Calculator *n*

Setup..
Limit Alarms..
Calculator *A..D*

Any X-STREAM XE analyzer can be upgraded with optional software packages to provide four calculators (A ... D). The results can be monitored to activate alarms.

Note!

This menu is available only, if a valid software upgrade code has been purchased and entered (☞ 6-106).

For more information on calculators, see the associated separate software features documentation.

Calculator A

Alarm Monitor:	On
LoLo Level:	50.000
Lo Level:	100.000
Hi Level:	400.000
HiHi Level:	600.000
Hysteresis:	1000
States..	

Switch **On** or **Off** the alarm monitor for the current calculator (here: exemplary Calculator A).

Specify up to four threshold levels:

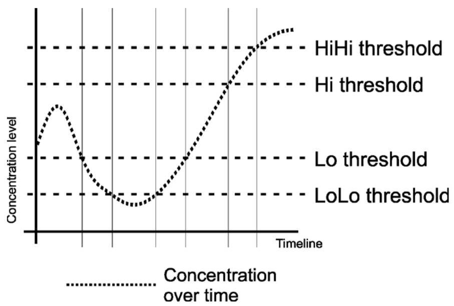
"*LoLo*" and "*Lo*" levels are to be setup below the expected calculator result range.

"*HiHi*"and "*Hi*" levels are to be setup above the calculator result range.

See the figure to the left for details.

Specify the hysteresis to be considered around the threshold levels, to avoid oscillating alarms.

To view the current alarm states; ☞ 6-99



Note!

The unit used for calculator results is taken from the entry at SETUP - CALCULATOR (☞ 6-124).

6.2.3.6.6.1 Setup Alarms Calculator *n* States

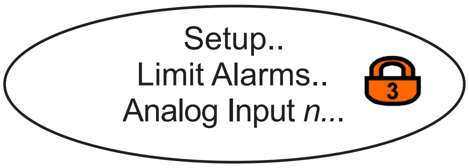
Setup..
Limit Alarms..
Calculator *n*..
States..

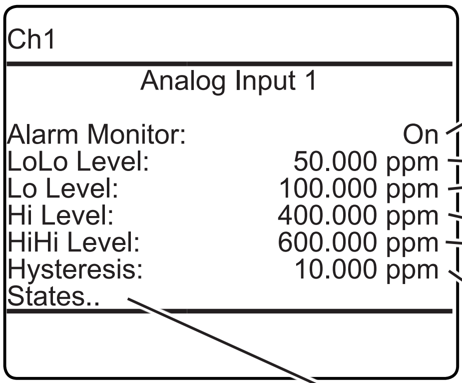
3

Calculator A Alarms	
LoLo Alarm	Off
Lo Alarm	Off
Hi Alarm	Off
HiHi Alarm	Off
Result A	468.000 Unit A

This menu gives an overview of activated alarms, based on the currently calculated "*Result* n" (here of Calculator A).

6.2.3.6.7 Setup Limit Alarms for Analog Input n





Switch **On** or **Off** the alarm monitor for the analog input.

Specify up to four threshold levels:
"*LoLo*" and "*Lo*" levels are to be setup below the expected value.
"*HiHi*"and "*Hi*" levels are to be setup above the expected value.

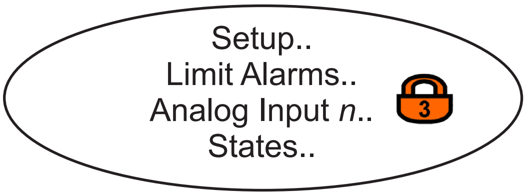
Specify the hysteresis to be considered around the threshold levels, to avoid oscillating alarms.

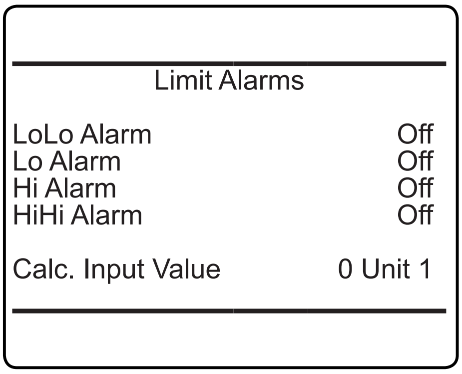
To view the current alarm states; ☞ 6-104

Note!
HiHi und LoLo are main alarms,
Hi and Lo are pre-alarms.

Multi-channel unit:
Press LEFT *to enter SELECT COMPONENT, to change the settings for another channel.*

6.2.3.6.7.1 Setup Alarms Analog Input *n* States





This menu gives an overview of activated alarms, based on the currently calculated *"Calc. Input value"* (here of Analog Input 1).

6.2.3.7 Setup Installed Options

Setup..
Installed Options..

Note!
Don't change settings in this menu without experienced knowledge! Wrong settings may result in a defective instrument.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

```
     Installed Options 1of2
Licenses..

Valves:                 None
Pumps Installed:        None
DIO#1 Installed:          No
DIO#2 Installed:          No
Anal. Outputs:             4
▼AIN Installed:           No
```

Some software features are optional and can be unlocked with a license code. To do so, ☞ 6-106

Lines 3 to 6 show if the related optional component is installed with the current instrument (**Yes**) or not (**None**), respectively shows, how they are installed ("*Valves*": **Internal**, **External** or **Int+Ext**), or which ("*Pumps*": **Pump 1, Pump 1&2**).

Indicates how many analog outputs are installed (**0** ... **5**).

Indicates if analog inputs are installed, or not.

Component ?

Multi-channel unit:
In SELECT COMPONENT select the channel to be setup.

```
▲     Installed Options 2of2

Flow..
Pressure..
```

Setup flow sensor installation, ☞ 6-107

Setup pressure sensor installation, ☞ 6-108

Multi-channel unit:

Press LEFT *to enter SELECT COMPONENT to change the settings for a different channel.*

6.2.3.7.1 Setup Installed Options Licenses

Setup..
Installed Options..
Licenses..

This menu is used to unlock software features, to be purchased separately.

By default, X-STREAM XE analyzers provide a web browser interface and a basic data logger. 3 optional software packages are available, to upgrade the software:

Enhanced: add PLC and calculator.

Advanced: add advanced data logger, event/calibration logger and e-mail support.

Professional: add all enhanced and advanced packages options.

Note!
For more information on these options, see the associated separate software features manual.

Licenses

Key 1:	88888
Key 2:	88888
Key 3:	88888
Package	Trial
Trial Days	21

Trial version
Enter **88888** into each line "*Key 1*" to "*Key 3*" to unlock a **30 days full version (Professional) trial**. This trial is available only once for each analyzer, and only, if no other package has been activated before ("*Package*" shows **None**). Once entered, "*Trial Days*" shows the remaining time, until the package is disabled.

To unlock one of above packages for unlimited time, contact your EMERSON sales office. Have the analyzer serial number at hand, to purchase and receive an unlock code.

The code (3 5-digit numbers) has to be entered into lines "*Key 1*" to "*Key 3*". If the entered code is correct, "*Package*" shows the related name (see above).

Upgrades from one to another package are possible at any time, by purchasing and entering a valid unlock code.

6.2.3.7.2 Setup Installed Options Flow

Setup..
Installed Options.. 
Flow..

Ch1	
Flow	
Flow Source:	XSP F1
Flow	1.00 l/min
SensorMin.:	0.00 l/min
SensorMax.:	1.50 l/min
Flow Status	Good
Min Scale:	0.00 l/min
Max Scale:	2.00 l/min

Select the flow measurement data source for the currently selected channel.

Available options:

XSP F1 ...XSP F4: internal sensors, connected to the board XSP

AIN1, AIN2: analog inputs

Currently measured flow.

The sensor's minimum and maximum limits.

The sensor's status.

Possible entries: **Good, Absent, Failure**

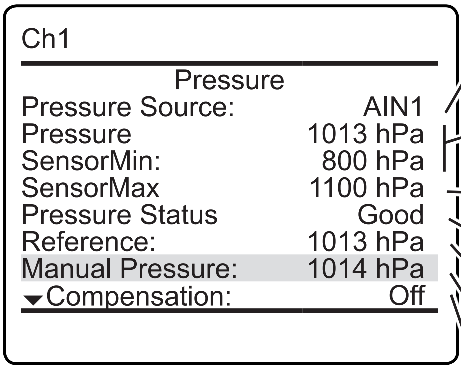
In case, the measured values are transferred to an analog output, a 4 mA signal is generated, if the flow equals the value specified under "MinScale".

In case, the measured values are transferred to an analog output, a 20 mA signal is generated, if the flow equals the value specified under "MaxScale".

6.2.3 Setup Menu

6.2.3.7.3 Setup Installed Options Pressure

Setup..
Installed Options..
Pressure..



Select the pressure measurement data source for the currently selected channel.

Available options:

XSP P1, XSP P2: internal sensors, connected to the board XSP

AIN1, AIN2: analog inputs

Manual: enter the current pressure manually

Currently measured pressure, or currently entered manual pressure value.

The sensor's minimum and maximum limits, or the limits for manual pressure entries.

The sensor's status.

Possible entries: **Good, Absent, Failure**

Enter the reference pressure for pressure compensaion here.

Manually enter the current ambient pressure here.

Note!

*If "Pressure source" is set to an option other than **Manual**, this line is hidden.*

Enable or disable pressure compensation for the selected channel.

Available options: **On, Off**

Ch1
Pressure
MinScale: 800 hPa
MaxScale: 1500 hPa

In case, the measured values are transferred to an analog output, a 4 mA signal is generated, if the pressure equals the value specified under “MinScale”.

In case, the measured values are transferred to an analog output, a 20 mA signal is generated, if the pressure equals the value specified under “MaxScale”.

6.2.3.8 Setup Save-Load

Setup..
Save-Load..

This menu allows to save or restore configuration files from or to your analyzer.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

Save-Load

Local Backup..
Factory Defaults..
USB Backup..

USB Firmware Update..

Enables to save/restore analyzer configuration data to/from a special internal memory area; ☞ 6-111

Restore the factory configuration; ☞ 6-111

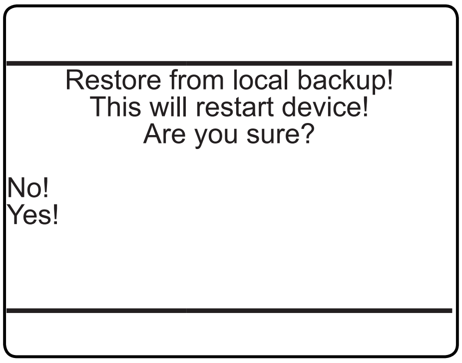
Save/restore analyzer configuration data to/from external USB devices; ☞ 6-112

Update the analyzer firmware with a new version, to be provided on a connected USB device; ☞ 6-113

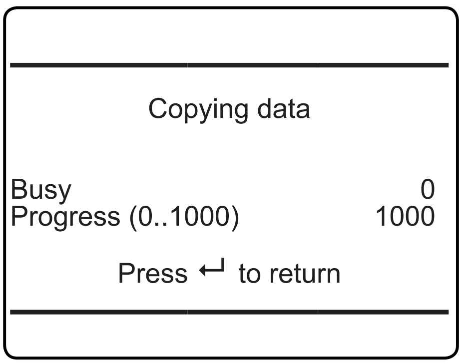
6.2.3.8.1 Notes on Save-Load Procedures

After selecting any ‘backup’ procedure, a safety prompt appears: select “*Yes!”* to start the backup; “*No!”* cancels.

Note!
There is no undo for this procedure, overwriting any older backup!



After selecting any ‘restore’ procedure, a safety prompt appears: select “*Yes!”* to start the backup; “*No!”* cancels.



While a backup or restore procedure is ongoing, an information screen appears, as shown to the left:

Wait until “*Progress (0..1000)*” shows **1000**, then press *ENTER* to return to the previous menu.

6.2.3.8.2 Save-Load Local Backup

Setup..
Save-Load..
Local Backup..

This menu allows to save or restore the current analyzer configuration to/from a special internal memory area.

Consider the notes on ☞ 6-110!

```
Local Backup

Save..
UsrBack Date          7/29/09 14:26
Restore..
Undo Restore!
Busy                              0
Progress (0..1000)                0
```

Save the configuration data

Date of last backup.

Restore saved configuration data

Undo a restore.

Wait until "*Progress (0..1000)*" shows **1000**, then press ENTER to return to LOCAL BACKUP.

6.2.3.8.3 Save-Load Factory Defaults

Setup..
Save-Load..
Factory Defaults..

Note!
Factory defaults are saved once after factory startup and can only be restored!

Consider the notes on ☞ 6-110!

```
Factory Defaults

FacBack Date          7/29/09 14:26
Restore..
Undo Restore!
Busy                              0
Progress (0..1000)                0
```

Date of last backup.

Restore saved factory configuration data

Undo a restore.

Wait until "*Progress (0..1000)*" shows **1000**, then press ENTER to return to LOCAL BACKUP.

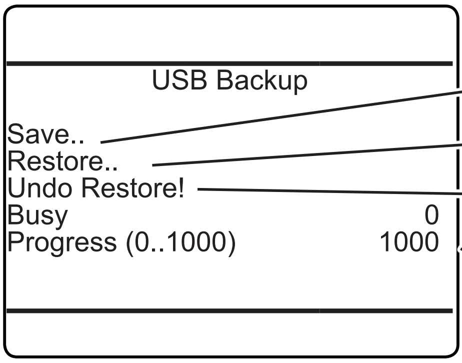
6.2.3 Setup Menu

6.2.3.8.4 Save-Load USB Backup

This menu enables to save or restore the current analyzer configuration to/from an external USB device.

Consider the notes on ☞ 6-110!

Note!
Take care to consider the important information on ☞ 7-83, before starting any procedures with USB devices!



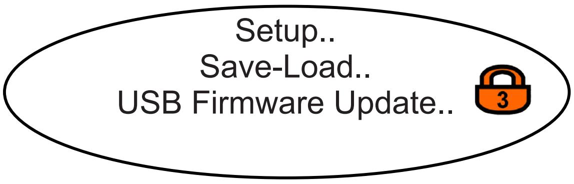
Save the configuration data.

Restore saved configuration data

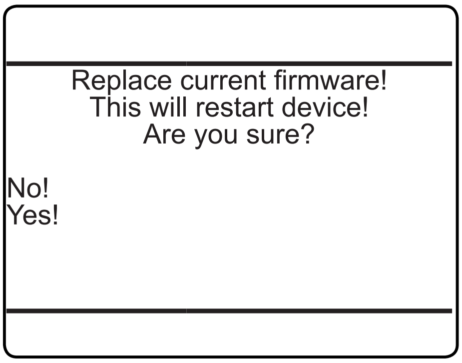
Undo a restore.

Wait until "*Progress (0..1000)*" shows **1000**, then press *ENTER* to return to LOCAL BACKUP.

6.2.3.8.5 Save-Load USB Firmware Update



Firmware is the analyzer's basic operation software. This menu enables to update your current analyzer firmware from an external USB device, e.g. to add new features, etc.



After selecting the firmware update procedure, a safety prompt appears: select "*Yes!*" to start the procedure; "*No!*" cancels.

Firmware USB update procedure

- The USB devices is checked for the directory EMERSON_XE/[SERAL NUMBERIENNUMMER]/FIRMWARE/PROGRAM. If existant, the files within this directory are copied to the internal SD card. If not existant, the USB device in the given order is scanned for the following directories to contain valid firmware data

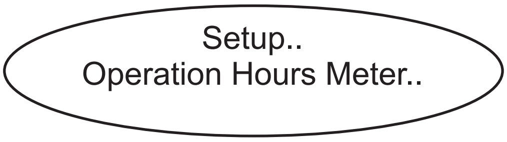
  EMERSON_XE/UPGRADE/FIRMWARE/PROGRAM

  EMERSON_XE/ [SERIAL NUMBER]/FIRMWARE/WEB

  or EMERSON_XE/UPGRADE/FIRMWARE/WEB.

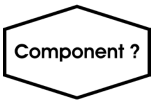
  The first found valid data are copied to the internal SD card.
- After the files are copied to the SD card, the analyzer reboots.
- After the reboot, the analyzer configuration files are copied to the SD card.
- Now the firmware files are copied to their final destination.
- Configuration files are restored from the SD card.
- All passwords are reset to factory defaults!
- A final analyzer reboot completes the update procedure.

6.2.3.9 Setup Operation Hours Meter

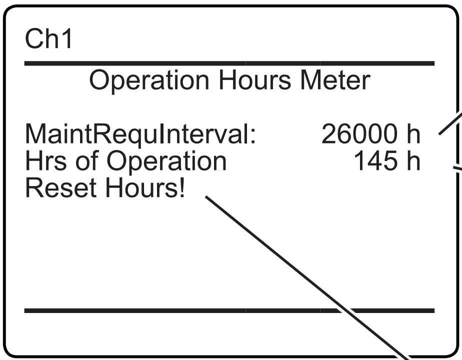


This menu allows to specify intervals for maintenance tasks.

If the system is set up accordingly, the access code for level 2 must be entered to gain access to this menu.



Multi-channel unit:
In SELECT COMPONENT select the channel to be configured.



Enter the operating hours for the selected channel's maintenance requests interval.

Accepted range: **0** ... **26280** hrs.

Note!
*Enter **0** to disable operation hours monitoring for the selected channel.*

Operating hours since last reset.

Note!
*If this function is enabled, a maintenance request is triggered the moment, "*Hrs of Operation*" matches "*MaintRequInterval*". To reset this message, activate "*Reset Hours*".*

Press ENTER in this line to reset the operating hours meter for the selected channel.

Multi-channel unit:

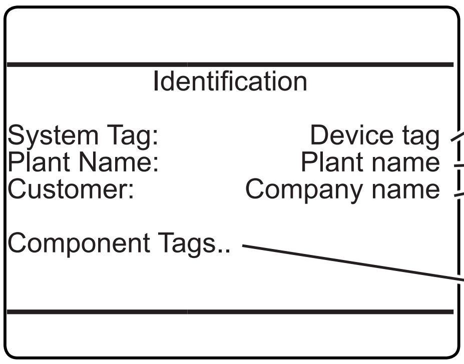
Press LEFT to enter SELECT COMPONENT to change the settings for a different channel.

6.2.3.10 Setup Identification

Setup..
Identification..

This menu allows to enter analyzer identification data to identify the analyzer within a network.

If the system is set up accordingly, the access code for level 3 must be entered to gain access to this menu.

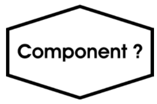


Enter a device tag here to identify the analyzer in e.g. a network

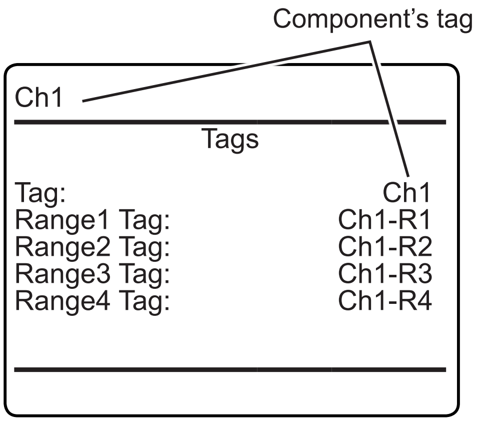
Enter a plant and customer name here.

Enter tags for components; ☞ 6-116.

6.2.3.10.1 Component Tag Setup Menu



Multi-channel unit:
In SELECT COMPONENT select the channel to be setup.



Within this menu, you may configure the component’s tag, and individual tags for each range.

Accepted entries: alphanumeric text, up to 8 characters long.

Note!
If set, the “Tag” always appears in the very top menu line, if the current menu refers to a specific component.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT to change the settings for a different channel.

☞ MEASUREMENT DISPLAY setup, page 6-42, to setup labels, and see examples of usage.

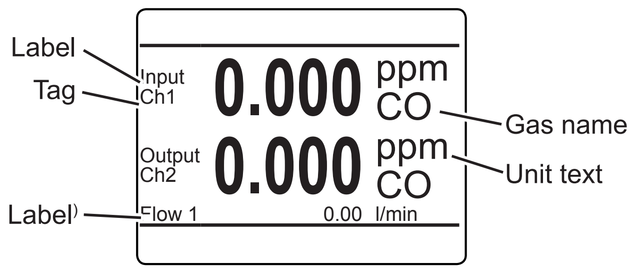


Fig. 6-4: *Measurement Display With Labels and Tags (example)*

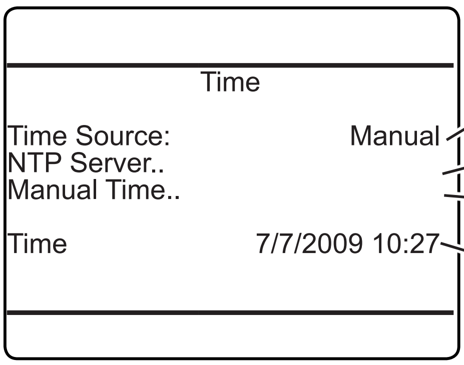
6.2.3.11 Setup Time

Setup..
Time..

This menu allows to configure time settings.

Note!
Correct time settings are important for e.g. time interval based calibrations, validation and log files entries.

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.



Select, how the analyzer time is set
Available options: **Manual, NTP**

Configure a NTP time server ☞ 6-118

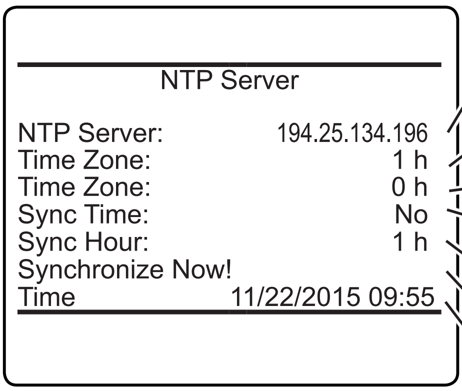
Enter this menu to setup the analyzer time manually ☞ 6-119

The last line shows the current analyzer time.
Note!
Time format is 24h (13 = 1 pm)

6.2.3.11.1 Setup NTP Server

Setup..
Time..
NTP Server..

If the system is set up accordingly, the access code for level 3 must be entered to gain access to this menu.



Enter the IP-adress of the NTP-server.
There are many NTP-servers available on the internet. Visit www.ntp.org for the IP-adress of a NTP-server.

Enter the hours offset of the local area to the GMT.

Enter the minutes offset of the local area to the GMT.

Choose “yes” to activate the synchronization of the gas analyzer time with the NTP-Sever.

Enter the time of the day in which the gas analyzer should be synchronized with the NTP-server time.

Synchronize the gas analyzer time with the NTP-server time.

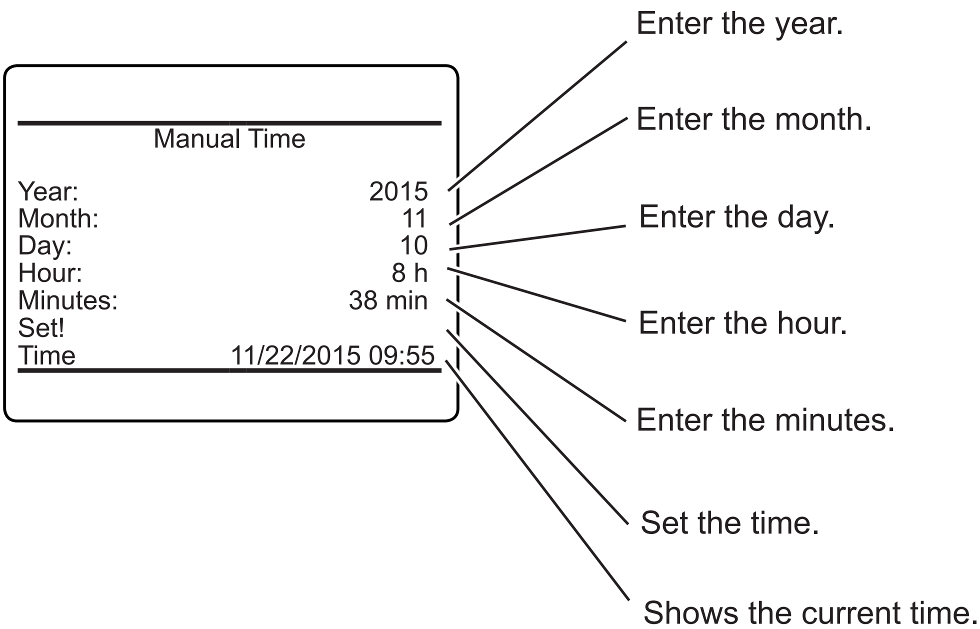
Shows the current time.

6.2.3 Setup Menu

6.2.3.11.2 Setup Manual Time

Setup..
Time..
Manual Time..

If the system is set up accordingly, the access code for level 3 must be entered to gain access to this menu.

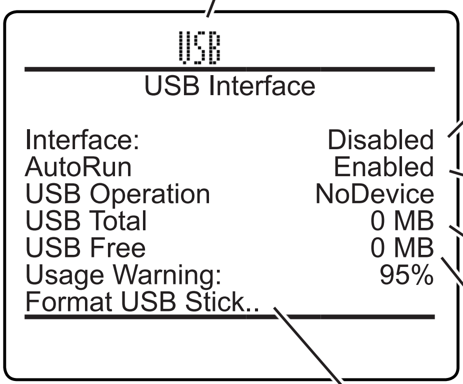


6.2.3.12 Setup USB Interface

Setup..
USB Interface..

If the system is set up accordingly, the access code for level 3 must be entered to gain access to this menu.

Indicator for an connected USB device.



If "*Interface*" is set to **Enabled**, this line shows status USB information:

MassMemory, if a memory stick is connected

Formatting, if formatting a device is ongoing

NoDevice, if no device is connected

If "*Interface*" is set to **Disabled**, the line shows **Disabled**, too.

If *"AutoRun"* is **Enabled** and a USB device with a software update is connected, than the system is updated automatically.

USB stick memory information (if a device is connected).

Specify the usage limit for the USB stick, to give a warning.

Format an USB memory stick before using it with this analyzer ☞ 6-121

6.2.3.12.1 Format USB Stick

Setup..
USB interface..
Format USB stick...

USB

Format USB stick
and erase all existing data!
Are you sure?

No!
Yes!

Select “Yes!” to start formatting.

A progress screen appears. Formating has ended when “*Busy*” in this screen shows **0.**

Note!

*While formatting is in progress, “*USB operation*” in the previous menu shows* ***formatting****.*

Do not remove a device while formatting!

This may cause loss of data or abnormal behaviour of the instrument!

Formatting creates a basic file system structure on the stick:

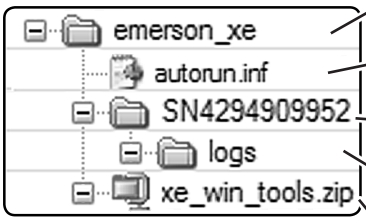


Fig. 6-5: *USB File System Structure*

‘emerson_xe’ directory within the root

File, to automatically run functions when connecting the stick to an analyzer, ☞ 7-92

‘Serial number directory’, beginning with ‘SN’, followed by the analyzer’s numeric serial number.

‘logs’ directory to hold the log files, copied to the stick by “*Export data to USB!*” actions within logger menus. Files within this directory are specific only for the analyzer with the serial number of the parent directory.

File with USB tools, ☞ 7-93

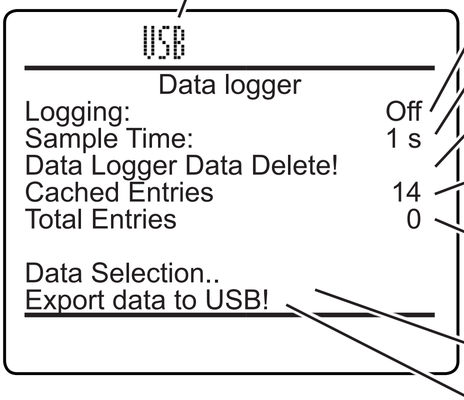
6.2.3 Setup Menu

6.2.3.13 Setup Data Logger

Setup..
Data Logger..

If the system is setup accordingly, the access code for level 3 must be entered to gain access to this menu.

Information on connected USB device.



Enable (**On**) or disable (**Off**) data logging.

Specify data logging interval time.
Accepted values: **0 ... 30,000** s

Delete current set of logged data.
Note!
There is no undo for this procedure!

Number of records currently in RAM, not yet saved to the internal data logger file.
Note!
Data is written to the internal file every 30 min, or the moment, "Logging" is turned ***Off***

Total number of records in the internal data logger file.

Setup data logger export options
(☞ 6-123).

Export logged data to an USB device.
Note!
See left hand notes.

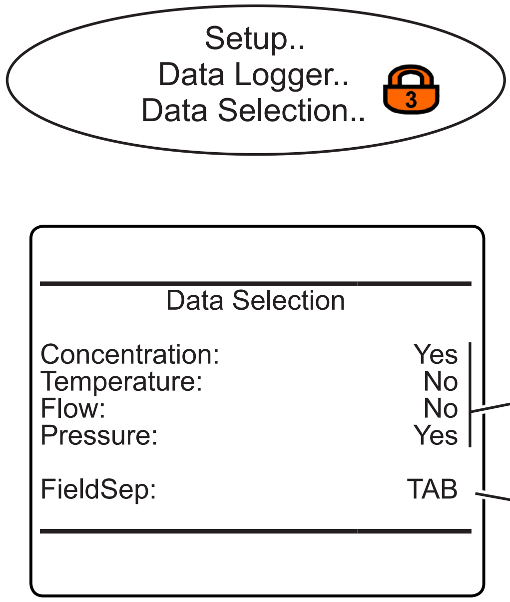
Notes!
Make sure, there's a memory device connected!

If not yet present, the structure as shown on ☞ 6-121 is created on the stick, without formatting.

The log files can be found within the 'logs' directory, ☞ 6-121.

☞ 7-88 for detailed information on the content of logfiles.

6.2.3.13.1 Setup Data Logger Data Selection



Menu lines 1 ... 4:
Specify which data to be exported.
Available options: **Yes, No**

Select the field separator, separating the different data columns in the exported text file.
Available options: **TAB, Semikol, Comma**

6.2.3.14 Setup Event Logger

Setup..
Event Logger..

Note!
This menu is available only, if a valid software upgrade code has been purchased and entered (☞ 6-106). See the separate software options manual for more information on this menu.

6.2.3.15 Setup PLC

Setup..
PLC..

Note!
This menu is available only, if a valid software upgrade code has been purchased and entered (☞ 6-106). See the separate software options manual for more information on this menu.

6.2.3.16 Setup Calculator

Setup..
Calculator..

Note!
This menu is available only, if a valid software upgrade code has been purchased and entered (☞ 6-106). See the separate software options manual for more information on this menu.

6.2.4 Status Menu

Status..

This menu allows to open any submenu to see detailed information about related status.

Note!
Lines 1 to 4 conform with NAMUR status. If no status of a specific type is active (no message to show), the related menu line is hidden.

Failures..
OffSpecs..
Maintenance Requests..
Function Checks..
Measurement..
Calibration/Validation..
Limit Alarms..
Operation Hours Meter..
Time 11/22/2015 10:57

Failure status information (☞ 6-126)

Off-specs status information (☞ 6-126)

Maintenance request status information (☞ 6-127)

Function checks status information (☞ 6-127)

Measurement status information (☞ 6-128)

Calibration and validation status information (☞ 6-133)

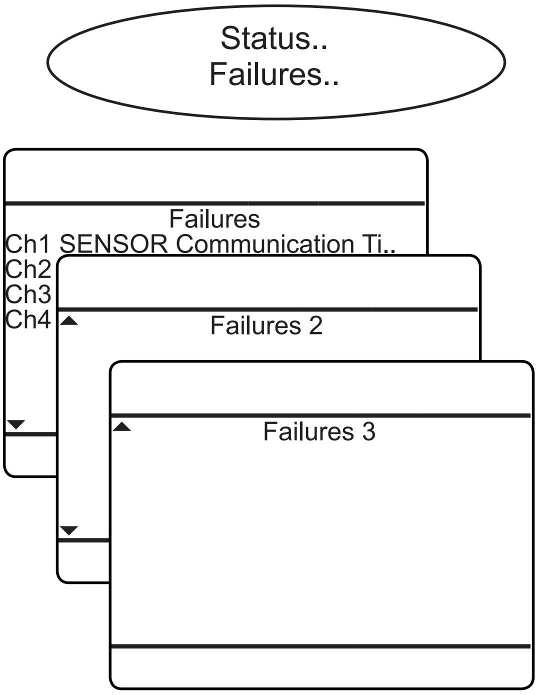
Limit Alarms status information (☞ 6-138)

Operation hours information (☞ 6-140)

Current date & time

6.2.4 Status Menu

6.2.4.1 Status Menu Failures



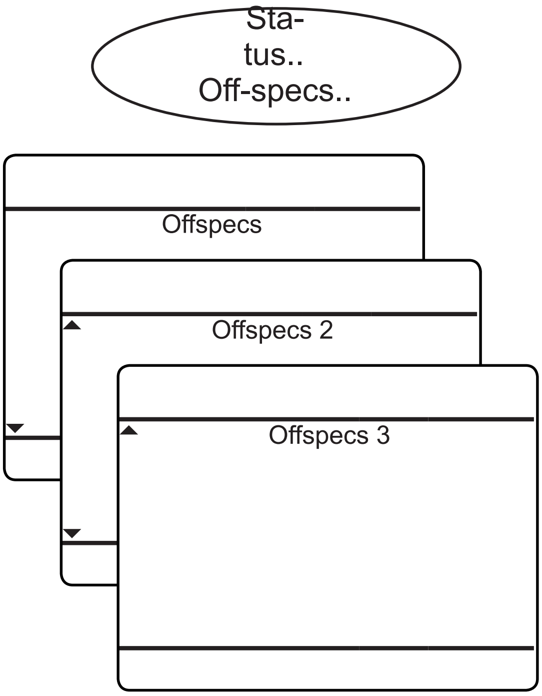
Up to 3 menu pages are prepared to show status messages of type ‘Failure’.

Note!
If no failure is active (no message to show), this menu is hidden.

Messages starting with strings like ‘Ch1’ are channel related, while all others are analyzer related.

For a detailled description of messages, hints on causes of failures and recommended actions, ☞ Chapter 8 ‘Troubleshooting’.

6.2.4.2 Status Menu Off-Specs



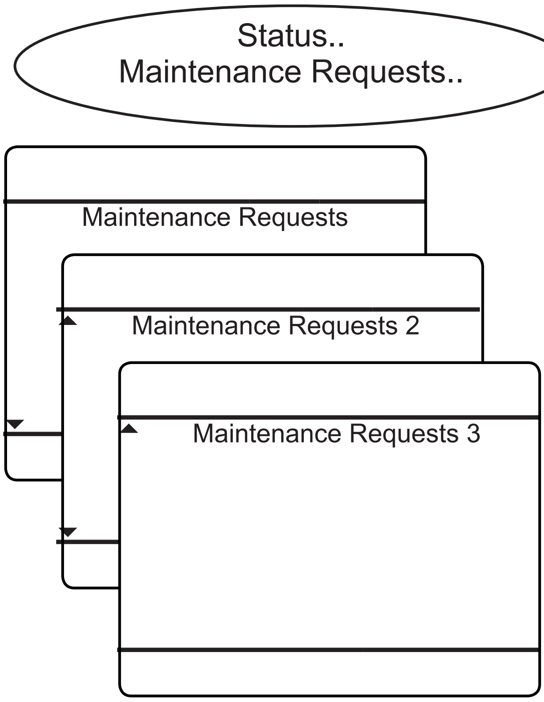
Up to 3 menu pages are prepared to show status messages of type ‘Off-specs’.

Note!
If no off-spec is active (no message to show), this menu is hidden.

Messages starting with strings like ‘Ch1’ are channel related, while all others are analyzer related.

For a detailled description of messages, hints on causes of off-specs and recommended actions, ☞ Chapter 8 ‘Troubleshooting’.

6.2.4.3 Status Menu Maintenance Requests



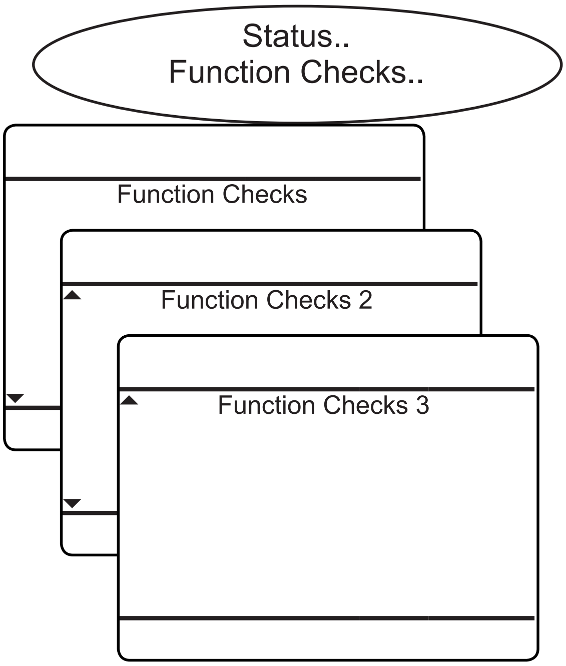
Up to 3 menu pages are prepared to show status messages of type ‘Maintenance requests’.

Note!
If no maintenance request is active (no message to show), this menu is hidden.

Messages starting with strings like ‘Ch1’ are channel related, while all others are analyzer related.

For a detailled description of messages, hints on causes of maintenance requests and recommended actions, ☞ Chapter 8 ‘Troubleshooting’.

6.2.4.4 Status Menu Function Checks



Up to 3 menu pages are prepared to show status messages of type ‘Function check’.

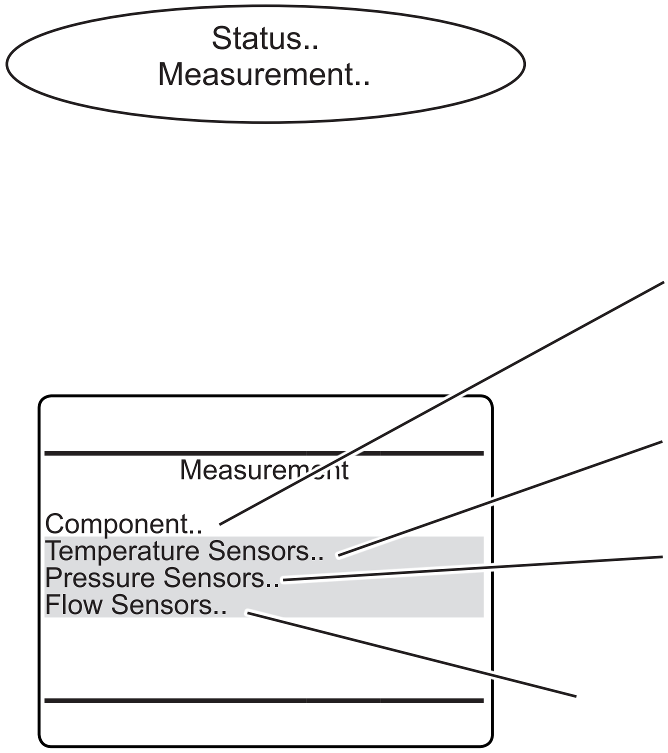
Note!
If no function check is active (no message to show), this menu is hidden.

Messages starting with strings like ‘Ch1’ are channel related, while all others are analyzer related.

For a detailled description of messages, hints on causes of function check and recommended actions, ☞ Chapter 8 ‘Troubleshooting’.

6.2.4 Status Menu

6.2.4.5 Status Menu Measurement



View status information on a specific component (☞ 6-129)

Optional: View status information on temperature sensors (☞ 6-131)

Optional: View status information on pressure sensors (☞ 6-132)

Optional: View status information on flow sensors (☞ 6-132)

6.2.4.5.1 Status Menu Component (Channels)

Status..
Measurement..
Component..

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be viewed.

Ch1

Component

Raw Signal1	109518.000
Raw Signal2	54321.000
Raw Signal	2.016
Concentration	1,984 %
Current Range	Range 1
Statistics..	
Secondary Variables..	

Statistics..: Opens a submenu with measurement statistics for the selected channel; ☞ 6-130

Secondary Variables..: Opens a submenu with information on secondary variables (pressure, flow, ...) of this channel; ☞ 6-131

Multi-channel unit:

Press LEFT *to enter SELECT COMPONENT, to view the status for another channel.*

6.2.4 Status Menu

6.2.4.5.1.1 Status Menu Component Statistics

Status..
Measurement..
Component..
Statistics..

Ch1	
Statistics	
MinConc	0.000 ppm
MinDate	7/7/2009 07:42:49
MaxConc	5000.000 ppm
MaxDate	8/7/2009 12:11:10
StdDev	100 ppm
Start Date	1.1.10 10:00
Reset Statistics..	

This menu page provides some statistical data for the selected component:

- Minimum and maximum measured concentrations, and the related date
- standard deviation of measured concentrations, and date when calculation started

To reset statistics ☞ below 

6.2.4.5.1.1.1 Status Menu Reset Statistics

Status..
Measurement..
Component..
Reset statistics..

If the system is setup accordingly, the access code for level 2 must be entered to gain access to this menu.

Ch1
Reset Statistics

Reset Peak!
Reset StdDeviation!

Select, which statistic to reset.

Note!
There's no undo for these functions!

6.2.4.5.1.2 Status Menu Secondary Variables

Status..
Measurement..
Component..
Secondary Variables..

Ch1	
Temperature	40.0 °C
Temp Status	Good
TempZComp	0.0 °C
TempSComp	0.0 °C
Pressure	1013 hPa
Pressure Status	Good
Flow	1.1 l/min
Flow Status	Good
Source Current	

This menu provides some secondary measurement data for the selected component:

- Temperature, pressure and flow values
- Status of the related sensors
- Reference temperature for temperature compensation, separately for zero and span

Possible status values:
Good, Simulated, Failure, Absent

If the analyzer features an IR measurement, this line shows the IR source current**.**

6.2.4.5.2 Status Menu Temperature Sensors

Status..
Measurement..
Temperature Sensors..

Ch1	
Temperature Sensors 1of2	
XSP-T1	40.0 °C
Status	Installed
XSP-T2	0.0 °C
Status	Absent
XSP-T3	0.0 °C
Status	
XSP-T4	
▼Status	

Ch1	
▲Temperature Sensors 2of2	
AIN1	20.0 °C
Status	Installed
AIN2	0.0 °C
Status	Absent

View data for all possibly installed temperature sensors, provided in two lines each:

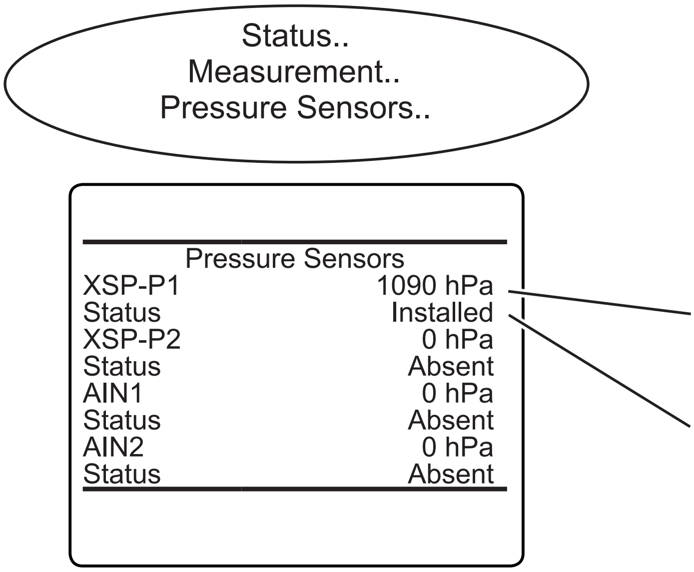
Each first line shows the temperature sensor and the currently measured value, followed by a related line showing the sensor status:

Sensor (possible values: **XSP-T1 ... -T4, AIN1, AIN2)** and current temperature.

Sensor status

Possible values: **Installed, Absent, Failure**.

6.2.4.5.3 Status Menu Pressure Sensors



This menu shows data for all possibly installed pressure sensors, provided in two lines each:

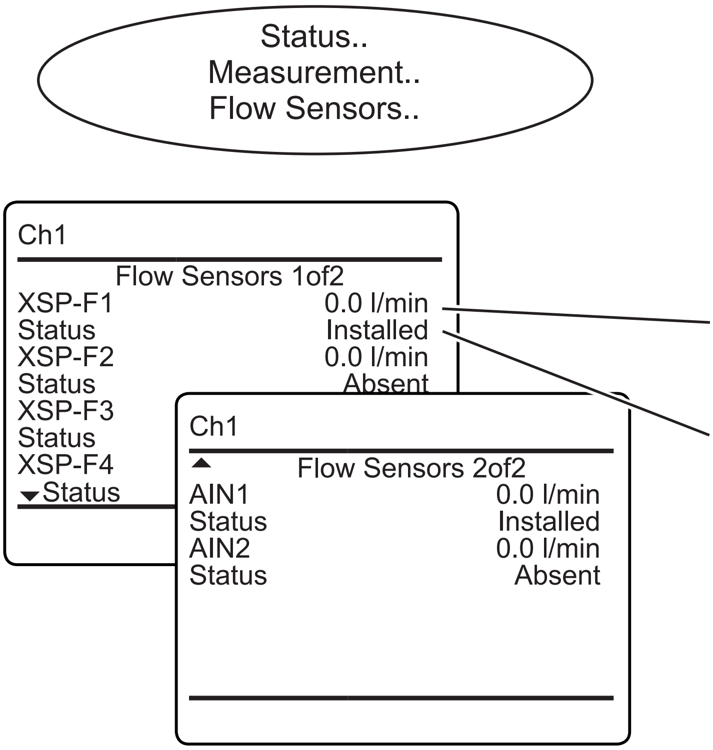
Each first line shows the pressure sensor and the currently measured value, followed by a related line showing the sensor status:

Sensor (possible values: **XSP-P1, XSP-P2, AIN1, AIN2)** and current pressure.

Sensor status

Possible values: **Installed, Absent, Failure**.

6.2.4.5.4 Status Menu Flow Sensors



This menu shows data for all possibly installed flow sensors, provided in two lines each:

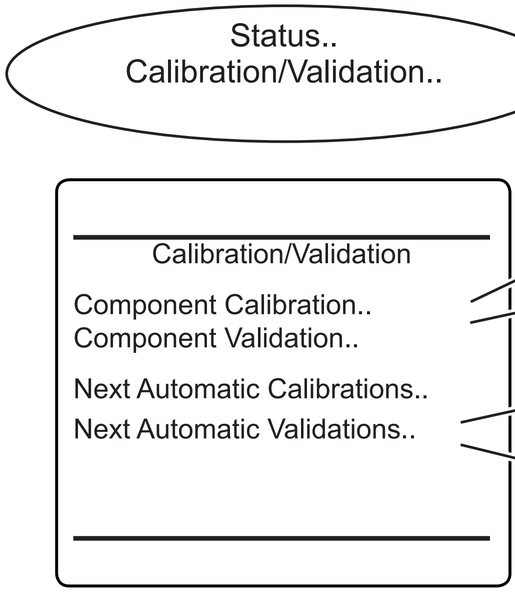
Each first line shows the flow sensor and the currently measured value, followed by a related line showing the sensor status:

Sensor (possible values: **XSP-F1 ... -F4, AIN1, AIN2)** and current flow.

Sensor status

Possible values: **Installed, Absent, Failure**.

6.2.4.6 Status Menu Calibration/Validation



This menu allows to view calibration and validation status information.

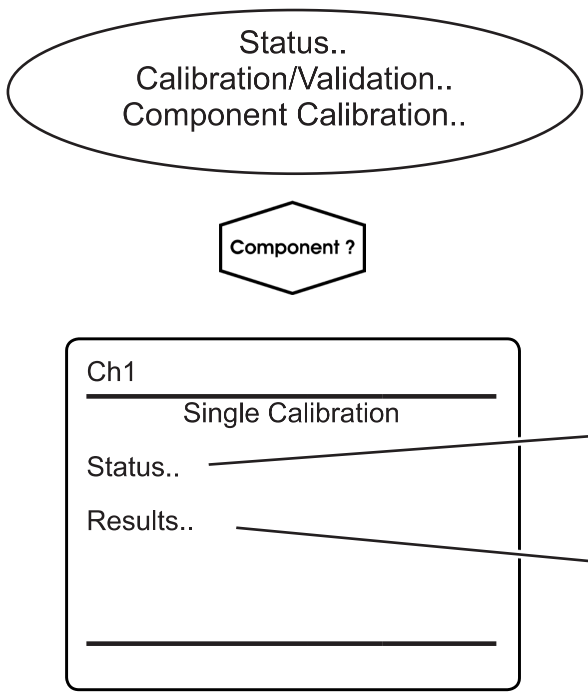
View calibration data for a specific component ☞ 6-133.

View validation data for a specific component ☞ 6-135.

Enter this menu to view scheduled dates for the next automatically performed calibrations; ☞ 6-137.

Enter this menu to view scheduled dates for the next automatically performed validations; ☞ 6-137.

6.2.4.6.1 Status Calibration/Validation Component Calibration



Multi-channel unit:
In SELECT COMPONENT, select the channel to be viewed.

View the calibration status for the current channel; ☞ 6-134.

View the calibration results for the current channel; ☞ 6-134.

Multi-channel unit:

Press LEFT *to enter SELECT COMPONENT, to view the status for another channel.*

6.2.4.6.1.1 Calibration Status Single Menu

Status..
Calibration/Validation..
Component Calibration..
Status..

Ch1	
Calibration Status Single	
CalibrStatus	Ready
Remaining Time	0 s
Concentration	0.000 ppm
Zero Gas	0.000 ppm
Span Gas	5000.000 ppm
Current Range	Range 1
Applied Gas	SampleGas

This menu provides calibration status information for the last calibration for the selected component.

6.2.4.6.1.2 Calibration Results Single Menu

Status..
Calibration/Validation..
Component Calibration..
Results...

Ch1	
Calibration Results Single	
Zero Result	Success
Zero Date	7/7/2009
Span Result	Success
Span Date	7/7/2009
CalibrRanges	None
Deviations..	

This menu provides calibration results for the selected channel.

Deviations..: Calibration result deviations for the current channel; ☞ 6-135.

6.2.4.6.2.2.1 Calibration Results Single Deviations

Status..
Calibration/Validation..
Component Calibration..
Results..
Deviations..

This menu provides calibration results for the selected channel.

Ch1

Deviations

ZeroDev	0.000 %
ZeroDev Total	0.000 %
SpanDev	0.000 %
SpanDev Total	0.000 %

6.2.4.6.2 Status Calibration/Validation Component Validation

Status..
Calibration/Validation..
Component Validation..

Component ?

Multi-channel unit:
In SELECT COMPONENT, select the channel to be viewed.

Ch1

Single Validation

Status..

Results..

View the validation status for the current channel; ☞ 6-136.

View the validation results for the current channel; ☞ 6-136.

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to view the status for another channel.

6.2.4 Status Menu

6.2.4.6.2.1 Validation Status Single Menu

Status..
Calibration/Validation..
Component Validation..
Status..

This menu provides validation status information for the last validation for the selected component.

Ch1

Validation Status Single

Validation Status	Ready
Remaining Time	0 s
Concentration	0.000 ppm
Zero Gas	0.000 ppm
Span Gas	5000.000 ppm
Current Range	Range 1
Applied Gas	SpanGas

6.2.4.6.2.2 Validation Results Single Menu

Status..
Calibration/Validation..
Component Validation..
Results...

This menu provides validation results for the selected channel.

Ch1

Validation Results Single

Zero Result	Success
Zero Date	7/7/2009
Span Result	Success
Span Date	7/7/2009
ZeroValidDev	0.000 %
SpanValidDev	0.000 %

6.2.4.6.3 Next Automatic Calibrations Menu

...
...
Next Automatic Calibrations..

Next Automatic Calibrations

Zero All	4/15/10 14:30
Zero & Span All	--
Progr. Sequence	--
Blowback All	--

Note!
This menu is accessible from STATUS - CALIBRATION/VALIDATION, and CONTROL - ADVANCED CALIBRATION.

This menu provides information about scheduled automatic calibrations.

6.2.4.6.4 Next Automatic Validations Menu

Status..
Calibration/Validation..
Next Automatic Validations..

Next Automatic Validations

Zero All	--
Zero & Span All	--

This menu provides information about scheduled automatic calibrations.

6.2.4.7 Status Menu Limit Alarms

Status..
Limit Alarms..

This menu allows to select from several alarm functions, to view detailed status information.

Limit Alarms

Concentration..
Conc Average..
Temperature..
Pressure..
Flow..
▼

The first menu page opens submenus for component (channel) related alarms, where you have so select the component of interest first, before gaining access to the detailed information.

▲ Limit Alarms 2

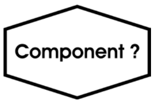
Calculator A..
Calculator B..
Calculator C..
Calculator D..
Analog Input1..
Analog Input2..

The second menu page is available only, if the calculator option has been installed, and then allows to view related alarm status information.

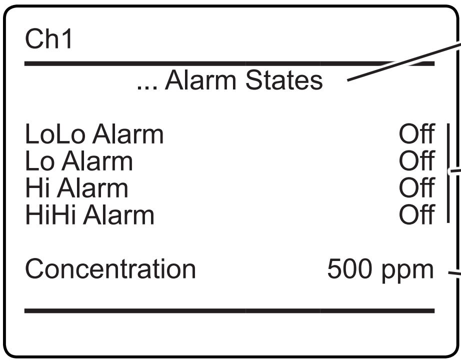
6.2.4.7.1 Alarms Status Details

All alarm status menus, accessible from STATUS - LIMIT ALARMS (☞ previous page), are designed in a similiar way to provide the information.

For submenus of the first STATUS - ALARMS menu page only:



Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.



'...' in the title is replaced by the text of the submenu line, selected in the previous menu, e.g. "*Concentration*"

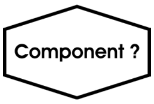
These four menu lines show, if alarms are activated (**On**), or not (**Off**).

The last line shows the current value for the selected function, e.g. the currently measured concentration.

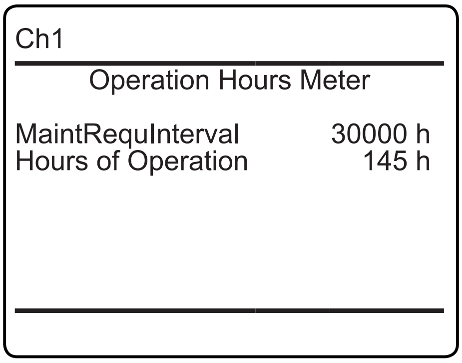
Multi-channel unit:

Press LEFT *to enter SELECT COMPONENT, to view the status for another channel.*

6.2.4.8 Operation Hours Status



Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.



Multi-channel unit:

Press LEFT to enter SELECT COMPONENT, to view the status for another channel.

6.2.5 Info Menu

Info..

This menu allows to view the most important information about your instrument at a glance.

Info	
Firmware	1.0
XSP Version	1.0
Serial no	123456789
Components..	
Installed Options..	
Ethernet1 IP	192.168.1.1
Ethernet2 IP	192.168.1.2
▼ Time	10/01/10 14:00

Enter this submenu to see how many measuring channels are installed; ☞ 6-142.

Enter this submenu to see information about installed options; ☞ 6-143.

▲ Data Logger	Off
Event Logger	Off
PLC Enabled	Yes
Calculator Enabled	No
Identification..	
LOI Firmware	V1.00 12.02.10
Phrase Version	EN 1.09
Time	10/01/10 10:00

Enter this submenu to see how the analyzer is identified, e.g. in a network; ☞ 6-144.

6.2.5 Info Menu

6.2.5.1 Info Menu Components

Info..
Components..

Components

Channel1	Enabled
Channel2	Enabled
Channel3	Enabled
Channel4	Disabled
Channel5	Disabled
Measurement..	

Only measuring channels indicating **Enabled** are installed in the current analyzer.

See below for the measurement info menu.

6.2.5.1.1 Info Menu Measurements

This menu shows the full scale limits.

Info..
Components..
Measurement..

Component ?

Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.

Measurement

RangeAbsMin	-10000 ppm
RangeAbsMax	10000000 ppm

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT to change the settings for a different channel.

6.2.5 Info Menu

6.2.5.2 Info Menu Installed Options

Info..
Installed Options..

Installed Options	
Package	None
Valves	None
Pump	None
DIO#1 Installed	Yes
DIO#2 Installed	No
Anal. Outputs	4
AIN Installed	No

This menu indicates, if your analyzer features any of the listed options.

(“*Package*” refers to the software upgrade options; ☞ 6-106).

6.2.5 Info Menu

6.2.5.3 Info Menu Identification

Info..
Identification..

Identification

System Tag	My Tag
Plant Name	My Plant
Customer	Me

Component Tags..

See how the instrument is identified.

6.2.5.3.1 Info Menu Component Tags

Info..
Identification..
Component Tags..

View channel and range tags for a selected component.

Component ?

Multi-channel unit:
In SELECT COMPONENT select the channel to be viewed.

Tags

Tag	Ch1
Range1 Tag	Ch1-R1
Range2 Tag	Ch1-R2
Range3 Tag	Ch1-R3
Range4 Tag	Ch1-R4

Multi-channel unit:

Press LEFT to enter SELECT COMPONENT to change the settings for a different channel.

6.2.6 Service Menu

Service..

Service

Europe..
Americas..
Middle East & Africa..
Asia Pacific..

Factory Setup..

This menu provides contact information about Emerson Process Management offices in several world regions (see below).

The factory setup menu is protected by access level 4 code, and intended to be used by special trained personnel (Emerson Process Management service) only!

Service information (exemplary; see analyzer or contact your sales office for latest data)

Europe

Emerson Process Management
GmbH & Co. OHG
Industriestr. 1
D-63594 Hasselroth
Germany
T +49(6055) 884-0
T +49(6055) 884-209

Chapter 7
Maintenance and Other Procedures

7.1 Introduction

This chapter gives instructions not only for maintenance procedures, but also covers several procedures useful for properly operating the instruments.

Maintenance carried out on a regular basis ensures long-term efficiency of your EMERSON Process Management gas analyzer!

☞ 7-2 for general information about maintenance procedures and intervals.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Live parts are accessible when working at open and powered instruments, which is subject to instructed and trained personnel only!

Take care to observe all applicable safety instructions!

Disregarding may cause death, personal injury or property damage!

7.2 General Maintenance Information

Intervals given in the following tables are based on standard operating conditions (ambient temperatures +10 ... +40 °C / +50 ... +104 °F; temperature changes < 10 K/hr).
Try cleaning contaminated components.
Replace components showing corrosion, or not passing inspections or tests!

Maintenance intervals must be shortened for differing operating conditions, and if aggressive gases are supplied.

Take care of special maintenance instructions in separate manuals for accessories or safety equipment, e.g. infallible containments, etc.

If applicable, consider the manual addendums for instruments for hazardous areas!

Visual Inspections		
Component		**Interval**
Tubing, flexible	Leakage, embrittlement, contamination	Once a year
Tubing, stainless steel (SS)	Corrosion, contamination	
Pressure sensor, pressure switch, Flowmeter	Corrosion, leakage	
Pump	Fixed screws, swing free to move	
Valve block	Corrosion, leakage	
Flame arrestors	Corrosion, damages, firmly seated	
Field housings (IP 66 / NEMA 4X)	Corrosion, damages on enclosure and gaskets	
Field housings stopping plugs	Firmly seated	
Field housings cable glands	Firmly seated	

7.2 General Maintenance Information

Tests		
Component		**Interval**
X-STREAM gas analyzer	Calibration or validation	weekly
Tubing, flexible	Leak Test	Once a year
Pressure sensor, pressure switch		
Valve block		
Pump diaphragm	Leak Test	After 4000 hrs of operation (approx. 1/2 year, if continuously operating)
Capillars	Pressure drop	Once a year
Flame arrestors	Pressure drop	See instructions in separate manual
Infallible containments	Several	See instructions in separate manual
RAW measuring values	Verify counts for zero gases *(decreasing counts may indicate contamination of optical components)*	Monthly, then quarterly *Acceptable values:* *photometer quotient: 1.0 ± 0.1* *NO, N_2O quotient: 1.0 ± 0.2* *pO_2, eO_2, TC: 0 ± 100,000 counts (for zero gas N_2)*

Replace Components Regularly	
Component	**Interval**
Electrochemical oxygen cell	Depending on output signal (see details later in this section)
Electrochemical TRACE oxygen cell	Once a year
Filter, internal	Once a year, at least and always when contaminated
Filter, external	Several times a year, depending on process conditions

7.3 Performing a Leak Test

To achieve best and proper measuring results and keep up the safety requirements for flammable or toxic gases you must ensure the gas path system does not have leaks.
The following procedure describes how to perform a leak test with focus on the instrument.
The gas path system should be leak tested at least on a bimonthly basis or according to safety standards and after maintenance, replacement or repair of gas path parts.
Note!
It is recommended to include external equipment (e.g. cooler, dust filters, etc.) into a leak test!

Required tools

- U-turn manometer for max. 1.45 psi (100 hPa) with a minuimum resolution of 1 hPa
- Stop valve

Procedure

- Connect the water filled u-turn manometer to the analyzer's sample gas output (disconnect external gas lines).
- Install the stop valve between gas input fitting and a nitrogen (N_2) supply.
- Open the stop valve until the internal gas path is under pressure of approx. 0.725 psi/50 hPa (corresponding to 19.7 inch/500 mm water column)
- Close the stop valve. After a short time for the water to balance, the water level must not change over a time period of approx. 5 minutes!

WARNING

HAZARD FROM GASES

Before opening gas paths they must be purged with ambient air or neutral gas (N2) to avoid hazards caused by toxic, flammable, explosive or harmful to health sample gas components!

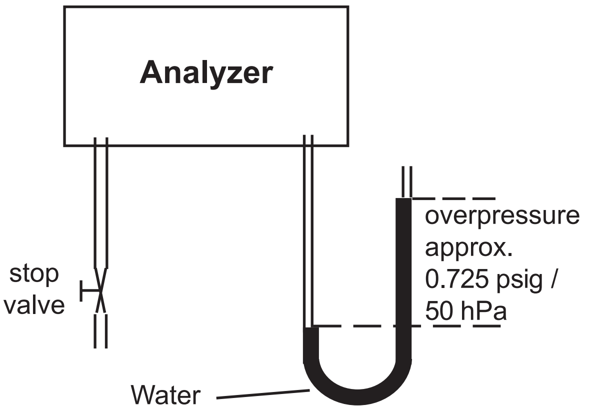


Fig. 7-1: *Leak Testing With U-Turn Manometer*

Max. pressure 7.25 psig (500 hPa)!

Multi channel instruments: Analyzers with parallel tubing require separate leak tests for each gas path !

7.4 Calibration and Validation Procedures

X-STREAM gas analyzers support several calibration and validation procedures:

Manual calibration/validation
Typically a calibration/validation procedure is carried out manually by supplying the gases sequentially by hand and activating the procedures via front panel keys.The operator has to take care to consider purge times and supply the proper gases in correct order.
It is the operators responsibility to not perform a span calibration without a preceding zero calibration!

Advanced calibration/validation
Advanced calibration/validation is a more comfortable variation of manual calibration/validation, providing ONE KEY calibrations/validations supported by internal and/or external valves. The analyzer automatically supplies the right gas and considers purge times.

Remote calibration/validation
Remote calibrations/validations may be activated by means of digital inputs or Modbus commands. Calibrations/validation activated via digital inputs require either internal or external valves to be installed. Modbus supports both calibrations/validation with or without valves as well as calibration/validation sequences.

Unattended automatic calibration/validation
Unattended automatic calibrations/validations are activated utilizing the analyzer software time interval setting:
After a specified time interval has elapsed, the analyzer automatically carries out valve supported zero or span calibrations/validations.
The main advantage is that no user interaction is required to start a calibration/validation or during calibrations/validations: The analyzer automatically supplies the right gas and considers purge times. The gas analyzer also considers that a span calibration has to be preceded by a zero calibration.

Configuring and performing calibrations or validations is important to ensure proper analyzer function. For this reason, several calibration and validation related SETUP and CONTROL menus and their submenus can be protected by different access codes.

In the following sections this manual does not note when to enter access codes.

For information about which calibration or validation related menus can be access code protected ☞ Chapter 6 - CONTROL menus, 6-6 and SETUP menus, 6-33.

7.4.1 Preparing Calibrations and Validations

CAUTION

OPERATION AT LOW TEMPERATURES

When operating an instrument at temperatures below 0 °C (32 °F), do NOT apply gas nor operate an internal pump before the warmup time has elapsed!

Violation may result in condensation inside the gas paths or damaged pump diaphragm!

Do NOT calibrate/validate the TRACE OXYGEN sensor (tO_2) without prior reading the instructions!

Together with each sensor an installation manual is shipped, also giving comprehensive calibration/validation information.

Read these information PRIOR intending to activate calibration/validation procedures!

Do NOT calibrate/validate the TRACE MOISTURE sensor (tH_2O)!

The sensor is completely calibrated/validated with all calibration/validation data stored in its flash memory and does not require recalibration/revalidation:

If the sensor is included into a calibration/validation procedure, it might end up with a wrong calibration/validation and unusable sensor. Therefore the analyzer's trace moisture measurement channel is configured to be excluded from autocalibration/autovalidation procedures, by default calibrating/validating all channels. **This exclusion is done by factory setup and cannot be changed.**

For proper measurement results we recommend to exchange the sensor regularly after 12 months of operation. For instructions on how to exchange, ☞ later in this chapter.

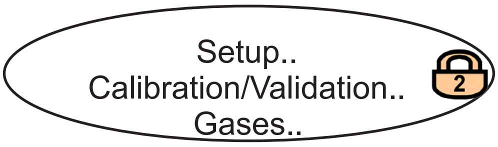
Before performing any actions, make sure the required calibration/validation gas is applied and flowing!

Supply all calibration/validation gases with the same flow and pressure as the sample gas (recommended: approx. 1 l/min and maximum pressure 1500 hPa), and utilizing the correct gas fitting.

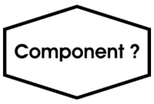
Ensure the warm-up time after switching on has elapsed! Warm-up time depends on installed measuring system and configuration, ☞ Measurement Specifications in Chapter 3!

7.4.1 Preparing Calibrations and Validations

Before starting calibrations or validations it is required to tell the instrument the calibration or validation gas concentrations.

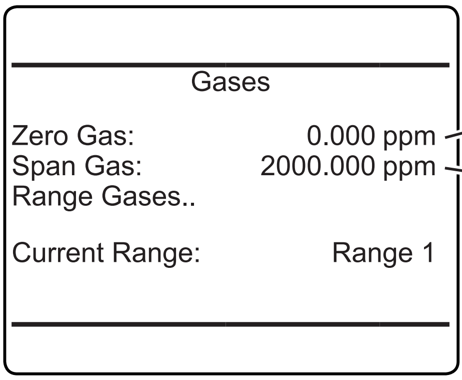


Starting from the MEASUREMENT SCREEN press DOWN to open the MAIN MENU, enter SETUP- CALIBRATION/VALIDATION and directly enter GASES.



Multi-channel unit:
Select the channel to be calibrated in SELECT COMPONENT.

Note!
Within the following sections it is not always pointed out, where to enter access codes or select components!



Enter the concentration value for the zero gas to be used during zero calibration and zero validation.

Enter the concentration value for the span gas to be used during span calibration or span validation.

Note!
The units for the calibration/validation gases are taken from the related entry in the display setup menu.

Multi-channel unit:
Press LEFT to enter SELECT COMPONENT to change the settings for a different channel.

When done, press LEFT to return to CALIBRATION/VALIDATION.

7.4.1 Preparing Calibrations and Validations

Tolerances 1of2	
ZeroValidTol:	10.0 %
SpanValidTol::	10.0 %
CalibDeviatTolerance	Off
ZeroCalTol:	20.0 %
SpanCalTol:	20.0 %
▼AfterCalCheck:	On

Example:
Measuring range: 0 ... 50 %
Zero gas: 0 %
Span gas: 50 %
Tolerance limits during calibration: 20.0 % (see figure above)
Situation:
Due to a fault zero gas is supplied to carry out a span calibration, instead of span gas.
CalibDeviatTolerance disabled (Off):
The analyzer calibrates the span with the wrong gas resulting in an analyzer out of tune.
CalibDeviatTolerance enabled (On):
Starting a span calibration with zero gas connected instead of span gas, the analyzer gives an error message and stops calibrating because the measured (expected span gas) value differs more than the value specified, from the upper measuring range limit.

Next enter TOLERANCES:

Enter the tolerance values for validation gases ('*ZeroValidTol*' and '*SpanValidTol*') and the tolerance values for calibration gases ('*ZeroCalTol*' and '*SpanCalTol*').

By default the option '*CalibDeviatTolerance*' (deviation tolerance check during calibration) is disabled (**Off**).

With the calibration deviation tolerance check enabled (**On**), during calibration the analyzer compares the currently measured concentration to the expected value, as setup in the GASES menu.
If the measured concentration differs from the expected values by more than the percentage of measuring range respectively span gas value, given in the menu lines 6&7, calibration is aborted and a maintenance request alarm is set (symbol, message and optional relay output).
Resetting the alarm requires to perform a valid calibration, or to confirm it within CONTROL - ACKNOWLEDGEMENTS.
So, tolerance check helps avoiding calibrating with a wrong gas (e.g. starting a span calibration while zero gas is flowing), resulting in an instrument out of tune (see example to the left side).

There are situations, when the calibration deviation tolerance check **must** be disabled, e.g. during first time calibration after changing the span gas concentration. In this cases select **Off**.

7.4.1 Preparing Calibrations and Validations

Note!
Unacknowledged maintenance requests are stored even if the instrument is switched off and on again!
In addition: If, for example, a calibration was aborted because of a tolerance check, the maintenance request is active. If the operator does not acknowledge the request and performs a new calibration, now with disabled tolerance check, the earlier maintenance request is stored and re-activated again, when the tolerance check is enabled somewhere in the future!

When done, press LEFT several times to return to SETUP:
If you use analog output signals, you may want to check or setup, how the analog signals proceed during calibrations or validations.

To do so, enter IN-/OUTPUTS - ANALOG OUTPUTS and enter the submenu of your analog output:

Analog outputs

Output1..
Output2..
Output3..
Output4..
Output5..

The menu to the left shows up, where the last line parameter specifies the behaviour during calibrations:

Signal:	0
Out range:	0-20 mA
LowScale:	0.00
MaxScale:	100.00
Auto scale:	Yes
Fail mode:	Live
0/4 mA:	0.00
20 mA:	100.00
▼Hold:	No

When "*Hold*" is set to **Yes**,
- the analog output is fixed to the last measured value;
- concentration alarms, which may otherwise be triggered by the concentrations of the calibration gases, are supressed.

When set to **No**,
- the analog output signal always corresponds to the actual measured value during calibration; this may trigger alarms when limits are exceeded.
  Note!
  This behaviour may be undesireable if e.g. the unit is connected to a data acquisition system.

Setup this parameter in a way to serve your needs.

7.4.1 Preparing Calibrations and Validations

If you do not intend to carry out valve supported calibrations, continue with ☞ 7-17.

If If you do not intend to carry out valve supported validations, continue with ☞ 7-32.

7.4.1.1 Valve Assignment for Valve Supported Calibrations and Validations

Note!
If your gas analyzer supports valves it is delivered with valves assigned in a standard way. The valve assignment offers the possibility to adapt the configuration to customer needs.

As described earlier, several calibration and validation procedures require installed internal and/or external valves.
In addition this requires all requested calibration and validation gases to be connected to the valves and the valves to be software assigned to the gases.

Why is assigning valves required?
For valve supported calibrations and validations the analyzer controls the gas flow and therefore needs to 'know' about the different valve functions - this is done by valve assignment.
In addition variable valve assignment allows to use one valve for different functions.

Example:

- *Dual channel analyzer for measuring CO and CO_2.*
- *Span gases are CO and CO_2 , zero gas for both channels is N_2.*

***Without** variable assignment one would need to zero span channel 1 separately from channel 2. Taking into account the purge times before a calibration or validation calculation starts, to ensure the measuring cells are filled with calibration/validation gas, the whole procedure would take a quite long time.*

***With** variable valve assignment the operator can specify e.g. the valve V1 to be the zero gas valve for channel 1 AND channel 2.
Now, when starting a zero calibration or validation procedure, the analyzer calculates the zero values for both channels at a time!*

7.4.1 Preparing Calibrations and Validations

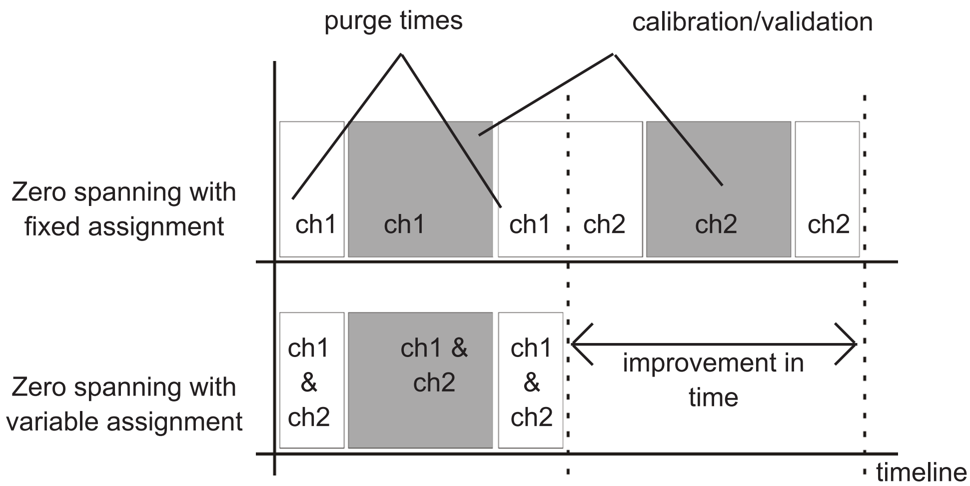


Fig. 7-2: *Calibration/Validation Improvement by Variable Valve Assignments*

Before starting to assign valves to gases and channels, you need to check if valves are supported:

```
       Installed Options 1of2
Licenses..

Valves:                    None
Pumps Installed:           None
DIO#1 Installed:             No
DIO#2 Installed:             No
Anal. Outputs:                4
▼AIN Installed:              No
```

Open SETUP - INSTALLED OPTIONS and check the *“Valves:”* line.
Available options:
None: Valves are not supported
Internal: Open INTSHS (☞ 7-12) to assign internal valves.
External: Open DIGITAL OUTPUTS (☞ 7-13) to assign external valves.
Int+Ext: Open both, INTSHS (☞ 7-12) and DIGITAL OUTPUTS (☞ 7-13) to assign internal and external valves.

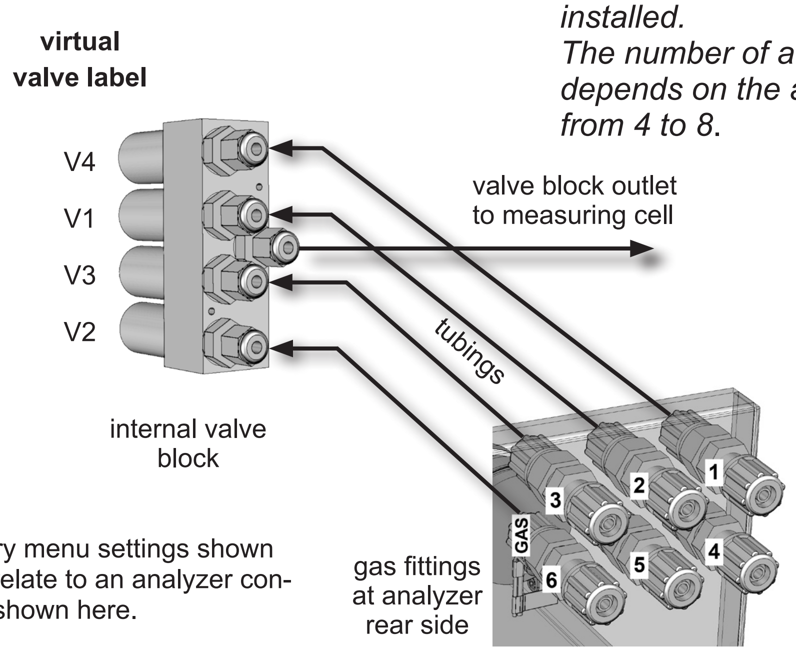
7.4.1.1.1 Internal Valve Assignment

If your analyzer provides internal valves, at first open SETUP - IN-/OUTPUTS - INTERNAL SHS to assign the valves to the gas inlets.

Internal SHS (1of2)	
Gas1 Signal:	V4
Gas2 Signal:	V1
Gas3 Signal:	V3
Gas4 Signal:	Off
Gas5 Signal:	Off
Gas6 Signal:	V2
Gas7 Signal:	Off
▼Gas8 Signal:	Off

This menu allows to configure the optional internal valves for routing gas.
Each available analyzer gas inlet ("Gas1 Signal... Gas8 Signal") with a valve connected is assigned a virtual valve label (V1...V8). (If the components have been installed in the factory, the configuration is already setup).

Notes!
If already factory setup, changing the configuration could result in inproper operation!
Depending on the analyzer model, 1 or 2 valve blocks with up to 4 or 8 valves can be installed.
The number of available gas connections depends on the analyzer model and varies from 4 to 8.



The exemplary menu settings shown above could relate to an analyzer configuration as shown here.

Fig. 7-3: *Internal Valves Assignments*

The next step is to assign the **internal valves** to the channels. If there are no **external** valves to be controlled by your analyzer, continue with ☞ 7-15.

7.4.1 Preparing Calibrations and Validations

7.4.1.1.2 External Valve to Digital Output Assignment

```
Setup..
In-/Outputs..
Digital Outputs..
```

If your analyzer has to control external valves, at first check if all valves required for calibration or validation are connected to digital outputs.
Then open SETUP - IN/OUTPUTS - DIGITAL OUTPUTS, to software assign the valves to the outputs.

```
      Digital Outputs (X1)
Output1 Node:          System
Output1 Signal:           Off
Output2 Node:          System
Output2 Signal:           Off
Output3 Node:          System
Output3 Signal:           Off
Output4 Node:          System
▼Output4 Signal:          Off
```

This menu allows to configure the digital outputs: All outputs (default and optional) support the same range of signals/functions. Outputs 1 to 4 are available in every unit, and by default setup to provide NAMUR signals (see figures to the left).

```
▲  Digital Outputs (X4.1) 1of3
Output5 Node:          System
Output5 Signal:           Off

▲  Digital Outputs (X4.1) 2of3
Output8 Node:          System
Output8 Signal:           Off

▲  Digital Outputs (X4.1) 3of3
Output11 Node:         System
Output11 Signal:          Off

Output12 Node:         System
Output12 Signal:          Off

Output13 Node:         System
▼Output13 Signal:         Off
```

Further pages are indicated by a down arrow (▼), only when at least one extension card (outputs 5 - 13) is installed:

Outputs 5 - 13 are present on the first extension card, labelled X4.1 (outputs 9 to 13 setup on separate menu pages are not shown in this example).

Note!
Depending on the analyzer model, 1 or 2 Digital I/O extension cards can be installed.

Verify which digital outputs are connected to control your external valves, and how the valves are labelled.
Next enter the menu page showing these outputs, and for each output select **System** in the line "*Output*n *Node*" (where "n" is replaced by the output number).
Finally for each output setup the valve's label.

```
▲ Digital Outputs (X4.1) 1of3
Output5 Node:            System
Output5 Signal:              V5

Output6 Node:            System
Output6 Signal:              V6

Output7 Node:            System
▼Output7 Signal:             V7
```

Example:
For our example we assume, that the analyzer controls 4 internal and 3 external valves:

- *Internal valves are connected as shown in fig. 7-3.*
- *3 external valves are labelled V5 ... V7, and connected to digital outputs 5 .. 7*

For this to be setup, enter the second page of the Digital Outputs menu, and for each output 5 ... 7

- *select **System** for the "...* Node*"*
- *select the label of the connected valve (**V5, V6** or **V7**) for the "...*Signal*", as shown in the lefthand figure.*

The next step is to assign the valves to the channels: Continue with ☞ 7-15.

7.4.1 Preparing Calibrations and Validations

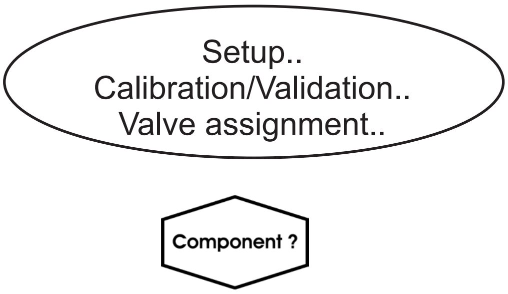
7.4.1.1.3 Calibration/Validation Valve Assignment

For each channel a valve has to be assigned zero gas valve or span gas valve, whereas the valves can be freely assigned to any channel. This includes:

- selecting the same combination for all channels
- selecting combinations where one valve has the same function for several channels
- selecting combinations where one valve has different functions for several channels, e.g. the channel 1 zero valve is the channel 2 span valve.

Depending on the gases used, this may allow higher calibration/validation performance.

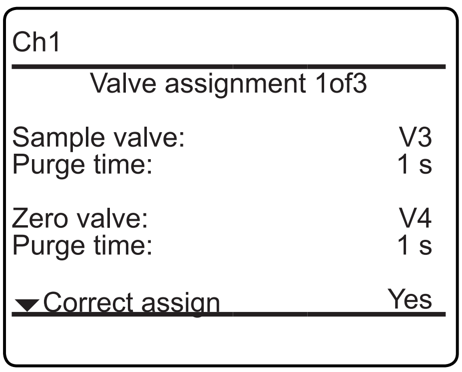
Note!
If one valve is used for multiple measuring ranges, take care that this requires to specify the same calibration/validation gas concentration for all these ranges! Means: One valve = one calibration/validation gas!



To do so, enter SETUP - CALIBRATION/VALIDATION - VALVE ASSIGNMENT:

Multi-channel unit:
Select the component to be set in SELECT COMPONENT.

Note!
The selected channel is indicated in the uppermost display line!



On the first menu page, configure the sample and zero valves to be used for the selected channel with their individual purge times (this is the time needed to completely fill the cell with the gas, after the valve is activated. If the calibration or validation is started earlier, the gas lines will still contain other components and the calibration or validation will be inaccurate).

"*Correct assign*" indicates, if the current assignment is correct (**Yes**), or not (**No**).

```
Ch1
▲        Valve assignment 2of3
Span1 valve:                V1
Purge time:                1 s
Span2 valve:              None
Purge time:                0 s
Span3 valve:              None
Purge time:                0 s
Span4 valve:              None
▼Purge time:               0 s
```

Now open the next menu to assign up to 4 span gas valves to the selected channel: one for each range.

Note!

Depending on the gas analyzer and SHS configuration, it may be possible to assign a specific valve to multiple ranges.

Again, don't forget to specify the individual purge times.

```
Ch1
▲        Valve assignment 3of3

Blowback valve:           None
Purge time:                0 s
```

On the 3rd menu page, assign a blowback valve for the selected channel, if such is installed.

Note!

*To check, if entries, made on menu pages 2 & 3 are correct, go back to menu 1 and check "*Correct assign*".*

Multi-channel unit:

On menu 1, press LEFT *to open SELECT COMPONENT to change the settings for a different channel.*

7.4.2 Validation Procedures

From the table below, in the first column select your preferred validation procedure, and notice the information in the columns aside.

Proper configuration and performing of validations is essential to keep the functionality of your analyzer. Therefore, to avoid misvalidations, several menus can be locked by access codes.

Descriptions in subsequent sections do not care about locking of menus.

Information about locking menus are provided in Chapter 6.

<table>
<tr><th>Type of Procedure</th><th>Menu Page (CONTROL - VALIDATION)</th><th>Valves</th><th>Simultaneously Validated Channels</th><th>More Information</th></tr>
<tr><td rowspan="2">Manual validation</td><td>Zero Validation...</td><td rowspan="2">optional</td><td rowspan="2">single channel</td><td rowspan="2">page 7-18</td></tr>
<tr><td>Span Validation...</td></tr>
<tr><td rowspan="3">Advanced validation</td><td>Advanced Validation- Zero Validation All!</td><td rowspan="3">required</td><td rowspan="3">all channels</td><td rowspan="3">page 7-21</td></tr>
<tr><td>Advanced Validation - Span Validation All!</td></tr>
<tr><td>Advanced Validation: - Zero&Span Validation All!</td></tr>
<tr><td>Remote validation</td><td>n.a. (via Modbus or Dig IN)</td><td>recommended</td><td>all channels</td><td>page 7-51</td></tr>
<tr><td rowspan="2">Unattended validation</td><td>Setup - Calibration/Validation - Interval Times - Zero Valid All</td><td>required</td><td>all channels</td><td>page 7-55</td></tr>
<tr><td>Setup - Calibration/Validation - Interval Times - Zero &SpanValid All</td><td>required</td><td>all channels</td><td>page 7-55</td></tr>
</table>

7.4.2 Validation Procedures

7.4.2.1 Manual Zero Validation

To perform a zero validation supply either nitrogen (N_2) or another suitable zero gas [conditioned ambient air or industrial air (NOT for oxygen measurement!)] to the gas path.

Control..
Validation..

Starting from the MEASUREMENT SCREEN press *DOWN* to open the MAIN MENU and enter CONTROL - VALIDATION.

Validation

Zero validation..
Span validation..
Advanced validation..

To start a zero validation select “Zero Validation..”

Component ?

Multi-channel unit:
Select the channel to be validated in SELECT COMPONENT.

Before selecting any further line make sure the required validation gas is applied and flowing!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Ensure the warm-up time after switching on has elapsed! Warm-up time is 15 to 50 minutes depending on installed measuring system and configuration!

7.4.2 Validation Procedures

```
Ch1
        Zero Validation
Cancel!
Start!
Zero gas                0.000 ppm
ZeroValidTol+-        200.000 ppm
Concentration           0.000 ppm
Flow                    0.00 l/min
Status..
Results..
```

The first line gives you the choice to cancel the procedure now.
Select the second line to **start the validation**.

The next lines show

- the validation gas setup (here: required zero gas concentration is 0.000 ppm),
- the allowed +- tolerance limits for an acceptable validation
- the currently measured gas concentration
- and the current gas flow, if a flow sensor is installed.

```
Ch1
      Validation status single

Validation Status           Ready
Remaining Time                0 s
Concentration           0.000 ppm
Zero gas                0.000 ppm
Span gas             2000.000 ppm
Current range             Range 1
Applied gas            Sample gas
```

"*Status..*" opens a new screen with enhanced validation information about the current channel (indicated in the uppermost display line).

Results.." opens a new screen with results of earlier validations (see left side).

```
Ch1
     Validation Results Single

Zero result               Success
Zero date              31/10/2012
Span reuslt               Success
Span date              21/10/2012

ZeroValidDev              0.0 ppm
SpanValidDev              0.0 ppm
```

"*ZeroValidDev*" and "*SpanValidDev*" show the values in concentration units, that means how far they deviate from the nominal values for zero resp. span gas determined by the last successful validation procedure.

When finished press LEFT several times to return to **either**
SELECT COMPONENT (multi channel analyzer only), to perform a zero validation for another channel,
or
to VALIDATION, where you may start a span validation. The procedure and screens look similiar to those of a zero validation.

7.4.2.2 Manual Span Validation

Supply span gases with concentrations of 80 % to 110 % of the upper measuring range limit to the gas path. Using lower concentrations may decrease accuracy when measuring above the span gas concentration!
If the oxygen concentration is known, ambient air may be used for an oxygen channel span validation.

```
Validation

Zero Validation..
Span Validation..
Advanced Validation..
```

To start a span validation select *"Span validation.."*

Component ?

Multi-channel unit:
Select the channel to be validated in SELECT COMPONENT.

Before selecting any further line make sure the required validation gas is applied and flowing!

```
Span Validation
Cancel!
Start!
Span Gas            2000.000 ppm
SpanValidTol+-       200.000 ppm
Concentration       2151.000 ppm
Flow                   0.00 l/min
Status..
Results..
```

Span validation offers the same options as zero validation, so for a detailled description ☞ 7-17.

When finished, press *LEFT* several times to return to SELECT COMPONENT (multi channel analyzer only), to perform a span validation for another channel,
or
press *HOME* to return to the MEASUREMENT SCREEN, to finish with manual validation procedures.

7.4.2.3 Advanced Validation

Standard manual validation procedures offer limited functionality:
To zero and span validate a multi channel instrument the operator has to manually start 2 procedures per channel in proper sequence. In addition he has to stay at the instrument to see when the one sequence has finished and to start the following.
The same is applicable for a single channel instrument, when the operator wants to perform both zero and span validations.

To improve even manual validation procedures, X-STREAM analyzers offer an ADVANCED VALIDATION menu: It allows single key activation for

- zero validation of all channels of an analyzer
- span validation of all channels of an analyzer
- zero **and** span validation of all channels of an analyzer

Although advanced validation offers most advantages for multi channel instruments, it may be used for single channel analyzers as well, that is to activate zero **and** span validation for the one channel by a single key press.

The only precondition for making use of this feature is to have internal and/or external valves installed and properly assigned (☛ 7-10).

For a description of how to perform

all channel zero validations ☛ page 7-22
all channel span validations ☛ page 7-25
all channel zero & span validations ☛ page 7-28

7.4.2.3.1 Zero All Validation

Before selecting any further line make sure the required validation gas is applied!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Make sure the purge time is set to a value ensuring the measuring cell is filled properly with the related validation gas after the valve has opened!

Ensure the warmup time after switching on has elapsed! Warmup time is 15 to 50 minutes depending on installed measuring system and configuration!

The procedure starts with the zero valve of the first channel then it checks if other channels use the same zero valve. If this is the case it parallel zero validates all these channels and then selects the next zero valve. ☞ Fig. 7-4 on 7-24 for a procedure flow diagram.

Control..
Validation..
Advanced Validation..

Advanced Validation
Cancel!
Zero&Span Validation Single..
Zero Validation All!
Span Validation All!
Zero&Span Validation All!
Status..
Results..
Next Automatic Validations..

Starting from the MEASUREMENT SCREEN press *ENTER* to open the MAIN MENU and enter CONTROL - VALIDATION - ADVANCED VALIDATION.

To start a zero validation for all channels select the 3^{rd} line.

Note!
Single channel analyzers show the same menu, with the restriction, that the term ‘all’ relates to the single channel only!

7.4.2 Validation Procedures

The analyzer immediately begins zero validation(s), showing the VALIDATION STATUS SUMMARY screen.

Validation Status Summary	
Validation Status Single..	
Current Action	None
Action Detail	Off
Current Duration	0 s
Prev. Duration	0 s

"*Current action*" indicates, what currently is carried out (**None, Purging, WaitForProc, Valve, Program Step, Cancelling, ZeroValid, SpanValid**)

"Action detail" shows the current procedure, or **Off**

"*Current duration*" gives the remaining time for the current procedure

"*Prev. duration*" shows the time elapsed since start of procedure

To see a detailled validation status for a single channel, enter VALIDATION STATUS SINGLE.

Component ?

Multi-channel unit:
Select the channel in SELECT COMPONENT.

Ch1

Validation Status Single	
Validation Status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	2000.000 ppm
Current range	Range 1
Applied gas	Sample Gas

This menu shows enhanced validation information about the current channel (indicated in the uppermost display line), including remaining validation time, currently measured concentration, setup of zero & span gas concentrations and currently validated range (only valid for span validations).

The procedure has finished when *"Applied gas"* shows **Sample gas**, or *"Current action"* in the previous screen says **None**.

Press *HOME* to return to the MEASUREMENT SCREEN.

7.4.2 Validation Procedures

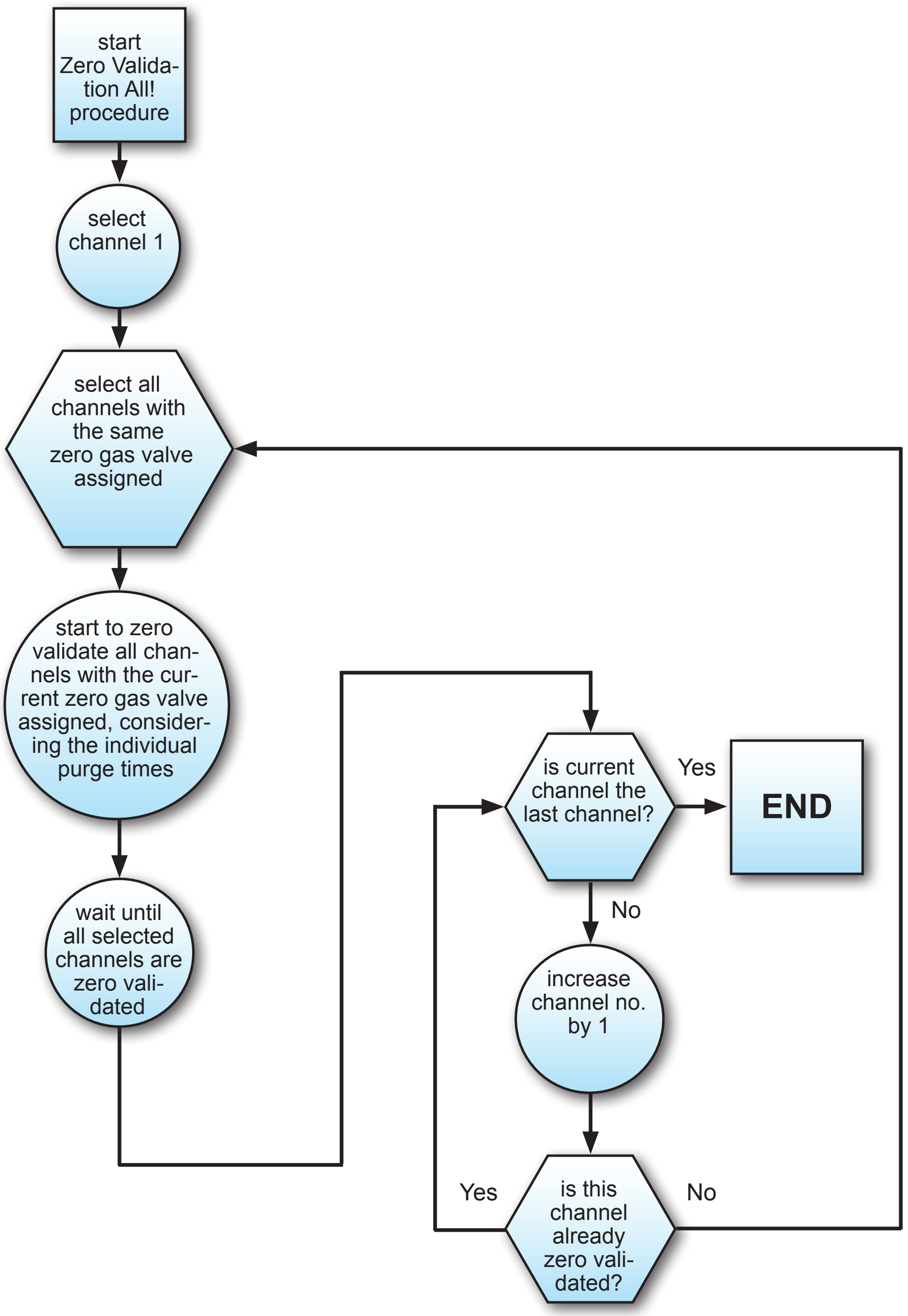


Fig. 7-4: *Zero Validation All Procedure Flow Diagram*

7.4.2.3.2 Span All Validation

Before selecting any further line make sure the required validation gas is applied!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Make sure the purge time is set to a value ensuring the measuring cell is filled properly with the related validation gas after the valve has opened!

Ensure the warmup time after switching on has elapsed! Warmup time is 15 to 50 minutes depending on installed measuring system and configuration!

Control..
Validation..
Advanced Validation..

Starting from the MEASUREMENT SCREEN press *ENTER* to open the MAIN MENU and enter CONTROL - VALIDATION - ADVANCED VALIDATION.

Advanced Validation
Cancel!
Zero&Span Validation Single..
Zero Validation All!
Span Validation All!
Zero&Span Validation All!
Status..
Results..
Next Automatic Validations..

To start a span validation for all channels select the 4th line.
☞ 7-50 for notes on span validating channels with multiple ranges!

Notes!
Single channel analyzers show the same menu, with the restriction, that the term 'all' relates to the single channel only!

The procedure starts with the span valve of the first channel then it checks if other channels use the same span valve. If this is the case it parallel span validates all these channels and then selects the next span valve. ☞ Fig. 7-5 on 7-27 for a procedure flow diagram.

7.4.2 Validation Procedures

The analyzer immediately begins span validation(s), showing the VALIDATION STATUS SUMMARY screen.

Validation Status Summary	
Validation Status Single..	
Current Action	None
Action Detail	Off
Current Duration	0 s
Prev. Duration	0 s

"*Current action*" indicates, what currently is carried out (**None, Purging, WaitForProc, Valve, Program Step, Cancelling, ZeroValid, SpanValid**)

"Action detail" shows the current procedure, or **Off**

"*Current duration"* gives the remaining time for the current procedure

"*Prev. duration"* shows the time elapsed since start of procedure

To see a detailled validation status for a single channel, enter VALIDATION STATUS SINGLE.

Component ?

Multi-channel unit:
Select the channel in SELECT COMPONENT.

Ch1

Validation status single	
Validation Status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	2000.000 ppm
Current range	Range 1
Applied gas	Sample Gas

This menu shows enhanced validation information about the current channel (indicated in the uppermost display line), including remaining validation time, currently measured concentration, setup of zero & span gas concentrations and currently validated range (only valid for span validations).

The procedure has finished when *"Applied gas"* shows **Sample gas**, or *"Current action"* in the previous screen says **None**.

Press HOME to return to the MEASUREMENT SCREEN.

7.4.2 Validation Procedures

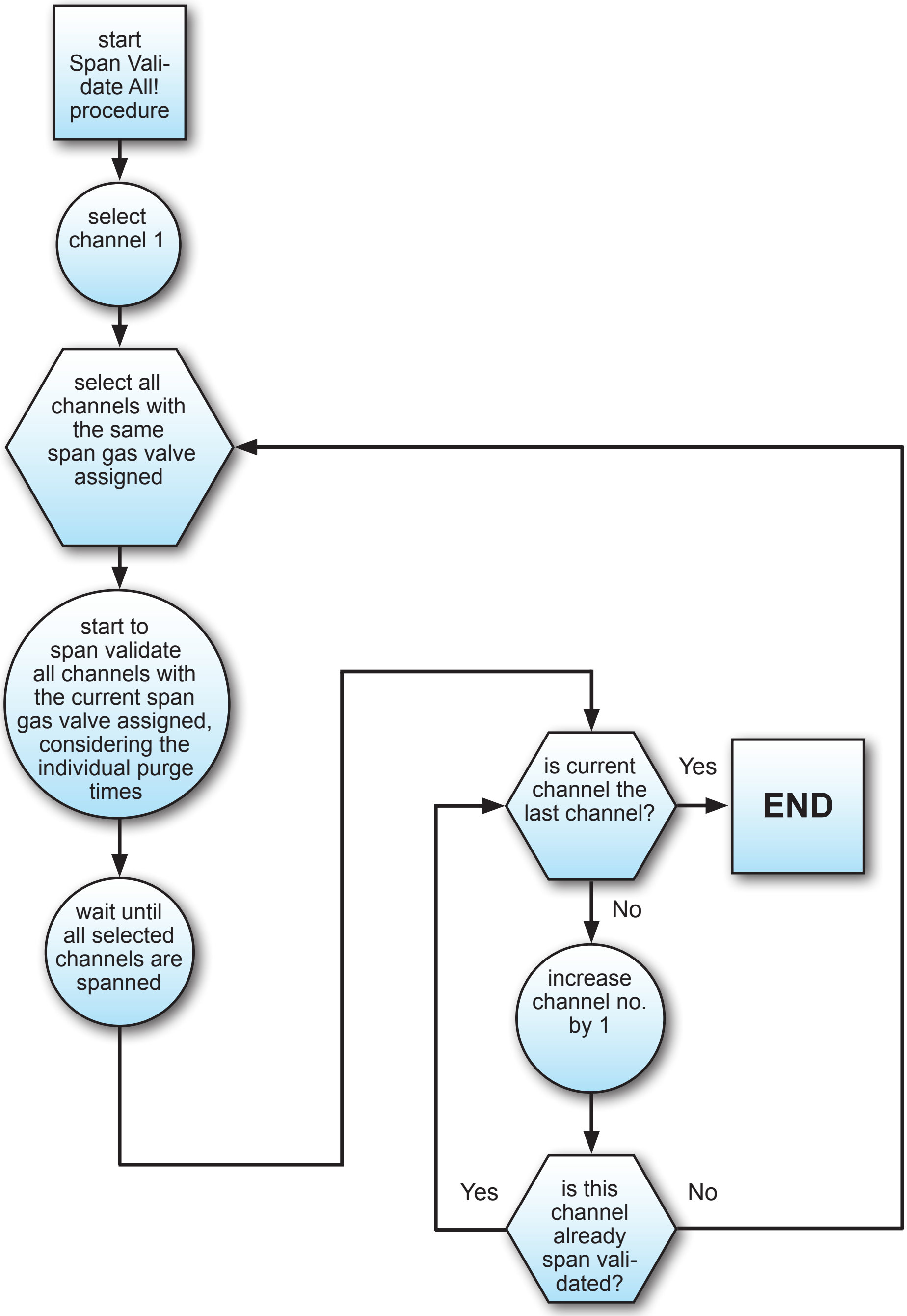


Fig. 7-5: Span Validation All Procedure Flow Diagram

7.4.2.3.3 Zero&Span All Validation

Before selecting any further line make sure the required validation gas is applied!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Make sure the validation purge time is set to a value ensuring the measuring cell is filled properly with the related validation gas after the valve has opened!

Ensure the warmup time after switching on has elapsed! Warmup time is 15 to 50 minutes depending on installed measuring system and configuration!

This procedure is a combination of the two described before, with an important deviation: If a selected zero gas valve is also assigned span gas valve for an other channel, this channel is spanned, while others are zeroed in parallel (☞ Fig. 7-6 on page 7-30 for a procedure flow diagram).

Control..
Validation..
Advanced Validation..

Starting from the MEASUREMENT SCREEN press ENTER to open the MAIN MENU and enter CONTROL - VALIDATION --ADVANCED VALIDATION.

Advanced Validation
Cancel!
Zero&Span Validation Single..
Zero Validation All!
Span Validation All!
Zero&Span Validation All!
Status..
Results..
Next Automatic Validations..

To start a zero & span validation for all channels select the 5th line.
☞ 7-50 for notes on span validating channels with multiple ranges!

Notes!
Single channel analyzers show the same menu, with the restriction, that the term 'all' relates to the single channel only!

7.4.2 Validation Procedures

The analyzer immediately starts to validate, showing the VALIDATION STATUS SUMMARY screen.

Validation Status Summary	
Validation Status Single..	
Current Action	None
Action Detail	Off
Current Duration	0 s
Prev. Duration	0 s

"*Current action*" indicates, what currently is carried out (**None, Purging, WaitForProc, Valve, Program Step, Cancelling, ZeroValid, SpanValid**)

"Action detail" shows the current procedure, or **Off**

"*Current duration*" gives the remaining time for the current procedure

"*Prev. duration*" shows the time elapsed since start of procedure

To see a detailled validation status for a single channel, enter VALIDATION STATUS SINGLE.

Component ?

Multi-channel unit:
Select the channel in SELECT COMPONENT.

Ch1	
Validation status single	
Validation Status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	2000.000 ppm
Current range	Range 1
Applied gas	Sample Gas

This menu shows enhanced validation information about the current channel (indicated in the uppermost display line), including remaining validation time, currently measured concentration, setup of zero & span gas concentrations and currently validated range (only valid for span validations).

The procedure has finished when *"Applied gas"* shows **Sample gas**, or *"Current action"* in the previous screen says **None**.

Press *HOME* to return to the MEASUREMENT SCREEN.

7.4.2 Validation Procedures

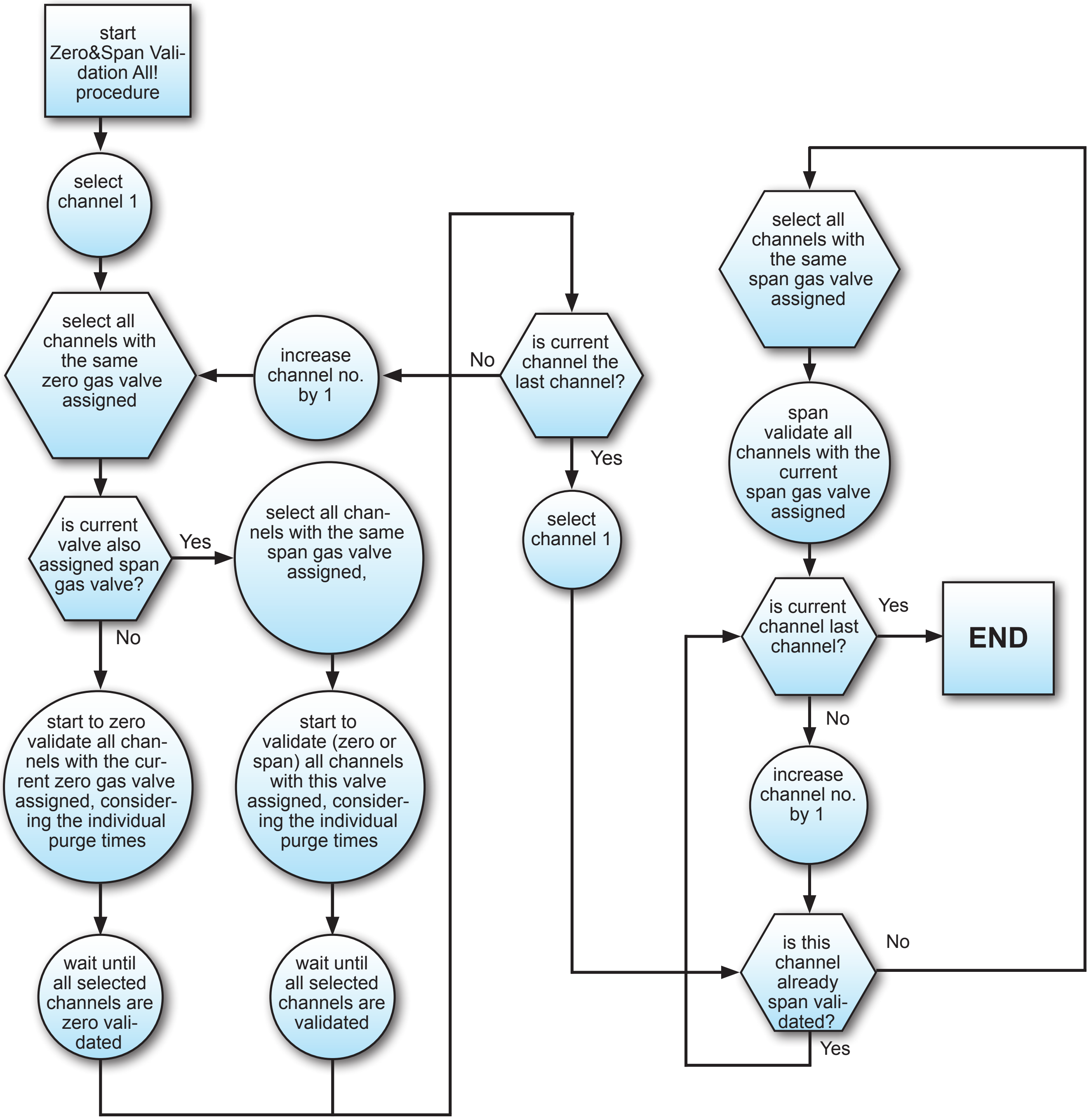
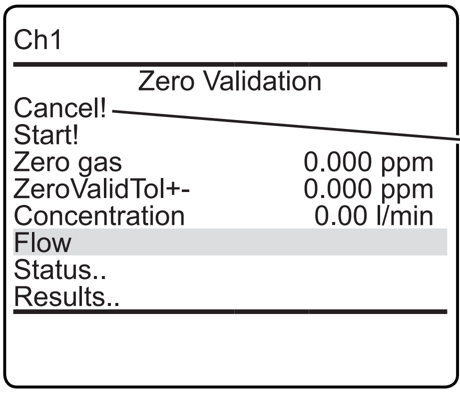


Fig. 7-6: Zero&Span Validation All Procedure Flow Diagram

7.4.3 Cancelling an Ongoing Validation



Any menu, from where a validation can be started, shows a line *“Cancel!”* (see example to the left).
Press ENTER in such a line to cancel any ongoing validation. While canceling, a ‘Function executing’ message appears.

7.4.4 Calibration Procedures

From the table below, in the first column select your preferred calibration procedure, and notice the information in the columns aside.

Proper configuration and performing of calibrations is essential to keep the functionality of your analyzer. Therefore, to avoid miscalibrations, several menus can be locked by access codes.

Descriptions in subsequent sections do not care about locking of menus.

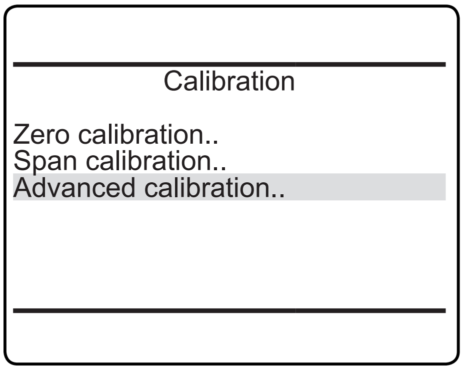
Information about locking menus are provided in Chapter 6.

Type of Procedure	Menu Page (CONTROL - CALIBRATION)	Valves	Simultaneously Calibrated Channels	More Information ☞
Manual calibration	Zero Calibration...	optional	single channel	page 7-33
	Span Calibration...			
Advanced calibration	Advanced Calibration - ZeroCal All!	required	all channels	page 7-36
	Advanced Calibration - SpanCal All!			
	Advanced Calibration - Zero&SpanCal All!			
Remote calibration	n.a. (via Modbus or Dig IN)	recommended	all channels	page 7-51
Unattended Calibration	Setup - Calibration/Validation - Interval Times - ZeroCal All	required	all channels	page 7-55
	Setup - Calibration/Validation - Interval Times - Zero &SpanCal All	required	all channels	page 7-55

7.4.4 Calibration Procedures

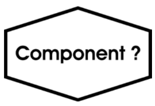
7.4.4.1 Manual Zero Calibration

Starting from the MEASUREMENT SCREEN press DOWN to open the MAIN MENU and enter CONTROL - CALIBRATION..



To start a zero calibration select “Zero Calibration”

To perform a zero calibration supply either nitrogen (N_2) or another suitable zero gas [conditioned ambient air or industrial air (NOT for oxygen measurement!)] to the gas path.



Multi-channel unit:
Select the channel to be calibrated in SELECT COMPONENT.

Before selecting any further line make sure the required calibration gas is applied and flowing!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Ensure the warm-up time after switching on has elapsed!
Warm-up time is 15 to 50 minutes depending on installed measuring system and configuration!

7.4.4 Calibration Procedures

Ch1	
Zero calibration	
Cancel!	
Start!	
Zero gas	0.000 ppm
Concentration	0.000 ppm
Flow	0.00 l/min
Status..	
Results..	
Restore!	

The first line gives you the choice to cancel the procedure now.
Select the second line to **start the calibration**.

The next lines show
- the calibration gas setup (here: required zero gas concentration is 0.000 ppm),
- the currently measured gas concentration
- and the current gas flow, if a flow sensor is installed.

Ch1	
Calibration status single	
Calibr.status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	5000.000 ppm
Current range	Range 1
Applied gas	Sample gas

"*Status..*" opens a new screen with enhanced calibration information about the current channel (indicated in the uppermost display line).

"*Results..*" opens a new screen with results of earlier calibrations (see left side).

Ch1	
Calibration results single	
Zero result	Success
Zero date	31/10/2012
Soan result	Success
Span date	31/10/2012-
Calibr. ranges	None
Deviations..	

Within this screen, *"Deviations.."* enables to open another screen, showing the last and and the summary of all deviations of earlier calibrations.

When finished press LEFT several times to return to **either**
SELECT COMPONENT (multi channel analyzer only), to perform a zero calibration for another channel,
or
to CONTROL, where you may start a span calibration. The procedure and screens look similiar to those of a zero calibration.

7.4.4.2 Manual Span Calibration

Note!
A zero calibration must always precede a span calibration!

Calibration

Zero calibration..
Span calibration..
Advanced calibration..

To start a span calibration select *"Span calibration.."*

Supply span gases with concentrations of 80 % to 110 % of the upper measuring range limit to the gas path. Using lower concentrations may decrease accuracy when measuring above the span gas concentration!
If the oxygen concentration is known, ambient air may be used for an oxygen channel span calibration.

Component ?

Multi-channel unit:
Select the channel to be calibrated in SELECT COMPONENT.

Before selecting any further line make sure the required calibration gas is applied and flowing!

Span calibration	
Cancel!	
Start!	
Span gas	0.000 ppm
Concentration	0.000 ppm
Flow	0.00 l/min
Status..	
Results..	
Restore!	

Span calibration offers the same options as zero calibration, so for a detailled description ☞ 7-32.

When finished, press LEFT several times to return to SELECT COMPONENT (multi channel analyzer only), to perform a span calibration for another channel,
or
press HOME to return to the MEASUREMENT SCREEN, to finish with manual calibration procedures.

7.4.4.3 Advanced Calibration

Standard manual calibration procedures offer limited funtionality:
To zero and span calibrate a multi channel instrument the operator has to manually start 2 procedures per channel in proper sequence. In addition he has to stay at the instrument to see when the one sequence has finished and to start the following.
The same is applicable for a single channel instrument, when the operator wants to perform both zero and span calibrations.

To improve even manual calibration procedures, X-STREAM analyzers offer a new ADVANCED CALIBRATION menu: It allows single key activation for
- zero calibration of all channels of an analyzer
- span calibration of all channels of an analyzer
- zero **and** span calibration of all channels of an analyzer

(Although advanced calibration offers most advantages for multi channel instruments, it may be used for single channel analyzers as well, that is to activate zero **and** span calibration for the one channel by a single key press.)

The only precondition for making use of this feature is to have internal and/or external valves installed and properly assigned (☞ 7-10).

For a description of how to perform

all channel zero calibrations	☞	page 7-37
all channel span calibrations	☞	page 7-40
all channel zero & span calibrations	☞	page 7-43
calibrations with programmed sequences	☞	page 7-48

7.4.4.3.1 Zero All Calibration

Before selecting any further line make sure the required calibration gas is applied!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Make sure the purge time is set to a value ensuring the measuring cell is filled properly with the related calibration gas after the valve has opened!

Ensure the warmup time after switching on has elapsed! Warmup time is 15 to 50 minutes depending on installed measuring system and configuration!

The procedure starts with the zero channel of the first channel, then it checks if other channel use the same zero valve. If this is the case it parallel zeroes all these channels and then selects the next zero valve. ☞ Fig. 7-7 on 7-39 for a procedure flow diagram.

Control..
Calibration..
Advanced Calibration..

Starting from the MEASUREMENT SCREEN press *ENTER* to open the MAIN MENU and enter CONTROL - CALIBRATION - ADVANCED CALIBRATION.

```
Advanced calibration 1of2
Cancel!
Zero&span single..
Zero all!
Span all!
Zero&span all!
Programmed sequence!
Blowback!
▼
```

To start a zero calibration for all channels select the 3rd line.

Note!
Single channel analyzers show the same menu, with the restriction, that the term 'all' relates to the single channel only!

7.4.4 Calibration Procedures

The analyzer immediately begins zero calibration(s), showing the CALIBRATION STATUS SUMMARY screen.

Calibration Status Summary	
Calibration Status Single..	
Current Action	None
Action Detail	Off
Current Duration	0 s
Prev. Duration	0 s
Current Step	0

"*Current action*" indicates, what currently is carried out (**Purging, Zeroing, None**)
"Action detail" shows the current procedure, or **Off**
"*Current duration"* gives the remaining time for the current procedure
"*Prev. duration"* shows the time elapsed since start of procedure
"*Current step"* gives information about the step currently carried out.

To see a detailled calibration status for a single channel, enter CALIBRATION STATUS SINGLE.

Component ?

Multi-channel unit:
Select the channel in SELECT COMPONENT.

Ch1	
Calibration status single	
Calibr.status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	5000.000 ppm
Current range	Range 1
Applied gas	Zero gas

This menu shows enhanced calibration information about the current channel (indicated in the uppermost display line), including remaining calibration time, currently measured concentration, setup of zero & span gas concentrations and currently calibrated range (only valid for span calibrations).

The procedure has finished when *"Applied gas"* shows **Sample gas**, or *"Current action"* in the previous screen says **None**.

Press *HOME* to return to the MEASUREMENT SCREEN.

7.4.4 Calibration Procedures

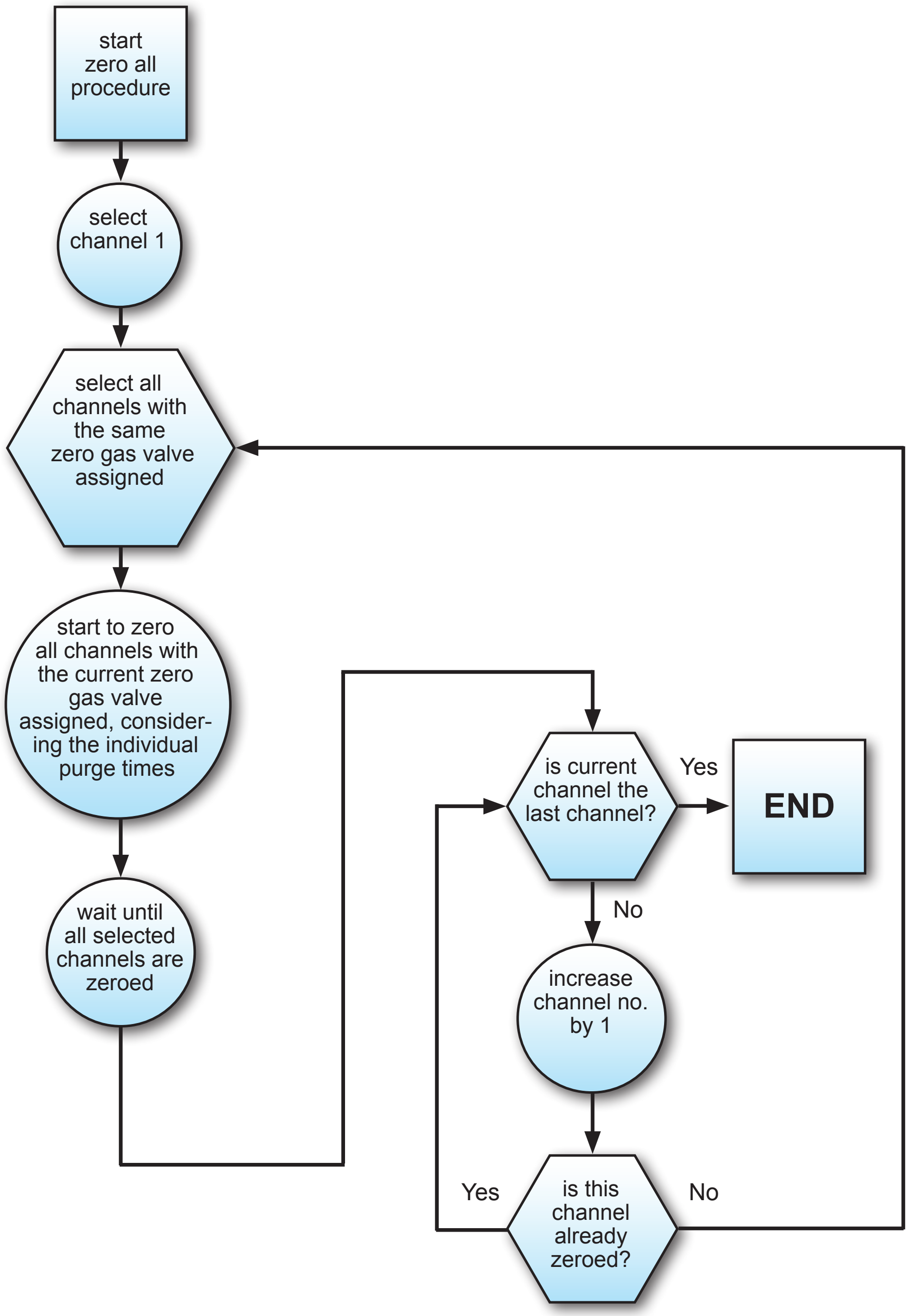


Fig. 7-7: *Zero All Calibration Procedure Flow Diagram*

7.4.4.3.2 Span All Calibrations

Before selecting any further line make sure the required calibration gas is applied!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Make sure the purge time is set to a value ensuring the measuring cell is filled properly with the related calibration gas after the valve has opened!

Ensure the warmup time after switching on has elapsed! Warmup time is 15 to 50 minutes depending on installed measuring system and configuration!

Notes!
Perform zero calibrations before initiating span calibrations
Single channel analyzers show the same menu, with the restriction, that the term 'all' relates to the single channel only!

Control..
Calibration..
Advanced Calibration..

Starting from the MEASUREMENT SCREEN press *ENTER* to open the MAIN MENU and enter CONTROL - CALIBRATION - ADVANCED CALIBRATION.

Advanced calibration 1of2
Cancel!
Zero&span single..
Zero all!
Span all!
Zero&span all!
Programmed sequence!
Blowback!
▼

To start a span calibration for all channels select the 4th line.
☞ 7-50 for notes on span calibrating channels with multiple ranges!

The procedure starts with the span valve of the first channel, then it checks if other channel use the same span valve. If this is the case then it parallel spans all these channels, and then selects the next span valve. ☞ Fig. 7-8 on 7-42 for a procedure flow diagram.

7.4.4 Calibration Procedures

The analyzer immediately begins span calibration(s), showing the CALIBRATION STATUS SUMMARY screen.

Calibration Status Summary	
Calibration status single..	
Current action	None
Action detail	Ch2
Current duration	0 s
Prev. duration	0 s
Current Step	0

Press *ENTER* in the first line to cancel the current calibration

"*Current action*" indicates, what currently is carried out (**Purging, Spanning, None**)

"Action detail" shows the current procedure, or **Off**

"*Current duration*" gives the remaining time for the current procedure

"*Prev. duration*" shows the time elapsed since start of procedure

"*Current step*" gives information about the step currently carried out.

To see a detailled calibration status for a single channel, enter CALIBRATION STATUS SINGLE.

Component ?

Multi-channel unit:
Select the channel in SELECT COMPONENT.

Ch1	
Calibration status single	
Calibr.status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	5000.000 ppm
Current range	Range 1
Applied gas	Zero gas

This menu shows enhanced calibration information about the current channel (indicated in the uppermost display line), including remaining calibration time, currently measured concentration, setup of zero & span gas concentrations and currently calibrated range.

The procedure has finished when '*Applied gas*' shows **Sample gas**, or "*Current action*" in the previous screen says **None**.

Press *HOME* to return to the MEASUREMENT SCREEN.

7.4.4 Calibration Procedures

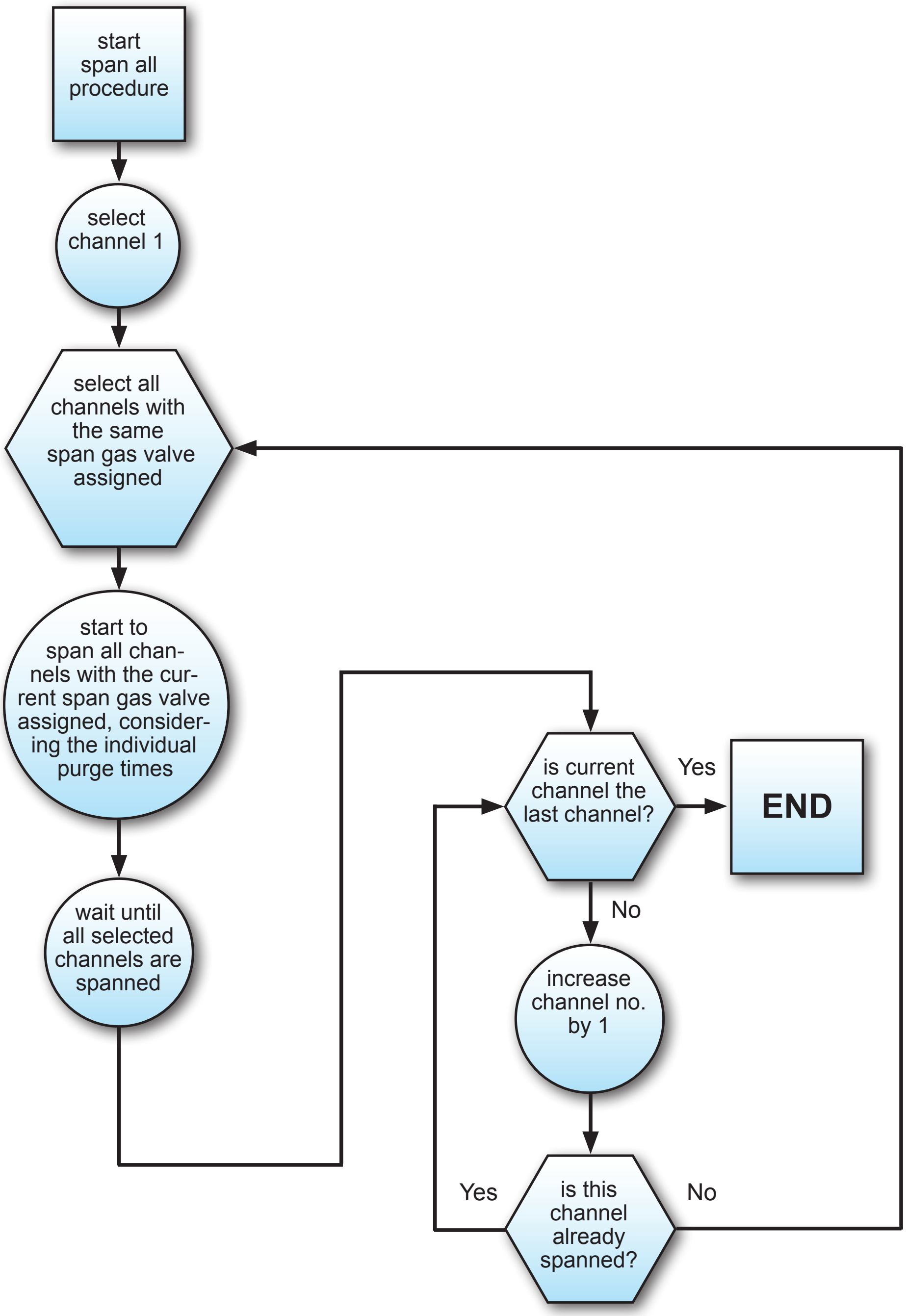


Fig. 7-8: *Span All Calibration Procedure Flow Diagram*

7.4.4.3.3 Zero&Span All Calibration

Before selecting any further line make sure the required calibration gas is applied!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (Sect. 7.4.1.1). Make sure the calibration purge time is set to a value ensuring the measuring cell is filled properly with the related calibration gas after the valve has opened!

Ensure the warmup time after switching on has elapsed! Warmup time is 15 to 50 minutes depending on installed measuring system and configuration!

This procedure is a combination of the two described before, with an important deviation: If a selected zero gas valve is also assigned span gas valve for an already zeroed channel, this channel is spanned, while others are zeroed in parallel (Fig. 7-9 on 7-45 for a procedure flow diagram).

Control..
Calibration..
Advanced Calibration..

Starting from the MEASUREMENT SCREEN press *ENTER* to open the MAIN MENU and enter CONTROL - CALIBRATION --ADVANCED CALIBRATION.

Advanced Calibration 1of2
Cancel!
Zero&span single..
Zero all!
Span all!
Zero&span all!
Programmed sequence!
Blowback!
▼

To start a zero & span calibration for all channels select the 5th line.
7-50 for notes on span calibrating channels with multiple ranges!

Notes!
Single channel analyzers show the same menu, with the restriction, that the term 'all' relates to the single channel only!

7.4.4 Calibration Procedures

The analyzer immediately begins to calibrate, showing the CALIBRATION STATUS SUMMARY screen.

Calibration Status Summary	
Calibration status single..	
Current action	None
Action detail	Ch2
Current duration	0 s
Prev. duration	0 s
Current Step	0

"*Current action"* indicates, what currently is carried out (**Purging, Zeroing, Spanning, None**)
"*Action detail"* shows the channel currently calibrated
"*Current duration*" gives the remaining time for the current procedure
"*Prev. duration*" shows the time elapsed since start of procedure
Current step" gives information about the step currently carried out.

To see a detailled calibration status for a single channel, enter CALIBRATION STATUS SINGLE.

Component ?

Multi-channel unit:
Select the channel in SELECT COMPONENT.

Ch1	
Calibration Status Single	
Calibr.status	Ready
Remaining time	0 s
Concentration	0.000 ppm
Zero gas	0.000 ppm
Span gas	5000.000 ppm
Current range	Range 1
Applied gas	Zero gas

This menu shows enhanced calibration information about the current channel (indicated in the uppermost display line), including remaining calibration time, currently measured concentration, setup of zero & span gas concentrations and currently calibrated range.

The procedure has finished when "*Applied gas"* shows **Sample gas**, or "*Current action*" in the previous screen says **None**.

Press *HOME* to return to the MEASUREMENT SCREEN.

7.4.4 Calibration Procedures

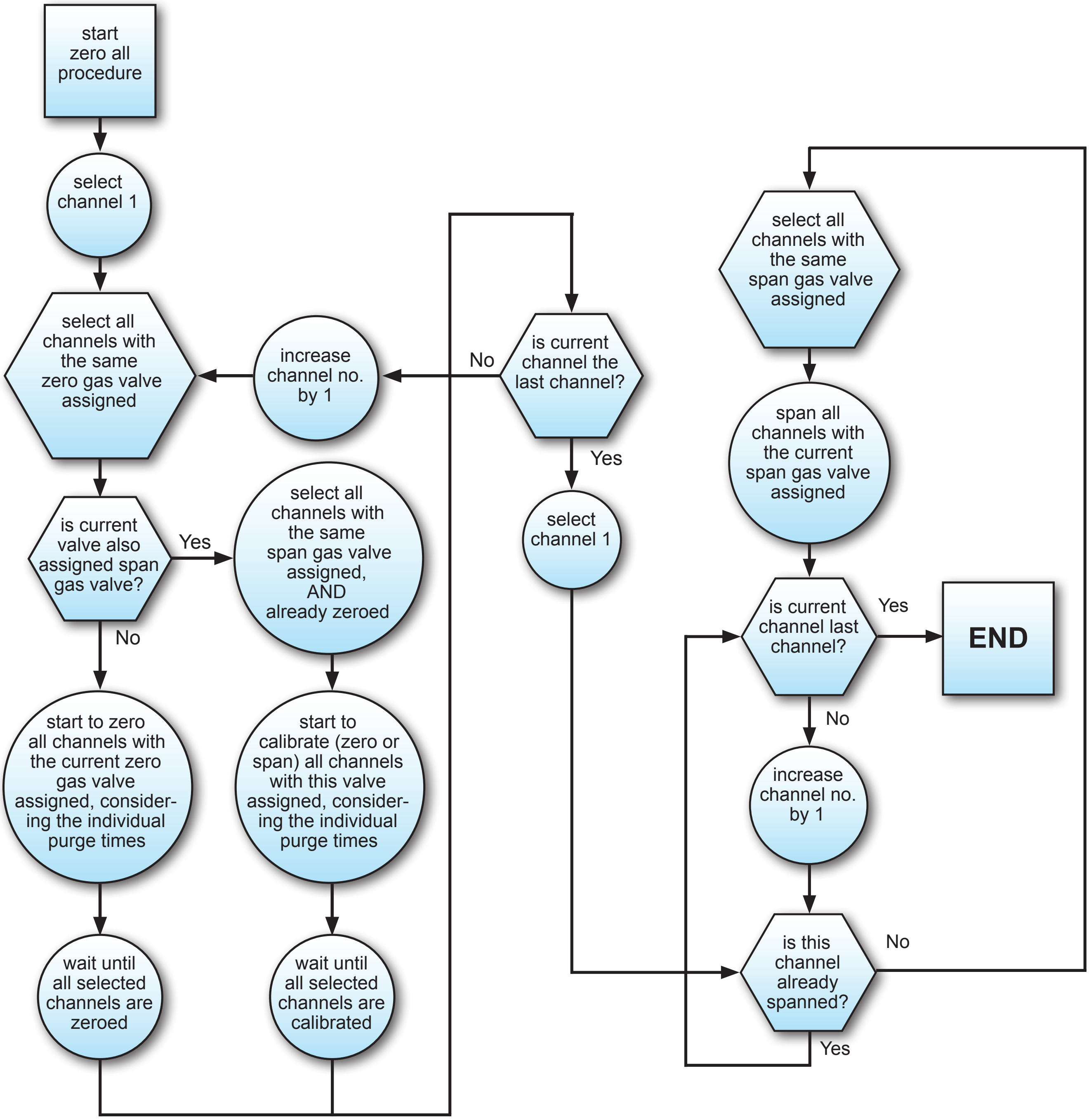


Fig. 7-9: Zero&Span All Calibration Procedure Flow Diagram

7.4.4.4 Blowback

Advanced calibration 1of2
Cancel!
Zero&span single..
Zero all!
Span all!
Zero&span all!
Programmed sequence!
Blowback!

From ADVANCED CALIBRATION you may also start a blowback procedure:
Press *ENTER* in this line to start the blowback procedure.
While the procedure is active, a “Function executing” message appears.

7.4.5 Restoring a Calibration

Ch1	
Zero calibration	
Cancel!	
Start!	
Zero gas	0.000 ppm
Concentration	0.000 ppm
Flow	0.00 l/min
Status..	
Results..	
Restore!	

In case a wrong configuration was detected after a calibration was carried out (e.g. wrong gas connected), there is an option to restore the last calibration data:
Any menu, from where a channel specific calibration can be started, shows a line “*Restore!*” (see example to the left).
Press *ENTER* in such a line to restore the last calibration data for the selected channel and type of calibration (zero/span). While restore is processing, a ‘Function executing’ message appears.

7.4.6 Cancelling an Ongoing Calibration

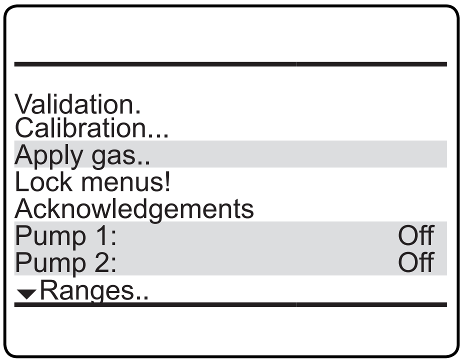
Ch1	
Zero calibration	
Cancel!	
Start!	
Zero gas	0.000 ppm
Concentration	0.000 ppm
Flow	0.00 l/min
Status..	
Results..	
Restore!	

Any menu, from where a calibration can be started, shows a line *“Cancel!”* (see example to the left).
Press *ENTER* in such a line to cancel any ongoing calibration. While canceling, a ‘Function executing’ message appears.

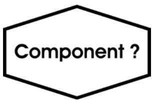
7.4.7 Verifying a Calibration

For instruments **without** internal and/or external valves simply apply either span or zero calibration gas to the sample gas inlet. If the calibration still is proper, the reading on the MEASUREMENT SCREEN should show the related value.

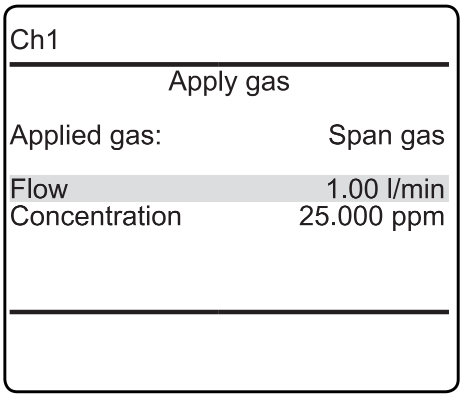
For instruments **with** internal and/or external valves follow the procedure below:



Starting from the MEASUREMENT SCREEN press DOWN to open the MAIN MENU and enter CONTROL.
Enter APPLY GAS



Multi-channel unit:
Select the component to be verified in SELECT COMPONENT.



Changing the "*Applied gas*" parameter opens the related valve.
Available options:
SpanGas-1 ... -4, ZeroGas, SampleGas, Blowback, All closed.

"*Flow"* shows the current gas flow, while "*Concentration"* should show the expected value, if the calibration is valid and correct.

7.5 Calibrating or Validating With Sequence Programming

Program sequences enable to carry out complex calibration/validation procedures with up to 30 steps. A requirement to setup a sequence is, that “Valves” in INSTALLED OPTIONS i*s set to a value other than* ***none*** *(☞ 6-105). Once this condition is fulfilled, a sequence can be setup in* SETUP - CALIBRATION/VALIDATION - PROGRAM SQEUENCE.

Setup..
Calibration/Validation..
Program Sequence..

```
       Program Sequence 1of8
Action1:                 Zero-Cal
Node1:                        All
Action2:              Rg1SpanCal
Node2:                        Ch1
Action3:              Rg2SpanCal
Node3:                        Ch3
Action4:              END-OF-PGRM
▼Node4:                       All
```

Page 1

...

```
▲      Program Sequence 4of8
Action13:             END-OF-PGRM
Node13:                       All
Action14:
Node14:
Action15:
Node15:
Action16:
▼Node16:
```

Page 4

```
▲      Program Sequence 8of8
Action29:             END-OF-PGRM
Node29:                       All
Action30:             END-OF-PGRM
Node30:                       All
```

Page 8

This menu with 8 pages allows to setup a sequences of up to 30 actions (steps), to carry out individual calibration/validation procedures. Each step consists of an action and a related node (channel).

Available actions are:

Action name	*What to happen*
Rg1SpanCal ... Rg4SpanCal	span calibrate range1 ... range4
ZSpanCal	zero & span calibrate
SpanCal	span calibrate
ZeroCal	zero calibrate
ZSpanValid	zero & span validate
SpanValid	span validate
ZeroValid	zero validate
NoOp	no action
Blowback	start blowback
END-OF-PGRM	end of programmed sequence

Available nodes are (depending on number of channels installed within your analyzer):

Node name	*Selected action is carried out for*
All	all installed channels
Ch1 ... Ch5 (depending on the analyzer setup, an assigned component tag may show here instead; ☞ 6-116	the selected channel only

7.5 Calibrating or Validating with Sequence Programming

A sequence is executed step (action) by step until

- it reaches an action **END-OF-PRGM,**

or

- "*Action30*" has been executed, after which the sequence quits automatically.

Example

The channels of an analyzer are to be calibrated in the following order:

***All**:*

(Action1) Zero calibration

***Channel 1**:*

(Action2) Span gas calibration

***Channel2**:*

(Action3) Blowback
(Action4) Span gas calibration

***Channel3**:*

(Action5) Span gas calibration range1
(Action6) Span gas calibration range3

... (Action7) End of program sequence

```
     Program Sequence 1of8
Action1:              Zero-Cal
Node1:                     All
Action2:               SpanCal
Node2:                     Ch1
Action3:             Blowback
Node3:                     Ch2
Action4:               SpanCal
▼Node4:                    Ch2
```

```
▲    Program Sequence 2of8
Action5:            Rg1SpanCal
Node5:                     Ch3
Action6:            Rg3SpanCal
Node6:                     Ch3
Action7:           END-OF-PGRM
Node7:                     All
Action8:           END-OF-PGRM
▼Node8:                    All
```

7.6 Notes on Span Calibrating or Validating Channels With Multiple Ranges

Setup..
Calibration/Validation..
Valve assignment..

```
Ch1
▲
        Valve assignment 2of3
Span1 valve:                  V1
Purge time:                  1 s
Span2 valve:                  V1
Purge time:                  5 s
Span3 valve:                  V4
Purge time:                  5 s
Span4 valve:                  V4
▼Purge time:                 2 s
```

X-STREAM XE series gas analyzers support up to 4 ranges per measuring channel (☞ 6-59).
For valve supported calibrations/validations, each range can be assigned an individual span gas valve (☞ 6-51 and figure to the left).

During calibrations/validations, ranges are considered in a special way:

- Ranges not assigned a span gas valve are disregarded for span procedures.
- The main order of span calibrations/validations is based on ascending order of channels: Firstly the channel 1 valves are selected in ascending order, then the (not yet used) valves of channel 2, etc., considering the next two conditions, saving time and gas consumption:
  - Ranges of the same channel with the same valve assigned: Only one range is span calibrated/validated, and the resulting data is copied into the other range.
  - Ranges of different channels with the same valve assigned are calibrated/validated in parallel, considering the individual purge times.

Note!
Except for copied data, all calibration/validaton steps can be reviewed in the event logger file.

Example:
Span gas valves configuration

Channel	***Range 1***	***Range 2***	***Range 3***	***Range 4***
1	*V1*	*V1*	*V4*	*V4*
2	*V1*	*V2*	*V4*	*V4*
3	*V4*	*V2*	*V5*	*--*
4	*V5*	*V5*	*V5*	*V5*

Resulting span calibration/validation procedure, focusing on handling of ranges

Step	***Valve***	***Calibrated/Validated channel / range (Cn / Rn)***				
1	*V1*	*Ch1 / R1*	*Ch 1 / R2 (R1 data copied)*	*Ch2 / R1*		
2	*V4*	*Ch1 / R3*	*Ch1 / R4 (R3 data copied)*	*Ch2 / R3*	*Ch2 / R4 (R3 data copied)*	Ch3 / R2
3	*V2*	*Ch2 / R2*	*Ch3 / R2*			
4	*V5*	*Ch3 / R3*	*Ch4 / R1*	*(Ch4 / R1 data copied to all remaining Ch4 ranges)*		

7.7 Remote Calibration or Validation

Remote calibrations/validations may be initialized by digital inputs or Modbus commands, whereas both offer different functionalities:

Remote calibration/validation via **digital inputs** (option) is feasible only in combination with internal or external valves and is limited to 3 procedures, to be assigned to any digital input:

- Zero calibrate/validate all channels,
- span calibrate/validate all channels and
- zero & span calibrate/validate all channels

Note!
By activating span calibrations/validations, it is the operators responsibility to not perform a span calibration/validation without a preceding zero calibration/validation!

The **Modbus interface** offers more variability in performing calibrations/validations:

- *Calibration/validation without valves*:
  The Modbus command initializes the procedure within the analyzer, but the operator has to take care that the gases are supplied in proper order, has to consider purge times as well as the condition to not perform a span calibration/validation without a preceding zero calibration/validation. So, in this configuration Modbus may be used e.g. together with an external sample handling system that controls the gas flow.
- *Calibration/validation with valves*:
  Installed and assigned valves (☞ 7-10) support two different variations of how to perform calibrations/validations:
  1. Perform single calibrations/validations
     The Modbus command initializes single procedures (zero or span calibrations/ validations). The analyzers controls gas supply and purge times while it is the operators responsibility to not activate a span calibration/validation without a preceding zero calibration/validation!
  2. Special calibration/validation procedures:
     - Zero calibrate/validate all channels
     - Span calibrate/validate all channels
     - Zero & span calibrate/validate all channels.

     Initialized by the Modbus command the analyzer performs above mentioned procedures and controls gas supply, purge times and (for the last given procedure only) performs a zero calibration/validation for all channels before activating span calibrations/validations.

For detailled descriptions on how to perform

calibrations/validations initialized via digital inputs ☞ 7-52
calibrations/validations initialized via Modbus, without valves ☞ 7-54
calibrations/validations initialized via Modbus, with valves ☞ 7-54

7.7.1 Calibrations/Validations Initialized by Digital Inputs

As already mentioned, the analyzer must either provide internal valves or external valves (connected to its digital outputs), to make use of this feature.

☞ Chapter 4 for information about electrical data and installation of digital inputs and outputs.

Digital inputs are edged triggered whereat the type of edge (rising or falling) can be setup via software menu (☞ 6-86*)*.

An edge is detected within a time slot of 300 to 500 ms after the edge is applied. To be accepted as an input signal,
- no change in signal is permitted for a minimum duration of 500 ms after the edge has been applied, otherwise it is rejected.

Furthermore take care
- calibrations/validations can only be canceled by an approriate digital input signal or command, but not by another calibration /validation trigger signal
- while a calibration/validation is ongoing, any valve can only be activated if it is not used by this calibration/validation procedure, and not assigned to a channel currently calibrated/validated.
- input signals, intended to start another procedure, must be applied complying to the following condition:
  - if this next procedure affects components already in use for the ongoing procedure, the edge detection time slot must start after the ongoing procedure has ended

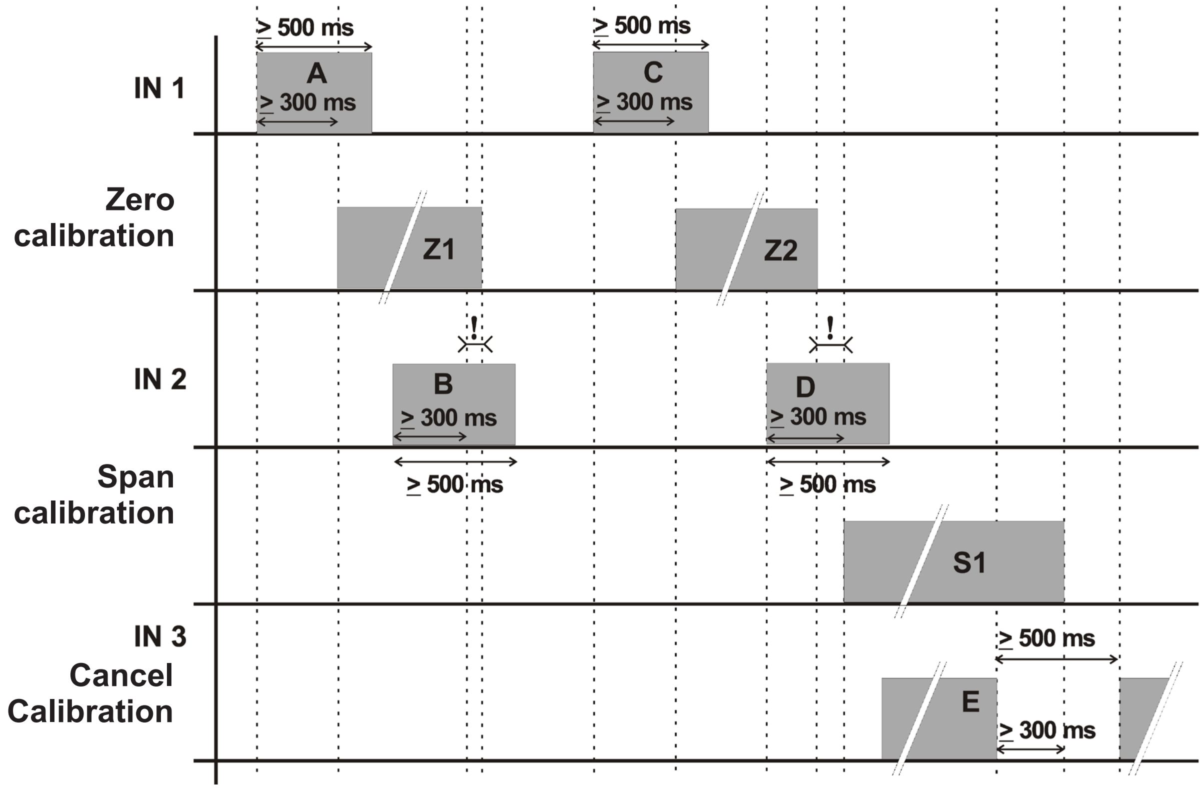
  For example, during an ongoing zero calibration/validation, an input signal to start a span calibration/validation for the same channel should be applied after the zero calibration/validation has finished. At least it must be applied in a way, that the 300 to 500 ms edge detection time slot starts after the zero calibration/validation has ended (see Fig. 7-10, signal D), otherwise it is rejected (signal B)..

7.7.1 Calibrations/Validations Initialized by Digital Inputs

Examples

The sequences shown in Fig. 7-10 are based on the following setup for digital inputs IN1 to IN3:

- IN1 starts a zero calibration, initiated by a rising edge
- IN2 starts a span calibration, initiated by a rising edge
- IN3 cancels all calibrations with its falling edge



If signals are applied as shown, then

- IN1 (A) starts a zero calibration (Z1)
- the detection window (300 - 500 ms after edge) for IN2 (B) begins while the zero calibration (Z1) is ongoing: Signal (B) is ignored
- the edge of IN1 (C) is detected and the associated zero calibration (Z2) is started
- the detection window (300 - 500 ms after edge) for IN2 (D) begins after the zero calibration (Z2) has ended, so the span calibration (S1) is started
- the span calibration (S1) is canceled by the falling edge of IN3 (E)

Fig. 7-10: *Digital Inputs - Examples of Sequences*

7.7.2 Modbus Activated Calibrations/Validations Without Valves

Several Modbus commands allow to start calibrations/validations (List of Modbus Commands).

If the analyzer does neither provide internal valves nor digital inputs and outputs (for controlling external valves), then the procedure corresponds to the manual calibration/validation, with the Modbus commands replacing the manual front panel button keypresses.

This means, the Modbus command immediately starts the calculation. The operator has to ensure in this moment, the proper gas is applied and the measuring system is filled with calibration/validation gas. If applicable, he also has to take care to not activate a span calibration/validation without a preceding zero calibration/validation.

For detailled instructions about manual calibration ☞ 7-32.

For detailled instructions about manual validation ☞ 7-17.

7.7.3 Modbus Activated Calibrations/Validations With Valves

Several Modbus commands allow to start calibrations/validations List of Modbus Commands.

If the analyzer provides either internal valves or digital inputs and outputs (for controlling external valves), then Modbus commands allow to make use of all the options described in Section “7.4.4.3 Advanced Calibration” on page 7-36 and in Section “7.4.2.3 Advanced Validation” on page 7-21 with the Modbus commands replacing the manual front panel button keypresses.

This means, Modbus commands can initialize

- Zero calibrations/validations for all channels
- Span calibrations/validations for all channels
- Zero and span calibrations/validstaions for all channels.

The analyzer controls the gas flow, if applicable optimizes the sequence of multiple calibrations/validations and takes care to not activate a span calibration/validation without a preceding zero calibration/validation.

7.8 Unattended Automatic Calibration or Validation

The unattended automatic calibration/validation feature allows to program the analyzer to automatically perform valve supported calibration/validation procedures without the need of digital inputs or Modbus interface connections.

Compared to the procedures described in the section before (advanced calibration/validation), there are only very limited options, comparable to the manual calibration/validation procedures: The operator has the simple choice of programming zero, or zero and span calibration/validation intervals.

The main features compared to advanced calibrations/validations as described from 7-21 are:

1) an interval time specifies the time between two calibrations/validations
2) starting and processing calibrations/validations does not need operator interaction
3) for span calibrations/validations the analyzer considers the requirement, that always a zero calibration/validation has to be carried out first,
4) (multi channel instruments only): Every time an unattended calibration/validation is started, it is carried out for all channels!

Before selecting any further line make sure the required calibration/validation gases are applied, and valves are assigned properly!

Supply all validation gases with the same flow as the sample gas (recommeded approx. 1 l/min, maximum 1500 hPa absolute pressure) and utilizing the correct gas fitting (☞ Sect. 7.4.1.1).

Make sure the calibration/validation purge time is set to a value ensuring the measuring cell is filled properly with the related calibration/validation gas after the valve has opened!

Ensure the warm-up time after switching on has elapsed! Warm-up time is 15 to 50 minutes depending on installed measuring system and configuration!

7.8 Unattended Automatic Calibration or Validation

Setup..
Calibration/Validation..
Interval times..

Interval times

ZeroCal All..
Zero&SpanCal All..
Programmed sequence..
Blowback All..
ZeroValid All..
Zero&SpanValid All

Within SETUP - CALIBRATION/VALIDATION, "*Interval time..*" opens the following screen:

Several time intervals may be specified:

"ZeroCal all..": This entry specifies intervals for zero calibrations only! If there is an entry for *"Zero&SpanCal all..",* too, the instrument will carry out **additional** zero calibrations based on the *"Zero&SpanCal all.."* interval.

"Zero&SpanCal all..": This is the interval to elapse before the analyzer automatically starts a **full** calibration procedure, consisting of a zero calibration followed by a span calibration.

"Programmed sequence..": This is the interval time for the sequence, setup in SETUP - CALIBRATION/VALIDATION - PROGRAM SEQUENCE

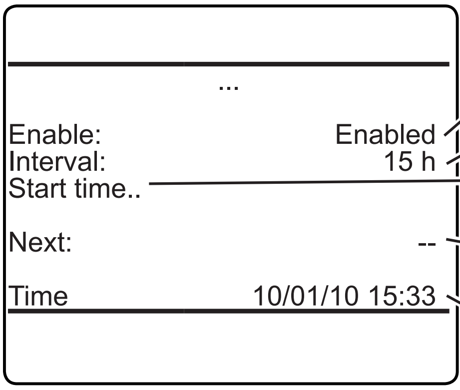
"Blowback All..": To blowback all channels at regular intervals, enter this submenu.

"ZeroValid All..": This entry specifies intervals for zero validations only! If there is an entry for *"Zero&SpanValid All..",* too, the instrument will carry out **additional** zero validations based on the *"Zero&SpanValid All.."* interval.

"Zero&SpanValid All..": This is the interval to elapse before the analyzer automatically starts a **full validation** procedure, consisting of a zero validation followed by a span validation.

7.8 Unattended Automatic Calibration or Validation

All submenus opened by above menu lines have the same content, exemplarily described below:



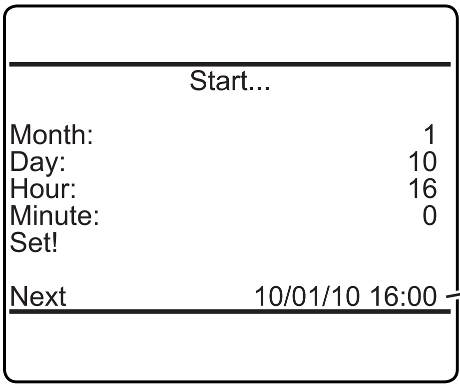
Set to **Enabled**, to use interval times for the selected calibration (here: Zero all)

Enter the interval time
Accepted range: **1 ... 10,000** h

In this submenu enter the start time for the first calibration (s. below)

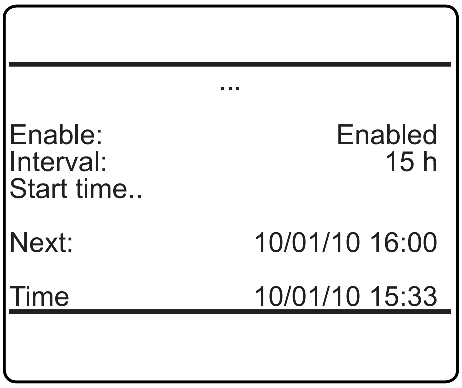
Start time & date for the next calibration, based on the entered parameters (empty until date & time have been entered in the submenu)

Current date & time



In this submenu enter the date and start time for the first calibration after finishing this setup.
Note!
Time format is 24h (1 pm = 13)

Start time & date for the next calibration, based on the entered parameters



Press *LEFT* to return to the previous menu, to see a summary.

Note!
If the displayed current time is not correct, update the system setup on ☞ 6-117.

7.8 Unattended Automatic Calibration or Validation

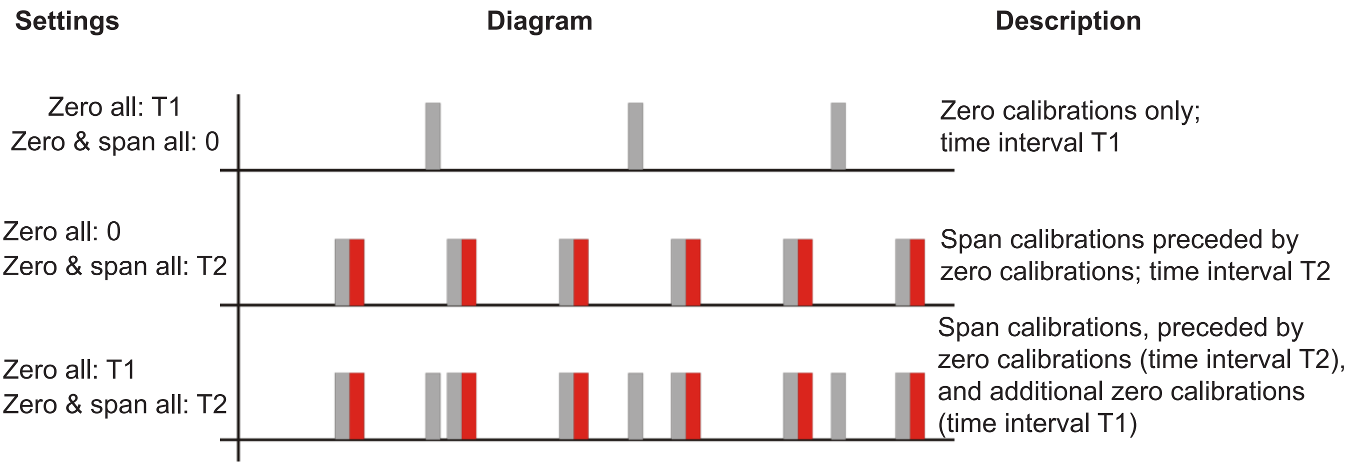


Fig. 7-11: *Graphical Explanation of Interval Time Settings*

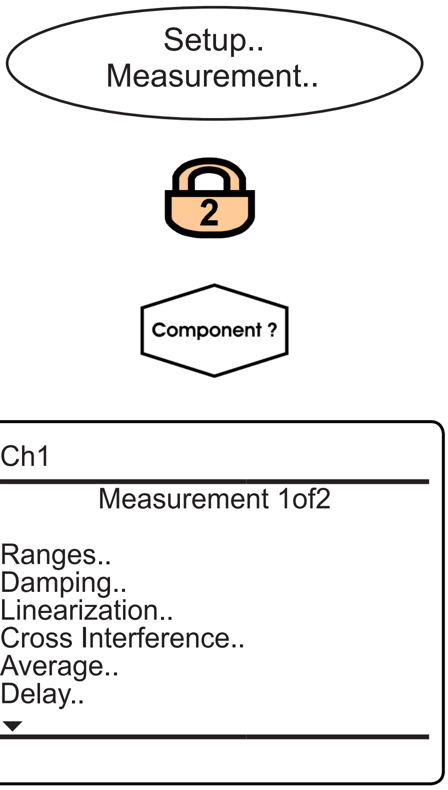
7.9 Cross Interference Compensation

The menu “Cross Interference” allows to calculate/compensate the influence of up to four components into the result of the measured component. Sources of interference can be

- any internal channel,
- external signals, supplied via (optional) analog inputs
- results of (optional) internal calculators.

Conditions for calculating and compensating cross interferences:

- Calibrate all channels before starting interference compensation.
- Apply the signal causing the interference.
  If an internal channel is the source of interference, apply pure gas or mixtures of such a gas with inert gas (e.g. CH_4 in N_2) only. Do not use gas mixtures!



Calculation of the cross interference compensation:

1. Select the channel for which to carry out a cross interference compensation (SETUP - MEASUREMENT)

2. On menu page 1of2 select CROSS INTERFERENCE.

7.9 Cross Interference Compensation

Write down or keep in mind the current setting of "*Activated*" to reset it after finishing the cross interference compensation setup!

```
Ch1
        Cross Interference
Activated:                     Off

IF Source1..
IF Source2..
IF Source3..
IF Source4..
```

3. Select **Off** in line "*Activated*", otherwise the result would be influenced during the determination of the interference component factor.

4. To configure the first source of interference of this channel select "*IF Source1*".

5. Within this menu, configure the source and effect of interference of the component, interfering the currently selected channel.

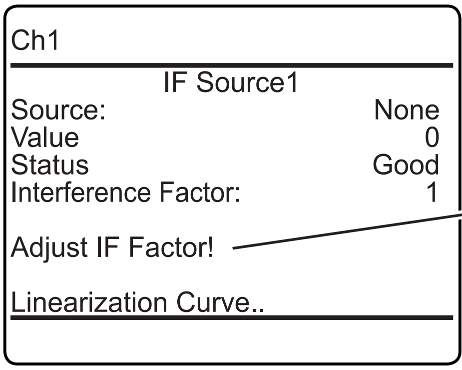
```
Ch1
          IF Source1
Source:                       None
Value                            0
Status                        Good
Interference Factor:             1

Adjust IF Factor!

Linearization Curve..
```

Select the source of interference used for cross compensating the selected channel.
Available options:
None: source is disabled for cross compensation
Conc1…**Conc5:** Measurement values of internal channels 1…5
*(**Note!***
The currently selected channel, here Ch1, cannot be setup as a source!)
AIN1, AIN2: Analog input 1 or 2
Calc A…**Calc D:** Result of Calc A to Calc D

"*Value*" shows the current interfering components value, formatted with the related basic unit (e. g. ppm if Conc1…Conc5 is selected).

"*Status*" shows if the interfering components signal currently is available (e. g. properly connected).
Possible status values: **Absent, Good**.

7.9 Cross Interference Compensation



6a. If the signal of the selected source is **linear**:
To automatically calculate the proper interference compensation factor, enter "*Adjust IF Factor!*" and press ENTER.

The analyzer now starts calculating and, when finished, shows the result in line "*Interference Factor:*"
Note!
*If it turns out during measurement, that the calculated factor is not satisfactory, you may change the "*Interference Factor*" manually. Simply enter the line, press* ENTER *and change the value.*

7. If need be,
   - repeat from step 4 for more sources of interference for the currently selected channel,
   or
   - start from step 1 to configure interference compensation for another channel.

Don't forget now to set "*Activated*" to the previous value after finishing the cross interference compensation setup!

7.9 Cross Interference Compensation

```
Ch1
            IF Source1
Source:                       None
Value                            0
Status                        Good
Interference Factor:             1

Adjust IF Factor!

Linearization Curve..
```

6b. If the signal of the selected source is **nonlinear**:
Enter LINEARISATION CURVE to configure a fourth-order polynomial, representing the nonlinear signal curve.

7. Based on the following formula, enter up to four polynomial factors $a_4 \ldots a_1$;
a_0 cannot be changed and is set to “0”.

$$a_4 \cdot x^4 + a_3 \cdot x^3 + a_2 \cdot x^2 + a_1 \cdot x + a_0$$

Furthermore you need to specify which value of the interference signal is to be used to normalize the linearization curve.

```
Ch1
            IF Source1

Reference Value:                 1

IF Polynomial a1:       1.00000000
IF Polynomial a2:       0.00000000
IF Polynomial a3:       0.00000000
IF Polynomial a4:       0.00000000
```

Reference value of the interference signal to be used to normalize the linearization curve.
Accepted range: **-1E+9 ... +1E+9**

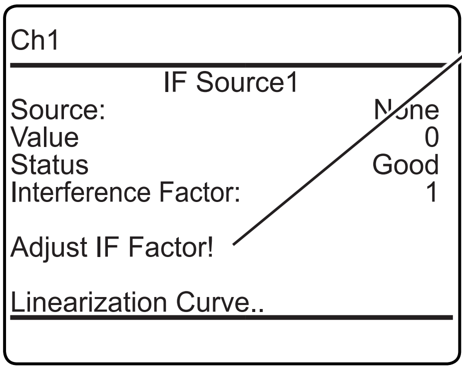
Enter up to 4 polynomial factors here

Note!

If you don’t have the polynomials data available, see the USB stick provided together with your X-STREAM analyzer: The subdirectory ***Interference Compensation*** *provides a spreadsheet which you can use to calculate the polynomials from a set of measurement values.*

This spreadsheet is provided without any support! The use of its contents is the sole responsibility of the user.

Emerson Process Management does not take liability for accuracy of the results and completeness of the contents of this spreadsheet.



8. After all data has been entered, press left to return to the previous menu.
   To automatically calculate the proper interference compensation factor, enter "*Adjust IF Factor!*" and press ENTER.

   The analyzer now starts calculating and, when finished, shows the result in line "*Interference Factor:*"
   Note!
   *If it turns out during measurement, that the calculated factor is not satisfactory, you may either change the "*Interference Factor*" manually (simply enter the line, press* ENTER *and change the value), or adjust the polynomials (repeat step 7).*

9. If need be,
   - repeat from step 4 for more sources of interference for the currently selected channel,
     or
   - start from step 1 to configure interference compensation for another channel.

Don't forget to set "*Activated*" to the previous value after finishing the cross interference compensation setup!

If no additional sources of interference are to be configured, press *HOME* to return to the MEASUREMENT SCREEN.

7.10 Replacing Worn Out Sensors

7.10.1 Safety Instructions

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Live parts are accessible when working at open instruments!

Take care to observe all applicable safety instructions!

⚠ WARNING

EXPLOSIVE, FLAMMABLE AND HARMFUL GASES HAZARD

Before opening gas paths they must be purged with ambient air or neutral gas (N_2) to avoid hazards caused by toxic, flammable, explosive or harmful to health gas components!

⚠ CAUTION

ELECTROSTATIC DISCHARGE HAZARD

Working at internal components of electronical and electrical instruments may cause electrostatic discharge (ESD), destroying components!

Working at open instruments is recommended at special workplaces only! If no such workplace is available, at minimum perform the following procedures to not destroy electronic components:

Discharge the electric charge from your body. Do this by touching a device that is grounded electrically (e.g. instruments with earth connectors, heating installations). This should be done periodically when working at open instruments (especially after leaving the service site, because e.g. walking on low conducting floors might cause additional ESD).

7.10 Replacing Worn Out Sensors

7.10.2 Opening X-STREAM Analyzers

7.10.2.1 How to Open X-STREAM XEGP

Remove the top cover after loosening the 12 screws.

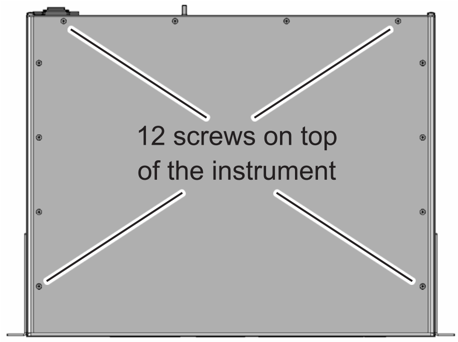
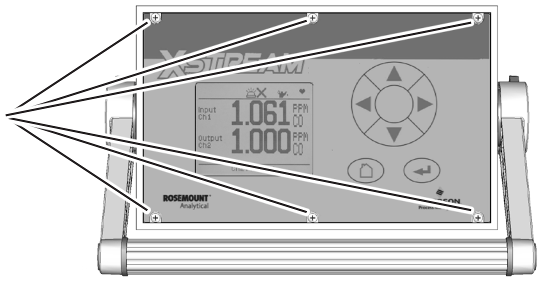


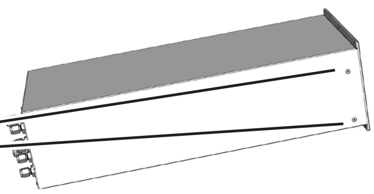
Fig. 7-12: *X-STREAM XEGP*

7.10.2.2 How to Open X-STREAM XEGK

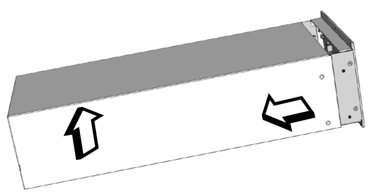
If your instrument is equipped with a handle
- loosen the 6 screws at the front panel,
- to only get access to the cover screws, push frame and handle about 2 cm / 1" towards the rear.

Note!
To completely remove frame and handle, you need to disconnect all gas and electrical connections and push frame and handle over the rear panel.





- remove the 4 screws for the cover, (2 screws on each side of the instrument



- push the cover towards the rear and remove it.

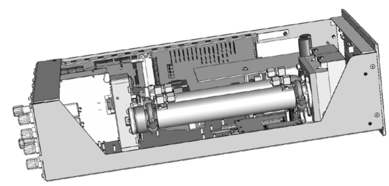


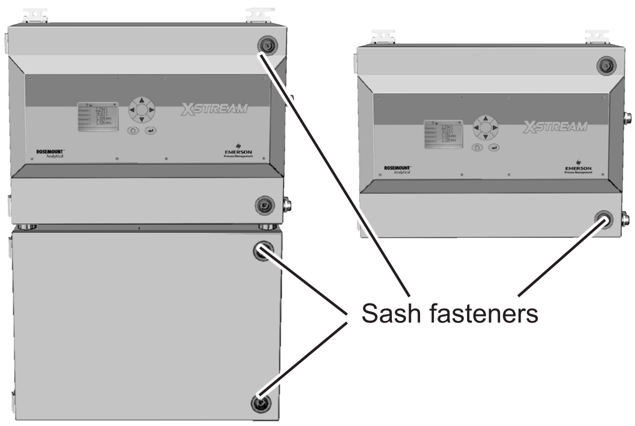
Fig. 7-13: *X-STREAM XEGK*

7.10.2.3 How to Open X-STREAM Fieldhousings

Depending on the individual analyzer configuration, either open the upper or lower front door to the left, utilizing the two sash fasteners.

7.10.2.4 How to Open X-STREAM XEFD

To open a X-STREAM XEFD loosen the 20 screws located at the instrument's flange. Then carefully flip down the front door to not damage the instrument, hinges or equipment installed below the analyzer.



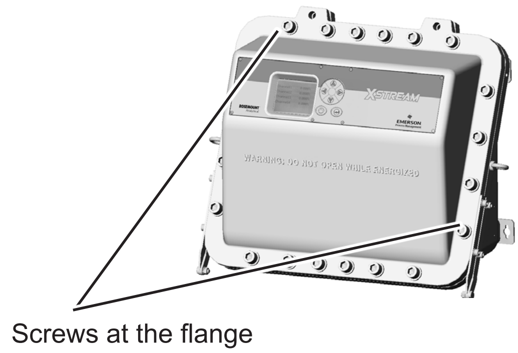


Fig. 7-14: X-STREAM XEXF Field Housings and XEFD - How to Open

WARNING

EXPLOSION HAZARD

X-STREAM XEFD as well as special variations of X-STREAM XEXF Fieldhousings are intended to be installed in hazardous areas.

Maintaining such instruments is permitted only considering special conditions, given in the associated separate manuals.

Do not open nor maintain instruments in hazardous areas without having read and understood all associated instruction manuals!

CAUTION

GASKETS AT LOW TEMPERATURES

Consider that enclosure gaskets may be frozen when the instrument is installed outdoors. Carefully open the enclosure at temperatures below -10 °C to not damage the gaskets.

Damaged gaskets void the ingress protection, possibly causing property damage, personal injury or death.

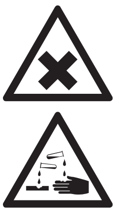
7.10 Replacing Worn Out Sensors

Separate sections describe the replacement of the various sensors:

Electrochemical oxygen sensor (eO_2)	☞ page 7-68
Trace oxygen sensor (tO_2)	☞ page 7-75
Trace moisture sensor (tH_2O)	☞ page 7-76

7.10 Replacing Worn Out Sensors

7.10.3 Replacing the Electrochemical Oxygen-Sensor



WARNING

HAZARD FROM WEAK ACID AQUEOUS SOLUTION

If the electrolyte leaks due to sensor damage, put the sensor in a plastic bag so that the solution will not be smeared on other places and return the sensor to Emerson Process Management or an industrial waste management contractor.

The electrolyte is a weak acid aqueous solution of 5 to 6 in pH with an irritating odor. It will not ignite spontaneously even if it is left. Nevertheless, lead acetate, which is a component of the solution, is harmful to human bodies and should be handled with care as follows:

- **If electrolyte is smeared on the skin or clothing, immediately wash the contacted part with soapy water and wash off the solution with a large amount of tap water.**
- **If electrolyte gets into an eye, immediately wash the eye with a large amount of tap water for 15 minutes and consult a doctor promptly.**
- **If electrolytic solution or atomized electrolytic solution is inhaled, immediately wash the nostrils and gargle with tap water and consult a doctor promptly.**
- **If electrolyte is swallowed, DO NOT INDUCE VOMITING! Immediately wash the mouth with tap water. Swallow a large amount of tap water. Consult a doctor promptly.**

Do not disassemble or repair the sensor. Removing a sensor part or remodeling the sensor will damage the sensor or leak the electrolyte, and restoration to the original condition may not be possible.

Discarded sensors cause environmental contamination. Return a Worn Out sensor to Emerson Process Management or an industrial waste management contractor when discarding a Worn Out sensor.

7.10 Replacing Worn Out Sensors

GENERAL HINTS ON HANDLING THE SENSOR

Do not expose the sensor to a temperature other than the temperature range of -20 to +60 °C (-4 to +140 °F). Exposing to a temperature outside the temperature range may cause abnormal output or leak of the electrolyte due to parts degradation or damage.

Make sure to prevent condensation of the oxygen concentration detecting part. If condensed, the output will lower and response speed will slow down, disabling accurate concentration measurement. The sensor characteristics will return to the original characteristics if condensation moisture evaporates after putting the sensor in dry air several hours to several days.

Do not drop or apply a violent shock or vibration to the sensor. If shocked or vibrated, the sensor output may temporarily vary or become unstable. The original sensor condition will usually reset by putting the sensor in a stationary condition in the atmosphere at a ordinary temperature several hours to several days. Depending on the degree of a shock or vibration, the internal sensor structure may break and the sensor may not return to original condition.

Do not disassemble or repair the sensor. Removing a sensor part or remodeling the sensor will damage the sensor or leak the electrolyte and restoration to the original condition may not be possible.

7.10 Replacing Worn Out Sensors

Consider all applicable safety instructions, especially those at the beginning of this Section 7.10!

In consequence of its design the sensor's lifetime is limited and depends on theoretical designed life and Oxygen concentration. The sensor output can be taken as a rough criterion for end of lifetime: The sensor is Worn Out when the output in atmosphere is below 70 % of the initial output. The period till then can be calculated by

$$\text{Lifetime} = \frac{\text{designed life (\% hours)}}{O_2 \text{ concentration (\%)}}$$

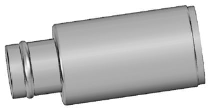
The sensor's designed life under constant conditions of 20 °C is approx. **900,000 hrs.**

The lifetime at 21 % oxygen is therefore calculated to approx. **42,857 hrs, corresponding to approx. 5 years.**

Irrespective of all calculations above:
A sensor is Worn Out when, connected to ambient air, the output voltage is less than 2.8 V: Replace the sensor!

For replacing the electrochemical sensor the following tools are required:

- Philips screw drivers # 0 & 2
- 1 digital volt meter (measuring range 0 ... 2 V dc minimum) with suitable cables and probes.



Note 1!
The given lifetime values are for reference only! The expected lifetime is greatly affected by the temperature of the environment in which the sensor is used or stored. Increases or decreases in atmospheric pressure have the same effect as that by increases or decreases in oxygen concentration. (Operation at 40 °C halves lifetime).

Note 2!
Due to the measuring principle the electrochemical oxygen cell requires a minimum internal consumption of oxygen (residual humidity avoids drying up the cell). Supplying cells continuously with dry sample gas of low grade oxygen concentration or with sample gas free of oxygen could result in a reversible detuning of O_2 sensitivity. The output signal will become unstable, but response time remains constant.
For proper measurement results the cell needs to be supplied continuously with concentrations of at least 0.1 Vol.-% O_2.
We recommend using the cell if need be in alternating mode, means to purge the cell with conditioned ambient air (not dried, but dust removed) when measurement pauses.
If it is necessary to interrupt the oxygen supply for several hours or days, the cell has to regenerate (supply cell for about one day with ambient air). Temporary flushing with nitrogen (N_2) for less than 1 h (e.g. for analyzer zeroing purpose) has no influence on measuring characteristics.

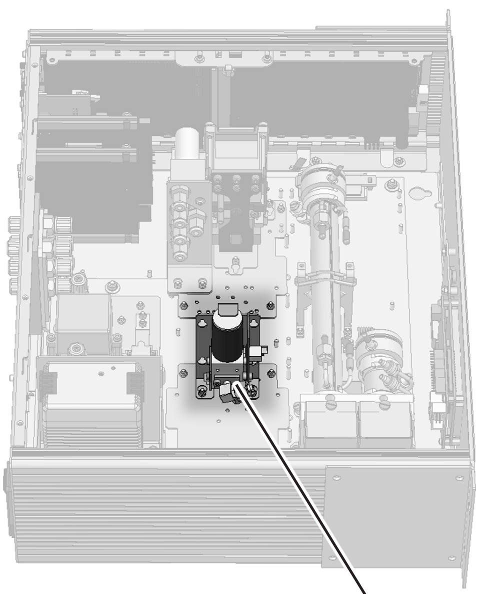
7.10.3.1 Locating the Sensor

Basically X-STREAM analyzers provide different variations of internal designs:

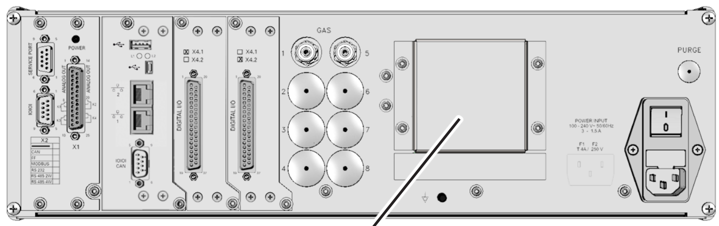
- In instruments with internal heated box covering the physical components, electrochemical sensors are installed outside this box.

Instruments without internal thermostatic control have the sensor installed onto the basic mounting plate (see left side of Fig. 7-15).

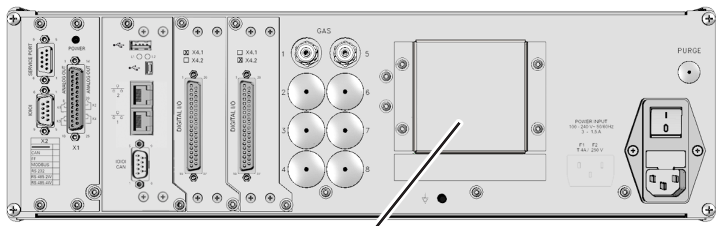
- XEGP may also have the electrochemical oxygen sensor installed at the rear panel (see right side of Fig. 7-15).



1



2



1 (shown behind transparently visualized cover)

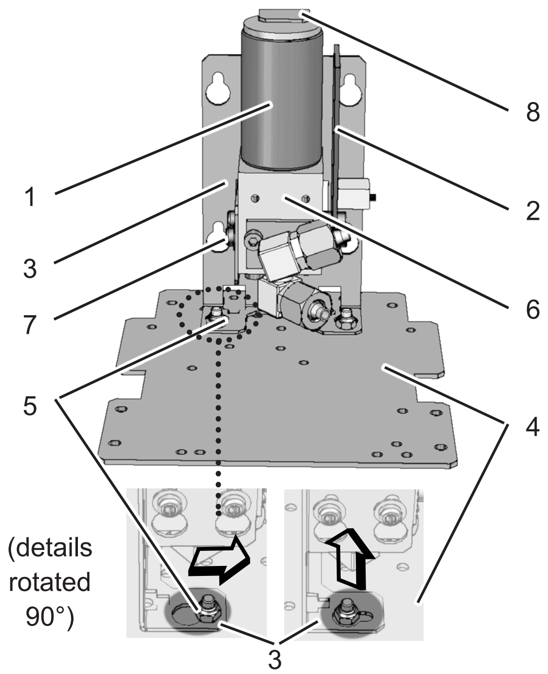
1 eO2 sensor Unit
2 Cover for rear panel installation

Fig. 7-15: *Location of the EO_2 Sensor Unit*

If your analyzer features eO2 sensor at rear panel, continue with page 7-72.

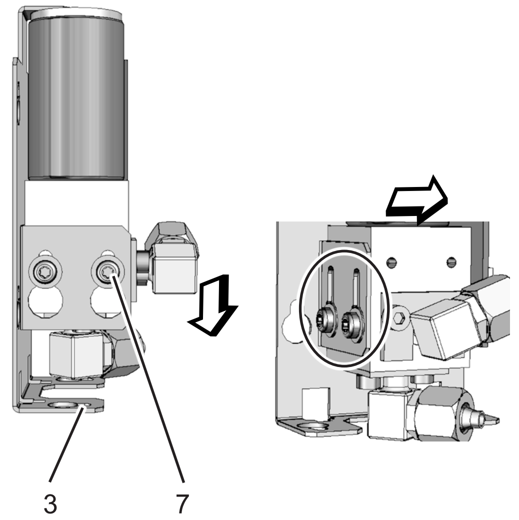
7.10.3.2 Disassembling the Sensor Unit

The sensor unit consists of a holder, an electronics board and the sensor itself, all together installed on a base plate (Fig. 7-16).
After loosening the nut (5), push the holder (3) with sensor (1) until the nut is above the hole (see details), then lift the holder from the base plate (4). The sensor is still fixed in the holder by means of a clip (8).
Now loosen the screws (7), fixing the sensor block (6) to the holder, push the holder downwards until the screws heads slip through the holes.

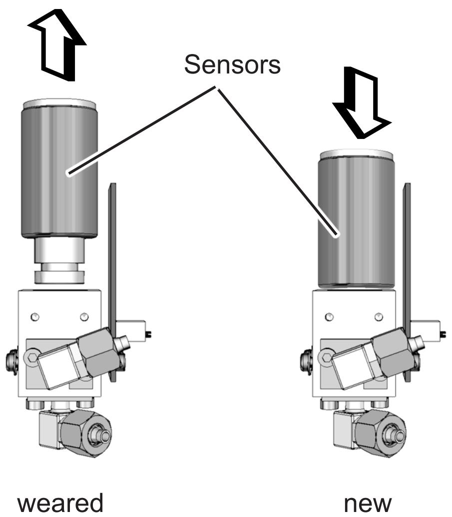


1 Sensor
2 Electronics Board
3 Holder
4 Base Plate
5 Nuts
6 Sensor block
7 Screws
8 Clip

Fig. 7-16: *Sensor Unit Design*



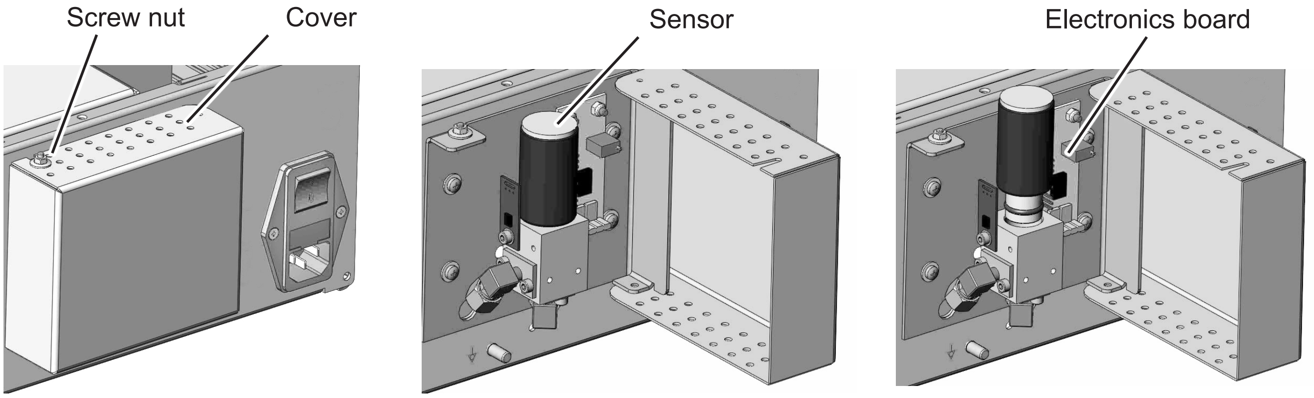
Pull off the signal connector from the electronics board (2) and take off the sensor.
Take a new sensor, remove its plug, insert the sensor into the block and connect the signal connector to P3 on the electronics board (Fig. 7-17).



Now re-assemble the sensor unit in reverse order, but do not yet install it into the analyzer as it requires a signal adjustment.

7.10 Replacing Worn Out Sensors

Replacing the sensor if rear panel installed



1. Loosen the screw nut at the cover's upper side.
2. Open the cover to get access to the sensor.
3. Take out the sensor by pulling it upwards.
4. Properly insert the new sensor into the block.

Fig. 7-17: *Sensor At Rear Panel*

7.10.3.3 Adjusting the Output Signal

Consider all applicable safety instructions, especially those at the beginning of this Section 7.10

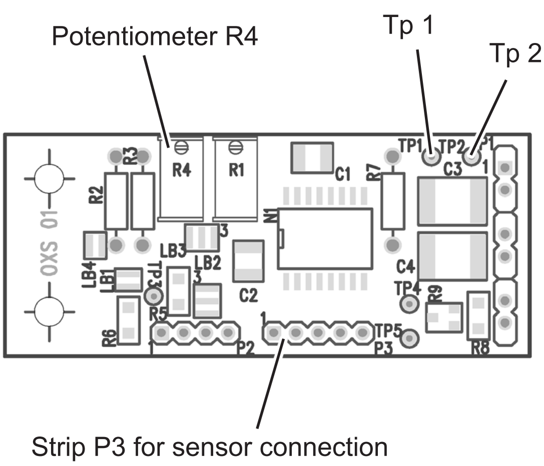


Fig. 7-18: *OXS Board, Top View*

Having replaced the worn sensor, the board's output signal requires some adjustment.

Procedure:

- power on the open instrument.
- Supply ambient air (approx. 21 % O_2)
- Connect a digital voltmeter (DVM) to Tp 1 (signal) and Tp 2 (GND) on the electronics board OXS (fig. 7-15).
- Adjust the measured signal to 3360 mV DC (± 5 mV) utilizing the potentiometer R4 on OXS board.

Note!
Once the output signal has been adjusted for a specific sensor, further changing the potentiometer settings will cause incorrect measuring results!

7.10.3.4 Finalizing the Sensor Replacement

- Disconnect the analyzer from power
- Re-install the sensor unit into the analyzer (not required if installed at rear panel)
- Close the housing. Take care to use all screws, especially if the instrument is to be used in hazardous areas!

  or

  close the rear panel cover (XEGP) and secure it with the screw nut.

WARNING

EXPLOSION HAZARD

Special conditions and instructions for start-up after maintenance apply to instruments to be operated in hazardous areas!

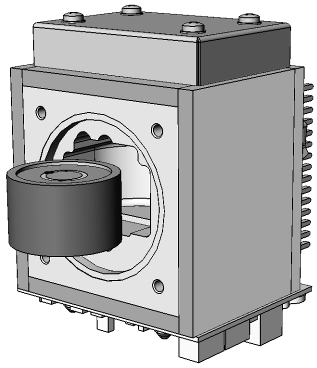
Not observing these conditions and instructions may cause explosions!

See the associated manuals, provided with instruments for use in hazardous areas, for more information.

In a next step for proper measuring results, perform a zero and a span calibration at least for the channel with the replaced sensor.

To ensure proper disposal, send back the old sensor to the EMERSON Process Management factory (or to your local sales office) or to an industrial waste management contractor for waste disposal.

7.10.4 Replacing the Trace Oxygen Sensor



Replacing the trace oxygen sensor requires considering special instructions, shipped together with every single sensor.
Two versions of this sensor are available, differing in the background gas they can be used for:

P/N 427.9102: For sample gases **containing** acid gases, hydrocarbons or hydrogen

P/N 427.9103: For sample gases **without** acid gases, hydrocarbons and hydrogen
If replacing this sensor is necessary (consumable), contact Emerson for information on how to order a substitute.
A new sensor will be provided together with detailled installation and handling instructions.

Consider all information given by the replacement instructions to avoid damaging the sensor, and to achieve best possible life time!

7.10.5 Replacing the Trace Moisture Sensor

Consider all applicable safety instructions, especially those at the beginning of this Section 7.10

- Locate the sensor unit within your analyzer.
- Open the fittings, connecting the unit to the piping.
- Only loosen the small nuts (do not remove them), fixing the sensor unit to the analyzer plate and carefully take the unit out of the analyzer.
- Take off the signal plug at the sensor's end (it is fixed by a screw!).
- Place a wrench (size: 27 mm) at the hexagon and screw out the sensor by turning it counterclockwise (ccw).

Do not use the cylindric sensor body to losen the sensor!

Place a second wrench with size 30 mm from the top to counterhold the block.

- Take the new sensor and carefully place the HDPE protected end of the sensor into the sensor block.
- Place the one wrench at the hexagon, the other at the block to counterhold and fix the sensor by turning it clockwise (cw).

To ensure proper measurements, apply a torque of min. 30.5 Nm (269 in.lb).

Do not use the cylindrical sensor body to install the sensor!

- Install the connector to the sensor and fix it with the screw.
- Place the unit into the analyzer and fix it with the small nuts.
- Re-install the piping fittings.
- Make sure that all the plugs associated with the sensor are properly connected the same way as before.

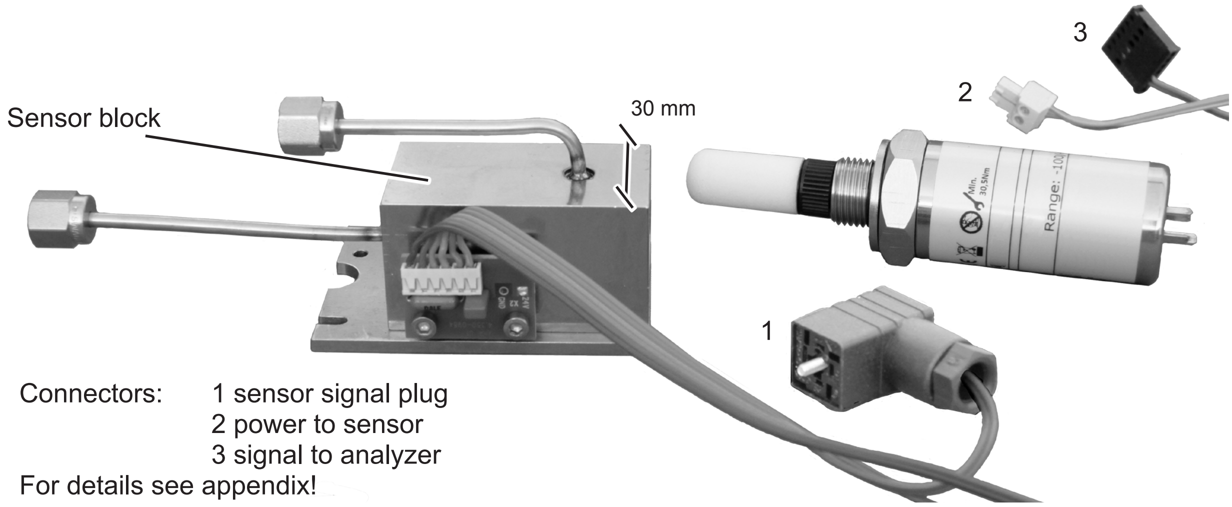


Fig. 7-19: Trace Moisture Sensor Assembly Separated

7.11 Cleaning the Instrument's Outside

Use a liquid general purpose detergent and a lint-free cloth for cleaning the analyzer's outside.

WARNING

HAZARD FROM UNHEALTHY SUBSTANCES

Take care to follow the safety instructions and instructions for use given by the manufacturer of the chosen general purpose detergent!

Procedure

- Disconnect the instrument from power!
- If disconnecting from gas lines is required, take care of the following:

WARNING

EXPLOSIVE, FLAMMABLE AND HARMFUL GASES HAZARD

Before opening gas paths they must be purged with ambient air or neutral gas (N_2) to avoid hazards caused by toxic, flammable, explosive or harmful to health gas components!

Seal the open analyzer's gas fittings utilizing PVC caps to avoid contamination of inner gas path.

- Moisten the lint-free cloth with a mixture of 3 parts of water and 1 part of the general purpose detergent.

Do NOT drench the cloth, just moisten it to prevent liquid entering the housing!

- Clean the analyzer housing outside with the moistened cloth.
- If need be dry the housing after cleaning.

7.12 Save / Restore Configuration Data Sets

After some time of operating the instrument, one can assume all the parameters (calibration/validation gases setup, measuring ranges, inputs and outputs, etc) are setup to meet the application's and operator's needs. To save these settings for means of restoring them in case of failures, data loss or even overwriting, use the options of the SETUP - SAVE-LOAD menus.
X-STREAM analyzers support saving analyzer data by providing different options:

Local backup
Use this option to save the current data in a special analyzer memory section.

Factory defaults..
This is the data, stored in a special memory section after the instrument has been configured in the factory. The user cannot change, but only restore this data.

USB backup
This option enables to save or restore an analyzer configuration to/from an external USB device. This way e.g. administrators can save analyzer configurations separately from the analyzer at a safe location.

Note!
During backup or restore processes, a progress indicator menu is shown: "Busy" turns from **0** *to* **1**. *"Progress (0..1000)" shows* **1000** *when copying data has finished.*

Copying data

Busy	0
Progress (0..1000)	1000

7.12 Save / Restore Configuration Data Sets

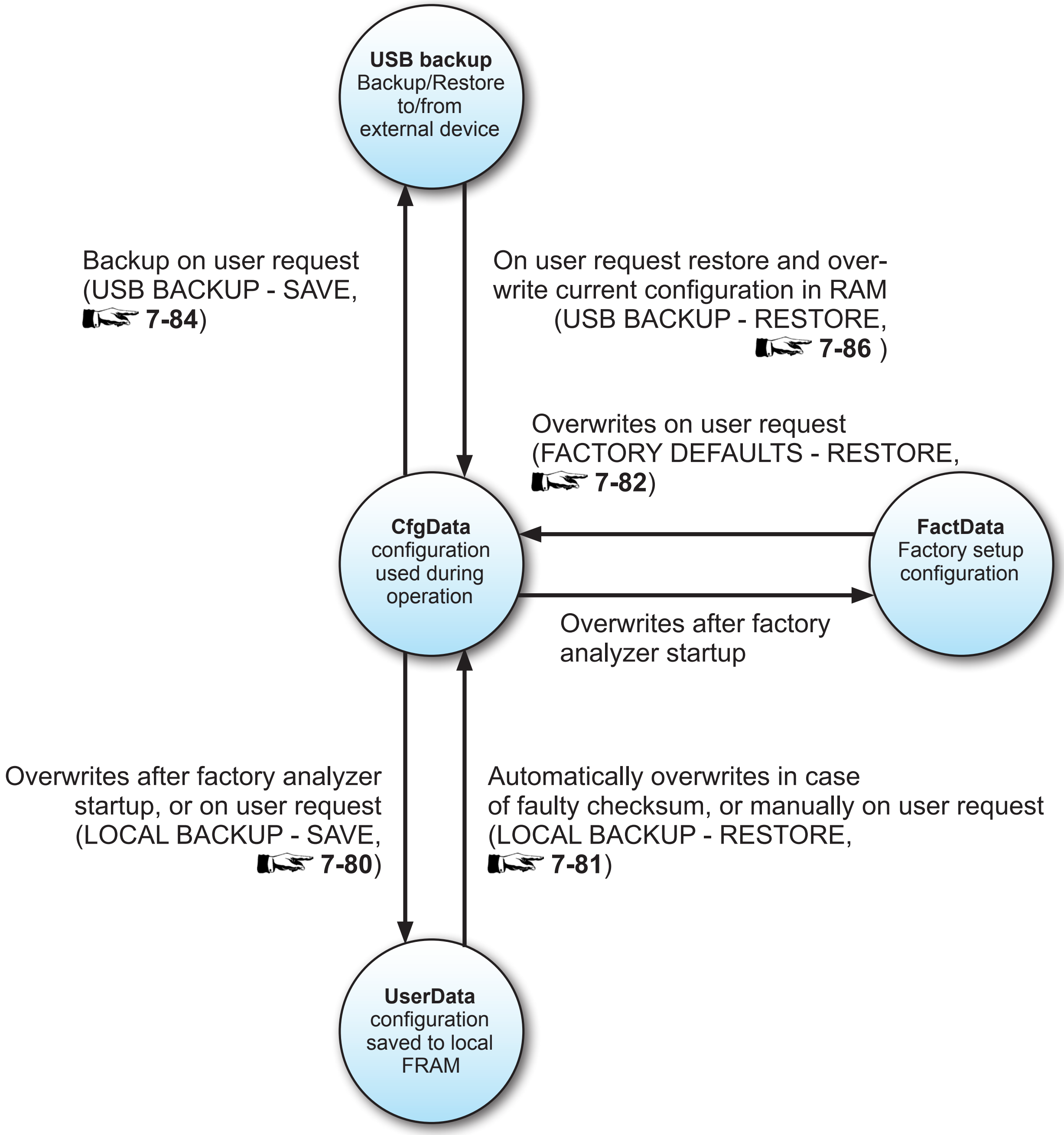


Fig. 7-20: *Relations of Supported Data Sets, and Where to Find Further Information*

7.12 Save / Restore Configuration Data Sets

7.12.1 Local Backup - Save

Setup..
Save-Load..

Starting at the MEASUREMENT SCREEN press *DOWN* to open the MAIN MENU, enter SETUP and next SAVE-LOAD.. .

If system is setup accordingly, access level 3 code must be entered to gain access to this menu.

Save-Load

Local backup..
Factory defaults..
USB backup..

USB Firmware Update

Highlight *"Local backup.."* and press *ENTER*.

Local backup

Save..	
UsrBack date	7/29/09 14:26
Restore..	
Undo restore!	
Busy	0
Progress	0

Highlight 'Save..' and enter the submenu.

Store new local backup
and overwrite old one!
Are you sure?

No!
Yes!

A screen appears to confirm the operation: Select **Yes!** and press *ENTER* to see a new screen, showing the current status.

7.12.2 Local Backup - Restore

Setup..
Save-Load..

Starting at the MEASUREMENT SCREEN press *DOWN* to open the MAIN MENU, enter SETUP and next SAVE-LOAD.. .

If system is setup accordingly, access level 3 code must be entered to gain access to this menu.

Save-Load

Local backup..
Factory defaults..
USB backup..

USB Firmware Update

Highlight "*Local backup..*" and press *ENTER*.

Local backup

Save..	
UsrBack date	7/29/09 14:26
Restore..	
Undo restore!	
Busy	0
Progress	0

Information about the last backup

Highlight "*Restore*.." and enter the submenu.

Restore from local backup!
This will restart device!
Are you sure?

No!
Yes!

A screen appears to confirm the operation: Select **Yes!** and press *ENTER* to see a new screen, showing the current status.

7.12.3 Factory Defaults - Restore

Setup..
Save-Load..

Starting at the MEASUREMENT SCREEN press *DOWN* to open the MAIN MENU, enter SETUP and next SAVE-LOAD.. .

If system is setup accordingly, access level 3 code must be entered to gain access to this menu.

Save-Load

Local backup..
Factory defaults..
USB backup..

USB Firmware Update

Highlight "*Factory defaults..*" and press *ENTER*.

Factory defaults

FacBack date 7/29/09 14:26
Restore..
Undo restore!
Busy
Progress

Information about the last backup

Highlight "*Restore..*" and enter the submenu.

Restore factory defaults!
This will restart device!
Are you sure?

No!
Yes!

A screen appears to confirm the operation: Select **Yes!** and press *ENTER* to see a new screen, showing the current status.

Note!

All changes regarding the analyzer setup, applied after instrument was shipped, will be overwritten!

7.12.4 USB Backup

IMPORTANT INFORMATION!
Read carefully before activating USB procedures!

The analyzer provides a dual-mode USB 1.0 interface, which comes with two connectors. The primary purpose of the bigger connector is to attach mass storage devices such as sticks or disk drives, while the smaller mini USB connector is preserved to connect a PC/ computer.

Note!
Using both connectors in parallel is not supported. Connecting a PC will disable mass storage functionality.

Supported Mass Storage Device Types
Unfortunately not all USB mass storage devices are completely compatible with the interface.
It is recommended to use brands like SANDISK, KINGSTON, TOSHIBA etc.
Before finally storing data, check for proper operation!

Installation
Mass storage devices can be hot-plugged. After attaching a device, the analyzer will automatically recognize it, if the USB interface is enabled; ☞ 6-120. However, do not remove a memory device, while data transmission is ongoing, this can cause loss of data!

Formatting
Prior to first usage, it is recommended to format the mass storage device by the analyzer:
- Attach an USB device
- Enter SETUP - USB INTERFACE (may require to enter access level 3 code)
- Select "*Format USB stick..*" and press *ENTER*.

File System
The analyzer requires a special file system on the memory device:
After installation (and formatting), the analyzer checks the file system on the mass storage device, and automatically creates whatever is required.

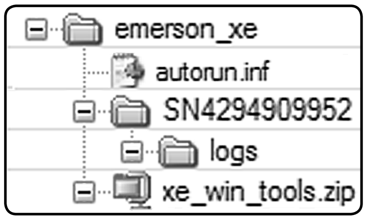


Fig. 7-21: *USB File System Structure*

Auto-Run Feature
It is possible to initiate special procedures upon connecting a mass storage device, e.g. updating the firmware, firmware backup, configuration backup, etc., ☞ 7-92 for more information.

7.12.4.1 USB Backup - Save

Setup..
Save-Load..

Starting at the MEASUREMENT SCREEN press *DOWN* to open the MAIN MENU, enter SETUP and next SAVE-LOAD.

3

If system is setup accordingly, access level 3 code must be entered to gain access to this menu.

USB
Save-Load

Local backup..
Factory defaults..
USB backup..

USB Firmware Update

Highlight *“USB backup..”* and press *ENTER*.

USB
USB backup

Save..
Restore..
Undo restore!
Busy 0
Progress 1000

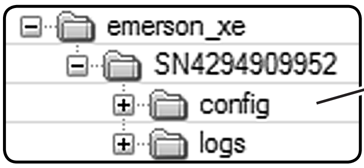
Highlight *“Save..”* and enter the submenu.

USB
Save config to USB stick
and overwrite old file!
Are you sure?

No!
Yes!

Note!
Take care to have an USB device connected to the analyzer’s USB port!
A screen appears to confirm the operation: Select **Yes!** and press *ENTER* to see a new screen, showing the current status.

7.12 Save / Restore Configuration Data Sets

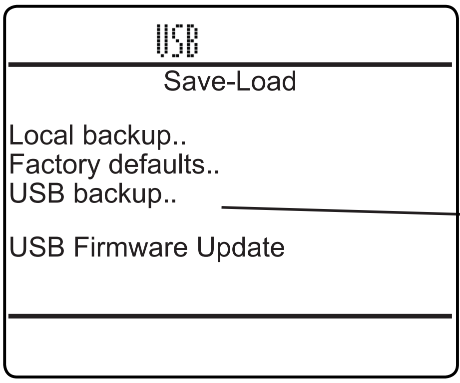


The backup files are stored within the USB device' file structure, in a subdirectory 'config'. For more information on the USB device file system structure, ☞ 6-121.

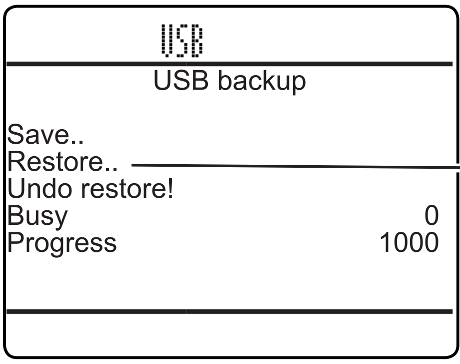
7.12.4.2 USB Backup - Restore

Starting from the MEASUREMENT SCREEN, press *DOWN* to open the MAIN MENU, enter SETUP and next SAVE-LOAD.. .

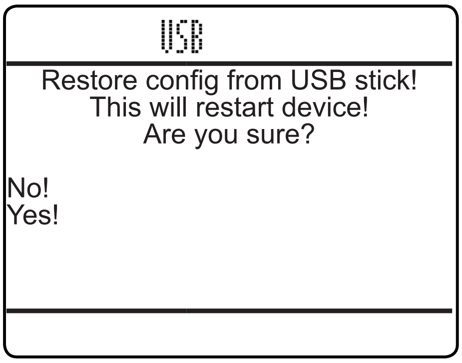
If system is setup accordingly, access level 3 code must be entered to gain access to this menu.



Highlight *"USB backup.."* and press *ENTER*.



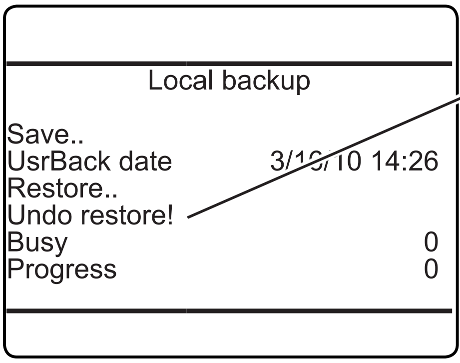
Enter this submenu.



Note!
Take care to have an USB device connected to the analyzer's USB port (icon to be visible in the first menu line)!

A screen appears to confirm the operation: Select **Yes!** and press *ENTER* to start the process.

7.12.5 Undo Restore



Each backup menu has a function line called *"Undo restore!"* to undo the last restore backup operation, as shown exemplarily shown by the figures to the left (local backup menu). This works from any backup/restore menu, and undoes any last restore, regardless if this was started from the current or from another. During the undo process, a 'Function executing' message appears.

7.13 Handling Log Files

Log files are created by the internal data logger, event logger, calibration logger and validation logger, whereat the latter are part of optional software upgrade packages.

Working with log files is in the following exemplarily explained on the basis of the data logger:

7.13.1 Configuring Log Files

Open SETUP - DATA LOGGER (this may require to enter the access code for level 3), to see the following menu:

Data logger	
Logging:	Off
Sample time:	1 s
Data logger data delete!	
Cached entries	14
Total entries	0
Data Selection	
Export data to USB!	

Highlight the 7th line and open the associated submenu to see a list of data available for logging.

Data Selection	
Concentration:	Yes
Temperature:	No
Flow:	No
Pressure:	No
FieldSep:	TAB

Each entry in the log file contains the following fields

- date
- time, followed by
- the fields as selected in the menu:

For each parameter select, if it is to be included (**Yes**) or not (**No**) in the log file:
"*Concentration*" includes the measured concentration (ppm) and current status of all installed channels.
"*Temperature*", "*Flow*" and "*Pressure*" include the associated measured values.

Data Selection	
Concentration:	Yes
Temperature:	No
Flow:	No
Pressure:	No
FieldSep:	TAB

The separator for the fields within an entry is specified with the last menu line: Available options are **TAB**(ulator), **Comma** and **SemiKol**(on). Entries are separated by a carrige return and line feed.

7.13 Handling Log Files

```
Data logger
Logging:                         On
Sample time:                     1 s
Data logger data delete!
Cached entries                   14
Total entries                     0

Data Selection..
Export data to USB!
```

Press left to return to the previous menu, and

- enter a sample time to specify the time interval between entries
- turn "*Logging*" **On**, to start logging.

All the log file data is kept in an internal memory, and written into a file on the internal memory card every 30 minutes (or when "*Logging*" is turned **Off**.
So,

- "*Cached entries*" shows the number of entries in memory
- "*Total entries*" gives the number of entries, already saved to the internal memory card.

7.13.2 Exporting Log Files

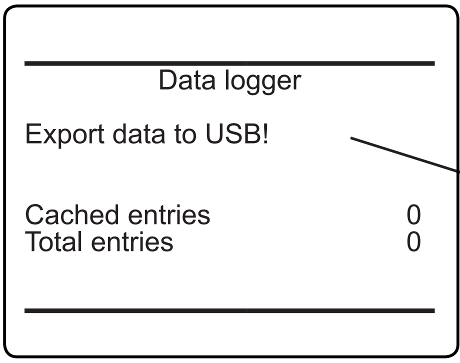
There are two options to export log files to an USB device:

1st option:
From within SETUP - DATA LOGGER (this may require to enter the access code for level 3)

```
Data logger
Logging:                         On
Sample time:                     1 s
Data logger data delete!
Cached entries                   14
Total entries                     0

Data Selection..
Export data to USB!
```

The last line "*Export data to USB!*" enables to export the total entries to a connected USB device.

7.13 Handling Log Files



2^{nd} option:
From within CONTROL - DATA LOGGER (this may require to enter the access code for level 1)

The line "*Export data to USB!*" enables to export the total entries to a connected USB device.

Before starting to export, the analyzer automatically adds the cached entries to the total entries file, so all available data is exported to the log file.

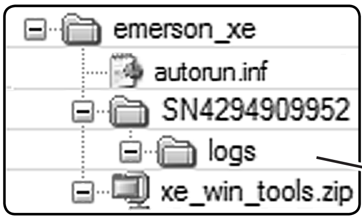


Fig. 7-22: *Subdirectory for Log Files*

Take care to have a proper USB memory device connected (☞ 6-121), before starting to export a log file, otherwise an error message shows up.

Log files are exported to the subdirectory named 'logs' beneath a directory, named with the serial number of the current analyzer.

Notes!
If not already present, the file system structure is created automatically.

One memory device may have multiple 'serial number' directories, each created automatically, when for the first time connected to a new analyzer, and containing only the files for that specific analyzer.

Note!
Data logger exports into data.log, event logger into events.log, calibration logger into calibration.log and validation logger into validation.log.
Several files of the same type are added by extending the file names with increasing numbers, e.g. data001.log, data002.log, ...

7.13.3 Log Files Content

The exported log file does not only show the discussed entries data, but also separate lines with

- the type of log file
- the analyzer tag, if such has been setup (☞ 6-115)
- the analyzer serial number
- column headings for the entries fields

For further processing, import that file e.g. into a spreadsheet.

Example

Imported into a text file, for a 3 channel instrument the above settings would give the following log file layout:

```
# EMERSON→X-STREAM XE→Data Logs CR
CR LF
# Tag:    →-- The Device Tag --CR
CR LF
# Serial: →SN4294909952 CR
CR LF
# --------→--------→--------CR
CR LF
Date→Time→→Ch1:Conce[ppm]→Status→→Ch2:Conce[ppm]→Status→→Ch3:Conce[ppm]→Status→CR LF
10/22/2009→10:20:36→→933.00→G→→500.00→G→→390.00→G→CR LF
10/22/2009→10:20:37→→934.00→G→→498.00→G→→392.00→G→CR LF
10/22/2009→10:20:38→→936.00→G→→499.00→G→→391.00→G→CR LF
```

Imported into a spreadsheet software, it looks like this:

# EMERSON	X-STREAM XE	Data Logs								
# Tag:	-- The Device Tag --									
# Serial:	SN4294909952									
# --------	--------	--------								
Date	Time		Ch1:Conce[ppm]	Status		Ch2:Conce[ppm]	Status		Ch3:Conce[ppm]	Status
10/22/2009	10:20:36		933	G		500.00	G		390.00	G
10/22/2009	10:20:37		934	G		498.00	G		392.00	G
10/22/2009	10:20:38		936	G		499.00	G		391.00	G

Note!
Date format is dd/mm/yyyy
Time format is hh:mm:ss (with 24 h format)
Status codes are: G = Good, F = Failure, A = Alarm, M = Maintenance, C = Check function, O = Out of specification, S = Simulate, X = Absent

Fig. 7-23: *Example of Log File*

7.14 Files on USB Memory Device

After connecting or formatting an USB device, or after a first log file export, a special file structure is present on the stick, ☞ figure below.

Furthermore, two files are created within this structure:

- autorun.inf
- xe_win_tools.zip

7.14.1 autorun.inf

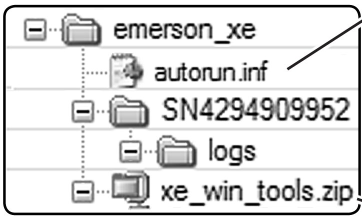


Fig. 7-24: *USB File System Structure*

'Autorun.inf' can be used to automatically start actions, when the USB device, it is saved on, is connected to the analyzer.
Each time, an USB mass memory device is connected, the analyzer checks for the presense of a plain text file, called 'autorun.inf'. If such a file does not exist, a template file is automatically created, as well as, if need be, the file structure.

Another file, automatically created, is called 'xe_win_tools.zip'; ☞ 7-93.

```
# Emerson X-STREAM XE | USB-AUTORUN File
#
# -- Functions  ---------------------------------------
#
# Remove # from a line below to activate a function
#
# SAVE_CONFIG Save current configuration to USB
# SAVE_FIRMWARE Save firmware (incl. config) to USB
# SAVE_DATALOGS Save data logger files to USB
# SAVE_EVENTLOGS Save event logger files to USB
# SET_PASSWORDS Set all passwords to factory
#                    defaults (LOI and webbrowser)
#
# .---------------------------------------------------
```

Fig. 7-25: *Autorun.inf Template*

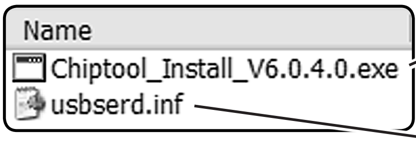
The automatically created autorun.inf acts as a template, containing

- help text,   and
- instruction lines: To enable, just remove the leading '#' and save the file as text file to the device again.

The file is scanned line by line. Any line not starting with '#' is checked for a valid key word (CAPITAL terms in the template's functions section), which is passed to a batch loop processor, to be executed as soon as possible.

7.14.2 xe_win_tools.zip

This ZIP contains some files to be used with a Microsoft Windows based computer only.



Chiptool for Ethernet connections, enables to remotely identify an analyzer by its IP address, without requiring front panel access.

USB driver for MS Windows PC

7.15 Web Browser

7.15.1 Connection Via Network

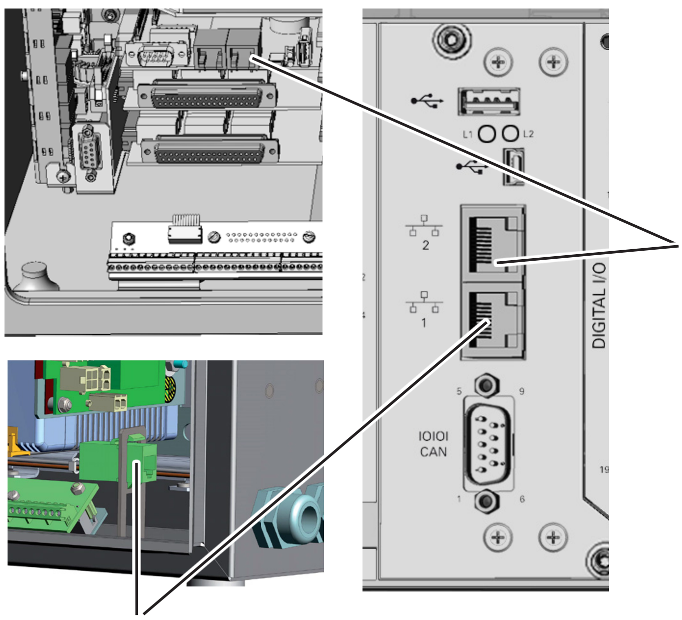


Fig. 7-26: *Ethernet Connectors*

To gain access to the instrument's web browser interface, first ensure the instrument is powered and connected to your network via Ethernet1 connector (Fig. 7-26)

By factory default settings the analyzer is configured to receive a valid network address by a DHCP server.
Next enter INFO, to check if the instrument has been assigned a valid network IP address:

Info	
Firmware	1.0
DSP version	1.0
Serial no	1234567.10
Components..	
Installed options..	
Ethernet1 IP	123.456.78.9
Ethernet2 IP	192.168.1.2
▼ Time	10/01/10 14:00

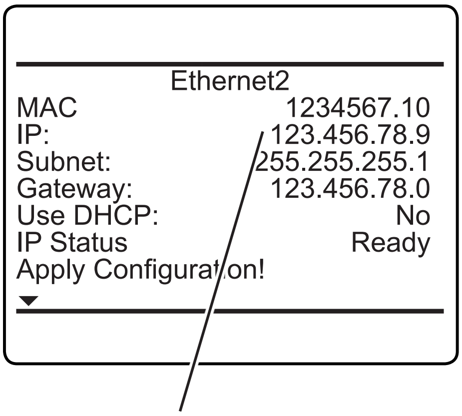
IP address for Ethernet1 connector

If no network IP address has been assigned, check the network settings (☞ 6-94)

Connect your computer to the network, open a web browser and enter the instrument's IP address. If everything is configured properly, the analyzer's logon screen shows up (☞ 7-96).

7.15.2 Connection to Single Computer

Setup..
Communcation..
Ethernet2..



IP address for Ethernet2 connector

To directly gain access to the instrument's web browser interface, first ensure the instrument is powered. Next connect it to the computer's network adapter via Ethernet2 connector (see Fig. 7-28) by means of an **Ethernet cross-over cable**. Standard Ethernet cables do NOT support direct connections!

- For Ethernet2 connector set *"Use DHCP"* to **No** (see figure to the left).

Depending on settings possibly carried out earlier, the analyzer may now show an IP (see figure to the left). If so, setup your computer's IP the same way, only differing in the last group (here e.g. to 123.456.78.10).

Alternatively you may use the analyzer's fixed IP, that is not shown on any menu page and is accessible via Ethernet2 only:

- The analyzer is now assigned the IP 192.168.1.88.
- Configure your computer's IP to meet the same net (192.168.1.) and assign a new IP (e. g. 192.168.1.10). Do not use the same IP as is assigned to the analyzer.

Configuring an IP Address for Computers Running Microsoft Windows

- **To configure your computer you need an administrator account!**
- Go to Start > Control Panel > Network Connections
- Right-click on your LAN connection and click "Properties"
- Under the heading "This connection uses the following items", click "Internet Protocol (TCP/IP)"
- Click "Properties"
- A new window should pop up, click "Alternate Configuration"
- Click "User Configured" radio button
- Setup the IP Address as 192.168.1.10, Subnet Mask as 255.255.255.0 and Default Gateway as 192.168.1.1.
- Click "OK"
- Click "Close" in "LAN connection properties".

On your computer open a web browser and enter the instrument's IP address. If everything is configured properly, the analyzer's logon screen shows up (☞ next page).

7.15 Web Browser

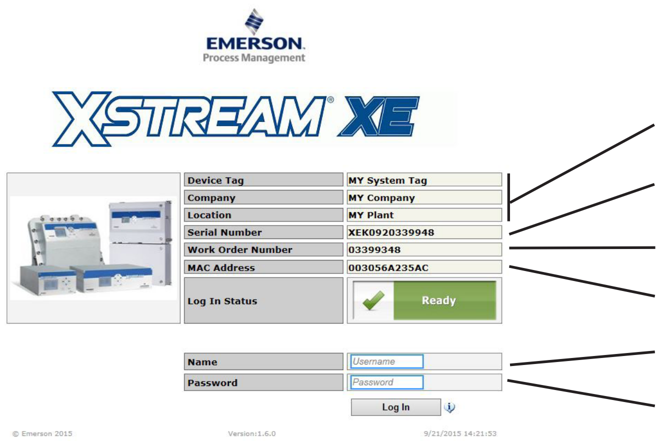


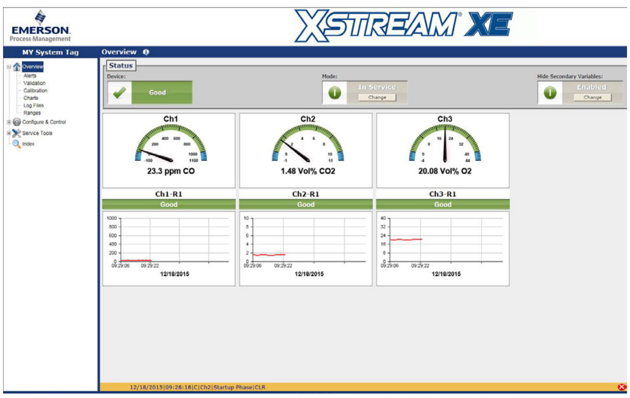
Fig. 7-27: *Web Browser Logon Screen*

You find the IP address in your web browser address line.

Default user name is: **user1**

Default password is: **password**

We recommend to set new passwords, to limit access to critical submenus (see online help).



After logon, the measurements screen appears.
Click on the left most icon (question mark) in the status bar, to receive comprehensive online help on the X-STREAM XE web browser interface.

Chapter 8
Troubleshooting

8.1 Abstract

This chapter covers troubleshooting the analyzer:

Section 8.2 describes messages possibly appearing in the measuring screen‘s status line gives hints on the potential causes and on how to solve the problem(s).

Two tables differentiate between analyzer related messages and channel related messages.

As the analyzer software is not capable to detect all problems and faults, Section 8.3 describes such faults, their consequences, gives hints on potential causes and on how to solve the problem(s).

Section 8.4 gives detailled instructions on how to replace or adjust components, addressed to personnel familiar with the aspects of working on such components.

8.2 Solving Problems Indicated by NAMUR Status Messages

As mentioned before, status messages show up in the measuring display‘s last line. Multiple status messages, active at a time, show up sequentially in this status line. To see all status messages at a glance, enter STATUS: If any status is set, the corresponding menu line appears, whereat only the first 4 lines are of interest here (NAMUR status).

```
Failures..
Off-Specs..
Maintenance requests..
Function checks..
Measurement..
Calibration..
Alarms..
Operation Hours Meter..
Time                    4/01/11 13:30
```

Enter any status line to see detailled status messages.

In the following table, all possible NAMUR status messages are listed in alphabetical order, together with hints on the possible causes, and tips on how to solve the problems.

Depending on the NAMUR status level assigned, the instrument can also activate status relay outputs, according the NAMUR NE 107 specifications.

Notes!

Digital outputs assigned to status signals are automatically setup to be Failsafe: Failsafe means, relay output coils are powered during normal operation.

Recommended actions preceded by a bullet are alternatives.

If recommended actions do not solve a problem, call Emerson Service!

Supported NAMUR status levels:

Failures: Require immediate actions. The analyzer is not any longer working properly, and the output signal is invalid due to malfunction.

Off-spec: The analyzer is working outside its specification (e.g. measuring range), or internal diagnostics indicate deviations due to internal problems. To achieve proper outputs, corrective action is required.

If solving a reported problem requires working inside an open instrument, take care of the safety instructions, given at the beginning of this manual!

Check request (*or maintenance requests***)**: The instrument is still working properly, within its specifications and the output signal is valid, but maintenance is required in for-seeable future, because a function will soon be restricted or a wear reserve is nearly exhausted.

Function check: The analyzer is still working properly, but currently is in a status where the output signal is temporarily invalid (e.g. frozen) due to some ongoing procedures (e.g. during calibration).

8.2.1 Analyzer Related NAMUR Messages

<table>
<tr><th>Message
Status level</th><th>Explanation</th><th>Recommended Actions</th></tr>
<tr><td rowspan="2">Calculator program error
Maintenance</td><td>While running the calculator, an inconsistency was detected</td><td rowspan="2">• Check the calculator program for syntax errors, impossible commands or signal references
• Check for divisions by 0</td></tr>
<tr><td>Division by 0 detected</td></tr>
<tr><td>Can‘t open Data Logger file
Maintenance</td><td>Accessing the data logger file is not possible</td><td rowspan="2">• Check if internal disk is present / installed
• Call Emerson Service</td></tr>
<tr><td>Can‘t write to Data Logger file
Maintenance</td><td>Accessing the data logger file is not possible</td></tr>
<tr><td>Checksum error
Maintenance</td><td>Creating the factory configuration file caused a checksum error.</td><td>Store a new factory configuration file.</td></tr>
<tr><td>Cfg checksum error
Maintenance</td><td>Creating the user configuration file caused a checksum error.</td><td>Create a new user configuration file.</td></tr>
<tr><td>Cfg file open error
Maintenance</td><td>Opening the user configuration file is not possible.</td><td rowspan="3">Call Emerson service</td></tr>
<tr><td>Cfg file read error
Maintenance</td><td>Writing to the user configuration file is not possible.</td></tr>
<tr><td>Cfg file write error
Maintenance</td><td>Writing to the user configuration file is not possible</td></tr>
<tr><td>Device not in Service
Function check</td><td>Operator has set the analyzer to function check mode</td><td>Set analyzer into service</td></tr>
<tr><td>DISK Free space warning
Maintenance</td><td>Internal disk usage exceeded specified limit (default: 80 %)</td><td rowspan="2">Free space by deleting files</td></tr>
<tr><td>DISK full
Maintenance</td><td>Internal disk usage exceeded 95 % limit</td></tr>
</table>

8.2.1 Analyzer Related Messages

Message *Status level*	Explanation	Recommended Actions
E-Mail: Not sent *Maintenance*	Failed to send e-mail	• Check Ethernet connection • Check SMTP configuration
E-Mail: Could not open LOG file *Maintenance*	Accessing log file not possible No NAMUR!	• Check if internal disk is present / installed • Call Emerson service
External Failure *Failure*	An external source (e.g. digital input or PLC program) meets a failure condition that is forwarded to the self-diagnostics system.	• Check the assigned digital input for the condition. • Check PLC program for the condition. • Reassign digital inputs to not being forwarded to the diagnostic system.
External FctCheck *Function check*	An external source (e.g. digital input or PLC program) meets a function check condition that is forwarded to the self-diagnostics system.	
External MaintRequ *Maintenance*	An external source (e.g. digital input or PLC program) meets a maintenance request condition that is forwarded to the self-diagnostics system.	
External OffSpec *Off-spec*	An external source (e.g. digital input or PLC program) meets a out-of-specification condition that is forwarded to the self-diagnostics system.	
Factory file open error *Maintenance*	Opening the factory configuration file is not possible.	• Create a new factory configuration file • Check the file system for consistency using CHKDISK tool

8.2.1 Analyzer Related Messages

Message *Status level*	**Explanation**	**Recommended Actions**
Factory file read error *Maintenance*	Reading the factory configuration file is not possible	• Check if internal disk is present / installed • Call Emerson service
Factory file write error *Maintenance*	Writing the factory configuration file is not possible. This message does not appear during normal operation!	
FATAL!! Configuration data destroyed *Failure*	The instrument is now unconfigured, because retrieving the configuration data from several sources failed.	
FATAL: FRAM read/write error *Maintenance*	The instrument is now unconfigured, because retrieving the configuration data from several sources failed.	Call Emerson service
Flash write count over limit *Maintenance*	Write cycles to internal CPU Flash Memory exceeded number of 90,000	
Limitation analog output 1 *Off-spec*	Concentration assigned to the indicated analog output is outside configured ranges: Analog output is limited to configured ranges	• Use another measurement range. • Extend analog output range configuration if possible. • Run measurement inside its given ranges.
Limitation analog output 2 *Off-spec*		
Limitation analog output 3 *Off-spec*		
Limitation analog output 4 *Off-spec*		
Limitation analog output 5 *Off-spec*		
PLC program error *Maintenance*	While installing the PLC program, a program error was discovered	Check the PLC program for syntax errors, wrong commands or references

8.2.1 Analyzer Related Messages

Message *Status level*	**Explanation**	**Recommended Actions**
SCAL blowback *Function check*	Device runs system calibration's blowback mode	• Wait until system calibration procedure is finished • Cancel system calibration procedure
SCAL program sequence *Function check*	Device runs system calibration's program sequence	
SCAL spanning *Function check*	Currently a system calibration's spanning is ongoing	
SCAL zeroing *Function check*	Currently a system calibration's zeroing is ongoing	• Wait until system calibration procedure is finished • Cancel system calibration procedure
SCAL zeroing & spanning *Function check*	Currently a system calibration (zeroing and spanning) is ongoing	
Sensor CRC-check *Failure*	XPSV - CPU communication failure	Call Emerson service, if message shows up repeatedly
Sensor command buffer overflow *Failure*		
Sensor failure *Failure*		
Sensor invalid message length *Failure*		
SENSOR RESET *Maintenance*		

8.2.1 Analyzer Related Messages

Message *Status level*	**Explanation**	**Recommended Actions**
USB free space warning *Maintenance*	The attached USB storage devices's free memory exceeded the setup limit (☞ 6-120)	
USB stick full *Maintenance*	The attached USB storage device has not sufficient free memory to store data	

8.2.2 Channel Related Messages (preceded by Channel Tag, e.g. CO2.1)

<table>
<tr><th>Message
Status level</th><th>Description</th><th>Recommended Actions</th></tr>
<tr><td>Concentration Is Higher Than Limit
Off-spec</td><td rowspan="2">Currently the actual concentration is outside the analyzer's range limits. The shown measuring value does not comply to the actual concenctration.</td><td>Reduce concentration</td></tr>
<tr><td>Concentration Is Lower Than Limit
Off-spec</td><td>Increase concentration</td></tr>
<tr><td>Device Not in Service
Function check</td><td>Operator has set the analyzer to function check mode</td><td>Set analyzer into service</td></tr>
<tr><td>External Failure
Failure</td><td rowspan="4">An external source (e.g. digital input or PLC program) meets a failure condition that is forwarded to the self-diagnostics system.</td><td rowspan="4">• Check the assigned digital input for the condition.
• Check PLC program for the condition.
• Reassign digital inputs to not being forwarded to the diagnostic system.</td></tr>
<tr><td>External FctCheck
Function check</td></tr>
<tr><td>External MaintRequ
Maintenance</td></tr>
<tr><td>External OffSpec
Off-spec</td></tr>
<tr><td>Flow High
Maintenance</td><td>The activated flow monitor detected a too high flow according its configured high level.</td><td>• Ensure proper flow
• Increase limit if appropriate</td></tr>
<tr><td>Flow High-High
Failure</td><td>The detected flow is too high</td><td>• Check flow adjusting equipment, reduce flow to accepted value
• If applicable check internal or external pump function, reduce flow to accepted value</td></tr>
<tr><td>Flow Low
Maintenance</td><td>The activated flow monitor detected a too low flow according its configured low level.</td><td>• Ensure proper flow
• Decrease limit if appropriate</td></tr>
</table>

8.2.2 Channel Related Messages

Message *Status level*	Description	Recommended Actions
Flow Low-Low *Failure*	The detected flow is too low or missing due to a leak, not limited to the instrument's internal gas path	• Check the external and internal gas path for leakage and plugging • If applicable check internal pump function
Invalid Interference Value *Off-spec*	A measuring value used for cross interference compensation is found to be erroneous.	Check status of interfering components
Linearizer Overflow *Off-spec*	The current concentration value is above the upper linearization range limit, so measuring results are not reliable.	Adjust gas concentration to be within range
Linearizer Underflow *Off-spec*	The current concentration value is below the lower linearization range limit, so measuring results are not reliable.	Adjust gas concentration to be within range
Operation Hours Exceeded *Maintenance*	The operation hours exceeded the service interval time.	• The instrument, or selected components require maintenance • After maintenance, enter SETUP - OPERATION HOURSMETER(☞6-114),to reset the counter.
No Sample Gas *Function check*	The concentration measurement does not represent the normal value. Possible reasons: Calibration procedure is busy.	• Check, if a calibration is ongoing • If no calibration is ongoing, check if sample gas is applied (if need be, check for open sample gas valves)
Range Overflow *Off-spec*	Gas concentration is out of measurement range and therefore linearization curve does not apply (measuring results are not reliable).	• Select higher range (*polynomial linearization mode only*) • Adjust gas concentration to be within range

8.2.2 Channel Related Messages

Message *Status level*	**Description**	**Recommended Actions**
Range Underflow *Off-spec*	Gas concentration is out of measurement range and therefore linearization curve does not apply (measuring results are not reliable).	• Select lower range (*polynomial linearization mode only*) • Adjust gas concentration to be within range
Secondary Sensor Signal Simulation *Function check*	Any secondary sensor's signal is simulated for service purposes	• Restart device. • Ask service personnel to deactivate simulation.
Sensor ADC *Failure*	Input voltage applied to an internal DC signal input (DC 1...5) too high	• Adjust sensors output voltage to be within 0 .. 5 V limit • Replace sensor
	Input voltage applied to an internal AC signal input (WS 1...4)too high	• Adjust sensors output voltage to be within ± 6 V limit • Replace sensor
Sensor Chopper *Failure*	Internal failure bit of electronics board XSP is set	• Switch analyzer off and on again • Check red LED on chopper board UCC • Replace chopper
Sensor Communication Timeout *Failure*	The serial communication between the main controller and the sensor interface has timed out. The reason is unknown.	Check both boards, and proper connections
Sensor Detector *Failure*	XSP's failure bit was set	• Switch off / on the analyzer • Check if VVS signal is proper • Replace detector
Sensor Flow *Failure*	The flow sensor is not working properly	Check the sensors function, and if need be, replace the sensor.
Sensor Pressure *Off-spec*	The pressure measurement is not working properly for compensation purposes	Configure pressure to be within limits
Sensor Signal Simulation *Function check*	The primary sensor signal is simulated for service purposes	• Restart device. • Ask service personnel to deactivate simulation.

8.2.2 Channel Related Messages

Message *Status level*	Description	Recommended Actions
Sensor Source + *Failure*	The current through the IR or UV source is too high	• Check for IR source internal resistance is > 6 Ohms • Replace source
Sensor Source - *Failure*	The current through the IR or UV source is too low	• Check for IR source internal resistance is < 8 Ohms • Check for broken cables • Replace source
Sensor Temperature *Off-spec*	The temperature measurement is not working properly	• Check the temperature sensor • Check function of heaters
Spanning Started *Function check*	Span calibration is ongoing	• Wait for the procedure to finish. • Cancel the procedure
STANDBY Status *Function check*	All valves are closed	-
Startup Phase *Function check*	Physical components starting up	Wait until all components are working properly
Tolerance Check Failed *Maintenance*	Difference between setpoint and actuals is too high	• Disable check or change tolerance • Check components for proper function
Unstable Measurement *Maintenance*	Measurement too noisy while calibrating	• Check for constant gas flow • Increase t_{90} time
Warming Up *Function check*	Some components need to be at a specific temperature to work properly. This message shows, until all components reached their temperatures.	• Wait until warmup time has elapsed • Check function of heaters and temperature control
Zeroing Started *Function check*	Zero calibration ongoing	• Wait for the procedure to finish. • Cancel the procedure

8.3 Solving Problems Not Indicated by Status Messages

The following table lists possible faults not detectable by the instrument's software, gives hints on the potential causes, and tips on how to solve the problems.

If solving a problem requires working inside the instrument take care of the safety instructions given at the beginning of this manual!

Note on X-STREAM field housings!

To see the current analyzer status, or operate the instrument even if the front door is open, just loosen the screw, fixing the front panel, and swivel the front panel to the side or to the top (flameproof XEFD), as shown in figure 8-1.

Notes!

Recommended actions preceded by a bullet are alternatives.

If recommended actions do not solve a problem, call Emerson Service!

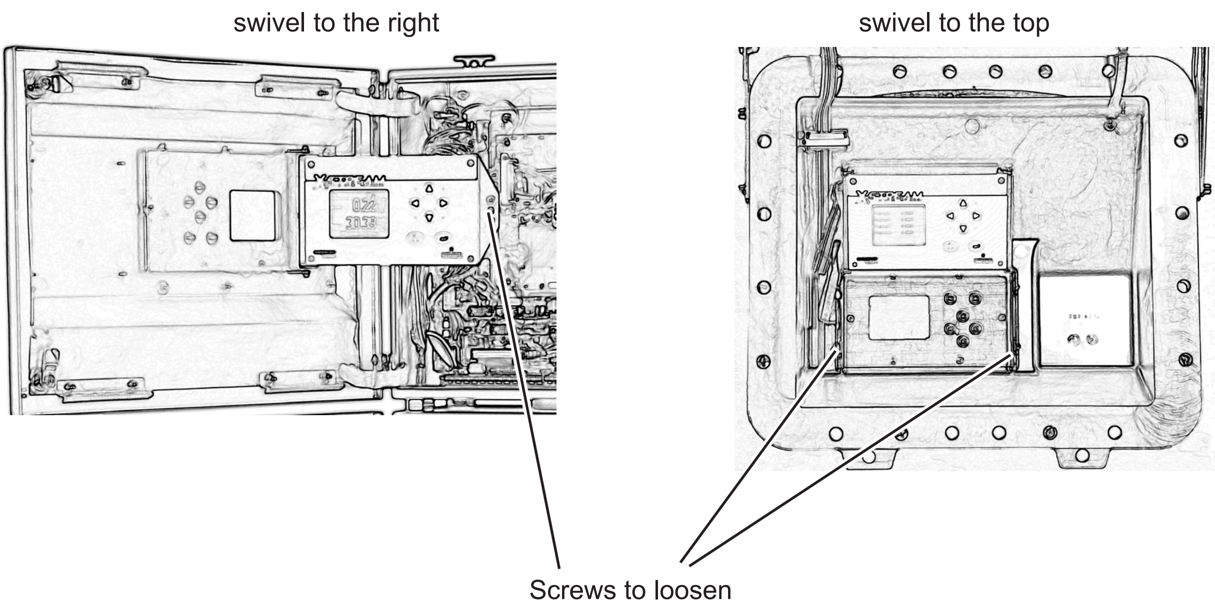


Fig. 8-1: *X-STREAM XEF, XDF and XEFD, Opened With Visible Front Panel*

8.3 Solving Problems Not Indicated by Status Messages

Situation	Description	Recommended Actions
Display Dark	Power supply missing	• Check power connection • Check power supply • Check instrument‘s power fuses • Check power supply unit: green LED (OK)
	Front panel connection faulty	Check front panel connections
Instrument Does Not Work nor Respond on Inputs	CPU hang up	Disconnect power to reset CPU
No Analog Output Signal	External failure	Check external circuitry for failures
	Internal connection failure	• Check signal connection at P22 of board XPSA • XPSA: If red LED “No PWM” glows - check connection to P19 • XPSA: LED “No PWM” dark - check power connection to XPSA (2-pole cable br/wht)
	Analog outputs 2 - 4 affected	Check installation of module XSIA on XPSA board
Digital Outputs Not Working Properly	External failure	Check external circuitry for failures
	Configuration failure	Check digital outputs menu settings
	Outputs 1 - 4 affected	• XPSA: If red LED “TIME-OUT” glows - check connection to P33 • XPSA: LED “TIMEOUT” dark - check power connection to XPSA (2-pole cable br/wht)

8.3 Solving Problems Not Indicated by Status Messages

Situation	Description	Recommended Actions
Digital Outputs Not Working Properly (cont.)	Outputs on extension board(s) (XDIO) affected	• XDIO: If LED “TIMEOUT” glows - check jumpers on XDIO. XDIO #1: jumper on ADR2 XDIO #2: jumpers on ADR2 & ADR0 • XDIO: If LED “TIMEOUT” glows - check connection to P33 • XDIO: If LED “NO SPI” glows - check internal SPI communication cable (10 pole cable)
Digital Inputs Not Working Properly	External failure	Check external circuitry for failures
	Configuration failure	Check digital inputs menu settings
	Outputs on extension board(s) (XDIO) affected	• XDIO: If LED “TIMEOUT” glows - check jumpers on XDIO. XDIO #1: jumper on ADR2 XDIO #2: jumpers on ADR2 & ADR0 • XDIO: If LED “TIMEOUT” glows - check connection to P33 • XDIO: If LED “NO SPI” glows - check internal SPI communication cable (10 pole cable)
Internal Valves Not Working Properly	Connection failure	• Check electrical connection of valves • XPSA: If red LED “TIMEOUT” glows - check connection to P33 • XPSA: LED “TIMEOUT” dark - check power connection to XPSA (2-pole cable br/wht)
External Valves Not Working Properly	Valves connected to digital outputs	See “Digital outputs not working properly”
	Valves not connected to digital outputs	Check external valve controller

8.3 Solving Problems Not Indicated by Status Messages

Situation	Description	Recommended Actions
Serial Communication Not Working Properly	External failure	Check external circuitry for failures
	Connection failure	• XPSA: If red LED "TIME-OUT" glows - check connection to P33 • Check installation of interface module (SIF 232 or 485)
Fluctuating or Invalid Readout	Leak in gas path	Perform a leak test
	Ambient air contains high concentration of measured gas component	• Check absorber (at chopper/measuring cell) and replace if need be. • Purge instrument with inert (neither absorbing, nor interfering) gas
	Fluctuating gas pressure	• Check gas path before and behind cell and sensor • Remove restriction behind gas outlet • Reduce gas flow or pump rate
	Sensor or detector not connected	Check detectors connections
	Electrochemical Oxygen sensor worn-out	Check sensor and replace if need be
	IR channel: Source not connected or defective	• Check connections: X3 (1/2) / source channel 1 X3 (4/5) / source channel 2 • If source housing is cold: Exchange all sources in case of multi-channel analyzer / replace source if need be (see service manual)

8.3 Solving Problems Not Indicated by Status Messages

Situation	Description	Recommended Actions
Fluctuating or Invalid Readout (continued)	Analog preamplifier of affected channel defective	Check measuring point (☞ page 8-19)
	Gas path(s) polluted	• Check analysis cells and windows for pollution • Clean polluted parts (see service manual) • Check gas paths for pollution and clean gas paths if need be
	Wrong pressure value used for compensation	• Set ambient pressure to proper value (☞ page 6-74) • Sensor failure (☞ status message “Sensor pressure”, page 8-10)
	Condensation inside gas path	• Check temperature of gas path(s) • Remove all sources of condensation • Keep all temperatures at least 10 °C above dew point
Readout Damping Time Too Long	Wrong signal damping settings	
	Pump rate too low	
	Gas path(s) polluted	• Check gas path and sample handling system for pollution • Clean gas path

8.3 Solving Problems Not Indicated by Status Messages

Situation	Description	Recommended Actions
No Gas Flow	Sample gas pump (option) switched off	
	Membrane of sample gas pump defective	Replace sample pump membrane
	Sample gas pump defective	Replace sample gas pump
	Solenoid valves (option) not opened / defective	External valves: • Check connection between valves and digital outputs All valves: • Check valve seat and replace if need be • Replace solenoid valves • For valve control via serial interface or digital inputs: • Any valve activated?
	Gas path(s) polluted	• Check gas path and sample handling system for pollution • Clean gas path

8.4 Troubleshooting on Components

This section gives information on how to check and replace internal components.

Some work described on the next pages need to be carried out by qualified personnel only, and may require special tools, to ensure the instrument or component is not damaged or disadjusted!

Opening X-STREAM analyzers ☞ page 8-20

Signal connectors ☞ page 8-23

Sample Pump: Replacement of Diaphragm ☞ page 8-24

Paramagnetic Oxygen Cell: Adjustment of physical zero ☞ page 8-35

Thermal Conductivity Cell: Adjustment of output signal ☞ page 8-38

WARNING

ELECTRICAL SHOCK HAZARD

Working at opened and powered instruments means working near live parts and is subject to instructed and trained personnel only!

WARNING

ELECTRICAL SHOCK HAZARD

Live parts are accessible when working at open instruments!

Take care to observe all applicable safety instructions!

8.4 Troubleshooting on Components

⚠ WARNING

HAZARD FROM EXPLOSIVE, FLAMMABLE AND HARMFUL GASES

Before opening gas paths they must be purged with ambient air or neutral gas (N_2) to avoid hazards caused by toxic, flammable, explosive or harmful to health sample gas components!

⚠ CAUTION

HIGH TEMPERATURES

While working at internal components hot surfaces may be accessible, even after the instrument has been disconnected from power!

⚠ CAUTION

ELECTROSTATIC DISCHARGE HAZARD

Working at internal components of electronical and electrical instruments may cause electrostatic discharge (ESD), destroying components!

We recommend special antistatic workplaces for working at open instruments! If no such workplace is available, at minimum perform the following procedures to not destroy electronic components:

Discharge the electric charge from your body. Do this by touching a device that is grounded electrically (e.g. instruments with earth connectors, heating installations). This should be done periodically when working at open instruments (especially after leaving the service site, because e.g. walking on low conducting floors might cause additional ESD).

8.4 Troubleshooting on Components

8.4.1 Opening X-STREAM Analyzers

WARNING

ELECTRICAL SHOCK HAZARD

Live parts are accessible when working at open instruments!

Take care to observe all applicable safety instructions!

8.4.1.1 How to Open X-STREAM XEGP

Remove the top cover after loosening the 12 screws.

If your instrument features an internal heated box, ☞ fig. 8-4 on next page for information on how to open.

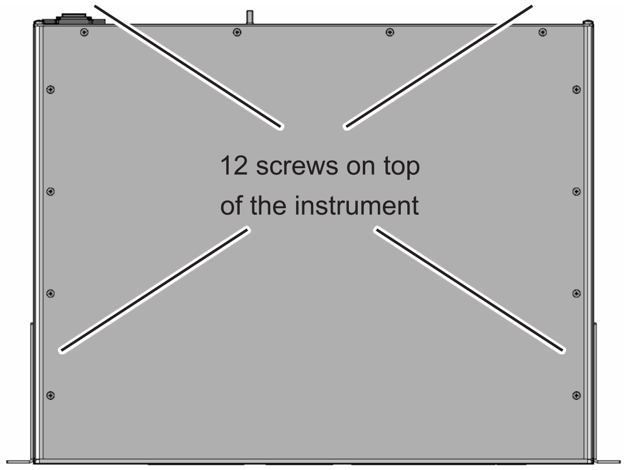
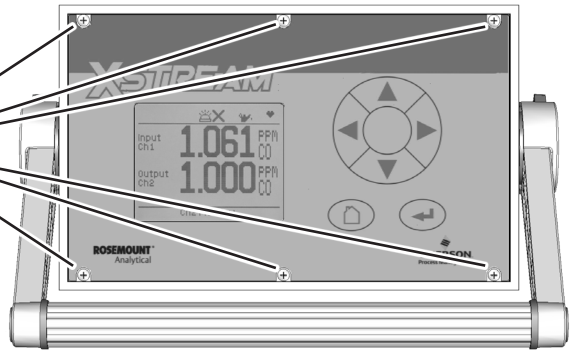


Fig. 8-2: *X-STREAM XEGP*

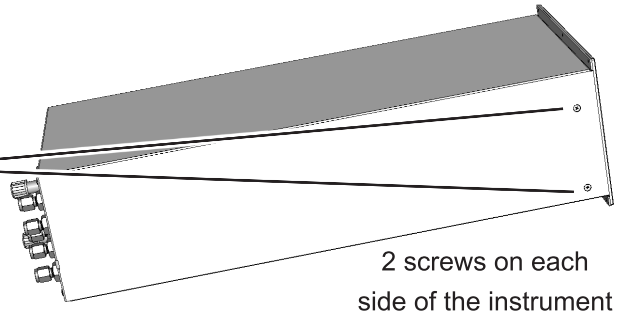
8.4.1.2 How to Open X-STREAM XEGK



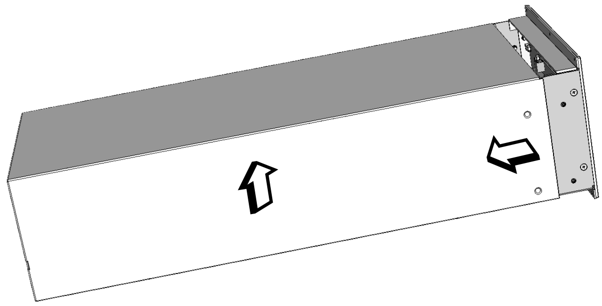
If your instrument is equipped with a handle
- loosen the 6 screws at the front panel,
- to only get access to the cover screws, push frame and handle about 2 cm / 1" towards the rear.

Note!

To completely remove frame and handle, you need to disconnect all gas and electrical connections and push frame and handle over the rear panel.



- remove the 4 screws for the cover,



- push the cover towards the rear and remove it.

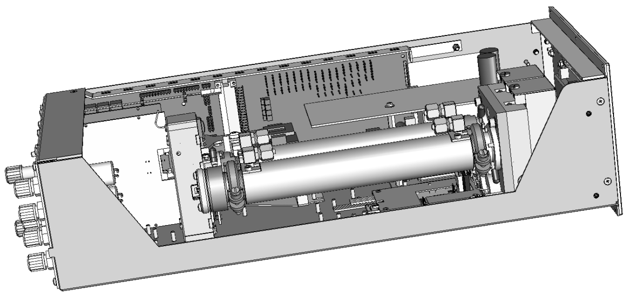


Fig. 8-3: *X-STREAM XEGK*

8.4 Troubleshooting on Components

8.4.1.3 How to Open X-STREAM Field-housings

Depending on the individual analyzer configuration, either open the upper or lower front door to the left, utilizing the two sash fasteners.

8.4.1.4 How to Open X-STREAM XEFD

To open a X-STREAM XEFD loosen the 20 screws located at the instrument‘s flange. Then carefully flip down the front door to not damage the instrument, hinges or equipment installed below the analyzer.

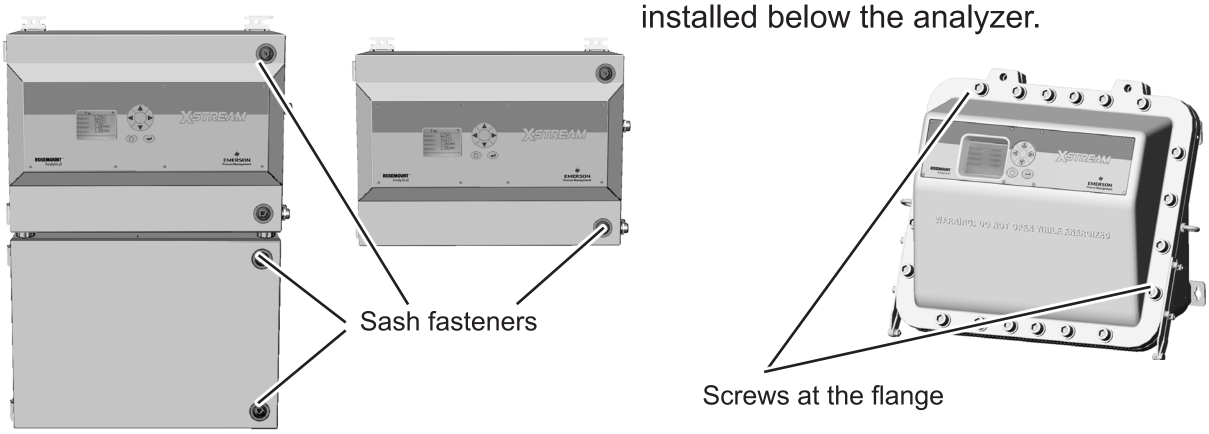


Fig. 8-4: *X-STREAM XEXF Field Housings and XEFD - How to Open*

WARNING

EXPLOSION HAZARD

X-STREAM XEFD as well as special variations of X-STREAM XEF and XDF Fieldhousings are intended to be installed in hazardous areas.

Maintaining such instruments is permitted only considering special conditions, given in the associated separate manuals.

Do not open nor maintain instruments in hazardous areas without having read and understood all associated instruction manuals!

CAUTION

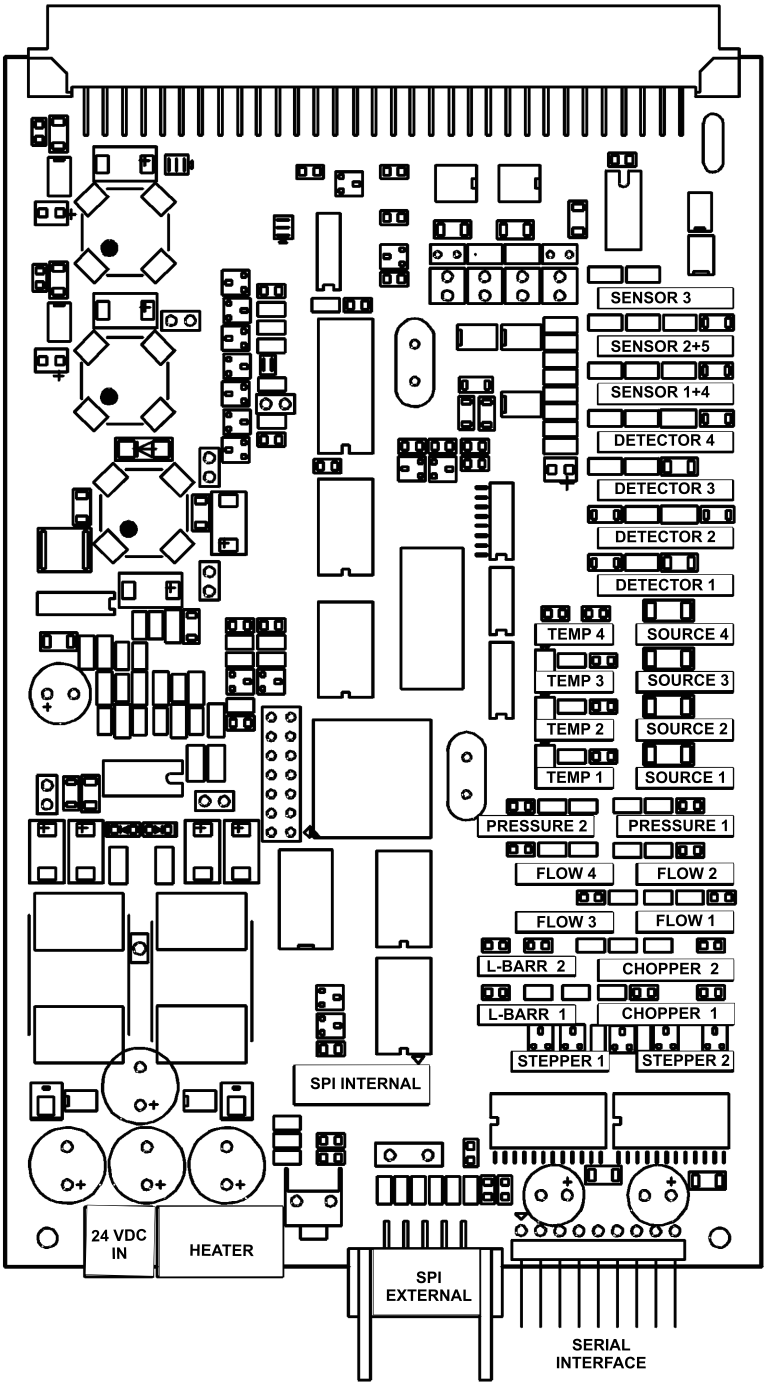
GASKETS AT LOW TEMPERATURES

Consider that enclosure gaskets may be frozen when the instrument is installed outdoors. Carefully open the enclosure at temperatures below -10 °C to not damage the gaskets.

Damaged gaskets void the ingress protection, possibly causing property damage, personal injury or death.

8.4 Troubleshooting on Components

8.4.2 Signal Connectors on XSP Board



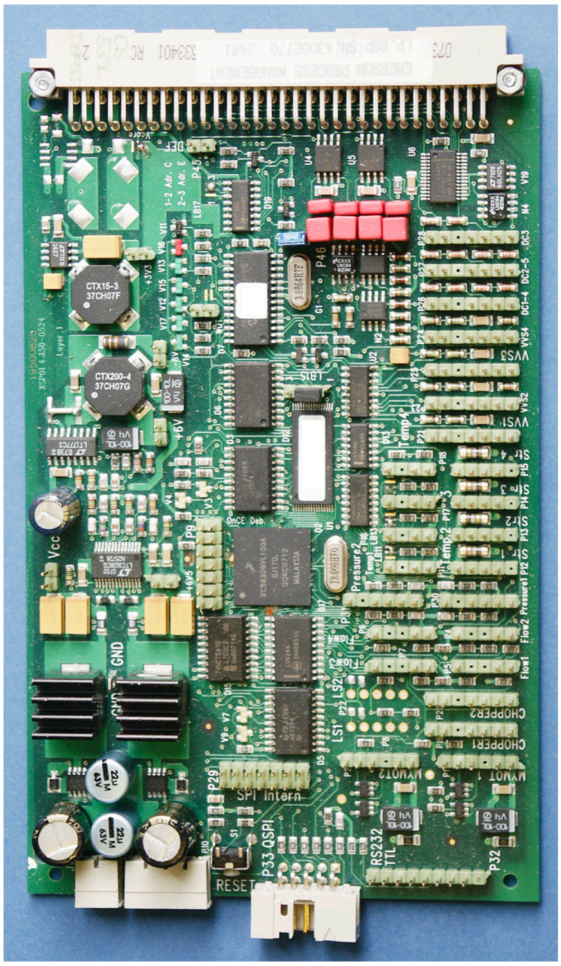
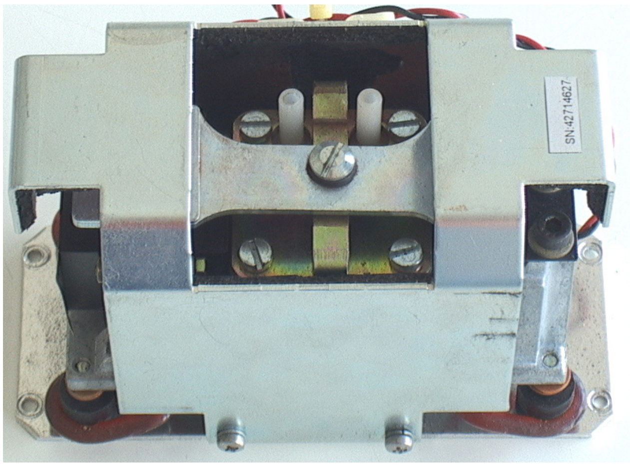


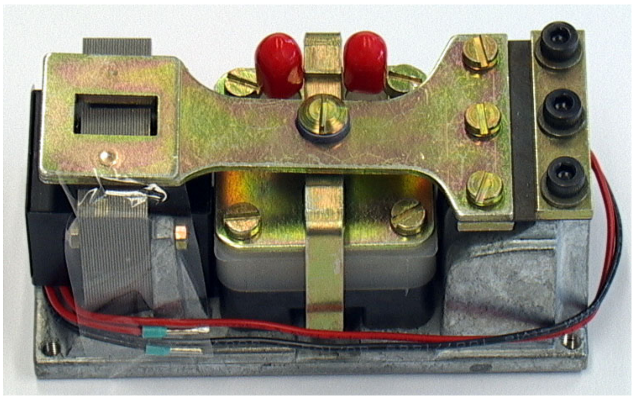
Fig. 8-5: XSP - Allocation of Signal Connectors

8.4.3 Sample Pump: Replacement of Diaphragm

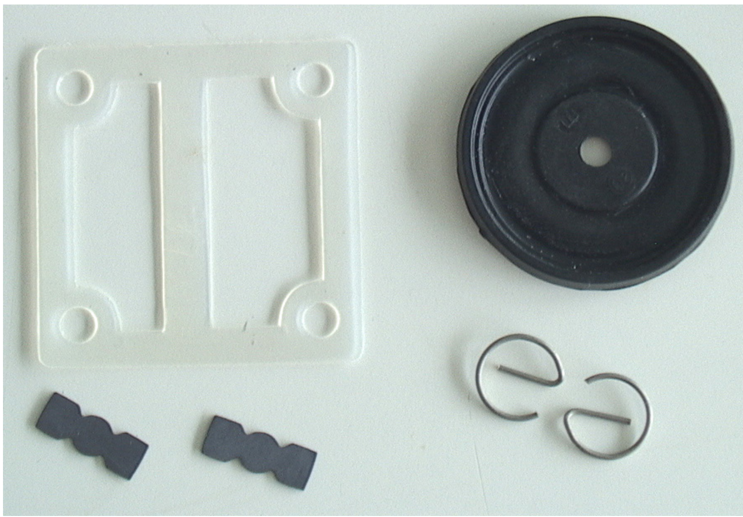


This instruction explains the procedure to replace the diaphragms of sample gas pumps (PN 42716569) used in the X-STREAM series gas analyzers.

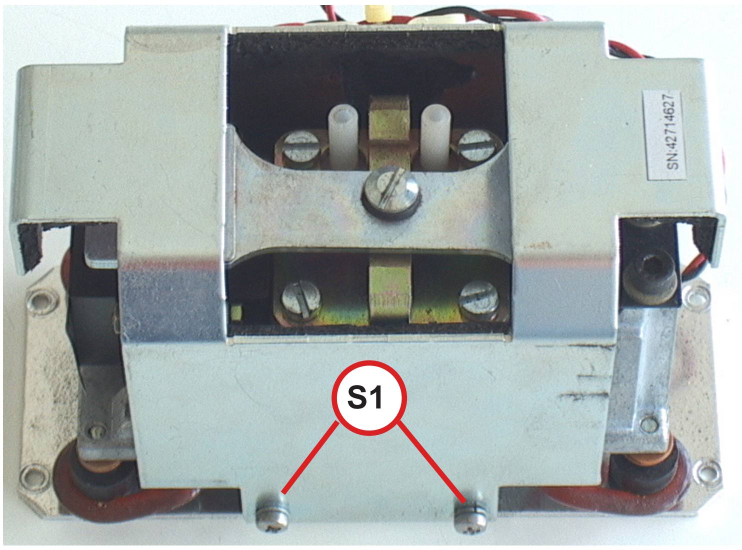
To do so you need to dismantle the pump from your analyzer.



8.4 Troubleshooting on Components



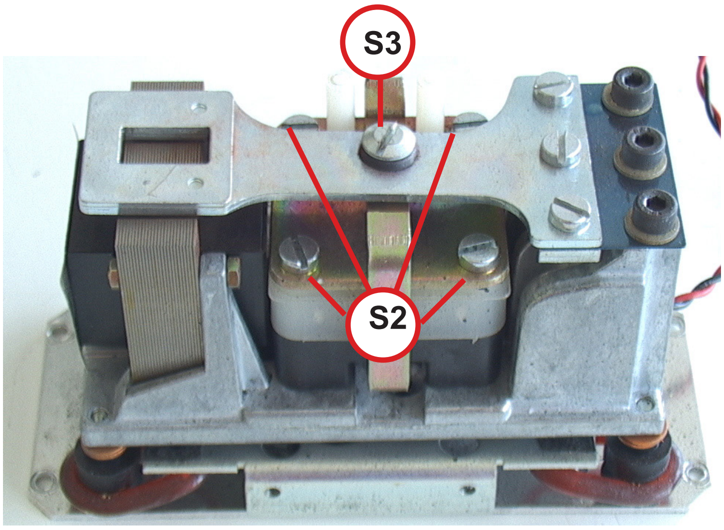
Required parts for the spare parts kit for the pump (PN 0375946).



Step 1:

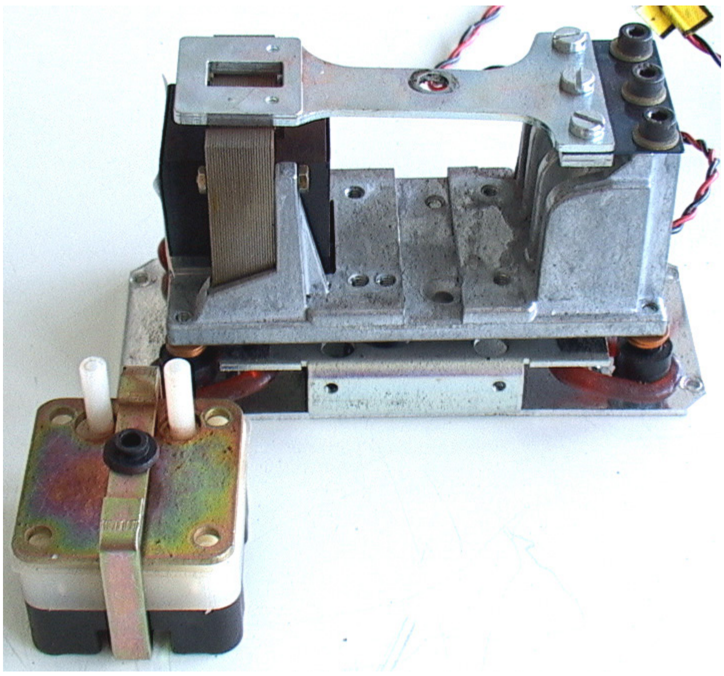
If applicable:
Remove the screws **S1** on both sides of the pump. Take off the cover.

8.4 Troubleshooting on Components



Step 2:

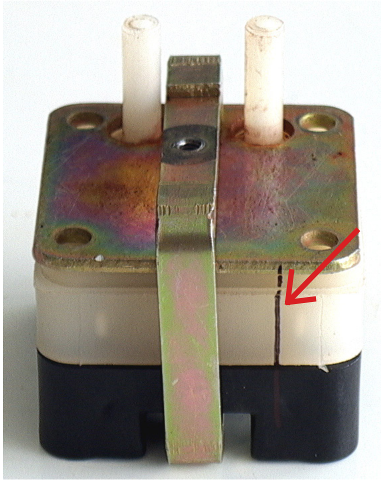
Remove the screws **S2** and screw **S3**.



Step 3:

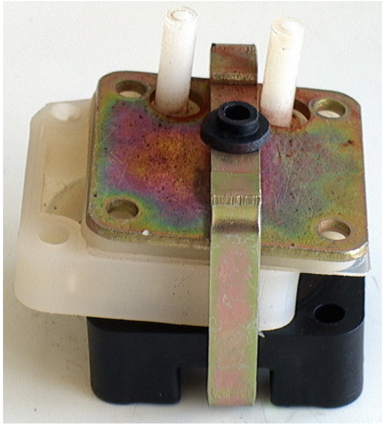
Take out the pump assembly.

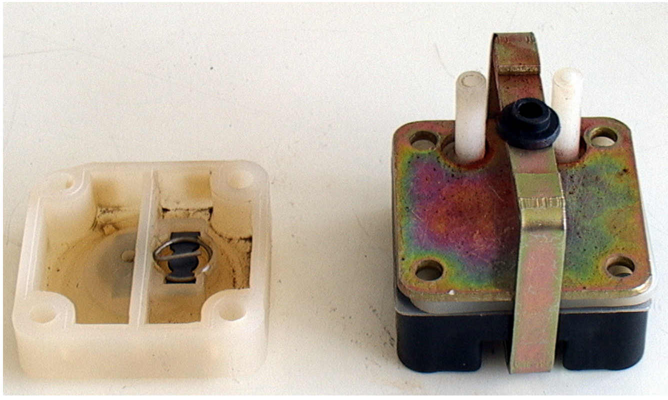
8.4 Troubleshooting on Components



Step 4:

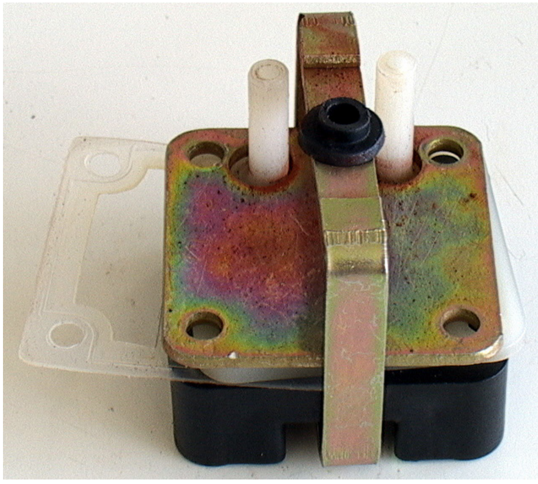
Mark the pump assy. before disassembly.





Step 5:

Remove the white block.



Step 6:

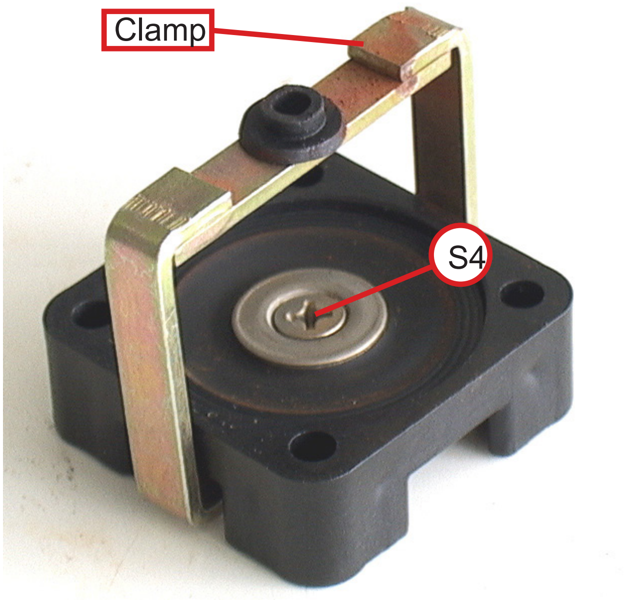
Remove the teflon gasket.

Step 7:

Remove the remaining two pump parts.

Clean the white plate for the gas in- and outlet.

8.4 Troubleshooting on Components

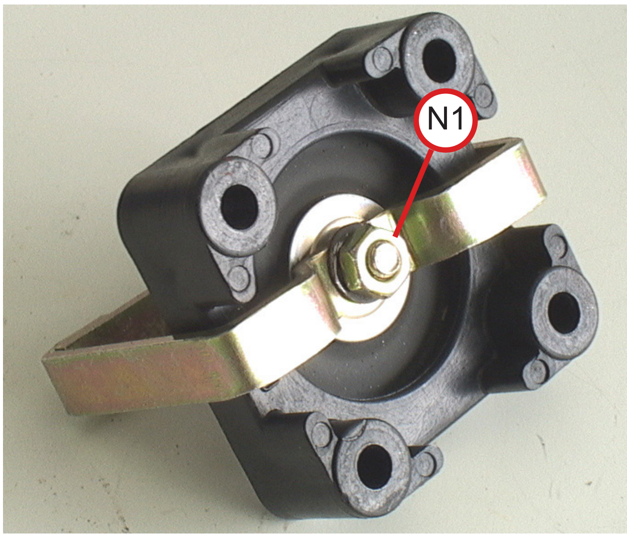


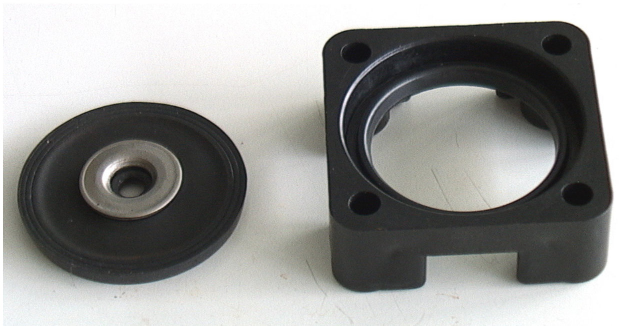
Step 8:

Disassemble the lower block and the clamp.

Loosen the screw **S4** and

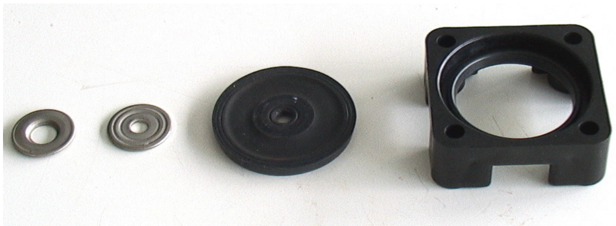
the nut **N1**.





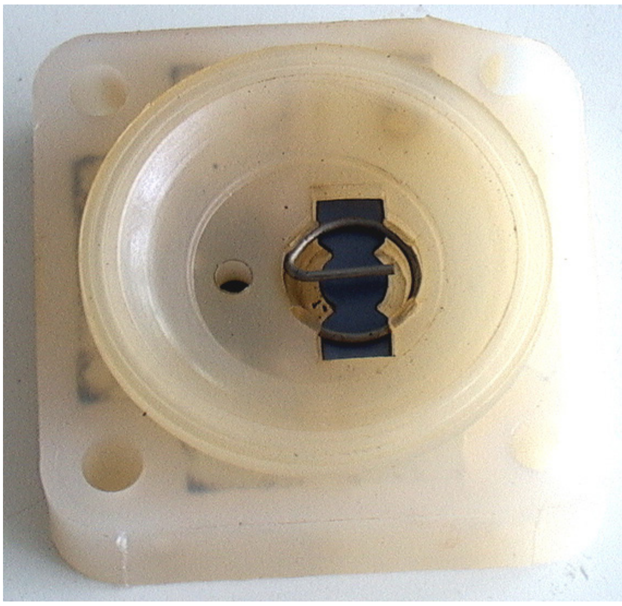
Step 9:

Remove the two washers on the diaphragm.



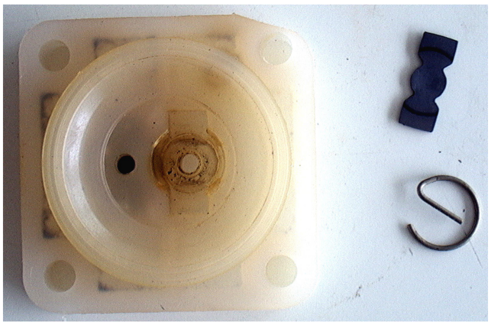
Step 10:

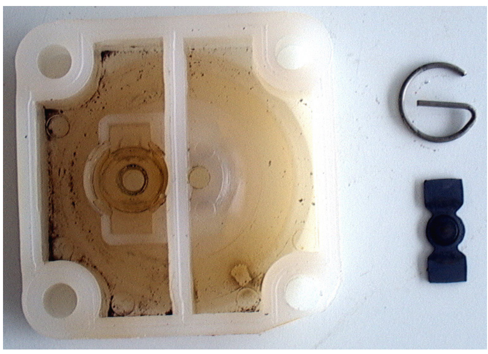
Replace the old with the new diaphragm and assemble the washers and the clamp in reverse order (step 9 and 8).



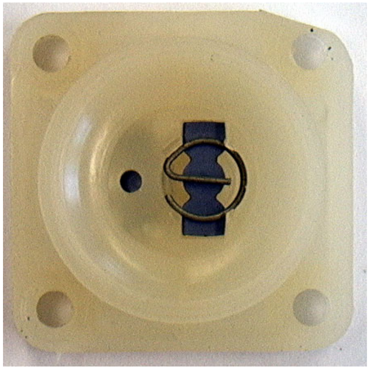
Step 11:

Remove the locking springs on both sides of the white block and take out the old diaphragms on both sides.





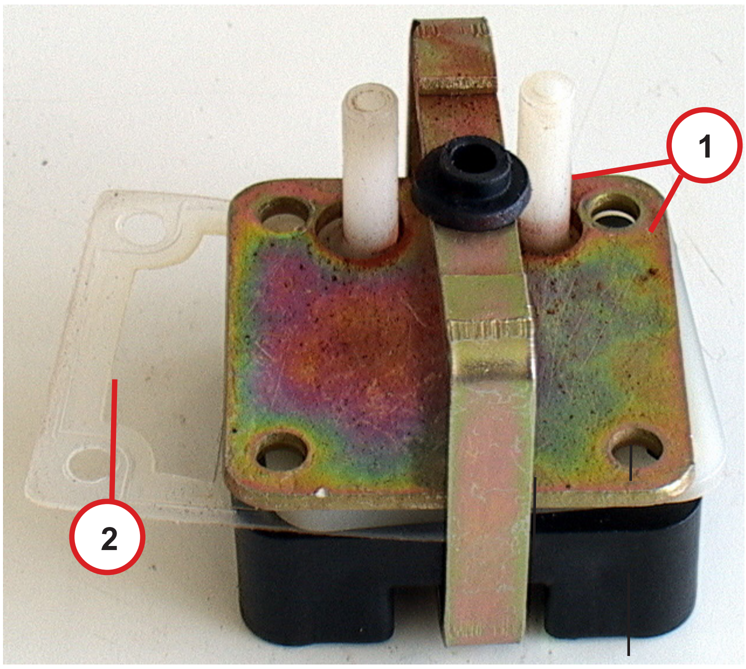
8.4 Troubleshooting on Components



Step 12:

Clean the white block.

Afterwards put in the new dia-phragms and fix them with the new locking springs.



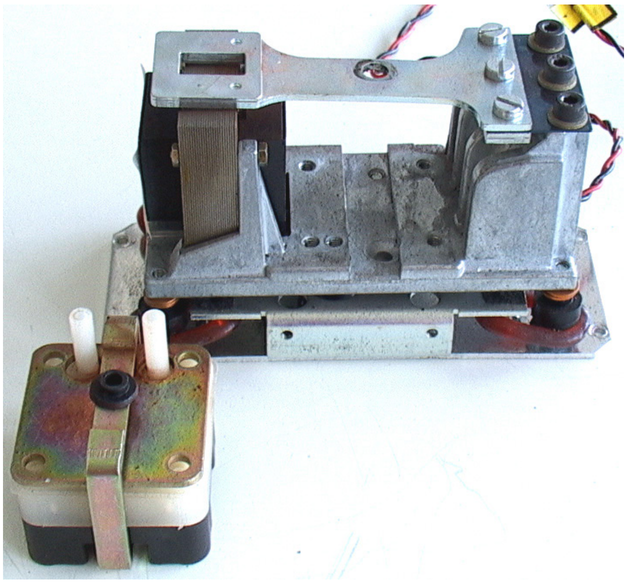
Step 13:

Assemble the pump assy. Take care of your marker (☞ step 4)

1. Put the two upper plates under the clamp (☞ steps 6 & 7 for reference).

2. Put the white block and the **new** teflon gasket between the lower block and the in-outlet plate.

8.4 Troubleshooting on Components

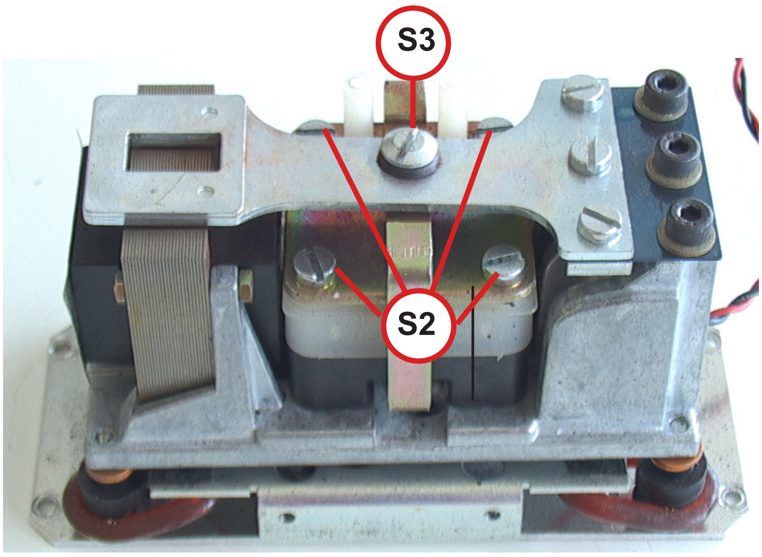


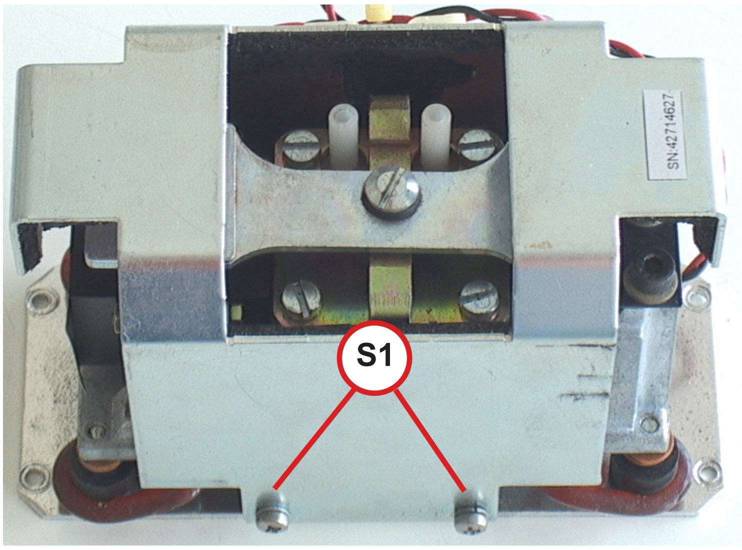
Step 14:

Assemble the pump assy in reverse order.

Put it in the pump housing and fix it with the screws **S2**.

Fix the clamp with screw **S3** and the black buffer.





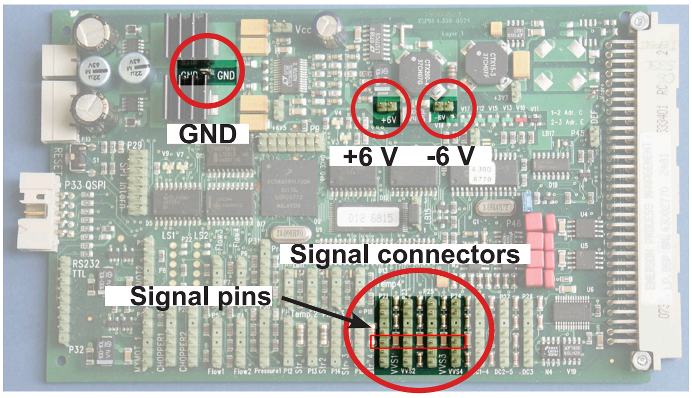
Step 15:

If applicable:

Install the cover and fix it with screws **S1** at both sides.

Finally re-install the pump into your analyzer, to complete the replacement of pump diaphragm.

8.4.4 Paramagnetic Oxygen Cell for Standard Applications: Adjustment of Physical Zero



To adjust the physical zero you need to measure some voltages on the XSP board:

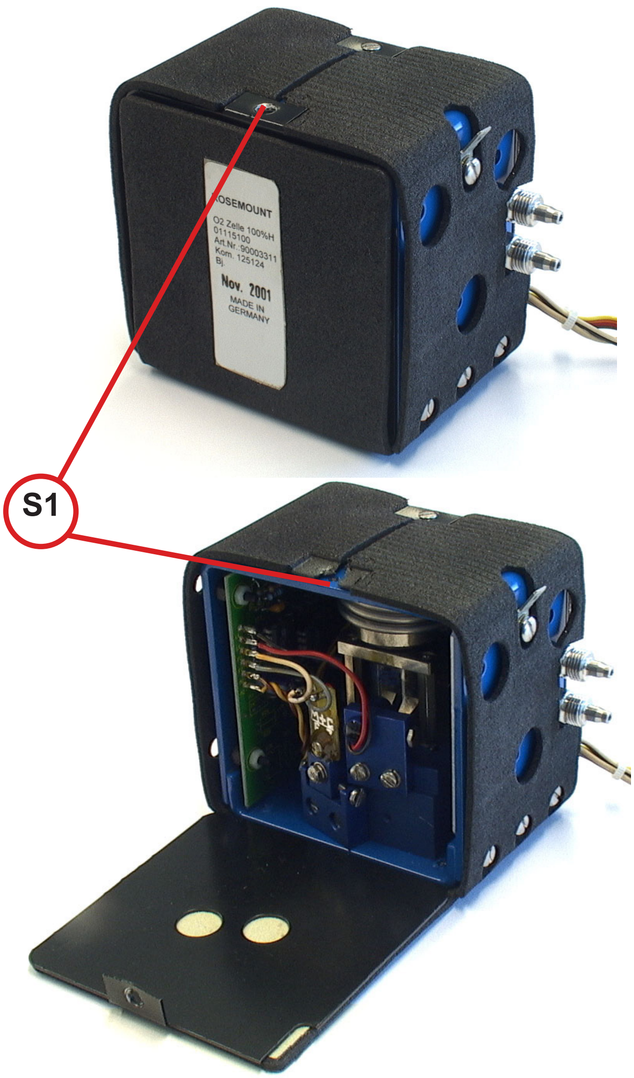
Depending on which channel the cell is assigned to, the measuring signal (+) can be measured at pin 3 of the related connector. GND (-) is available at a separate pin (see figure).

The measured voltage should be

0 V ± 50 mV.

The cell contains strong magnets!

Use only non-magnetic tools to adjust the zero point!



Step 1:

The figure to the left shows a heated paramagnetic oxygen cell.

Note!

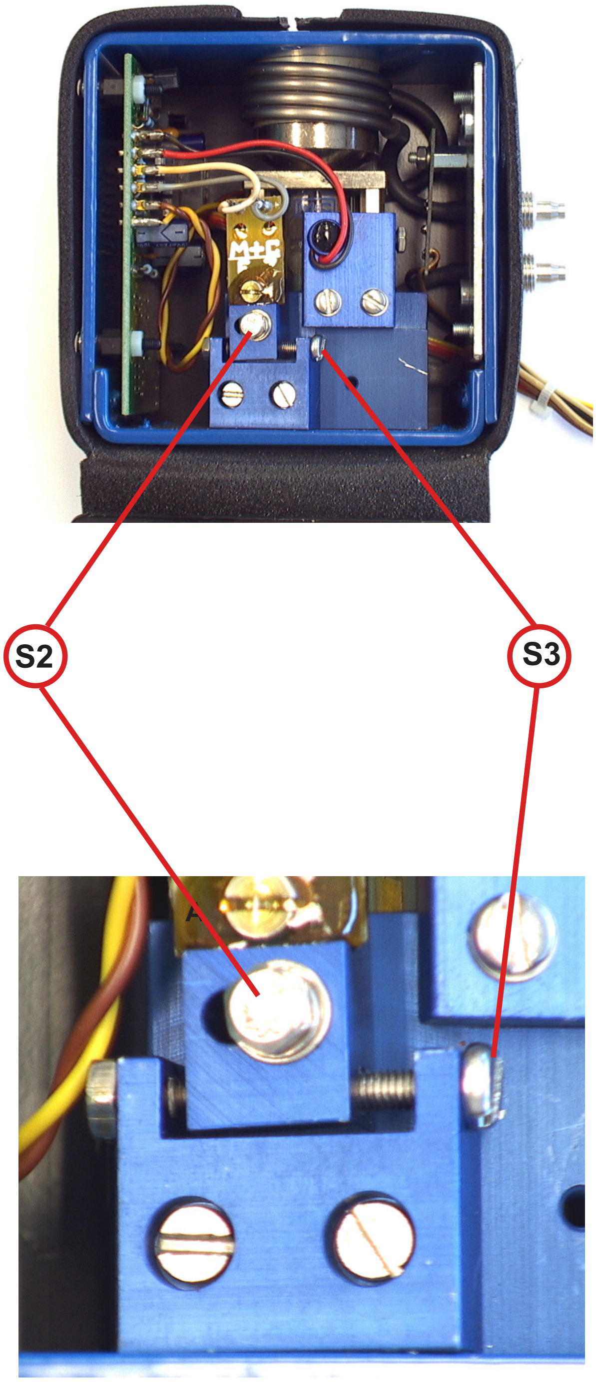
Depending on your specific instrument alternatively an unheated cell may be installed.

In this case skip step 2 and continue with step 3.

Step 2:

Open the cell cover by loosening the screw **S1** at the top.

8.4 Troubleshooting on Components



Step 3:

Apply N2 to the analyzer.

Step 4:

Carefully loosen the screw **S2**.
Now you can adjust the physical zero point with screw **S3**.
Turn the screw carefully.

The cell's electronic is light sensitive: When exposed to light while adjusting the zero point utilizing screw S3, a zero point shift may arise after the cover is closed.

Tip:
Shade the cell with a cloth when adjusting screw S3.

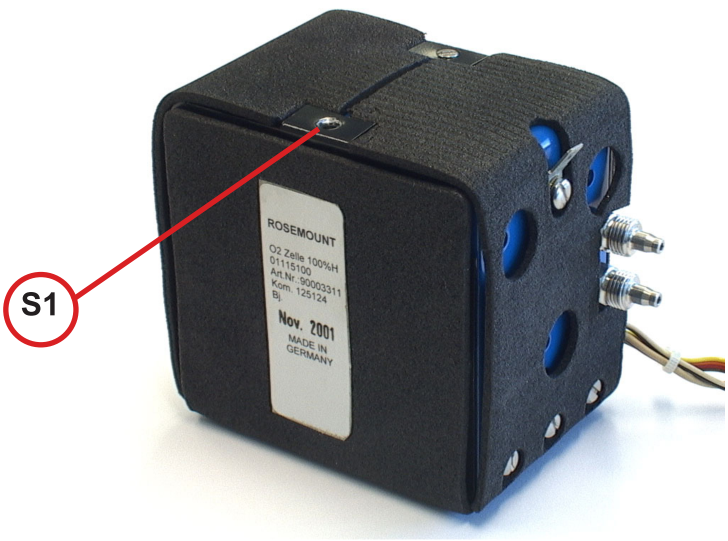
Step 5:

Tighten the screw **S2** with care, close the cover and check the zero point again.

Note!
If the cell itself does not provide a cover, close the instrument while checking the cell!

You might have to re-adjust the zero point several times until it remains at the expected value.

8.4 Troubleshooting on Components



Step 6:

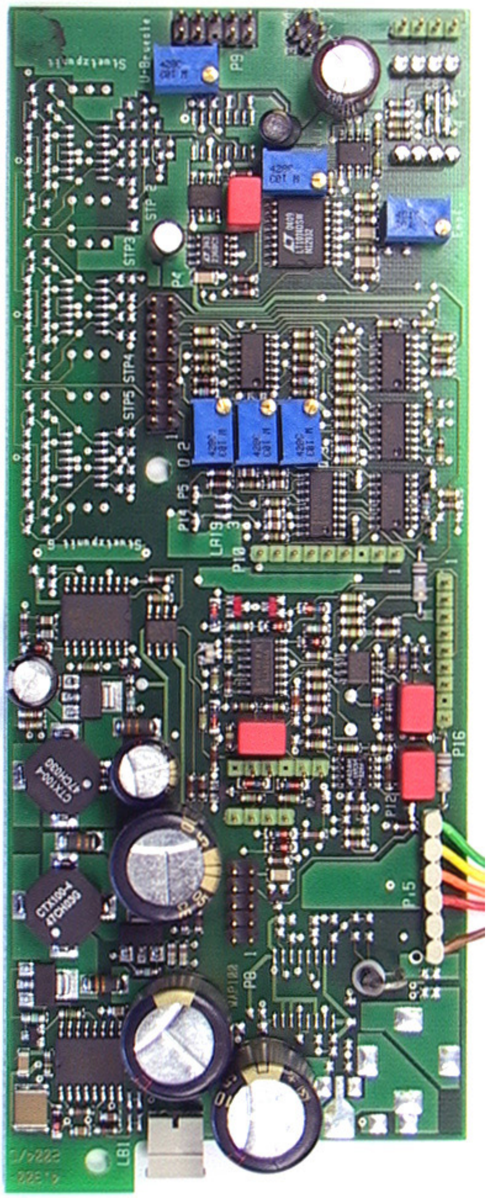
Fix the closed cell's cover with screw **S1**.

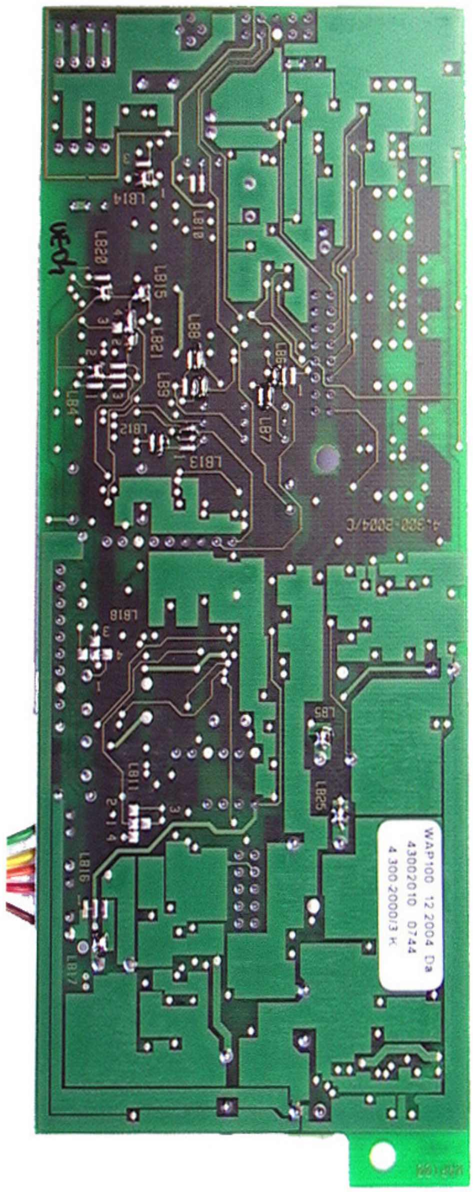
This completes the zero point adjustment procedure.

8.4.5 Thermal Conductivity Cell: Adjustment of Output Signal

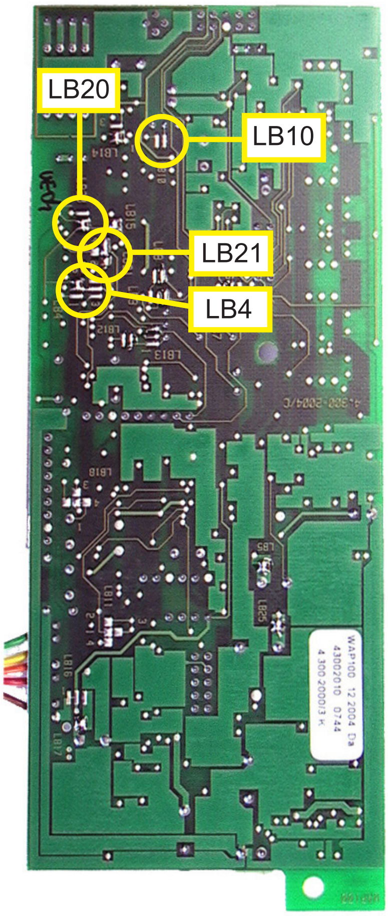
To adjust the zero signal of this measuring cell you need to have access to both sides of the related electronics board WAP 100.

A digital voltmeter (DVM) is required to measure and adjust several voltages!





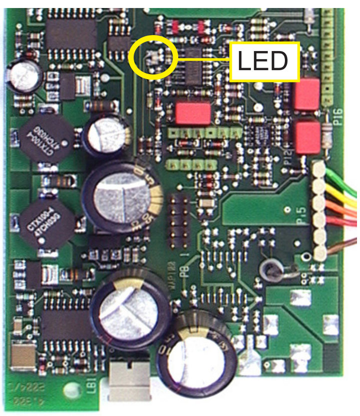
8.4 Troubleshooting on Components



Step 1:

Check the solder bridges, located at the solder side of the board, for proper configuration:

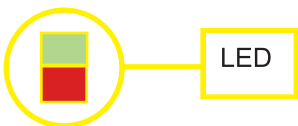
LB10	open
LB4 2-5	closed
LB21 1-4	closed
LB20	open



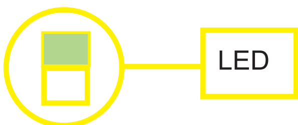
Step 2:

Switch on the analyzer.

The onboard LED will light up red and green.



When the warmup time has elapsed, the LED flashes green.



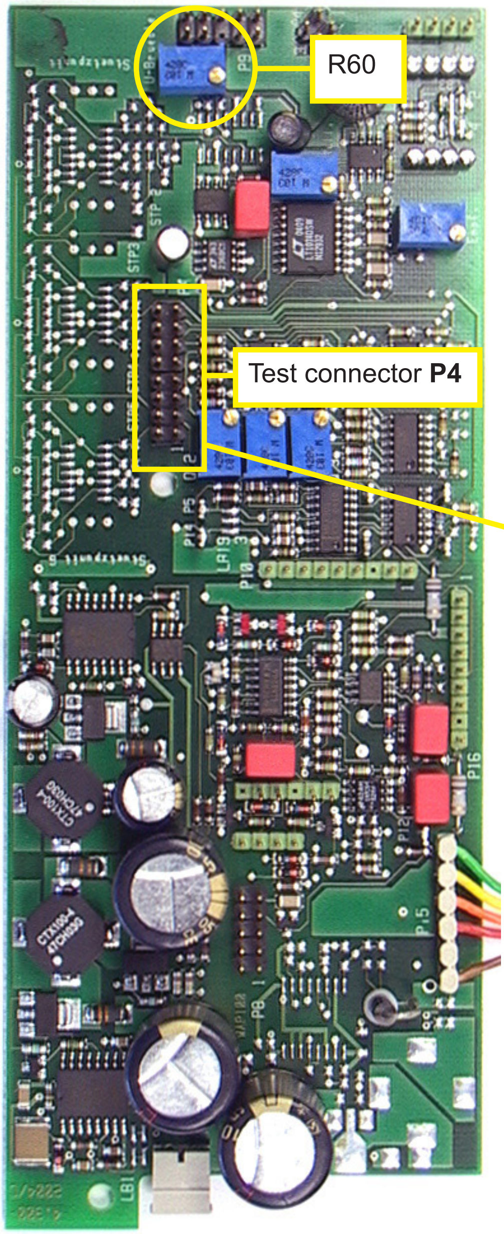
8.4 Troubleshooting on Components

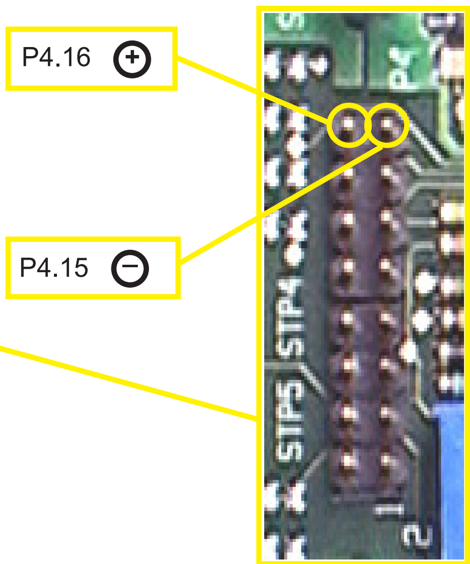
Step 3:

Locate test connector P4 to **measure the bridge voltage**:

P4.16	Bridge voltage (+)
P4.15	Bridge voltage (-); GND

CAUTION!
Do not short-circuit pins!



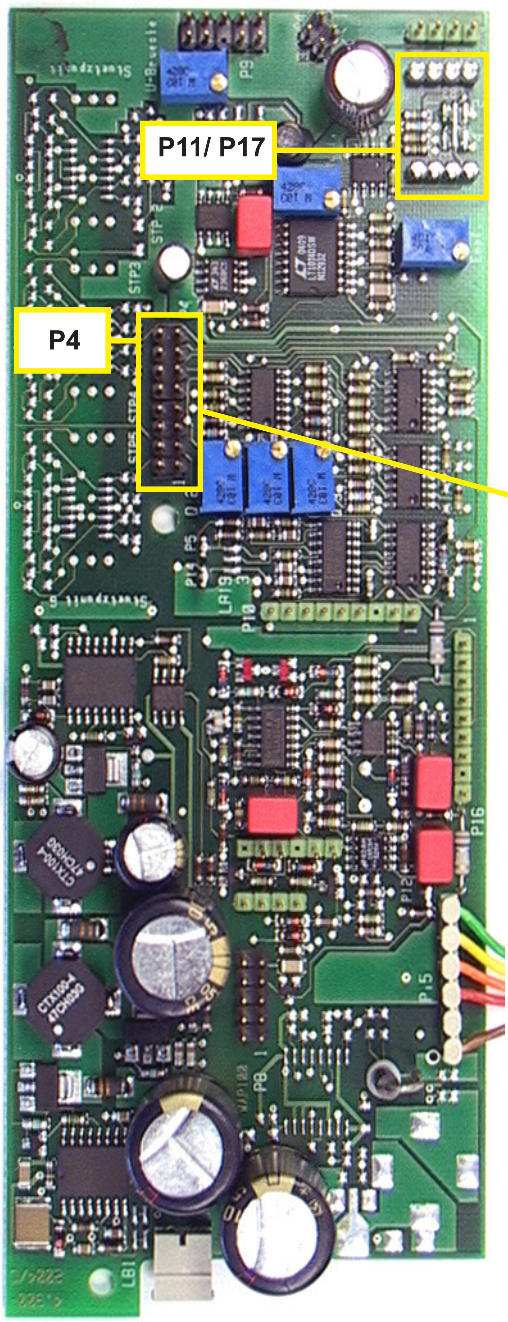


Alternatively the GND signal (-) is accessible on the main board BKS, too: Locate X11 (☞ Fig. 8-3, page 8-21) .

The bridge voltage depends on range and sample gas and should be between 3V and 5V.

Only if the WAP 100 board has been replaced, it is necessary to adjust the voltage with potentio-meter R60.

8.4 Troubleshooting on Components



Step 4:

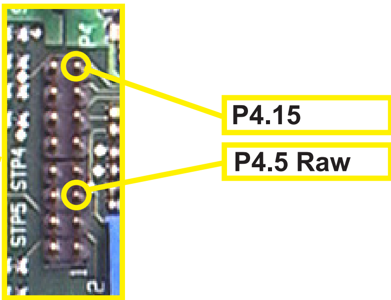
To **adjust the physical zero point**:

Apply zero gas to the analyzer.

Connect the DVM to the following pins:

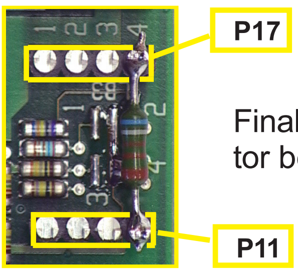
P4.5 Raw signal (+)
P4.15 Bridge voltage (-); GND

CAUTION!
Do not short-circuit pins!



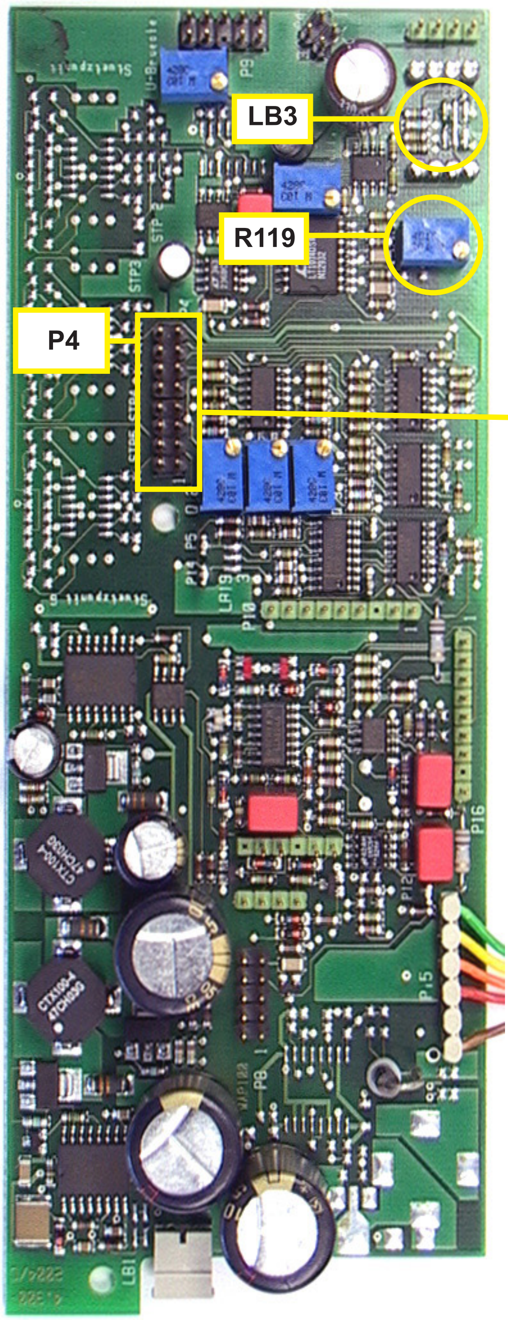
To adjust the physical zero point, it is necessary to install a resistor between **P11/P17** at position 1, 2, 3 or 4 (the following figure shows it at position 4). The position and value depends on the individual cell parameters. Proper configuration is a result of “try and error”!

Change resistor and/or position until the voltage is **0 V ± 500 mV**.



Finally solder in the resistor between P11/ P17.

8.4 Troubleshooting on Components



Step 5:

To **adjust the physical span**:

Apply span gas to the analyzer.

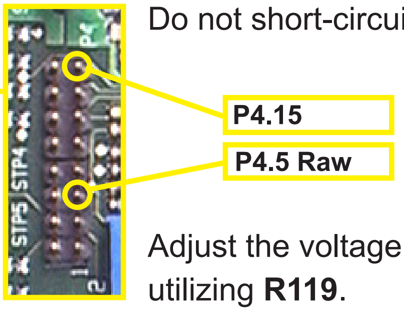
Do not disconnect the DVM:

P4.5 Raw signal (+)

P4.15 Bridge voltage (-); GND

CAUTION!

Do not short-circuit pins!



Adjust the voltage to **10V** utilizing **R119**.

If 10V is not within the adjustable range, it is necessary to change the signal amplification with **solder bridge LB3**:

For an amplification factor of	close
20	1-5
150	3-5
300	4-5
500	2-3-4-5

Step 6:

Now once more check the zero point:

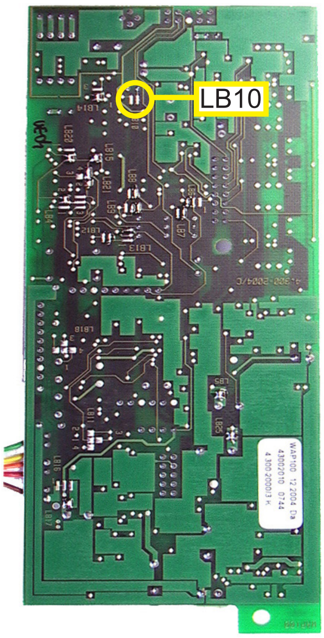
Apply zero gas to the analyzer.

Do not disconnect the DVM:

The voltage should be **0 V ± 500 mV.**

If it does not, repeat from step 3!

8.4 Troubleshooting on Components



Step 7:

To **finetune the physical zero point**:

Close solder bridge LB10.

Apply zero gas to the analyzer.

Do not disconnect the DVM:

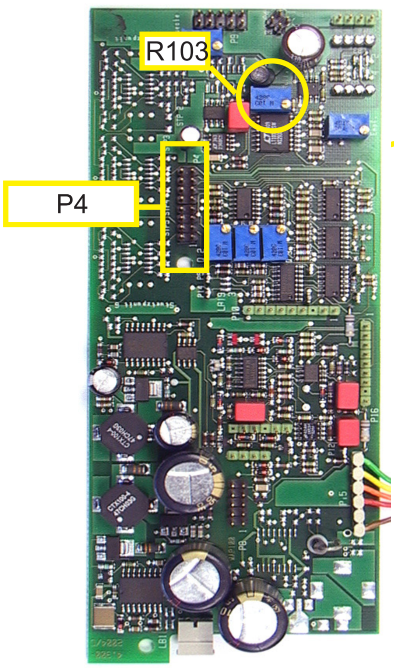
P4.5 Raw signal (+)

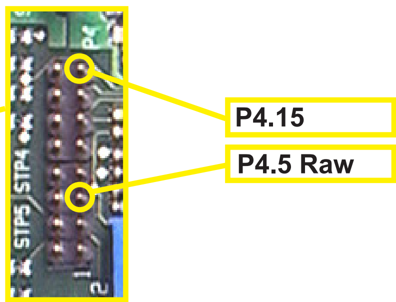
P4.15 Bridge voltage (-); GND

CAUTION!

Do not short-circuit pins!

Now you can finetune the zero point to a minimum value, using R103.





Check the zero point with **zero gas** again and perform a **zero calibration**.

Check the full scale signal (10V at P4.5) with **span gas** and perform a **span calibration**.

This step completes the adjustment of output procedure.

Chapter 9
Service Information

9.1 Return of Material

If factory repair of defective equipment is required, proceed as follows:

1. Secure a return authorization from a Rosemount Analytical Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted. Contact one of the following offices to receive return information:

   In Europe:

   Emerson Process Management GmbH & Co. OHG
   Service Department
   Germany
   +49 6055 884-470/-472

   In US:

   Emerson Process Management
   Rosemount Analytical Inc.
   Customer Service Center
   1-800-433-6076
   1-440-914-1261

   In Asia Pacific:

   Emerson Process Management Asia Pacific Pte Limited
   Singapore
   +65-6-777-8211

2. In no event will Rosemount be responsible for equipment without proper authorization and identification.

3. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to ensure no additional damage will occur during shipping.

   The completed and signed Declaration of Decontamination (☞ page A-27) must be included with the instrument (we recommend to attach it to the packaging outside)!

4. In a cover letter, describe completely:
   a. The symptoms that determined the equipment is faulty.
   b. The environment in which the equipment was operating (housing, weather, vibration, dust, etc.).
   c. Site from which equipment was removed.
   d. Whether warranty service or non-warranty service is requested.
   e. Complete shipping instructions for the return of the equipment.

5. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in a Rosemount Return Authorization, prepaid, to the address provided at step 1

If warranty service is expected, the defective unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

9.2 Customer Service

For order administration, replacement parts, applicaton assistance, on-site or factory repair, service or maintenance contract information, contact:

In Europe:

Emerson Process Management
GmbH & Co. OHG
Service Department
Germany
T +49 6055 884-470/-472

In US:

Emerson Process Management
Rosemount Analytical Inc.
Customer Service Center
T 1-800-433-6076
T 1-440-914-1261

In Asia Pacific:

Emerson Process Management
Asia Pacific Pte Limited
1 Pandan Crescent
Singapore 128461
T +65-6-777-8211

9.3 Training

A comprehensive Factory Training Program of operator and service classes is available. For a copy of the training schedule contact:

In Europe:

Emerson Process Management
GmbH & Co. OHG
Service Department
Germany
T +49 6055 884-470/-472

In US:

Emerson Process Management
Rosemount Analytical Inc.
Customer Service Center
T 1-800-433-6076
T 1-440-914-1261

In Asia Pacific:

Emerson Process Management
Asia Pacific Pte Limited
1 Pandan Crescent
Singapore 128461
T +65-6-777-8211

Chapter 10
Dismounting and Disposal

10.1 Dismounting and Diposal of the Analyzer

WARNING

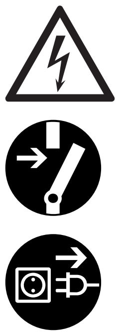
HAZARDS FROM DISMOUNTING

Dismounting instruments installed in hazardous area requires special documents to be issued and instructions to be followed! Do not dismount such instruments without written permit!

Failure to follow may result in explosion!

Gas lines may contain unhealthy or toxic gases, depending on the application, the instrument has been used for! Take care to purge such gas lines prior to disconnection, to remove all unhealthy or toxic components.

Failure to follow may result in personal injury or death!



WARNING

ELECTRICAL SHOCK HAZARD WHEN DISMOUNTING

Only qualified personnel, observing all applicable technical and legal requirements, may disconnect power and signal cables, and dismount these devices.

Failure to follow may cause exposure to risk of damage, injury or death.

Units with screw-type terminals must be de-energized by unplugging it or operating the separate cut-off switch or circuit breaker, when working on the power connections.

CAUTION

HEAVY INSTRUMENT

The models intended for outside and wall mounted use (X-STREAM XEXF and XEFD) weigh between 26 kg (57 lb) and 63 kg (139 lb), depending on version and options installed.

Two people and/or lifting equipment is required to lift and carry these units.

10 Dismounting & Disposal

When the instrument has reached the end of its useful life, do not throw it in a trash can!

This instrument has been made of materials to be recycled by waste disposal contractors specialised in this field. Let the instrument and the packing material duly disposed of and in environmentally sound manner. Ensure the equipment is free of dangerous and harmful substances (decontaminated).

Take care of all local regulations for waste treatment.

Advice concerning the disposal of batteries

- This instrument contains a CR primary lithium button cell battery of size CR 2032.
- The battery is soldered to an electronics board and usually does not need to be replaced during the instrument´s lifetime.
- At the end of useful life, the instrument must be disposed of in compliance with the wast regulations, see instructions below.

Advice concerning the disposal of chemicals

This instrument may contain electrochemical sensors, e. g. for measuring O_2. For these sensors the same applies as to the battery:

- Don‘t dispose of together with household carbage.
- At the end of their or the instruments useful life, the sensors must be disposed of in compliance with the wast regulations, see instructions below.

When the instrument has reached the end of its useful life,

- purge all gas lines with inert gas
- ensure all gas lines are pressureless
- disconnect all gas lines
- switch off power and signal lines
- disconnect and remove all electrical connections
- for wall mounted instruments, support the instrument before loosening the fixing screws.
- properly fill out the Declaration of Decontamination (☞ A-27)
- hand over the dismounted instrument together with the Declaration of Decontamination to a waste disposal contractor. This contractor then has to disassemble the instrument, recycle and also dispose of the contained battery in compliance with all applicable waste treatment regulations.

Appendix

This chapter contains

A.1 Modbus Specification

MODBUS over Serial Line

Specification and Implementation Guide

V1.02

A.1 Modbus Specification

3 Physical Layer

3.1 Preamble

A new MODBUS solution over serial line should implement an electrical interface in accordance with EIA/TIA-485 standard (also known as RS485 standard). This standard allows point to point and multipoint systems, in a “two-wire configuration”. In addition, some devices may implement a “Four-Wire” RS485-Interface.

A device may also implement an RS232-Interface.

In such a MODBUS system, a Master Device and one or several Slave Devices communicate on a passive serial line.

On standard MODBUS system, all the devices are connected (in parallel) on a trunk cable constituted by 3 conductors. Two of those conductors (the “Two-Wire” configuration) form a balanced twisted pair, on which bi-directional data are transmitted, typically at the bit rate of 9600 bits per second.

Each device may be connected (see figure 19):

- either directly on the trunk cable, forming a daisy-chain,
- either on a passive Tap with a derivation cable,
- either on an active Tap with a specific cable.

Screw Terminals, RJ45, or D-shell 9 connectors may be used on devices to connect cables (see the chapter “Mechanical Interfaces”).

3.2 Data Signaling Rates

9600 bps and 19.2 Kbps are required and 19.2 is the required default

Other baud rates may optionally be implemented : 1200, 2400, 4800, … 38400 bps, 56 Kbps, 115 Kbps, …

Every implemented baud rate must be respected better than 1% in transmission situation, and must accept an error of 2% in reception situation.

A.1 Modbus Specification

3.3 Electrical Interfaces

3.3.1 Multipoint Serial Bus Infrastructure

Figure 19 gives a general overview of the serial bus infrastructure in a MODBUS multipoint Serial Line system.

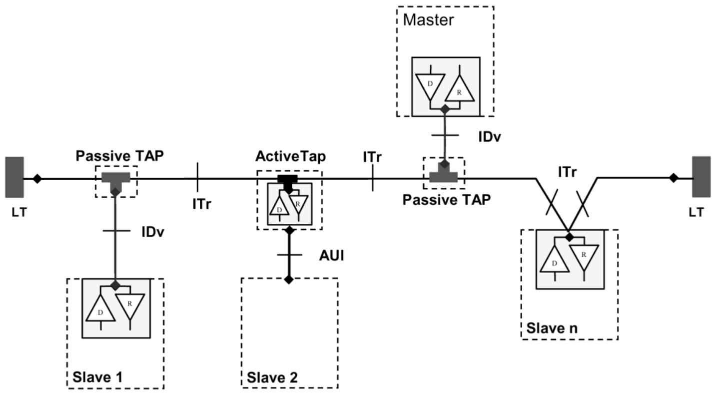


Figure 19 : Serial bus infrastructure

A multipoint MODBUS Serial Line bus is made of a principal cable (**the Trunk**), and possibly some **derivation** cables.
Line terminations are necessary at each extremity of the trunk cable for impedance adaptation (see § "Two-Wire MODBUS Definition" & "Optional Four-Wire MODBUS Definition" for details).

As shown in figure 19, different implementations may operate in the same MODBUS Serial Line system :

- the device integrates the communication transceiver and is connected to the trunk using a **Passive Tap** and a derivation cable (case of Slave 1 and Master) ;
- the device doesn't integrate the communication transceiver and is connected to the trunk using an **Active Tap** and a derivation cable (the active TAP integrates the transceiver) (case of Slave 2) ;
- the device is connected directly to the trunk cable, in a **Daisy-Chain** (case of Slave n)

The following conventions are adopted :

- The interface with the **trunk** is named **ITr** (Trunk Interface)
- The interface between the device and the **Passive Tap** is named **IDv** (Derivation Interface)
- The interface between the device and the **Active Tap** is named **AUI** (Attachment Unit Interface)

Remarks :

1. In some cases, the Tap may be connected directly to the IDv-socket or the AUI-socket of the device, without using a derivation cable.
2. A Tap may have several IDv sockets to connect several devices. Such a Tap is named **Distributor** when it is a passive one.
3. When using an active Tap, power supply of the Tap may be provided either via its AUI or ITr interface.

ITr and **IDv** interfaces are described in the following chapters (see § "Two-Wire MODBUS DEFINITION" & "Four-Wire MODBUS DEFINITION").

A.1 Modbus Specification

3.3.2 Two-Wire MODBUS Definition

A MODBUS solution over serial line should implement a "Two-Wire" electrical interface in accordance with EIA/TIA-485 standard.

On such a 2W-bus, at any time one driver only has the right for transmitting.

In fact a third conductor must also interconnect all the devices of the bus : the common.

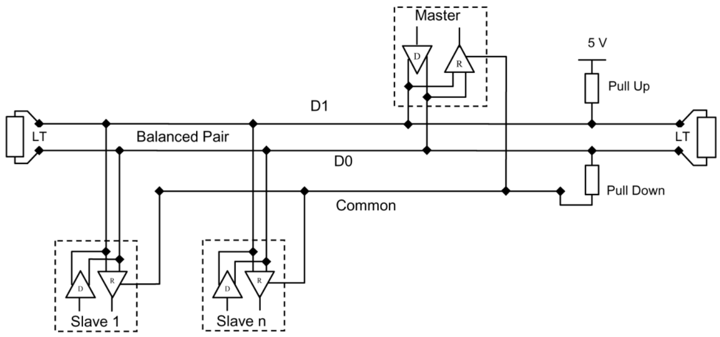


Figure 20: General 2-Wire Topology

2W-MODBUS Circuits Definition

Required Circuits		For device	Required on device	EIA/TIA-485 name	Description
on ITr	on IDv				
D1	D1	I/O	**X**	B/B'	**Transceiver terminal 1, V1 Voltage** (V1 > V0 for binary 1 [OFF] state)
D0	D0	I/O	**X**	A/A'	**Transceiver terminal 0, V0 Voltage** (V0 > V1 for binary 0 [ON] state)
Common	Common	--	**X**	C/C'	Signal and optional Power Supply Common

Notes :

- For Line Termination (LT), Pull Up and Pull Down resistors, please refer to section "Multipoint System requirements".
- D0, D1, and Common circuit names must be used in the documentation related to the device and the Tap (User Guide, Cabling Guide, …) to facilitate interoperability.
- Optional electrical interfaces may be added, for example :
  - **Power Supply :** 5..24 V D.C.
  - **Port mode control :** PMC circuit (TTL compatible). When needed, port mode may be controlled either by this external circuit and/or by another way (a switch on the device for example). In the first case while an open circuit PMC will ask for the 2W-MODBUS mode, a Low level on PMC will switch the port into 4W-MODBUS or RS232-MODBUS Mode, depending on the implementation.

A.1 Modbus Specification

3.3.3 Optional Four-Wire MODBUS Definition

Optionally, such MODBUS devices also permit to implement a **2-pair** bus (4 wires) of mono directional data. The data on the **master pair** (RXD1-RXD0) are only received by the slaves ; the data on the **slave pair** (TXD1-TXD0) are only received by the only master.

In fact a fifth conductor must also interconnect all the devices of the 4W-bus : the common.

In the same way as on a 2W-MODBUS, at any time one driver only has the right for emitting.

Such a device must implement, for each balanced pair, a driver and a transceiver **in accordance with EIA/ TIA-485**. (Sometimes this solution has been named "RS422", which is not correct : the RS422 standard does not support several drivers on one balanced pair.)

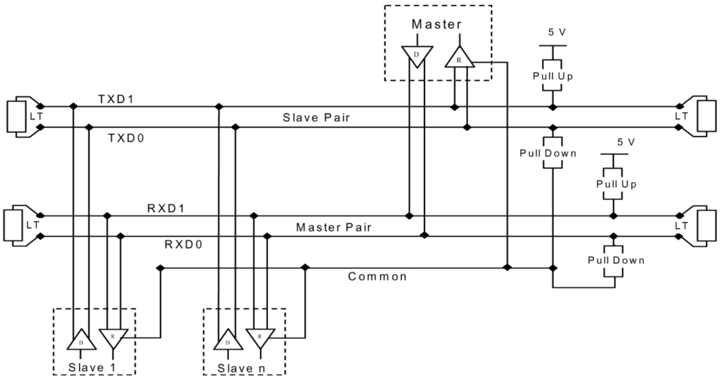


Figure 21: General 4-wire topology

Optional 4W-MODBUS Circuits Definition

Required Circuits		For device	Required on device	EIA/TIA-485 name	Description for IDv
on ITr	**on IDv**				
TXD1	TXD1	Out	**X**	B	**Generator terminal 1,** Vb Voltage (Vb > Va for binary 1 [OFF] state)
TXD0	TXD0	Out	**X**	A	**Generator terminal 0**, Va Voltage (Va > Vb for binary 0 [ON] state)
RXD1	RXD1	In	**(1)**	B'	**Receiver terminal 1**, Vb' Voltage (Vb' > Va' for binary 1 [OFF] state)
RXD0	RXD0	In	**(1)**	A'	**Receiver terminal 0**, Va' Voltage (Va' > Vb' for binary 0 [ON] state)
Common	Common	--	**X**	C/C'	Signal and optional Power Supply **Common**

Notes :

- For Line Termination (LT), Pull Up and Pull Down resistors, please refer to section "Multipoint System requirements".
- Those circuits **(1)** are required only if an 4W-MODBUS option is implemented.
- The name of the 5 required circuits must be used in the documentation related to the device and the Tap (User Guide, Cabling Guide, …) to facilitate interoperability.
- Optional electrical interfaces may be added, for example :
  - **Power Supply :** 5..24 V D.C.
  - **PMC circuit :** See above (In 2W-MODBUS Circuits Definition) the note about this optional circuit.

A.1 Modbus Specification

3.3.3.1 4W-Cabling System Important Topic

In such a 4W-MODBUS, Master Device and Slave Devices have IDv interfaces with the same 5 required circuits.
As the master has to :

- receive from the slave the data on the slave pair (TXD1-TXD0),
- and transmit on the master pair (RXD1-RXD0 , received by the slaves) ,

the 4W-cabling system <u>must</u> cross the two pairs of the bus between ITr and the IDv of the master :

	Signal on Master IDv		EIA/TIA-485 Name	Circuit on ITr
	Name	Type		
Slave Pair	RXD1	In	B'	TXD1
	RXD0	In	A'	TXD0
Master Pair	TXD1	Out	B	RXD1
	TXD0	Out	A	RXD0
	Common	--	C/C'	Common

This crossing may be implemented by crossed cables, but the connection of such crossed cables in a 2-wire system may cause damages. To connect a 4W master device (which have a MODBUS connector) a better solution is to use a Tap which includes the crossing function.

3.3.3.2 Compatibility between 4-Wire and 2-Wire cabling

In order to connect devices implementing a 2-Wire physical interface to an already existing 4-Wire system, the 4-Wire cabling system can be modified as described below :

- TxD0 signal shall be wired with the RxD0 signal, turning them to the D0 signal
- TxD1 signal shall be wired with the RxD1 signal, turning them to the D1 signal.
- Pull-up, Pull-down and line terminations resistors shall be re-arranged to correctly adapt the D0, D1 signals.

A.1 Modbus Specification

The figure hereafter gives an example where slaves 2 and 3 which use a 2-Wire interface can operate with the Master and the slave 1 which use a 4-Wire interface.

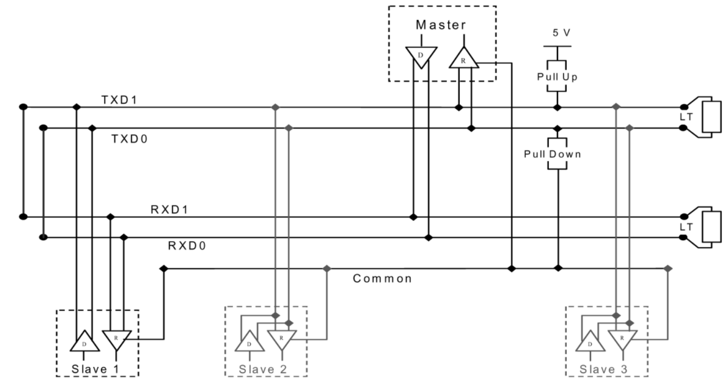


Figure 22 : Changing a 4-Wire cabling system into a 2-Wire cabling system

In order to connect devices implementing a 4-Wire physical interface to an already existing 2-Wire system, the 4-Wire interface of the new coming devices can be arranged as describe below :

On each 4-Wire device interface :

- TxD0 signal shall be wired with the RxD0 signal and then connected to the D0 signal of the trunk ;
- TxD1 signal shall be wired with the RxD1 signal and then connected to the D1 signal of the trunk.

The figure hereafter gives an example where slaves 2 and 3 which use a 4-Wire interface can operate with the Master and the slave 1 which use a 2-Wire interface.

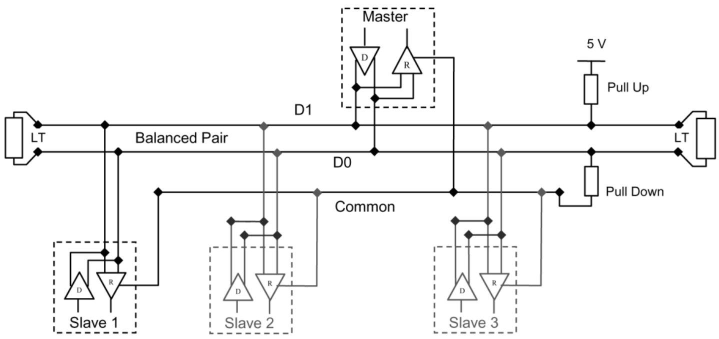


Figure 23 : Connecting devices with 4-Wire interface to a 2-Wire cabling system

A.1 Modbus Specification

3.3.4 RS232-MODBUS Definition

Some devices may implement an RS232-Interface between a DCE and a DTE.

Optional RS232-MODBUS Circuits Definition

Signal	For DCE	Required on DCE (1)	Required on DTE (1)	Description
Common	--	X	X	**Signal Common**
CTS	In			Clear to Send
DCD	--			Data Carrier Detected (from DCE to DTE)
DSR	In			Data Set Ready
DTR	Out			Data Terminal Ready
RTS	Out			Request to Send
RXD	In	X	X	**Received Data**
TXD	Out	X	X	**Transmitted Data**

Notes :

- "X" marked signals are required only if an RS232-MODBUS option is implemented.
- Signals are in accordance with EIA/ TIA-232.
- Each TXD must be wired with RXD of the other device ;
- RTS may be wired with CTS of the other device,
- DTR may be wired with DSR of the other device.
- Optional electrical interfaces may be added, for example :
  - **Power Supply :** 5..24 V D.C.
  - **PMC circuit :** See above (In 2W-MODBUS Circuits Definition) the note about this optional circuit.

3.3.5 RS232-MODBUS requirements

This optional MODBUS on Serial Line system should only be used for short length (typically less than 20m) point to point inter-connection.

Then, the EIA/TIA-232 standard must be respected :

⇒ circuits definition,

⇒ maximum wire capacitance to ground (2500 pF, then 25 m for a 100 pF/m cable).

Please refer to chapter "Cables" for the shield, and for the possibility to use Category 5 Cables.

Documentation of the device must indicate :

⇒ if the device must be considered as a DCE either as a DTE,

⇒ how optional circuits must work if such is the case.

A.1 Modbus Specification

3.4 Multipoint System requirements

For any EIA/ TIA-485 multipoint system, in either 2-wire or 4-wire configuration, the following requirements all apply.

3.4.1 Maximum number of devices without repeater

A figure of **32 devices** is always authorized on any RS485-MODBUS system without repeater.

Depending of :

- all the possible addresses,
- the figure of RS485 Unit Load used by the devices,
- and the line polarization in need be,

A RS485 system may implement a larger number of devices. Some devices allow the implementation of a RS485-MODBUS serial line with more than 32 devices, without repeater.

In this case these MODBUS devices must be documented to say how many of such devices are authorized without repeater.

The use of a **repeater** between two heavy loaded RS485-MODBUS is also possible.

3.4.2 Topology

An RS485-MODBUS configuration without repeater has one trunk cable, along which devices are connected, directly (daisy chaining) or by short derivation cables.

The trunk cable, also named “Bus”, can be long (see hereafter). Its two ends must be connected on Line Terminations.

The use of repeaters between several RS485-MODBUS is also possible.

3.4.3 Length

The end to end length of the **trunk cable** must be limited. The maximum length depends on the baud rate, the cable (Gauge, Capacitance or Characteristic Impedance), the number of loads on the daisy chain, and the network configuration *(2-wire or 4-wire)*.

For a maximum 9600 Baud Rate and AWG26 (or wider) gauge, the maximum length is 1000m. In the specific case shown in the figure 22 (4 Wire cabling used as a 2 Wire cabling system) the maximum length must be divided by two.

The **derivations** must be short, never more than 20m. If a multi-port tap is used with n derivations, each one must respect a maximum length of 40m divided by n.

3.4.4 Grounding Arrangements

The « Common » circuit (Signal and optional Power Supply Common) must be connected directly to protective ground, preferably at **one point only** for the entire bus. Generally this point is to choose on the master device or on its Tap.

3.4.5 Line Termination

A reflection in a transmission line is the result of an impedance discontinuity that a travelling wave sees as it propagates down the line. To minimize the reflections from the end of the RS485-cable it is required to place a Line Termination **near each of the 2 Ends** of the Bus.

It is important that the line be terminated at **both** ends since the propagation is bi-directional, but it is not allowed to place more than 2 LT on one passive D0-D1 balanced pair . Never place any LT on a derivation cable.

A.1 Modbus Specification

Each line termination must be connected between the two conductors of the balanced line : D0 and D1.

Line termination may be a 150 ohms value (0.5 W) resistor.

A serial capacitor (1 nF, 10 V minimum) with a 120 Ohms (0.25 W) resistor is a better choice when a polarization of the pair must be implemented (see here after).

In a 4W-system, each pair must be terminated at each end of the bus.

In an RS232 interconnections, no termination should be wired.

3.4.6 Line Polarization

When there is no data activity on an RS-485 balanced pair, the lines are not driven and, thus susceptible to external noise or interference. To insure that its receiver stays in a constant state, when no data signal is present, some devices need to bias the network.

Each MODBUS device must be documented to say :

- if the device needs a line polarization,
- if the device implements, or can implement, such a line polarization.

If one or several devices need polarization, **one** pair of resistors must be connected on the RS-485 balanced pair :

- a Pull-Up Resistor to a 5V Voltage on D1 circuit,
- a Pull-Down Resistor to the common circuit on D0 circuit.

The value of those resistors must be between 450 Ohms and 650 Ohms. 650 Ohms resistors value may allow a higher number of devices on the serial line bus.

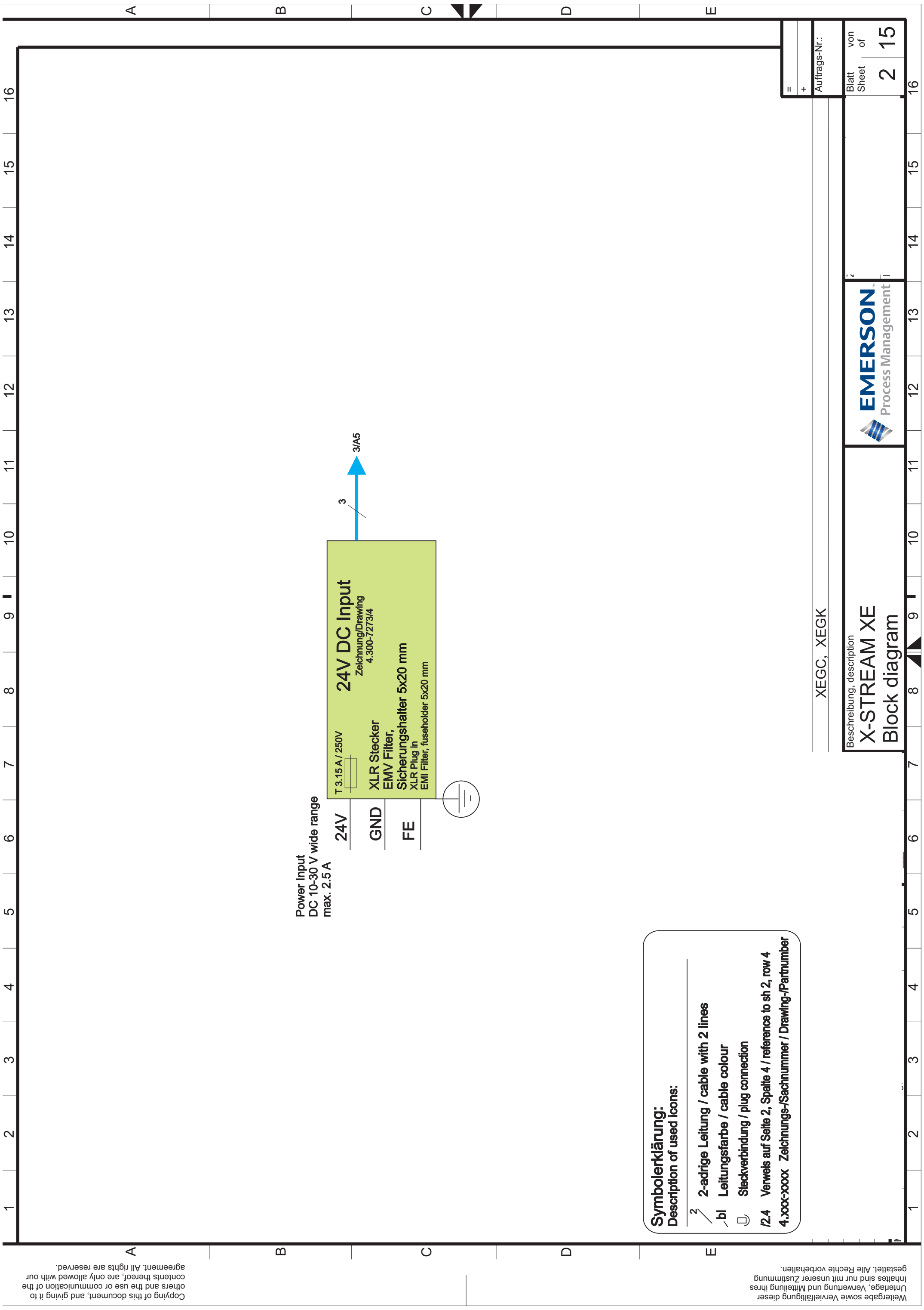
In this case, a polarization of the pair must be implemented **at one location for the whole Serial Bus**. Generally this point is to choose on the master device or on its Tap. Other devices must not implement any polarization.

The maximum number of devices authorized on such a MODBUS Serial Line is reduced by 4 from a MODBUS without polarization.

A.2 Block Diagram

A.2 Block Diagram

A.2 Block Diagram



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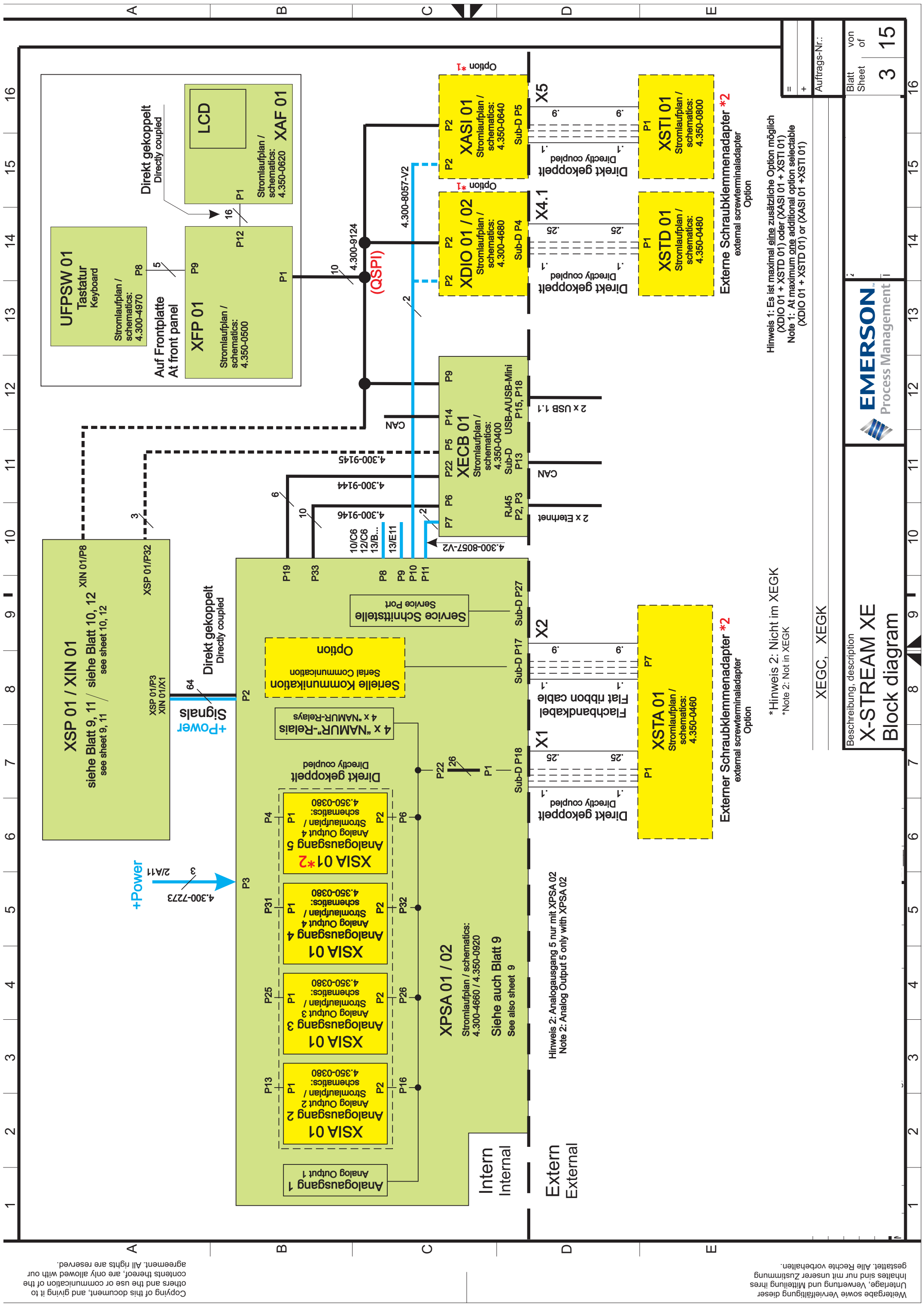
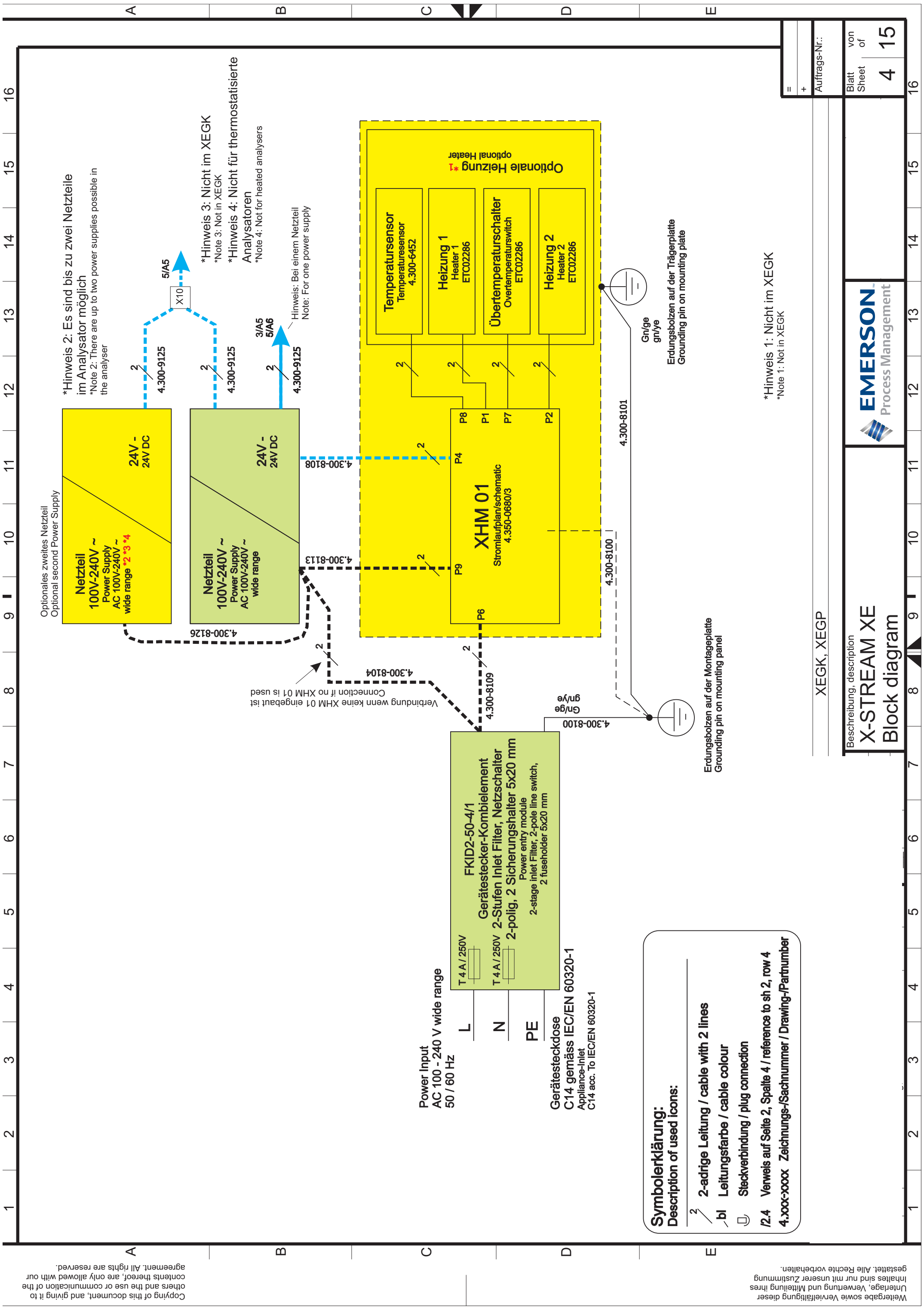
A.2 Block Diagram

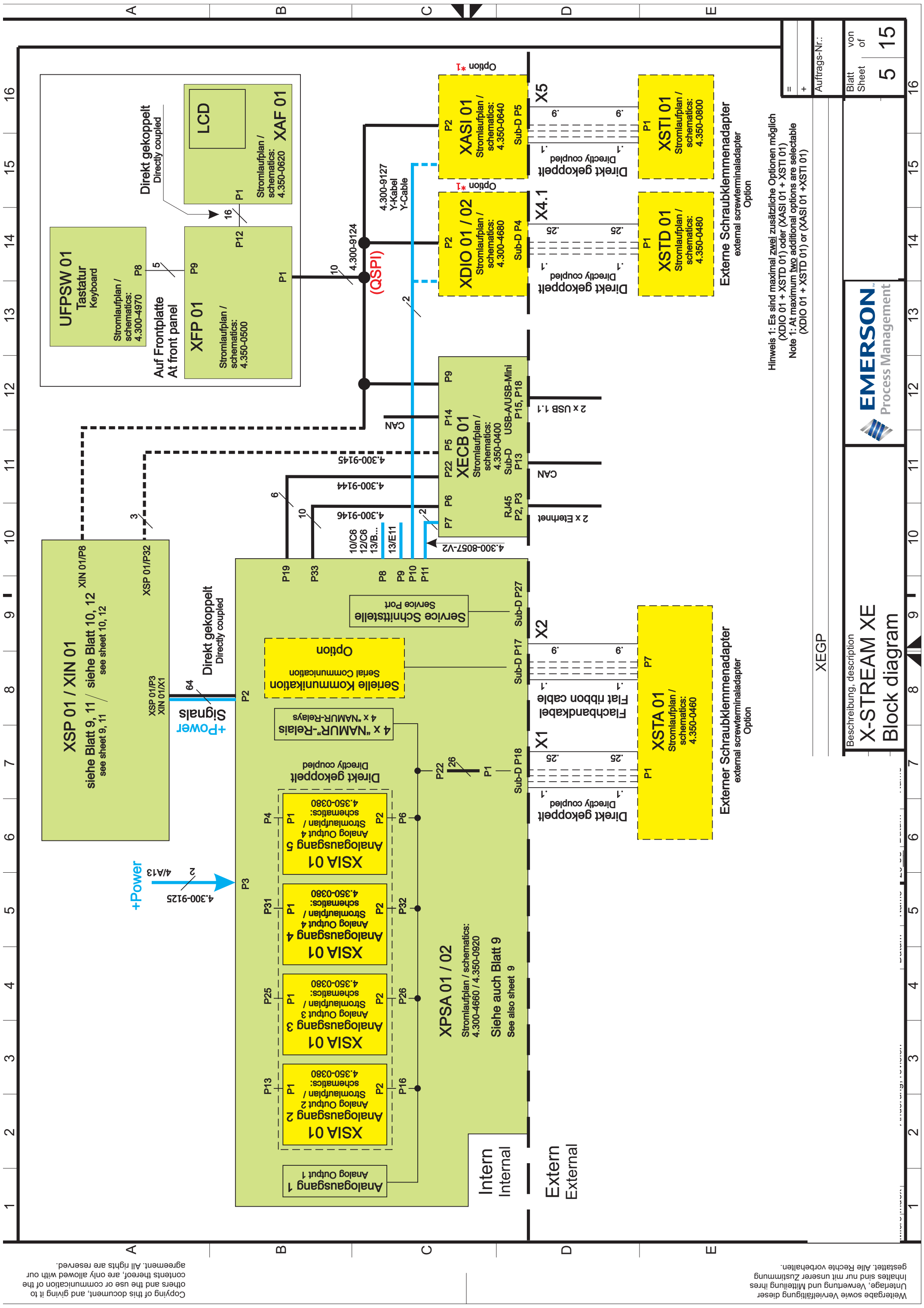


A.2 Block Diagram

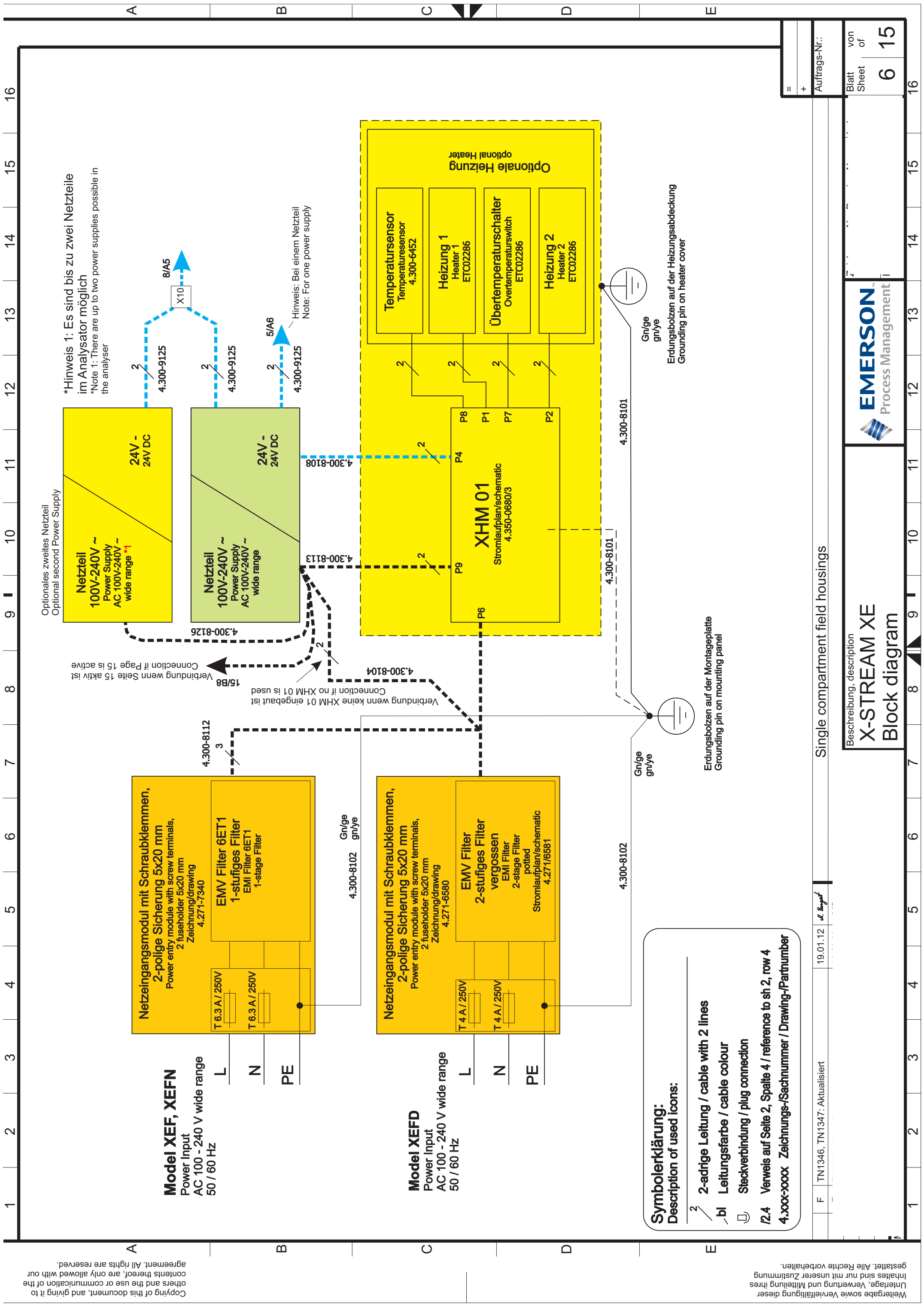


A Appendix

A.2 Block Diagram

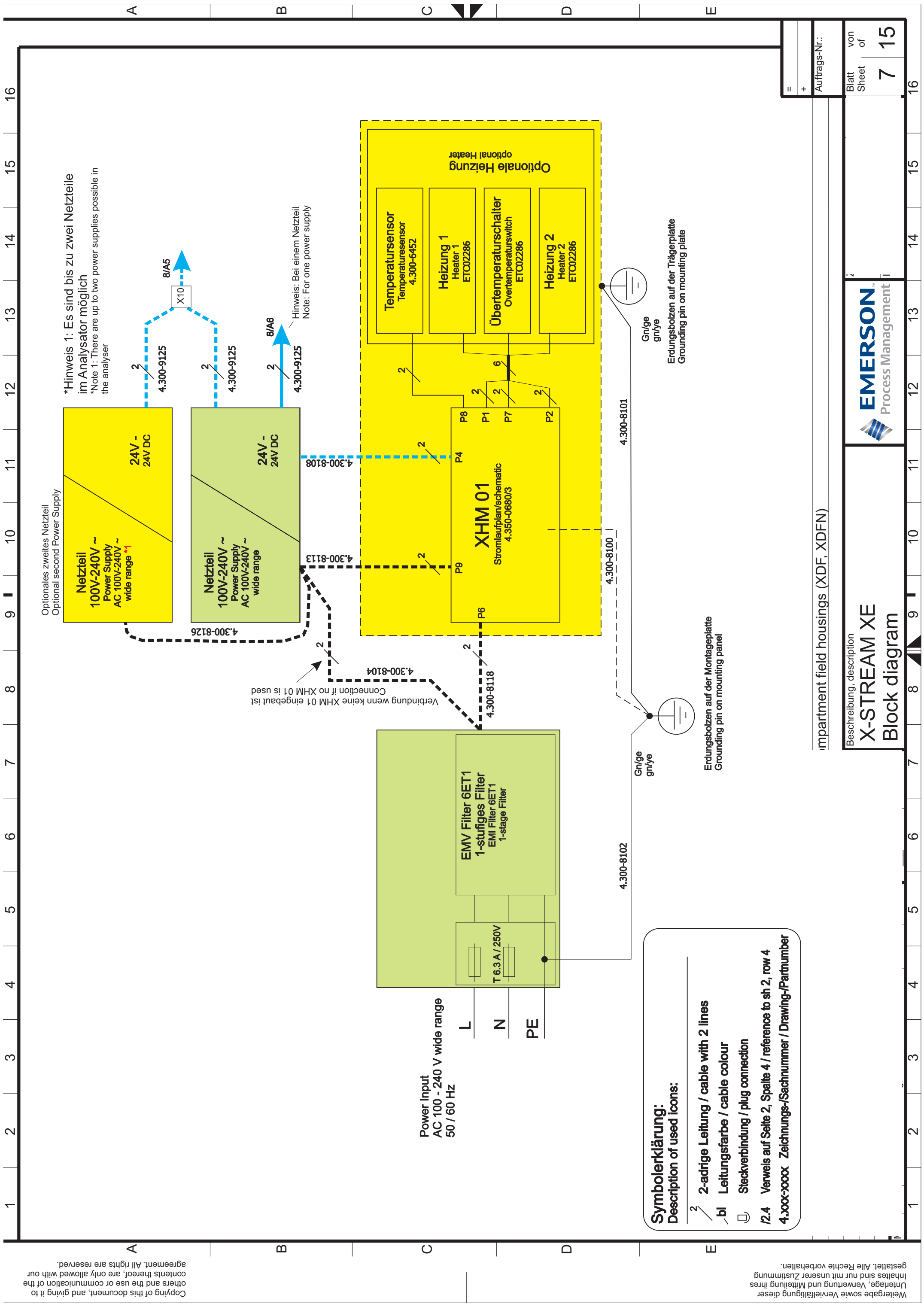


A.2 Block Diagram

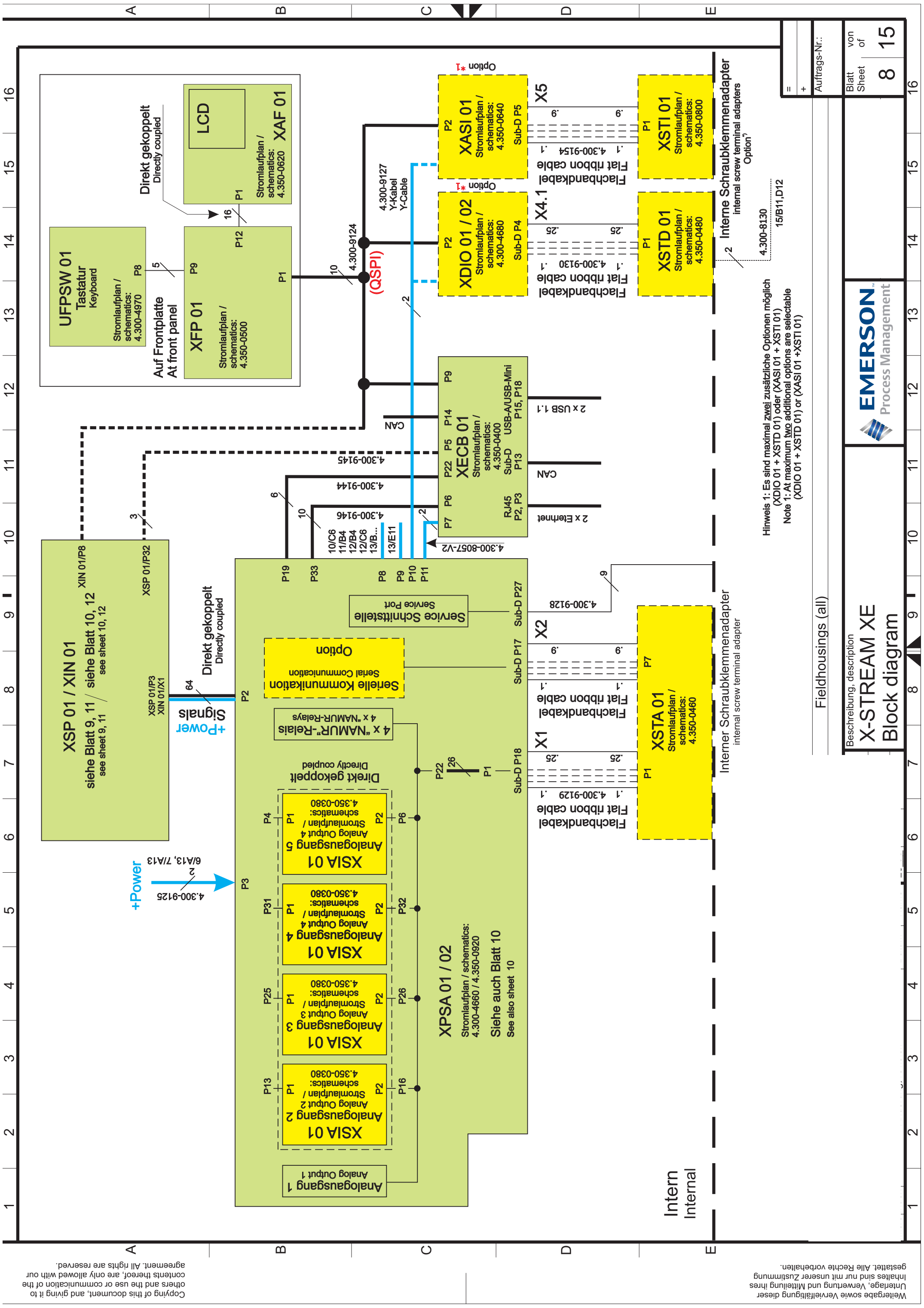


A Appendix

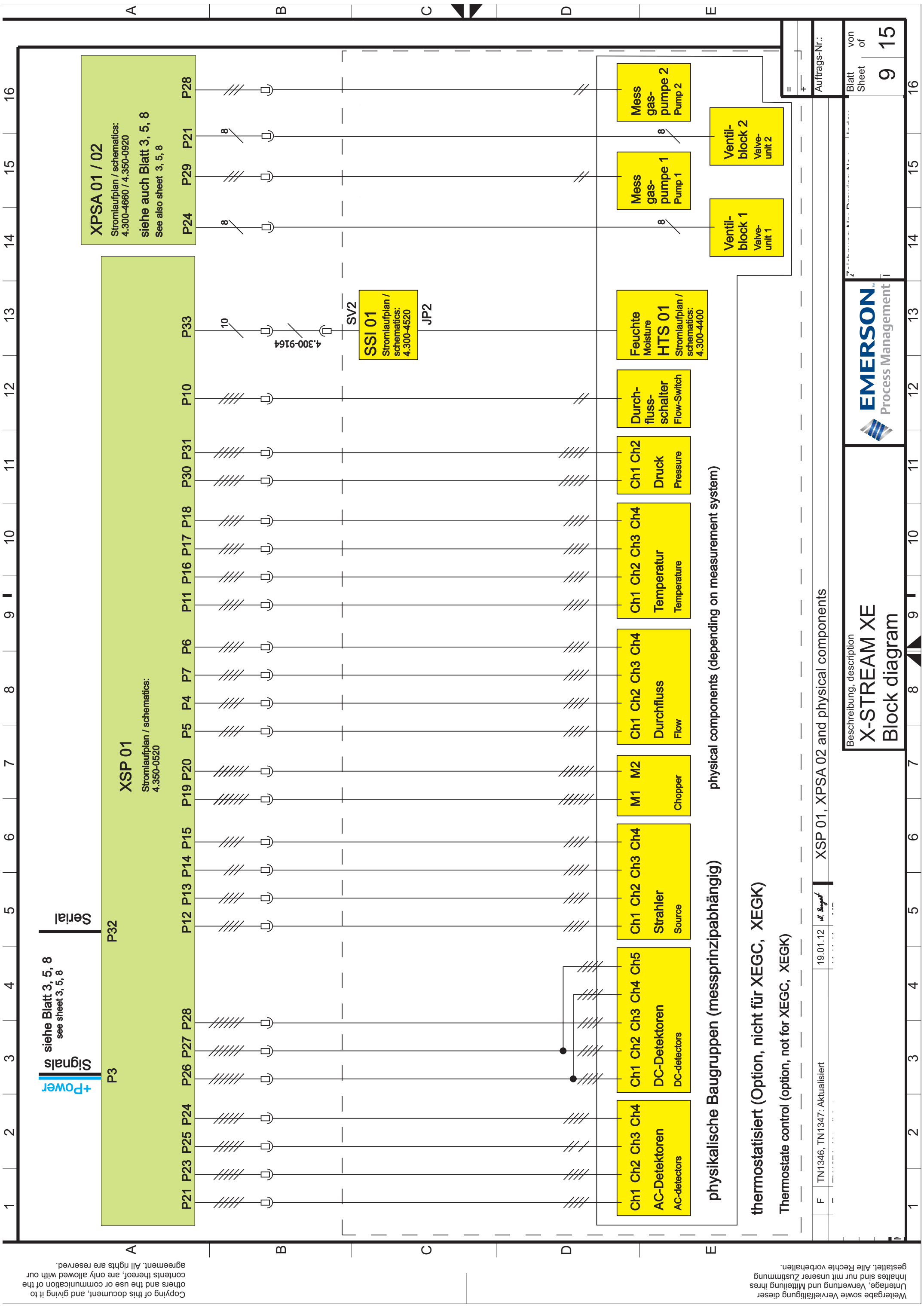
A.2 Block Diagram



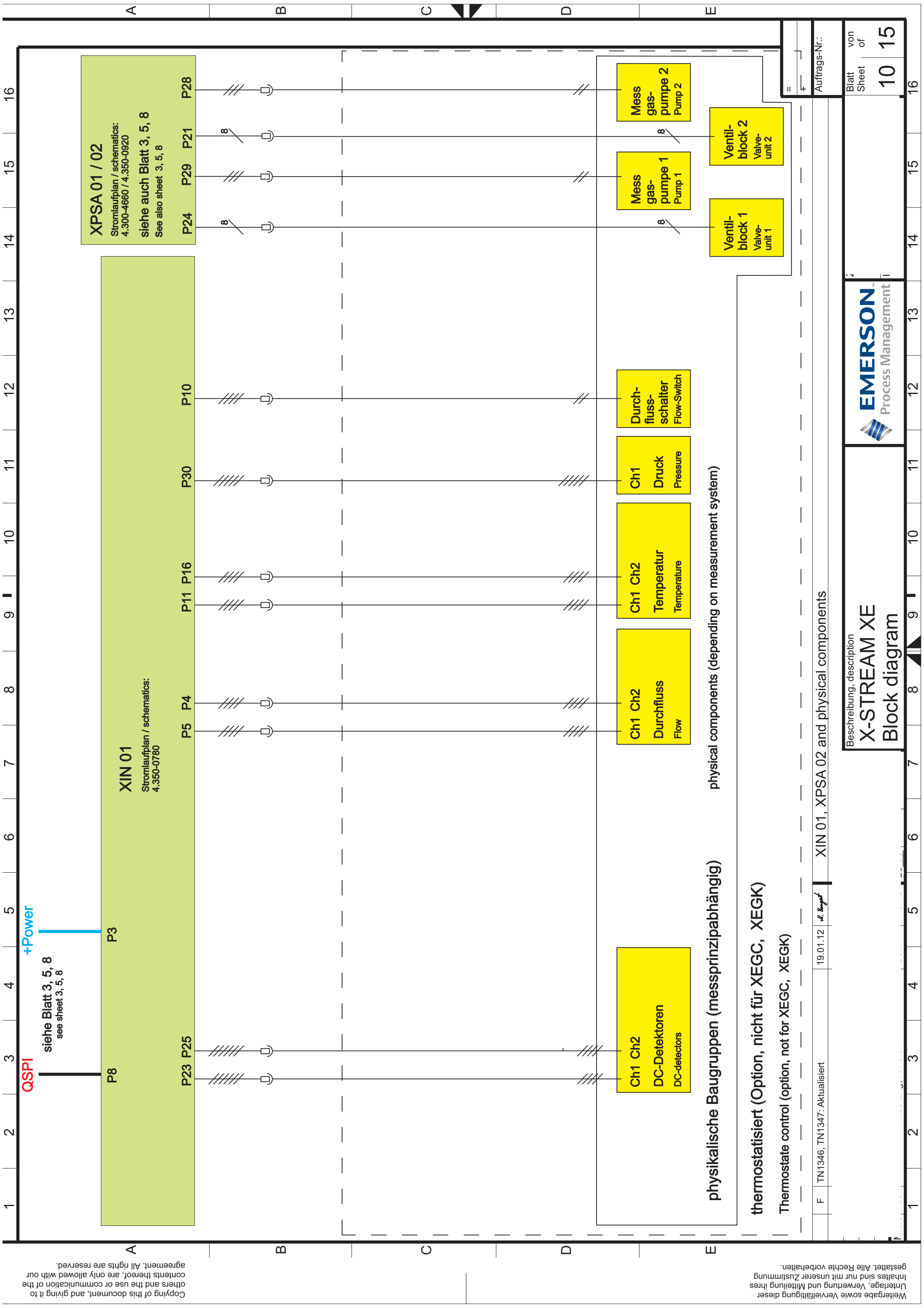
A.2 Block Diagram



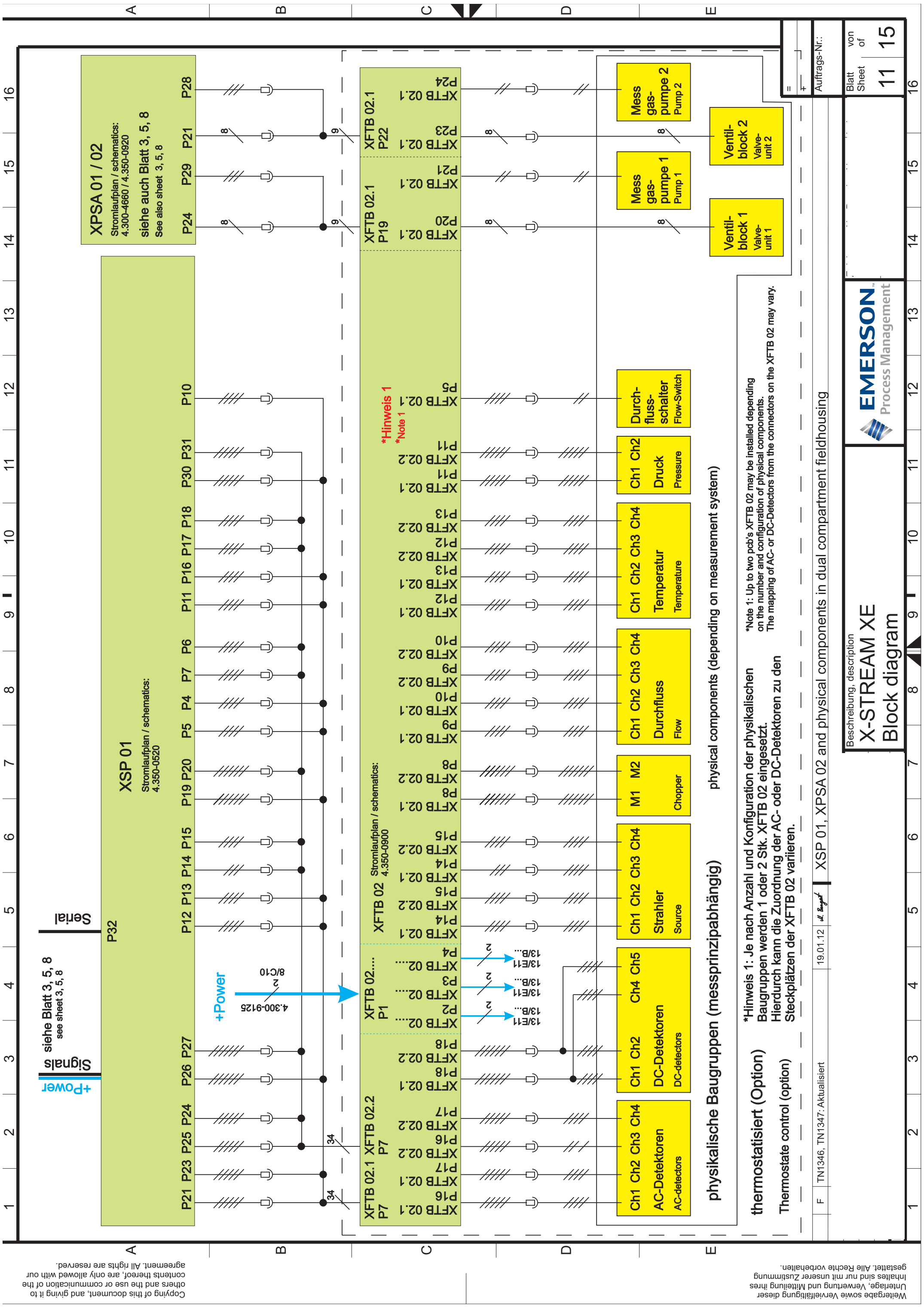
A.2 Block Diagram



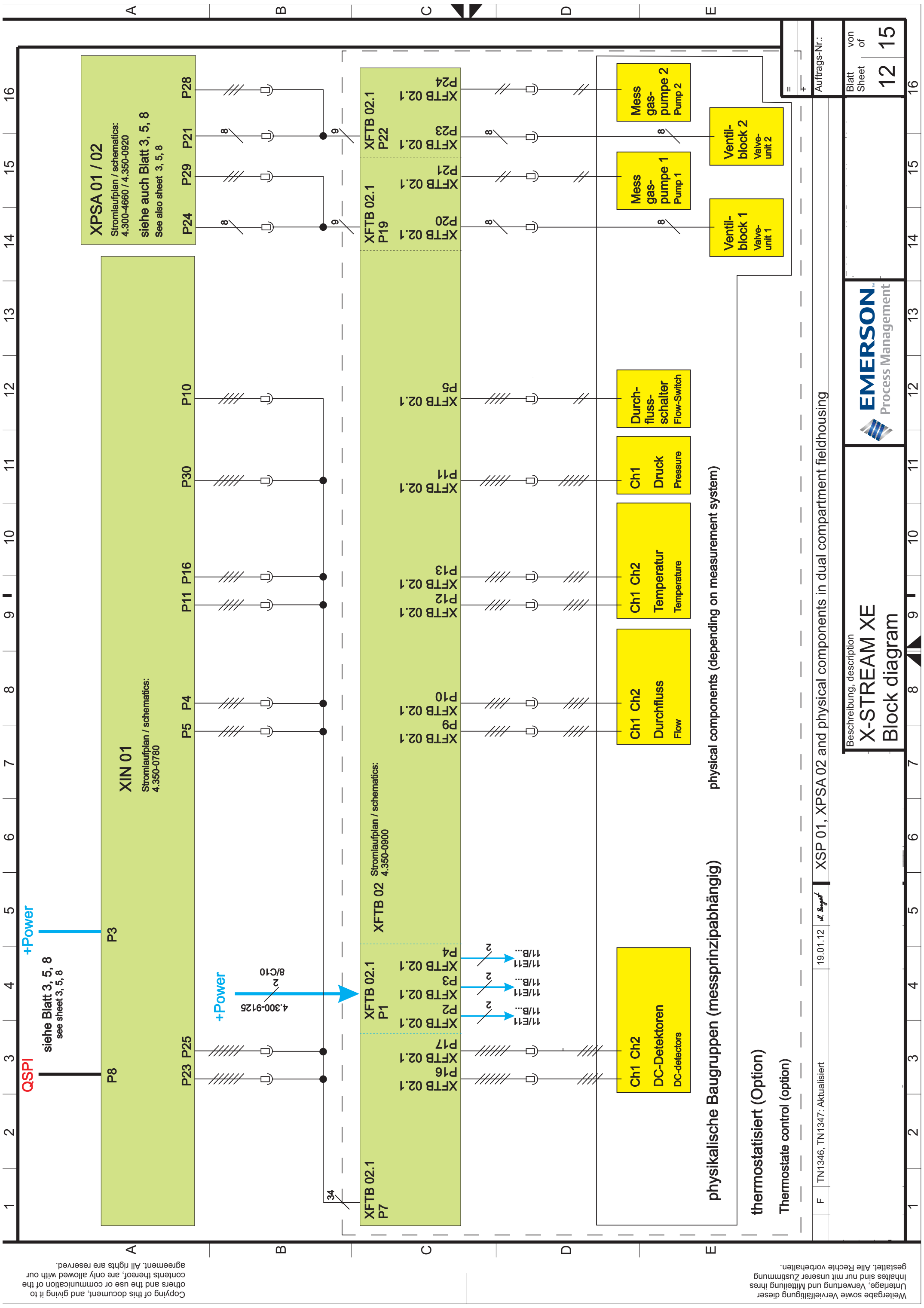
A.2 Block Diagram



A.2 Block Diagram

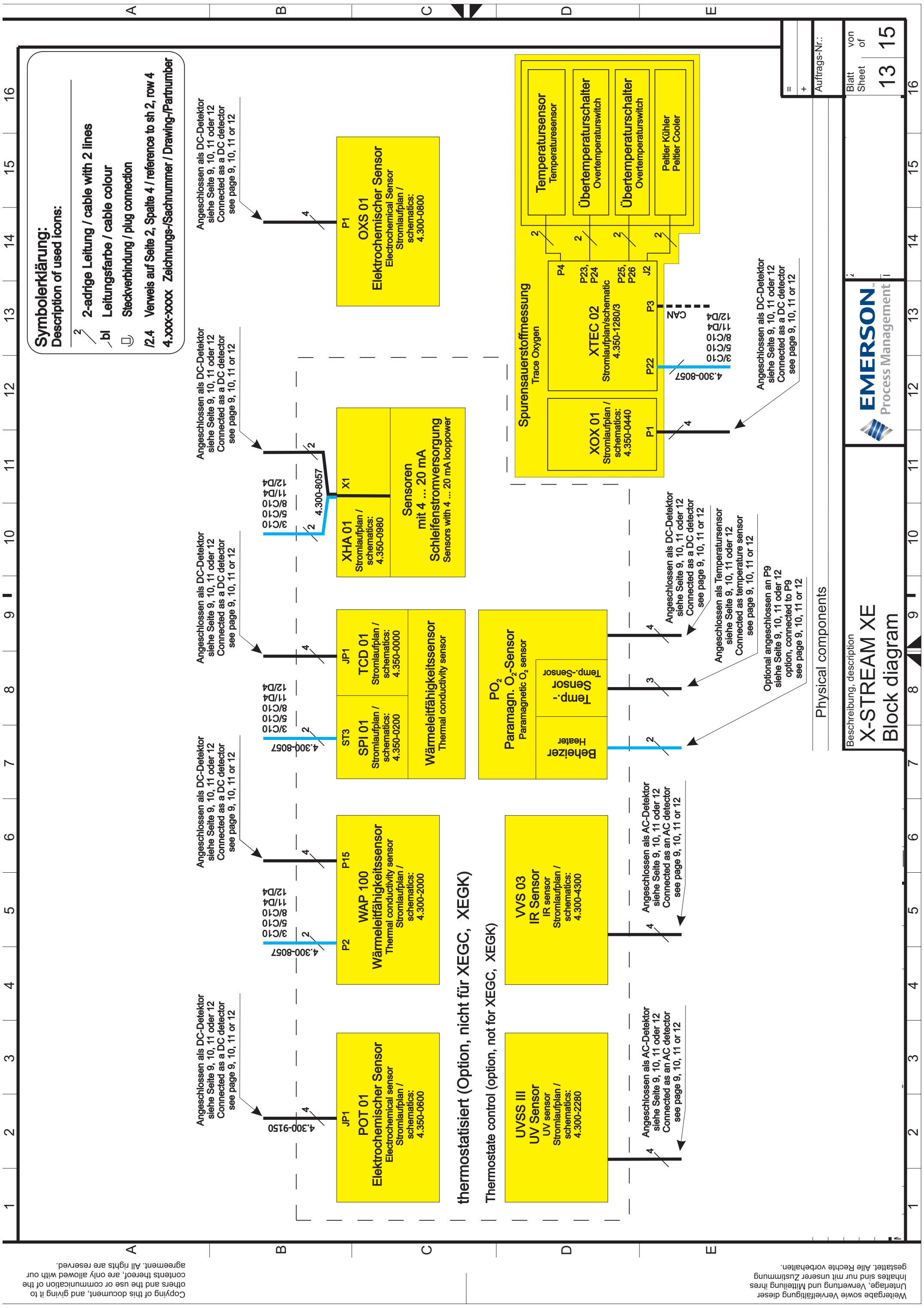


A.2 Block Diagram

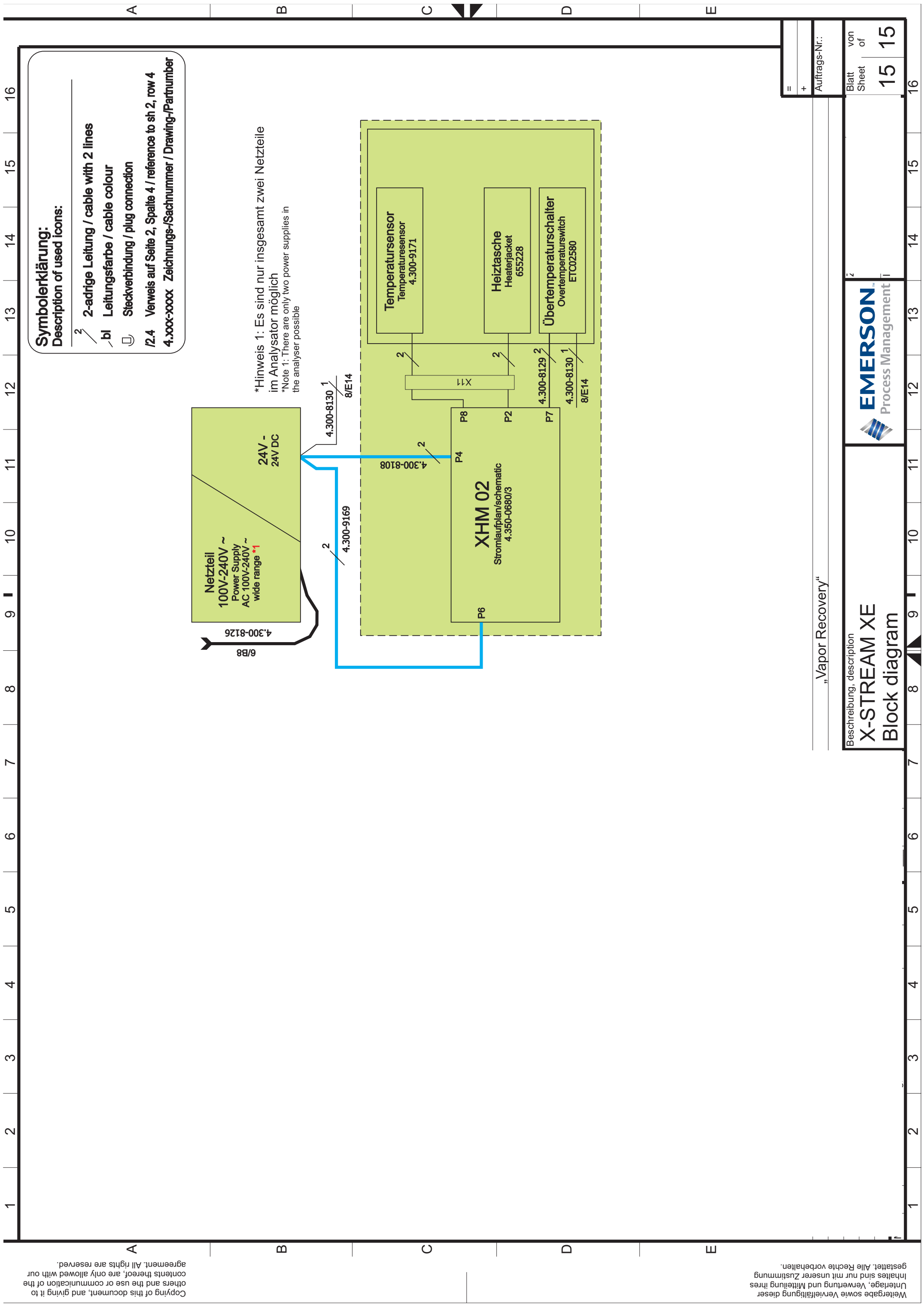


A
Appendix

A.2 Block Diagram



A.2 Block Diagram



Note!
Sheet 14 of block diagram is intentionally missing here!

A.3 Water Vapor: Relationship of Dewpoint, Vol.-% and g/Nm³

Dewpoint		Content of Water	Water Concentration
° C	° F	Vol. -%	g/Nm³
0	32,0	0,60	4,88
1	33,8	0,65	5,24
2	36,8	0,68	5,64
3	37,4	0,75	6,06
4	39,2	0,80	6,50
5	41,0	0,86	6,98
6	42,8	0,92	7,49
7	44,6	0,99	8,03
8	46,4	1,06	8,60
9	48,2	1,13	9,21
10	50,0	1,21	9,86
11	51,8	1,29	10,55
12	53,6	1,38	11,29
13	55,4	1,48	12,07
14	57,2	1,58	12,88
15	59,0	1,68	14,53
16	60,8	1,79	14,69
17	62,6	1,90	16,08
18	64,4	2,04	16,72
19	66,2	2,16	17,72
20	68,0	2,30	19,01
21	69,8	2,45	20,25
22	71,6	2,61	21,55
23	73,4	2,77	22,95
24	75,2	2,95	24,41
25	77,0	3,12	25,97
26	78,8	3,32	27,62
27	80,6	3,52	29,37
28	82,4	3,73	32,28
29	84,2	3,96	33,15
30	86,0	4,18	35,20
31	87,6	4,43	37,37
32	89,6	4,69	39,67
33	91,4	4,97	42,09
34	93,2	5,25	44,64
35	95,0	5,55	47,35

Dewpoint		Content of Water	Water Concentration
° C	° F	Vol. -%	g/Nm³
36	96,8	5,86	50,22
37	98,6	6,20	53,23
38	100,4	6,55	56,87
39	102,2	6,90	59,76
40	104,0	7,18	62,67
42	107,6	8,10	70,95
44	111,2	8,99	79,50
45	113,0	9,45	84,02
46	114,8	9,96	89,20
48	118,4	11,07	99,80
50	122,0	12,04	110,81
52	125,6	13,43	124,61
54	129,2	14,80	139,55
55	131,0	15,55	147,97
56	132,8	16,29	156,26
58	136,4	17,91	175,15
60	140,0	19,65	196,45
62	143,6	21,55	220,60
64	147,2	23,59	247,90
66	150,8	25,80	279,20
68	154,4	28,18	315,10
70	158,0	30,75	356,70
72	161,6	33,50	404,50
74	165,2	36,47	461,05
76	168,8	39,66	527,60
78	172,4	43,06	607,50
80	176,0	46,72	704,20
82	179,6	50,65	824,00
84	183,2	54,84	975,40
86	186,8	59,33	1171,50
88	190,4	64,09	1433,30
90	194,0	69,18	1805,00

Note!

Standard conditions: 273 K (0 °C) and 1013 hPa.
Water concentration calculated at dry standard conditions.

A.4 Declaration of Decontamination

Because of legal regulations and for the safety of Emerson Process Management employees and operating equipment, we need this “**Declaration of Decontamination**”, signed by an authorized person, prior to processing your order. Ensure to include it with the shipping documents, or (recommended) attach it to the outside of the packaging.

Instrument details	Analyzer model	
	Serial no.	
Process details	Temperature	
	Pressure	

Please check where applicable, include safety data sheet and, if necessary, special handling instructions!								
The medium was used for	Medium and concentration	CAS No.	toxic	harmful	corrosive	flam-mable	other[1)]	harmless
Process								
Process cleaning								
Cleaning of returned parts								

1) e.g. explosive, radioactive, environmentally hazardous, of biological risk, etc.
Describe:

Declaration and Sender Data

We hereby declare that the retumed parts have been carefully cleaned. To the best of our knowledge they are free from any residues in dangerous quantities.

Company	Contact Person / Function
Address	
	Phone
Location, Date	Signature

Appendix
A

A.5 PLC Quick Reference

EMERSON. Process Management

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PLC Quick Reference Card

Program lines not to exceed 100 chars, otherwise runtime errors show up!
First program line to start with ####, otherwise upload to analyzer fails!

If timers need to be used, they have to be setup at the beginning of the program (see Example Program)
For USB transfer save `PLC.TXT` on the USB stick into the directory
`emerson_xe\<Analyzer Serial Number>\config`

PLC Timer Setup

Syntax: `<COMMAND> <ID> <VALUE>; [Comment]`
For details see *Timer Modes* below

COMMAND	ID	VALUE
TMR_MODE	1...8	OFFDELAY, ONDELAY, REPPULSE, SINGLEPULSE, RETRIGSPULSE, INHIBSPULSE, CLKTRGPULSE , COUNTER
TMR_DURATION	1...8	1...3600
TMR_PERIOD_CNT	1...8	1...3600 (REPPULSE: sec CLKTRGPULSE: min COUNTER: counts)
TMR_TRIG_TIME	1...8	YYYY,MM,DD,hh,mm

Sequencer Setup

Syntax: `<COMMAND> <ID> <VALUE>; [Comment]`
For details see *Sequencer Function Block* below

COMMAND	ID	VALUE	DESCRIPTION
SEQ_DURATION	1...4	1...3600	Set switch duration
SEQ_STAB_TIME	1...4	0...3599, but max. (<SEQ_DURATION> -1)	Set stabilization time
SEQ_NUM_OUTS	1...4	2...10	Set no. of outputs to be used
SEQ_SNGL_CYCLE	1...4	TRUE, FALSE	Set single cycle mode

Programming Quick Reference

Syntax: `<OPERATOR> [<OPERAND>,<OPERAND>,...]; [Comment]`
Maximum amount of operators & operands: approx. 400

SPECIAL CHARACTER	Function
,	Separation of Operands
;	Command Termination
#	Start of Comment Line

A.5 PLC Quick Reference

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OPERATOR	OPERANDS	Description
CLR	-	Set register to FALSE
SET	-	Set register to TRUE
AND	O1, [O2, O3, ...]	Logical AND of register and <read operands>
OR	O1, [O2, O3, ...]	Logical OR of register and <read operands>
NEG	-	Negate register
LOAD	O1	load register with state of <read operands>
STO	O1, [O2, O3, ...]	Store register to <write operands>
IF	O1, O2	if register = TRUE then load register with state of first <read operand> else load register with state of second <read operand>
CALL	O1, [O2, O3, ...]	if register = TRUE then call <call operand>
END	-	End of program

READ & WRITE OPERANDS	Description
R1 ... R10	Result 1 ... 10
M1 ... M15	Memory 1 ... 15

WRITE ONLY OPERANDS	Description
T1I1, T1I2	Timer 1 / Input 1, 2
T2I1, T2I2	Timer 2 / Input 1, 2
T3I1, T3I2	Timer 3 / Input 1, 2
T4I1, T4I2	Timer 4 / Input 1, 2
T5I1, T5I2	Timer 5 / Input 1, 2
T6I1, T6I2	Timer 6 / Input 1, 2
T7I1, T7I2	Timer 7 / Input 1, 2
T8I1, T8I2	Timer 8 / Input 1, 2
SQ1ENA, SQ1HLD, SQ1RST	Sequencer 1 / Enable, Hold, Restart
SQ2ENA, SQ2HLD, SQ2RST	Sequencer 2 / Enable, Hold, Restart
SQ3ENA, SQ3HLD, SQ3RST	Sequencer 3 / Enable, Hold, Restart
SQ4ENA, SQ4HLD, SQ4RST	Sequencer 4 / Enable, Hold, Restart

Syntax of channel related operands indices: `<CHANNELNUMBER><SIGNALNUMBER>`

READ ONLY OPERANDS	Description
S01 ... S76	System Digital Output Pool (see below)
S101 ... S540	Channel Digital Output Pool (see below)
T1 ... T8	Output Timer 1 ... 8
SQ1O1 ... SQ1O10, SQ1RDY, SQ1STAB	Sequencer 1 / Outputs 1...10, Ready, Stabilize
SQ2O1 ... SQ2O10, SQ2RDY, SQ2STAB	Sequencer 2 / Outputs 1...10, Ready, Stabilize
SQ3O1 ... SQ3O10, SQ3RDY, SQ3STAB	Sequencer 3 / Outputs 1...10, Ready, Stabilize
SQ4O1 ... SQ4O10, SQ4RDY, SQ4STAB	Sequencer 4 / Outputs 1...10, Ready, Stabilize
DI1 ... DI14	Digital Input 1 ... 14
PU1, PU2	Pump State 1, 2
TRUE	Logical TRUE operand
FALSE	Logical FALSE operand

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CALL ONLY OPERANDS	Description
A01 … A15	System Actions (see below)
A101 … A521	Channel Actions (see below)

System Actions Pool Index

Usage example: `CALL A06; # Start programmed sequence if register changed to TRUE`

ANR	Description
01	None
02	Zero All
03	Span All
04	Zero&Span All
05	Cancel All
06	ProgSequ
07	Blowback
08	CalCheckMod
09	*Reserved*
10	Failure
11	OffSpec
12	MaintRequ

ANR	Description
13	FctCheck
14	Pump1
15	Pump2
16	Ext Alarm1
17	Ext Alarm2
18	Ext Alarm3
19	Ext Alarm4
20	Ext Alarm5
21	Ext Alarm6
22	Ext Alarm7
23	Ext Alarm8

System Digital Output Pool Index

Usage example: `LOAD S41; Load the state of pump1 into register`

SNR	Signal
01	Off
02	On
03	Heartbeat
04	Any Failure
05	Any OffSpec
06	Any MaintRequ
07	Any FctCheck
11	Any Zero Failed
12	Any Span Failed
13	Any Range Low
14	Any Range High
15	Any ConcAlarm
21	V1
22	V2
…	…
39	V19

SNR	Signal
40	V20
41	Pump1
42	Pump2
43	Ext Alarm1
44	Ext Alarm2
…	…
49	Ext Alarm7
50	Ext Alarm8
51	PLC Result1
52	PLC Result2
…	…
59	PLC Result9
60	PLC Result10
76	CalcD Rslt HiHi

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Channel Actions Pool Index

Usage example: `CALL A103; Start span cal for channel 1, if register changed to TRUE`
`# Replace 'x' in table by channel # (1 … 5)`

ANR	Description
x01	None
x02	ZeroCal
x03	SpanCal
x04	ZeroSpanCal
x05	Cancel
x06	Range1
x07	Range2
x08	Range3
x09	Range4
x10	Failure
x11	OffSpec

ANR	Description
x12	MaintRequ
x13	FctCheck
x14	SampleGas
x15	ZeroGas
x16	SpanGas1
x17	SpanGas2
x18	SpanGas3
x19	SpanGas4
x20	All Closed
x21	Blowback

Channel Digital Output Pool Index

Usage example: `LOAD S332; Load press low alarm state of channel 3 into register`
`# Replace 'x' in table by channel # (1 … 5)`

SNr	Description
x01	Off
x02	On
x03	Heartbeat
x04	Failure
x05	OffSpec
x06	MaintRequ
x07	FctCheck
x08	Calibrating
x09	Zeroing
x10	Spanning
x11	Zero Failed
x12	Span Failed
x13	Range Underflow
x14	Range Overflow
x15	Range1
x16	Range2
x17	Range3
x18	Range4
x19	Conc. LoLo
x20	Conc. Lo

SNR	Description
x21	Conc. Hi
x22	Conc. HiHi
x23	Average LoLo
x24	Average Lo
x25	Average Hi
x26	Average HiHi
x27	Temperature LoLo
x28	Temperature Lo
x29	Temperature Hi
x30	Temperature HiHi
x31	Pressure LoLo
x32	Pressure Lo
x33	Pressure Hi
x34	Pressure HiHi
x35	Flow LoLo
x36	Flow Lo
x37	Flow Hi
x38	Flow HiHi
x39	Off
x40	Off

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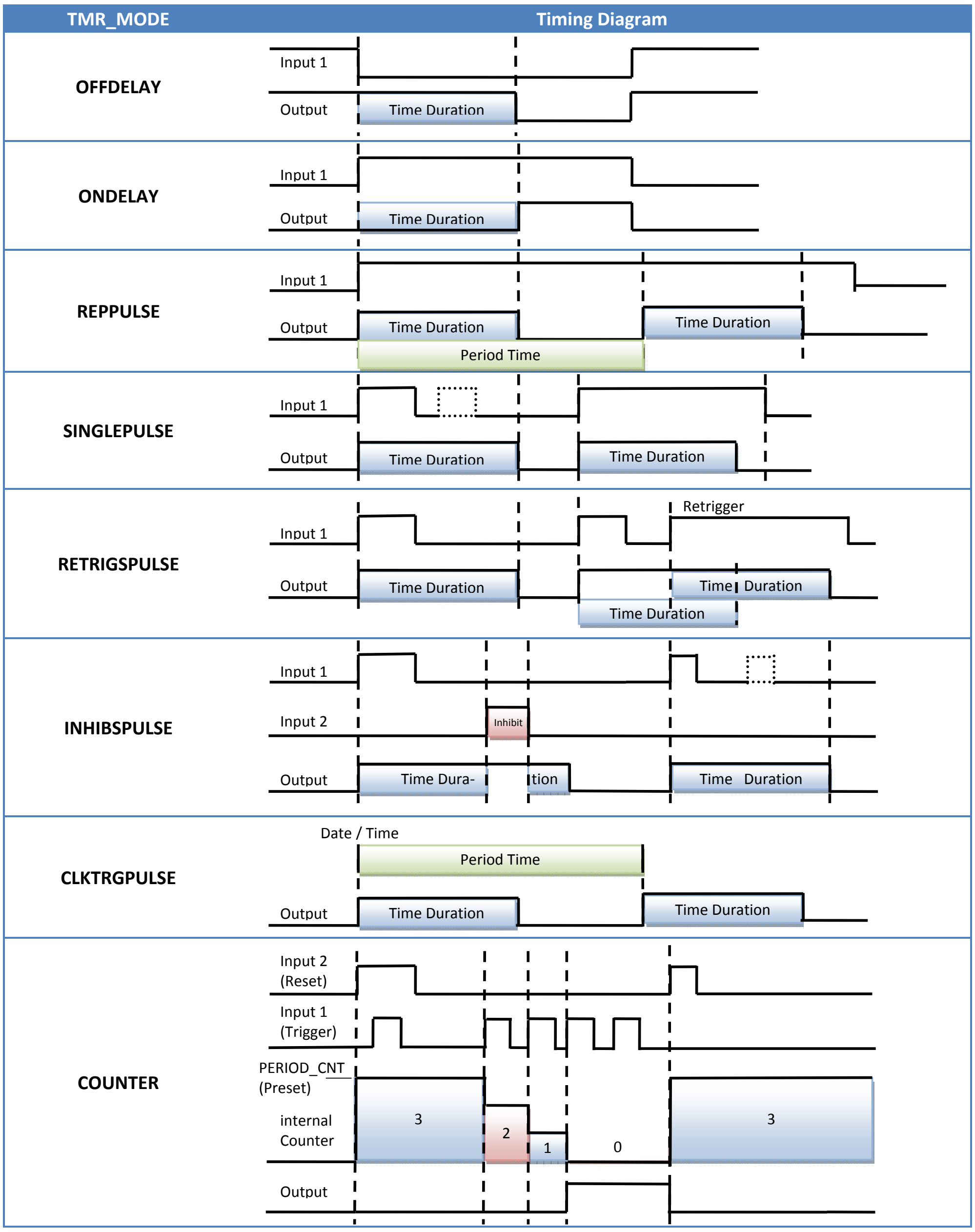
Timer Modes



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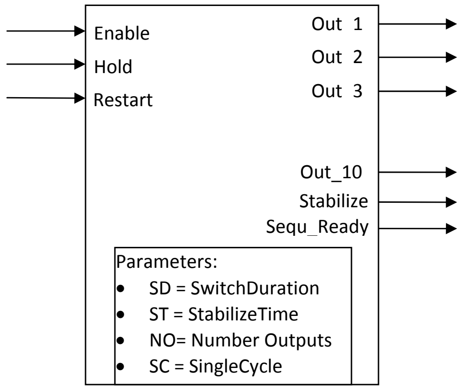
Sequencer Function Block



Example Program 1

```
#### First program line MUST begin with '####'
#-Sequencer #1 is used-----------
SEQ_DURATION  1 5;      SD = 5 seconds
SEQ_STAB_TIME 1 2;      ST = 2 seconds
SEQ_NUM_OUTS  1 8;
SEQ_SNGL_CYCLE 1 FALSE;

#--------------------------------
#Digital Input#1 is used for enabling the sequencer
LOAD  DI1;        load Digital Input#1
STO   SQ1ENA;     feed Enable input of Sequencer1 with this state

LOAD  SQ1O1;      load Sequencer1 Out#1
STO   R1;         store as result#1
LOAD  SQ1O2;      load Sequencer1 Out#2
STO   R2;         store as result#2
LOAD  SQ1O3;      load Sequencer1 Out#3
STO   R3;         store as result#3
LOAD  SQ1O4;      load Sequencer1 Out#4
STO   R4;         store as result#4
LOAD  SQ1O5;      load Sequencer1 Out#5
STO   R5;         store as result#5
LOAD  SQ1O6;      load Sequencer1 Out#6
STO   R6;         store as result#6
LOAD  SQ1O7;      load Sequencer1 Out#7
STO   R7;         store as result#7
LOAD  SQ1O8;      load Sequencer1 Out#8
STO   R8;         store as result#8

LOAD  SQ1STAB;    load Sequencer1 Stabilize
STO   R9;         store as result#9

END;              Program end
```

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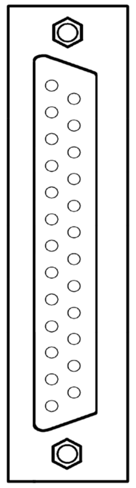
Example Program 2

```
#### First program line MUST begin with '####'
#-Example for Timer 1---------------------
TMR_MODE      1 OFFDELAY;
TMR_DURATION  1 5; delay 5 sec

#-Example for Timer 2---------------------
TMR_MODE      2 ONDELAY;
TMR_DURATION  2 5; delay 5 sec

#-Example for Timer 3---------------------
TMR_MODE      3 REPPULSE;
TMR_DURATION  3 5; pulse width 5 sec
TMR_PERIOD_CNT 3 20;   periode 20 sec

#-Example for Timer 4---------------------
TMR_MODE      4 SINGLEPULSE;
TMR_DURATION  4 5; pulse width 5 sec

#-Example for Timer 5---------------------
TMR_MODE      5 RETRIGSPULSE;
TMR_DURATION  5 5; pulse width 5 sec

#-Example for Timer 6---------------------
TMR_MODE      6 INHIBSPULSE;
TMR_DURATION  6 10; pulse width 10 sec

#-Example for Timer 7---------------------
TMR_MODE      7 CLKTRGPULSE;
TMR_DURATION  7 5; pulse width 5 sec
TMR_PERIOD_CNT 7 10; pulse trigger is repeated each 10 minutes
TMR_TRIG_TIME 7 2009,10,26,17,00; start triggering Oct26 2009, 05:00 pm

#-Example for Timer 8---------------------
TMR_MODE      8 COUNTER;
TMR_PERIOD_CNT 8 10; preset count value = 10

#--------------------------------
LOAD  DI1;  Digital Input#1
STO   T1I1,T2I1,T3I1; feed Input1 of Timers1..3 with this state
STO   R9;   assign Digital Input#1 also to Result#9
LOAD  DI5;  load Digital Input#2
STO   T1I2,T2I2,T3I2; feed Input2 of Timers1..3 with this state
#--------------------------------
LOAD  T1;   read Timer 1 output
STO   R1;   store as Result#1
#--------------------------------
LOAD  DI5;  read Digital Input #5
IF    R10,R2;  if DI5 then load Result#10 else load Result#2
CALL  A110; simulate an 'External Failure" of Ch1 if loaded with '1' state
LOAD  T3;   read Timer 3 output
CALL  A311; simulate an "MaintRequ" of Ch3 if loaded with '1' state
#--------------------------------
LOAD  S62;  CalcA rslt Lo
STO   R3;   store as Result#3
LOAD  S208;   Ch2 calibrating
STO   R4;   store as Result#4

END;           Program end
```

B.6 Assignment of Terminals and Sockets

B.6.1 Tabletop & Rack Mount Analyzers

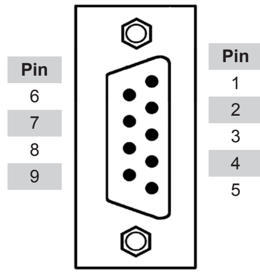
	Signal	Pin
Analog outputs	Channel 1, (+) 4 (0) - 20 mA	1
Analog outputs	Channel 2, (+) 4 (0) - 20 mA	2
Analog outputs	Channel 3, (+) 4 (0) - 20 mA	3
Analog outputs	Channel 4, (+) 4 (0) - 20 mA	4
Analog outputs	Channel 5, (+) 4 (0) - 20 mA	5
	unused	6
	unused	7
Relay contacts (Status signals)	Output1 (Failure) NC	8
Relay contacts (Status signals)	Output1 (Failure) NO	9
Relay contacts (Status signals)	Output1 (Failure) COM	10
Relay contacts (Status signals)	Output3 (Off spec) NC	11
Relay contacts (Status signals)	Output3 (Off spec) NO	12
Relay contacts (Status signals)	Output3 (Off spec) COM	13



Pin	Signal	
14	Channel 1, GND	Analog outputs
15	Channel 2, GND	Analog outputs
16	Channel 3, GND	Analog outputs
17	Channel 4, GND	Analog outputs
18	Channel 5, GND	Analog outputs
19	*unused*	
20	Output2 (Maintenance request) NC	Relay contacts (Status signals)
21	Output2 (Maintenance request) NO	Relay contacts (Status signals)
22	Output2 (Maintenance request) COM	Relay contacts (Status signals)
23	Output4 (Function check) NC	Relay contacts (Status signals)
24	Output4 (Function check) NO	Relay contacts (Status signals)
25	Output4 (Function check) COM	Relay contacts (Status signals)

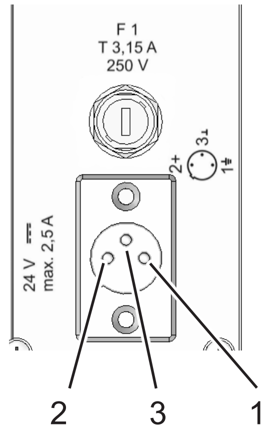
Note!
Configuration of relay contacts as per standard factory setting (NAMUR status signals)

Socket X1 - Analog Outputs, Relay Outputs 1...4
(Assignment of Screw Terminals Adaptor: See XSTA on Next Page)



Pin no.	MOD 485/ 2 wire	MOD 485/ 4 wire	RS 232
1	Common	Common	Common
2	*not used*	*not used*	RXD
3	*not used*	*not used*	TXD
4	*not used*	RXD1(+)	*not used*
5	D1(+)	TXD1(+)	Common
6	*not used*	*not used*	*not used*
7	*not used*	*not used*	*not used*
8	*not used*	RXD0(-)	*not used*
9	D0(-)	TXD0(-)	*not used*

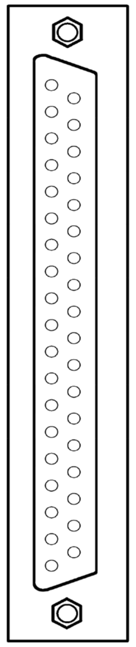
Connector X2 - IOIOI - Serial Interface
(Assignment of Screw Terminals Adaptor: See XSTA on Next Page)



1: ME
2: + 24 V⎓
3: 0 V (⊥)

DC 24 V Input (½ 19" Analyzer)

	Signal	Pin
Digital inputs	Input 1	1
Digital inputs	Input 2	2
Digital inputs	Input 3	3
Digital inputs	Input 4	4
Digital inputs	GND for all digital inputs	5
	unused	6
	unused	7
Digital outputs	Output 5 NC	8
Digital outputs	Output 5 NO	9
Digital outputs	Output 5 COM	10
Digital outputs	Output 6, NC	11
Digital outputs	Output 6, NO	12
Digital outputs	Output 6, COM	13
Digital outputs	Output 7, NC	14
Digital outputs	Output 7, NO	15
Digital outputs	Output 7, COM	16
Digital outputs	Output 8, NC	17
Digital outputs	Output 8, NO	18
Digital outputs	Output 8, COM	19

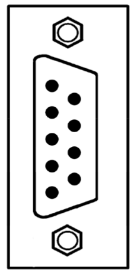


Pin	Signal	
20	Input 5	Digital inputs
21	Input 6	Digital inputs
22	Input 7	Digital inputs
23	Output 9, NC	Digital outputs
24	Output 9, NO	Digital outputs
25	Output 9, COM	Digital outputs
26	Output 10, NC	Digital outputs
27	Output 10, NO	Digital outputs
28	Output 10, COM	Digital outputs
29	Output 11, NC	Digital outputs
30	Output 11, NO	Digital outputs
31	Output 11, COM	Digital outputs
32	Output 12, NC	Digital outputs
33	Output 12, NO	Digital outputs
34	Output 12, COM	Digital outputs
35	Output 13, NC	Digital outputs
36	Output 13, NO	Digital outputs
37	Output 13, COM	Digital outputs

Note!
The configuration illustrated here is that of the first socket, labelled X4.1.
Inputs 8-14 and outputs 14-22, are on the second socket (X4.2), if installed.

Socket X4 - Digital I/O
(Assignment of Screw Terminals Adaptor: See XSTD on Next Page)

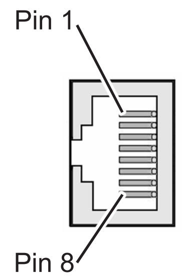
Signal	Pin
BR 2 { fit a wire bridge here to apply analog }	5
BR 2 { signal in current mode to input 2*) }	4
unused	3
BR 1 { fit a wire bridge here to apply analog }	2
BR 1 { signal in current mode to input 1**) }	1



Pin	Signal
9	Input 2 high (+)
8	Input 2 low (-)
7	Input 1 low (-)
6	Input 1 high (+)

*) alternatively set jumper P1 on electronics board XASI
**) alternatively set jumper P2 on electronics board XASI

Connector X5 - Analog Inputs
(Assignment of Screw Terminals Adaptor: See XSTI on Next Page)



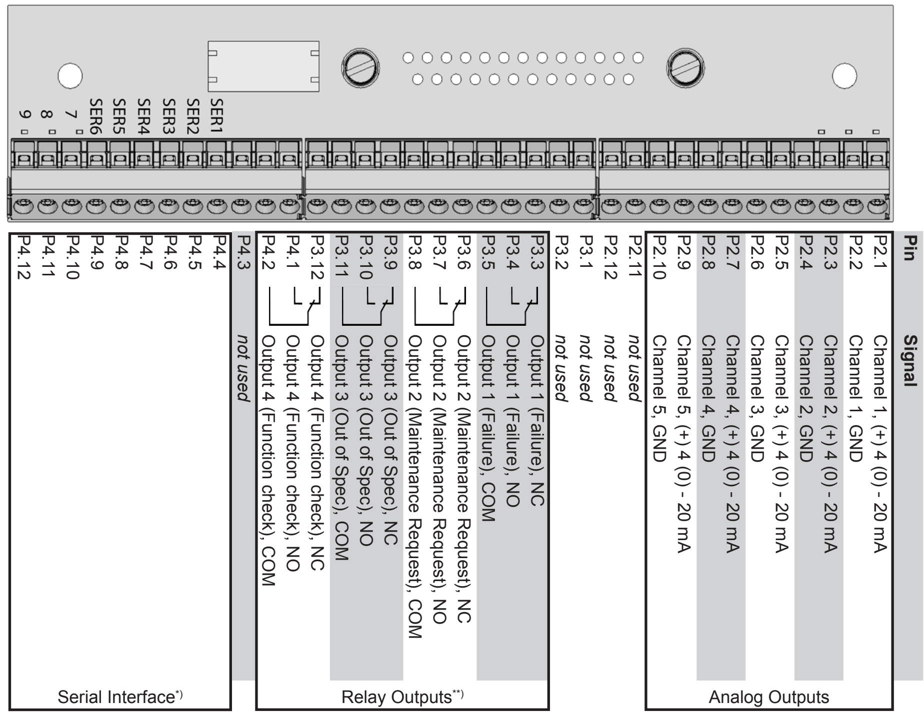
Pin no.	Signal
1	TX+
2	TX-
3	RX+
6	RX-
other	*not used*

Ethernet Connector for Modbus

Appendix
A

B.6.2 Field Housings

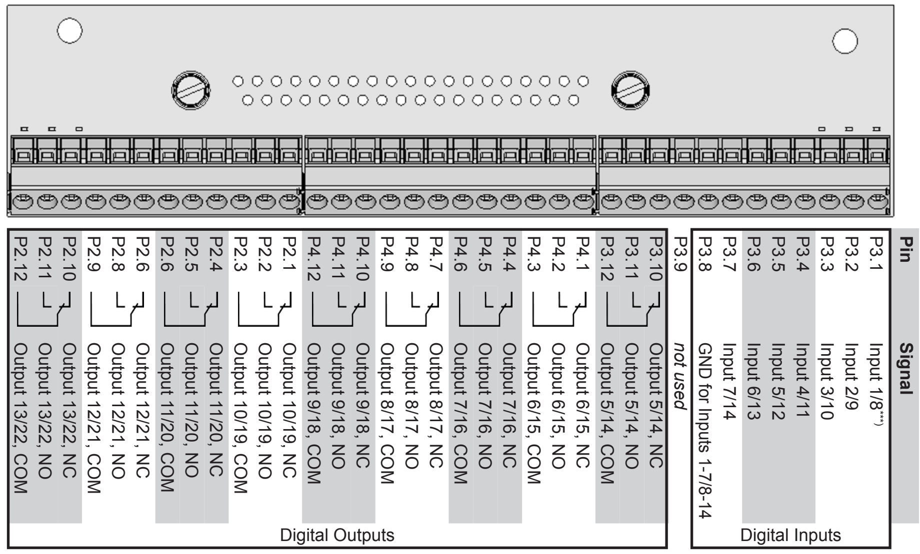
XSTA: Standard Strip With Standard and Optional Signals



*) See table below

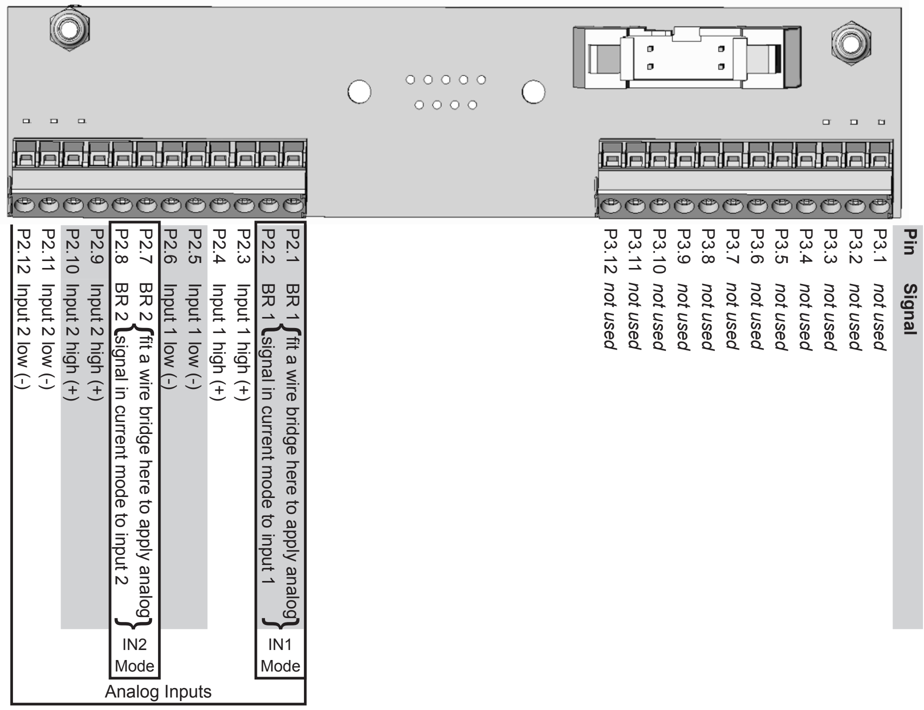
**) Configuration of relay output terminals as per standard factory setting (NAMUR status signals)

XSTD: Optional Strips With 7 Dig Inputs and 9 Dig Outputs Each



***) 1st/2nd no. identifies inputs/outputs on the 1st/2nd expansion board

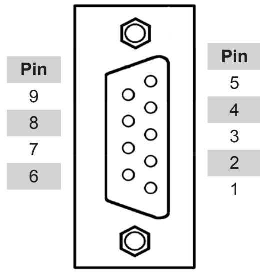
XSTI: Analog Inputs



Assignment of serial interface terminals

Terminal		MOD 485/ 2 wire	MOD 485/ 4 wire	RS 232
P4.4	*SER1*	Common	Common	Common
P4.5	*SER2*	*not used*	*not used*	RXD
P4.6	*SER3*	*not used*	*not used*	TXD
P4.7	*SER4*	*not used*	RXD1(+)	*not used*
P4.8	*SER5*	D1(+)	TXD1(+)	Common
P4.9	*SER6*	*not used*	*not used*	*not used*
P4.10	*7*	*not used*	*not used*	*not used*
P4.11	*8*	*not used*	RXD0(-)	*not used*
P4.12	*9*	D0(-)	TXD0(-)	*not used*

Signal Terminals Strips

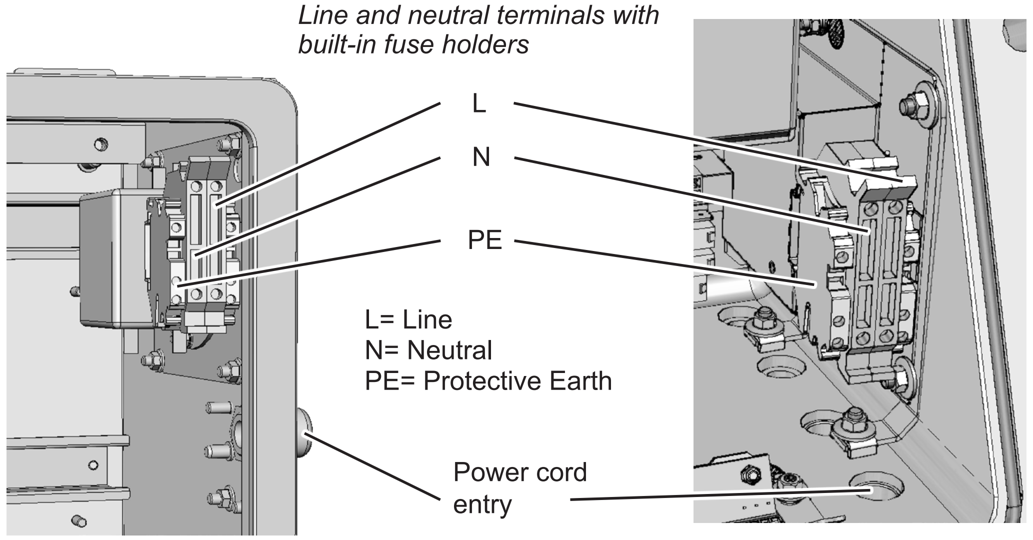


Pin no.	RS 232
1	Common
2	RXD
3	TXD
4	*not used*
5	Common
6	*not used*
7	*not used*
8	*not used*
9	*not used*

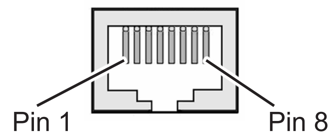
Service Port Connector - Serial RS 232 Interface

Note!

Line and neutral terminals with built-in fuse holders



Field housing ***Power Terminals*** ***Flameproof (cast) housing***



Pin no.	Signal
1	TX+
2	TX-
3	RX+
6	RX-
other	*not used*

Ethernet Connector for Modbus

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