Operating Instructions
JT33 TDLAS gas analyzer

Endress+Hauser

People for Process Automation

Table of Contents

1 Introduction

1.1 Document function

This operating instruction contains information required to install and operate the JT33 TDLAS gas analyzer. It is important to closely review the sections of this manual to ensure the analyzer performs as specified.

1.2 Symbols

1.2.1 Alerts

Structure of Information	Meaning
WARNING **Causes (/consequences)** Consequences of noncompliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or serious injury.
CAUTION **Causes (/consequences)** Consequences of noncompliance (if applicable) ▸ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** Consequences of noncompliance (if applicable) ▸ Action/note	This symbol alerts you to situations which may result in damage to property.

1.2.2 Safety symbols

Symbol	Description
⚠	The High Voltage symbol that alerts people to the presence of electric potential large enough to cause injury or damage. In certain industries, high voltage refers to voltage above a certain threshold. Equipment and conductors that carry high voltage warrant special safety requirements and procedures.
⚠	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible laser radiation when using the system. The laser is a class 3R radiation product.
⟨Ex⟩	The Ex mark signals to Authorities Having Jurisdiction and end-users in Europe that the product complies with the essential ATEX Directive for explosion protection.

1.2.3 Informational symbols

Symbol	Meaning
✓	**Permitted:** Procedures, processes, or actions that are permitted
✗	**Forbidden:** Procedures, processes, or actions that are forbidden
🛈	**Tip:** Indicates additional information
📖	Reference to documentation
📄	Reference to page
🖼	Reference to graphic
▶	Notice or individual step to be observed
1., 2., 3. …	Series of steps
↳	Result of a step

1.2.4   Communication symbols

Symbol	Description
	LED Light emitting diode is off
	LED Light emitting diode is on
	LED Light emitting diode is flashing

1.3   Associated documentation

Each analyzer shipped from the factory is packaged with documents for the model that was purchased. All documentation is available on the USB flash drive provided with the shipment. This document is an integral part of the document package, which includes:

Part Number	Document Type	Description
GP01198C	Description of device parameters	Reference for parameters, providing a detailed explanation of each individual parameter of the operating menu
KA01655C	Brief Operating Instructions	Short instructions for standard installation and commissioning of the device
SD02912C	Special Documentation Heartbeat Technology	Reference for using the Heartbeat Technology function integrated in the measuring device
SD03032C	Special Documentation Web server	Reference for using the web server integrated in the measuring device
TI01722C	Technical Information	Technical data for the device with an overview of associated models available
XA03137C	Safety Instructions	Requirements for installing or operating the analyzer as it relates to personnel or equipment safety
EX3100000056	Control drawing	Drawings and requirements for JT33 field interface connections

For additional instruction manuals, refer to the Endress+Hauser website to download the published documentation: www.endress.com.

1.4   U.S. export compliance

The policy of Endress+Hauser is in strict compliance with U.S. export control laws as detailed in the website of the Bureau of Industry and Security at the U.S. Department of Commerce

1.5   Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

1.6   Manufacturer address

Endress+Hauser
11027 Arrow Route
Rancho Cucamonga, CA 91730
United States
www.endress.com

2   Safety

Each analyzer shipped from the factory includes safety instructions and documentation to the responsible party or operator of the equipment for the purpose of installation and maintenance.

> ⚠ **WARNING**
>
> **Technicians are expected to be trained and to follow all safety protocols, established by the customer in accordance with the area hazard classification, to service or operate the analyzer.**
>
> ▶ This may include but is not limited to toxic and flammable gas monitoring protocols, lockout/tagout procedures, personal protective equipment (PPE) requirements, hot work permits, and other precautions that address safety concerns related to the use and operation of process equipment located in hazardous areas.

2.1   Personnel qualifications

Personnel shall meet the following conditions for mounting, electrical installation, commissioning, and maintenance of the device. This includes but is not limited to:

- Suitably qualified for their role and the tasks they perform
- Understand the general principles and types of protection and markings
- Understand the aspects of equipment design which affect the protection concept
- Understand the content of certificates and relevant parts of IEC 60079-14
- General understanding of inspection and maintenance requirements of IEC 60079-17
- Familiar with the techniques used in the selection and installation of equipment referenced in IEC 60079-14
- Understand the additional importance of permit to work systems and safe isolation in relation to explosion protection
- Familiar with national and local regulations and guidelines, such as ATEX/IECEx/UKEX and cCSAus
- Familiar with lockout/tagout procedures, toxic gas monitoring protocols, and personal protective equipment (PPE) requirements

Personnel shall also be able to demonstrate competency in the:

- Use of documentation
- Production of documentation in inspection reports
- Practical skills necessary for the preparation and implementation of relevant concepts of protection
- Use and production of installation records

> ⚠ **WARNING**
>
> **Substitution of components is not permitted.**
>
> ▶ Substitution of components may impair intrinsic safety.

2.2   Potential risks affecting personnel

This section addresses the appropriate actions to undertake when faced with hazardous situations during or before service of the analyzer. It is not possible to list all potential hazards within this document. The user is responsible for identifying and mitigating any potential hazards present when servicing the analyzer.

NOTICE

▶ Technicians are expected to be trained and follow all safety protocols that have been established by the customer in accordance with the area hazard classification to service or operate the analyzer and MAC controller.
▶ This may include, but is not limited to, toxic and flammable gas monitoring protocols, lockout/tagout procedures, the use of PPE requirements, hot work permits and other precautions that address safety concerns related to the use and operation of process equipment located in hazardous areas.

2.2.1   Electrocution hazard

⚠ **WARNING**

▶ Complete this action before performing any service that requires working near the main input power or disconnecting any wiring or other electrical components.

1. Shut off power at the main disconnect external to the analyzer.
2. Only use tools with a safety rating for protection against accidental contact with voltage up to 1000V (IEC 900, ASTF-F1505-04, VDE 0682/201).

2.2.2   Laser safety

The JT33 spectrometer is a Class 1 laser product, which poses no threat to equipment operators. The laser internal to the analyzer controller is classified Class 3R and could cause eye damage if the beam is viewed directly.

⚠ **WARNING**

▶ Before servicing, shut off all power to the analyzer.

2.3   Product safety

The JT33 TDLAS gas analyzer is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition that is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the analyzer system.

2.3.1   General

- Adhere to all warning labels to prevent damage to the unit.
- Do not operate the device outside the specified electrical, thermal, and mechanical parameters.
- Only use the device in media to which the wetted materials have sufficient durability.
- Modifications to the device can affect the explosion protection and must be carried out by staff authorized to perform such work by Endress+Hauser.
- Ensure foreign matter (solid, liquid, or gas) does not enter the MAC or controller enclosure during maintenance to preserve its pollution degree 2 rating.
- Only open the controller or MAC cover if the following conditions are met:
  - An explosive atmosphere is not present.
  - All device technical data is observed. See the nameplate.
- In potentially explosive atmospheres:
  - Do not disconnect any electrical connections while the equipment is energized.
  - Do not open the connection compartment cover or MAC cover when energized or the area is known to be hazardous.

- Install the controller circuit wiring according to the Canadian Electrical Code (CEC) respective National Electrical Code (NEC) using threaded conduit or other wiring methods in accordance with articles 501 to 505, and/or IEC 60079-14.
- Install the device according to the manufacturer's instructions and regulations.
- The flameproof joints of this equipment are other than the minimums specified in IEC/EN 60079-1 and shall not be repaired by the user.

2.3.2   General pressure

The system is designed and tested with appropriate margins to ensure that is it safe under normal operating conditions, which include temperature, pressure, and gas content. The operator is responsible for ensuring that the system is shut off when these conditions are no longer valid.

2.3.3   JT33 analyzer seals

The optical head of the analyzer interfaces with the process medium through a window and pressure transducer in the cell tube assembly. The window and pressure transducer are the primary seals of the equipment. The ISEM interface module assembly is the analyzer's secondary seal, which separates the transmitter head from the optical head. Although the JT33 analyzer contains other seals to prevent the migration of process medium into the electrical wiring system, if either of the primary seals fail, only the ISEM interface module assembly is considered a secondary seal.

The JT33 analyzer transmitter housing is certified for Class I, Division 1 with a factory-sealed terminal compartment which eliminates the need for external seals. The factory seal is only required when used in −40 °C (−40 °F) or lower ambient temperatures.

All optical heads for JT33 analyzers were assessed as "Dual Seal without Annunciation" devices. Refer to the markings on the label for the maximum working pressures.

MAC enclosure entries require either a barrier gland or conduit seal, depending on the application, and shall be located within 127 mm (5 in) of the MAC enclosure.

For Class I Zone 1, installation seals are required within 51 mm (2 in) of the analyzer transmitter housing. If the JT33 analyzer includes a heated enclosure, a suitable equipment certified seal shall be installed within 127 mm (5 in) of the outer MAC enclosure wall.

2.3.4   Electrostatic discharge

The powder coating and the adhesive label are nonconducting and may generate an ignition-capable level of electrostatic discharge under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions, such as high-pressure steam, which might cause a buildup of electrostatic charges on nonconducting surfaces. To clean the equipment, use only a damp cloth.

2.3.5   Chemical compatibility

Never use vinyl acetate, acetone, or other organic solvents to clean the analyzer housing or labels.

2.3.6   Canadian Registration Number

In addition to the requirements above for general pressure safety, Canadian Registration Number (CRN) systems must be maintained using CRN approved components without any modification to the sample conditioning system (SCS) or analyzer.

2.3.7   IT security

Our warranty is valid only if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the device and associated data transfer, must be implemented by the operators in line with their security standards.

2.4 Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater operational safety if used correctly. An overview of the most important functions is provided in the following section.

Function/interface	Factory setting	Recommendation
Write protection from hardware write protection switch	Not enabled	On an individual basis following risk assessment
Access code (also applies for web server login)	Not enabled (0000)	Assign a custom access code during commissioning.
WLAN (order option in display module)	Enabled	On an individual basis following risk assessment
WLAN security mode	Enabled (WPA2- PSK)	Do not change.
WLAN passphrase (password)	Serial number	Assign an individual WLAN passphrase during commissioning.
WLAN mode	Access Point	On an individual basis following risk assessment
Web server	Enabled	On an individual basis following risk assessment
CDI-RJ45 service interface	—	On an individual basis following risk assessment

2.4.1 Protecting access through hardware write protection

Write access to the device parameters from the local display and the web browser can be disabled with a write protection switch (DIP switch on the motherboard). When hardware write protection is enabled, only read-only access to the parameters is possible.

Hardware write protection is disabled when the device is delivered. See *Using the write protection switch → 🖺*.

2.4.2 Protecting access with a password

Different passwords are available through the WLAN interface to protect write access to the device parameters or access to the device,

- **User-specific access code.** Protect write access to the device parameters from the local display or web browser. Access authorization is clearly regulated with a user-specific access code.
- **WLAN passphrase.** The network key through the WLAN interface protects a connection between an operating unit (e.g., notebook or tablet) and the device; this can be ordered as an option.
- **Infrastructure mode.** When the device is operated in infrastructure mode, the WLAN passphrase corresponds to the WLAN passphrase configured on the operator side.

2.4.3 User-specific access code

Write access to the device parameters through the local display and web browser can be protected by the modifiable, user-specific access code. Refer to *Write protection with an access code → 🖺*. When the device is delivered, the device does not have an access code and is equivalent to **0000** (open).

2.4.4 Access from web server

The device can be operated and configured from a web browser with the integrated web server. Refer to *Access the operating menu from the web browser → 🖺*. The connection is through the service interface (CDI-RJ45), the connection for TCP/IP signal transmission (RJ45 connector), or the WLAN interface.

The web server is enabled when the device is delivered. The web server can be disabled if necessary (e.g., after commissioning) from the **web server functionality** parameter.

The JT33 TDLAS gas analyzer and status information can be hidden on the log in page to prevent unauthorized access to the information.

2.4.5   Access through service interface

The device can be accessed from the service interface (CDI-RJ45). Device-specific functions guarantee the secure operation of the device in a network.

NOTICE

▶ Connection to the service interface (CDI-RJ45) shall only be permitted by trained personnel on a temporary basis for the purpose of test, repair, or overhaul of the equipment, and only if the area where the equipment is to be installed is known to be nonhazardous.

The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures such as network segmentation.

3 Product description

3.1 How TDLAS gas analyzers work

Differential TDLAS is featured in the JT33 TDLAS gas analyzers for trace measurement of low concentrations of hydrogen sulfide (H_2S). This technology involves subtracting 1 spectrum from another. A dry spectrum, the response from a sample when the analyte of interest has been completely removed, is subtracted from the wet spectrum, the response from the sample when the analyte is present. The remainder is a spectrum of the pure analyte. This technology is used for very low or trace measurements and is also useful when the background matrix changes over time.

3.2 JT33 TDLAS gas analyzer system

The JT33 TDLAS gas analyzer for trace measurements features specialized equipment for mitigating and measuring analytes. It is a turnkey assembly configured with precertified equipment, including the heater, solenoid valves, scrubber, filter, isolation valves, enclosure, and SCS. The SCS allows more precise control of the sample gas before it flows through the spectrometer.

The system is comprised of a sample cell, intrinsically safe optical head, and an electronics assembly platform within a precertified flameproof enclosure. The cell is a sealed tube through which the gas mixture flows. The cell has a gas inlet and a gas outlet. On 1 end of the tube is a window through which a beam of infrared laser light travels, which in turn reflects on internal mirrors. In this arrangement, the gas mixture does not contact the laser or any other optoelectronics. Pressure, and in some cases temperature sensors, are employed in the cell assembly to compensate for the effects of pressure and temperature changes in the gas.

For information on servicing the scrubber for trace measurements, see *Replacing the scrubber* → 🗎.

Differential system for hydrogen sulfide (H_2S)

The Endress+Hauser JT33 TDLAS gas analyzer for trace hydrogen sulfide (H_2S) features a differential TDLAS system. Below is the front view of a sample analyzer for H_2S.
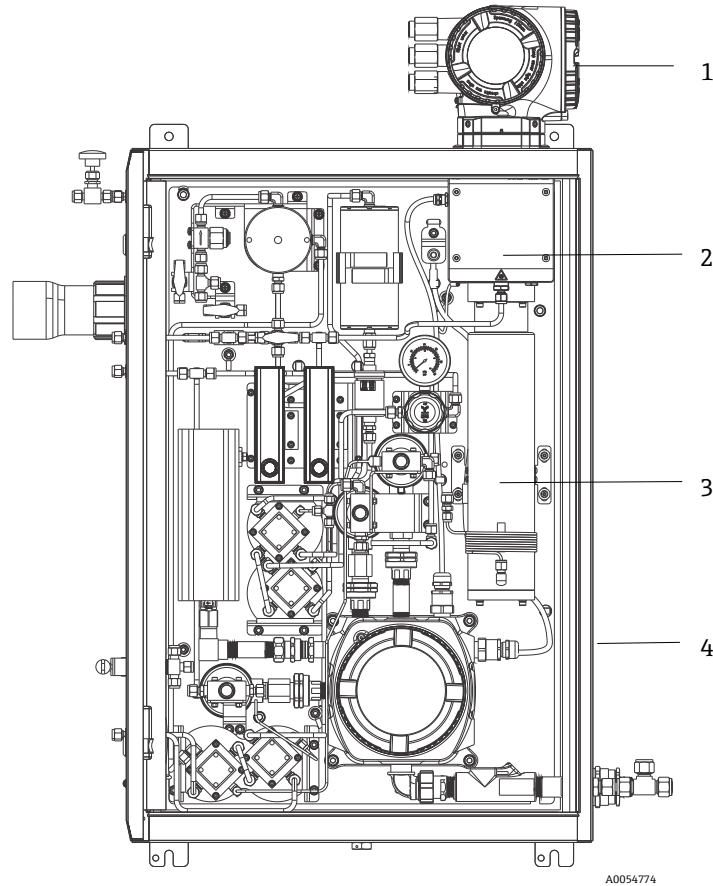
Figure 1. JT33 TDLAS gas analyzer with enclosed SCS, with heater

#	Name
1	Controller
2	Optical head enclosure assembly
3	Measurement head assembly
4	Sample system in enclosure

3.3   Sample conditioning system

3.3.1   Overview

A sample conditioning system (SCS) with the JT33 TDLAS gas analyzer has been specifically designed to deliver a sample stream that is representative of the process systems stream at the time of sampling. analyzers are designed for use with extractive gas sampling stations.

3.3.2   Scrubber

All trace measurement applications require the use of a scrubber. Typically, these devices are switched into the flowing sample going to the measurement cell to remove the trace hydrogen sulfide component. A spectrum of the sample gas free of H_2S is acquired and saved in the analyzer controller memory. This is the "dry" spectrum. The scrubber is bypassed and the sample spectrum is acquired with H_2S in the sample. This is the "wet" spectrum.

The analyzer controller subtracts the dry spectrum from the wet spectrum and the concentration of trace hydrogen sulfide measured. The same dry spectrum is typically used for 10 to 30 minutes, depending on logic programmed into the controller before a new dry spectrum is acquired. The automatic valves that control switching the sample stream into the scrubber or bypassing the scrubber are either electrical or pneumatically driven valves.

3.4   Product identification

The following options are available for identification of the measuring device:

- Nameplate specifications
- Order code with breakdown of the analyzer features on the delivery note

For an overview of the scope of the associated technical documentation, refer to *Associated documentation → 🖺*.

3.5   Equipment labels

3.5.1   Nameplate

Analyzer-specific information, approvals, and warnings are listed on these labels in the blank areas shown below.

Warning: DO NOT OPEN IN AN EXPLOSIVE ATMOSPHERE is listed on all nameplates.
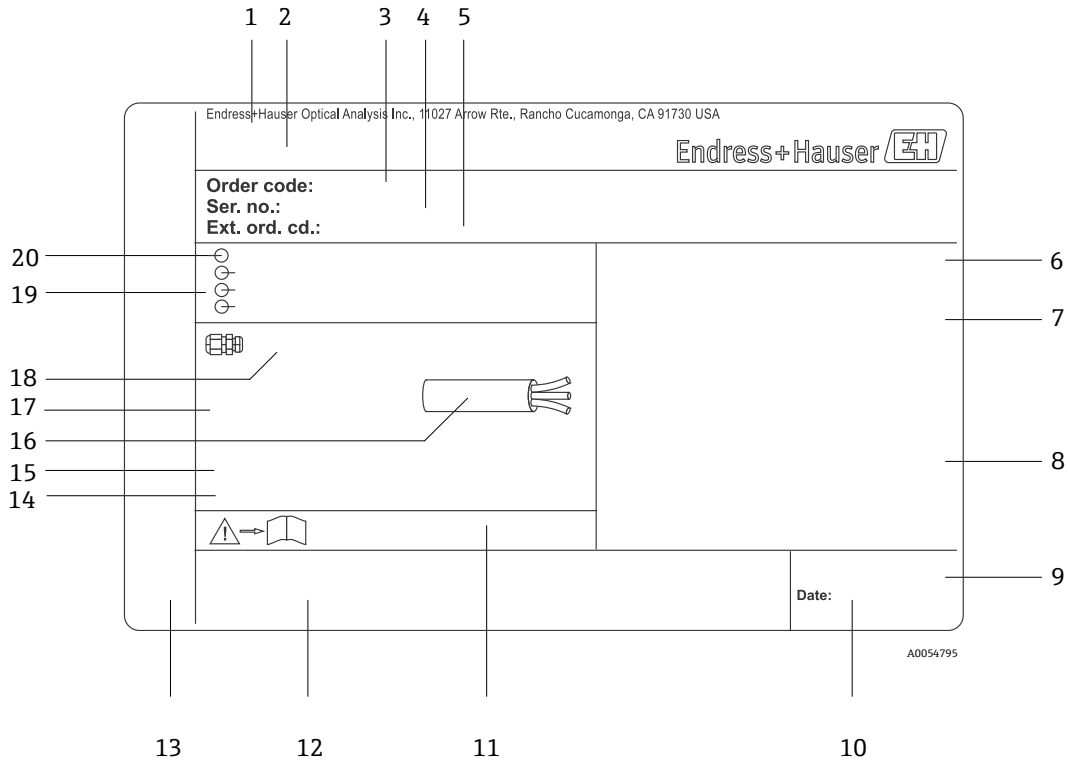
Figure 2. JT33 TDLAS gas analyzer nameplate template

#	Description		#	Description
1	Manufacturing name and location		11	Document number of safety-related supplementary documentation
2	Product name		12	Space for approval markings (e.g., CE mark)
3	Order code		13	Space for degree of protection of connection and electronics compartment when used in hazardous areas
4	Serial number (SN)		14	Space for additional information (special products)
5	Extended order code		15	Permitted temperature range for cable
6	Degree of protection		16	Permitted ambient temperature (Ta)
7	Space for approvals for use in hazardous areas, certificate numbers, and warnings		17	Information on cable gland
8	Electrical connection data: available inputs and outputs		18	Cable entry
9	2-D matrix code (serial number)		19	Available inputs and outputs, supply voltage
10	Manufacturing date: year–month		20	Electrical connection data: supply voltage

3.5.2 Order code

The analyzer is reordered using the appropriate order code.

Extended order code
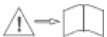
The complete extended order code including the analyzer model (product root) and basic specifications (mandatory features) are always listed.

3.6 Symbols on the equipment

3.6.1 Electrical symbols

Symbol	Description
⏚	Protective Earth (PE) This symbol identifies a terminal that is bonded to conductive parts of equipment for safety purposes and is intended to be connected to an external protective earthing system.

3.6.2 Informational symbols

Symbol	Description
⚠→📖	This symbol refers the user to the technical documentation for more information.

3.6.3 Warning symbols

Symbol	Description
☢	The Laser Radiation symbol is used to alert the user to the danger of exposure to hazardous visible laser radiation when using the system. The laser is a class 3R radiation product.

3.6.4 Controller labels

POWER Nicht unter Spannung offen Do not open when energized Ne pas ouvrir sous tension	*Terminate power prior to accessing equipment to prevent damage to the analyzer.*
Warning: DO NOT OPEN IN EXPLOSIVE ATMOSPHERE Attention: NE PAS OUVRIR EN ATMOSPHERE EXPLOSIVE	*Use caution before opening the analyzer enclosure to avoid injury.*

4   Installation

For safety requirements and guidance, refer to *Safety* → 🖹.

For environmental and wiring requirements, refer to *Technical Data* → 🖹.

Tools and hardware
- T20 Torx screwdriver
- 24 mm Open-ended wrench
- 3 mm Flat blade screwdriver
- #2 Phillips screwdriver
- 1.5 mm hex driver
- 3 mm hex driver
- Tape measure
- Felt-tip marker
- Level
- Seamless, stainless steel tubing (electro-polished), 6 mm (¼ in) O.D. x 0.1 mm (0.035 in) is recommended.

4.1   Installing the heat trace boot

The heat trace boot for JT33 TDLAS gas analyzer with an enclosure is an available option. For ease of shipping, the heat trace boot may have been removed at the factory. To reinstall the heat trace boot, follow the instructions below.

Tools and hardware
- Bushing
- Lubricated O-ring
- Heat trace boot

Install the heat trace boot

1. Locate the appropriate opening on the exterior of the sample conditioning system.
2. Open the sample conditioning system enclosure door and insert the bushing into the opening until the base is flush against the inside wall of the enclosure.
3. Apply the lubricated O-ring to the threaded bushing on the outside of the enclosure until flush against the outside wall.

   | **NOTICE** |

   ▶ Ensure there is no contamination of the O-ring lubricant prior to installation.

4. Holding the threaded connector from the inside of the enclosure, thread the boot onto the bushing and turn clockwise by hand until tight.
5. Torque the 2 in (approximately 50 mm) plastic heat trace boot to 7 Nm (63 in-lb).

   | **NOTICE** |

   ▶ Do not overtighten. The boot assembly can break.

4.2   Lifting and moving the analyzer

The JT33 analyzer weighs up to 102.5 kg (226 lb) and is shipped in a wooden crate. Because of the size and weight, Endress+Hauser recommends the following process for lifting and moving the analyzer for installation.

Equipment/materials

- Crane or forklift with lifting hook
- Dolly or scissor jack
- Four 25 mm (1 in) wide endless ratchet straps rated for a minimum of 500 kg (1100 lb) each
- Cloths

NOTICE

- ▶ Overtightening the ratchets on the horizontal straps may damage the enclosure. The horizontal straps must be tight enough to hold the vertical straps in position, but not too tight.
- ▶ Place cloths between the ratchet points and the enclosure to prevent scratches.

1. Move the crate as close to the final installation location as possible.
2. With the analyzer still in the crate, route 2 of the ratchet straps vertically on each side of the analyzer. Ensure the straps under the enclosure align outside of the bottom mounting tabs as shown in the figure below.
3. Bring both straps together at the top of the analyzer, allowing enough slack to pass the lifting hook through the straps.
4. Install the third strap horizontally toward the bottom of the enclosure by weaving it over and under the vertical straps. Install the fourth strap horizontally toward the top of the enclosure by weaving it over and under the vertical straps in the opposite pattern from the third strap.
5. Remove the analyzer from the crate using the crane or forklift.
6. Place the analyzer on a dolly or scissor jack and remove the straps to finish the installation.
   If necessary, the installation can be completed using the crane or forklift and the ratchet straps.

A0054862
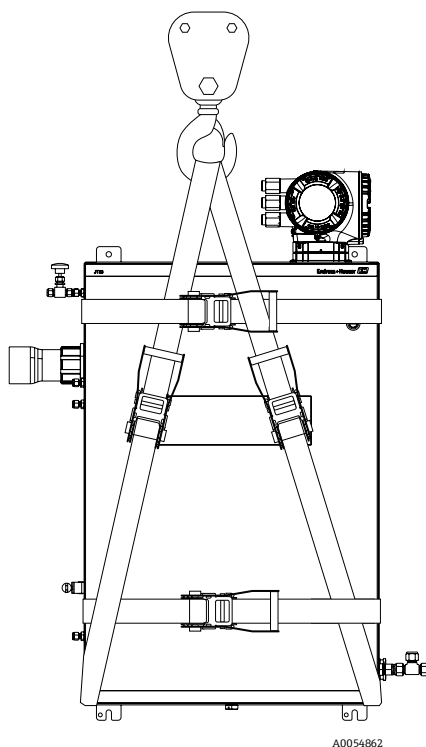
Figure 3. JT33 analyzer with ratchet straps for lifting and moving

4.3 Mounting the analyzer

The analyzer can be wall mounted. When mounting, position the instrument so that it is not difficult to operate adjacent devices.

4.3.1 Mounting dimensions
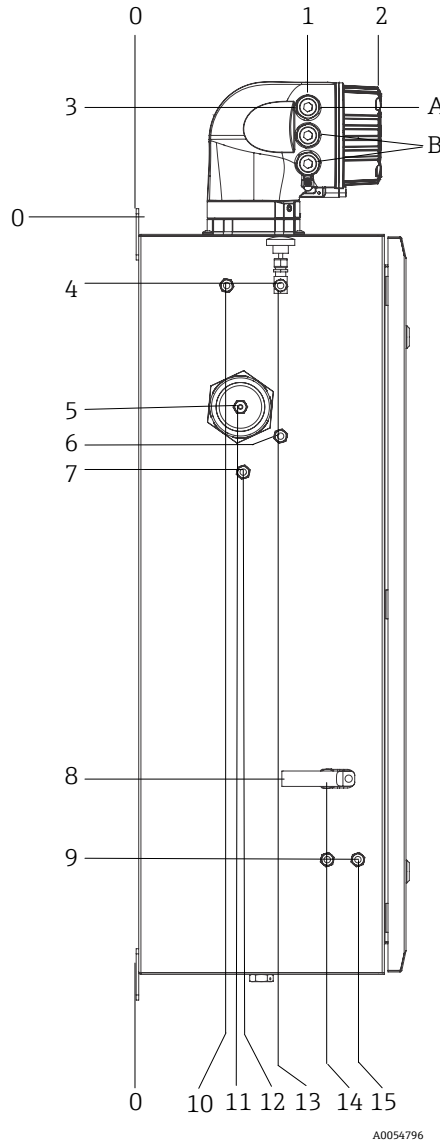
Figure 4. Mounting dimensions: Side view

#	From corner 0, mm (in)	#	From corner 0, mm (in)	#	Description
1	213 (8)	9	789 (31)	0	Top mounting location
2	304 (12)	10	112 (4)	A	Power in
3	141 (6)	11	129 (5)	B	Communication out
4	79 (3)	12	133 (5)		
5	229 (9)	13	179 (7)		
6	265 (10)	14	237 (9)		
7	310 (12)	15	275 (11)		
8	689 (27)				
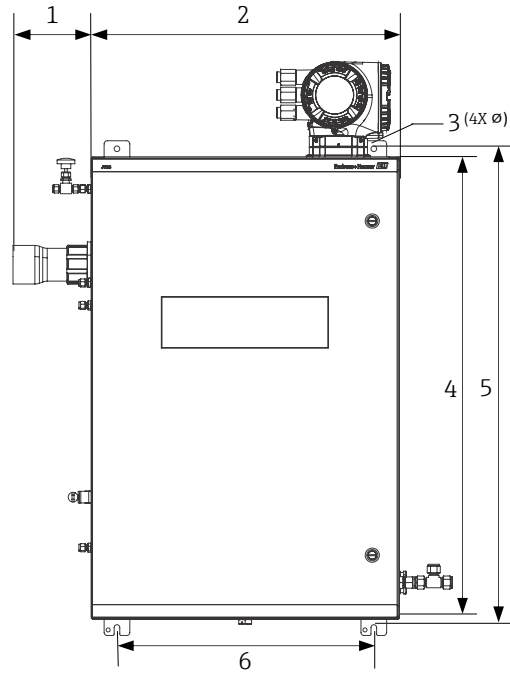
Figure 5. Mounting dimensions: Front view

#	mm (in)	#	mm (in)
1	155 (6)	4	914 (36)
2	610 (24)	5	946 (37)
3	11 (0.4)	6	508 (20)

4.3.2   Wall mounting

NOTICE

The JT33 TDLAS gas analyzer is designed for operation within the specified ambient temperature range. Intense sun exposure in some areas may cause the temperature inside the analyzer to exceed the ambient temperature specification.

▶   A sunshade or canopy installed over the analyzer for outdoor installations is recommended in those instances.
▶   Hardware used for mounting the JT33 TDLAS gas analyzer must be able to support 4 times the weight of the instrument, approximately 89.9 kg (196 lb) to 102.5 kg (226 lb), depending on configuration.

Hardware required (not supplied)

▪   Mounting hardware
▪   Spring nuts, if mounting on Unistrut
▪   Machine screws and nuts to fit the size of the mounting hole

To install the enclosure

1.   Install the bottom 2 mounting bolts to the mounting frame or wall. Do not fully tighten the bolts. Leave an approximately 10 mm (0.4 in) gap to slide the analyzer mounting tabs onto the bottom bolts.
2.   Safely lift the analyzer using the appropriate installation equipment. Refer to *Lifting and moving the analyzer → 🖺*.
3.   Install the analyzer onto the bottom bolts and slide the slotted bottom mounting tabs over the bolts. Continue to support the weight of the analyzer with the equipment.

Figure 6. Slotted bottom mounting tabs of enclosure

4. Tilt the analyzer towards the mounting frame or wall to align and secure the 2 top bolts.

Figure 7. Top mounting tabs of enclosure

5. Tighten all 4 bolts and then remove the installation equipment.

4.4 Turning the display module

The display module can be turned to optimize readability and operability.

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Turn the display module to the desired position: max. 8 × 45˚ in every direction.
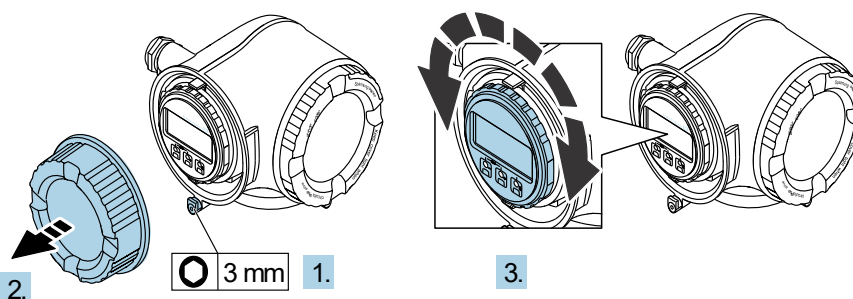
Figure 8. Turning the display module

4. Screw on the connection compartment cover.
5. Fit the securing clamp of the connection compartment cover.

4.5   Protective chassis and ground connections

Before connecting any electrical signal or power, connect the protective and chassis grounds.

- Protective and chassis grounds must be of equal or greater size than any other current-carrying conductors, including the heater located in the SCS.
- Protective and chassis grounds remain connected until all other wiring is removed.
- Protective grounding wire current carrying capacity must be at least the same as the main supply.
- Earth bonding/chassis ground shall be at least 6 mm^2 (10 AWG).

Protective ground cables

- Analyzer: 2.1 mm^2 (14 AWG)
- Enclosure: 6 mm^2 (10 AWG)
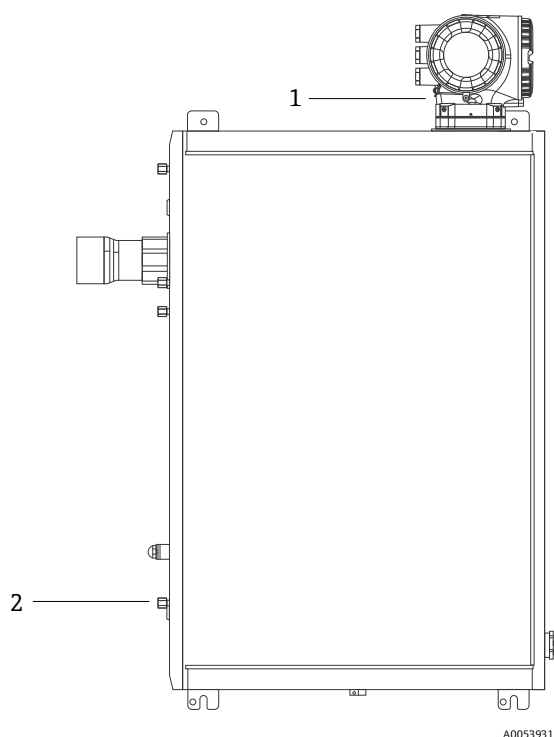
The grounding impedance must be less than 1 Ω.

A0053931

Figure 9. Ground connections

#	Name
1	Protective ground screw, M6 x 1.0 x 8 mm, ISO-4762
2	Protective ground stud, M6 x 1.0 x 20 mm

4.6 Electrical connections

⚠️ **WARNING**

Hazardous voltage and risk of electric shock

▶ Turn off lockout system power before opening the electronics enclosure and making any connections.

The installer is responsible for complying with all local installation codes.

▶ Power and signal field wiring should be accomplished using wiring methods approved for hazardous locations as per the Canadian Electrical Code (CEC) Appendix J, the National Electrical Code (NEC) Article 501 or 505, and IEC 60079-14.
▶ Use copper conductors only.
▶ For models of the JT33 TDLAS gas analyzer with SCS with enclosure, the inner sheath of the supply cable for the heater circuit should be sheathed with thermoplastic, thermosetting, or elastometric material. The material should be circular and compact. Any bedding or sheath should be extruded. Fillers, if any, should be nonhygroscopic.
▶ At a minimum, the cable length should exceed 3 m (9.8 ft).

4.6.1 Analyzer electrical connections

A0053929
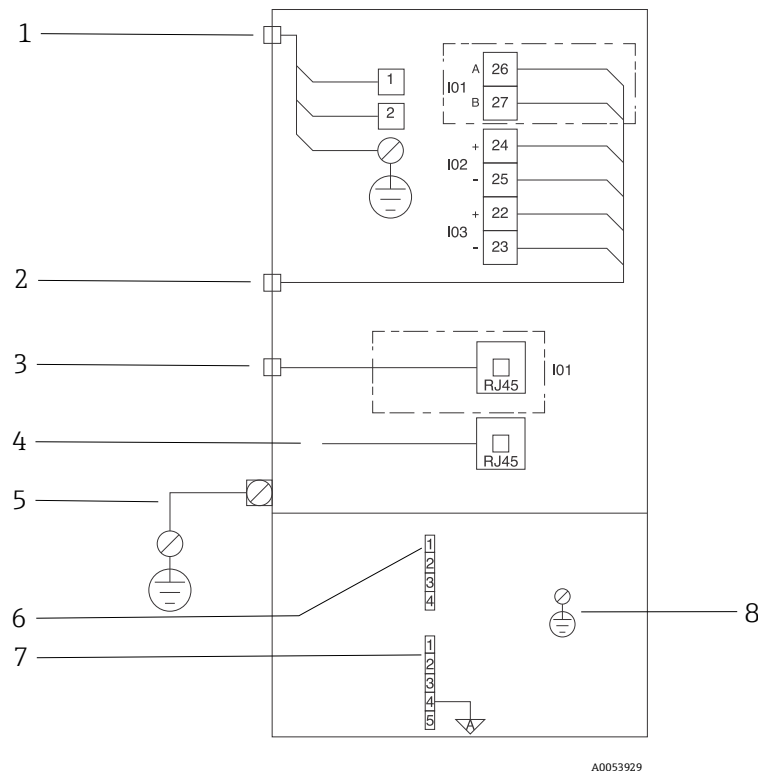
Figure 10. JT33 analyzer electrical connections

#	Description
	JT33 controller
1	AC 100 to 240 V ±10 %; DC 24 V ±20 % 1 = line; 2 = neutral Wire is 14 gauge or larger for ground connection (for line, neutral and ground). Cross section of the cable is ≥ 2.1 mm^2.

#	Description
2	Data ports I/O options: ■ Modbus RTU ■ Outputs: Current, Status, Relay ■ Inputs: Current, Status Terminals 26 and 27 are used for Modbus RTU (RS485) only.
3	Alternative data port 10/100 ethernet (optional), network option Modbus TCP Terminals 26 and 27 are replaced by an RJ45 connector for Modbus TCP.
4	Service port Internal connection is accessible only temporarily by trained personnel for test, repair, or overhaul of the equipment, and only if the area where the equipment is installed is known to be nonhazardous.
5	External ground lug Must be 10 gauge or larger. Cross section of the cable is ≥ 6 mm^2.
Optical head	
6	Flow switch connection (1 to 4) = connector J6. See drawing EX3100000056. 1 = flow switch line 2 = analog ground 3 = no connection 4 = no connection
7	RS485 MAC communication lines (1 to 5) = connector J7. See drawing EX3100000056. Connector J7 is for Endress+Hauser factory connection only. Do not use for installation or customer connection. 1 = negative intrinsically safe line 2 = positive intrinsically safe line 3 = no connection 4 = connection to the analog ground on the optical head enclosure (OHE) and to the RS485 harness shielding 5 = no connection
8	Internal ground to optical head cover

4.6.2   MAC electrical connections

The MAC (measurement accessories controller) certified equipment, consisting of a single, printed circuit board assembly and power supply–depending on voltage source–resides in an Ex d enclosure. It is powered independently of the ISEM and offers the capability for some intrinsically and non-intrinsically safe inputs and outputs.
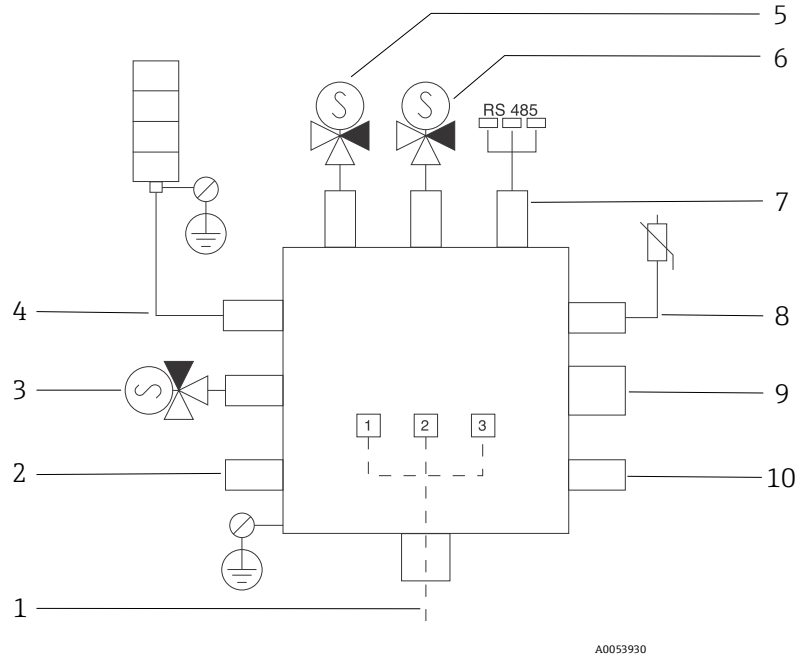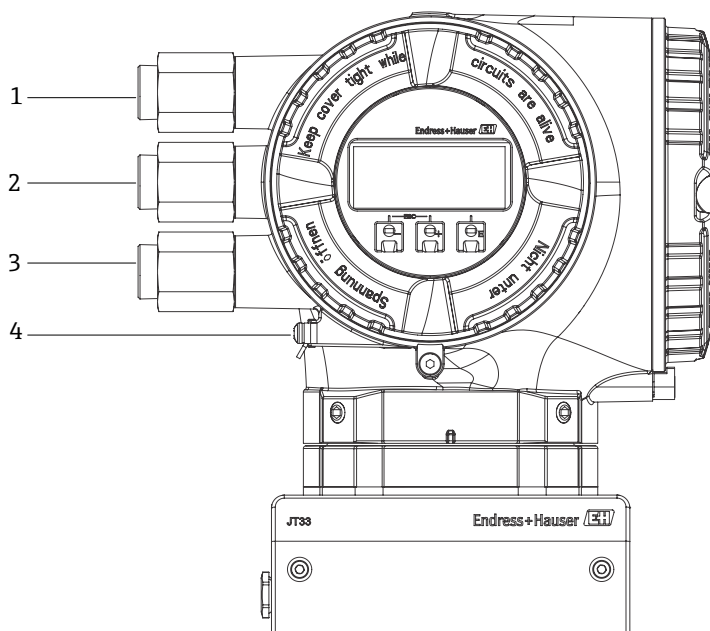

A0053930

Figure 11. MAC enclosure designed instrument/sensor locations

#	Description
1	Customer power entry AC 100 to 240 V ±10 % 50/60 HZ, 275 W maximum DC 24 V ±10 %, 67 W maximum | #	AC 100 to 240 V option	DC 24 V option
1	Hot	+24 V
2	Neutral main	−24 V
3	Main ground	open	
2	Not used currently Future solenoid entry
3	Validation solenoid
4	Sample conditioning system heater
5	Cell/scrubber solenoid 2
6	Cell/scrubber solenoid 1
7	RS485 communication Intrinsically safe OHE RS485 interface connected with a cable to the OHE board in the optical head enclosure, Endress+Hauser integrator
8	Sample conditioning system thermistor
9	Not used currently Future cell heater/cell thermistor entry
10	Not used currently Future pump entry

4.6.3 External cable entry points

Figure 12. Threaded entries

#	Description
1	Cable entry for supply voltage
2	Cable entry for signal transmission; I/O1, or Modbus RS485, or Ethernet network connection (RJ45)
3	Cable entry for signal transmission; I/O2, I/O3
4	Protective earth ground

4.6.4   Connecting Modbus RS485
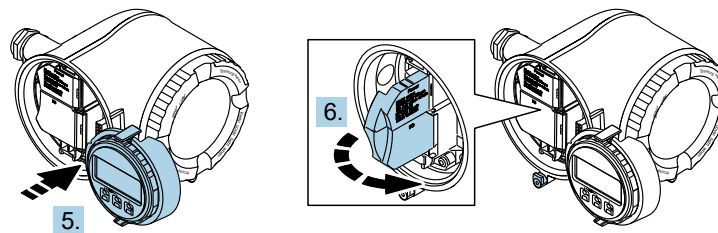
Open the terminal cover

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze together the tabs of the display module holder.
4. Remove the display module holder.
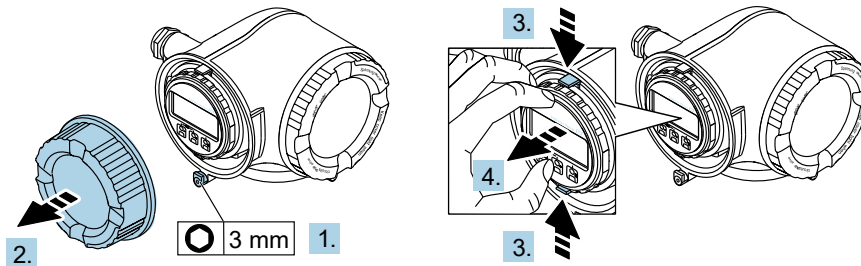
Figure 13. Removing the display module holder

5. Attach the holder to the edge of the electronics compartment.
6. Open the terminal cover.

Figure 14. Opening the terminal cover

Connect the cables

1. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.

   NOTICE

   ▶ The temperature of the gas analyzer can reach 67 °C (153 ℉) in 60 °C (140 ℉) ambient at the cable entry and branching point. This must be considered when selecting field wiring and cable entry devices.

2. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
3. Connect the protective ground.
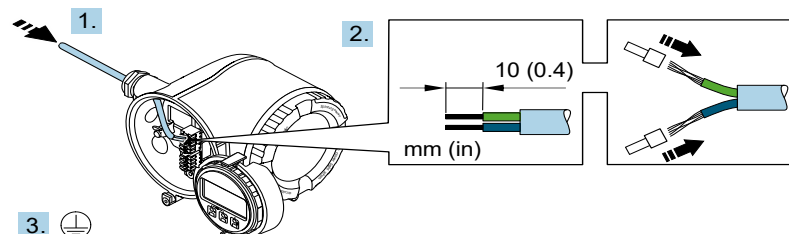
Figure 15. Feeding wiring and connecting the protective ground

4. Connect the cable in accordance with the **signal cable terminal assignment.** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
5. Firmly tighten the cable glands.

   ↳ This concludes the cable connection process.

ℹ️ Step 5 is not used for CSA-certified products. Under CEC and NEC requirements, conduit is used in place of cable glands.

Figure 16. Connecting the cables and tightening glands

6. Close the terminal cover.
7. Fit the display module holder in the electronics compartment.
8. Screw on the connection compartment cover.
9. Secure the securing clamp of the connection compartment cover.

4.6.5 Connecting Modbus TCP

In addition to connecting the device through Modbus TCP and the available inputs/outputs, Connecting to the analyzer through the service interface (CDI-RJ45) is an available option. Refer to *Connecting to the analyzer through the service interface (CDI-RJ45)* → 🗎.

Open the terminal cover

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze together the tabs of the display module holder.
4. Remove the display module holder.

Figure 17. Removing the display module holder

5. Attach the holder to the edge of the electronics compartment.
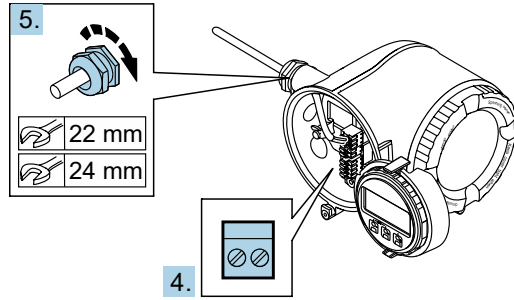6. Open the terminal cover.

Figure 18. Opening the terminal cover

Connect the cables

1. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
2. Strip the cable and cable ends and connect to the RJ45 connector.
3. Connect the protective ground.
4. Plug in the RJ45 connector.
5. Firmly tighten the cable glands.
   ↳ This concludes the Modbus TCP connection process.

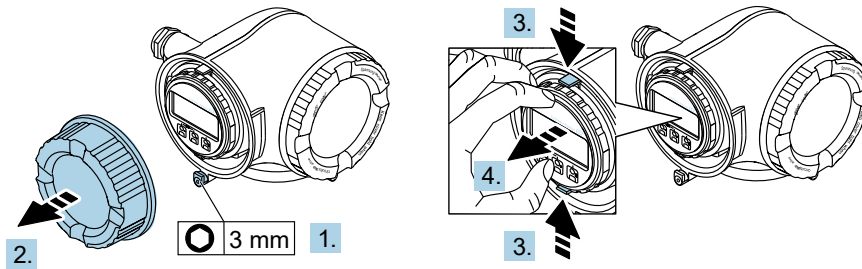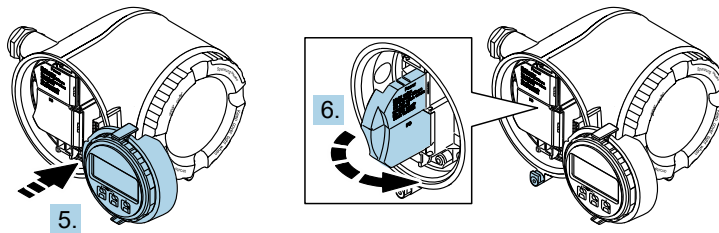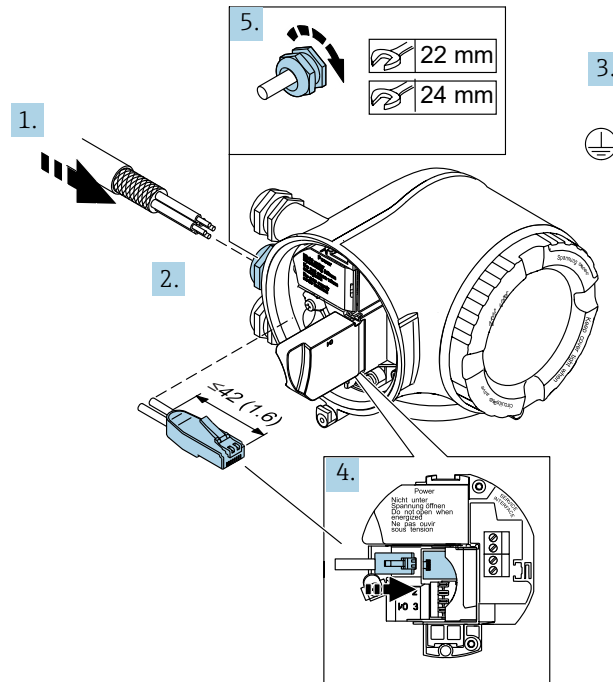*Figure 19. Connecting the RJ45 cable*

6. Close the terminal cover.
7. Fit the display module holder in the electronics compartment.
8. Screw on the connection compartment cover.
9. Secure the securing clamp of the connection compartment cover.

4.6.6   Connecting the supply voltage and additional inputs/outputs

⚠ **WARNING**

The temperature of the gas analyzer can reach 67 °C (153 °F) in 60 °C (140 °F) ambient at the cable entry and branching point.

▶ These temperatures must be considered when selecting field wiring and cable entry devices.
▶ The main electronic assembly shall be protected by a building installation overcurrent protection rated for 10 amp or less.

1. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
2. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
3. Connect the protective ground.
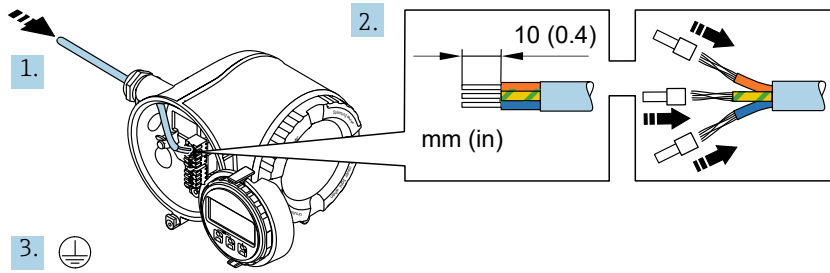
Figure 20. Feeding wiring and connecting the protective ground

4. Connect the cable in accordance with the terminal assignment: Signal cable terminal assignment or Supply voltage terminal assignment.

   ▶ The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
   ▶ Connection examples follow:
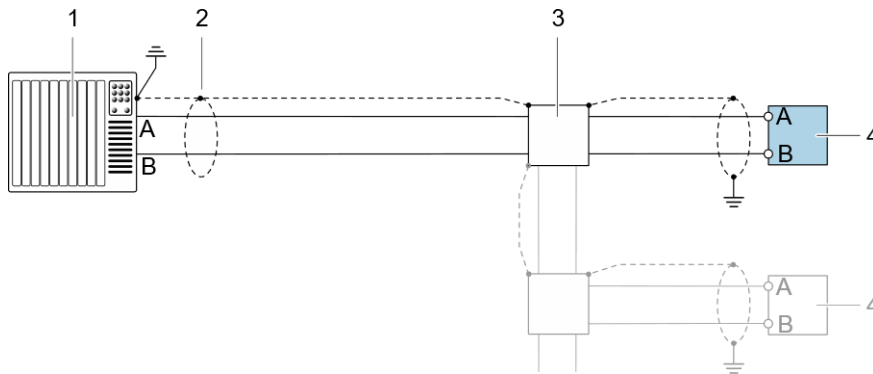
Figure 21. Connection example for Modbus RS485, nonhazardous area and Zone 2/Div.2

#	Name
1	Control system, such as PLC
2	Cable shield provided at one end. The cable shield must be grounded at both ends to comply with PMC requirements; observe cable specifications
3	Distribution box
4	Transmitter
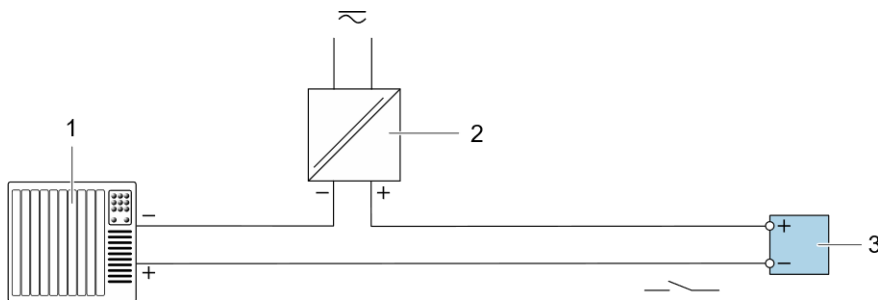
Figure 22. Connection example for switch output, passive

#	Name
1	Automation system with switch input, such as PLC with a 10 kΩ pull-up or pull-down resistor
2	Power supply
3	Transmitter
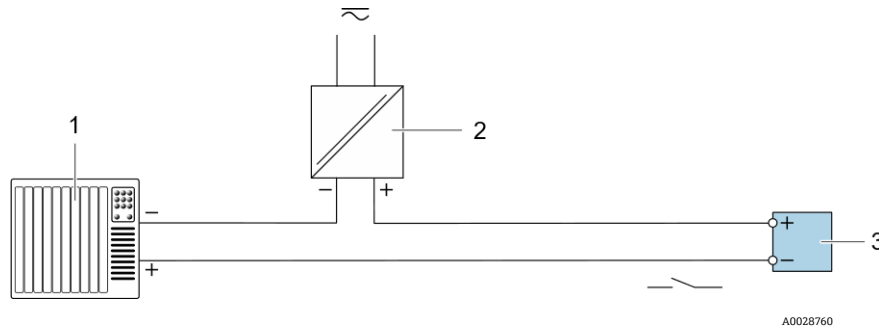
Figure 23. Connection example for relay output, passive

#	Name
1	Automation system with relay input, such as PLC
2	Power supply
3	Transmitter
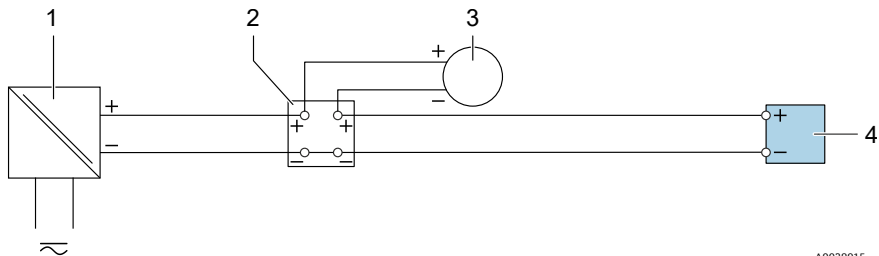
Figure 24. Connection example for 4 to 20 mA current input

#	Name
1	Power supply
2	Terminal box
3	External measuring device, such as to read in pressure or temperature
4	Transmitter
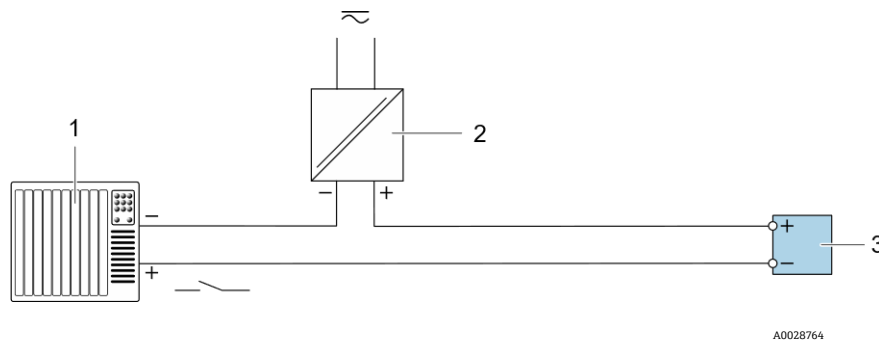
Figure 25. Connection example for status input

#	Name
1	Automation system with status output, such as PLC
2	Power supply
3	Transmitter
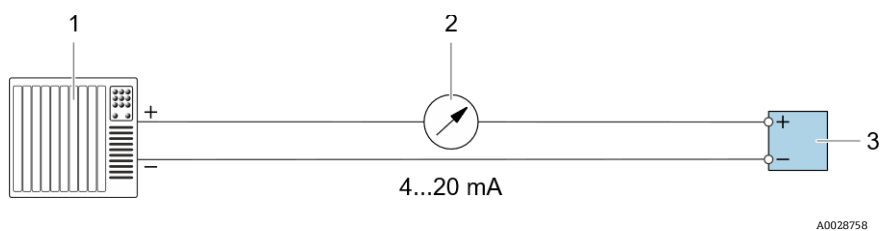
Figure 26. Connection example for 4-20 mA current output, active

#	Name
1	Automation system with current output, such as PLC
2	Analog display unit: observe maximum load
3	Transmitter
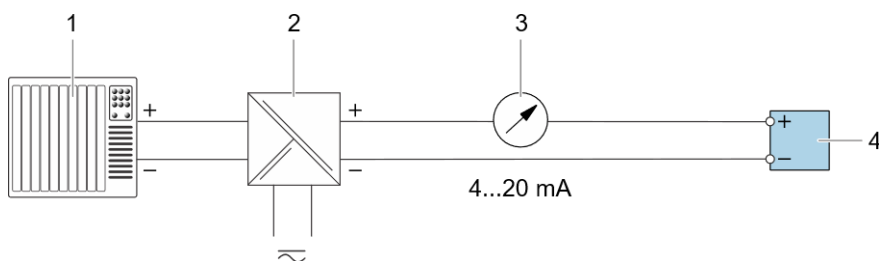
Figure 27. Connection example for 4-20 mA current output, passive

#	Name
1	Automation system with current input, such as PLC
2	Active barrier for power supply, such as RN221N
3	Analog display unit: observe maximum load
4	Transmitter

5. Firmly tighten the cable glands.

   ↳ This concludes the cable connection process.

6. Close the terminal cover.
7. Fit the display module holder in the electronics compartment.
8. Screw on the connection compartment cover.
9. Secure the securing clamp of the connection compartment cover.

Conduit is required for the power connection for the CSA-certified gas analyzer. The ATEX-certified model requires armored cable steel wire or braided wire.

4.6.7 Removing a cable

1. To remove a wire from the terminal, use a flat-blade screwdriver to push the slot between the 2 terminal holes.
2. Simultaneously pull the cable end out of the terminal.
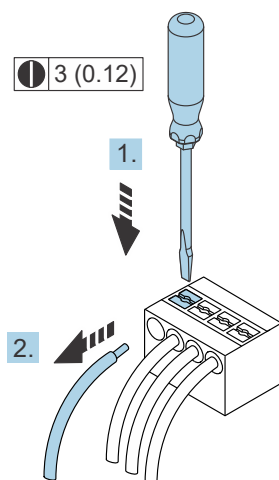
Figure 28. Removing a cable. Engineering unit: mm (in)

After installing all interconnecting wiring or cabling, make sure any remaining conduit or cable entries are plugged with certified accessories according to the intended use of the product.

⚠ **WARNING**

▶ Conduit seals and glands specific to the application (CSA or Ex d IP66) should be used where appropriate in compliance with local regulations.

4.6.8 Connecting the controller to a network

This section only presents the basic options for integrating the device into a network. For information on the procedure to follow to connect the controller correctly, see *Connecting Modbus RS485* → 📄.

4.6.9 Connecting through the service interface

The gas analyzer includes a connection to the service interface (CDI-RJ45).

NOTICE

▶ Connection to the service interface (CDI-RJ45) shall only be permitted by trained personnel on a temporary basis for the purpose of test, repair, or overhaul of the equipment and only if the area where the equipment is to be installed is known to be nonhazardous.

Note the following when connecting:

- Recommended cable: CAT 5e, CAT 6 or CAT 7, with shielded connector
- Maximum cable thickness: 6 mm (¼ in)
- Length of connector including bend protection: 42 mm (1.7 in)
- Bending radius: 5 x cable thickness
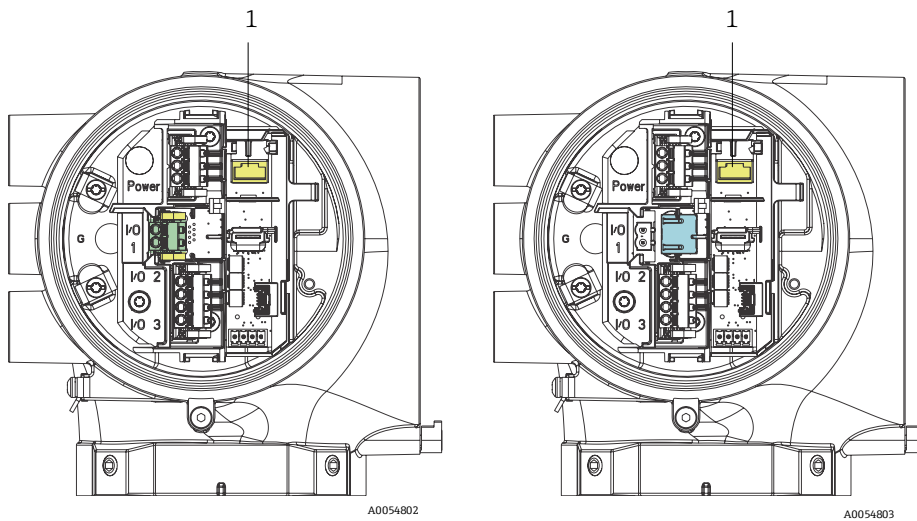
Figure 29. Service interface CDI-RJ45 (1) connections for I/O1
with Modbus RTU/RS485/2-wire (left) and Modbus TCP/Ethernet/RJ45 (right)

4.6.10 Connecting the flow switch

The JT33 analyzer can be offered with a variable flow meter equipped with an optional mechanical display and reed contact to measure the volume flow of flammable and nonflammable gases.

> **NOTICE**

▶ Installation shall be in accordance with the National Electrical Code NFPA 70, Article 500 to 505, ANSI/ISA-RP12.06.01, IEC 60079-14 and Canadian Electrical Code (CEC) Appendix J for Canada.
▶ Only insulated cables with insulation capable of withstanding a dielectric test of at least AC 500 V or DC 750 V shall be used in intrinsically safe circuits.
▶ The temperature rating of terminals, cable glands and field wires affected by both ambient and service temperatures shall be suitable for a temperature of at least 75 ℃ (167 ℉).

To connect the flow switch, run shielded interconnection cable with shield connected to FM-approved associated apparatus ground.

> ⚠ **WARNING**

▶ The variable area flow meter with coated parts shall be installed and maintained such that the risk of electrostatic discharge is minimized.

4.6.11 Threaded entries

> **NOTICE**

▶ Thread lubricant must be applied on all conduit hub threaded connections. Using Syntheso Glep1 or equivalent lubricant on all conduit screw threads is recommended.
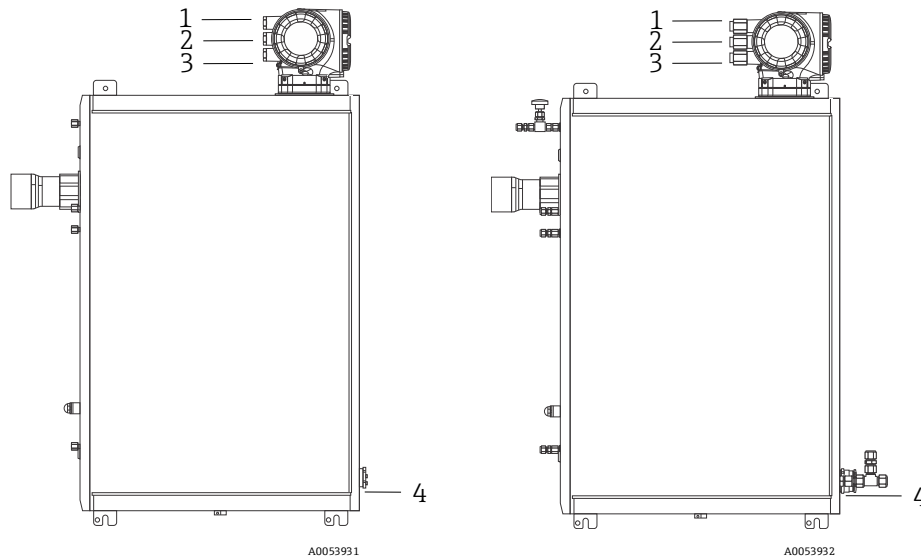
Figure 30. JT33 threaded entries on ATEX (left) and CSA (right) analyzer assemblies

Cable Entry	Description	ATEX, IECEx, UKEx	cCSAus
1	Controller power	Female M20 x 1.5	½" NPTF
2	Modbus power	Female M20 x 1.5	½" NPTF
3	2 Configurable I/O	Female M20 x 1.5	½" NPTF
4	MAC power	Male M25 x 1.5	¾" NPTM

Thread dimensions for the panel configuration are the same as shown for the enclosed sample system above.

4.6.12 Heat trace termination connection

The JT33 was designed for an exterior termination of the heat trace. To accomplish this, heat trace wiring must be looped back out of the heat trace boot during installation.

Connecting the heat trace termination

1. Identify the insulated line with heat trace and sample transport tubing.
2. Cut back the insulation until:
   - 76 cm (30 in) of the heat trace line is protruding
   - 15.2 cm (6 in) of the tubing is protruding
3. Place the heat shrink end cap over the heat trace line, tubing, and insulated line. Heat the end cap to form a seal.
4. Install insulated line into the heat trace boot and route the heat trace wire back through the boot. The supplier's bend radius for heat trace should be observed.
5. After tubing is installed and heat shrink is routed back out of the boot, apply heat to the boot to form a seal.
6. Cut back heat trace insulation and install the vendor's recommended junction box to power the heat trace.

4.7   Gas connections

Once you have verified that the JT33 TDLAS gas analyzer is functional and that the analyzer circuit is de-energized, you are ready to connect the sample supply and sample purge lines. As applicable, connect the pressure relief vent, validation source, and purge supply gas lines. All work must be performed by technicians qualified in pneumatic tubing.

⚠ **WARNING**

Process samples may contain hazardous material in potentially flammable or toxic concentrations.

▶ Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before installing the sample system.

▶ Do not exceed 3 barg (50 psig) in the sample cell. Damage to cell may result.

Using electropolished 6 mm or ¼ in, depending on order options, O.D. seamless, stainless steel tubing is recommended.

Connecting the sample supply line

1. Before connecting the sample supply line, confirm the following:
   a. The sample probe is installed correctly at the process sample tap and that the sample probe isolation valve is closed.
   b. The field pressure reducing station is installed properly at the sample probe and that the pressure regulator at the field pressure reducing station is closed by ensuring the adjustment knob is turned fully counterclockwise.

   ⚠ **WARNING**

   The process sample at the sample tap may be at high pressure.

   ▶ Use extreme caution when operating the sample probe isolation valve and field pressure reducing pressure regulator.

   ▶ All valves, regulators, switches, etc. should be operated in accordance with site lockout/tagout procedures.

   ▶ Consult sample probe manufacturer instructions for proper installation procedures.

   c. The relief valve vent line is properly installed from the field pressure reducing station to the low-pressure flare or atmospheric vent connection.
2. Determine appropriate tubing route from the field pressure reducing station to the sample system.
3. Run stainless steel tubing from the field pressure reducing station to the sample supply port of the sample system.
4. Bend tubing using industrial grade benders and check tubing fit to ensure proper seating between the tubing and fittings.
5. Fully ream all tubing ends.
6. Prior to making the connection, blow out the line for 10 to 15 seconds with clean, dry nitrogen or air.
7. Connect the sample supply tube to the sample system using 6 mm (¼ in) stainless steel tubing compression-type fitting, depending on the order configuration.
8. Tighten all new fittings 1¼ turns with a wrench from finger tight. For connections with previously swaged ferrules, thread the nut to the previously pulled up position, then tighten slightly with a wrench. Secure tubing to appropriate structural supports as required.
9. Use a leak detector to check all connections for gas leaks.

Connecting the sample returns

1. Confirm the low-pressure flare or atmospheric vent header shutoff valve is closed.

   ⚠ **WARNING**

   ▶   All valves, regulators, switches, etc. should be operated in accordance with site lockout/tagout procedures.

2. Determine the appropriate tubing route from the sample system to the low-pressure flare or atmospheric vent header.
3. Run stainless steel tubing from the sample return port of the sample system to the low-pressure flare or atmospheric vent header.
4. Bend tubing using industrial grade benders and check tubing fit to ensure proper seating between the tubing and fittings.
5. Fully ream all tubing ends.
6. Prior to making the connection, blow out the line for 10 to15 seconds with clean, dry nitrogen or air.
7. Connect the sample return tube to the sample system using a 6 mm (¼ in) stainless steel tubing compression-type fitting, depending on the order configuration.
8. Tighten all new fittings 1¼ turns with a wrench from finger tight. For connections with previously swaged ferrules, thread the nut to the previously pulled up position, then tighten slightly with a wrench. Secure tubing to appropriate structural supports as required.
9. Use a leak detector to check all connections for gas leaks.

4.8   Metric conversion kit

A metric conversion kit for the sample system converts the Imperial (in) analyzer system fittings to metric (mm) fittings. This kit is included with the JT33 TDLAS gas analyzer and includes the following parts:

Quantity	Description
6	Ferrule set, ¼" tube fitting
1	Ferrule set, ½" tube fitting
6	Tube nut, ¼" tube fitting, 316 stainless steel
1	Tube nut, ½" tube fitting, 316 stainless steel
6	6 mm tube fitting x ¼" tube stub, 316 stainless steel
1	12 mm tube fitting x ½" tube stub, 316 stainless steel

Required tools

- 7/8" open-ended wrench
- 5/16" open-ended wrench, for stabilizing adapter
- Felt-tip marker
- Gap inspection gauge

Installation

1. Select either the 6 mm (¼") or 12 mm (½") fitting, as appropriate.
2. Insert the tube adapter into the tube fitting. Make sure the tube adapter rests firmly on the shoulder of the tube fitting body and the nut is finger tight.
3. Mark the nut at the 6:00 position.
4. While holding the fitting body steady, tighten the tube nut 1¼ turns to the 9:00 position.
5. Use a gap inspection gauge, placing it between the nut and the body. If the gauge enters the gap, additional tightening is required.

   NOTICE

   ▶   Refer to Swagelok's manufacturer instructions.

4.9 Hardware settings

Refer to the following figure during the hardware start-up operation.
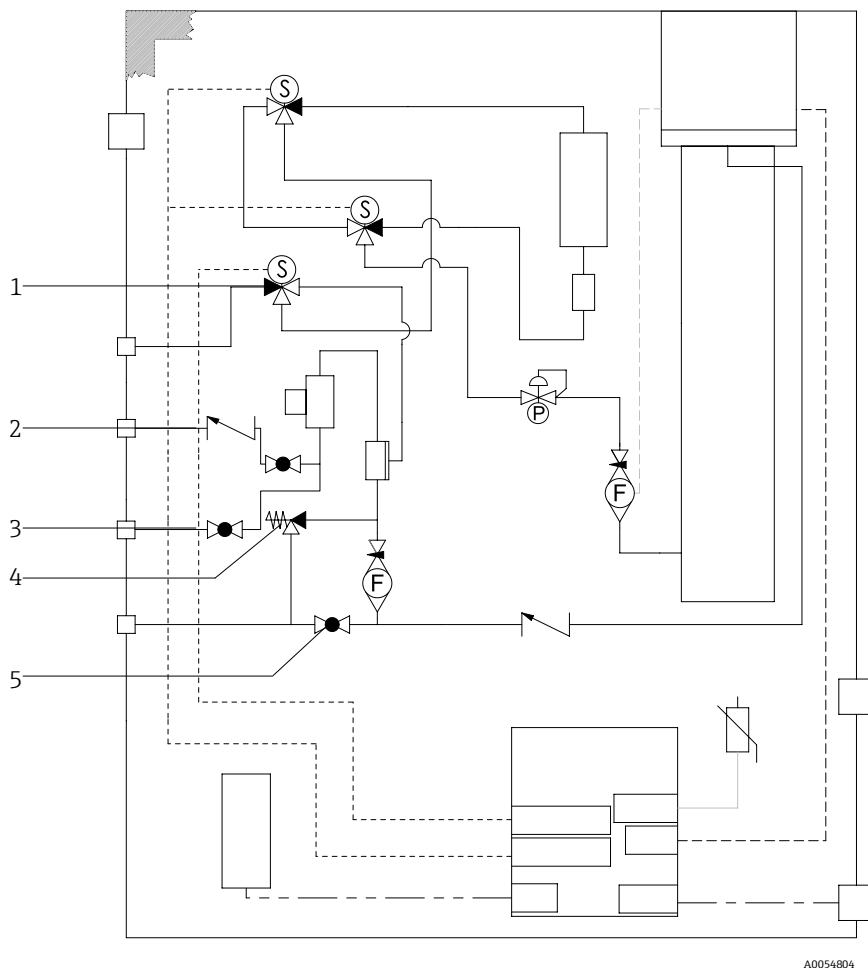
Figure 31. Electrical differential with one point validation

#	Description
1	Validation valve
2	Sample purge
3	Sample valve
4	Relief valve
5	System valve

For systems with the optional sample system enclosure purge, run a purge before startup. Refer to *Enclosure purge* → 🖺.

1. Open the enclosure door.
2. Set the pressure gauge to 69 to 103 kPa (10 to 14.9 psi).
3. Set the flow rate to 3 liters per minute and run the purge for at least 10 minutes for safety, and until the moisture reading is below an acceptable error level.
4. Change the sample supply valve to flow gas.
5. Position the validation/sample gas to open.
6. Confirm the pressure gauge and flow rate settings did not change. Adjust as needed.

   ⚠ **WARNING**

   ▶ Do not exceed 172 kPa (25 psi) setting on the pressure gauge. Operational pressure should be 103 kPa (14.9 psi).
   ▶ Do not exceed 310 kPa (45 psi) from the pressure reducing station.
   ▶ For CRN systems: Do not exceed 103 kPa (14.9 psi) setting on the pressure gauge.

7. Adjust the bypass flow meter to set point, then adjust the analyzer flow meter using the process gas at the maximum expected backpressure.

   ℹ Adjust the flow if the gas composition or back pressure changes.

8. Close the enclosure door.

4.9.1   Setting the flow switch

The flow switch is factory set to 2.5 slpm and should not require adjustment at installation. However, to check or reset the flow switch, use the following procedure and a multimeter in continuity mode, or monitor Alarm 904. Refer to *Overview of diagnostic information* → 🖺.

1. Set the gas to a minimum 2.5 slpm.

A0054805
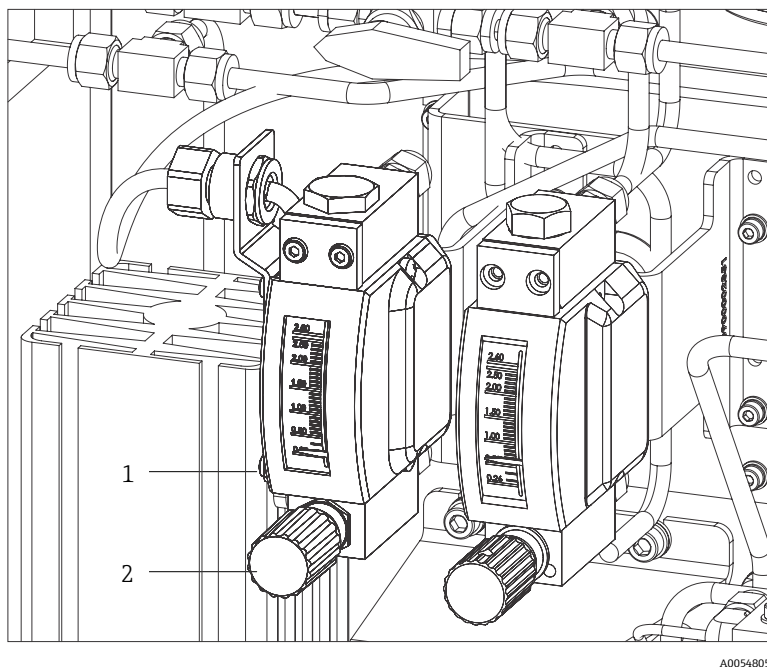
Figure 32. Flow switch adjustments

#	Name
1	Needle valve adjustment
2	Adjustable nut

2. Loosen the nut on the flow switch.
3. Adjust the reed cartridge to the desired value, minimum 2.5 slpm, until the alarm is activated.
4. Set the flow to the desired flow rate of 2.5 to 3 slpm . The alarm should resolve and change state.
5. Secure the nut.

ℹ️   During normal operation, the alarm has a 60-second delay.

4.9.2 Setting the analyzer address

Depending on the fieldbus, the hardware addressing works differently; Modbus RS485 uses a device address or Modbus TCP uses an IP address.

Hardware addressing for Modbus RS485

The device address must always be configured for a Modbus server. The valid device addresses are in the range from 1 to 247. If an address is not configured correctly, the measuring device is not recognized by the Modbus client. All measuring devices are delivered from the factory with the device address 247 and with the software addressing address mode.

> Each address may be assigned only once in a Modbus RS485 network.
> If all DIP switches are ON or OFF, all hardware addressing is OFF.

Modbus device address range	1 to 247
Addressing mode	Software addressing; all DIP switches for hardware addressing are set to OFF.

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Set the desired device address using the DIP switches in the connection compartment.
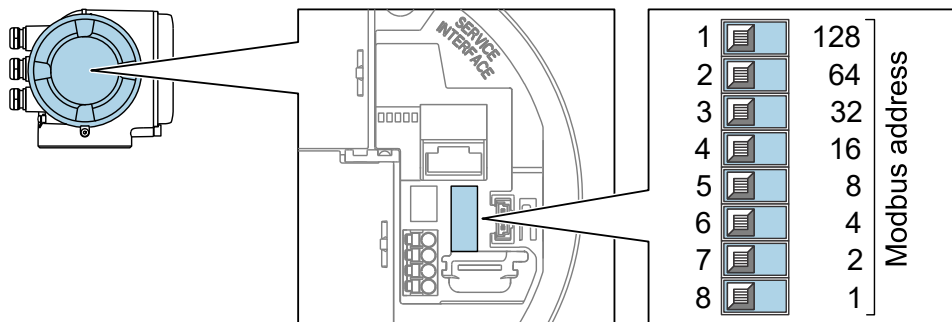
Figure 33. Modbus address DIP switches

4. The change of device address takes effect after 10 seconds.
5. Replace the compartment cover and secure the clamp.

Enabling the terminating resistor

To avoid incorrect communication transmission caused by impedance mismatch, terminate the Modbus RS485 cable correctly at the start and end of the bus segment.

▶ Set DIP switch 3 to On.
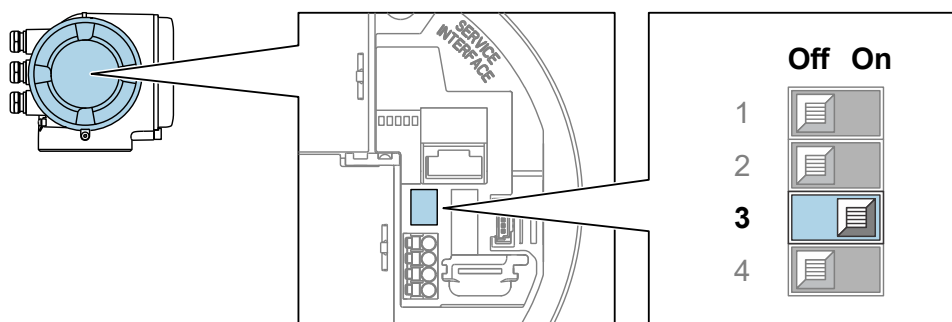
Figure 34. OFF/ON DIP switch selection for enabling the terminating resistor

Hardware addressing for Modbus TCP

The IP address for the JT33 can be configured from DIP switches.

Addressing data

The IP address and configuration options are listed below:

1st octet	2nd octet	3rd octet	4th octet
192.	168.	1.	XXX

> The 1st, 2nd, and 3rd octet can only be configured through software addressing.
> The 4th octet can be configured through software addressing and hardware addressing.

IP address range	1 to 254 (4th octet)
IP address broadcast	255
Addressing mode ex works	Software addressing: all DIP switches for hardware addressing are set to OFF.
IP address ex works	DHCP server active

> Software addressing: The IP address is entered through the IP address parameter. For more information, refer to the *J22 and JT33 TDLAS gas analyzers Description of device parameters (GP01198C)*.

Setting the IP address

⚠ **WARNING**

Risk of electric shock when opening the controller housing.

▶ Disconnect from power supply before opening the controller housing.

> The default IP address may **not** be activated.

Figure 35. DIP switches for setting the IP address

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Set the desired IP address using the corresponding DIP switches on the I/O electronics module.
4. Replace the compartment cover and secure the clamp.
5. Reconnect the device to the power supply.
   ↳ The configured device address is used once the device is restarted.

4.9.3   Activating the default IP address by DIP switch

The DHCP function is enabled in the device at the factory, so the device expects an IP address to be assigned by the network. This function can be disabled and the device can be set to the default IP address 192.168.1.212 by DIP switch.

> ⚠ **WARNING**

Risk of electric shock when opening the controller housing.

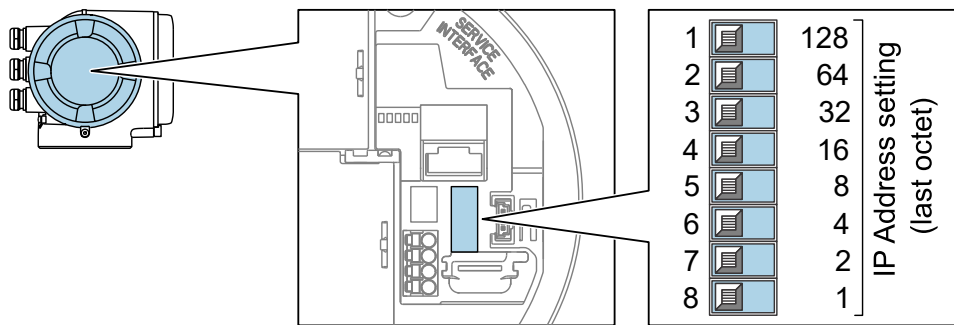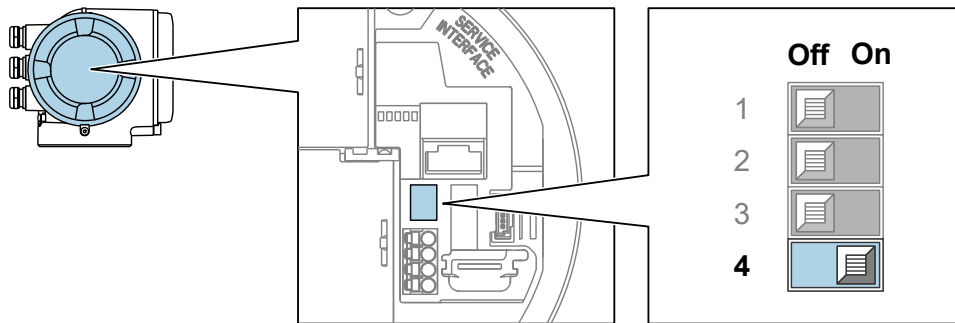▶ Disconnect from power supply before opening the controller housing.

Figure 36. OFF/ON DIP switch for default IP address

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover and disconnect the local display from the main electronics module where necessary.
3. Set DIP switch No. 4 on the I/O electronics module from OFF → ON.
4. Replace the compartment cover and secure the clamp.
5. Reconnect the device to the power supply.

    ↳ The default IP address is used once the device is restarted.

4.10   Ensuring IP66 degree of protection

The measuring device fulfills all the requirements for the IP66 degree of protection, Type 4X enclosure. To guarantee IP66 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry and clean seals or replace if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.
5. Route the cable so that it loops down before the cable entry/water trap to ensure that moisture does not enter the cable entry.
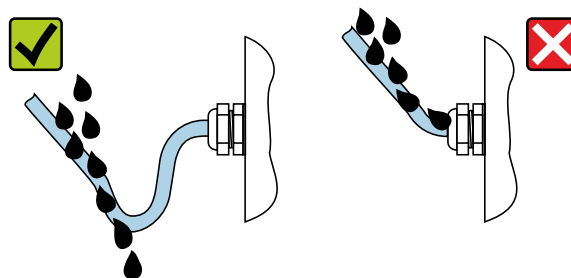
ℹ Ensure the minimum required cable radius is met.

Figure 37. Ensuring IP66 degree of protection

6. Insert dummy plugs into unused cable entries.

5   Operation options

5.1   Overview of operation options
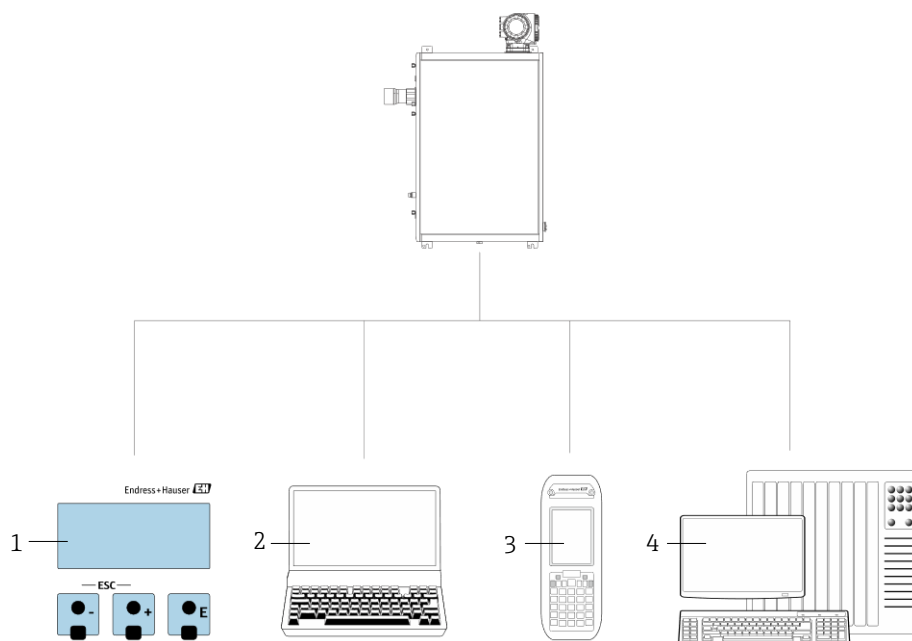
Figure 38. Operation options

#	Name
1	Local operation through the display module
2	Computer with web browser, such as Internet Explorer
3	Mobile device, such as a cellular telephone or tablet, used on the network to access the web server or Modbus
4	Control system, such as PLC

5.2 Structure and function of the operating menu

Operating menu for operators and maintenances

Language ☐	
Operation →	Language
	Parameter 1
	Parameter n
	Submenu 1 →
	Submenu n →
Setup →	Device tag
	Wizard 1 / Parameter 1 →
	Wizard n / Parameter n →
	Advanced setup → Enter access code
	Parameter 1
	Parameter n
	Submenu 1
	Submenu n
Diagnostics →	Parameter 1
	Parameter n
	Submenu 1 →
	Submenu n →

Operator / Maintenance — Task-oriented

Operating menu for experts

Expert →	Access status display
	Parameter n
	System →
	Sensor →
	Input →
	Output →
	Communication →
	Application →
	Diagnostics →

Expert — Function-oriented

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Figure 39. Schematic structure of the operating menu

5.2.1   Operating roles

The individual parts of the operating menu are assigned to certain user roles, such as operator and maintenance. Each user role contains typical tasks within the device lifecycle.

| Functional role/Menu		User Role and Tasks	Content/Meaning
Task Oriented	Display Language	**Role Operator, Maintenance** Tasks during operation ■ Configuring the operational display ■ Reading measured values	■ Defining the operating language ■ Defining the web server operating language
	Operation		■ Configuring the operational display, such as display format
	Setup	**Maintenance** Commissioning ■ Configuration of the measurement ■ Configuration of the inputs and outputs ■ Configuration of the communication interface	Wizards for fast commissioning ■ Set the system units ■ Configuration of the communication interface ■ Display I/O configuration ■ Configure the inputs and outputs ■ Configuring the operational display ■ Define the output conditioning Advanced setup ■ For more customized configuration of the measurement: adaptation to special measuring conditions ■ Administration: define access code, reset measuring device
	Diagnostics	**Maintenance** Fault elimination ■ Diagnostics and elimination of process and device errors ■ Measured value simulation	Contains all parameters for error detections and analyzing process errors ■ **Diagnostic list:** Contains up to 5 currently pending diagnostics messages ■ **Event logbook:** Contains event messages that have occurred ■ **Device information:** Contains information for identifying the device ■ **Measured values:** Contains all current measured values ■ **Data logging submenu:** Storage and visualization of measured values ■ **Heartbeat Technology:** The functionality of the device is checked on demand and the verification results are documented ■ **Simulation:** Used to simulate measured values or output values
Function Oriented	Expert	Tasks that require detailed knowledge of the function of the device ■ Commissioning measurements under difficult conditions ■ Optimal adaptation of the measurement to difficult conditions ■ Error diagnostics in difficult cases ■ Detailed configuration of the communication interface	Contains all the parameters of the device. The structure of this menu is based on the function blocks of the device: ■ **System:** Contains all higher-order device parameters that do not concern the measurement or the communication interface ■ **Sensor:** Configuration of the measurement ■ **Output:** Configuration of the analog current outputs and switch outputs ■ **Input:** Configuration of the analog current inputs. ■ **Communication:** Configuration of the digital communication interface and the web server ■ **Diagnostics:** Error detection and analysis of process and device errors, and for device simulation and Heartbeat Technology

5.3   Local operation
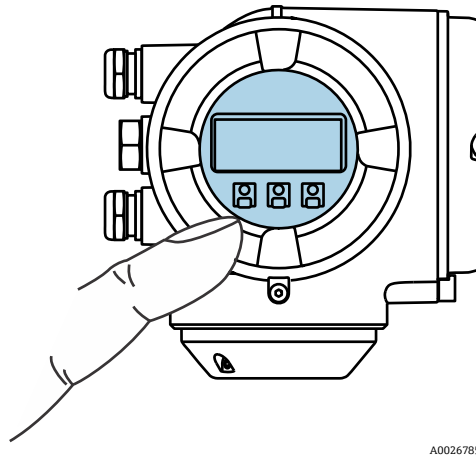
Figure 40. Operation with touch control

Display elements

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: −20 to 60 ℃ (−4 to 140 ℉)
  The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements

- External operation through touch control (3 optical keys) without opening the housing: ⊞, ⊟, ⋿
- Operating elements also accessible in various hazardous areas

5.4   Accessing the operating menu through the local display
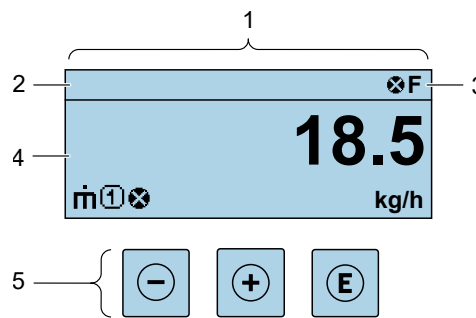
5.4.1   Operational display

Figure 41. Operational display

| #	Name
1	Operational display
2	Device tag
3	Status area
4	Display area for measured values (4-line)
5	*Operating elements → 🗎*

Status area

The following symbols appear in the status area of the operational display at the top right:

- *Status signals* → 📄

  F: Failure
  C: Function check
  S: Out of specification
  M: Maintenance required

- *Diagnostic behavior* → 📄. The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable, calculation error, or parameter misconfiguration. Refer to the *Measured variables submenu* → 📄.

  - ⊗ Alarm

  - ⚠ Warning

- 🔒 Locking: the device is locked from the hardware

- ↔ Communication: communication through remote operation is active

Display area

In the display area, each measured value is prefaced by certain symbol types for further description.

Measured variable	Measurement channel number	Diagnostic behavior
↓	↓	↓

Example:

Occurs due to a diagnostic event, calculation error, or parameter misconfiguration
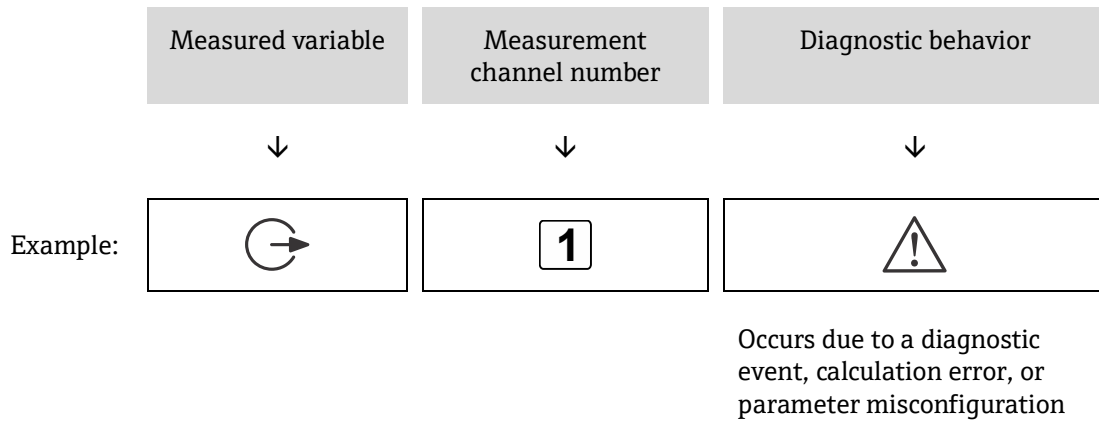
Measured variables

Symbol	Meaning
	Temperature
	Dew point temperature
	Output
	The measurement channel number indicates which of the outputs is displayed.
σ	Concentration
p	Pressure

Diagnostic behavior

ℹ️ The number and display format of the measured values can be configured from the **Format display** parameter. Refer to *Configuring the local display →* 🖹.

5.4.2   Navigation view

In the submenu	In the wizard

Figure 42. Navigation view

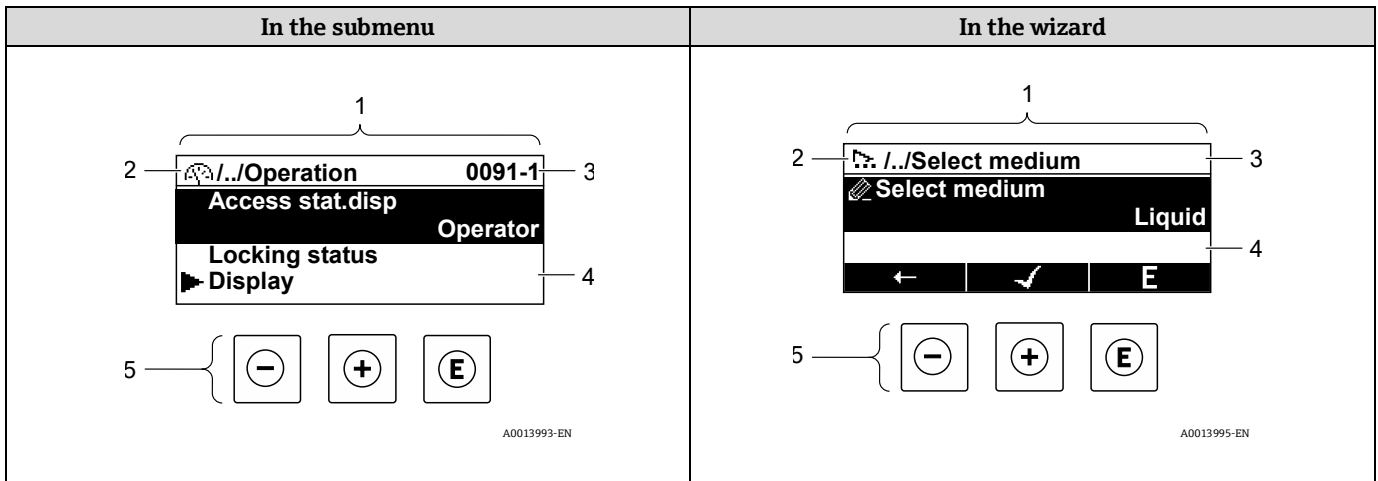| #	Name
1	Navigation view
2	Navigation path to current position
3	Status area
4	Display area for navigation
5	*Operating elements →* 🖹

Navigation path

The navigation path, displayed at the top left in the navigation view, consists of the following elements:

■ In the submenu: Display symbol for menu ■ In the wizard: Display symbol for wizard	Omission symbol for operating menu levels in between	Name of current ■ Submenu ■ Wizard ■ Parameters
↓	↓	↓

Example:	🕐	/ ../	Display
	⯊	/ ../	Display

Status area

The following appears in the status area of the navigation view in the top right corner:

- **In the submenu**: If a diagnostic event is present, the Diagnostic behavior and Status signal.
- **In the wizard**: If a diagnostic event is present, the Diagnostic behavior and Status signal.

Display area

Symbol	Meaning
	Operation ■ In the menu next to the Operation selection ■ At the left in the navigation path in the Operation menu
	Setup ■ In the menu next to the Setup selection ■ At the left in the navigation path in the Setup menu
	Diagnostics ■ In the menu next to the Diagnostics selection ■ At the left in the navigation path in the Diagnostics menu
	Expert ■ In the menu next to the Expert selection ■ At the left in the navigation path in the Expert menu
	Submenu
	Wizard
	Parameters within a wizard No display symbol exists for parameters in submenus.
	Parameter locked. When displayed in front of a parameter name, indicates that the parameter is locked by 1 of the following methods: ■ User-specific access code ■ Hardware write protection switch

Wizard operation

Symbol	Meaning
	Switches to the previous parameter
	Confirms the parameter value and switches to the next parameter
	Opens the editing view of the parameter

5.4.3   Editing view

In the submenu	In the wizard
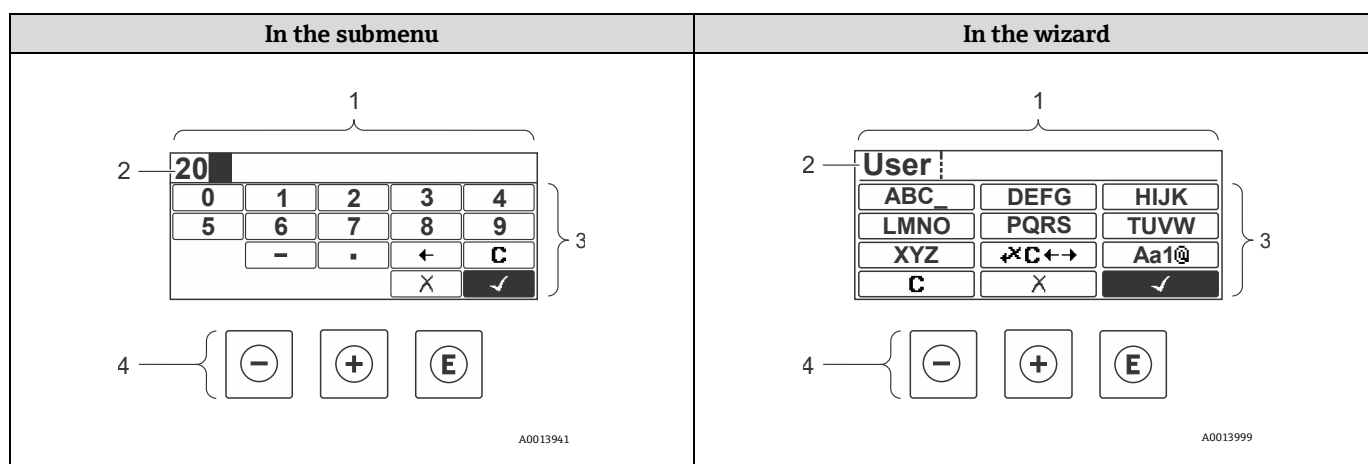
Figure 43. Editing view in the submenu and in the wizard

#	Name
1	Editing view
2	Display area of the entered values
3	Input mask
4	*Operating elements →* 📖

Input mask

The following input symbols are available in the input mask of the numeric and text editor:

Numeric editor

Symbol	Meaning
0 ... 9	Selection of numbers from 0 to 9
.	Inserts decimal separator at the input position
–	Inserts minus sign at the input position
✓	Confirms selection
←	Moves the input position 1 position to the left
✗	Exits the input without applying the changes
C	Clears all entered characters
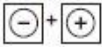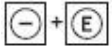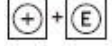
Text editor

Symbol	Meaning
Aa1@	Toggle ■ Between uppercase and lowercase letters ■ For entering numbers ■ For entering special characters
ABC_ ... XYZ	Selection of letters from uppercase A to Z
abc_ ... xyz	Selection of letters from lowercase a to z
"'^_ ... ~&_	Selection of special characters
✓	Confirms selection
✗C←→	Switches to the selection of the correction tools
✗	Exits the input without applying the changes
C	Clears all entered characters

Correction symbols under ✗C←→

Symbol	Meaning
C	Clears all entered characters
→	Moves the input position 1 position to the right
←	Moves the input position 1 position to the left
✗	Deletes 1 character immediately to the left of the input position

5.5   Operating elements

Symbol	Meaning
⊖	**Minus key** **In a menu or submenu:** Moves the selection bar up in a choose list **With a wizard:** Confirms the parameter value and goes to the previous parameter **With a text and numeric editor:** In the input mask, moves the selection bar backward to the left
⊕	**Plus key** **In a menu or submenu:** Moves the selection bar down in a choose list **With a wizard:** Confirms the parameter value and goes to the next parameter **With a text and numeric editor:** Moves the selection bar forward to the right in an input screen

Ⓔ	**Enter key**
	For operational display:
	   - Pressing the key briefly opens the operating menu - Pressing the key for 2 seconds opens the context menu **In a menu or submenu,**
	    pressing the key briefly:
	         - Opens the selected menu, submenu, or parameter - Starts the wizard - If help text is open, closes the help text of the parameter **pressing the key for 2 seconds for parameter:** If present, opens the help text for the function of the parameter
	With a Wizard: Opens the editing view of the parameter
	With a text and numeric editor,
	    pressing the key briefly:
	         - Opens the selected group - Carries out the selected action **pressing the key for 2 seconds** confirms the edited parameter value

⊖ + ⊕	**Escape key combination, pressing keys simultaneously** **In a menu or submenu,** **pressing the key briefly:** - Exits the current menu level and takes you to the next higher level - If help text is open, closes the help text of the parameter **pressing the key for 2 seconds** returns user to the operational display in home position **With a wizard:** Exits the wizard and takes you to the next higher level **With a text and numeric editor:** Closes the text or numeric editor without applying changes
⊖ + Ⓔ	**Minus/Enter key combination, pressing the keys simultaneously** Reduces the contrast to a brighter setting
⊕ + Ⓔ	**Plus/Enter key combination, pressing and holding down the keys simultaneously** Increases the contrast to a darker setting
⊖ + ⊕ + Ⓔ	**Minus/Plus/Enter key combination, pressing the keys simultaneously** **For operational display:** Enables or disables the keypad lock; only SD02 display module

5.5.1 Opening the context menu

Using the context menu, the user can call up the following menus quickly and directly from the operational display:
- Setup
- Data backup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

1. Press Ⓔ for 2 seconds.
   ↳ The context menu opens.
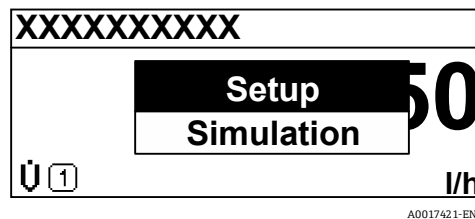
Figure 44. Context menu

2. Press ⊟ + ⊞ simultaneously.
   ↳ The context menu is closed and the operational display appears.

Calling up the menu from the context menu

1. Open the context menu.
2. Press ⊞ to navigate to the desired menu.
3. Press Ⓔ to confirm the selection.
   ↳ The selected menu opens.

5.5.2 Navigating and selecting

Different operating elements are used to navigate through the operating menu. The navigation path is displayed on the left in the header. Icons are displayed in front of the individual menus. These icons are also shown in the header during navigation. Refer to the example below for an overview of the navigation path.

Example: Setting the number of displayed measured values to 2 values
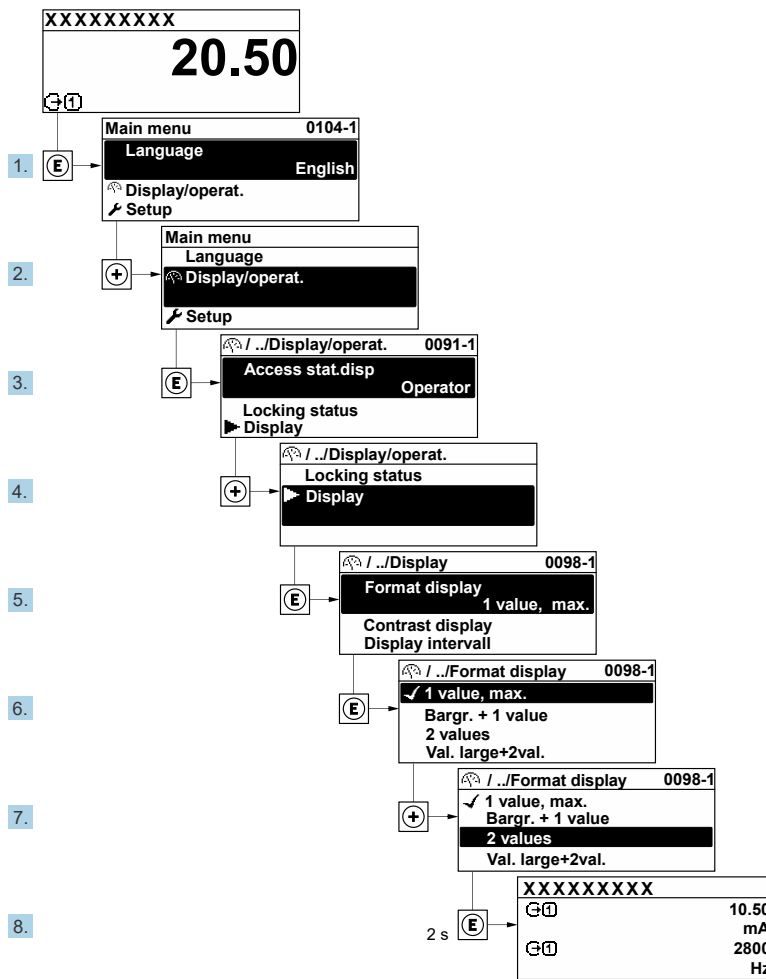
Figure 45. Setting the number of displayed measured values to 2 values

5.5.3   Calling up help text

Help text is available for some parameters and can be opened from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Opening and closing the help text

The user is in the navigation view and the selection bar is on a parameter.

1. Press Ⓔ for 2 seconds.
   ↳ The help text for the selected parameter opens.
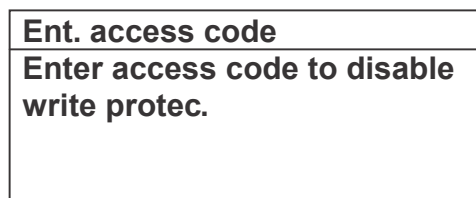
Figure 46. Help text for parameter "Enter access code"

2. Press ⊟ + ⊞ simultaneously.
   ↳ The help text closes.

5.5.4   Changing the parameters

ℹ️   For a description of the editing display consisting of text and numeric editors with symbols, see *Editing view → 📄*.

Example: Changing the tag name in the Tag description parameter from 001-FT-101 to 001-FT-102
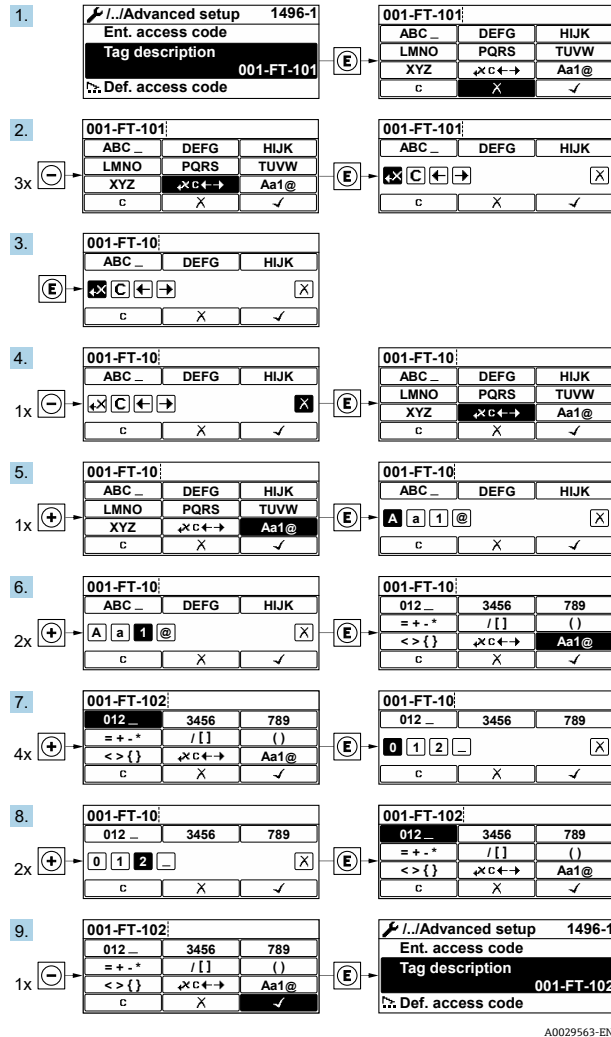
Figure 47. Changing the tag name in "Tag description" parameter

A message is displayed if the value entered is outside the permitted value range.
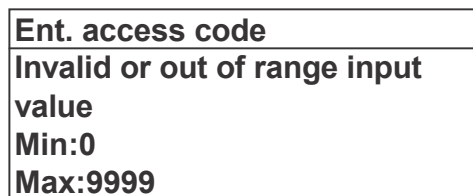
Figure 48. Value entered is outside permitted value range

5.5.5 User roles and related access authorization

The 2 user roles, Operator and Maintenance, have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration through the local display from unauthorized access. Refer to *Protecting settings from unauthorized access* → 🖺.

Access authorization to parameters: Operator user role

Access Code Status	Read Access	Write Access
An access code has not been defined; factory setting	✔	✔
After an access code has been defined	✔	--- [1]

Access authorization to parameters: Maintenance user role

Access Code Status	Read Access	Write Access
An access code has not been defined; factory setting	✔	✔
After an access code has been defined	✔	✔ [2]

> 🛈 The user role with which the user is currently logged on is indicated by the **Access status** parameter. Navigation path: Operation → Access status.

5.5.6 Disabling write protection with access code

If the 🖻-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the time using local operation. See *Write protection with an access code* → 🖺.

Parameter write protection through local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter from the respective access option.

1. After pressing ⒠, the input prompt for the access code appears.
2. Enter the access code.
   ↳ The 🖻-symbol in front of the parameters disappears. All previously write-protected parameters are now enabled.

5.5.7 Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu through local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

Local operation with touch control

The keypad lock is switched on and off from the context menu.

---

[1] Despite the defined access code, certain parameters can always be modified and, therefore, are exempt from the write protection because they do not affect the measurement. See *Write protection with an access code* → 🖺.

[2] If an incorrect access code is entered, the user obtains the access rights of the Operator user role.

Switching on the keypad lock

The keypad lock is switched on automatically:

- Each time the device is restarted
- If the device has not been operated for longer than 1 minute in the measured value display

1. The device is in the measured value display.

   Press Ⓔ for at least 2 seconds.

   ↳ A context menu appears.

2. In the context menu, select **Keylock on**.

   ↳ The keypad lock is on.

ℹ️ If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock

1. The keypad lock is on.

   Press Ⓔ for at least 2 seconds.

   ↳ A context menu appears.

2. In the context menu, select **Keylock off**.

   ↳ The keypad lock is off.

5.6 Access the operating menu from the web browser

Thanks to the integrated web server, the device can be operated and configured through a web browser through a service interface (CDI-RJ45) and connected for Modbus TCP signal transmission. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is displayed and allows the user to monitor the status of the device. The measuring device data can also be managed and the network parameters can be configured.

5.6.1 Computer requirements

5.6.1.1 Computer hardware

Hardware	Interface
	CDI-RJ45
Interface	The computer must have an RJ45 interface.
Connection	Standard Ethernet cable with RJ45 connector.
Screen	Recommended size: ≥12 in, depending on the screen resolution

5.6.1.2   Computer software

Software	Interface
	CDI-RJ45

Recommended operating systems	■ Microsoft Windows 7 or higher
	■ Mobile operating systems
	    • iOS
	    • Android

Web browsers supported	■ Microsoft Internet Explorer 8 or higher ■ Microsoft Edge ■ Mozilla Firefox ■ Google Chrome ■ Safari

5.6.1.3   Computer settings

Settings	Interface	
	CDI-RJ45	
User rights	Appropriate user rights, such as administrator rights, for TCP/IP and proxy server settings are necessary for adjusting the IP address, subnet mask, etc.	
Proxy server settings of the web browser	The web browser setting **Use a Proxy Server for Your LAN** must be deselected**.**	
JavaScript	JavaScript must be enabled. ℹ️ If JavaScript cannot be enabled, enter http://192.168.1.212/basic.html in the address line of the web browser. A fully functional but simplified version of the operating menu structure starts in the web browser. When installing a new firmware version: To enable correct data display, clear the temporary memory/cache of the web browser under **Internet options**.	
Network connections	Only the active network connections to the measuring device should be used.	
	Switch off all other network connections such as WLAN.	Switch off all other network connections.

ℹ️ For connection problems see *Verification, diagnostics, and troubleshooting* → 📖.

Measuring device

Settings	Interface
	CDI-RJ45
Measuring device	The measuring device has an RJ45 interface.
Web server	Web server must be enabled; Factory setting: ON. For information, see *Disabling the web server* → 📖.

Settings	Interface
	CDI-RJ45
IP address	If the IP address of the device is not known: ■ The IP address can be read out from local operation: **Diagnostics → Device information → IP address** ■ Communication with the web server can be established from the default IP address 192.168.1.212. The DHCP function is enabled in the device at the factory. In other words, the device expects an IP address to be assigned by the network. This function can be disabled, and the device can be set to the default IP address 192.168.1.212: set DIP switch No. 4 from OFF to ON. See *Setting the analyzer address* → 📄.

5.6.2   Connecting to the analyzer through the service interface (CDI-RJ45)

Preparing the measuring device

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Unhitch the display module and place on the side of the controller housing, and then open the transparent shield cover from the RJ45 connector.
4. Connect the computer to the RJ45 connector from the standard Ethernet connecting cable.
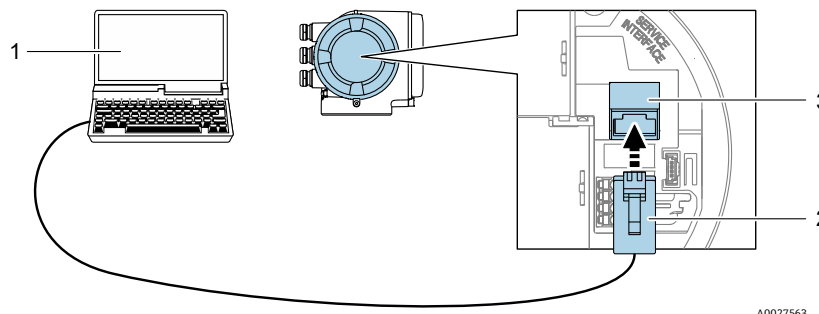
Figure 49. Connecting through CDI-RJ45

#	Name
1	Computer with web browser for accessing the integrated device web server
2	Standard Ethernet connecting cable with RJ45 connector
3	Service interface (CDI-RJ45) of the measuring device with access to the integrated web server

Configuring the internet protocol of the computer

The measuring device works with the Dynamic Host Configuration Protocol (DHCP) upon leaving the factory. The IP address of the measuring device is automatically assigned by the automation system/DHCP server.

The IP address can be assigned to the measuring device in a variety of ways:

■ **Dynamic Host Configuration Protocol (DHCP), Factory setting:** The IP address is automatically assigned to the measuring device by the automation system/DHCP server.
■ The IP address is set with DIP switches. Refer to *Activating the default IP address by DIP switch* → 📄.
■ **Software addressing:** The IP address is entered from the **IP address** parameter.
■ **DIP switch for Default IP address:** To establish the network connection through the service interface (CDI-RJ45), the fixed IP address 192.168.1.212 is used.

The following information refers to the default Ethernet settings of the device:

1. Turn on the measuring device.
2. Connect to the computer using a cable. Refer to *External cable entry points* → 🖹.
3. If a second network card is not used, close all the applications on the notebook.
   ↳ Applications requiring internet or a network include email, SAP applications, or internet browsers.
4. Close any open internet browsers.
5. Configure the properties of the internet protocol (TCP/IP) as defined in the table below:

- Only activate 1 service interface (CDI-RJ45 service interface)
- If simultaneous communication is necessary: Configure different IP address ranges, such as 192.168.0.1 and 192.168.1.212 (CDI-RJ45 service interface).

> 🛈 IP address of the device, factory setting: 192.168.1.212

IP address	192.168.1.XXX; for XXX all numerical sequences except: 0, 212 and 255 → e.g., 192.168.1.213
Subnet mask	255.255.255.0
Default gateway	192.168.1.212 or leave cells empty

NOTICE

▶ Avoid simultaneous access to the measuring device through the service interface (CDI-RJ45). This could cause a network conflict.

5.6.3   Starting the web browser

1. Launch the web browser on the computer.
2. Enter the IP address of the web server in the address line of the web browser: 192.168.1.212
   ↳ The login page displays.
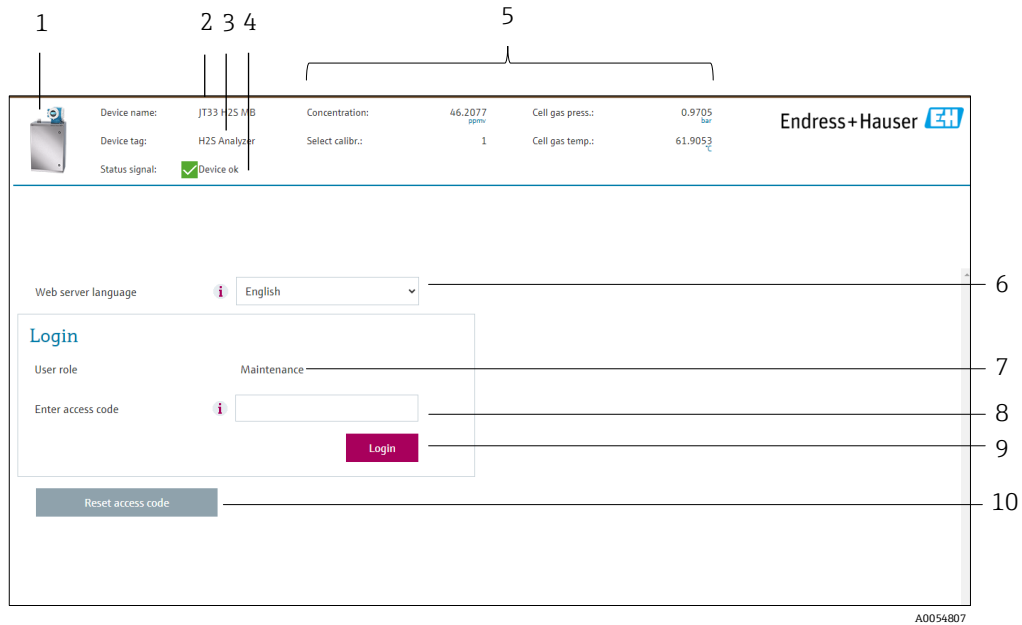
Figure 50. Login page

#	Description	#	Description
1	Picture of device	6	Operating language
2	Device name	7	User role
3	Device tag	8	Access code
4	Status signal	9	Login
5	Current measured values	10	*Resetting the access code → 🖺*

If a login page does not appear or if the page is incomplete, see *Verification, diagnostics, and troubleshooting → 🖺*.

5.6.4   Logging on

1. Select the preferred operating language for the web browser.
2. Enter the user-specific access code.
   0000
   This is the factory-set access code, which can be changed by customer.
3. Press **OK** to confirm the entry.

ℹ️   If no action is performed for 10 minutes, the web browser automatically returns to the login page.

5.6.5   User interface
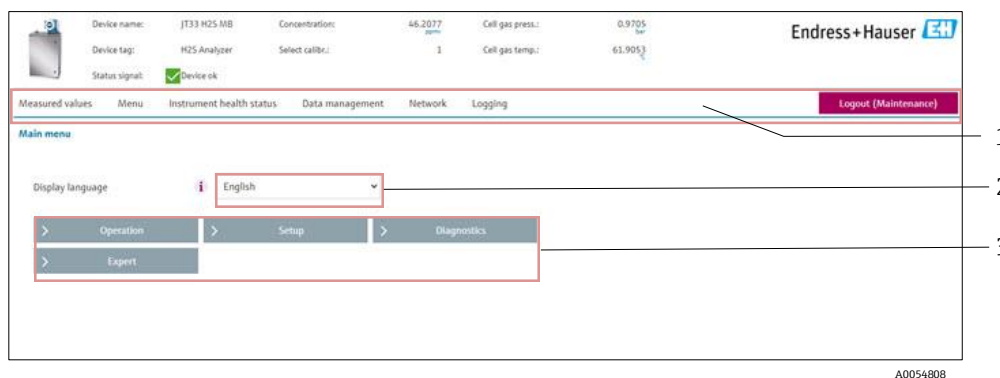
Figure 51. Web browser user interface

#	Description
1	Function row
2	Operating language
3	Navigation area

Header

The following information appears in the header:

- Device tag
- Device status with status signal. Refer to *Status signals* → 📖
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring device
Menu	Access to the operating menu from the measuring device The structure of the operating menu is the same as for the local display
Device status	Displays the diagnostic messages currently pending, listed in order of priority

Data management	■ Data exchange between PC and measuring device
	   • Load the configuration from the measuring device: XML format, save configuration
	   • Save the configuration to the measuring device: XML format, restore configuration
	   • Export the event list as a CSV file
	   • Export parameter settings as a CSV file and create documentation of the measuring point configuration
	   • Export the Heartbeat Verification log as a PDF file; only available with the Heartbeat Verification application package
	   • Export SD card log files as CSV files
	■ Flashing a firmware version

Network configuration	Configuration and checking of all the parameters required for establishing the connection to the measuring device ■ Network settings, such as IP address, MAC address ■ Device information, such as serial number, firmware version
Logout	End the operation and call up the login page

Navigation area

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:

- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

5.6.6 Disabling the web server

The web server of the measuring device can be switched on and off as required using the **web server functionality** parameter.

Navigation   Expert menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Web server functionality	Switch the web server on and off	- Off - On	On

Function scope of the web server functionality parameter

Option	Description
Off	- The web server is completely disabled. - Port 80 is locked.
On	- The complete functionality of the web server is available. - JavaScript is used. - The password is transferred in an encrypted state. - Any change to the password is also transferred in an encrypted state.

Enabling the web server

If the web server is disabled, it can only be enabled with the web server functionality parameter through the local display.

5.6.7 Logging out

Before logging out, perform a data backup through the **Data management** function.

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.

2. Close the web browser.

3. Reset the modified properties of the internet protocol (TCP/IP) if they are no longer needed. See *Modbus RS485 or Modbus TCP function codes* → 🗎.

ℹ️ If communication with the web server was established through the default IP address 192.168.1.212, DIP switch No. 10 must be reset from **ON** to **OFF**. Afterward, the IP address of the device is active again for network communication.

5.7   Remote operation using Modbus

5.7.1   Connecting the analyzer through Modbus RS485 protocol

This communication interface is available through Modbus RTU over RS485.
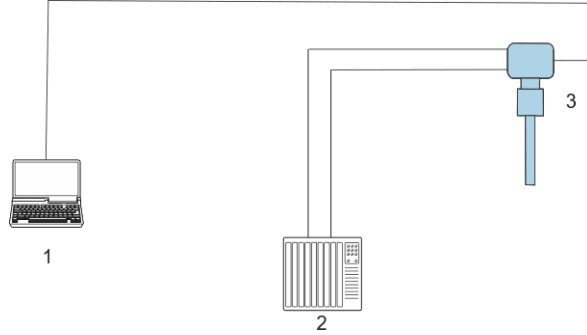
Figure 52. Connecting through Modbus RTU over RS485 protocol

#	Description
1	Computer with web browser for temporarily accessing the web server for settings and diagnostics
2	Automation/control system, such as PLC
3	JT33 TDLAS gas analyzer

5.7.2   Connecting the analyzer through Modbus TCP protocol

This communication interface is available through Modbus TCP/IP network: star topology.
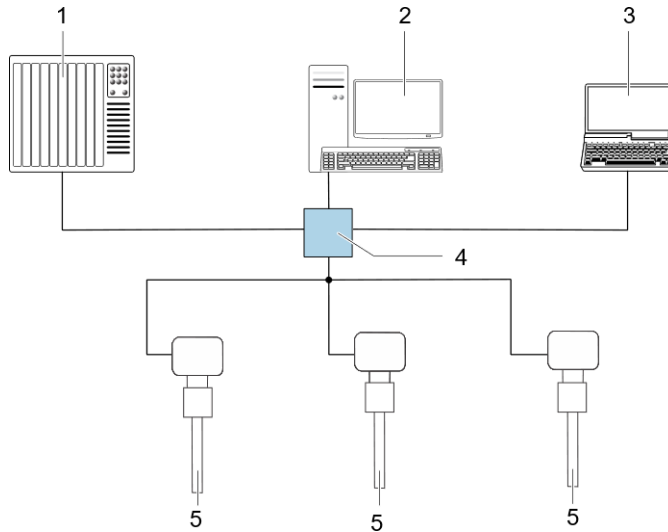
Figure 53. Connecting through Modbus TCP protocol

#	Description
1	Automation/control system, such as PLC
2	Workstation for measurement operation
3	Computer with web browser for accessing the integrated device web server
4	Ethernet switch
5	JT33 TDLAS gas analyzer

6 Modbus communication

6.1 Overview of device description files

Current version data for the device.

Firmware version	01.05	■ On the title page of the Operating instructions ■ Diagnostics → Device information → Firmware version
Release date of firmware version	06.2024	- - -

6.2 Modbus RS485 or Modbus TCP function codes

Function codes are used to define which read or write action is carried out through the Modbus protocol. The measuring device supports the following function codes:

Code	Name	Description	Application
03	Read holding register	Client reads 1 or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes. The measuring device does not make a distinction between function codes 03 and 04; these codes yield the same result.	Read device parameters with read and write access
04	Read input register	Client reads 1 or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes. The measuring device does not make a distinction between function codes 03 and 04; these codes yield the same result.	Read device parameters with read Access
06	Write single registers	Client writes a new value to 1 Modbus register of the measuring device. Use function code 16 to write multiple registers with just 1 telegram.	Write only 1 device parameter
08	Diagnostics	Client checks the communication connection to the measuring device. The following Diagnostics codes are supported: ■ Sub-function 00 = Return query data, for loopback test ■ Sub-function 02 = Return diagnostics register	
16	Write multiple registers	Client writes a new value to multiple Modbus registers of the device. A maximum of 120 consecutive registers can be written with 1 telegram. If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use the Modbus data map. Refer to *Modbus data map* → 🖺.	Write multiple device parameters
23	Read/Write multiple registers	Client reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed **before** read access.	Write and read multiple device parameters

ℹ️ Broadcast messages are only allowed with function codes 06, 16, and 23.

6.3   Response time

Response time of the measuring device to the request telegram of the Modbus client is typically 3 to 5 ms.

6.4   Modbus data map

Function of the Modbus data map

The device offers a special memory area, the Modbus data map for a maximum of 16 device parameters. This allows users to call up multiple device parameters through Modbus RS485 or Modbus TCP, not only individual device parameters or a group of consecutive device parameters. Modbus TCP/IP clients and servers listen and receive Modbus data through port 502.

Grouping of device parameters is flexible and the Modbus client can read or write to the entire data block simultaneously with a single request telegram.

Structure of the Modbus data map

The Modbus data map consists of 2 data sets:

- **Scan list, Configuration area:** The device parameters to be grouped are defined in a list in that their Modbus RS485 or Modbus TCP register addresses are entered in the list.
- **Data area:** The measuring device reads out the register addresses entered in the scan list cyclically and writes the associated device data values to the data area.

6.4.1   Scan list configuration

For configuration, the Modbus RS485or Modbus TCP register addresses of the device parameters to be grouped must be entered in the scan list. Please note the following basic requirements of the scan list:

Max. entries	16 device parameters
Supported device parameters	Only parameters with the following characteristics are supported: ▪ Access type: read or write access ▪ Data type: float or integer

Configuring the scan list through Modbus RS485 or Modbus TCP

Carried out using register addresses 5001 – 5016

Scan list

No.	Modbus RS485 or Modbus TCP register	Data type	Configuration register
0	Scan list register 0	Integer	Scan list register 0
. . .	. . .	Integer	
15	Scan list register 15	Integer	Scan list register 15

6.4.2 Reading out data through Modbus RS485 or Modbus TCP

The Modbus client accesses the data area of the Modbus data map to read out the current values of the device parameters defined in the scan list.

Client access to data area	From register addresses 5051 to 5081

Data area

Device parameter value	Modbus RS485 or Modbus TCP register	Data type[3]	Access[4]
Value of scan list register 0	5051	Integer/float	Read/write
Value of scan list register 1	5053	Integer/float	Read/write
Value of scan list register . . .	. . .	. . .	. . .
Value of scan list register 15	5081	Integer/float	Read/write

6.5 Modbus registers

Parameter	Register	Data Type	Access	Range
Concentration	9455 to 9456	Float	Read	Signed floating-point number
Cell gas temperature	21854 to 21855	Float	Read	Signed floating-point number
Cell gas pressure	25216 to 25217	Float	Read	Signed floating-point number
Diagnostic service ID	2732	Integer	Read	0 to 65535
Diagnostic number	6801	Integer	Read	0 to 65535
Diagnostic Status signal	2075	Integer	Read	0: OK 1: Failure (F) 2: Function check (C) 8: Out of specification (S) 4: Maintenance required (M) 16: --- 32: Not categorized
Diagnostic string	6821 to 6830	String	Read	Diagnostic number, service ID, and status signal
Pipeline pressure	9483 to 9484	Float	Read/Write	0 to 500 bar; write to this value when Pipeline pressure mode = External value
Start validation	30015	Integer	Read/Write	0: Cancel, 1: Start

---

[3] Data type depends on the device parameters entered in the scan list.

[4] Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed from the data area.

7 Commissioning

7.1 Language

Factory setting: English

7.2 Configuring the measuring device

The **Setup** menu with its guided wizards contains all the parameters needed for standard operation.

Navigation to the Setup menu
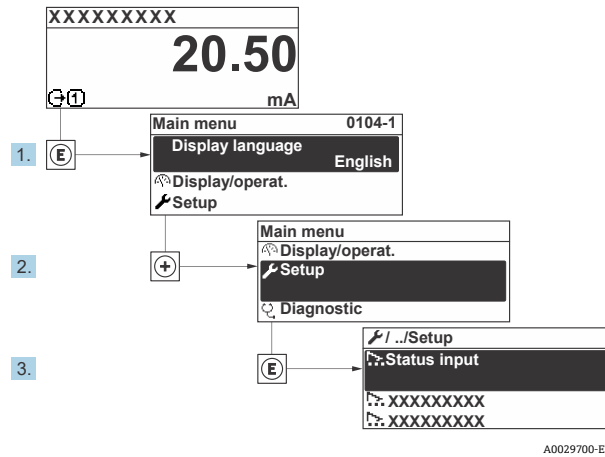
Figure 54. Local display example

Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Setup	Device tag	→ 📄
	Analyte type	→ 📄
	Select calibration	→ 📄
	System units	→ 📄
	Peak tracking	→ 📄
	Ramp adjustment	→ 📄
	Communication	→ 📄
	I/O configuration	→ 📄
	Current output 1 to n	→ 📄
	Current input 1 to n	→ 📄
	Switch output 1 to n	→ 📄
	Relay output 1 to n	→ 📄
	Display	→ 📄
	Advanced setup	→ 📄

7.3　Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a unique designation using the **Device tag** parameter and, therefore, change the factory setting.
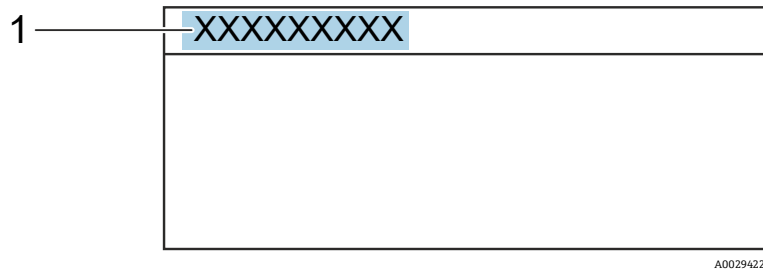
Figure 55. Header of the operational display with tag name (1)

Navigation　　Setup menu → Device tag

Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as number or special characters, such as @, %, /	H_2S analyzer

7.4　Setting the analyte type

Sets the analyte type measured by the analyzer.

Navigation　　Setup menu → Analyte type

Parameter	Description	User entry	Factory setting
Analyte type	The analyte measured by the analyzer.	—	H_2S

7.5　Selecting the measurement calibration

Select the calibration to be measured for your device.

Navigation　　Setup menu → Select calibration

Parameter	Description	User entry	Factory setting
Select calibration	Select the user-defined calibration for measurement. In most cases, calibrations are as follows: 1. Process stream as defined by customer ordered stream composition 2. Methane or nitrogen background for validation gas[5] 3. Not used 4. Not used	▪ 1 ▪ 2 ▪ 3 ▪ 4	1

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[5] The validation gas is determined by the stream composition selected for Feature 70. If the analyzer is set up for natural gas, the background is methane. For all other streams, it is nitrogen.

7.6   Setting system units

In the **System units** submenu, the units of all the measured values can be set.

ℹ️ Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Navigation   Setup menu → System units

▶ System units	Concentration unit	→ 🖺
	Temperature unit	→ 🖺
	Pressure unit	→ 🖺
	Length unit	→ 🖺
	Date/time format	→ 🖺

Parameter	Description	User entry	Factory setting
Concentration unit	Sets the display unit for concentration. The selected unit applies for concentration.	▪ ppmv ▪ ppbv ▪ % vol ▪ lb/MMscf ▪ mg/sm3 ▪ mg/Nm3 ▪ user concentration units	▪ ppmv
Temperature unit	Select temperature difference unit. The selected unit applies for cell gas temperature standard deviation.	SI units ▪ ℃ ▪ ℃K US units ▪ ℉ ▪ ℉R	Approval specific ▪ ℃ ▪ ℉
Pressure unit	Select process pressure unit. The selected unit applies for cell gas pressure.	SI units ▪ MPa a ▪ MPa g ▪ kPa a ▪ kPa g ▪ Pa a ▪ Pa g ▪ bar ▪ bar g US units ▪ ℉ ▪ R	Approval specific ▪ mbar a ▪ psi a
Length unit	Sets the display unit for length. The selected unit applies for cell length.	▪ m ▪ ft ▪ in ▪ mm ▪ μm	m

Parameter	Description	User entry	Factory setting
Date/time format	Sets the display unit for date/time format.	▪ dd.mm.yy hh:mm ▪ dd.mm.yy hh:mm am/pm ▪ mm/dd/yy hh:mm ▪ mm/dd/yy hh:mm am/pm	dd.mm.yy hh:mm

7.7   Setting peak tracking

The **Peak tracking** submenu controls the software utility that keeps the laser scan centered on the absorption peak. Under some circumstances, the peak tracking function can get lost and lock onto the wrong peak. If the system alarm displays, the peak tracking function should be reset.

Navigation   Setup menu → Peak Tracking

▸ Peak tracking	Peak track analyzer control	→ 🖹
	Peak track reset	→ 🖹
	Peak track average number	→ 🖹

Parameter	Prerequisite	Description	User entry	Factory setting
Peak track analyzer control	–	Sets peak tracking capability to Off or On.	▪ Off ▪ On	Off
Peak track reset	Used if peak tracking is set above.	Resets peak tracking.	▪ Off ▪ Reset	Off
Peak track average number	Used if peak tracking is set above.	Sets number of measurements before making a peak tracking adjustment.	Positive integer	10

7.8 Setting ramp adjustment

The **Ramp adjustment** submenu controls the software utility that keeps the laser scan at the correct width. Under some circumstances, the ramp adjustment function can get out of sync. If the system alarm displays, the ramp adjustment function should be reset.

Navigation   Setup menu → Ramp adjustment

▶ Ramp adjustment	Ramp adj control	→ 🖺
	Ramp adj reset	→ 🖺
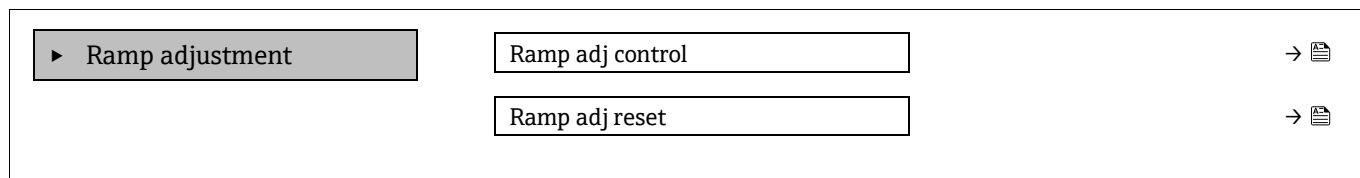
Parameter	Prerequisite	Description	User entry	Factory setting
Ramp adjustment analyzer control	–	Sets ramp adjustment capability to Off or On.	▪ Off ▪ On	Off
Ramp adjustment reset	Used if ramp adjustment is On	Resets ramp adjustment	▪ Off ▪ Reset	Off

7.9   Configuring the communication interface

The **Communication** submenu guides you systematically through all the parameters that must be configured for selecting and setting the communication interface.

Navigation   Setup menu → Communication

► Communication	Bus address[6]	→ 🖺
	Baudrate[6]	→ 🖺
	Data trans. mode[6]	→ 🖺
	Parity[6]	→ 🖺
	Byte order[7]	→ 🖺
	Prio. IP address[8]	→ 🖺
	Inactivity timeout[8]	→ 🖺
	Max connections[8]	→ 🖺
	Failure mode[7]	→ 🖺

Parameter	Prerequisite	Description	User entry	Factory setting
Bus address	Modbus RS485 only	Enter device address.	1 to 247	247
Baudrate	Modbus RS485 device	Define data transfer speed.	1200 BAUD 2400 BAUD 4800 BAUD 9600 BAUD 19200 BAUD 38400 BAUD 57600 BAUD 115200 BAUD	19200 BAUD
Data trans. mode	Modbus RS485 device	Select data transfer mode.	- ASCII - RTU	RTU
Parity	Modbus RS485 device	Select parity bits.	Picklist ASCII option 0 = Even option 1 = Odd option Picklist RTU option 0 = Even option 1 = Odd option 2 = None / 1 stop bit option 3 = None / 2 stop bits option	Even

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[6] Modbus RS485 only

[7] Both Modbus RS485 and TCP

[8] Modbus TCP only

Parameter	Prerequisite	Description	User entry	Factory setting
Byte order	Both Modbus RS485 and Modbus TCP	Select byte transmission sequence.	▪ 0-1-2-3 ▪ 3-2-1-0 ▪ 1-0-3-2 ▪ 2-3-0-1	1-0-3-2
Prio. IP address	Modbus TCP device	The IP address for which connections are accepted by the priority pool.	IP address	0.0.0.0
Inactivity timeout	Modbus TCP device	Time before a connection can be terminated due to inactivity. A setting of zero means no timeout.	0 to 99 seconds	0 seconds
Max connections	Modbus TCP device	Maximum number of concurrent connections. Priority pool connections take precedence and are never denied connection, causing the oldest connection to be terminated.	1 to 4	4
Failure mode	Both Modbus RS485 and Modbus TCP	Select measured value output behavior when a diagnostic message occurs through Modbus communication. Not a Num = NaN	–	–

7.10   Configuring the current input

The **Current input** wizard guides the user systematically through all the parameters that must be set for configuring the current input.

Navigation   Setup menu → Current input

▸ Current input 1 to n	Current span	→ 🖹
	Terminal number	→ 🖹
	Signal mode	→ 🖹
	0/4 mA value	→ 🖹
	20 mA value	→ 🖹
	Failure mode	→ 🖹
	Failure current	→ 🖹

Parameter	Prerequisite	Description	User entry	Factory setting
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA ▪ 4...20 mA NE ▪ 4...20 mA US ▪ 0...20 mA	Approval-specific ▪ 4...20 mA NE ▪ 4...20 mA US
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–

Parameter	Prerequisite	Description	User entry	Factory setting
Signal mode	The measuring device is not approved for use in the hazardous area with Ex-i protection type.	Select the signal mode for the current input.	▪ Passive ▪ Active	Passive
0/4 mA value	–	Enter 4 mA value.	Signed floating-point number	Approval-specific ▪ mbar a ▪ psi a
20 mA value	–	Enter 20 mA value.	Signed floating-point number	Approval-specific ▪ mbar a ▪ psi a
Failure mode	–	Define input behavior in alarm condition.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure current	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter the value to be used by the device if input value from external device is missing.	Signed floating-point number	0

7.11 Configuring the current output

The **Current output** wizard systematically guides you through all the parameters that must be set for configuring the current output.

Navigation Setup menu → Current output

▸ Current output 1 to n	Pro.var. outp	→ 📄
	Terminal number	→ 📄
	Current range output	→ 📄
	Signal mode	→ 📄
	Lower range value output	→ 📄
	Upper range value output	→ 📄
	Damping current	→ 📄
	Fixed current	→ 📄
	Fail.behav.out	→ 📄
	Failure current	→ 📄

Parameter	Prerequisite	Description	User entry	Factory setting
Pro.var. outp	—	Select process variable for current output.	- Off - Concentration - Cell gas temperature	Concentration
Terminal number	—	Shows the terminal numbers used by the current output module.	- Not used 24-25 (I/O 2) 22-23 (I/O 3)	—
Current range output	—	Select current range for process value output and upper/lower level for alarm signal.	4...20 mA NE 4...20 mA US 4...20 mA 0...20 mA - Fixed value	Approval specific: 4...20 mA NE 4...20 mA US
Signal mode	—	Select the signal mode for the current output.	- Passive - Active	Passive
Lower range value output	1 of the following options is selected in the **Current span** parameter 4...20 mA NE 4...20 mA US 4...20 mA 0...20 mA	Enter 4 mA value.	Signed floating-point number	0 ppmv

Parameter	Prerequisite	Description	User entry	Factory setting
Upper range value output	1 of the following options is selected in the **Current span** parameter ■ 4...20 mA NE ■ 4...20 mA US ■ 4...20 mA ■ 0...20 mA	Enter 20 mA value.	Signed floating-point number	Depends on calibration range
Damping current	1 of the following options is selected in the **Current span** parameter ■ 4...20 mA NE ■ 4...20 mA US ■ 4...20 mA ■ 0...20 mA	Set reaction time for output signal to fluctuations in the measured value.	0.0 to 999.9 seconds	0 seconds
Fixed current	In the **Current span** parameter, the Fixed current option is selected.		0 to 22.5 mA	22.5 mA
Fail.behav.out	1 of the following options is selected in the **Current span** parameter ■ 4...20 mA NE ■ 4...20 mA US ■ 4...20 mA ■ 0...20 mA	Define output behavior in alarm condition.	■ Min. ■ Max. ■ Last valid value ■ Actual value ■ Fixed value	Max.
Failure current	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter current output value in alarm condition.	0 to 22.5 mA	22.5 mA

7.12 Configuring the switch output

The **Switch output** wizard guides you systematically through all the parameters that can be set for configuring the selected output type.

Navigation Setup menu → switch output

► Switch output 1 to n	Operating mode	→ 🖺
	Terminal number	→ 🖺
	Signal mode	→ 🖺
	Switch output function	→ 🖺
	Assign diagnostic behavior	→ 🖺
	Assign limit	→ 🖺
	Assign status	→ 🖺
	Switch-on value	→ 🖺
	Switch-off value	→ 🖺
	Switch-on delay	→ 🖺
	Switch-off delay	→ 🖺
	Invert output signal	→ 🖺

Parameter	Prerequisite	Description	User entry	Factory setting
Operating mode	–	Define the output as a switch output.	Switch	Switch
Terminal number	–	Shows the terminal numbers used by the switch output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the switch output.	▪ Passive ▪ Active ▪ Passive NE	Passive
Switch output function	–	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Status	Diagnostic behavior
Assign diagnostic behavior	In the **Switch output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm

Parameter	Prerequisite	Description	User entry	Factory setting
Assign limit	In the **Switch output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	- Off - Concentration - Dew point 1[9] - Dew point 2[9]	Off
Assign status	The **Status** option is selected in the **Switch output function** parameter.	Select the device status for switch output.	- Off - Validation control	Off
Switch-on value	In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	0 ppmv
Switch-off value	In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	0 ppmv
Switch-on delay	The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Switch-off delay	The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Invert output signal	–	Invert the output signal.	- No - Yes	No

[9] Options may be dependent on other parameter settings.

7.13   Configuring the relay output

The **Relay output** wizard guides the user systematically through all the parameters that must be set for configuring the relay output.

Navigation   Setup menu → Relay output 1 to n

▶ Relay output 1 to n	Relay output function	→ ▤
	Terminal number	→ ▤
	Assign limit	→ ▤
	Assign diagnostic behavior	→ ▤
	Assign status	→ ▤
	Switch-off value	→ ▤
	Switch-on value	→ ▤
	Switch-off delay	→ ▤
	Switch-on delay	→ ▤
	Failure mode	→ ▤

Parameter	Prerequisite	Description	User entry	Factory setting
Relay output function	–	Select the function for the relay output.	▪ Closed ▪ Open ▪ Diagnostic behavior ▪ Limit ▪ Status	Diagnostic behavior
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Assign limit	In the **Relay output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Concentration	Off
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	Select **Diagnostic behavior** for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select device status for switch output.	▪ Off ▪ Validation control	Off
Switch-off value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	0 ppmv
Switch-on value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	0 ppmv

Parameter	Prerequisite	Description	User entry	Factory setting
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Switch-on delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Failure mode	—	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open

7.14   Configuring the local display

The **Display** wizard guides you systematically through all the parameters that can configured for configuring the local display.

Navigation   Setup menu → Display

▸ Display		Format display		→ 🖹
		Value 1 display		→ 🖹
		0% bargraph value 1		→ 🖹
		100% bargraph value 1		→ 🖹
		Value 2 display		→ 🖹
		Value 3 display		→ 🖹
		0% bargraph value 3		→ 🖹
		100% bargraph value 3		→ 🖹
		Value 4 display		→ 🖹

Parameter	Prerequisite	Description	User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 ▪ value ▪ 2 values ▪ 1 value large + 2 ▪ values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the display.	▪ Concentration ▪ Cell gas pressure ▪ Cell gas temperature	Concentration
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display	Signed floating-point number	0 ppmv
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display	Signed floating-point number	Depends on calibration range
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Concentration ▪ Cell gas pressure ▪ Cell gas temperature	Dewpoint 1
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter	Cell gas pressure
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	700 mbar a
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	1700 mbar a
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter	Cell gas temperature

7.15   Advanced settings

The **Advanced setup** submenu together with its submenus contains parameters for Administration settings.

Navigation to the Advanced setup submenu
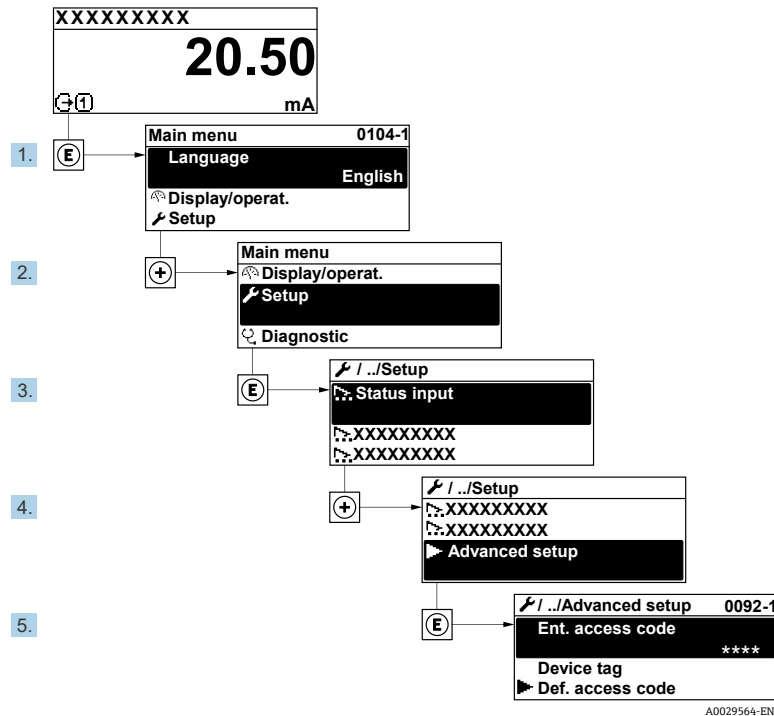
Figure 56. Navigation to advanced setup menu

🛈 The number of submenus can vary depending on the device version. Some submenus are not dealt with in the Operating Instructions. These submenus and the parameters they contain are explained in the Special Documentation for the device.

Navigation   Setup menu → Advanced setup

7.15.1 Stream submenu

In the Stream submenu, you can set parameters related to the stream that needs to be measured.

Navigation   Setup menu → Advanced setup → Stream

▶	Stream			Analyte type		→ 🖹
				Select calibration		→ 🖹
				Rolling average number		→ 🖹

Parameter	Description	User entry	Factory setting
Analyte type	The analyte measured by the analyzer	–	H_2O
Select calibration	Changes and sets the calibration	▪ 1 ▪ 2 ▪ 3 ▪ 4	1
Rolling average number	Sets the number of measurements included in the running average	Positive integer	4

7.15.2 Sensor adjustment submenu

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

Navigation   Setup menu → Advanced setup → Sensor adjustment

▶	Sensor adjustment		Concentration adjust	→ 🖹
			Concentration multiplier (RATA)	→ 🖹
			Concentration offset (RATA)	→ 🖹
			2fbase curve source	→ 🖹
			2fbase curve RT update	→ 🖹
			▶ Calibration 1 to n	→ 🖹

Parameter	Prerequisite	Description	User entry	Factory setting
Concentration adjust	–	Enables or disables adjustment factors.	▪ On ▪ Off	Off
Concentration multiplier (RATA)	Used if Concentration Adjust is enabled.	Slope adjustment factor.	Signed floating point number	1.0
Concentration offset (RATA)	Used if Concentration Adjust is enabled.	Offset adjustment factor.	Signed floating point number	0

Parameter	Prerequisite	Description	User entry	Factory setting
2fbase curve source	Used if Base Curve subtraction is enabled.	Selects which reference to subtract.	▪ Ref0Curve ▪ Ref0RTCurve	Ref0Curve
2fbase curve RT update	Used if Base Curve subtraction is enabled.	Option to update the stored RT base curve	▪ Cancel ▪ Start	Cancel

7.15.2.1 Calibration 1 to n submenu

Up to 4 calibrations are available. Only the active calibration will be displayed at any one time.

Navigation   Setup menu → Advanced setup → Sensor adjustment → Calibration

▸ Calibration 1 to n		Laser midpoint default	→ 🖺
		Laser ramp default	→ 🖺
		Laser modulation amplitude default	→ 🖺

Parameter	Description	User entry	Factory setting
Laser midpoint default	The factory set midpoint of the current ramp for the laser in 2f spectroscopy	Positive floating-point number	Per calibration
Laser ramp default	The factory set span of the current ramp for the laser in 2f spectroscopy	Positive floating-point number	Per calibration
Laser modulation amplitude default	The factory set amplitude of the current modulation for the laser in 2f spectroscopy	Positive floating-point number	Per calibration

7.15.3 Stream change compensation calibration submenu

This submenu contains parameters to configure the stream change compensation adjustment. Up to 4 calibrations are available. Only the active calibration will be displayed at any one time.

Navigation   Setup menu → Advanced setup → Stream change compensation

▸ Stream change compensation	▸ Calibration 1 to n

Navigation   Setup menu → Advanced setup → Stream change compensation→ Calibration 1 to n

▸ Calibration 1 to n		
	Stream change compensation	→ 🗎
	Methane CH4	→ 🗎
	Ethane C2H6	→ 🗎
	Propane C3H8	→ 🗎
	IButane C4H10	→ 🗎
	N-Butane C4H10	→ 🗎
	Isopentane C5H12	→ 🗎
	N-Pentane C5H12	→ 🗎
	Neopentane C5H12	→ 🗎
	Hexane+ C6H14+	→ 🗎
	Nitrogen N2	→ 🗎
	Carbon dioxide CO2	→ 🗎
	Hydrogen sulfide H2S	→ 🗎
	Hydrogen H2	→ 🗎

🛈 The term **mol** in the table below is an abbreviation for mole fraction.

Parameter	Description	User entry	Factory setting
Stream change compensation	Enables or disables the Stream Change Compensation feature	▪ On ▪ Off	Off
Methane CH_4	Sets the mole fraction of Methane in the dry gas mixture	0.4 to 1.0 mol	0.75 mol
Ethane C_2H_6	Sets the mole fraction of Ethane in the dry gas mixture	0.0 to 0.2 mol	0.1 mol
Propane C_3H_8	Sets the mole fraction of Propane in the dry gas mixture	0.0 to 0.15 mol	0.05 mol
IButane C_4H_{10}	Sets the mole fraction of Ibutane in the dry gas mixture	0.0 to 0.1 mol	0 mol
N-Butane C_4H_{10}	Sets the mole fraction of N-Butane in the dry gas mixture	0.0 to 0.1 mol	0 mol
Isopentane C_5H_{12}	Sets the mole fraction of Isopentane in the dry gas mixture	0.0 to 0.1 mol	0 mol
N-Pentane C_5H_{12}	Sets the mole fraction of N-Pentane in the dry gas mixture	0.0 to 0.1 mol	0 mol
Neopentane C_5H_{12}	Sets the mole fraction of Neopentane in the dry gas mixture	0.0 to 0.1 mol	0 mol
Hexane+ $C_6H_{14}+$	Sets the mole fraction of Hexane+ in the dry gas mixture	0.0 to 0.1 mol	0 mol
Nitrogen N_2	Sets the mole fraction of Nitrogen in the dry gas mixture	0.0 to 0.55 mol	0 mol
Carbon dioxide CO_2	Sets the mole fraction of Carbon dioxide in the dry gas mixture	0.0 to 0.3 mol	0.1 mol

Parameter	Description	User entry	Factory setting
Hydrogen sulfide H_2S	Sets the mole fraction of Hydrogen sulfide in the dry gas mixture	0.0 to 0.05 mol	0 mol
Hydrogen H_2	Sets the mole fraction of Hydrogen in the dry gas mixture	0.0 to 0.2 mol	0 mol

7.15.4 Additional display configurations submenu

In the **Display** submenu you can set all the parameters associated with the configuration of the local display.

Navigation   Setup menu → Advanced setup → Display

▶ Display		
	Format display	→ 🖹
	Value 1 display	→ 🖹
	0% bargraph value 1	→ 🖹
	100% bargraph value 1	→ 🖹
	Decimal places 1	→ 🖹
	Value 2 display	→ 🖹
	Decimal places 2	→ 🖹
	Value 3 display	→ 🖹
	0% bargraph value 3	→ 🖹
	100% bargraph value 3	→ 🖹
	Decimal places 3	→ 🖹
	Value 4 display	→ 🖹
	Decimal places 4	→ 🖹
	Display language	→ 🖹
	Display interval	→ 🖹
	Display damping	→ 🖹
	Header	→ 🖹
	Header text	→ 🖹
	Separator	→ 🖹
	Backlight	→ 🖹

Parameter	Prerequisite	Description	User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the display.	▪ Concentration ▪ Cell gas pressure ▪ Cell gas temperature	Concentration
0% bargraph value 1	A local display is provided.	Enter 0% value for bargraph display	Signed floating-point number	0 ppmv
100% bargraph value 1	A local display is provided.	Enter 100% value for bargraph display	Signed floating-point number	Depends on calibration range
Decimal places 1	A measured value is specified in the **Value 1 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Concentration ▪ Cell gas pressure ▪ Cell gas temperature	Dewpoint 1
Decimal places 2	A measured value is specified in the **Value 2 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter	Cell gas pressure
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bargraph display.	Signed floating-point number	700 mbar a
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bargraph display.	Signed floating-point number	1700 mbar a
Decimal places 3	A measured value is specified in the **Value 3 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter	Cell gas temperature

Parameter	Prerequisite	Description	User entry	Factory setting
Decimal places 4	A measured value is specified in the **Value 4 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Display language	A local display is provided.	Set display language	Picklist	English
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	▪ Device tag ▪ Free text	Device tag
Header text	In the **Header** parameter, the **Free text option** is selected.	Enter display header text.	Max. 12 characters such as letters, numbers, or special characters, such as @, %, /	------------
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	▪ . (point) ▪ , (comma)	. (point)
Backlight	1 of the following conditions is met: ▪ Order code for "Display; operation," option F "4-line, illum.; touch control" ▪ Order code for "Display; operation," option G "4-line, illum.; touch control +WLAN" ▪ Order code for "Display; operation," option O "remote 4-line display, illum; 10m/30ft cable; touch control"	Switch the local display backlight On and Off.	▪ Disable ▪ Enable	Enable

7.15.5 Configuration management submenu

After commissioning, you can save the current device configuration or restore the previous device configuration. You can do so using the **Configuration management** parameter and the related options found in the **Configuration backup** submenu.

Navigation   Setup menu → Advanced setup → Configuration backup

► Configuration backup	Operating time	→ 🖺
	Last backup	→ 🖺
	Configuration management	→ 🖺
	Backup state	→ 🖺
	Comparison result	→ 🖺

Parameter	Description	User interface/User entry	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Last backup	Shows when the last data backup was saved to embedded HistoROM.	Days (d), hours (h), minutes (m) and seconds (s)	–
Configuration management	Select action for managing the device data in the embedded HistoROM.	■ Cancel ■ Execute backup ■ Restore ■ Compare ■ Clear backup data	Cancel
Backup state	Shows the status of data saving or restoring.	■ None ■ Backup in progress ■ Restoring in progress ■ Delete in progress ■ Compare in progress ■ Restoring failed ■ Backup failed	None
Comparison result	Comparison of current device data with embedded HistoROM.	■ Settings identical ■ Settings not identical ■ No backup available ■ Backup settings corrupt ■ Check not done ■ Dataset incompatible	Check not done

Function scope of the Configuration management parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Execute backup	A backup copy of the current device configuration is saved from the integrated HistoROM to the memory of the device. The backup copy includes the controller data of the device.
Restore	The last backup copy of the device configuration is restored from the device memory to the device's integrated HistoROM. The backup copy includes the controller data of the device.
Compare	The device configuration saved in the device memory is compared with the current device configuration of the integrated HistoROM.
Clear backup data	The backup copy of the device configuration is deleted from the memory of the device.

NOTICE

▶ Integrated HistoROM: A HistoROM is a nonvolatile device memory in the form of an EEPROM.
▶ While this action is in progress, the configuration cannot be edited from the local display and a message on the processing status appears on the display.

7.16   Decommissioning

NOTICE

▶ If the analyzer will be stored or shut down for any reason, refer to *Intermittent operation* → 🖹 for the steps.

8   Operation

8.1   Reading measured values

With the **Measured values** submenu, it is possible to read all the measured values.

Navigation   Diagnostics menu → Measured values

▸ Measured values	▸ Measured variables	→ 🖹
	▸ Input values	→ 🖹
	▸ Output values	→ 🖹
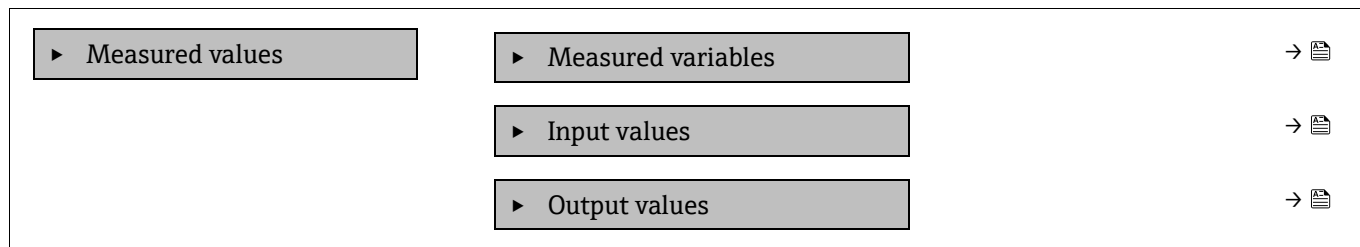
8.1.1   Measured variables submenu

The **Measured variables** submenu contains the calculation result parameters from the last measurement.

Navigation   Diagnostics menu → Measured values → Measured variables

▸ Measured variables	Concentration
	Dew point 1
	Cell gas pressure
	Cell gas temperature
	Detector reference level
	Detector zero level
	Peak 1 index
	Peak 1 index delta
	Peak 2 index
	Peak 2 index delta
	Peak track index
	Peak track index delta
	Midpoint delta
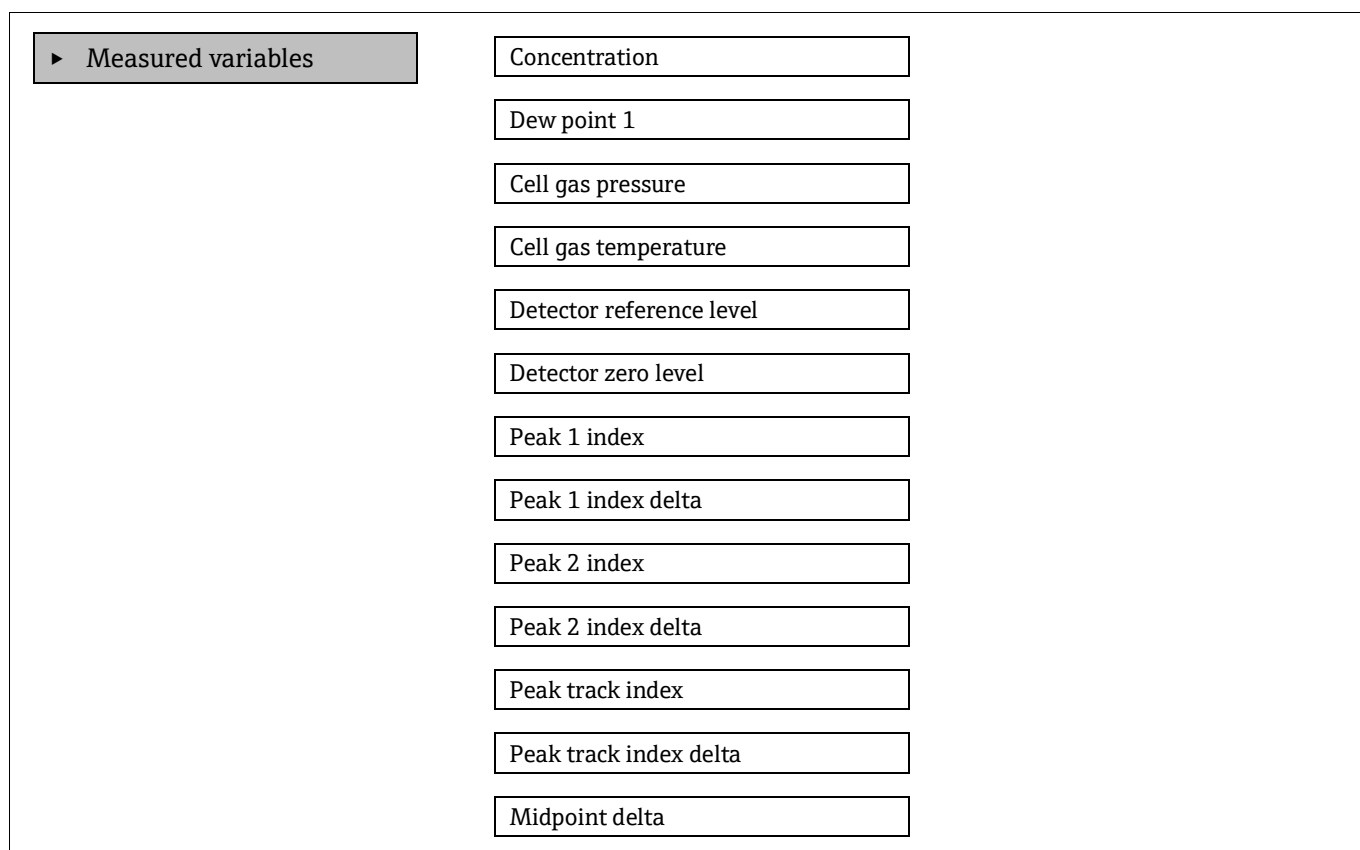
8.1.2   Input values submenu

The **Input values** submenu guides you systematically to the individual input values.

Navigation   Diagnostics menu → Measured values → Input values

▸ Input values	▸ Current Input 1 to n	→ 🖹
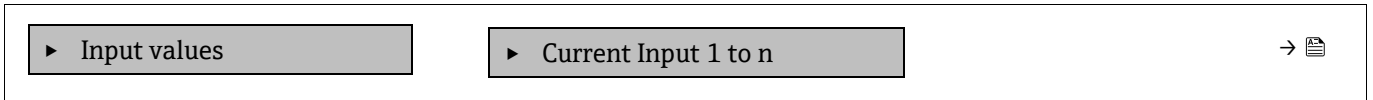
8.1.2.1   Current Input 1 to n submenu

The **Current Input 1 to n** submenu contains all the parameters needed to display the current measured values for every current input.

Navigation   Diagnostics menu → Measured values → Input values → Current input 1 to n

▸ Current input 1 to n	Measured values 1 to n	→ 🖹
	Measured current 1 to n	→ 🖹
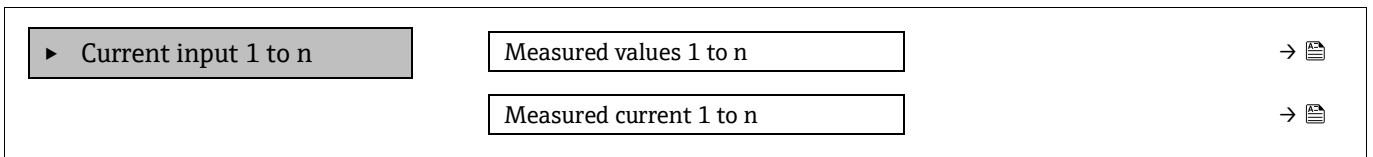
Parameter	Description	User interface
Measured values 1 to n	Displays the current input value.	Signed floating point number
Measured current 1 to n	Displays the current value of the current input.	0 to 22.5 mA

8.1.3   Output values submenu

The **Output values** submenu contains all the parameters needed to display the current measured values for every output.

Navigation   Diagnostics menu → Measured values → Output values

▸ Output values	▸ Current output 1 to n	→ 🖹
	▸ Switch output 1 to n	→ 🖹
	▸ Relay output 1 to n	→ 🖹
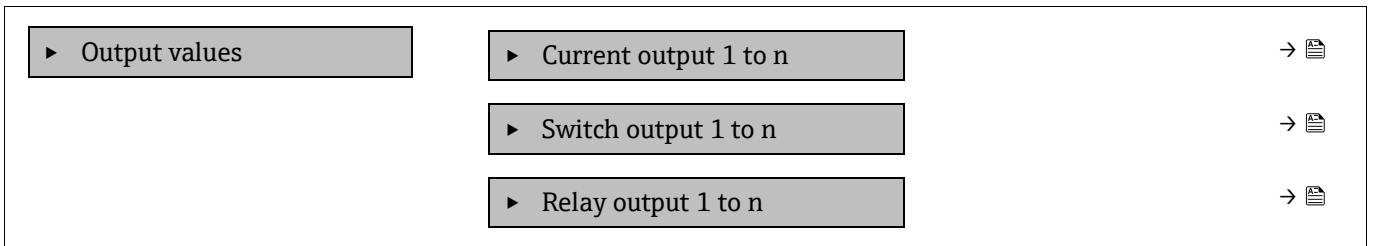
8.1.3.1 Current output 1 to n submenu

The **Value current** output submenu contains all the parameters needed to display the current measured values for every current output.

Navigation   Diagnostics menu → Measured values → Output values → Value current output 1 to n

| ▸ Current output 1 to n | Output current 1 | → 🖹 |
| | Measured current 1 to n | → 🖹 |

Parameter	Description	User interface
Output current 1	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current	Displays the current value currently measured for the current output.	0 to 30 mA

8.1.3.2 Switch output 1 to n submenu

The **Switch output 1 to n** submenu contains all the parameters needed to display the current measured values for every switch output.

Navigation   Diagnostics menu → Measured values → Output values → Switch output 1 to n

| ▸ Switch output 1 to n | Switch status 1 to n | → 🖹 |

Parameter	Prerequisite	Description	User interface/User entry	Factory setting
Switch status 1 to n	The **Switch** option is selected in the **Operating mode** parameter.	Displays the current switch output status.	Open Closed	–

8.1.3.3 Relay output 1 to n submenu

The **Relay output 1 to n** submenu contains all the parameters needed to display the current measured values for every relay output.

Navigation   Diagnostics menu → Measured values → Output values → Relay output 1 to n

▸ Relay output 1 to n	Switch status	→ 🖹
	Switch cycles	→ 🖹
	Max. switch cycles number	→ 🖹

Parameter	Description	User interface
Switch status	Shows the current relay switch status	Open Closed
Switch cycles	Shows number of all performed switch cycles	Positive integer
Max. switch cycles number	Shows the maximal number of guaranteed switch cycles	Positive integer

8.2   Showing data logging

The Extended HistoROM application package enables the **Data logging** submenu to display. This contains all the parameters for the measured value history. Data logging is also available through the web browser. Refer to *Access the operating menu from the web browser → 🗎*.

Function range:

- 1000 measured values can be stored
- Logging channels
- Adjustable logging interval for data logging
- Display of the measured value trend for each logging channel in the form of a chart (see figure below)
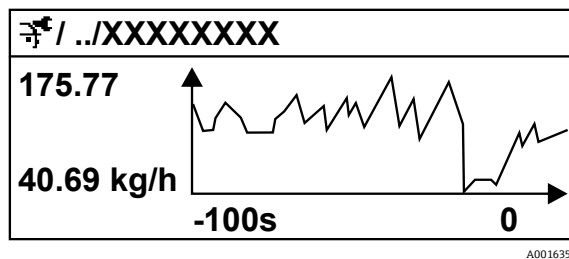
Figure 57. Chart of a measured value trend

Axis	Description
x	Depending on the number of channels selected, chart displays 250 to 1000 measured values of a process variable.
y	Chart displays the approximate measured value span and constantly adapts this to the ongoing measurement.

ℹ️ If the length of the logging interval or the assignment of the process variables to the channels is changed, the content of the data logging is deleted.

Navigation   Diagnostics menu → Data logging

▸ Data logging		Assign channel 1 to n	→ 🗎
		Logging interval	→ 🗎
		Clear logging data	→ 🗎
		Data logging	→ 🗎
		Logging delay	→ 🗎
		Data logging control	→ 🗎
		Data logging status	→ 🗎
		Entire logging duration	→ 🗎

Parameter	Prerequisite	Description	User interface/User entry	Factory setting
Assign channel 1 to n	The **Extended HistoROM** application package is available.	Assign process variable to logging channel.	▪ Off ▪ Concentration[10] ▪ Dew point 1 ▪ Dew point 2 ▪ Cell gas pressure ▪ Cell gas temperature ▪ Flow switch state ▪ Current output 1 to n	Off
Logging interval	The **Extended HistoROM** application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	0.1 to 999.0 s	1.0 s
Clear logging data	The **Extended HistoROM** application package is available.	Clear the entire logging data.	▪ Cancel ▪ Clear data	Cancel
Data logging	---	Select the data logging method.	▪ Overwriting ▪ Not overwriting	Overwriting
Logging delay	In the **Data logging** parameter, the **Not overwriting** option is selected.	Enter the time delay for measured value logging.	0 to 999 h	0 h
Data logging control	In the **Data logging** parameter, the **Not overwriting** option is selected.	Start and stop measured value logging.	▪ None ▪ Delete + start ▪ Stop	None
Data logging status	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the measured value logging status.	▪ Done ▪ Delay active ▪ Active ▪ Stopped	Done
Entire logging duration	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the total logging duration.	Positive floating-point number	0 s

[10] Visibility depends on order options or device settings.

8.3   Adapting the measuring device to the process conditions

Access these settings through the **Setup** menu:

- Basic settings
- Administration settings. Refer to the Advanced setup submenu in *Using parameters for device administration* → 🖺.

Navigation   Setup menu

🔧 Setup	Device tag	→ 🖺
	Analyte type	
	Select calibration	
	▸ System units	→ 🖺
	▸ Dew points	
	▸ Peak tracking	
	▸ Communication	→ 🖺
	▸ I/O configuration	→ 🖺
	▸ Current output 1 to n	→ 🖺
	▸ Current input 1 to n	→ 🖺
	▸ Switch output	→ 🖺
	▸ Relay output 1 to n	→ 🖺
	▸ Display	→ 🖺
	▸ Advance setup	→ 🖺

8.3.1   Displaying the I/O configuration

The **I/O configuration** submenu guides the user systematically through all the parameters in which the configuration of the I/O modules is displayed.

Navigation   Setup menu → I/O configuration

▸ I/O configuration	I/O module 1 to n terminal numbers	→ 🖺
	I/O module 1 to n information	→ 🖺
	I/O module 1 to n type	→ 🖺
	Apply I/O configuration	→ 🖺

Parameter	Description	User entry	Factory setting
I/O module 1 to n terminal numbers	Shows the terminal numbers used by the I/O module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2)[11] ▪ 22-23 (I/O 3)[11]	-
I/O module 1 to n information	Shows information of the plugged I/O module.	▪ Not plugged ▪ Invalid ▪ Not configurable ▪ Configurable	-
I/O module 1 to n type	Shows the I/O module type.	▪ Off ▪ Current output[12] ▪ Switch output[12]	-
Apply I/O configuration	Apply parameterization of the freely configurable I/O module.	▪ No ▪ Yes	No

8.3.2   Using parameters for device administration

The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation   Setup menu → Advanced setup → Administration

▸ Administration	Device reset	→ 🖹
	▸ Define access code	→ 🖹
	▸ Reset access code	→ 🖹
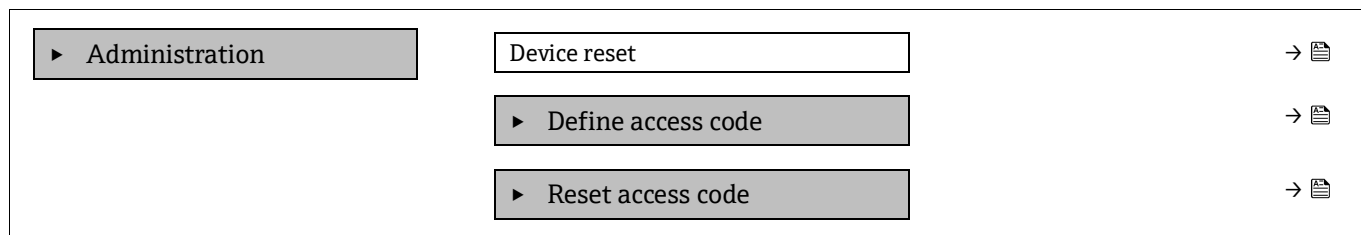
8.3.2.1   Resetting the device

Navigation   Setup menu → Advanced setup → Administration → Device reset

Parameter	Description	User entry	Factory setting
Device reset	Reset the device configuration, either entirely or in part, to a defined state.	▪ Cancel ▪ Restart device	Cancel

---

[11] Based on order configuration.
[12] Visibility depends on order options or device settings.

8.3.2.2 Defining the access code

Navigation   Setup menu → Advanced setup → Administration → Define access code

▶	Define access code		Define access code	→ 🖺
			Confirm access code	→ 🖺

Parameter	Description	User entry
Define access code	Restrict write-access to parameters to protect the configuration of the device against unintentional changes.	Max. 16-digit character string comprising of numbers, letters and special characters
Confirm access code	Confirm the entered access code.	Max. 16-digit character string comprising of numbers, letters, and special characters

8.3.2.3 Resetting the access code

Navigation   Setup menu → Advanced setup → Administration → Reset access code

▶	Reset access code		Operating time	→ 🖺
			Reset access code	→ 🖺

Parameter	Description	User entry	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Reset access code	Reset access code to factory settings. For a reset code, refer to *Service contact* → 🖺. The reset code can only be entered from the web browser.	Character string comprising numbers, letters, and special characters	0000

8.4   Simulation

The **Simulation** submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains, switching valves or closed-control loops.

Navigation   Diagnostics menu → Simulation

▶ Simulation	Current input 1 to n simulation	→ 🗎
	Value current input 1 to n	→ 🗎
	Current output 1 to n simulation	→ 🗎
	Current output value 1 to n	→ 🗎
	Switch output simulation 1 to n	→ 🗎
	Switch state 1 to n	→ 🗎
	Relay output 1 to n simulation	→ 🗎
	Switch state 1 to n	→ 🗎
	Device alarm simulation	→ 🗎
	Diagnostic event category	→ 🗎
	Diagnostic event simulation	→ 🗎

Parameter	Prerequisite	Description	User interface/User entry	Factory setting
Current input 1 to n simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On	Off
Value current input 1 to n	In the **Current input 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	0 to 22.5 mA	Set to the actual input current when the simulation is set to **On**.
Current output 1 to n simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On	Off
Current output value 1 to n	In the **Current output 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA	3.59 mA
Switch output simulation 1 to n	In the **Operating mode** parameter, the **Switch** option is selected.	Switch the simulation of the switch output on and off.	▪ Off ▪ On	Off
Switch state 1 to n	–	Select the status of the status output for the simulation.	▪ Open ▪ Closed	Open

Parameter	Prerequisite	Description	User interface/User entry	Factory setting
Relay output 1 to n simulation	–	–	▪ Off ▪ On	Off
Switch state 1 to n	In the **Switch output simulation 1 to n** parameter, the **On** option is selected.	–	▪ Open ▪ Closed	Open
Device alarm simulation	–	Switch the device alarm on and off.	▪ Off ▪ On	Off
Diagnostic event category	–	Select a diagnostic event category.	▪ Sensor ▪ Electronics ▪ Configuration ▪ Process	Process
Diagnostic event simulation	–	Select a diagnostic event to simulate this event.	▪ Off ▪ Diagnostic event picklist, depending on the selected category	Off

8.5   Protecting settings from unauthorized access

The following write protection options exist to protect the JT33 TDLAS gas analyzer software configuration from unintentional modification:

- Protect access to parameters with access code
- Protect access to local operation with keypad locking. Refer to *Enabling and disabling the keypad lock* → 📖.
- Protect access to measuring device with the write protection switch. Refer to *Using the write protection switch* → 📖.

8.5.1   Write protection with an access code

By enabling a user-specific access code, the parameters for the measuring device configuration are write-protected and their values can no longer be changed through local operation.

If parameter write protection is activated through an access code, it can only be deactivated with the same access code.

The user role with which the user is currently logged on through the local display is indicated by the **Access status** parameter. Navigation path: Operation → Access status.

8.5.2   Defining the access code through the local display

1. Navigate to the ***Define access code*** *parameter* → 📖.
2. Define the access code with a string of up to 16 numbers, letters, or special characters.
3. In the ***Confirm access code*** *parameter* → 📖, enter the access code again to confirm the code.
    ↳ The 📖-symbol appears in front of all write-protected parameters.

8.5.3   Automatic locking

The device automatically locks the write-protected parameters under these conditions:

- If a key is not pressed for 10 minutes in the navigation and editing view.
- After 60 seconds if the user skips back to the operational display mode from the navigation and editing view.

8.5.3.1   *Parameters that can be modified from the local display*

Parameters that do not affect the measurement are exempt from write protection through the local display. These parameters are

- Format display
- Contrast display
- Display interval

Despite the user-specific access code, these parameters can be modified even when other parameters are locked.

8.5.4   Defining the access code through the web browser

1. Navigate to the ***Define access code*** *parameter* → 📖.
2. Define a 4-digit numeric code as an access code.
3. In the ***Confirm access code*** *parameter* → 📖, enter the access code again to confirm the code.
    ↳ The web browser switches to the login page.

ℹ️ If no action is performed for 10 minutes, the web browser automatically returns to the login page.

   ▸ If parameter write protection is activated through an access code, it can only be deactivated with the same access code.
   ▸ The user role with which the user is currently logged on the web browser is indicated by the **Access status** parameter. Navigation path: Operation → Access status.

8.5.5   Resetting the access code

If the user-specific access code is misplaced, the code can be reset to the factory setting. A reset code must be entered for this purpose. The user-specific access code can then be redefined.

To reset the access code from the web browser through CDI-RJ45 service interface:

1. Contact your Endress+Hauser service organization to obtain a reset code. Refer to *Service contact → 🖺*.
1. Navigate to the **Reset access code** parameter.
2. Enter the reset code.

    ↳ The access code has been reset to the factory setting **0000** and can now be redefined.

8.5.6   Using the write protection switch

Unlike parameter write protection with a user-specific access code, the write protection switch allows write access to be locked to the entire operating menu, except the Contrast display parameter. The factory setting is OFF.

The write protection switch prevents editing of parameter values through the following methods:

- Local display
- Modbus RS485 protocol
- Modbus TCP protocol

8.5.6.1   Turning on the write protection switch

To enable hardware write protection:
Set the write protection (WP) switch No. 1 on the main electronics module to the **ON** position.
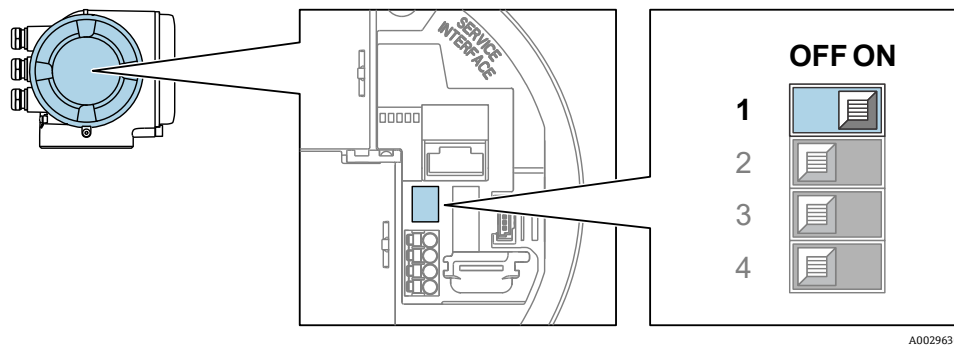
Figure 58. OFF/ON DIP switch for write protection

↳ In the Locking status parameter, the Hardware locked option is displayed. In addition, on the local display the 🔒-symbol appears in front of the parameters in the header of the operational display and in the navigation view.
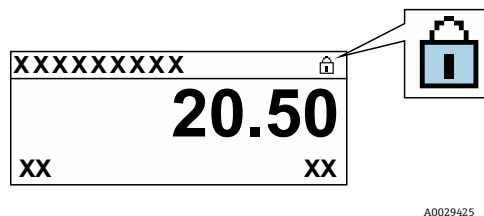
Figure 59. Hardware locked symbol in operational display

8.5.6.2   *Turning off the write protection switch*

To disable hardware write protection:

Set the WP switch on the main electronics module to the **OFF** position.

↳ No option is displayed in the Locking status parameter. On the local display, the 🔒-symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

NOTICE

▶   DIP switch No. 2 manages customer transfer applications, which are not used in this device. Keep this switch in the **OFF** position.

8.5.7   Reading the device locking status

Device active write protection: Locking status parameter

Navigation   Operation menu → Locking status

Function scope of the Locking status parameter

Options	Description
None	The access status displayed in the **Access status** parameter applies and appears only on the local display.
Hardware locked	DIP switch No. 1 for hardware locking is activated on the PCB board. This action locks write access to the parameters, such as from the local display or operating tool.
Temporarily locked	Write access to the parameters is temporarily locked due to internal processes running in the device, such as data upload, data download, or reset. Once the internal processing has been completed, the parameters can be changed.

9 Verification, diagnostics, and troubleshooting

9.1 Diagnostic information from light-emitting diodes

9.1.1 Controller

Different LEDs in the controller provide information on the device status.
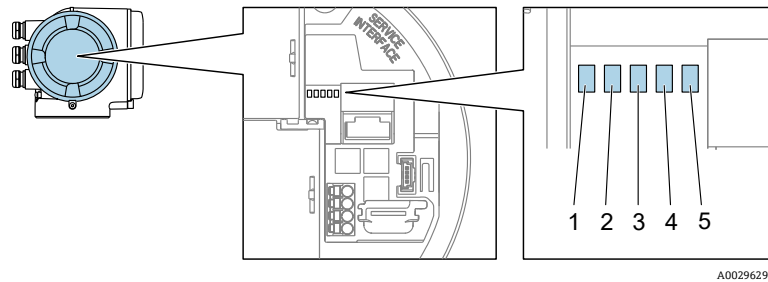
Figure 60. LED diagnostic indicators

#	LED	Color	Meaning
1	Supply voltage	Off	Supply voltage is off or too low
		Green	Supply voltage is ok
2	Device Status	Off	Firmware error
		Green	Device status is ok
		Flashing green	Device is not configured
		Flashing red	A device event with Warning Diagnostic behavior has occurred
		Red	A device event with Alarm Diagnostic behavior has occurred
		Flashing red/green	Device restart
3	Not used	—	—
4	Communication	White	Communication active
		Off	Communication not active
5	Service interface (CDI) active	Off	Not connected or no connection established
		Yellow	Connected and connection established
		Flashing yellow	Service interface active

9.2 Diagnostic information on local display

9.2.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.
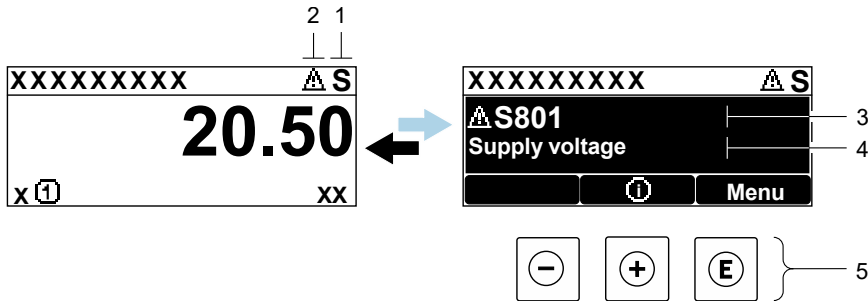
Figure 61. Diagnostic message

#	Description
1	Status signal
2	Diagnostic behavior
3	Diagnostic behavior with diagnostic code
4	Short text
5	*Operating elements →* 🗎

If 2 or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:

- From parameters
- Through submenus

9.2.1.1 Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information or event. The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107.

Symbol	Meaning
F	**Failure.** A device error has occurred. The measured value is no longer valid.
C	**Function check.** The device is in service mode, such as during a simulation.
S	**Out of specification.** The device is operated outside its technical specification limits, such as outside the process temperature range.
M	**Maintenance required.** Maintenance is required. The measured value remains valid.

9.2.1.2   Diagnostic behavior

Symbol	Meaning
⊗	**Alarm.** Measurement is interrupted. Signal outputs assume the defined alarm condition. A diagnostic message is generated.
⚠	**Warning.** Measurement is resumed. The signal outputs are not affected. A diagnostic message is generated.

9.2.1.3   Diagnostic information

The fault can be identified using the diagnostic information. The Short text helps you by providing information about the fault. In addition, the corresponding symbol for the Diagnostic behavior is displayed in front of the diagnostic information on the local display.
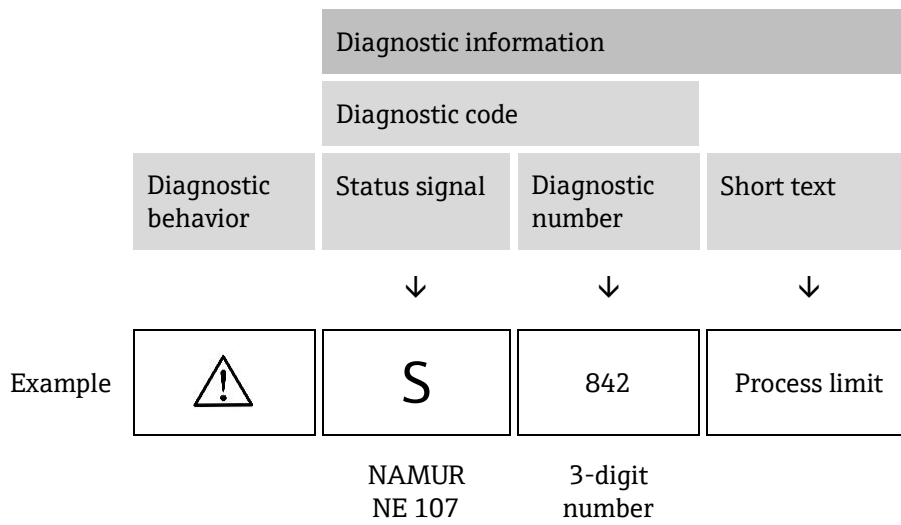
9.2.1.4   Operating elements

Symbol	Meaning
⊕	**Plus key.** In a menu or submenu, opens the message about remedy information.
Ⓔ	**Enter key.** In a menu or submenu, opens the operating menu.

Calling up remedial measures
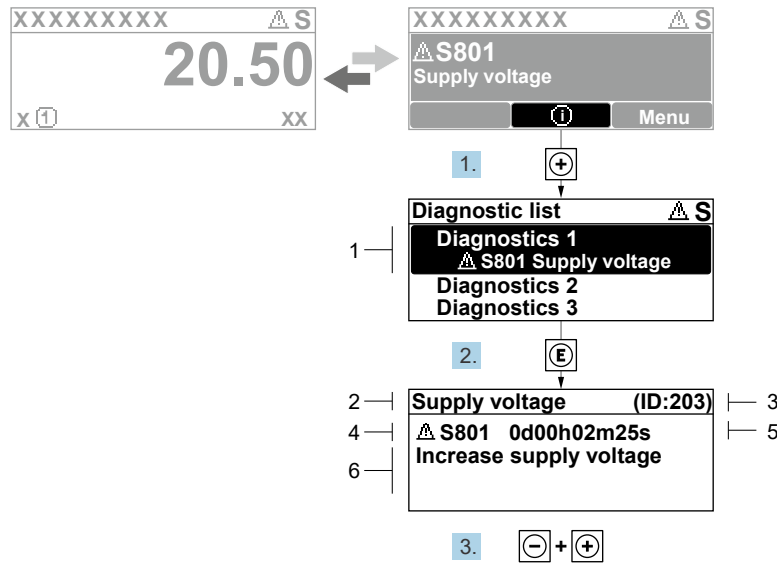
Figure 62. Message for remedial measures

#	Description
1	Diagnostic information
2	Short text
3	Service ID
4	Diagnostic behavior with diagnostic code
5	Operation time of occurrence
6	Remedial measures

The user is in the diagnostic message.

1. Press ⊞ (ⓘ symbol)
   ↳ The Diagnostic list submenu opens.

2. Select the desired diagnostic event with ⊞ or ⊟ and press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.

3. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

The user is in the **Diagnostics** menu at an entry for a diagnostics event, such as in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

1. Press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.

2. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

9.3   Diagnostic information in the web browser

9.3.1   Diagnostic options

Any faults detected by the measuring device are displayed in the web browser on the home page once the user has logged on.
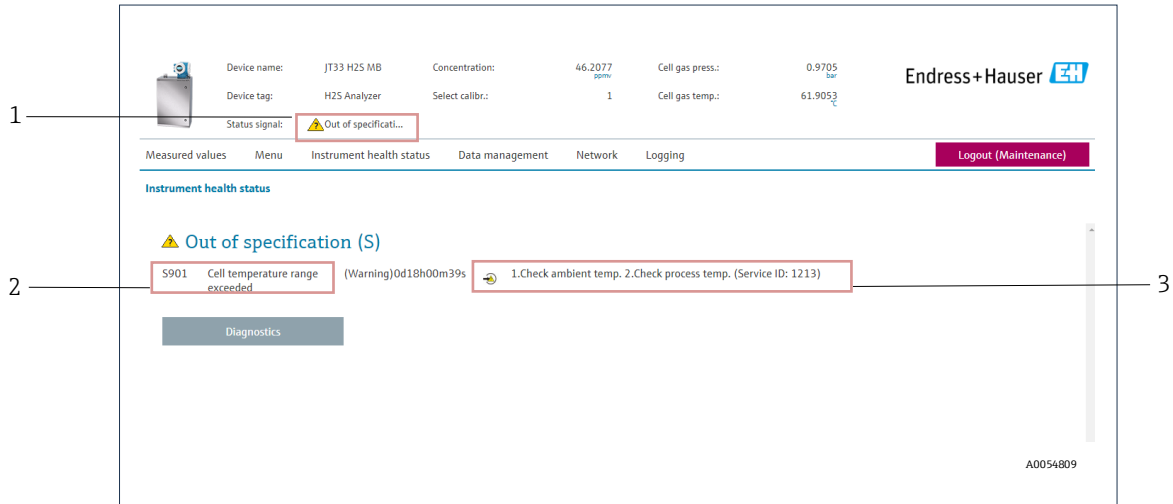
Figure 63. Diagnostic information in the web browser

#	Name
1	Status area with status signal
2	Diagnostic information. Refer to *Pending diagnostic events* → 📖.
3	Remedy information with Service ID

In addition, diagnostic events which have occurred can be shown in the Diagnostics menu:
- From parameters
- Through submenus

Status signals

The Status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

Symbol	Meaning
⊗	**Failure.** A device error has occurred. The measured value is no longer valid.
▽	**Function check.** The device is in service mode, such as during a simulation.
⚠	**Out of specification.** The device is operated outside its technical specification limits, such as outside the process temperature range.
◇	**Maintenance required.** Maintenance is required. The measured value is still valid.

9.3.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly. These measures are displayed in red along with the diagnostic event and the related diagnostic information.

9.4 Diagnostic information through the communication interface

9.4.1 Reading out diagnostic information

Diagnostic information can be read out from the Modbus RS485 or Modbus TCP register addresses. See *Modbus registers → 🖺* for more information.

- From register address 6821, data type = string: diagnosis code, such as F270
- From register address 6801, data type = integer: diagnosis number, such as 270

For an overview of diagnostic events with diagnosis number and diagnosis code, see *Overview of diagnostic information → 🖺*.

9.4.2 Configuring error response mode

The error response mode for Modbus RS485 or Modbus TCP communication can be configured in the **Communication** submenu using 2 parameters.

Navigation   Setup → Communication

Parameter	Description	User entry	Factory setting
Failure mode	Select measured value output behavior when a diagnostic message occurs through Modbus communication. The effect of this parameter depends on the option selected in the **Assign diagnostic behavior** parameter.	■ NaN value ■ Last valid value ℹ️ NaN = not a number	NaN value

9.5 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic behavior** submenu.

Navigation   Expert → Setup → Diagnostic handling → Diagnostic behavior

You can assign the following options to the diagnostic number as the diagnostic behavior:

Options	Description
Alarm	The device stops measurement. The measured value output from Modbus RS485 and Modbus TCP assume the defined alarm condition. A diagnostic message is generated. The background lighting changes to red.
Warning	The device continues to measure. The measured value output from Modbus RS485 and Modbus TCP are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is displayed only in the **Event logbook** submenu—**Event list** submenu—and is not displayed in alternation with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

9.6   Overview of diagnostic information

The amount of diagnostic information and the number of measured variables affected increases if the measuring device has 1 or more application packages. In the case of some items of diagnostic information, the diagnostic behavior can be changed. See *Adapting the diagnostic behavior → 🗎.*

Diagnostic number	Short text	Remedy instructions	Status signal from factory	Diagnostic behavior from factory
Diagnostic of sensor				
082	Data storage	1. Check module connections. 2. Contact service.	F	Alarm
083	Memory content	1. Restart device. 2. Restore HistoROM S-DAT backup; **Device reset** parameter. 3. Replace HistoROM S-DAT.	F	Alarm
100	Laser off	1. Restart device. 2. Replace sensor electronics. 3. Replace OH sensor.	F	Alarm
101	Laser off	1. Wait for laser to heat to temperature. 2. Replace OH sensor.	F	Alarm
102	Laser temperature sensor faulty	1. Restart device. 2. Replace sensor electronics. 3. Replace OH sensor.	C	Warning
103	Laser temperature unstable	1. Confirm that ambient temperature ramp meets specification. 2. Replace sensor electronics. 3. Replace OH sensor.	F	Alarm
104	Laser temperature settling	Wait for laser temperature to settle.	C	Warning
105	Cell pressure connection defective	1. Check connection to pressure cell. 2. Replace pressure cell.	F	Alarm
106	Sensor (Optical Head) faulty	1. Restart device. 2. Replace OH sensor.	F	Alarm
107	Detector zero range exceeded	1. Check process. 2. Check spectrum.	M, C	Warning
108	Detector reference level range exceeded	1. Check process. 2. Check spectrum.	M, C	Warning
109	Peak index @1 out of range	1. Check process. 2. Check spectrum. 3. Reset peak tracking.	F	Alarm
110	Peak track adjustment exceeded	1. Check process. 2. Check spectrum. 3. Reset peak tracking.	F	Alarm
111	Peak track adjustment warning	1. Check process. 2. Check spectrum. 3. Reset peak tracking.	C	Warning
112	Ramp adjustment exceeded	1. Check process. 2. Check spectrum. 3. Reset ramp adjustment.	F	Alarm
113	Ramp adjustment warning	1. Check process. 2. Check spectrum. 3. Reset ramp adjustment.	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal from factory	Diagnostic behavior from factory
114	Detector reference level delta rescrub exceeded	1. Check spectrum. 2. Check scrubber.	F	Alarm
Diagnostic of electronics				
201	Device failure	1. Restart device. 2. Contact service.	F	Alarm
242	Software incompatible	1. Check software. 2. Flash or change main electronics module.	F	Alarm
252	Modules incompatible	1. Check electronic modules. 2. Change electronic modules.	F	Alarm
262	Sensor electronic connection faulty	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics. 2. Check or replace ISEM or main electronics.	F	Alarm
270	Main electronic failure	Change main electronic module.	F	Alarm
271	Main electronic failure	1. Restart device. 2. Change main electronic module.	F	Alarm
272	Main electronic failure	1. Restart device. 2. Contact service.	F	Alarm
273	Main electronic failure	Change electronic.	F	Alarm
275	I/O module 1 to n defective	Change I/O module.	F	Alarm
276	I/O module 1 to n faulty	1. Restart device. 2. Change I/O module.	F	Alarm
283	Memory content	1. Reset device. 2. Contact service.	F	Alarm
300	Sensor electronics (ISEM) faulty	1. Restart device. 2. Replace sensor electronics.	F	Alarm
301	SD memory card error	1. Check SD card. 2. Restart device.	C	Warning
302	Device verification in progress	Device verification active, please wait.	C	Warning
303	I/O @1 configuration changed	1. Apply I/O module configuration; parameter **Apply I/O configuration**. 2. Reload device description and check wiring.	M	Warning
304	MAC electronics connection faulty	1. Check/replace connection cable between MAC electronics and sensor electronic module (ISEM). 2. Check/replace module MAC, ISEM.	F	Alarm
305	Solenoid @1 trigger error	1. Check/replace MAC solenoid connection. 2. Contact service.	F	Alarm
306	SCS thermistor faulty	1. Check/replace SCS thermistor connection. 2. Contact service.	F	Alarm
307	SCS heater connection	1. Check/replace heater connection. 2. Contact service.	F	Alarm
311	Electronic failure	1. Do not reset device. 2. Contact service.	M	Warning

Diagnostic number	Short text	Remedy instructions	Status signal from factory	Diagnostic behavior from factory
330	Flash file invalid	1. Update firmware of device. 2. Restart device.	M	Warning
331	Firmware update failed	1. Update firmware of device. 2. Restart device.	F	Warning
332	Writing in HistoROM backup failed	Replace User interface board Ex d/XP: replace controller	F	Alarm
361	I/O module 1 to n faulty	1. Restart device. 2. Check electronic modules. 3. Change I/O Module or main electronics.	F	Alarm
372	Sensor electronics (ISEM) faulty	1. Restart device. 2. Check if failure recurs. 3. Replace ISEM.	F	Alarm
373	Sensor electronic (ISEM) faulty	1. Transfer data or reset device. 2. Contact service.	F	Alarm
375	I/O – 1 to n communication failed	1. Restart device. 2. Check if failure recurs. 3. Replace module rack inclusive electronic modules.	F	Alarm
382	Data storage	1. Insert T-DAT. 2. Replace T-DAT.	F	Alarm
383	Memory content	1. Restart device. 2. Delete T-DAT from the **Reset device** parameter. 3. Replace T-DAT.	F	Alarm
387	HistoROM data faulty	Contact service organization.	F	Alarm
Diagnostic of configuration/service				
410	Data transfer	1. Check connection. 2. Retry data transfer.	F	Alarm
412	Processing download	Download active, please wait.	C	Warning
431	Trim 1 to n	Carry out trim.	C	Warning
437	Configuration incompatible	1. Restart device. 2. Contact service.	F	Alarm
438	Dataset	1. Check data set file. 2. Check device configuration. 3. Upload and download new configuration.	M	Warning
441	Current output 1 to n	1. Check process. 2. Check current output settings.	S	Warning
444	Current input 1 to n	1. Check process. 2. Check current input settings.	S	Warning
484	Failure mode simulation	Deactivate simulation.	C	Alarm
485	Measured variable simulation	Deactivate simulation	C	Warning
486	Current input 1 to n simulation	Deactivate simulation.	C	Warning
491	Current output 1 to n simulation	Deactivate simulation.	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal from factory	Diagnostic behavior from factory
494	Switch output simulation 1 to n	Deactivate simulation switch output.	C	Warning
495	Diagnostic event simulation	Deactivate simulation.	C	Warning
500	Laser current out of range	1. Check spectrum. 2. Reset peak tracking.	M, C	Warning
501	Stream Change Comp. (SCC) config. Faulty	1. Check gas composition settings. 2. Check gas composition sum.	C	Warning
520	I/O 1 to n hardware configuration invalid	1. Check I/O hardware configuration. 2. Replace wrong I/O module. 3. Plug the module of double pulse output on correct slot.	F	Alarm
594	Relay output simulation	Deactivate simulation switch output.	C	Warning
Diagnostic of process/environment				
803	Current loop @1	1. Check wiring. 2. Change I/O module.	F	Alarm
832	Electronics temperature too high	Reduce ambient temperature.	S	Warning
833	Electronics temperature too low	Increase ambient temperature.	S	Warning
900	Cell pressure range exceeded	1. Check process pressure. 2. Adapt process pressure.	S	Warning
901	Cell temperature range exceeded	1. Check ambient temperature. 2. Check process temperature.	S	Warning
902	Spectrum clipped	1. Check process. 2. Check spectrum.	C	Warning
903	Validation active	1. Switch stream from validation to process. 2. Disable validation. 3. Restart device.	C	Warning
904	Cell gas flow not detected	1. Cell gas flow not detected. 2. Check process gas flow rate. 3. Adjust flow switch.	S	Warning
905	Validation failed	1. Check validation settings. 2. Check validation gas. 3. Reset diagnostic event.	S	Warning
906	SCS enclosure temperature spike	1. Check SCS enclosure. 2. Contact service.	C	Warning
907	Cell pressure delta rescrub exceeded	1. Check process pressure. 2. Check scrubber.	F	Alarm
908	Cell temperature delta rescrub exceeded	1. Check process temperature. 2. Check scrubber.	F	Alarm
909	Scrubber depleted	1. Check scrubber efficiency indicator. 2. Replace scrubber. 3. Reset diagnostic.	M	Warning

9.7   Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

Call up the measures for resolving a diagnostic event as follows:

- Through the local display
- In the web browser

ℹ️   Other pending diagnostic events can be displayed in the **Diagnostic list** submenu.

Navigation   Diagnostics menu

Diagnostics	Actual diagnostics
	Previous diagnostics
	Operating time from restart
	Operating time
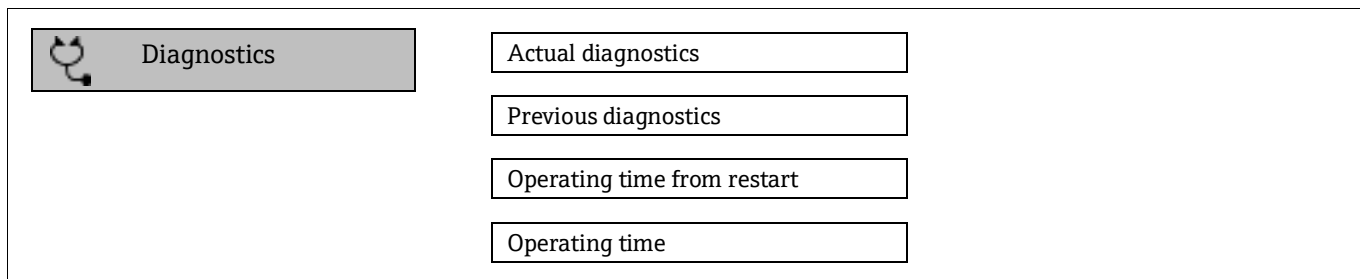
Parameter	Description	User entry	Factory setting
Actual diagnostics	A diagnostic event has occurred.	Shows the current diagnostic event along with its diagnostic information. If 2 or more messages occur simultaneously, the message with the highest priority is displayed.	Symbol for diagnostic behavior, diagnostic code, and short message.
Previous diagnostics	2 diagnostic events have already occurred.	Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code, and short message.
Operating time from restart	—	Shows the time the device has been in operation since the last device restart.	Days (d), hours (h), minutes (m), and seconds (s)
Operating time	—	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m), and seconds (s)

9.7.1   Diagnostic list

Up to 5 currently pending diagnostic events can be displayed in the **Diagnose list** submenu along with the associated diagnostic information. If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

Navigation   Diagnostics → Diagnose list

/ ../Diagnose list
Diagnostics
⊗F273 Main electronic
Diagnostics 2
Diagnostics 3
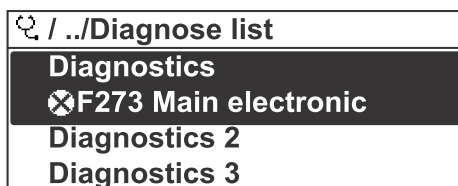
A0014006-EN

Figure 64. Diagnose list local display example

Call up the measures for resolving a diagnostic event as follows:

- Through the local display
- In the web browser

9.8   Event logbook

9.8.1   Event history

A chronological overview of the event messages that have occurred is provided in the **Eventlist** submenu.

Navigation   Diagnostics → Event logbook submenu → Event list
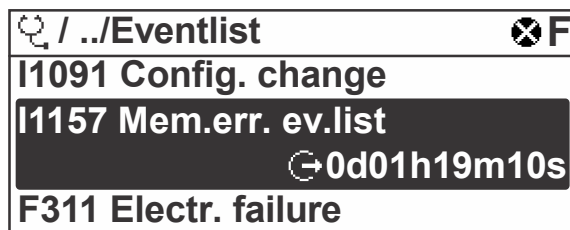
Figure 65. Eventlist local display example

With the Extended HistoROM application package, the event list contains up to 100 entries displayed in chronological order. The event history includes entries for:

- Diagnostic events
- Information events

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:

- Diagnostic event

    ⊙: Occurrence of the event

    ⊖: End of the event

- Information event

    ⊙: Occurrence of the event

Call up the measures for resolving a diagnostic event as follows:

- Through the local display
- In the web browser

9.8.2   Filtering the event logbook

Using the **Filter options** parameter, you can define which category of event message is displayed in the **Events list** submenu.

Navigation   Diagnostics → Event logbook → Filter options

Filter categories

- All
- Failure, F
- Function check, C
- Out of specification, S
- Maintenance required, M
- Information, I

9.8.3 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Options	Description	Options	Description
I1000	--------(Device ok)	I1513	Download finished
I1079	Sensor changed	I1514	Upload started
I1089	Power on	I1515	Upload finished
I1090	Configuration reset	I1618	I/O module replaced
I1091	Configuration changed	I1619	I/O module replaced
I1092	HistoROM backup deleted	I1621	I/O module replaced
I1137	Electronic changed	I1622	Calibration changed
I1151	History reset	I1625	Write protection activated
I1156	Memory error trend	I1626	Write protection deactivated
I1157	Memory error event list	I1627	Web server login successful
I1256	Display: access status changed	I1629	CDI login successful
I1278	I/O module restarted	I1631	Web server access changed
I1335	Firmware changed	I1632	Display login failed
I1361	Web server login failed	I1633	CDI login failed
I1397	Fieldbus: access status changed	I1634	Reset to factory settings
I1398	CDI: access status changed	I1635	Reset to delivery settings
I1440	Main electronic module changed	I1639	Max. switch cycles number reached
I1442	I/O module changed	I1649	Hardware write protection activated
I1444	Device verification passed	I1650	Hardware write protection deactivated
I1445	Device verification failed	I1712	New flash file received
I1459	I/O module verification failed	I1725	Sensor electronic module (ISEM) changed
I1461	Sensor verification failed	I1726	Configuration backup failed
I1462	Sensor electronic module verific.	I11201	SD card removed
I1512	Download started		

9.9 Resetting the measuring device

Using the **Device reset** parameter it is possible to reset the entire device configuration or some of the configuration to a defined state.

9.9.1 Function scope of the Device reset parameter

Options	Description
Cancel	No action is executed, and the user exits the parameter.
Restart device	At restart, every parameter with data in the volatile memory/RAM is reset to the factory setting. This includes measured value data. The device configuration remains unchanged.

9.10 Device information

The **Device information** submenu contains all parameters that display different information for device identification.

Navigation   Diagnostics menu → Device information

Device information	Device tag
	Serial number
	Firmware version
	Device name
	Order code
	Extended order code 1
	Extended order code 2
	ENP version

Parameter	Description	User entry	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers, or special characters, such as @, %, /	JT33 H2S MB
Serial number	Shows the serial number of the measuring device.	A maximum of 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format: xx.yy.zz	–
Device name	Shows the name of the controller. The name can also be found on the analyzer nameplate.	JT33 H_2S	–
Order code	Shows the device order code. The order code can be found on the analyzer nameplate in the **Order code** field.	Character string composed of letters, numbers, and certain special characters, such as /.	–

Parameter	Description	User entry	Factory setting
Extended order code 1	Shows the 1st part of the extended order code. The order code can also be found on the analyzer nameplate in the in the **Ext. ord. cd.** Field.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code. The order code can also be found on the analyzer nameplate in the in the **Ext. ord. cd.** Field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00

9.11   Signal alarms

Depending on the interface, failure information is displayed as noted in this section.

9.11.1 Modbus RS485 and Modbus TCP

Failure Mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

9.11.2 Current output 0/4 to 20mA

4 to 20 mA

Failure Mode	Choose from: ▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ▪ 4 to 20 mA in accordance with US ▪ Min. value: 3.59 mA ▪ Max. value: 22.5 mA ▪ Freely definable value: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure Mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value: 0 to 20.5 mA

9.11.3 Relay output

Failure Mode	Choose from: • Current status • Open • Closed

9.11.4 Local display

Plain text display	Provides information on cause and remedial measures.
Backlight	Red backlighting indicates a device error.

ℹ️ Status signal as per NAMUR recommendation NE 107.

9.11.5 Interface/protocol

• Through digital communication: Modbus RS485 and Modbus TCP
• Through service interface

Plain text display	Provides information on cause and remedial measures.

9.11.6 Web server

Plain text display	Provides information on cause and remedial measures.

9.11.7 Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes. The following information is displayed depending on the device version: • Supply voltage active • Data transmission active • Device alarm/error has occurred ℹ️ Diagnostic information from light emitting diodes.

9.12   Protocol-specific data

Protocol	Modbus Applications Protocol Specification V1.1
Response times	■ Direct data access: typically 25 to 50 ms ■ Auto-scan buffer data range: typically 3 to 5 ms
Device type	Server
Server address range[13]	1 to 247
Broadcast address range[13]	0
Function codes	■ 03: Read holding register ■ 04: Read input register ■ 06: Write single registers ■ 08: Diagnostics ■ 16: Write multiple registers ■ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: ■ 06: Write single registers ■ 16: Write multiple registers ■ 23: Read/write multiple registers
Supported baudrate[13]	■ 1 200 BAUD ■ 2 400 BAUD ■ 4 800 BAUD ■ 9 600 BAUD ■ 19 200 BAUD ■ 38 400 BAUD ■ 57 600 BAUD ■ 115 200 BAUD
Priority pool IP address	IP address
Inactivity timeout	0 to 99 seconds
Max connections	1 to 4

---

[13] Modbus RS485 only

Data transfer mode	▪ ASCII[13] ▪ RTU[13] ▪ TCP[14]
Data access	Each device parameter can be accessed through Modbus RS485 and Modbus TCP.

9.13   General troubleshooting

For local display

Error	Possible Causes	Solution
Local display dark and no output signals	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage. Refer to *Connecting the supply voltage and additional inputs/outputs* → 🖹.
	The polarity of the supply voltage is wrong.	Correct the polarity.
	No contact between connecting cables and terminals.	Check the cable connection and correct if necessary.
	Terminals are not plugged into the I/O electronics module correctly. Terminals are not plugged into the main electronics module correctly.	Check terminals.
	I/O electronics module is defective. Main electronics module is defective.	Order spare part.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
	The display module cable is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
	Display module is defective.	Order spare part.
Backlighting of local display is red	Diagnostic event with Alarm Diagnostic behavior has occurred.	Take remedial measures.
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	Check the cable and the connector between the main electronics module and display module. Order spare part.

---

[14] Modbus TCP only

For output signals

Error	Possible Causes	Solution
Signal output outside the valid range	Main electronics module is defective.	Order spare part.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error.	Check and correct the parameter configuration.
Device measures incorrectly.	Configuration error, or the device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the Technical Data.

For access

Error	Possible Causes	Solution
No write access to parameters	Hardware write protection enabled.	Set the write protection switch on main electronics module to the **OFF** position. Refer to *Using the write protection switch → 🖺*.
	Current user role has limited access authorization.	1. Check user role. 2. Enter correct customer-specific access code. Refer to *Resetting the access code → 🖺*.
No connection from Modbus RS485	Modbus RS485 cable incorrectly terminated.	Check terminating resistor.
	Incorrect settings for the communication interface.	Check the Modbus RS485 configuration.
No connection from Modbus TCP	Modbus TCP cable incorrectly terminated.	Check terminating resistor.
	Incorrect settings for the communication interface.	Check the Modbus TCP configuration.
Not connecting to web server	Web server disabled.	—
	Incorrect setting for the Ethernet interface of the computer.	Check the network settings with the IT manager.

Error	Possible Causes	Solution
Not connecting to web server[15]	Incorrect IP IP address is not known	1. If addressing through hardware: open the controller and check the IP address configured; last octet. 2. Check the IP address of the analyzer with the network manager. 3. If the IP address is unknown, set DIP switch no. 01 to **ON**, restart the device, and enter the factory IP address **192.168.1.212**.
	Web browser setting **Use a Proxy Server for Your LAN** is enabled.	Disable the use of the proxy server in the web browser settings of the computer. Example with Internet Explorer: 1. Under Control Panel, open **Internet options**. 2. Select the **Connections** tab and then double-click **LAN settings**. 3. In the LAN settings, disable the use of the proxy server and select **OK** to confirm.
	Apart from the active network connection to the device, other network connections are also being used.	▪ Confirm no other network connections or WLAN are established by the computer. Close other programs with network access to the computer. ▪ If using a docking station, make sure that a network connection to another network is not active.
Web browser frozen and operation no longer possible	Data transfer active.	Wait until data transfer or current action is finished.
	Connection lost.	1. Check cable connection and power supply. 2. Refresh the web browser and restart if necessary.
Content of web browser incomplete or difficult to read	Not using optimum version of web server.	1. Use the correct web browser version. 2. Clear the web browser cache and restart the web browser.
	Unsuitable view settings.	Change the font size/display ratio of the web browser.
Incomplete or no display of contents in the web browser	▪ JavaScript not enabled. ▪ JavaScript cannot be enabled.	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.

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[15] For Modbus TCP

10   Maintenance/service

Technicians are expected to be educated in the handling of hazardous sample gas and shall follow all safety protocols established by the customer that are necessary for servicing the analyzer. This may include, but is not limited to, lockout/tagout procedures, toxic gas monitoring protocols, personal protection equipment (PPE) requirements, hot work permits, and other precautions that address safety concerns related to performing service on process equipment located in hazardous areas.

Personnel shall use protective gear, such as gloves, masks, etc., while exposed to gases or vapor streams.

10.1   Cleaning and decontamination

To keep the sampling lines clean

1. Make sure that a membrane separator filter included with most systems is installed ahead of the analyzer and is operating normally.
2. If necessary, replace the membrane.
   If liquid enters the cell and accumulates on the internal optics, a **Detector reference level range exceeded** fault will result.
3. Turn off the sample valve at the tap in accordance with site lockout/tagout rules.
4. Disconnect the gas sampling line from the sample supply port of the analyzer.
5. Wash the sampling line with isopropyl alcohol or acetone and blow dry with mild pressure from a dry air or nitrogen source.
6. Once the sampling line is completely free of solvent, reconnect the gas sampling line to the sample supply port of the analyzer.
7. Check all connections for gas leaks. Using a liquid leak detector is recommended.

To clean the JT33 TDLAS gas analyzer exterior

The housing should be cleaned only with a moist cloth to avoid electrostatic discharge.

⚠ **WARNING**

▶ Never use vinyl acetate, acetone, or other organic solvents to clean the analyzer housing or labels.

10.2   Scrubber maintenance

The H_2S scrubber contains material that gradually loses its scrubbing ability with use. The lifetime of the material depends on how much analyte flows through the scrubber (gas composition) and how often (switching frequency). Thus, scrubber lifetime is application specific. The analyzer system predicts the remaining scrubber capacity by using the actual H_2S concentration measurements and dry cycle durations to calculate how much cumulative H_2S has been removed by the scrubber. Scrubber lifetimes have been simulated for typical natural gas and fuel gas applications. As shown in the figure below, under normal operating conditions a scrubber in a natural gas application with an average H_2S concentration of 4 ppmv will last for many years, whereas a scrubber in a fuel gas application with an average H_2S concentration of 100 ppmv would be expected to last approximately 190 days.
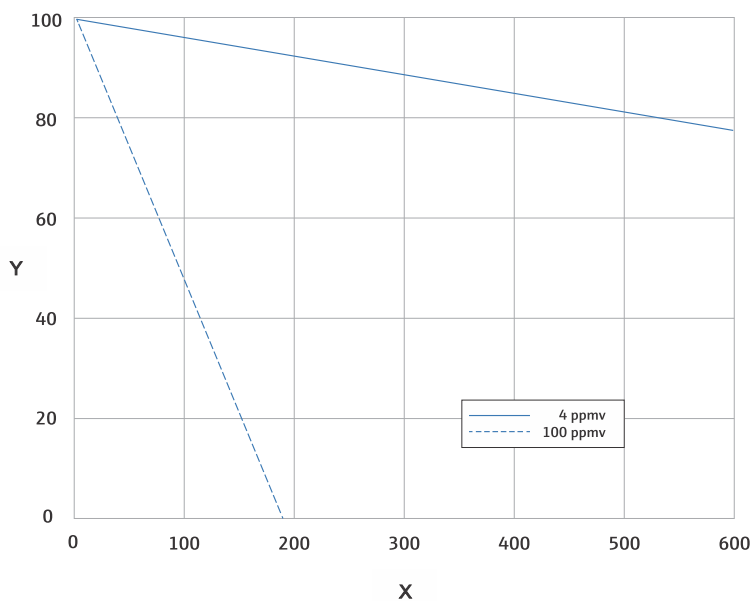
A0054962

Figure 66. Predicted scrubber lifetime based on average H₂S load

Axis	Description
X	Days
Y	Remaining capacity [%]

As an added precaution for H_2S systems, a scrubber efficiency indicator is mounted at the outlet of the scrubber as shown in the scrubber and scrubber efficiency indicator image below. The powder material in the scrubber efficiency indicator changes color from turquoise to dark grey if there is any H_2S breakthrough. Alternatively, regular validation of the system with an appropriate gas standard will indicate when the scrubber needs to be replaced.
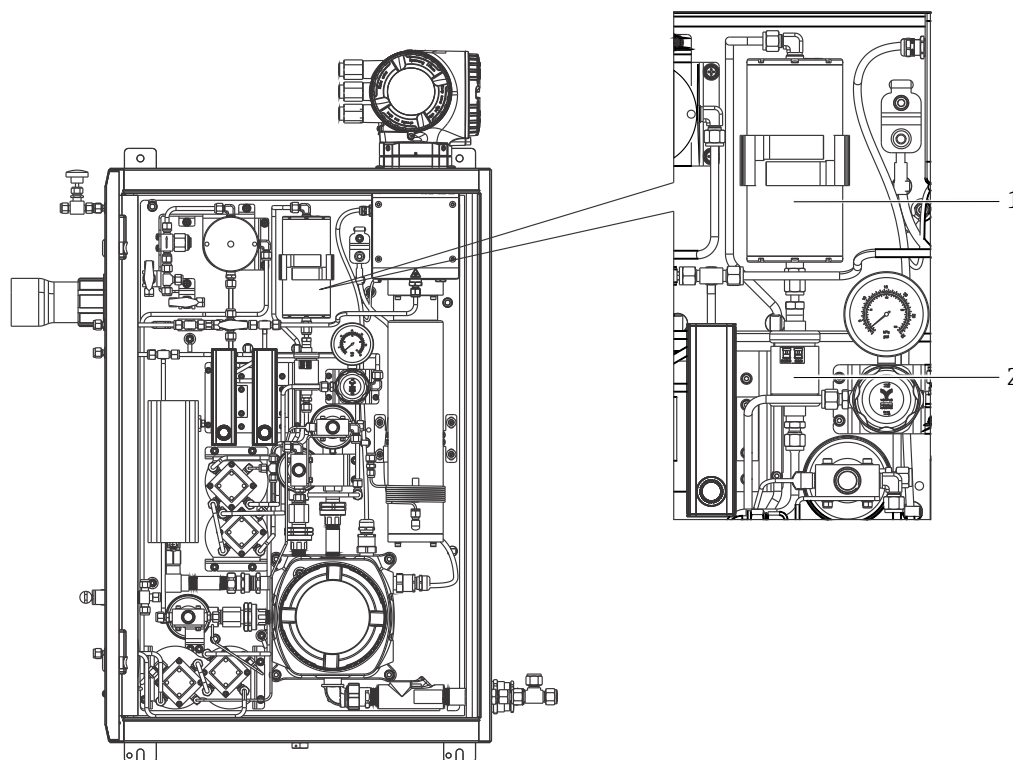
Figure 67. Scrubber and scrubber efficiency indicator

#	Description
1	Scrubber
2	Scrubber efficiency indicator

NOTICE

▶ When specifying gas standards, indicate H_2S in methane balance. For a measured range of 0 to 20 ppm, a concentration of 4 to 16 ppm is recommended.

The system will activate a scrubber diagnostic message to indicate when it is time to replace the scrubber and scrubber efficiency indicator. Once the scrubber and scrubber efficiency indicator have been replaced, reset the scrubber use monitor for the active diagnostic from the diagnostic behavior menu

If scrubber replacement is necessary, refer to *Replacing the scrubber → 🗐*. Replacement scrubbers, scrubber efficiency indicators, and other replacement parts can be ordered by the part numbers listed on www.endress.com.

10.2.1 Replacing the scrubber

To replace the sample conditioning system scrubber, please visit www.endress.com/contact or contact your local sales center.

1. Close the sample supply valve. Powering off the analyzer is optional.
2. Open the SCS enclosure door.
3. Using a wrench, loosen the fitting at the top and bottom of the scrubber.
4. Remove the retainer clip gasket and place in a safe location.
5. Remove the scrubber.
6. Secure the retainer clip gasket to the new scrubber unit.
7. Insert the new scrubber into the analyzer.
8. Connect the nuts at the top and bottom of the scrubber to finger tight.
9. Using a wrench, tighten the nuts ⅛" turn from finger tight.

10.2.2 Disposal of used scrubbers and scrubber efficiency indicators

⚠ **CAUTION**

Depleted H$_2$S scrubbers and scrubber indicators contain predominantly Copper (II) Sulfide [CAS# 1317-40-4] with some remaining Copper (II) Oxide [CAS# 1317-38-0] and basic cupric carbonate [CAS# 12069-69-1].

▶ These substances are dark, odorless powders that require few special precautions other than avoiding contact with the internal substances, keeping the scrubber tightly sealed, and protecting the contents against humidity.
▶ Discard used scrubber and scrubber indicator in an appropriate leak-proof receptacle.

10.3 Spare parts

All spare parts for the analyzer, along with their order codes, are listed in the spare parts finder tool on the Endress+Hauser website.

Spare parts finder tool: www.endress.com/product-tools

10.4 Troubleshooting/repairs

Ensure a membrane separator filter is operating normally. If liquid enters the cell and accumulates on the internal optics, a **Detector reference level range exceeded** fault will result.

Any repairs performed by the customer or on behalf of the customer must be recorded in a site dossier and kept available for inspectors.

10.4.1 Replacing the membrane separator filter

1. Close the sample supply valve.
2. Unscrew the cap from the membrane separator.
3. Determine if the membrane filter is dry or if liquid/contaminants are present. Follow the appropriate steps below.

If the membrane filter is dry:

1. Check if there are any contaminants or discoloring of the white membrane. If yes, the filter should be replaced.
2. Remove the O-ring and replace the membrane filter.
3. Replace the O-ring on top of the membrane filter.
4. Place the cap back onto the membrane separator and tighten.
5. Check upstream of the membrane for liquid contamination and clean and dry out before reopening the sample supply valve.

If liquid or contaminants are detected on the filter:

1. Drain any liquids and clean with isopropyl alcohol.
2. Clean any liquids or contaminants from the base of the membrane separator.
3. Replace the filter and the O-ring.
4. Place the cap onto the membrane separator and tighten.
5. Check upstream of the membrane for liquid contamination and clean and dry out before reopening the sample supply valve.

10.4.2   Replacing the 7 micron filter

Tools and hardware

- 1" open-ended wrench
- 1" crow's foot wrench
- Torque wrench capable of 73.4 N-m (650-in lb)

> ⚠️ **WARNING**
>
> ▶ Residual hazardous media may be left in the filter.

1. Close the sample supply valve.
2. If suspected hazardous elements are present, conduct a sample system purge. Refer to *Enclosure purge* → 🖺.
3. Stabilize the body with a wrench and loosen the bonnet.

A0054810
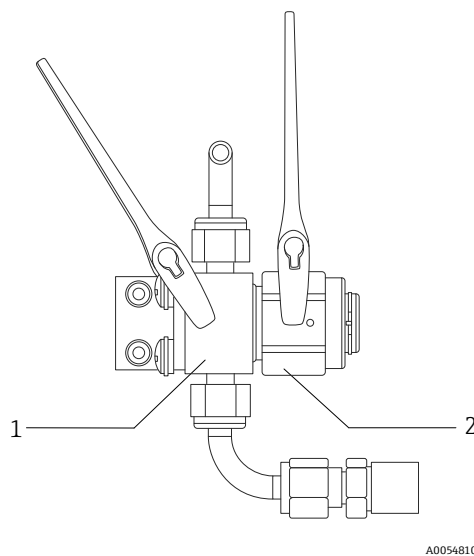
Figure 68. Loosen filter parts

#	Description
1	Filter body
2	Filter bonnet

4. Remove the bonnet, gasket, and filter element as shown in the figure below.
   - ▶ If replacing the gasket, discard the old gasket.
   - ▶ If replacing the filter element, discard the old filter.
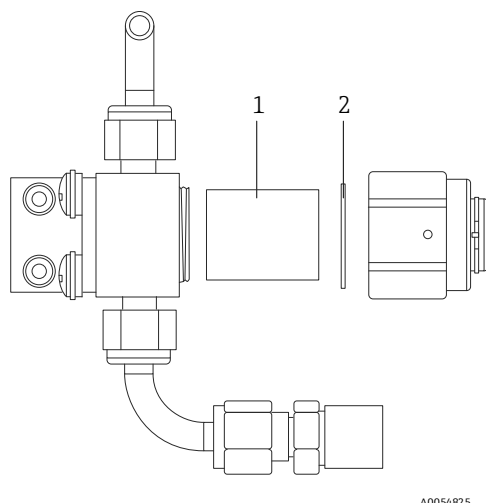
Figure 69. Remove filter and gasket

#	Description
1	Filter element
2	Gasket

5. If replacing the old filter element, clean the filter with isopropyl alcohol.
6. Press the open end of the filter element into the body.
7. Center the gasket on the bonnet seal surface.
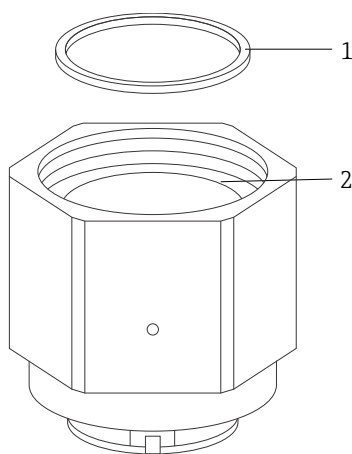
Figure 70. Centering gasket on bonnet seal surface

#	Description
1	Gasket
2	Bonnet seal surface

8. Thread the bonnet onto the body until the body threads are no longer visible.

> ℹ️ If the bonnet does not fully thread onto the body, the gasket is not centered on the bonnet seal surface.

9. Stabilize the body with a wrench and tighten the bonnet to 62.2 Nm (550 in-lb).
10. Test for proper operation.

10.4.3   MAC maintenance

The Measurement Accessory Controller (MAC) certified equipment is an accessory controller for various elements that are used in a sample conditioning system that support Endress+Hauser gas analyzers.

> **NOTICE**
>
> ▶ All MAC service should be performed by a certified user.
> ▶ Category 3: Elements allowed to be replaced in the field by the manufacturer:
>   - MAC printed circuit board assembly (PCBA)
>   - Power supply
>   - Thermal cutoff
> ▶ Category 1: Elements allowed to be replaced in the field by the customer:
>   - Electrical fuses
>   - O-ring
>   - Fuses
>   - Terminal block, plug

Tools and materials

- New fuses
  - F4 or F5
  - Thermal fuses rated up to 77 ℃
- 2.5 mm hex for TDK power supply removal
- 2 mm hex for Cincon power supply removal
- 5 mm flathead for fuse removal
- 2.5 mm flathead for power and SCS heater hookups
- #2 Phillips screwdriver for power support cage removal
- 20 x 20 x 165 mm bar for MAC cover removal
- 2 x 41 mm crescent wrench for servicing solenoids
- Ferrule crimping tool (p/n SQ28-10 or TRAP24-10)
- Syntheso Glep 1, grease
- Hardware that came with new power supply order

Remove the MAC stackup

Remove the MAC stackup to replace the thermal fuses, MAC PCBA, PCBA cover, or power supply.

1. Disconnect all internal harnesses from the MAC PCBA, including the protective ground wire linking J12-3 to the enclosure.
2. Pull the harnesses out of the enclosure through the main cavity the cover threads onto.
3. Tape the harnesses along the rim/threaded section of the enclosure.
4. Use a #2 Phillips screwdriver to remove the four #10-32 captive panel screws shown in the figure below.
5. Remove the stackup vertically out of the enclosure.
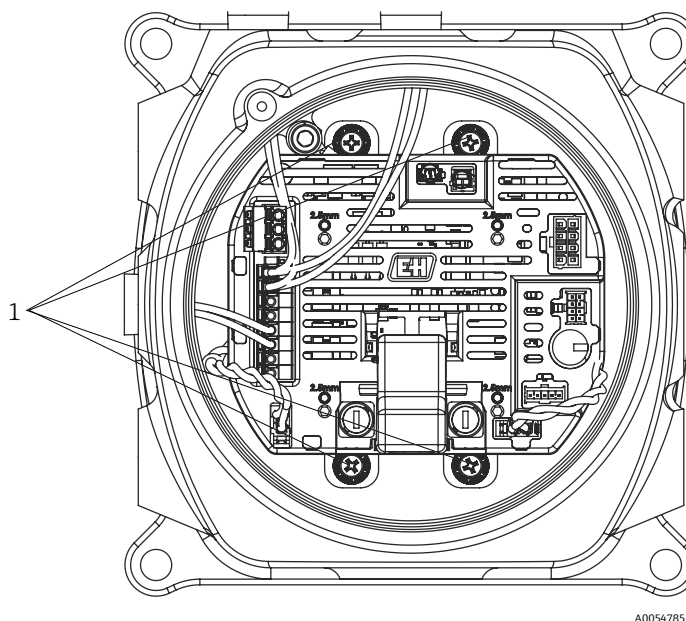
Figure 71. Captive panel screw locations (1)

⚠ **WARNING**

Fuses are voltage dependent. Be aware of the appropriate amperage.

The MAC PCBA has 2 fuses. F4 ensures the MAC is not damaged and the F5 ensures the heater is not damaged. Be aware of fuse locations prior to servicing.

- All fuses should be approved according to IEC 60127-2/1 and CSA22.2 No. 248.14.
- If servicing an AC 100 or 120 V system, the heater fuse (F5) is 2.5A and the MAC fuse (F4) is 1.25A.
- If servicing an AC 230 or 240 V system, the heater fuse (F5) is 1.25A and the MAC fuse (F4) is 1.25A.
- If servicing a 24 V system, the MAC fuse (F4) is 4A and no fuse is inserted in the heater slot.
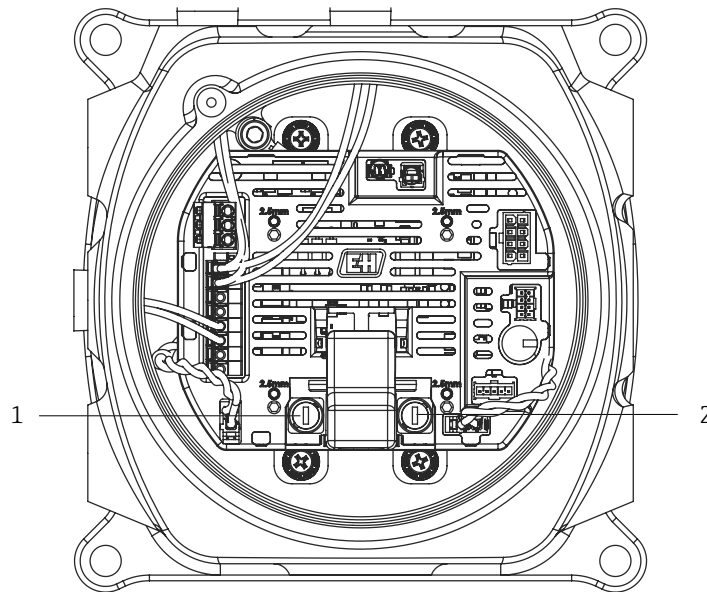
A0054785

Figure 72. MAC PCBA fuse locations

#	Description
1	SCS heater holder
2	MAC fuse holder

Replace the F4 or F5 fuses

1. Using the 5 mm flathead screwdriver, rotate the fuse holder cap counterclockwise.
2. Lift off the cap from the MAC PCBA.
3. Insert the new fuse into the cap.
4. Install the cap into the fuse holder by rotating clockwise until the cap is properly seated in the holder.

Replace the thermal fuses

1. Remove the MAC stackup. See *Remove the MAC stackup → 🗎*.

> ⚠ **WARNING**
>
> ▶ Do not remove the MAC cover from the enclosure unless the area is known to be free from explosive gas in the atmosphere.

2. Remove the cover to replace the thermal fuses.
   The fuses are not polarity dependent and, therefore, can be installed in any orientation. The SCS heater cutoff fuse is in the lower left side of the PCBA and the cell heater cutoff is in the right side of the board. See the figure below.
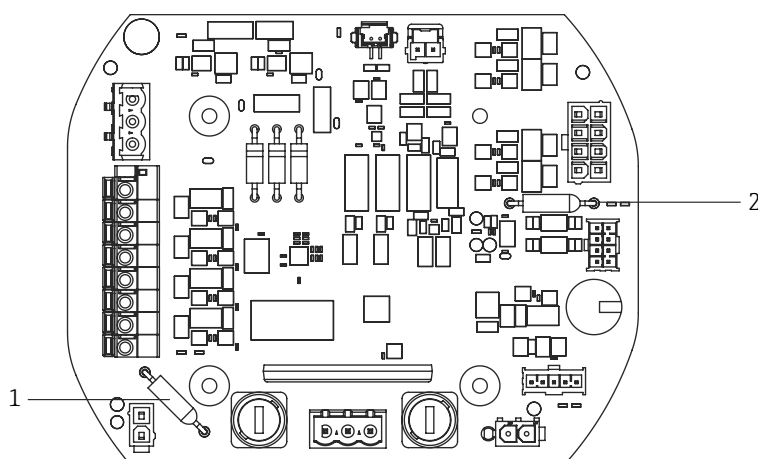
A0054787

Figure 73. Thermal fuse cutoff locations

#	Description
1	SCS heater thermal cutoff
2	Cell heater thermal cutoff

3. Remove the fuses from their pin sockets mounted on the PCBA.
4. Insert the replacement fuses. No soldering is needed.

Replace the MAC PCBA

1. Remove the MAC stackup. See *Remove the MAC stackup → 🗎*.
2. Remove the cover and the four M3 x 0.5 socket head cap screws that mount the PCBA to the stackup.
3. Install the new MAC PCBA using the same head cap screws.
4. The M3 x 0.5 head cap screws should be torqued down to 2.0 N-m (17.7 lb-in).
5. Replace the MAC cover.
6. Install the harnesses back to their proper locations.

Replace the power supply

1. Remove the MAC stackup. See *Remove the MAC stackup* → 🗎.
2. Loosen the 4 socket head cap screws.

   - For the TDK variant, use a 2.5 mm hex to remove the M3 x 0.5 screws.
   - For the Cincon variant, use a 2 mm hex to remove the M2.5 x 0.5 screws.

3. Remove the hardware from the power support cage under the MAC.
4. Remove the power supply.
5. Install the replacement power supply into the assembly in the same orientation it was removed. Use the new hardware that came with the replacement order. Refer to the figure below.

   - To replace the TDK power supply, orient the 2-pin connector toward the "AC IN" on the power support cage.
   - To replace the Cincon power supply, install the 3-pin connector facing the "AC IN."
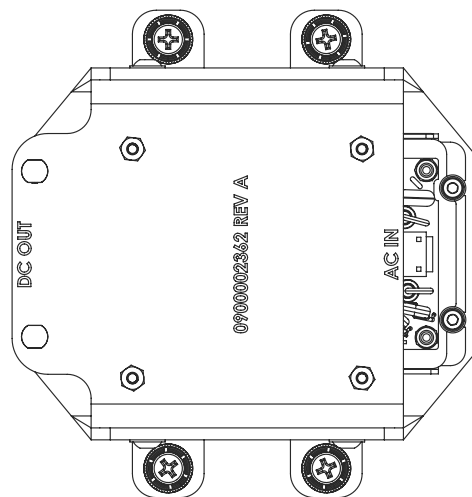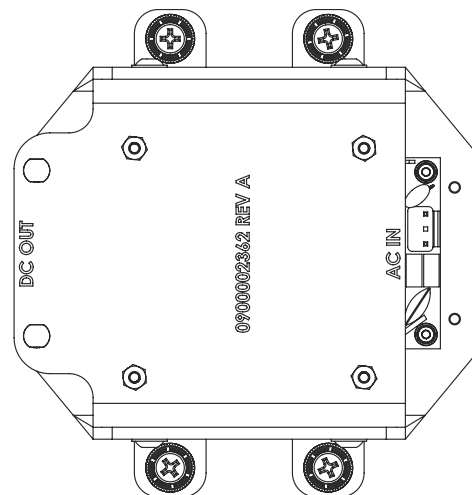
Figure 74. Power supply installation orientation: TDK (top) and Cincon (bottom)

Remove the Ex d cover

1. Use a 2.5 mm hex to rotate the locking screw clockwise to relax the force applied on the bottom of the cover.
2. After the locking screw is backed off, remove the cover by rotating counterclockwise by hand.
   Alternatively, use a 20 x 20 x 165 mm square bar (not issued by Endress+Hauser) to help remove the cover. Refer to the figure below.

> **NOTICE**
>
> ▶ Anything longer than the square bar listed may collide with SCS components.
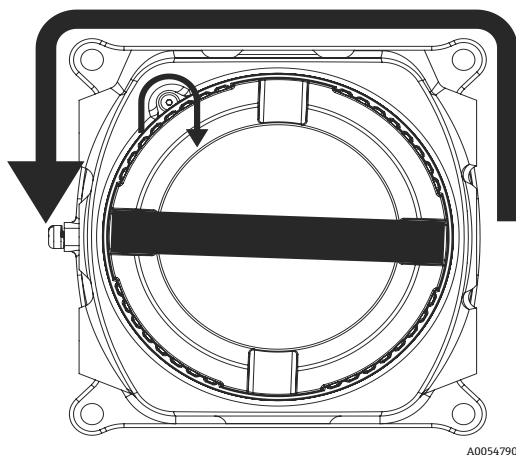
Figure 75. Removing the MAC cover

3. After removing the cover or glands from an entry point on the MAC enclosure, inspect all threads for galling or deformation.
   If threads are damaged, send the replacement enclosure or glands for service to ensure hazardous requirements are met. This cannot be repaired in the field.
4. Clean the threads and O-ring and apply a light coating of Synetheso Glep 1.
5. Install the cover back onto the enclosure.

Servicing the solenoids

- When servicing the 2 solenoids that control the differential stream switching logic, cut off the ferrules that are installed into the MAC to remove the assembly.
- When installing back into the enclosure, reinstall the two 2 x 22 AWG insulated nylon ferrules on both solenoids using the appropriate crimping tool.
- When servicing the validation solenoid, the ferrules usually do not need to be replaced.
- If an issue arises with the barrier gland, the ferrules may need to be replaced using the appropriate crimping tool.
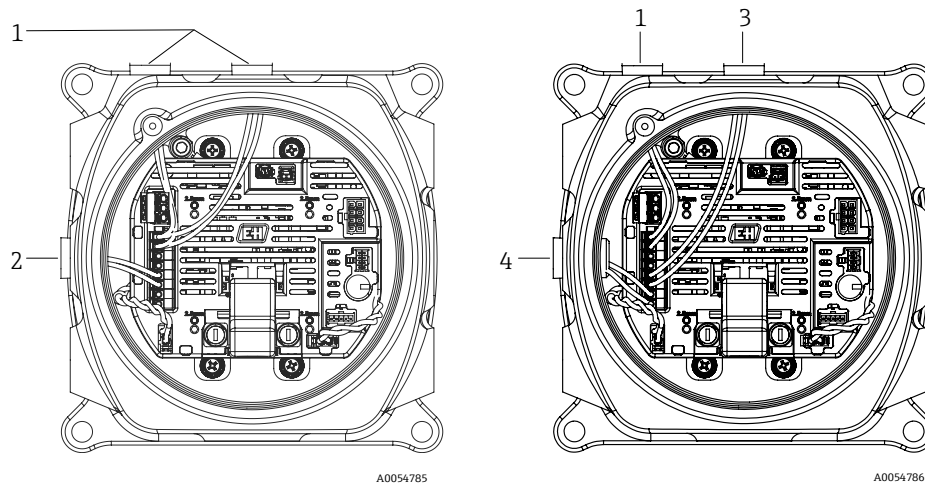
Figure 76. Solenoid wiring: electrical (left) and pneumatic (right) configurations

#	Description
1	Differential solenoid
2	Validation solenoid
3	Validation 1 solenoid
4	Validation 2 solenoid

10.4.4   Cleaning the cell tube

Endress+Hauser does not recommend changing the cell tube. If the cell tube is contaminated, it can be cleaned.

Tools and materials

- Lint-free cloth
- Reagent-grade isopropyl alcohol, such as Cole-Parmer® EW-88361-80 or equivalent, or acetone
- Permanent ink marker
- Acetone-impenetrable gloves, such as North NOR CE412W Nitrile Chemsoft™ CE Cleanroom Gloves or equivalent
- 4 mm hex driver

To clean the cell tube

1. Power down the analyzer.
2. Isolate the SCS from the process sample flow.
3. If possible, purge the system with nitrogen for 10 minutes.
4. Mark the orientation of the cell tube on the transition plate with a permanent ink marker.

> **NOTICE**
> ▶ The cell tube is very heavy. Use caution when removing it from the transition plate and panel.

5. Remove the 4 screws connecting the cell tube to the transition plate.
6. Remove the screws connecting the bracket to the panel. Leave the bracket attached to the cell tube.
7. Put on clean acetone-impenetrable gloves.
8. Using a lint-free cloth, clean the tube with isopropyl alcohol or acetone.

> **NOTICE**
> ▶ Ensure the cell tube is properly aligned with the transition plate before reattaching so the top mirror is not damaged.

9. Replace the cell tube in the same orientation as previously marked.

10.4.5   Cleaning the cell assembly mirror

If contamination makes its way into the cell and accumulates on the internal optics, a **Detector reference level range exceeded** fault will result.

When determining whether to perform this task, carefully review the notices and warnings below.

> **NOTICE**
> ▶ Do NOT clean the top mirror. If the top mirror is visibly contaminated or scratched in the clean area (see mirror figure below), refer to *Service contact* → 🖺.
> ▶ Cell assembly mirror cleaning should only be performed when there is a small amount of contamination. Otherwise, refer to *Service contact* → 🖺.
> ▶ Careful marking of the mirror orientation is critical to restoring system performance upon reassembly after cleaning.
> ▶ Always handle the optical assembly by the edge of the mount. Never touch coated surfaces of the mirror.
> ▶ Pressurized gas duster products are not recommended for cleaning components. The propellant may deposit liquid droplets onto the optic surface.
> ▶ Never rub an optical surface, especially with dry tissues, as this can mar or scratch the coated surface.
> ▶ This procedure should be used ONLY when necessary and is not part of routine maintenance.

⚠ **WARNING**

INVISIBLE LASER RADIATION: The sample cell assembly contains a low-power, 35 mW maximum, CW Class 3B invisible laser with a wavelength between 750 to 3000 nm.

▶ Never open the sample cell flanges or the optical assembly unless the power is turned off.

⚠ **WARNING**

Process samples may contain hazardous material in potentially flammable and toxic concentrations.

▶ Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the sample contents before operating the SCS.
▶ All valves, regulators, and switches should be operated in accordance with site lockout/tagout procedures.

The procedure for cleaning the cell assembly mirror is broken into 3 parts:

- Purging the SCS and removing the mirror assembly
- Cleaning the cell assembly mirror
- Replacing the mirror assembly and components

Tools and materials

- Lens cleaning cloth, such as Cole-Parmer® EW-33677-00 TEXWIPE® Alphawipe® Low-Particulate Clean Room Wipes or equivalent
- Reagent-grade isopropyl alcohol, such as Cole-Parmer® EW-88361-80 or equivalent
- Small drop dispenser bottle, such as Nalgene® 2414 FEP Drop Dispenser Bottle or equivalent
- Acetone-impenetrable gloves, such as North NOR CE412W Nitrile Chemsoft™ CE Cleanroom Gloves or equivalent
- Hemostats, such as Fisherbrand™ 13-812-24 Rochester-Pean Serrated Forceps or equivalent
- Bulb blower or dry compressed air/nitrogen
- Torque wrench
- Permanent ink marker
- Non-outgassing grease
- Flashlight

To purge the SCS and remove the mirror assembly

1. Power down the analyzer.
2. Isolate the SCS from the process sample flow.
3. If possible, purge the system with nitrogen for 10 minutes.
4. Carefully mark the orientation of the mirror assembly with a permanent ink marker on the cell body.
5. Gently remove the mirror assembly from the cell by removing the 4 socket head cap screws and set the mirror assembly on a clean, stable, flat surface.

To clean the cell assembly mirror

1. Using a bulb blower or dry compressed air/nitrogen, remove dust and other large particles of debris.
2. Put on clean acetone-impenetrable gloves.
3. Double fold a clean sheet of lens cleaning cloth. Using hemostats or your fingers, clamp near and along the fold to form a "brush."
4. Place a few drops of isopropyl alcohol onto the mirror and rotate the mirror to spread the liquid evenly across the mirror surface.
5. With gentle, uniform pressure, wipe the mirror from one edge to the other with the cleaning cloth only once and only in one direction to remove the contamination. Discard the cloth.
6. Repeat with a clean sheet of lens cleaning cloth to remove the streak left by the first wipe.
7. Repeat step 6, if necessary, until there is no visible contamination in the required clean area of the mirror. In the figure below, the shaded ring shows the area of the mirror that must be clean and free of scratches.
   If the mirror is not clean and free of scratches in the required area, replace the mirror assembly.
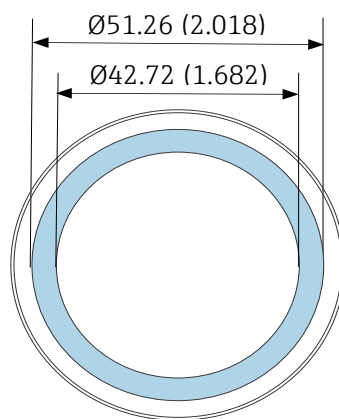
Figure 77. Required clean area on mirror. Dimensions: mm (in)

To replace the mirror assembly and components

1. Carefully replace the mirror assembly onto the cell in the same orientation as previously marked.
2. Add a very thin layer of non-outgassing grease to the O-ring.
3. Replace the O-ring and ensure it is properly seated.
4. Tighten the socket head cap screws evenly with a torque wrench to 30 in-lb.
5. Restart the system.

10.4.6 Enclosure purge

ℹ️ The optional enclosure purge is performed when the sample gas contains high concentrations of H_2S.

When maintenance of the JT33 TDLAS gas analyzer is required, follow 1 of the 2 methods for purging the enclosure described below prior to opening the enclosure door.

Purging the enclosure with a gas sensor

⚠️ **WARNING**

▸ Ensure an appropriate sensor is used based on the toxic components in the process gas stream.

1. Allow the sample gas to continue flowing through the system.
2. Open the tee-fitting cap on the exhaust port on the lower right side of the enclosure and insert a sensor to determine if there is H_2S inside the enclosure.
3. If no hazardous gas is detected, proceed with opening the enclosure door.
4. If hazardous gas is detected, follow the instructions below for purging the enclosure.

Purging the enclosure when no gas sensor is available

1. Turn off the sample gas to the system.
2. Connect the purge gas to the purge inlet on the upper right side of the enclosure.
3. Open the exhaust on the bottom right side of the enclosure and connect a piece of tubing that vents to safe area.
4. Input the purge gas at 10 liters per minute (0.35 scfm).
5. Operate the purge for 20 minutes.

Purging the sample system, optional

1. Shut off gas to the analyzer.
2. Ensure the vent and bypass, if present, are open.
3. Connect the purge gas to 'sample purge in' port.
4. Switch the gas select valve from 'sample in' to 'purge in.'
5. Set the flow rate to 3 liters per minute and run the purge for at least 10 minutes for safety.

Repair verification

When repairs have been completed correctly, alarms will clear from the system.

10.5   Intermittent operation

If the analyzer is to be stored or shut down for a short period, follow the instructions for isolating the cell tube and SCS.

1. Purge the system.
   a. Shut off the process gas flow.
   b. Allow all residual gas to dissipate from the lines.
   c. Connect a nitrogen (N_2) purge supply, regulated to the specified sample supply pressure, to the sample supply port.
   d. Confirm that any valves controlling the sample flow effluent to the low-pressure flare or atmospheric vent are open.
   e. Turn on the purge supply to purge the system and clear any residual process gases.
   f. Turn off the purge supply.
   g. Allow all residual gas to dissipate from the lines.
   h. Close any valves controlling the sample flow effluent to the low-pressure flare or atmospheric vent.

2. Disconnect electrical connections to the system.
   a. Disconnect power to the system.

   > ⚠ **CAUTION**
   >
   > ▶ **Confirm the power source is disconnected at the switch or circuit breaker. Make sure the switch or breaker is in the OFF position and locked with a padlock.**

   b. Confirm all digital/analog signals are turned off at the location from which they are being monitored.
   c. Disconnect the phase and neutral wires from the analyzer.
   d. Disconnect the protective ground wire from the analyzer system.

3. Disconnect all tubing and signal connections.
4. Cap all inlets and outlets to prevent foreign material such as dust or water from entering the system.
5. Ensure the analyzer is free from dust, oils, or any foreign material. Follow the instructions found in *Cleaning and decontamination → 🖺*.
6. Pack the equipment in the original shipping packaging, if available. If the original packaging material is no longer available, the equipment should be adequately secured to prevent excessive shock or vibration.
7. If returning the analyzer to the factory, complete the Decontamination Form provided by Endress+Hauser and attach to the outside of the shipping package as instructed before shipping.

10.6   Packing, shipping, and storage

The JT33 TDLAS gas analyzer Systems and auxiliary equipment are shipped from the factory in appropriate packaging. Depending on the size and weight, the packaging may consist of a cardboard-skinned container or a wooden palletized crate. All inlets and vents are capped and protected when packaged for shipment. The system should be packed in the original packaging when shipped or stored for any length of time.

If the analyzer has been installed or operated—even for purposes of a demonstration—the system should be decontaminated and purged with an inert gas before powering down the analyzer.

⚠ **WARNING**

Process samples may contain hazardous material in potentially flammable and/or toxic concentrations.

▶ Personnel should have a thorough knowledge and understanding of the physical properties of the sample and prescribed safety precautions before installing, operating, or maintaining the analyzer.

Preparing the analyzer for shipment or storage

1. Shut off the process gas flow.
2. Allow all residual gas to dissipate from the lines.
3. Conduct an optional enclosure purge, if provided with the system.
4. Connect a purge supply (N_2) regulated to the specified sample supply pressure to the sample supply port.
5. Confirm that any valves controlling the sample flow effluent to the low-pressure flare or atmospheric vent are open.
6. Turn on the purge supply and purge the system to clear any residual process gases.
7. Turn off the purge supply.
8. Allow all residual gas to dissipate from the lines.
9. Close any valves controlling the sample flow effluent to the low-pressure flare or atmospheric vent.
10. Disconnect power to the system.
11. Disconnect all tubing and signal connections.
12. Cap all inlets, outlets, vents, or gland openings to prevent foreign material such as dust or water from entering the system. Use the original fittings supplied as part of the packaging from the factory.
13. Pack the equipment in the original packaging in which it was shipped, if available. If the original packaging material is no longer available, the equipment should be adequately secured to prevent excessive shock or vibration.
14. If returning the analyzer to the factory, complete the Decontamination Form provided by Endress+Hauser and attach to the outside of the shipping package as instructed before shipping. Refer to *Service contact* → 🖺.

Storage

The packaged analyzer should be stored in a sheltered environment that is temperature controlled between −40 to 60 ℃ (−40 to 140 ℉), and should not be exposed to rain, snow, caustic, or corrosive environments.

10.7   Service contact

For service, refer to our website (www.endress.com/contact) for the list of local sales channels in your area.

10.8   Before contacting service

Before contacting service, prepare the following information to send with your inquiry:

- Analyzer serial number (SN)
- Contact information
- Description of the problem or questions

Access to the information above will expedite the response to technical requests.

10.9   Factory return

If returning the analyzer or components is required, obtain a **Service Repair Order (SRO) number** from service before returning to the factory. Service can determine whether the analyzer can be serviced on site or should be returned to the factory. All returns should be shipped to:

Endress+Hauser
11027 Arrow Route
Rancho Cucamonga, CA 91730
United States

10.10 Disclaimers

Endress+Hauser accepts no responsibility for consequential damages arising from the use of this equipment. Liability is limited to replacement and/or repair of defective components.

This manual contains information protected by copyright. No part of this guide may be photocopied or reproduced in any form without prior written consent from Endress+Hauser.

10.11 Warranty

For a period of 18 months from date of shipment or 12 months in operation, whichever comes first, Endress+Hauser warrants that all products sold by it shall be free from defects in material and workmanship under normal use and service when correctly installed and maintained. Endress+Hauser's sole liability and Customer's sole and exclusive remedy for a breach of warranty is limited to Endress+Hauser' repair or replacement at Endress+Hauser's sole option of the product or part thereof which is returned at Customer's expense to Endress+Hauser's plant. This warranty shall apply only if Customer notifies Endress+Hauser in writing of the defective product promptly after the discovery of the defect and within the warranty period. Products may only be returned by Customer when accompanied by a return authorization reference number (SRO) issued by Endress+Hauser. Freight expenses for products returned by Customer will be prepaid by Customer. Endress+Hauser shall pay for shipment back to Customer for products repaired under warranty. For products returned for repair that are not covered under warranty, Endress+Hauser's standard repair charges shall be applicable in addition to all shipping expenses.

11   Technical data

Technical specifications are provided in the following tables that outline recommended equipment settings, ratings, and physical specifications.

11.1   Electrical and communications

Electrical and communications: input voltages	
JT33 TDLAS spectrometer	AC 100 to 240 V tolerance ±10 %, 50/60 Hz, 10W[16] DC 24 V tolerance ±20 %, 10W U_M = AC 250 V
MAC	AC 100 to 240 V ±10 %, 50/60 Hz, 275W[16] U_M = AC 250 V

Electrical and communications: output type	
JT33 TDLAS spectrometer	
Modbus RS485 or Modbus TCP over Ethernet (I/O1)	U_N = DC 30 V U_M = AC 250 V N = nominal M = maximum
Relay output (I/O2 and/or I/O3)	U_N = DC 30 V U_M = AC 250 V I_N = DC 100 mA/AC 500 mA
Configurable input/output (I/O) Current 4-20 mA I/O passive/active (I/O2 and/or I/O3)	U_N = DC 30 V U_M = AC 250 V
Intrinsically safe (IS) output flow switch	Uo = Voc = ±5.88 V Io = Isc = 4.53 mA Po = 6.66 mW Co = Ca = 43 µF Lo = La = 1.74 H

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[16] Transient over-voltages according to Over Voltage Category II.

Electrical and communications: output type	
SCS	
Intrinsically safe output RS485 to optical head electronics (Manufacturer connection)	ATEX/IECEx/UKEX: J7 connector, Pin 1/Pin 2 w.r.t. enclosure earth North America Zone/Division: J7 connector, Pin 1/Pin 2 w.r.t. enclosure ground/earth $U_i = U_i/V_{max} = \pm5.88$ V $I_i = I_i/I_{max} = -22.2$ mA, resistively limited by a minimum resistance $R_{min} = 265\ \Omega$ $C_i = 0$ $L_i = 0$ $U_o = U_o/V_{oc} = 5.36$ V $I_o = I_o/I_{sc} = 39.7$ mA (resistively limited) $P_o = 52.9$ mW
	Pin 1 w.r.t Pin 2 $U_i = U_i/V_{max} = \pm11.76$ V $C_i = 0$ $L_i = 0$ $U_o = U_o/V_{oc} = \pm5.36$ V $I_o = I_o/I_{sc} = \pm10$ mA (resistively limited) $P_o = 13.3$ mW
Intrinsically safe output sample conditioning system (SCS) thermistor	J5 connector $U_i/V_{max} = 0$ $U_o = V_{oc} = +5.88$ V, -1.0 V $I_o = I_o/I_{sc} = 1.18$ mA (resistively limited) $P_o = 1.78$ mW $C_i = 0$ $L_i = 0$
SCS heater output	$U_N = $ AC 100 to 240 V ±10 % $U_M = $ AC 250 V $I_N = $ AC 758 to 2000 mA
Output rating for solenoid valves	$U_N = $ DC 24 V $U_M = $ AC 250 V $I_N = $ 1A contact rating $P_{sov} = \leq 42$W

11.2 Application data

Item	Specification
Environmental temperature range: JT33 TDLAS gas analyzer system [17]	Storage: −40 to 60 ℃ (−40 to 140 ℉) Ambient (T_A): −20 to 50 ℃ (−4 to 122 ℉) Ambient (T_A): −20 to 60 ℃ (−4 to 140 ℉)[18]
Environmental temperature range: MAC[17]	Storage: −40 to 60 ℃ (−40 to 140 ℉) Operation: −20 to 70 ℃ (−4 to 158 ℉)
Environmental relative humidity	80 % at temperatures up to 31 ℃ (88 ℉), decreasing linearly to 50 % at 40 ℃ (104 ℉)
Environment, pollution degree: JT33 TDLAS spectrometer	Rated Type 4X and IP66 for outdoor use and considered pollution degree 2 internally
Environment, pollution degree: MAC	Rated Type 4X and IP66 for indoor/outdoor use and considered pollution degree 2 internally
Altitude	Up to 2000 m
Measurement ranges (H_2S)	0 to 10 ppmv 0 to 500 ppmv Other ranges available upon request
Sample inlet pressure (SCS)	207 to 310 kPaG (30 to 45 psig)
Validation inlet pressure	207 to 310 kPaG (30 to 45 psig)
Sample cell operating pressure range	Application dependent 800 to 1200 mbara (standard) 800 to 1700 mbara (optional)
Sample cell tested pressure range	−25 to 517 kPaG (−7.25 to 75 psig)
Factory relief valve set point	Approximately 345 kPaG (50 psig)
Operational temperature	−20 to 50 ℃ (−4 to 122 ℉) −10 to 60 ℃ (14 to 140 ℉)[18]
Sample process temperature (T_P)	−20 to 50 ℃ (−4 to 122 ℉) −20 to 60 ℃ (−4 to 140 ℉)[18]
Sample flow rate	2.5 to 3 slpm (5.30 to 6.36 scfh)
Bypass flow rate	0.5 to 2.0 slpm (1 to 4.24 scfh)
Process seal	Dual seal without annunciation
Primary process seal[19] 1	SCHOTT NG11 glass Sealant: Master Bond EP41S-5

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[17] Both the electronics and MAC power have to be on to ensure the cell is maintained at the target temperature.

[18] Approval pending

[19] See *JT33 analyzer seals* → 🖺.

Item	Specification
Primary process seal[19] 2	Primary process seal 2 Material: alumina ceramic
Secondary process seal[19]	ISEM interface module assembly

11.3 Physical specifications

Item	JT33 TDLAS gas analyzer system
Weight	89.9 kg (196 lb) to 102.5 kg (226 lb), depending on configuration
Dimensions (H x D x W)	914 x 305 x 610 mm (36 x 12 x 24 in)

11.4 Area classification

Item	Description
JT33 TDLAS gas analyzer system	<u>cCSAus</u>: Ex db ia [ia Ga] op is IIC T3 Gb Class I, Zone 1, AEx db ia [ia Ga] op is IIC T3 Gb [Ex ia] Class I, Division 1, Groups B, C, D, T3 Tambient = −20 ℃ to 60 ℃ <u>ATEX/IECEx/UKEX</u>: ⟨Ex⟩ II 2(1)G Ex db ia [ia Ga] ib op is h IIC T3 Gb Tambient = −20 ℃ to 60 ℃
MAC	<u>cCSAus</u>: Ex db ia [ia Ga] IIC T4 Gb Class I, Zone 1, AEx db [ia Ga] IIC T4 Gb [Ex ia] Class I, Division 1, Groups A, B, C, D, T4 Tambient = −20 ℃ to 70 ℃ <u>ATEX/IECEx/UKEX</u>: ⟨Ex⟩ II 2(1)G Ex db [ia Ga] IIC T4 Gb Tambient = −20 ℃ to 70 ℃
Ingress protection	Type 4X, IP66

11.5 Supported operating tools

Supported Operating Tool	Operating Unit	Interface
Web browser	Notebook, PC, or tablet with web browser	CDI-RJ45 service interface

11.6   Web server

Thanks to the integrated web server, the device can be operated and configured from a web browser and through a service interface (CDI-RJ45). The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is also displayed and allows the user to monitor the status of the device. Furthermore, the measuring device data can be managed and the network parameters can be configured.

Data exchange between the operating unit, such as a notebook, and the measuring device supports the following functions:

- Uploading the configuration from the measuring device: XML format, configuration backup
- Save the configuration to the measuring device: XML format, restore configuration
- Export event list as a CSV file
- Export parameter settings as a CSV file: Create documentation of the measuring point configuration
- Export the Heartbeat Verification log as a PDF file: Only available with the Heartbeat Verification application package
- Flash firmware version for device firmware upgrade, for example

11.7   HistoROM data management

The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure, and efficient.

> **NOTICE**
> ▶ When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, such as after commissioning.

Additional information on the data storage concept

There are different types of data storage units in which device data are stored and used by the device, as shown in the table below.

Item	Device memory	T-DAT	S-DAT
Available data	▪ Event history, such as diagnostic events ▪ Parameter data record backup ▪ Device firmware package	▪ Measured value memory ▪ Current parameter data record used by firmware at run time ▪ Maximum indicators (min/max values)	▪ Sensor data ▪ Serial number ▪ User-specific access code to use the Maintenance user role ▪ Calibration data ▪ Device configuration, such as SW options, fixed I/O, or multi I/O
Storage location	Fixed on the user interface board in the connection compartment	Can be plugged into the user interface board in the connection compartment	Fixed in the optical head enclosure

11.8   Data backup

11.8.1   Automatic

▪ The most important device data (sensor and controller) are automatically saved in the DAT modules.
▪ If the controller or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors.
▪ If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors.

11.8.2   Manual

Additional parameter data record with complete parameter settings in the integrated device memory for:

▪ Data backup function
▪ Backup and subsequent restoration of a device configuration in the device memory
▪ Data comparison function
▪ Comparison of the current device configuration with the device configuration saved in the device memory

11.9   Manual data transfer

Using the export function from the web server, you can transfer a device configuration to another device to duplicate the configuration or to store in an archive, such as for backup purposes.

11.10 Automatic event list

Extended HistoROM application package gives chronological display of up to 100 event messages in the events list along with a time stamp, plain text description, and remedial measures. The events list can be exported and displayed through a variety of interfaces and operating tools, such as the web server.

11.11 Manual data logging

Extended HistoROM package provides:

- Record up to 1000 measured values from 1 to 4 channels.
- User-configurable recording interval.
- Record up to 250 measured values from each of the 4 memory channels.
- Export the measured value log from a variety of interfaces and operating tools, such as a web server.
- Use the recorded measured value data in the integrated device simulation function in the **Diagnostics** submenu.

11.12 Diagnostics functions

Package	Description
Extended HistoROM	Comprises extended functions concerning the event log and the activation of the measured value memory. **Event log:** Memory volume is extended from 20 message entries, standard version, to up to 100 entries. **Data logging, line recorder:** - Memory capacity for up to 1000 measured values is activated. - 250 measured values can be output from each of the 4 memory channels. The recording interval can be defined and configured by the user. - Measured value logs can be accessed through the local display or operating tool, such as the web server.

11.13 Heartbeat Technology

Item	Description
Heartbeat Verification + Monitoring	**Heartbeat Monitoring** Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to: - Draw conclusions—using these data and other information—about the impact process influences have on the measuring performance over time. - Schedule servicing in time. - Monitor the process or product quality. **Heartbeat Verification** Meets the requirement for traceable verification to DIN ISO 9001:2008. - Functional testing for standard verification testing in the installed state without interrupting the process. - Traceable verification to validation standard gas with results on request, including a report. - Simple testing process through local operation or web server. - Clear analyte measuring point pass/fail assessment with high test coverage within the framework of manufacturer specifications.

11.14 Extended Heartbeat Verification with validation

The JT33 TDLAS gas analyzer extends Heartbeat Verification with the ability to validate against a gas standard to increase the system's test coverage.

Validation relies upon calibration gas of a known concentration value. Validation of the analyzer can be automatically conducted using solenoids to control the flow of validation gas and to block process gas. It can be initiated based on a scheduled time or by using the **Start validation** parameter.

The validation gas concentration value is input into the analyzer. The validation measurement is compared with a percent allowance of the gas concentration value to determine a pass or fail. Validation results can be viewed on the webserver, tied to a validation warning alarm, and are saved as a Heartbeat Technology verification report.

For more information on validation, consult your local sales channel. Detailed instructions on Endress+Hauser Heartbeat Technology can be found in the *J22 and JT33 TDLAS gas analyzers Special Documentation (SD02912C)* for the Heartbeat Verification + Monitoring application package.

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