Operating Instructions
FLOWSIC100 Flare-XT

Ultrasonic Mass Flow Measuring Device

Endress+Hauser
People for Process Automation

Described product
Product name: FLOWSIC100 Flare-XT

Manufacturer
Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

Legal information

Original document
This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

Warning symbols


IMMEDIATE HAZARD
of severe injuries or death


Hazard (general)


Voltage hazard

Hazard in potentially explosive atmospheres


Hazard through explosive substances/substance mixtures


Hazard by noxious substances


Hazard by toxic substances

Warning levels/signal words

DANGER
Risk or hazardous situation which *will* result in severe personal injury or death.

WARNING
Risk or hazardous situation which *could* result in severe personal injury or death.

CAUTION
Hazard or unsafe practice which *could* result in less severe or minor injuries.

NOTICE
Hazard which *could* result in property damage.

Information symbols


Important technical information for this product


Supplementary information


Link referring to information at another place

FLOWSIC100 Flare-XT

1 About this document

Function of this document
Scope of application
Target groups
Further information

1.1 Function of this document

These Operating Instructions describe for the FLOWSIC100 Flare-XT measuring system with FLSE100-XT sender/receiver units and Interface Unit:

- Device components
- Installation
- Operation
- Maintenance work required for reliable operation

For detailed information on functional checks/device settings, data backup, software update, malfunction and error handling and possible repairs, see the Service Manual.

Retention of documents

► Keep these Operating Instructions and all associated documents available for reference.

► Pass the documents on to a new owner.

1.2 Scope of application

These Operating Instructions apply exclusively to the FLOWSIC100 Flare-XT measuring system with the described system components.

They are not applicable to other Endress+Hauser measuring devices.

These Operating Instructions cover standard applications which conform with the technical data specified. Additional information and assistance for special applications are available from your Endress+Hauser representative.

It is generally recommended to take advantage of qualified consulting services provided by Endress+Hauser experts for your specific application.

1.3 Target groups

This Manual is intended for persons installing, operating and maintaining the device.

Operation

The device may only be operated by authorized persons who, based on their training on, and knowledge of the specific device, as well as knowledge of the relevant regulations can assess the tasks given and recognize the hazards involved.

Installing and maintaining

Skilled persons are required for installation and maintenance.

Please observe the information at the beginning of the respective sections.

1.4 Further information

NOTICE:

Observe all supplied documents.

FLOWSIC100 Flare-XT

2 For your safety

Basic safety information
Intended use
Information on cybersecurity threats

2.1 Basic safety information

Observe the safety information here and the warning information in the following Sections of these Operating Instructions to reduce health risks and avoid dangerous situations.

In the case of warning symbols on the devices, the Operating Instructions must be consulted to determine the nature of the potential hazard and the actions required to avoid the hazard.

- ► Only put the FLOWSIC100 Flare-XT into operation after reading the Operating Instructions.
- ► Observe all safety information.
- ► If there is something you do not understand: Contact Endress+Hauser Customer Service.
- ► Only use the FLOWSIC100 Flare-XT measuring system as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- ► Do not attempt any work on or repairs to the FLOWSIC100 Flare-XT unless described in this Manual.
- ► Do not modify the FLOWSIC100 Flare-XT in any way unless specifically instructed and permitted to do so by the manufacturer.
- ► Only use accessories approved by the manufacturer.
- ► Do not use damaged components or parts.
- ► If you do not follow these guidelines, the following applies:
  - Any warranty by the manufacturer becomes void,
  - The FLOWSIC100 Flare-XT can become dangerous
  - The approval for use in potentially explosive atmospheres is no longer valid.

Special local requirements

Follow all local laws, regulations and company policies applicable at the respective installation location.

2.2 Intended use

Use the system components of the FLOWSIC100 Flare-XT measuring system only as described in this document.

Do not exceed the maximum permissible pressure and temperature values shown on the type plates of the FLSE100-XT sender/receiver units in operation.

The manufacturer bears no responsibility for any other use.

- FLSE100-XT sender/receiver units: → p. 36, §5.1
- Interface Unit: → p. 94, §6.1

2.3 Information on cybersecurity threats

Protection against cybersecurity threats requires a comprehensive cybersecurity concept that must be continuously reviewed and maintained.

A suitable concept consists of organizational, technical, procedural, electronic and physical levels of defense and takes into account appropriate measures for the different types of risk. The measures implemented in this product can only support protection against cybersecurity threats if the product is used as part of such a concept.

Visit *www.endress.com/cybersecurity* for more information, such as:

- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (Security Advisories)

FLOWSIC100 Flare-XT

3 System description

3.1 System components

The FLOWSIC100 Flare-XT measuring system comprises the components:

- FLSE100-XT sender/receiver unit (details → p. 35, §5)
  For transmitting and receiving ultrasonic pulses, signal processing and controlling the system functions
- Control unit Interface Unit (details→ p. 93, §6)
  For control, evaluation and output of the sensor data connected via the RS485 interface
- Installation accessories (e.g., nozzle, nozzle installation tool, ball valve)
- Connection cable between sender/receiver units
- Connection cable between sender/receiver units and Interface Unit
- Spool piece option
  Spool piece ready for installation in an existing pipeline (flange connection or welded connection) including assembly means for fitting the sender/receiver units

  Measuring systems with spool piece option additionally available as:
  - Dry calibrated (high precision measured system, geometry uncertainties are minimized.)
  - Flow calibrated (the complete measuring system has been calibrated on a flow test bench.)

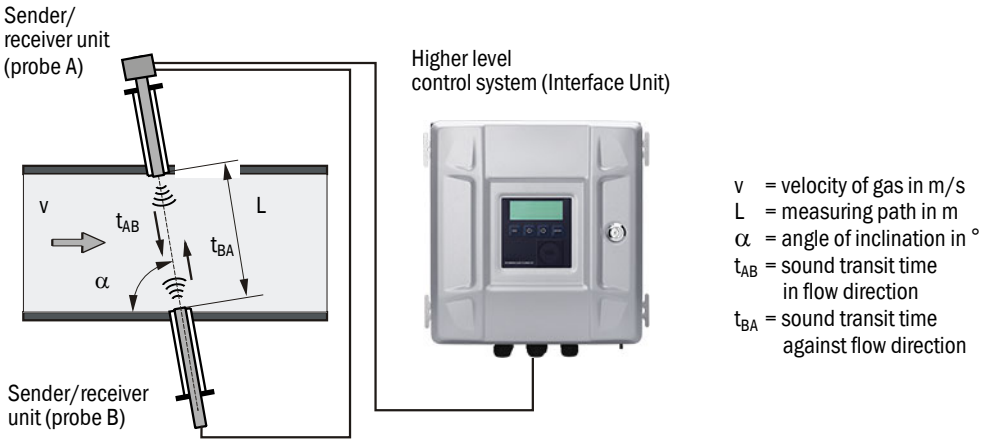
  Both variants reduce measurement uncertainty.
- External temperature and pressure transmitters available on request

3.2 Functional principle

The FLOWSIC100 Flare-XT gas flow rate measuring devices operate according to the principle of ultrasonic transit time difference measurement. Sender/receiver units are mounted on both sides of a pipeline at a certain angle of inclination to the gas flow (Fig. 1). These sender/receiver units contain piezoelectric ultrasonic transducers that function alternately as senders and receivers. The sound pulses are emitted at an angle α to the flow direction of the gas. Depending on angle α and gas flow rate v, the transit time of the respective sound direction varies as a result of certain "acceleration and braking effects". The higher the gas velocity and the smaller the angle to the flow direction, the more the transit times of the sound pulses differ.

Gas flow rate v is calculated from the difference between both transit times, independent of the sound velocity value. With this measuring method, changes of the sound velocity due to pressure or temperature variations therefore have no influence on the gas velocity determined.

Fig. 1 Functional principle FLOWSIC100 Flare-XT



Determination of gas velocity

Measuring path L is equivalent to the active measuring path, i.e. the free flow path. For measuring path L, sound velocity c and path angle α between sound and flow directions, the following is valid for the transit time of the sound for sound propagation in direction of the gas flow (forward direction):

$$t_{AB} = \frac{L}{c + v \cdot \cos \alpha} \qquad (2.1)$$

Valid against the flow is:

$$t_{BA} = \frac{L}{c - v \cdot \cos \alpha} \qquad (2.2)$$

Resolving for v results in:

$$v = \frac{L}{2 \cdot \cos \alpha} \cdot \left(\frac{1}{t_{AB}} - \frac{1}{t_{BA}}\right) \qquad (2.3)$$

i.e. a relation in which only the path length and the path angle exist as constants.

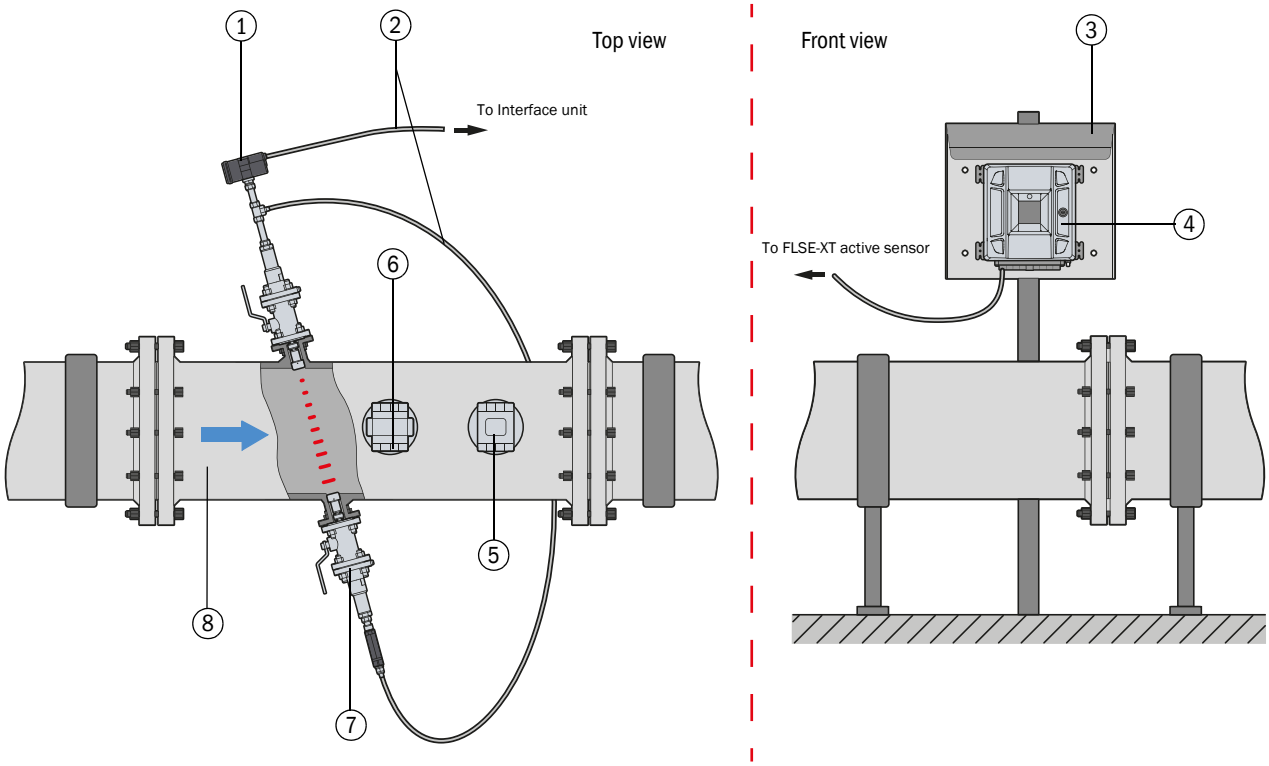
Determination of sound velocity

The sound velocity can be determined by resolving formulas 2.1 and 2.2 for c.

$$c = \frac{L}{2} \cdot \left(\frac{t_{AB} + t_{BA}}{t_{AB} \cdot t_{BA}} \right) \qquad (2.4)$$

3.3 System overview

Fig. 2 System overview FLOWSIC100 Flare-XT



1 Sender/receiver unit, FLSE-XT active sensor
2 Connection cable
3 Weatherproof cover for Interface Unit
4 Interface Unit
5 Temperature sensor
6 Pressure sensor
7 Sender/receiver unit, FLSE-XT passive sensor
8 Optional spool piece

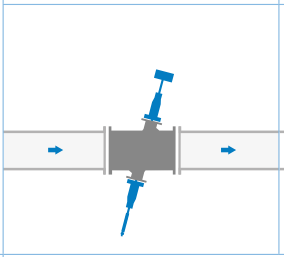
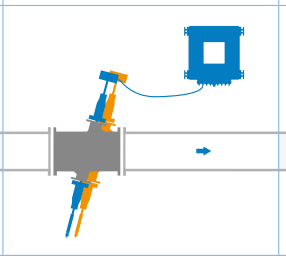
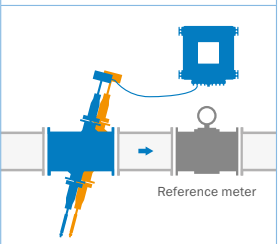
3.4 System configuration

3.4.1 Configuration as Flare Instrument or Flare Meter

The FLOWSIC100 Flare-XT measuring system is available as a flare instrument, where the nozzles are welded to the existing pipeline. Optionally available as a variant with separately supplied spool piece for easier fitting of the sensors without welding. Here, the sensors are first integrated in the spool piece at the measuring point.

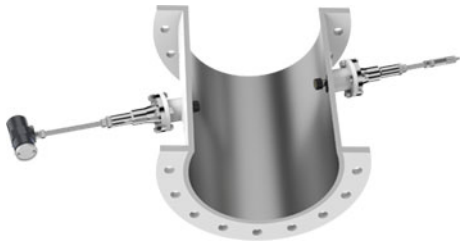
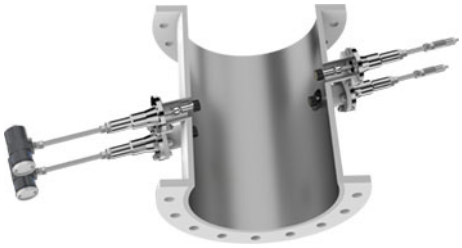
To increase the measuring accuracy, the FLOWSIC100 Flare-XT is alternatively available as a Flare Meter with a fully integrated spool piece. Here, the sensors are already mounted at the factory and the complete Flare Meter is measured and tested. Optionally, a flow calibration can be performed to achieve the highest measurement accuracy.

Fig. 3 Product configurations

Product configurations	Flare Transmitter	Flare Instrument	Flare Meter
Blue parts: Endress+Hauser scope of delivery Orange parts: Additional set of matching sensors (2nd path) Gray parts: Optional parts			
Standard delivery scope	Sensors incl. interconnection cable		
	-	Interface unit	
	Product and material certification		
	-		Flare meter fully assembled in measured spool piece
	-		Performance capability evaluation
Optional delivery scope	Performance capability evaluation		FLOW calibration
	-	Customized documentation	
	Customer service training		
	Accessory spool piece for installation without welding		-
I/O	Modbus® RTU	Modbus® RTU/TCP	
		Foundation Fieldbus	
		Analog incl. HART / digital / frequency	
Display	-	x	
Counter / logbook / data archives	-	x	
i-diagnostics™	-	x	
Voltage supply	24 V DC	24 V DC / 115 V ... 230 V AC	
Advantages	Lean measurement solution for basic requirements	Extended functionality	Extended functionality and lowest measurement uncertainty
Number of possible measuring paths	1-path	1-path / 2-path	
Measurement uncertainty	★	★★	★★★

3.4.2 Configuration as 1-path or 2-path measuring system

FLOWSIC100 Flare-XT is available as 1- or 2-path measuring system. The following Figures show cross-duct installations (F1F-S, F1F-M, F1F-H). In principle, the configuration also applies to one-sided installation (F1F-P).

Configuration	Description
1-path measurement	Two sender/receiver units are mounted on the pipeline. The measuring path is positioned across the center of the pipeline. Special operating conditions can make it necessary to position the path outside the pipeline center (shortens the measuring path). A probe version can also be used instead of two sender/receiver units (type F1F-P). 
2-path measurement	Two pairs of sender/receiver units are installed at the same measuring location and connected to the same Interface Unit. Both measuring paths are positioned outside the center of the pipeline and run parallel to one another. The Interface Unit calculates a measuring result from both measuring paths. 2-path measurement is used to achieve higher measurement accuracy or when flow conditions are complicated. 2-path measurement can also be used as redundancy for additional reliability. The path velocity ratio is taught in during operation with two functional paths. If one path should fail, the failing path is compensated by using the taught in ratio and the measurement value of the remaining path. 

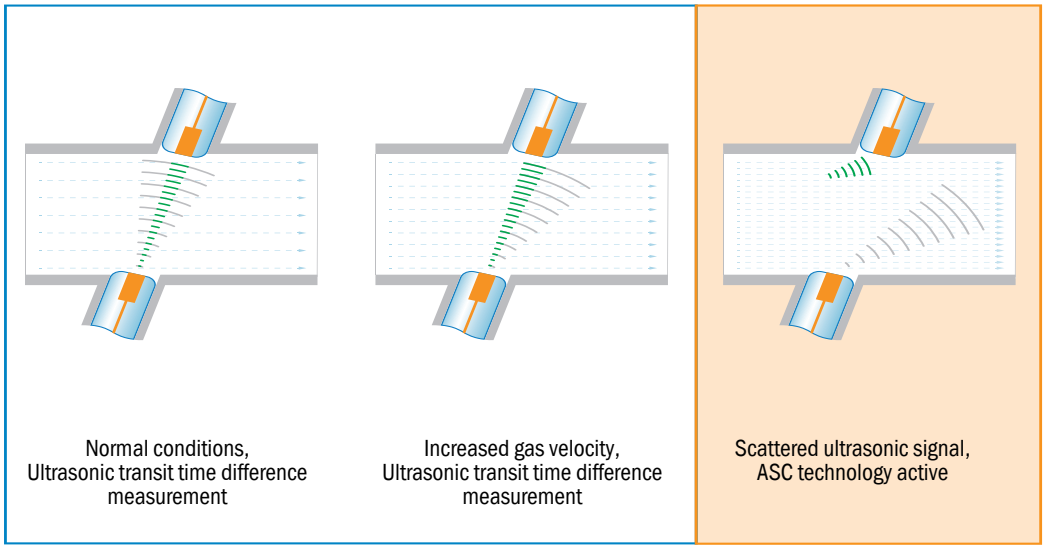
3.5 ASC technology (patented) – active sound correlation technology

If the ultrasonic signal is scattered due to extreme gas velocity, the ASC technology (active sound correlation technology) takes over. The ultrasonic transducer works like a microphone and correlates the strong noises at high flow rates to gas velocity.

This ensures measurement is still available even for extreme flare gas behavior.

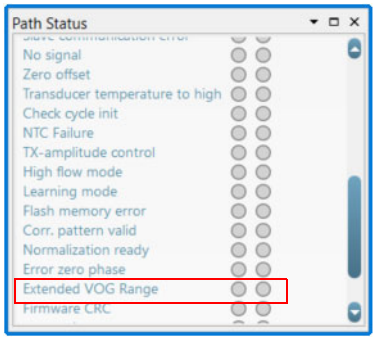
Measurement uncertainty is higher as compared to ultrasonic transit time difference measurement, see technical data, → p. 181, §12.

Fig. 4 ASC technology



When ASC technology is active, the FLOWgate™ operating software signals path status “Extended VOG Range”.

Fig. 5 Signaling “Extended VOG Range” in the path status



3.6 Logbook and archives

3.6.1 Logbook

The FLOWSIC100 Flare-XT stores certain relevant events in an event logbook with time stamp and counter reading.

The following events are documented

- User logins
- Device status (information, maintenance, error)
- Parameter changes

3.6.2 Archives

The following archives are available in the Interface Unit.

- Data archive A and data archive B

  Data archive A and data archive B are customer-specific archives whose interval can be freely selected.

  The recording intervals can be configured according to your requirements during commissioning, → p. 150, §7.5.3.

  The archives are ring buffers.

  A typical setting at daily archives allows saving data for a period of 10 years.

- Diagnosis archive

  The Diagnosis archive creates an entry every hour and is intended for troubleshooting with Endress+Hauser.

- 24 h archive

  The 24 h archive creates and entry every full hour with retrospect (averaging/summation) to the last respective day, i.e. the 24 hours preceding the entry generation.

Table 1 Archive overview

Archive	Recording interval unit	Content
Data archive A	Hour(s) Day(s) Week(s) Month(s) Quarter(s) Year(s)	● Actual volume flow ● Standard volume flow ● Mass volume ● CO2 emission ● Temperature ● Pressure ● Actual volume counter without and with ASC ● Standard volume counter without and with ASC ● Mass volume counter without and with ASC ● Device Status
Data archive B	Hour(s) Day(s) Week(s) Month(s) Quarter(s) Year(s)	● Actual volume flow ● Standard volume flow ● Mass volume ● CO2 emission ● Temperature ● Pressure ● Actual volume counter without and with ASC ● Standard volume counter without and with ASC ● Mass volume counter without and with ASC ● Device Status
24h Archive	Fixed 24h	● Actual volume flow ● Standard volume flow ● Mass volume ● CO2 emission ● Temperature ● Pressure ● Actual volume counter without and with ASC ● Standard volume counter without and with ASC ● Mass volume counter without and with ASC ● Device Status
Diagnosis Archive	Fixed 1h	● Temperature ● Pressure ● Device Status ● Molar mass ● VoG path x ● SOS path x ● SNR A and B of Path x ● AGC A and B of Path x ● Error A and B of path x ● Path status x

FLOWSIC100 Flare-XT

4 Project planning

Overview
Recommendations for the installation location of the FLSE100-XT sensors
Determining the installation location of the Interface Unit

4.1 Overview

The following Table provides an overview of the project planning work necessary as prerequisite for trouble-free assembly and subsequent device functionality.

Task	Requirements		Work step	
Determine measuring and installation locations	Flow distribution, inlet and outlet paths	Lowest possible influence on the measurement accuracy	Follow specifications for new equipment; select best possible location for existing equipment	☐
	Access, accident prevention	Easy and safe	Provide platforms or pedestals as required.	☐
	Installation free of vibrations	Maximum allowable vibration velocity 7 mm/s (rms)	Avoid/reduce vibrations through adequate measures.	☐
	Ambient conditions	Limit values in accordance with Technical Data	If necessary: Provide weatherproof covers / sun protection, enclose or lag device components.	☐
Select device components	Internal pipe diameter	Sender/receiver unit type	Select components according to the Configuration Table and information as from → p. 57, §5.6.6 as well as the Application Evaluation Sheet.	☐
	Gas temperature	Sender/receiver unit type		
	Gas composition	Material of duct probe and transducer		
	Fitting locations	Cable lengths		
Plan power supply	Operating voltage, power requirements	According to Technical Data	Plan adequate cable cross-sections and fuses	☐

4.2 Recommendations for the installation location of the FLSE100-XT sensors

To ensure the best performance of the FLSE100-XT sensors, it is crucial to analyze the flow profile and determine the optimal measurement location. Key points to consider:

1 *Fully developed flow:* The device's uncertainty is defined under conditions of a fully developed flow profile. This means that the flow has stabilized and is uniform, which is ideal for accurate measurements.

2 *Flow disturbances:* Elements like elbows, diameter changes, reducers, diffusers, and injection nozzles can disturb the flow profile, leading to asymmetric flow, swirl, and other non-axial velocity components. These disturbances can negatively impact the measurement accuracy.

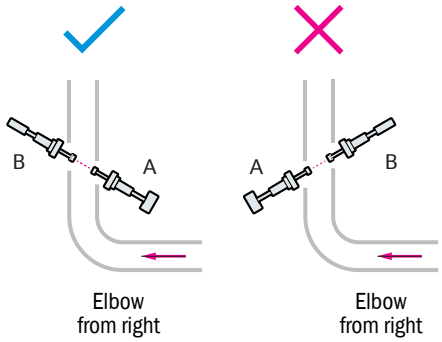
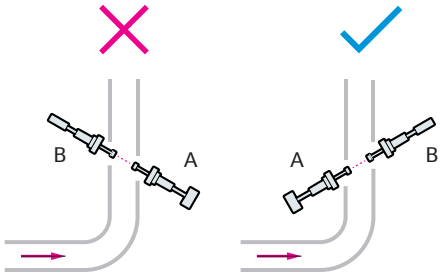
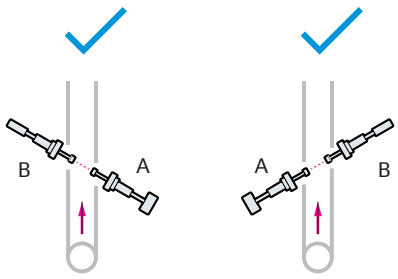
For best possible device performance, it is recommended to analyze the flow profile and determine the optimal measurement location. Detailed procedure for pre-investigations can be found for example in ISO 16911-2 section 8.2.

Device recommendation based on result of pre-investigation

Result of pre-investigation	Probe	Cross-Duct	
		1 path	2 paths
Flow profile not likely to change	Yes	Yes	Yes
Flow profile is expected to change with flow rate	No	Yes	Yes
A skewed flow profile, possibly due to swirl, i.e. the point in the profile with the maximum flow rate is rotating	No	No	Yes

4.2.1 General requirements

Criteria		Requirements
Measuring location	Flow behavior	Position with swirl-free as well as rotationally symmetrical flow profile Balanced, uniform profiles are most likely to be expected for long inlet and outlet paths
	Pipeline design	Whenever possible, no deflections, cross-section variations, curves, feed and drain lines, flaps or fittings in the area of the inlet and outlet paths
	Inlet and outlet path lengths	Isometric conditions at the measuring point are most important for determining the required inlet and outlet piping and should be investigated carefully. The conditions depend on the specific application and the device configuration. Typically, an upstream 20 D straight pipe section and a downstream 5 D straight pipe section are required. ● Uncritical flow inlet conditions require straight inlet piping. ● More complex inlet disturbances require longer inlet and outlet piping.
Pipeline		Pipelines with vertical, horizontal or inclined direction Pipelines with horizontal or vertical direction ● Horizontal installation: Align the spool piece so that the planes formed by the measuring paths are horizontal. This minimizes the problem of dirt in the pipeline entering the transducer ports. ● Vertical installation: Only possible if the measuring system is used for dry, non-condensing gases.

Criteria	Requirements
Installation location	Almost free of vibrations, maximum allowable vibration velocity 7 mm/s (rms)
	Largest possible distance to control valves or other noisy fixtures
	With electrical connections and lighting
	Special care should be taken on the recommended orientation of the sensors. Ensure that the measurement path is aligned with one of the following setups: ● *Elbow in plane with measurement path (from left or right)*: Place sensor A at the side of the inner radius of the nearest upstream elbow (see pictures 1 and 2). ● *Elbow out of plane with measurement path (from top or below):* The sensors can be placed in either orientation (see picture 3).
	(1)  Elbow from right Elbow from right
	(2)  Elbow from left Elbow from left
	(3)  Elbow from top/below Elbow from top/below
Working platform	Easy and safe access for installation and maintenance work of the sender/receiver units
	Platform secured by a railing to prevent possible accidents
	Sufficient clearance to fit/remove the sender/receiver units

Criteria	Requirements
Wall and insulation thickness	● Maximum wall thickness 15 mm Larger wall thicknesses require customer-specific solutions (available on request only). ● Minimum wall thickness depends on pressure, temperature, pipe size and static/dynamic load at the measurement location (contact Endress+Hauser for support). Nozzles may only be isolated when the gas temperature is < 100 °C. Ball valve, venting valve and electronics must not be insulated.

4.2.2 Additional requirements for optional spool piece

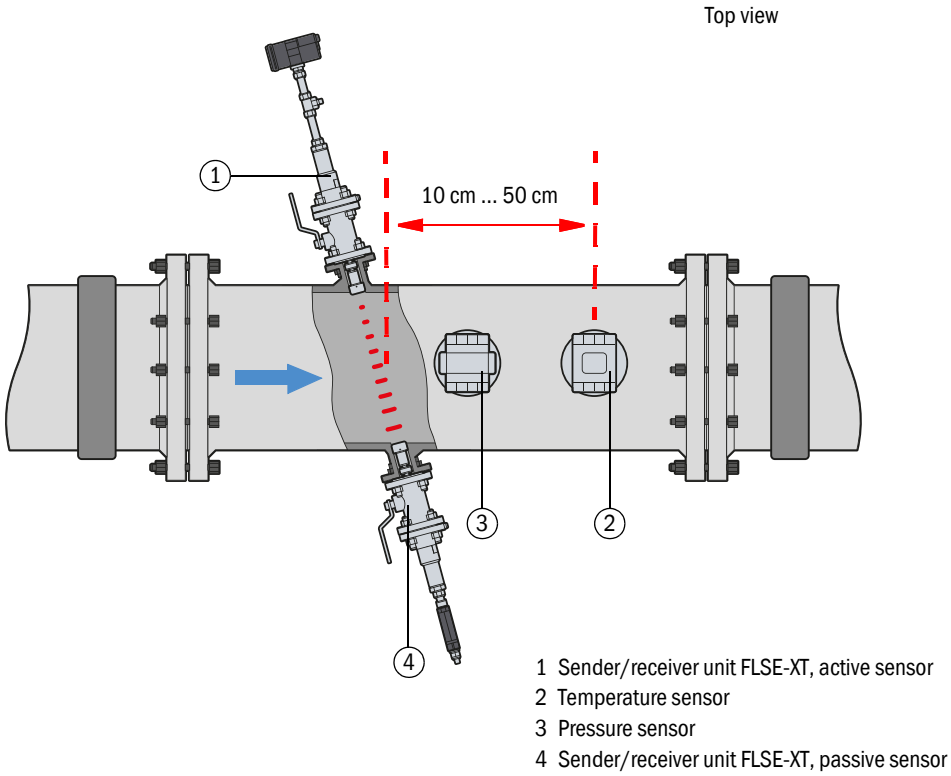
Criteria	Requirements
Pipeline design	● Same nominal size of adjacent pipes and spool piece. ● Differences of internal diameters of inlet pipe and spool piece < 1%. ● No welding beads and burs on the flanges of the inlet pipe
Gas flow	Free from any foreign material, dust and liquids. Otherwise, filters and traps shall be used.
Seals between spool piece and pipeline	Must not protrude into the pipeline. Any protrusion into the flowing gas stream may change the flow profile and thus may adversely affect measuring accuracy.
Pressure sensor	Pressure tapping over the measuring path
Temperature sensor	Spool piece with standard installation length with integrated pressure tapping, temperature sensor 10 cm ... 50 cm in the outflow area
Fastening and sealing material	Bolts, nuts and flange seals used must be suitable for the operational conditions and comply with legal regulations and relevant standards.

4.2.3 Installation location for external pressure and temperature transmitters (option)

Pressure tappings and thermowells for external transmitters have to be installed in the following way:

- Pressure tapping connection: Directly at the measuring point, centrally above the measuring path, on the top of the pipeline
- Temperature sleeve: Outlet section with distance 10 cm ... 50 cm, measured from the middle of the measuring path, on the top of the pipeline

Fig. 6 Installation location



The Table shows for which calculations the use of external pressure and temperature transmitters is required.

Calculation of	External pressure transmitter	External temperature transmitter
Volumetric flow in standard condition	x	x
Mass flow rate	x	x
Molecular weight	—	x

4.2.4 Applications with wet gas

The ultrasonic transit time measurement is suitable for wet gas in general. However, if condensate accumulates in the weld-on nozzles or in or around the sensor contour, this can lead in rare cases to measurement interruptions or spikes caused by solid-borne noise. With higher flow rates which are typically seen in flaring applications, condensates are normally blown away and the measurement returns to optimal performance.

The following solutions can help to prevent measurement interruptions or damage when removing the sender/receiver units (condensate runs out).

- Operate in dry gas whenever possible (i.e. use a gas dehydration).
- Use a weld-on nozzle position which prevents accumulations of condensates in the nozzles.
- Use a closed continuous or periodical condensate drain with backflow to the pipeline.
- Isolate the pipeline and weld-on nozzles to reduce dew point depression.
- Active heating of the nozzles or the adjacent pipe section can be used to eliminate the negative impact of condensate or frozen condensate onto the measurement performance

4.2.5 Clearance for fitting and removing the sender/receiver units

NOTICE:
Observe the dimension drawings in → p. 197, §12.8.1.

4.3 Determining the installation location of the Interface Unit

4.3.1 Installation location requirements

► Fit the Interface Unit in an easily accessible and protected position.

► Observe the information in → p. 109, §6.4.

Providing suitable cables are used, the Interface Unit can be installed up to 1000 meters from the sender/receiver units. The installation of a flameproof version of the interface unit directly on site is therefore unnecessary in many situations. For easier access to the Interface Unit, we recommend installation in a control room (measuring station or similar). This considerably simplifies communication with the FLOWSIC100 Flare-XT for configuration or location of failure or error causes.

NOTICE:
The Interface Unit is only suitable for vertical installation.

4.3.2 Clearance for fitting the Interface Unit

NOTICE:
Observe the dimension drawings in → p. 199, §12.8.2.

FLOWSIC100 Flare-XT

5 Installation FLSE100-XT

Intended use
Product description
Installation
Electrical installation

5.1 Intended use

FLSE100-XT sender/receiver units may only be used to measure the gas velocity, gas volume, mass flow and molecular weight in pipelines.

Do not exceed the maximum permissible pressure and temperature values shown on the type plates of the FLSE100-XT sender/receiver units in operation.

Using the device for purposes other than those intended can lead to safety-critical conditions. The manufacturer bears no responsibility for any other use.

5.2 Safety information

5.2.1 Hazards due to hot, cold (cryogenic) or aggressive gases, or high pressure

The FLSE100-XT sender/receiver units are mounted directly on the gas-carrying pipeline.

On equipment with low hazard potential, e.g., non-toxic, aggressive or explosive gases, gases not hazardous to health, uncritical pressure, moderate gas temperature (not hot, very low/cryogenic), the installation or removal can be performed while the equipment is in operation, however only as far as the valid regulations and equipment safety notices are observed and suitable protective measures are taken. Special regulations that apply to the plant must be observed.

WARNING: Gas hazard

- Activities on equipment with increased hazard potential, e.g. by toxic, aggressive, explosive gases, health endangering, higher pressure, high temperatures, low temperature (cryogenic), have to follow legitimate regulations, general standards and guidelines as well as plant operator instructions. Only authorized personnel with special qualification for fitting using the ”Hot Tapping” method may install the devices when the plant is in operation (requirements on the qualification of the personnel, see → p. 42, §5.2.8). Otherwise, serious injuries might occur, e.g. poisoning, burns etc.

  These persons must be trained and technically adept in ”hot tapping” installation work and must know and implement legal as well as generally applicable regulations and in-house regulations.
- The express approval of the plant operator in written form is required for installations on running equipment at all times. The plant operator carries the responsibility for professional implementation alone. All safety requirements relevant for the equipment must be observed as well as essential and suitable protective measures taken. All regulations/special regulations that can be applicable for the plant must be observed.

5.2.2 Hazard through electrical equipment

WARNING: Danger through main voltage

- ► Disconnect power supply lines before working on power connections or parts carrying main voltage.
- ► Refit any contact protection removed before switching the main voltage back on again.

5.2.3 Hazards through explosive or ignitable gases

FLSE100-XT sender/receiver units may be used in potentially explosive atmospheres only according to the respective specifications.

WARNING: Hazards through explosive or ignitable gases

- ► In potentially explosive atmospheres, only use the version of the FLSE100-XT sender/receiver units specified for such use (→ p. 45, §5.3).
- ► Observe the information on → p. 36, §5.2.1 during installation work on running equipment (”hot tapping” method).

5.2.4 Hazards through electrostatic discharges

The electronic housing of the sender/receiver units and the optionally available spool piece are painted by the manufacturer with a layer thickness of max. 0.2 mm as standard.

WARNING: Ignition hazard through electrostatic discharge

Ignition hazards through electrostatic discharges exist when FLSE100-XT sender/receiver units with special paintwork and a layer thickness > 0.2 mm are used in applications with ignition group IIC according to ATEX and IECEx.

- ► For installation, the risk of electrostatic charging of the surface must be reduced to a minimum.
- ► Use appropriate caution when performing maintenance and cleaning work. For example, the surfaces should only be cleaned with a damp cloth. The respective devices will be identified by the manufacturer with a warning sign.

5.2.5 Retraction mechanism of the sender/receiver units

The retraction mechanism serves to remove and fit complete sender/receiver units of the FLSE100-XT for maintenance or replacement without relieving pressure in the pipeline in which the measuring system is fitted. Sender/receiver units with ball valve must be installed to use the retraction mechanism.

This allows maintenance work without having to interrupt the process.

WARNING: Hazard through incorrect use of the retraction mechanism

The retraction mechanism may only be used when the sender/receiver unit is fitted with a ball valve. The retraction mechanism must not be used when a ball valve is not installed.

Only operate the retraction mechanism within the following pressure ranges:

- Maximum operating pressure
  - For use of the retraction mechanism: 0.5 bar (g)
  - With additional extraction tool: 8 bar (g)

  For information on the extraction tool, refer to the corresponding Operating Instructions (Part No. 8030464).

  Endress+Hauser recommends participating in a training for handling the extraction tool.
- Temperature range:

  For health and safety reasons (high/low temperatures), Endress+Hauser recommends only operating the retraction mechanism in the temperature range 0 °C ... 70 °C.

WARNING: Hazardous gas (possibly explosive or toxic)

Small gas quantities escape during the removal and installation of the transducer assemblies. When used correctly, the gas amount enclosed in the retraction nozzle is max. 0.81 dm^3 with F1F-P and max. 0.27 dm^3 with F1F-S, F1F-M and F1F-H.

► In order to prevent damage to health, it is therefore essential that suitable protective equipment is used by the personnel carrying out work on systems containing toxic gases or gases otherwise hazardous to health.

WARNING: Hazardous gas (possibly explosive or toxic)

The retraction nozzle of the sender/receiver units has a connection for optional venting.

► This connection is closed with a dummy plug at the factory.

► The dummy plug may only be removed when a venting valve is installed, → p. 78, §5.6.8.3.

5.2.6 Operation in potentially explosive atmospheres

Depending on the respective device version, the FLSE100-XT sender/receiver units are designed for use in potentially explosive atmospheres:

Table 2 Device versions

Version	Approval		
	IECEx	ATEX	NEC/CEC (USA/CA)
F1F-S	Ex db [ia Ga] IIA T4 Ga/Gb Ex db [ia Ga] IIB T4 Ga/Gb Ex db [ia Ga] IIC T6/T4 Ga/Gb Ex ia IIC T6/T4 Ga	II 1/2G Ex db [ia Ga] IIA T4 Ga/Gb II 1/2G Ex db [ia Ga] IIB T4 Ga/Gb II 1/2G Ex db [ia Ga] IIC T6/T4 Ga/Gb II 1G Ex ia IIC T6/T4 Ga	Class I, Division 1, Group D, T4; Class I, Zone 1, Ex/AEx d[ia] IIA, T4; Class I, Division 2, Group D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIA, T4 Class I, Division 1, Groups C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB, T4; Class I, Division 2, Groups C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIB, T4 Class I, Division 1, Groups B, C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB + H2, T4; Class I, Division 2, Groups A, B, C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIC, T4
F1F-M	Ex db [ia Ga] IIA T4 Ga/Gb Ex db [ia Ga] IIB T4 Ga/Gb Ex db [ia Ga] IIC T6/T4 Ga/Gb Ex ia IIC T6/T4 Ga	II 1/2G Ex db [ia Ga] IIA T4 Ga/Gb II 1/2G Ex db [ia Ga] IIB T4 Ga/Gb II 1/2G Ex db [ia Ga] IIC T6/T4 Ga/Gb II 1G Ex ia IIC T6/T4 Ga	Class I, Division 1, Group D, T4; Class I, Zone 1, Ex/AEx d[ia] IIA, T4; Class I, Division 2, Group D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIA, T4 Class I, Division 1, Groups C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB, T4; Class I, Division 2, Groups C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIB, T4 Class I, Division 1, Groups B, C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB + H2, T4; Class I, Division 2, Groups A, B, C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIC, T4
F1F-H	Ex db IIC T6/T4 Gb	II 2G Ex db IIC T6/T4 Gb	Class I, Division 1, Groups B, C and D, T4; Class I, Zone 1, Ex/AEx d IIB + H2, T4; Class I, Division 2, Groups A, B, C and D, T4; Class I, Zone 2, Ex/AEx nA IIC, T4
F1F-P	Ex db [ia Ga] IIA T4 Ga/Gb Ex db [ia Ga] IIB T4 Ga/Gb Ex db [ia Ga] IIC T6/T4 Ga/Gb	II 1/2G Ex db [ia Ga] IIA T4 Ga/Gb II 1/2G Ex db [ia Ga] IIB T4 Ga/Gb II 1/2G Ex db [ia Ga] IIC T6/T4 Ga/Gb	Class I, Division 1, Group D, T4; Class I, Zone 1, Ex/AEx d[ia] IIA, T4; Class I, Division 2, Group D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIA, T4 Class I, Division 1, Groups C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB, T4; Class I, Division 2, Groups C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIB, T4 Class I, Division 1, Groups B, C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB + H2, T4; Class I, Division 2, Groups A, B, C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIC, T4

5.2.6.1 **Specific conditions of use (denoted by X after the certificate number)**

> ***NOTICE:***
> The specific conditions mention devices that belong to the predecessor product and are not described in this document.

Specific conditions for FLSE100-XT-S, FLSE100-XT-R, FLSE100-XT-M and FLSE100-XT-P

- The intrinsically safe and non-intrinsically safe connections are connected with each other and with the potential equalization by their reference conductor. Potential equalization has to be exist in the entire range of erection of the intrinsically safe circuit inside and outside the explosive hazardous area.
- The sender/receiver type FLSE100-EXS resp. FLSE100-EXPR resp. FLSE100-XT-R resp. FLSE100-XT-S resp. FLSE100-XT-M resp. FLSE100-XT-P may be operated in hazardous areas in which equipment of EPL Ga (Ultrasonic transducer, passive and temperature sensor, passive); and EPL Ga/Gb are required only if atmospheric pressure exist. (Temperatures: See thermal data, pressure from 0.8 bar to 1.1 bar).
- The lengths of the flameproof joints are in parts longer and the gaps of the flameproof joints are in parts smaller than the values of table 3 of EN / IEC 60079-1:2014. For information of the dimensions of the flameproof joints contact the manufacturer.
- The electronic enclosure is manufactured from aluminium alloy and must be protected against impact or friction.
- The ultrasonic transducers are manufactured from titanium and must be protected against impact or friction.
- The maximum piezo-electric energy released by impact on the ultrasonic transducers exceeds the limit for Gas Group IIC. The ultrasonic transducers must be protected against impact.
- The sender/receiver type FLSE100-EXS resp. FLSE100-EXPR resp. FLSE100-XT-R resp. FLSE100-XT-S resp. FLSE100-XT-M resp. FLSE100-XT-P has to be installed and used in such a way, that electrostatic charging from operation, maintenance and cleaning is excluded.
- The sender/receiver units with the intrinsically safe transducers may be install into a duct wall separating Zone 0 from another area, e.g. Zone 1. The user must ensure that the material of the ultrasonic transducers shall not be subject to environmental conditions, e.g. chemical exposure or abrasion, which might adversely affect their housing and in particular their membrane.
- Cable entries and closing plugs have to be Ex certified and contain a suitable sealing gasket in order to ensure minimum IP64.

Specific conditions for FLSE100-XT-H

- The lengths of the flameproof joints are in parts longer and the gaps of the flameproof joints are in parts smaller than the values of table 3 of EN / IEC 60079-1:2014. For information of the dimensions of the flameproof joints contact the manufacturer.
- The electronic enclosure is manufactured from aluminum alloy. The ignition source due to impact and friction sparks could occur. The enclosure must be protected against impact or friction.
- The ultrasonic transducers are manufactured from titanium. The ignition source due to impact and friction sparks could occur. The enclosure must be protected against impact or friction.
- The sender/receiver FLSE100-EX resp. FLSE100-EXRE resp. FLSE100-XT-H has to be installed and used in such a way, that electrostatic charging from operation, maintenance and cleaning is excluded.
- Cable entries and closing plugs have to be Ex certified and contain a suitable sealing gasket in order to ensure minimum IP64.

5.2.6.2 **Use of FLSE100-XT, depending on the temperature code and process temperature**

Installation and use of sender/receiver units - electronics and transducers parts in the same area

This area is a hazardous area, i.e. Zone 1 or Zone 2 in which an explosive atmosphere exists under normal atmospheric conditions of:

- Specified ambient temperature -40 … +70 °C for T4 or -40 … +55 °C for T6, Optionally minimum ambient temperature -50 °C
- Ambient pressure 80 kPa (0.8 bar) to 110 kPa (1.1 bar)
- Air with normal oxygen content, typically 21 percent by volume.

Permissible gas temperature, depending on the temperature code of the sender/ receiver units

Case 1 (see →Table 3):

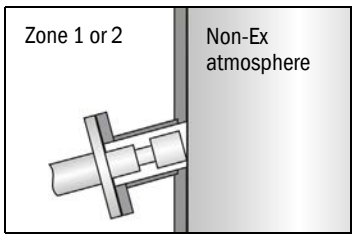
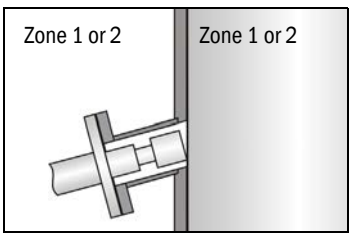
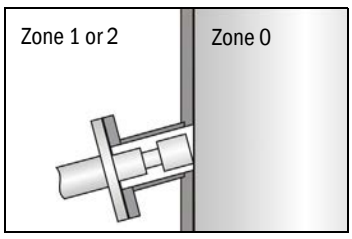
Under normal atmospheric conditions, an explosive atmosphere categorized as Zone 1 or Zone 2 exists outside the pipeline. Process conditions in the pipeline can differ from the atmospheric conditions. Process conditions can be in the range specified on the type plate of the sender/receiver units. In this case the gas or gas mixture can be combustible but must not be explosive.

Case 2 and 3 (see →Table 3):

On both sides of the pipeline an explosive atmosphere exists under normal atmospheric conditions. The pipe wall separates different zones, i.e. Zone 1 exists inside the pipe and Zone 2 outside. This means gas temperature and line pressure may not exceed the specified ambient values.

> ***NOTICE:***
> The pipe wall can separate different hazardous areas (zones).

Table 3 Permitted gas temperature for temperature code

	Case 1	**Case 2**	**Case 3**
Classified temperature code in the hazardous area	● Ultrasonic sensor outside explosive atmosphere Zone 1 or 2 ● Electronics in explosive atmosphere Zone 1 or 2 ● Gas pressure and gas temperature according to specification on device label	● Ultrasonic sensor in explosive atmosphere Zone 1 or 2 ● Electronics in explosive atmosphere Zone 1 or 2 ● Gas pressure and gas temperature according to ambient specification of device	● Ultrasonic sensor in explosive atmosphere Zone 0 ● Electronics in explosive atmosphere Zone 1 or 2 ● Gas pressure atmospheric, gas temperature max +60 °C ● Not for F1F-H
			
The sender/receiver units can be used with the following gas temperatures:			
T6	-196 [1] … +80 °C	-196 [1] … +55 °C	-50 … +55 °C
T4	-196 [1] … +130 °C	-196 [1] … +70 °C	-50 … +70 °C
T3	-196 [1] … +195 °C	-196 [1] … +70 °C	-50 … +70 °C
T2	-196 [1] … +280 °C	-196 [1] … +70 °C	-50 … +70 °C

[1] For F1F-H: -70 °C

NOTICE: **Observe the ambient temperature**

Be aware that the ambient air around the pipeline might heat up.

- The ambient temperature around the electronic housing may not exceed +70 °C for the sender/receiver unit marked with T4.
- The ambient temperature around the electronic housing may not exceed +55 °C for the sender/receiver unit marked with T6.

The compliance with these requirements is the sole responsibility of the user.

A temperature fuse protects the sender/receiver unit electronics against impermissible high temperatures. The temperature fuse interrupts the function of the electronics should such high temperatures occur. The switch-off reaction of the temperature fuse is permanent and can only be reset by the manufacturer through repair.

5.2.7 Warning information on device

WARNING: Danger identification on device

The following symbol draws attention to important dangers directly on the device:

► Consult the Operating Instructions in all cases where the symbol is attached to the device or shown on the display.

5.2.8 Requirements on the personnel's qualification

Designated users

The FLSE100-XT sender/receiver units may only be installed and operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved. Skilled persons are persons according to DIN VDE 0105, DIN VDE 1000-10 or IEC 60050-826 or directly comparable standards.

The named persons must have exact knowledge of operational hazards caused, e.g., by low voltage, hot, toxic, explosive gases or gases under pressure, gas-liquid mixtures or other media as well as adequate knowledge of the measuring system gained through training.

Specific requirements for use of devices in hazardous areas

► Cabling/installation, device setup, maintenance and testing may only be carried out by experienced persons familiar with the rules and regulations for hazardous areas, in particular:
  - Degree of protection
  - Fitting instructions
  - Area definition

► Regulations to be applied:
  - IEC 60079-14
  - IEC 60079-17

  or comparable national regulations.

5.2.9 Restrictions on use

WARNING: Hazard through pressure/temperature

► Use the FLSE100-XT sender/receiver units only within the pressure and temperature limits as specified in these Operating Instructions and on the device type plate.

► The selected materials must be resistant to the process gases. It is the responsibility of the plant operator to ensure this.

WARNING: Dangerous voltage

- The rated voltage U_M may not exceed 125 V in the safe area for use of the sender/receiver units F1F-S, F1F-M and F1F-P for Zone 1. Higher voltages can jeopardize intrinsic safety of the ultrasonic transducer circuit when errors occur.
  - ► Ensure the rated voltage U_M used in the safe area does not exceed 125 V.
- The FLSE100-XT sender/receiver units are not equipped with a main power switch for switching off the operating voltage.
  - ► Plan and install a suitable switching off device.

The sender/receiver units are intended for installation in gas-carrying pipelines. It is not absolutely necessary that atmospheric conditions prevail within the pipeline. The pipe wall is then a zone-separating wall, i.e. no Ex zone is defined within the pipeline, at least temporarily (→ Table 3, Case 1).

WARNING: Leakage hazard

Operation with leakage is not permitted.

- The metallic and hermetically sealed, fully welded enclosure and the seal must comply with all safety requirements which must also be fulfilled by the pipeline itself with respect to design pressure and temperature and compatibility of the material with the medium.
- The ultrasonic transducers with their gas-tight and pressure-proof enclosures must be installed in the pipeline gas-tight and pressure-tight. The FLSE100-XT is fitted with standardized sealing flanges for this purpose.
- The sealing itself must consist of material which is compatible with the medium and is suitable for the application conditions.
  - ► Check the sealing surfaces and elements for intactness before installation.
  - ► Check the sealing effect with suitable methods after installation.
  - ► Leak tightness is to be checked regularly during operation and the seal replaced, as required.
- Before every re-installation new seals have to be used in the required design.

Application limitations for use in Ex zone 1

- ► Ultrasonic probes made of titanium may be used in Zone 1 only when risks of ignition arising from impacts or friction on the sensor enclosure can be ruled out.
- ► When ultrasonic probes are installed in pipelines with a defined hazardous area, solid parts, e.g. dust or other particles may not cause an ignition hazard.

Application limitations for use in hazardous area classification Ex zone 0 in the pipeline

Use in applications of Zone 0 is generally only possible for device types F1F-S, F1F-M and F1F-P under consideration of the application limitations described in these Operating Instructions.

- Ultrasonic probes can also be operated in Zone 0 under atmospheric conditions (ambient temperature -40 °C to +70 °C and ambient pressure 0.8 bar to 1.1 bar absolute). The devices must be labeled at least with the information Ex ia.
- Ultrasonic probes made of titanium may be used in Zone 0 only when no rigid components transported through the medium (e.g. dust and other particles) are present and the ultrasonic probes are fitted in Zone 0 in a way (e.g. inside a pipeline) that risks of ignition arising from impacts or friction can be ruled out. The intrinsically safe ultrasonic transducers with their gas-tight and pressure-proof enclosures must be installed gas-tight and pressure-tight in the zone-separating wall to Zone 0. The wall must be thicker than 3 mm. The requirements in EN 60079-26 Section 4.6 must be adhered to.

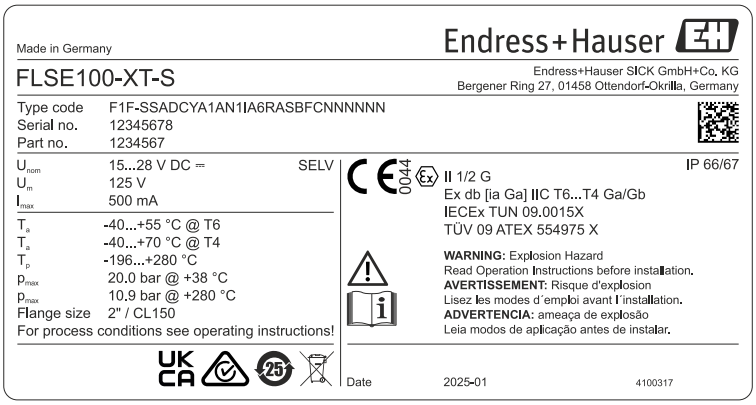
5.3 Product description

5.3.1 Product identification

Product name:	FLSE100-XT
Manufacturer	Endress+Hauser SICK GmbH+Co. KG Bergener Ring 27 01458 Ottendorf-Okrilla Germany

Type plate

Fig. 7 Type plate example FLSE100-XT-S



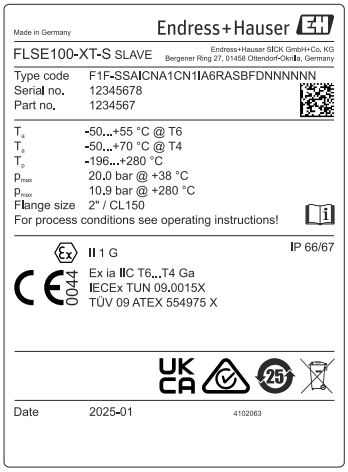
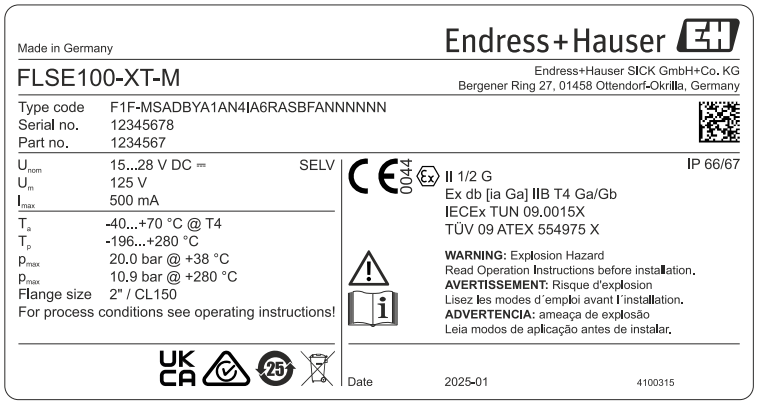


Fig. 8 Type plate example FLSE100-XT-M



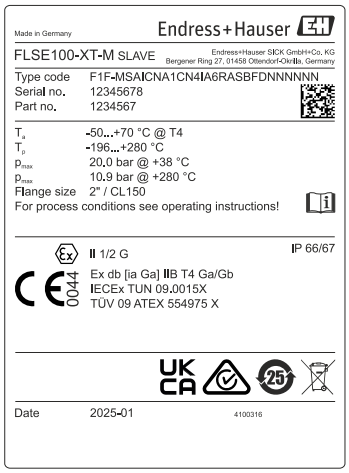


Fig. 9 Type plate example FLSE100-XT-H

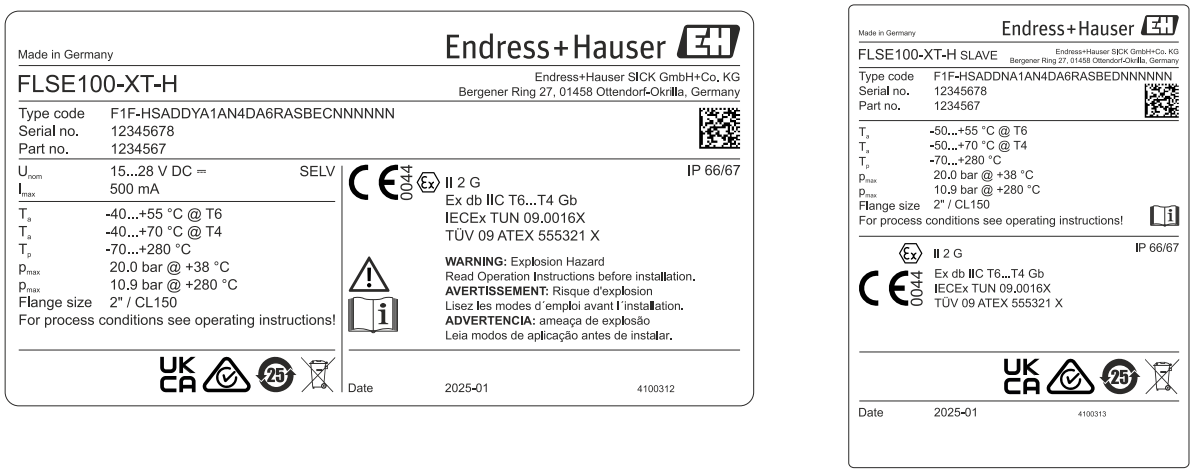
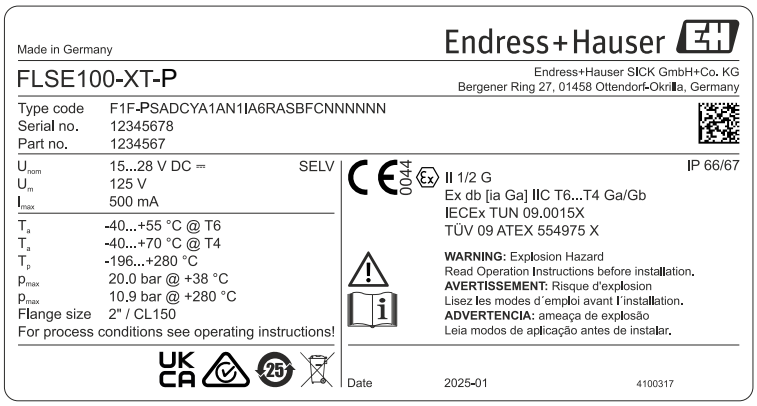


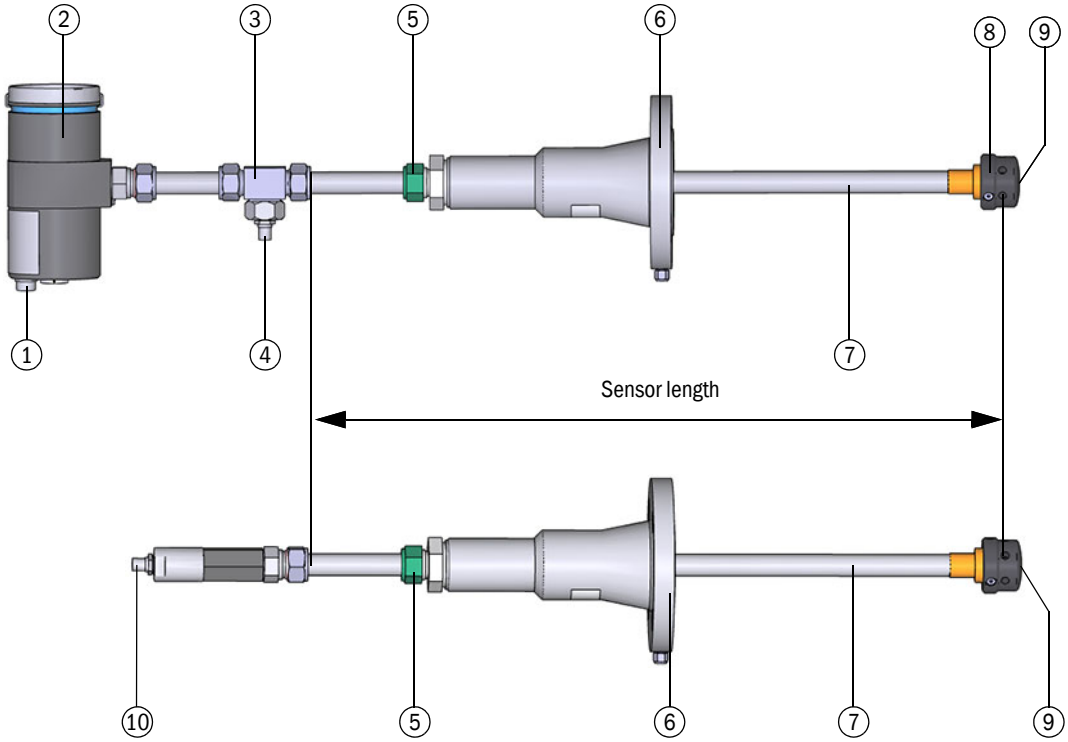
Fig. 10 Type plate example FLSE100-XT-P



5.3.2 Sender/receiver units

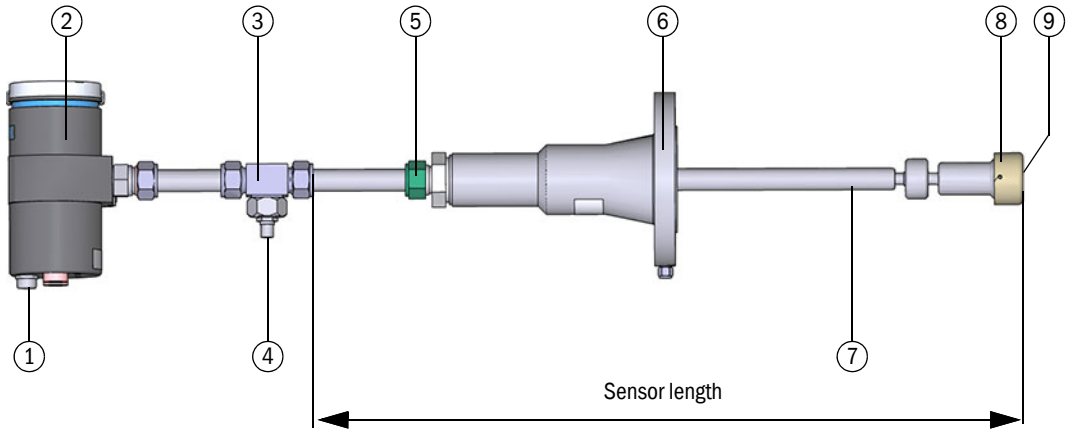
Cross-duct

Fig. 11 F1F-S (Active and passive sensor shown as examples)



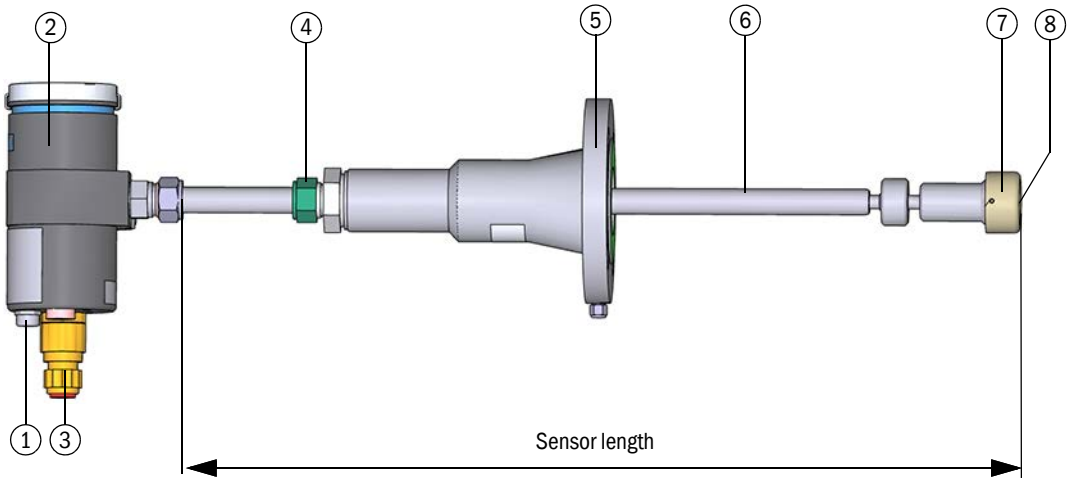
1 Pressure compensation element
2 Electronics unit
3 T-connector
4 TNC connector (connection for passive sensor)
5 Self-cutting ring
6 Retraction nozzle
7 Duct probe
8 Sensor contour
9 Transducer
10 TNC connector (connection for active sensor)

Fig. 12 F1F-M (only active sensor shown)



1 Pressure compensation element
2 Electronics unit
3 T-connector
4 TNC connector (connection for passive sensor)
5 Self-cutting ring
6 Retraction nozzle
7 Duct probe
8 Sensor contour
9 Transducer

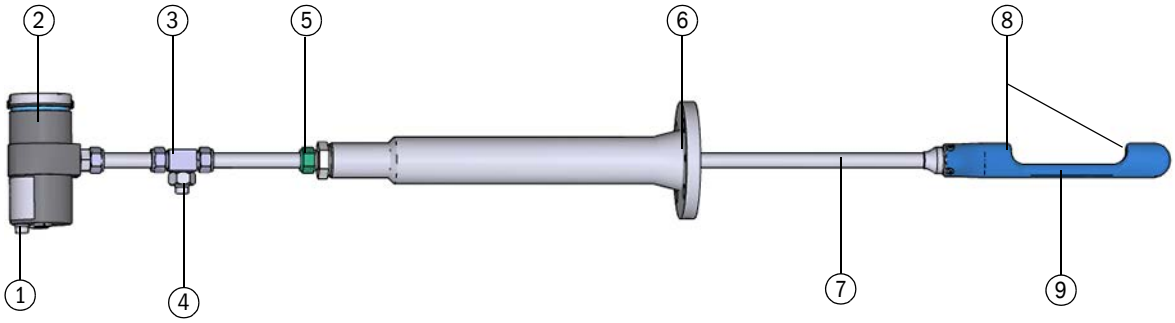
Fig. 13 F1F-H (only active sensor shown)



1 Pressure compensation element
2 Electronics unit
3 Cable gland (connection for passive sensor)
4 Self-cutting ring
5 Retraction nozzle
6 Duct probe
7 Sensor contour
8 Transducer

Probe version

Fig. 14 F1F-P

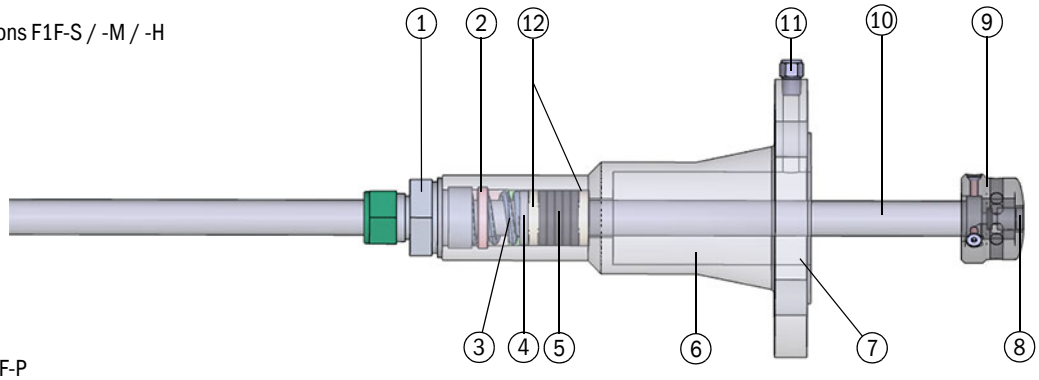


1 Pressure compensation element
2 Electronics unit
3 T-connector
4 Pressure compensation element
5 Self-cutting ring
6 Retraction nozzle
7 Duct probe
8 Transducer
9 Sensor contour

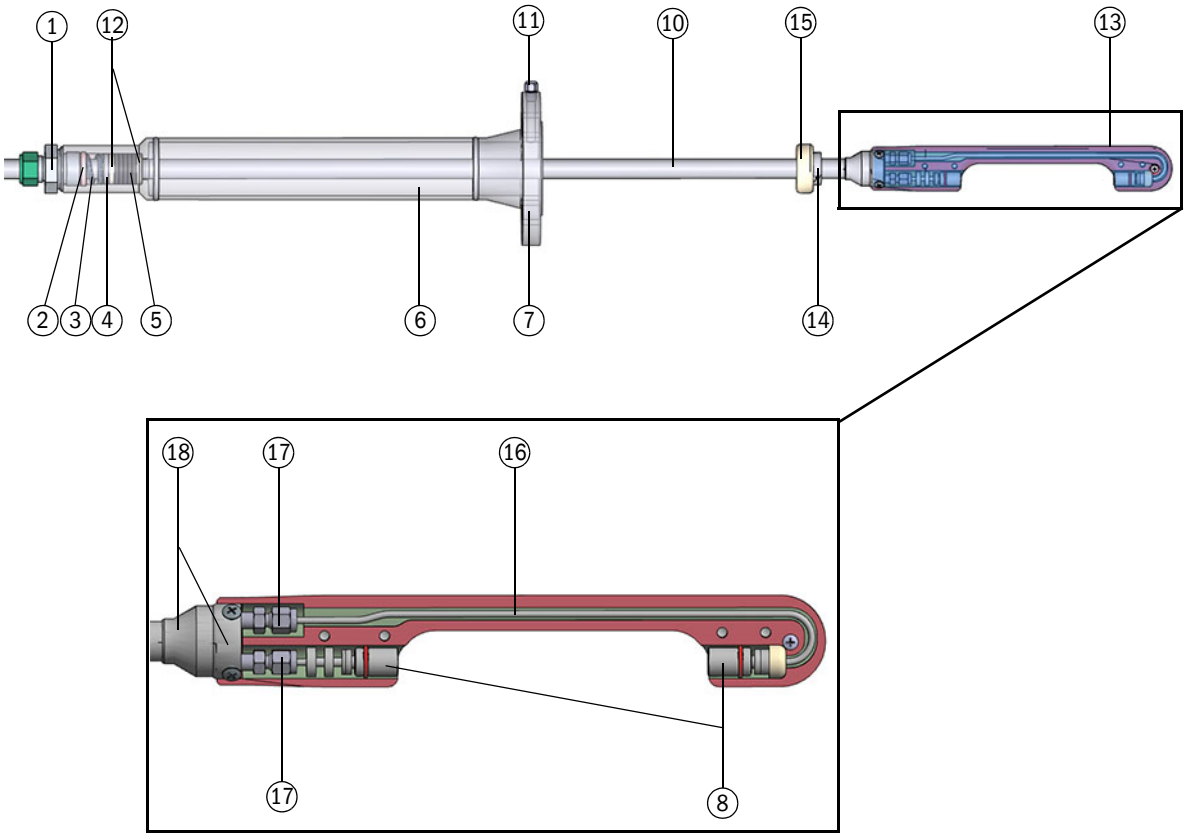
5.3.3 Material for wetted parts (parts with process gas contact)

Fig. 15 Parts with process gas contact

Cross-duct versions F1F-S / -M / -H



Probe version F1F-P



1 Pipe screw fitting
2 Threaded ring
3 Spring
4 Sealing disc
5 Sealing profile
6 Retraction nozzle
7 Retraction flange
8 Transducer
9 Sensor contour
10 Duct probe
11 Connection for optional venting
12 Centering
13 Sensor contour probe version F1F-P
14 Adjusting ring
15 Thrust ring
16 Probe tube
17 Transducer pipe screw fitting
18 Transducer and contour holder

Table 4 Overview of parts with process gas contact

Material	Component	Type FLSE100-XT			
		F1F-S	F1F-M	F1F-H	F1F-P
Stainless steel 1.4404	Retraction flange (7), threaded ring (2)	x	x	x	x
	Connection for optional venting (11), retraction nozzle (6)	x	x	x	x
	Duct probe (10), sensor contour (13), transducer and contour holder (18), transducer pipe screw fitting (17)				x
	Adjusting ring (14), pipe screw fitting (1), sealing disc (4)	x	x	x	x
Titanium	Duct probe (10), transducer assembly (8)	x	x	x	
	Transducer assembly (8), probe tube (16)				x
PTFE	Centering (12)	x	x	x	x
	Sensor contour (9)	x	x	x	
	Thrust ring (15)				x
PTFE/graphite	Sealing profile (5)	x	x	x	x
Stainless steel 1.4568	Spring (3)	x	x	x	x

5.4 Spool piece option

The FLOWSIC100 Flare-XT can also be fitted with an optional spool piece to reduce geometric uncertainty of device installation and to simplify assembly. The exact design (nominal diameter, connection, material) always depends on the customer specifications.

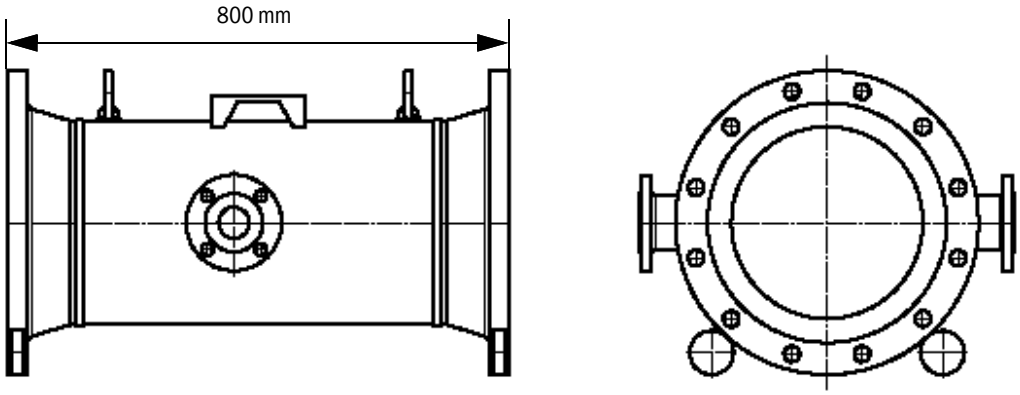
The installation length of the spool piece depends on the nominal diameter of the pipe:

- Installation length 800 mm for pipe diameter up to 28”
- Installation length 1100 mm for pipe diameter 30” ... 60”
- Installation length for pipe diameter >60”...72” on request

All system solutions (FLOWSIC100 Flare-XT + spool piece) are optionally available with pressure and temperature sensors. For the positioning of pressure and temperature transmitters the following configurations are available:

- Spool piece with standard installation length with integrated pressure tapping, temperature sensor 10 cm ... 50 cm in the outflow area
- Spool piece, extended length with integrated pressure and temperature tapping.

Fig. 16 Spool piece option (example)



5.5 Transport and storage

Comply with permissible storage conditions (→ p. 181, §12).

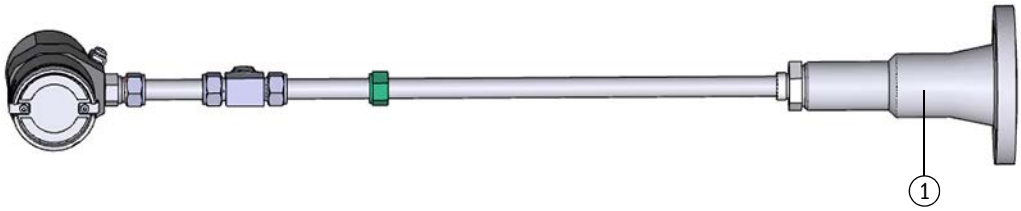
5.5.1 Transport protection

To prevent transport damage, the FLSE100-XT sender/receiver units must be secured according to Fig. 17 before each transport.

- ► Retract the transducer fully into the retraction nozzle.
- ► Ensure in a suitable manner that the transducer cannot slip out of the retraction nozzle during transport.

> ***NOTICE:***
> No additional loads may act on the electronics unit and on the cable outlet of the sender/receiver units. Especially in the retracted position, no additional force (except in the direction of the duct probe) may act on the electronics unit.

Fig. 17 Transport protection



1 Retraction nozzle

5.5.2 Special notes for handling the spool piece option

Transport and storage

- ► During all transport and storage work, ensure:
  - The spool piece is well secured at all times
  - Measures are taken to avoid mechanical damage
- ► Protect sealing surfaces of the flanges and the interior of the spool piece if it must be stored outside for more than one day, e.g. with Anticorit spray (not required for spool pieces made of stainless steel). Do the same if the meter must be stored in dry conditions, but for more than a week.

Lifting requirements

WARNING: Danger due to size and mass of the spool piece

- ► Only use lifting gear and load handling equipment (e.g. lifting straps) which are suitable for the weight to be lifted. Max. load information can be found on the type plate of the lifting gear.
- ► Only use the eye bolts when lifting the spool piece.
- ► Do not lift the spool piece using these eye bolts when additional loads (e.g. blind flanges, filling for pressure tests or tubes) are attached.
- ► During transport, the spool piece must not be turned over or start to swing.

Fig. 18 Lifting requirements (installed sender/receiver units are not shown)

5.6 Installation

5.6.1 Safety information

WARNING: Risks during installation

- ► Observe the relevant safety regulations as well as the safety notices on → p. 13, §2 during all installation work.
- ► Carry out assembly work on equipment with hazard potential (hot or aggressive gases, higher internal pipeline pressure) only when the equipment is at a standstill.
  Fitting when the equipment is running is only possible using the ”hot tapping method”. Such work may only be carried out by a specialized contractor authorized by the plant operator.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.

WARNING: Mechanical burden

The static load moment of all parts to be installed on the pipeline can be up to approx. 600 Nm. Strong pipe vibrations can cause damage and can lead to dangerous situations.

- ► Use a mechanical support for the nozzles welded to the pipeline, e.g. ”gusset plates”.

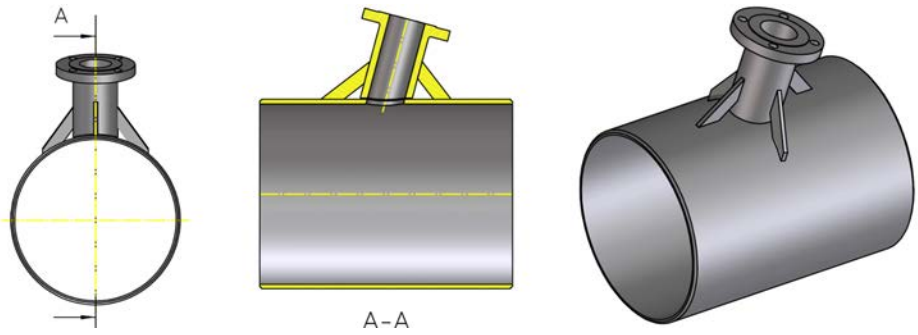
NOTICE:

The plant operator is responsible for the safety of the system under mechanical load.

NOTICE:

If the flanges, valves, nozzles, etc. are installed or uninstalled incorrectly, the duct probe may be mechanically deformed during installation or removal. As a result, the measuring function may no longer be guaranteed.

Fig. 19 Option mechanical support for nozzle ”gusset plates”



5.6.2 Scope of delivery

- ► Check that delivery includes all ordered parts.
- ► Check parts for possible transport damage. Pay particular attention to transducer surfaces, sealing surfaces on the flanges and, if delivered, the interior of the spool piece.
- ► Immediately document and report damage to the manufacturer.

> ***NOTICE:***
> To ensure safe and reliable operation of the measuring devices, it must be ensured the current operating conditions on the plant side match the specification on the type plates of the sender/receiver units.

5.6.3 Fitting the spool piece (option)

The spool piece must be mounted in the pipeline so that the arrow marking on it corresponds to the flow direction.

The flow is output by the measuring system as a positive value when the active sensor and the passive sensor of the sender/receiver units for the cross-duct versions are installed according to → p. 20, §3.3.

> **WARNING: Danger due to size and mass of the spool piece**
> ► Observe the transport information in → p. 52, §5.5.2!

Required fitting work

- ► Position the spool piece at the desired section of the pipeline using the hoist.
- ► After attaching the flange bolts, but before tightening, check the correct seating and alignment of the flange seal.
- ► Align the spool piece so that the offset between inlet pipe, spool piece and outlet pipe is minimized.
- ► Insert the remaining fixing screws and tighten the nuts crosswise. The applied torque must not be lower than specified in the project planning.
- ► Install the pressure measurement line between the pressure tapping point (option) and the pressure sensor (option).

Perform a leak tightness check with suitable means after completion of the installation work,→ p. 82, §5.6.8.5.

> ***NOTICE:***
> If the sender/receiver units of a measuring system configured as a Flare Meter (→ p. 21, §3.4.1) are removed for transport, the spool piece is provided at the factory with markings for fitting.
> ► Fit the sender/receiver units according to the markings on the spool piece to ensure measuring accuracy.

5.6.4 Installation sequence

Carry out all assembly work on-site.

This includes:

- ► Determining the nozzle position
- ► Welding the nozzle on

  The nozzles are manufactured precisely at the factory according to customer specifications for fitting on the pipeline.
- ► For retractable installation:

  Fitting the ball valves (measuring system without optional spool piece)
- ► Fitting the sender/receiver units

> ***NOTICE:***
> To ensure measurement accuracy, the geometry parameters must be determined as exactly as possible. Maximum tolerances:
> – Nozzle positions and fitting angle of the nozzles: ±1 mm / ±1°
> – Measurement of nozzle length: ±1 mm
> – Measurement of ball valves: ±1 mm

> ***NOTICE:***
> The exact wall thickness must be determined for precise calculation of the pipeline inner diameter. “Schedule” information from the applicable standards is less accurate than an exact measurement.
> The wall thickness must be determined accurately to 0.1 mm. Endress+Hauser recommends using a suitable ultrasonic measuring instrument to determine the wall thickness.

5.6.5 Geometry calculator in FLOWgate™

Certain geometry parameters must be determined and calculated for installation of FLSE100-XT sender/receiver units.

The following dimensions can be calculated using the geometry calculator integrated in FLOWgate™:

- Probe offset a (nozzle offset),→ p. 62, §5.6.7.2.

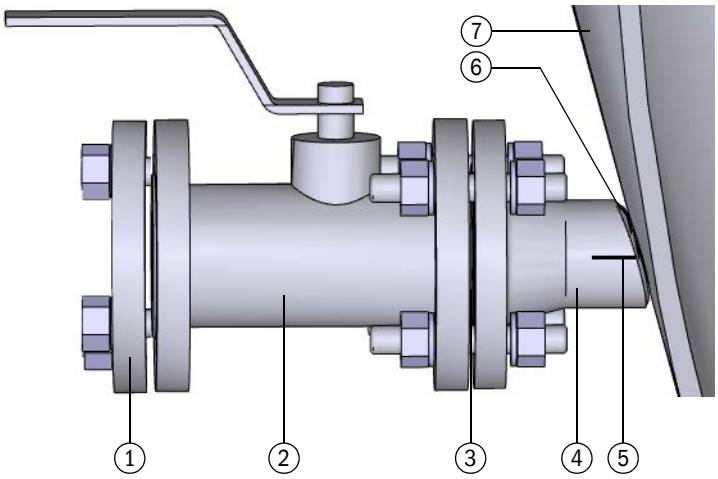
  The following parameters must be determined during installation for calculation of the probe offset:
  – Circumference, wall thickness and nominal nozzle angle
- Wetted part length wL, → p. 73, §5.6.8.1.

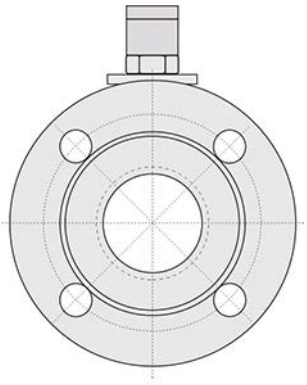
  For installation of the sender/receiver units, the wetted part length is calculated from:
  – Circumference
  – Wall thickness
  – Gasket thickness
  – Nozzle length
  – For retractable installation: Ball valve length
  – Nozzle angle
  – Additionally for cross-duct versions: Probe offset a
- Geometry installation parameters for commissioning the measuring system, → p. 73, §5.6.8.1.

5.6.6 Installation accessories

Sender/receiver units are fitted to the pipeline using the following material:

Fig. 20 Installation accessories (using ANSI CL150 as example)





Connection ANSI CL150 2"

1 Blind flange
2 Ball valve (only when sender/receiver units are to be retracted in operation)
3 Seal
4 Nozzle
5 Marking
6 Welding bevel
7 Pipeline

NOTICE:

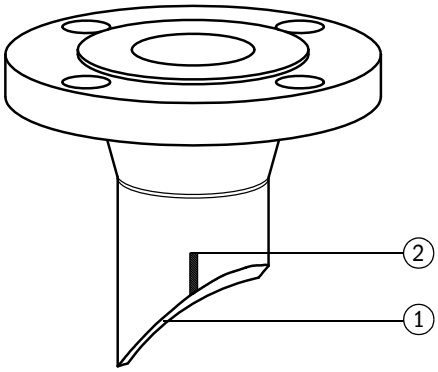
Use of installation accessories for temperature range according to type plate:

- The ball valve must not be insulated for media temperatures below -40 °C or higher than +160°C.
- For gas temperatures higher than +180°C or below -40 °C , the temperature at the nozzle flange must be checked after through-heating during initial start-up. If required, the nozzle insulation must be removed as required to stay in the specified temperature limit.
- Do not exceed temperature and pressure ranges listed in → p. 195, §12.7.
  It must be ensured that the temperature of the nozzle and ball valve is not so high that the material strength is no longer guaranteed when derating the pressure over the temperature, → p. 195, §12.7.

5.6.6.1 **Nozzles, blind flanges and seals**

Nozzles are delivered with factory adaption to the nominal pipe diameter, welding bevel and marking for nozzle alignment according to the gas flow.

Fig. 21 Nozzle



1 Welding bevel
2 Marking

Nozzles and blind flanges

NOTICE:
Observe the diagrams on → p. 195, §12.7.

Table 5 Available nozzles and blind flanges

Flange connection	Material	Temperature ranges
CL150	LTCS P355 QH1 / A350 LF2	-46 ... +280 °C
	SS 1.4401, 1.4404, ASTM A182 Gr. 316, 316L	-196 ... +280 °C
CL300	LTCS P355 QH1 / A350 LF2	-46 ... +280 °C
	SS 1.4401, 1.4404, ASTM A182 Gr. 316, 316L	-196 ... +280 °C
PN25 DN50	LTCS P355 QH1 / A350 LF2	-46 ... +280 °C
	SS 1.4401, 1.4404, ASTM A182 Gr. 316, 316L	-196 ... +280 °C

NOTICE:
Observe the diagrams on → p. 195, §12.7.

To prevent galvanic corrosion between LTCS nozzles and stainless steel ball valves, a nozzle insulation set (sealing material set with polymer seals and sleeves) is available as an accessory, → p. 70, §5.6.8.

Seals

NOTICE:
Observe the diagrams on → p. 195, §12.7.

Flat seals are required for the flange connection between nozzle and ball valve and between the ball valve and the sender/receiver unit. These seals are included in the standard scope of delivery of the ball valve and/or sender/receiver unit.

Table 6 Available seals

Material	Temperature range
Serrated gasket B9A 1.4571	-196 ... +280 °C

5.6.6.2 **Ball valve**

The ball valve serves for safe separation of the sender/receiver units from the process and is required when the sender/receiver units are to be dismounted during the process. Endress+Hauser recommends using a ball valve.

Ball valves for various flange connections (Cl150, CL300, PN25 DN50) and temperature ranges) are available.

NOTICE:
Observe the diagrams on → p. 195, §12.7.

Table 7 Ball valve according to ANSI

Component	Connection	Material (ASTM)	Gas temperature range
Standard temperature			
Ball valve CL150 2" SS	CL150 2"	Stainless steel 1.4408 (CF08M)	-46...+200°C (-50...+392°F)
Ball valve CL300 2" SS	CL300 2"	Stainless steel 1.4408 (CF08M)	-46...+200°C (-50...+392°F)
Low temperature			
Ball valve CL150 2" SS	CL150 2"	Stainless steel 1.4408 (CF08M)	-196...+200°C (-320...+392°F)
Ball valve CL300 2" SS	CL300 2"	Stainless steel 1.4408 (CF08M)	-196...+200°C (-320...+392°F)
High temperature			
Ball valve CL150 2" SS	CL150 2"	Stainless steel 1.4408 (CF08M)	-50...+400°C (-58...+752°F)
Ball valve CL300 2" SS	CL300 2"	Stainless steel 1.4408 (CF08M)	-50...+400°C (-58...+752°F)

Table 8 Ball valve according to DIN

Component	Connection	Material (ASTM)	Gas temperature range
Standard temperature			
Ball valve PN16 DN50 SS	PN16 DN50	Stainless steel 1.4408 (CF08M)	-46...+200°C (-50...+392°F)
Low temperature			
Ball valve		Stainless steel 1.4408 (CF08M)	-196...+200°C (-320...+392°F)
High temperature			
Ball valve PN40 DN50	PN40 DN50	Stainless steel 1.4408 (CF08M)	-50...+400°C (-58...+752°F)

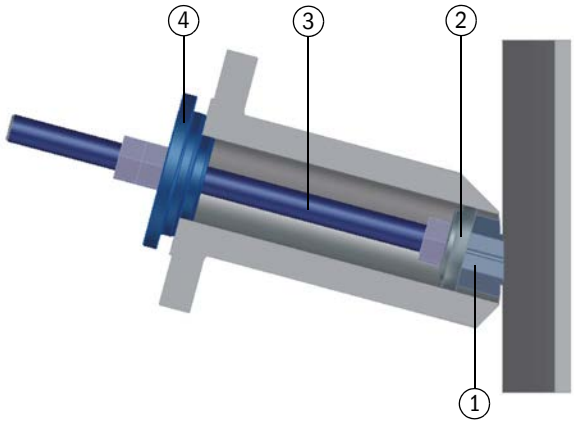
5.6.6.3 **Nozzle installation tool**

The installation tool serves to align and weld the nozzle on the pipeline. Endress+Hauser offers various nozzle installation tools depending on the nominal pipe diameter and path configuration.

The nozzle installation tool contains, per nozzle

- Welding aid M16 75°(1),
- Centering plate 2” (2),
- Threaded rod M16 length 290 mm (3),
- Centering 2” (4),
- Assembly material
- Installation paper strip as tool to determine the exact nozzle position on the pipeline.

Fig. 22 Nozzle installation tool



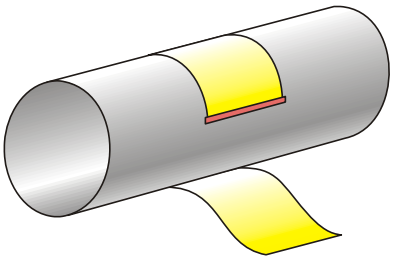
5.6.7 Fitting the nozzles on the pipeline (measuring system without spool piece option)

5.6.7.1 General preparation work

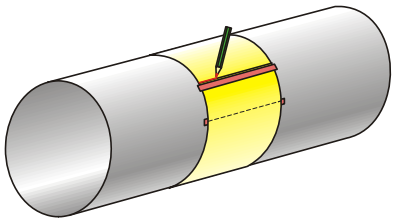
The installation tool (→ p. 60, §5.6.6.3) contains a foil strip (length approx. 4 times the pipe diameter, width approx. 0.75 of the pipe diameter) as a resource to determine the exact position of the nozzle on the pipeline. The foil strip is prepared with nozzle markings for different pipe diameters.

Fig. 23 General preparation work

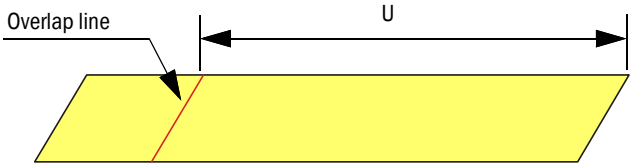
1) Wind the strip around the pipeline at the selected measuring point (ensure exact right-angled alignment) and secure (e.g. with adhesive strips).



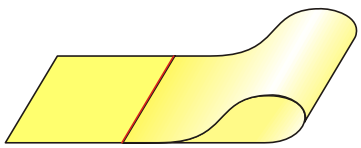
2) Mark the strip where overlapping starts.



3) Loosen the fastening, take the strip off and lay it out on a level surface.



For 1-path measurements, fold the strip to the overlap line so that the part matching pipe circumference (U) is halved.



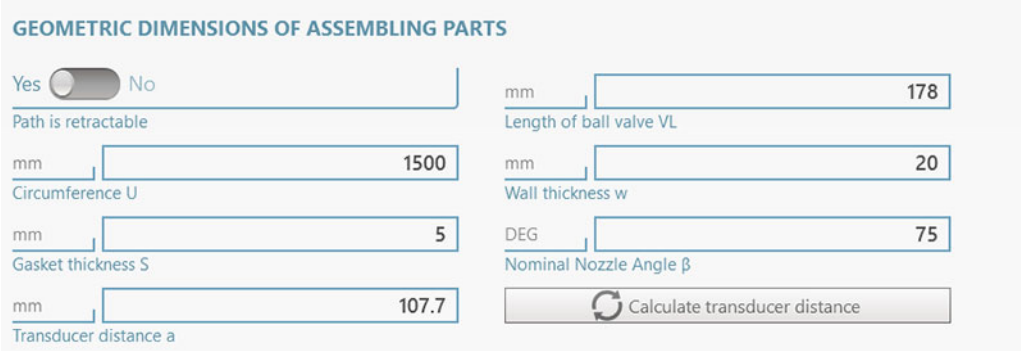
5.6.7.2 **Determining the nozzle position for cross-duct versions**

> ***NOTICE:***
> Note probe offset a, the wall thickness and circumference U; these values are required for calculating the path angle and path length with FLOWgate™ during commissioning.

Calculate probe offset a with the geometry calculator in FLOWgate™

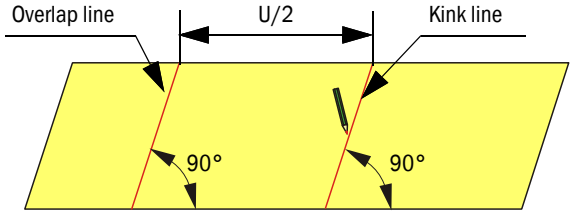
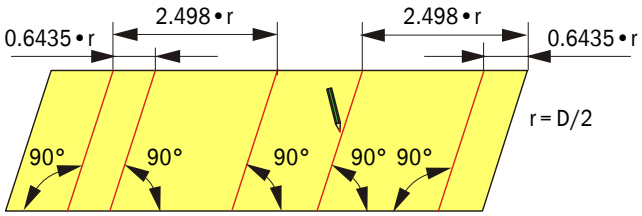
1 Start FLOWgate™ operating software.
2 Create a FLOWSIC100 Flare-XT off-line device.
3 Open the “Geometry calculator” tile in the “Change parameters” menu.
4 Select the “Cross-duct” device type.
5 Select whether the installation is a 1- or 2-path installation.
To do this, move the “Number of paths” slider to “One path” or “Two paths” accordingly.
6 Enter circumference U and the wall thickness w in the “Dimensions of components” section.
7 Click “Calculate probe offset”.
Probe offset a is calculated.

Fig. 24 Geometry calculator in FLOWgate™



Marking the nozzle positions on the pipeline

Fig. 25 Determining the nozzle positions on the strip

1-path measurement	2-path measurement
4a) Roll the strip out again and mark the kink line.	4b) Roll the strip out again and mark the lines as follows:
	
5) Draw guide lines (1) for the nozzle positions with the previously calculated nozzle offset a, mark crossing points (2) and draw marking points (3) in distance 60 mm (x) from the crossing points.	

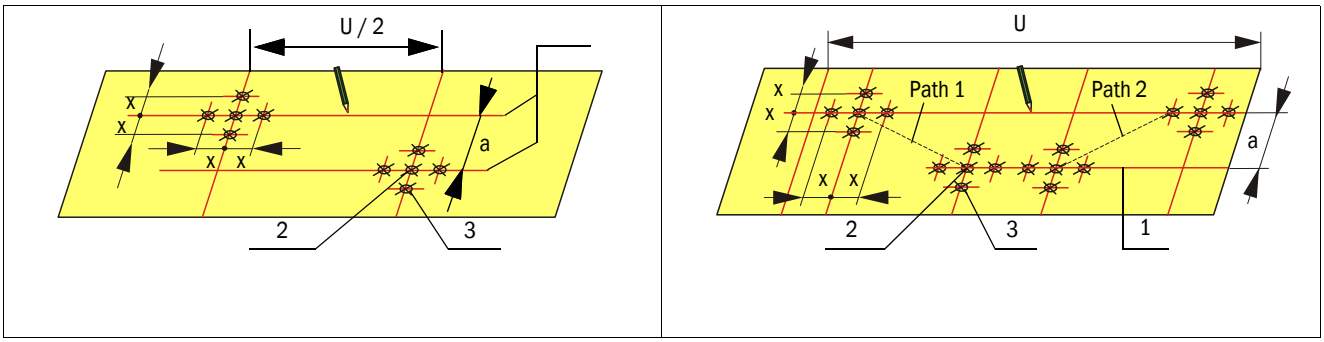
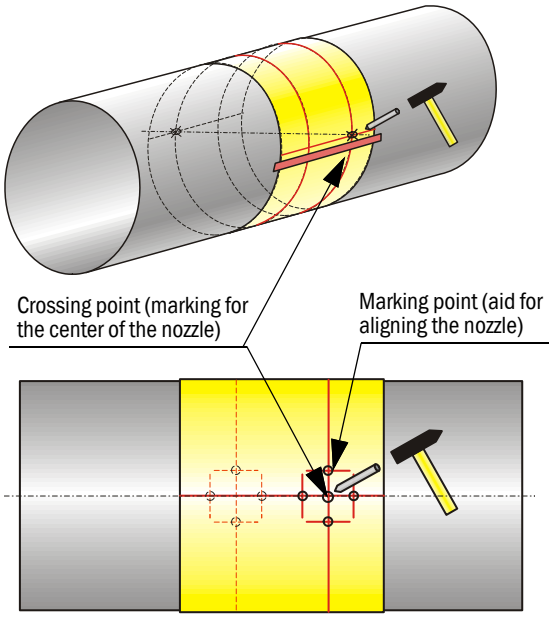
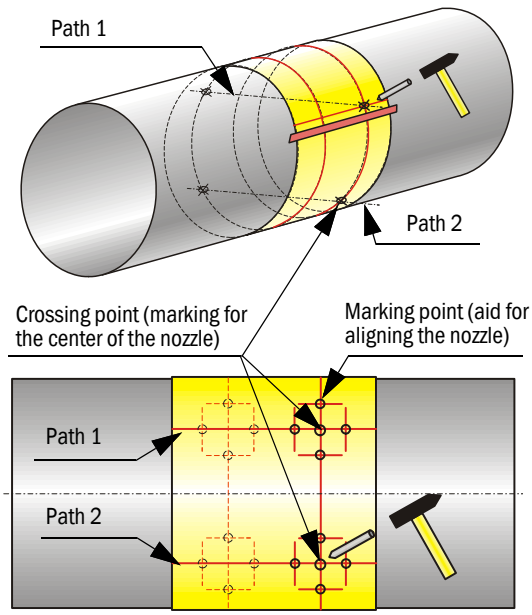
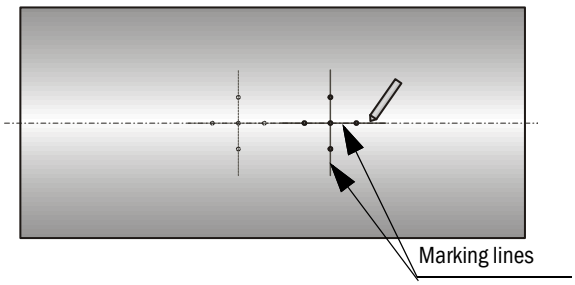
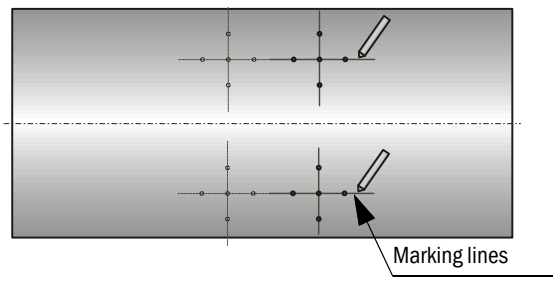


Fig. 26 Marking the nozzle positions on the pipeline for cross-duct versions

1-path measurement	2-path measurement
6) Roll the strip back around the pipeline and mark the nozzle positions with crossing and marking points by using a metal center punch.	
	
7) Take the strip off again and join the additional markings with a line.	
	

5.6.7.3 Determining the nozzle position for the probe version

Fig. 27 Determining the nozzle positions on the strip

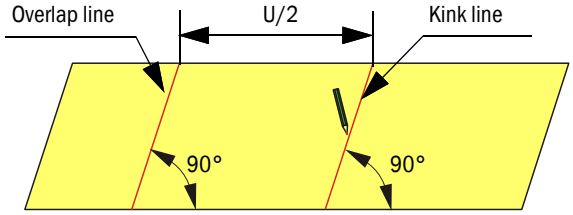
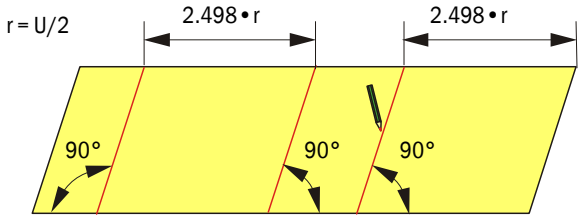
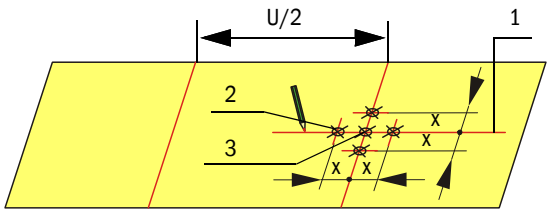
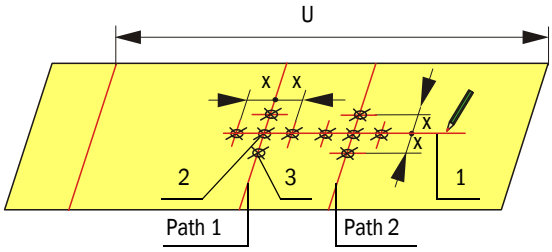
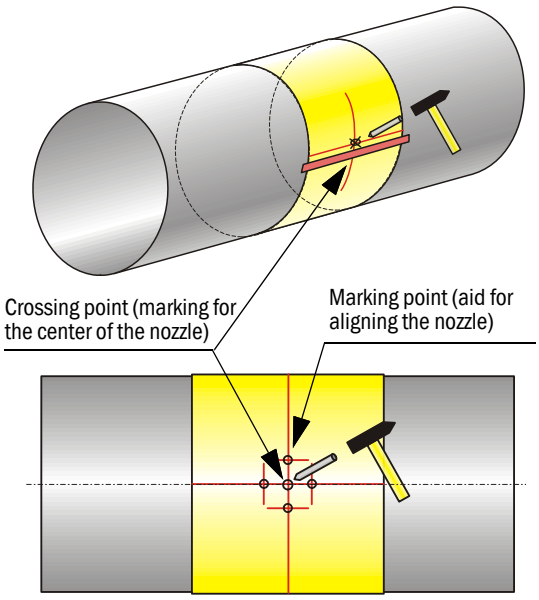
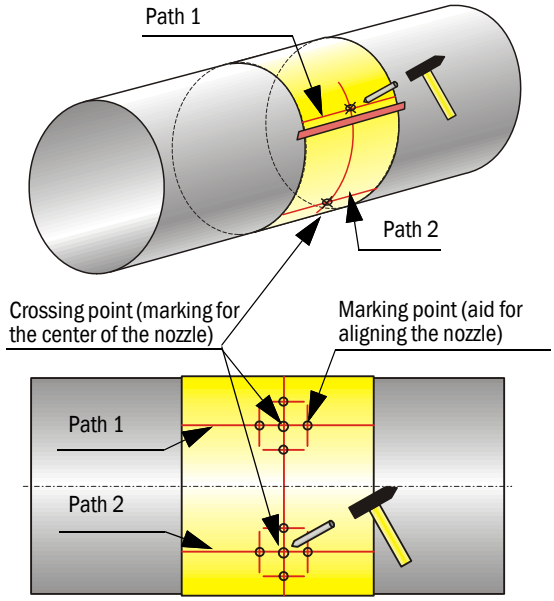
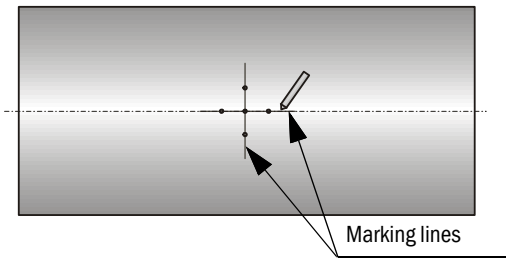
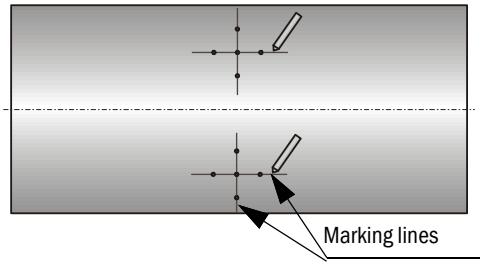
1-path measurement	2-path measurement
1) Start preparation work as shown in → p. 61, Fig. 23.	
4a) Roll the strip out again and mark the kink line. 	4b) Roll the strip out again and mark the lines as follows: 
5) Draw a guide line (1) for the nozzle position(s), mark crossing points (2) and draw marking points (3) in distance 80 mm (x) from the crossing points. 	

Fig. 28 Marking the nozzle position(s) on the pipeline for the probe version

1-path measurement	2-path measurement
6) Roll the strip back around the pipeline and mark the nozzle positions with crossing and marking points by using a metal center punch.	
	
7) Take the strip off again and join the additional markings with a line.	
	

5.6.7.4 **Welding the nozzle on**

Use the installation tool that corresponds to the nozzle to be welded on the pipeline to carry out the following work.

WARNING: Hazards through combustible gases or high pressure
If “hot tapping” is not used, depressurize the pipeline and flush free of flammable gases before starting the work.

WARNING: Risk of explosion/health hazard
A faulty welding seam can allow gas to escape from the pipeline. This can immediately lead to a dangerous situation.
- ► Ensure welding seams are gas-tight.
- ► Check strength and durable tightness of the welding seams.

WARNING: Qualified personnel required

- Any welding and installation work on pipelines may only be carried out by authorized personnel with a specific qualification.
- Special qualified and approved procedures have to be followed. This procedure requires the written agreement by the plant operator.
- The general safety requirements and all other plant operator instructions have to be followed.

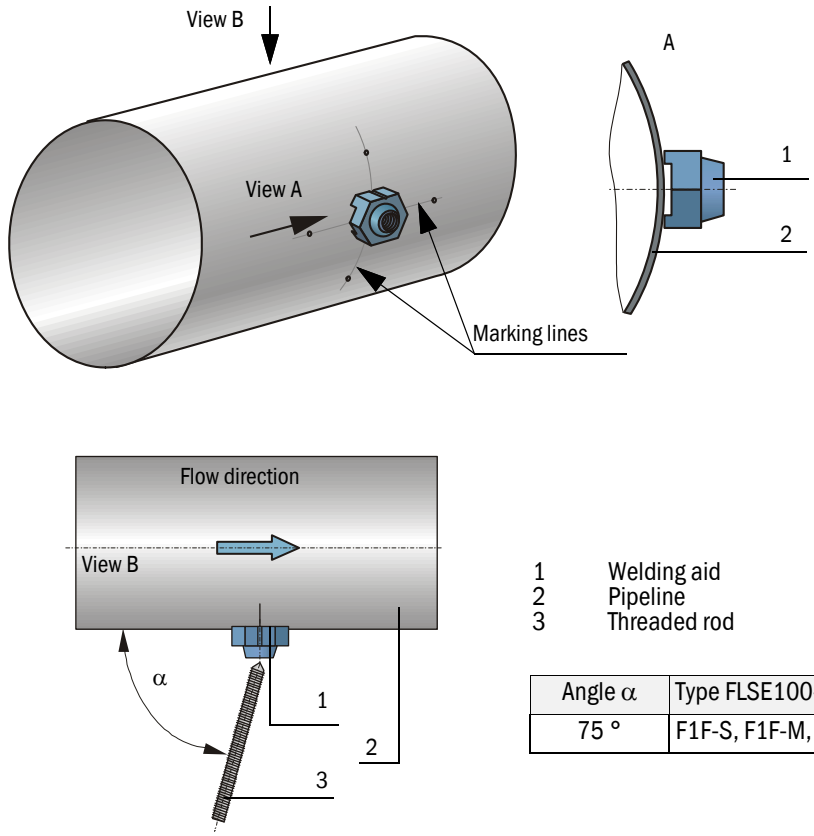
► Position the welding aid (1) on the pipeline (2) as shown in → Fig. 29.

NOTICE:
Check the welding aid position after welding. The deviation from the drawn lines must not be more than 0.5 mm. Otherwise reposition the welding aid.

► Screw in threaded rod (3) with the sharp tip in the welding aid.

NOTICE:
The threaded rod is fitted by the manufacturer with a clamp ring. This is to aid removal of the centering plate following installation of the nozzles. The clamp ring should therefore not be removed.

Fig. 29 Positioning of the welding aid



1 Welding aid
2 Pipeline
3 Threaded rod

Angle α	Type FLSE100-XT
75 °	F1F-S, F1F-M, F1F-H, F1F-P

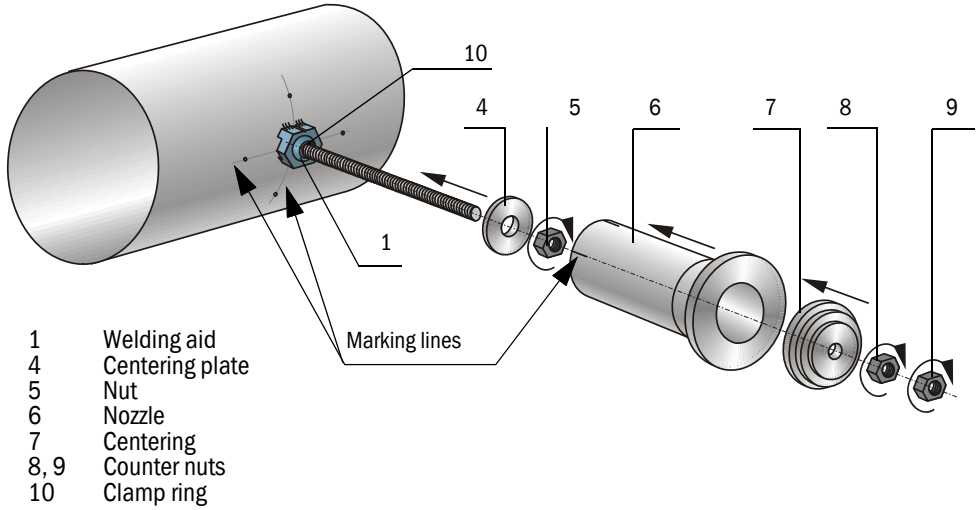
► Slide centering plate (4) on the cone of the welding aid (1) and fasten with the nut (5).
► Slide nozzle (6) over threaded rod and centering plate.

- ► Position centering (7) into the nozzle opening so that the marking on the centering corresponds to the nozzle type (ANSI or DIN, size).
- ► Screw counternuts (8), (9) onto the threaded rod, position and secure the nozzle with suitable auxiliary materials so that the required weld gap is achieved (e.g. use an uncoated wire).

  Align the nozzle so that the marking lines on nozzle and pipe wall are flush.

  Especially for two-path installations, the additional nozzle identifications "Left" and "Right" must be observed! On a horizontally running pipe, the nozzle with identification "Left" must be aligned above and with identification "Right" below the pipe, with the marking lines in the direction of flow.
- ► Then fasten the nozzle.

Fig. 30 Fitting the nozzle

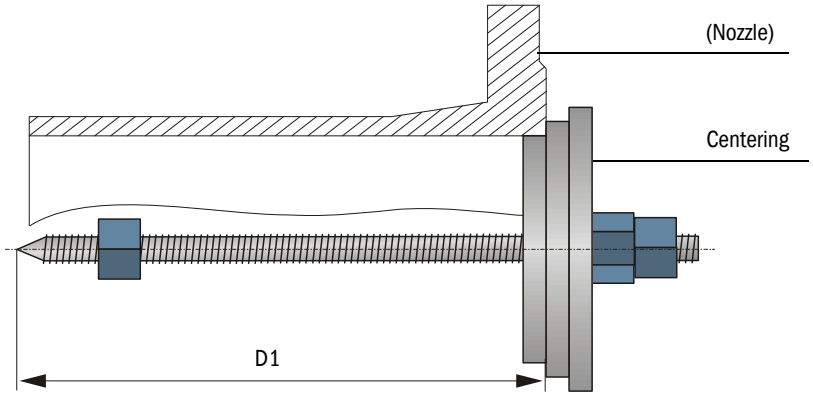


1	Welding aid
4	Centering plate
5	Nut
6	Nozzle
7	Centering
8, 9	Counter nuts
10	Clamp ring

- ► Unscrew the threaded rod as a whole from the welding aid. To do this, place a wrench on the counternuts. The centering plate will be removed by the clamp ring.
- ► Finish off the weld seam piece by piece and allow sufficient time for cooling down to avoid unnecessary strain or distortion on the nozzle and pipe wall.

  In order to ensure the promised measurement uncertainty according to → p. 181, §12 “Technical data”, a sinking of the nozzles into the pipe wall or a distortion of the nozzles must be avoided.
- ► For cross-duct versions of FLOWSIC100 Flare-XT (F1F-S, F1F-M, F1F-H):
  - Determine the distance D1 between outer pipe wall and centering after a sufficient time for cooling down.
  - On cross-duct versions, weld the nozzle on the opposite pipeline side in the same manner and then determine distance D2.
  - Note measures D1 and D2; these measures are required for the geometry calculation during commissioning .

Fig. 31 Determining the effective nozzle length



- ► Ball valves have to be installed when using retractable sender/receiver units. The ball valves are installed after finishing nozzle welding.
- ► Check and ensure gas tightness of ball valve installation before you continue.

WARNING: Hazard through leakage
- ► Operation in leaky condition is not allowed and potentially dangerous.
- ► Hazard through explosive, toxic and hot gas!

Drilling holes into the pipeline if plant is out of operation

The pipe wall must be drilled out at the nozzle position so that the sender/receiver unit can be inserted into the pipeline (→ p. 61, §5.6.7).

- ► Only once on each nozzle.
- ► Have this work done by skilled persons specially qualified for this work.

Drilling holes into the pipeline if plant is in operation (“hot tapping”)

WARNING: Hazards during “hot tapping”
When sender/receiver units are installed on the pipeline when the system is in operation (“hot tapping”):
- ► Only have this work done by skilled persons qualified for “hot tapping”.
- ► Comply with all legal, general and company-internal regulations.
- ► Only start installation work when all planned measures have been checked and approved by the plant operator.

- ► Only once on each nozzle.
- ► The hole cutter diameter must be 46 … 48 mm for 2“ nozzles.

- ► Mount the drilling tool on the ball valve.
- ► Open the ball valve and drill out the holes in the pipeline in the center of the nozzle position.
- ► Retract the drilling tool.
- ► Close the ball valve again. Then, remove the drilling tool.
- ► Mount a blind flange on the ball valve as long as no sender/receiver unit is installed.

WARNING: Accident risk
When the hole has been drilled and no sender/receiver unit has been installed: Gas flows through the pipeline when the ball valve is opened.
- ► Keep the ball valve closed and fitted until a sender/receiver unit has been fitted.
- ► Secure the ball valve against unintentional activation.
- ► Instruct other persons accordingly.

5.6.8 **Fitting the sender/receiver units**

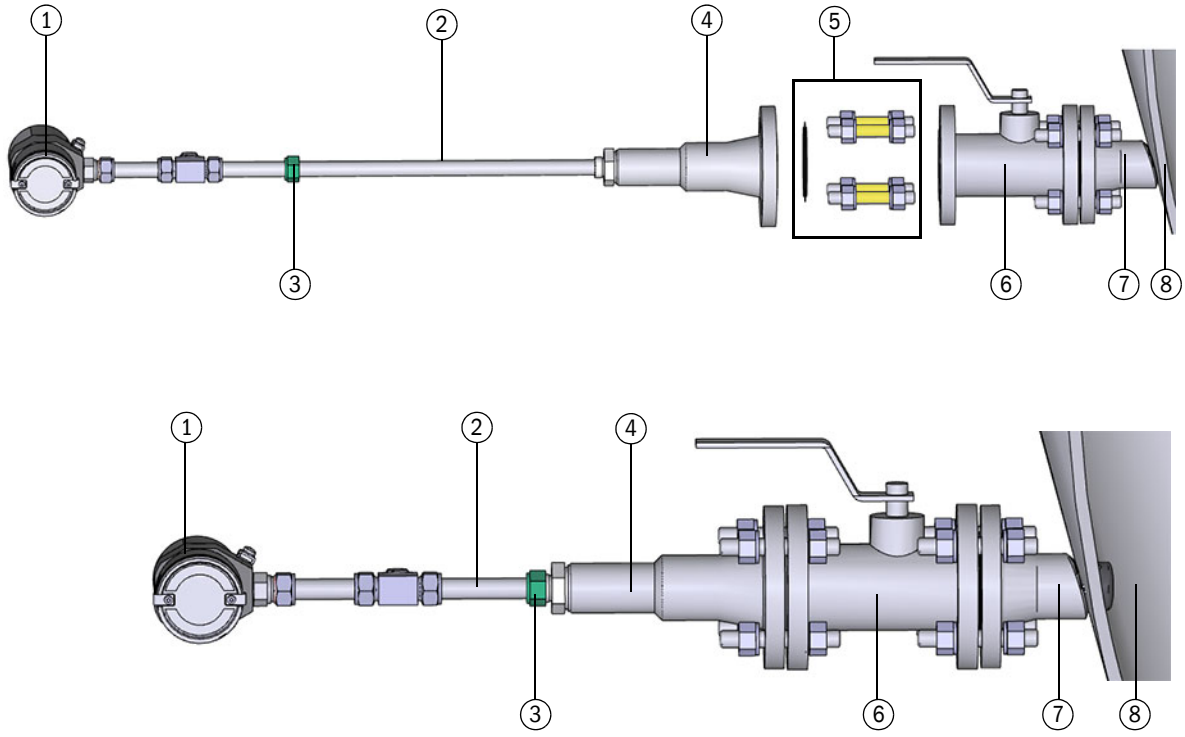
WARNING: General risks during installation

- ► Observe and follow the valid regulations and safety regulations as well as the safety notices in → p. 36, §5.2.
- ► Take special precautions for plants with increased hazard potential (toxic/ aggressive/explosive gases, higher pressure, higher temperature). Otherwise serious injuries are possible.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.
- ► Observe the allowable operating parameters during all work.
- ► Ball valve and sender/receiver unit do not function correctly following incorrect installation. Both parts can be damaged. Serious injuries are possible.

Tools required

- 2 jaw wrenches, size 27and jaw wrench, size 30
- Length gauge: tolerance 1 mm
- Torque wrench, size 41, tightening torque: 150 Nm

Fig. 32 Overview



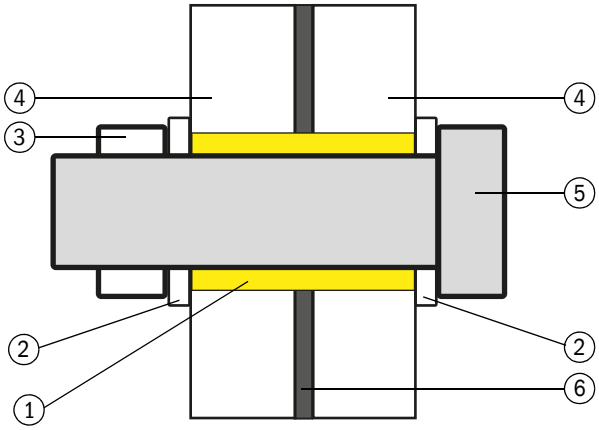
1 Electronics unit
2 Duct probe
3 Cutting ring screw connection
4 Retraction nozzle
5 Mounting kit (gasket, fastening screws, nuts, washers, centering sleeves)
6 Ball valve
7 Nozzle
8 Pipeline

Using the centering sleeves

The mounting kit for the sender/receiver units includes centering sleeves.

The centering sleeves serve to ensure the centering of the process flanges of the sender/receiver units.

Fig. 33 Using the centering sleeves

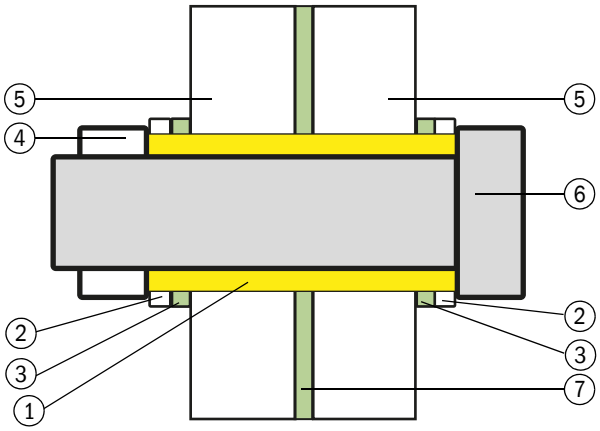


1 Centering sleeve
2 Washer
3 Nut
4 Flange
5 Fastening screw
6 Seal

Using the nozzle insulation set (accessory)

A nozzle insulation set is available as an option (Part No. 2057569) to prevent galvanic corrosion of the LTCS nozzles and stainless steel ball valves. The insulation sleeves included in the nozzle insulation set replace the standard centering sleeves. In this case, dispose of the centering sleeves and use the longer insulation sleeves instead.

Fig. 34 Using the nozzle insulation set



1 Insulation sleeve
2 Washer
3 Insulating disc
4 Nut
5 Flange
6 Fastening screw
7 Seal

Check the following points before installation

- Sender/receiver units to be fitted for a particular measuring point must belong to the same system to ensure the maximum measurement accuracy possible. Exchanging structurally identical sender/receiver units from different measuring systems is not allowed.
- Sender/receiver unit pairs are matched and can only be exchanged in pairs for identical units.
- Sender/receiver units from one system are marked with sequential serial numbers (printed on the device label).

  The FLSE100-XT active sensor always has the lower number and the FLSE100-XT passive sensor has the higher number.
- The flange connections of the sender/receiver units and nozzles must be compatible.
- The flange connections of the nozzles must be free of welding beads on the inside.

NOTICE:

The deformation characteristic of the flange gasket has an influence on the geometry of the installation and therefore on the uncertainty of the measurement. Endress+Hauser recommends:

- Only use the same gasket type as the original delivery.
- Apply a tightening torque according to the installed gasket, → p. 225, §15.6.

5.6.8.1 **Calculating wetted part length wL with the geometry calculator in FLOWgate™**

Before installation, calculate how deep the sender/receiver units will be pushed into the pipeline.

The wetted part length depends on:

- Nozzle length
- Gasket thickness
- Ball valve length
- Wall thickness

> ***NOTICE:***
> The wall thickness must be determined accurately to 0.1 mm. Endress+Hauser recommends using a suitable ultrasonic measuring instrument to determine the wall thickness.

1 Start operating software FLOWgate™.
2 Create a FLOWSIC100 Flare-XT off-line device.
1 Open the “Geometry calculator” tile in the “Change parameters” menu.
2 Select the “Cross-duct” or “probe” device type.
3 Select whether the installation is a 1- or 2-path installation.
To do this, move the “Number of paths” slider to “One path” or “Two paths” accordingly.
4 For installations with ball valve, move the “Path is changeable” slider to “Yes”, for installations without ball valve, move it to “No”.
5 For cross-duct versions, enter the “Probe offset” as determined during nozzle installation, → p. 62, §5.6.7.2.
6 Enter the required dimensions:
– Circumference U
– Wall thickness w
– Gasket thickness S
– Gasket thicknesses D1 and D2
– For installation with ball valve: Length of ball valve VL
– Angle β: For cross-duct versions, enter the nominal nozzle angle (e.g. 75°, 60°, 45°). For the probe version, measure the installation angle and enter the exact value (maximum tolerance for measuring the installation angle: ±0.3°).
7 Click “Calculate parameter values” in “Parameter values”.
The wetted part length wL is calculated .
8 Click “Create Report” to generate a protocol of the geometry data.

> ***NOTICE:***
> The Geometry Data report is required when commissioning the measuring system with FLOWgate™ , → p. 151, §7.5.4.

Fig. 35 Creating a protocol

Fig. 36 Installation of F1F-S, F1F-M, F1F-H (cross-duct versions)

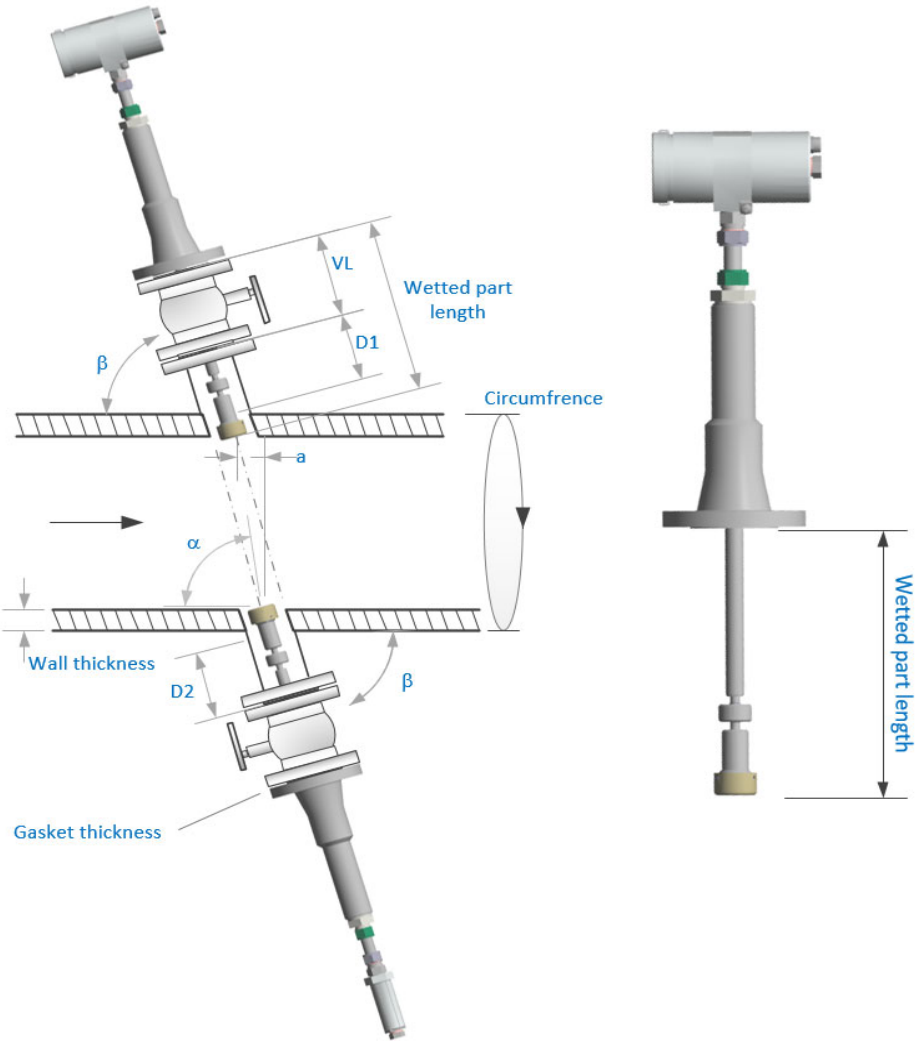
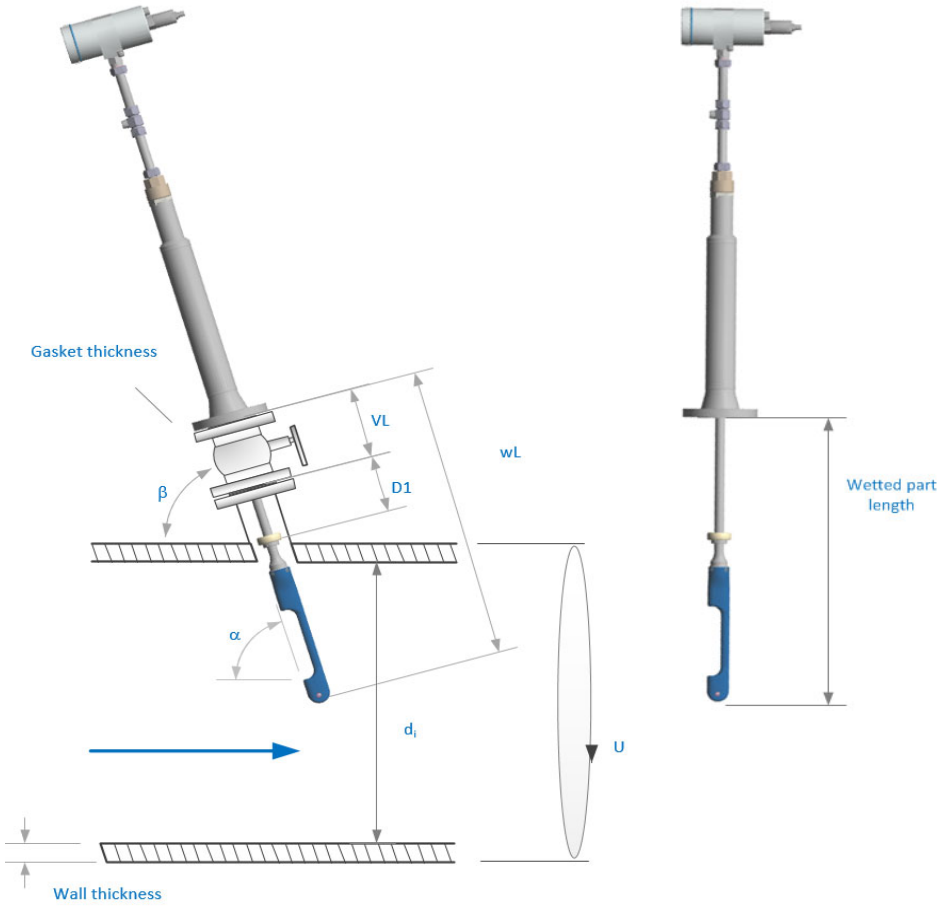


Fig. 37 Installation of F1F-P (probe version)



5.6.8.2 **Tightening the self-cutting ring**

Endress+Hauser recommends that the correct setting of the wetted part length and tightening the cutting ring be carried out in a workshop before installation in the pipeline.

Tightening the self-cutting ring in the correct position ensures the correct wetted part length for installation in the pipeline.

WARNING: Risk of leakage due to damage to the duct probe

If the duct probe is displaced when the pipe screw fitting is tightened, the duct probe may be damaged so that no tightness can be achieved after tightening the cutting ring.

- ► Only move the duct probe when the pipe screw fitting is loosened.
- ► Tighten the pipe screw fitting with a torque of 150 Nm after positioning the duct probe.

Otherwise there a risk of leakage.

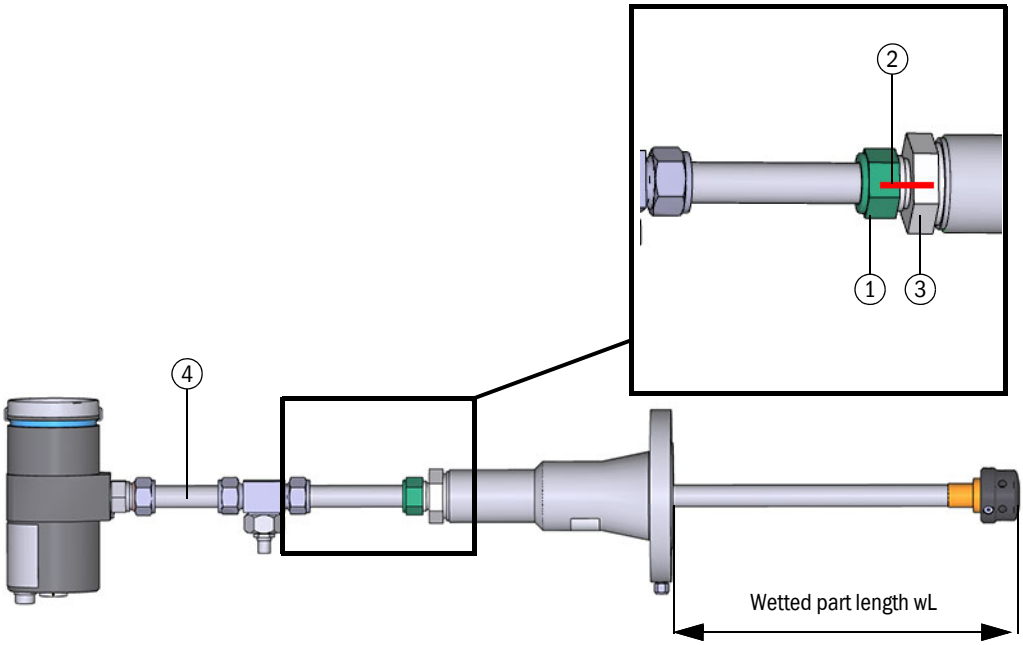
***NOTICE:* Damage due to incorrect position of the self-cutting ring**

The position of the self-cutting ring cannot be changed after tightening! If the self-cutting ring is tightened in the wrong position, the sender/receiver unit must be replaced; for cross-duct versions both sender/receiver units must be replaced.

Before tightening the self-cutting ring, make sure that the wetted part length has been calculated correctly:

- ► Check the measured values.
- ► Check that the wetted part length is plausible compared with nozzle length and ball valve length.

Fig. 38 Positioning of self-cutting ring (overview)

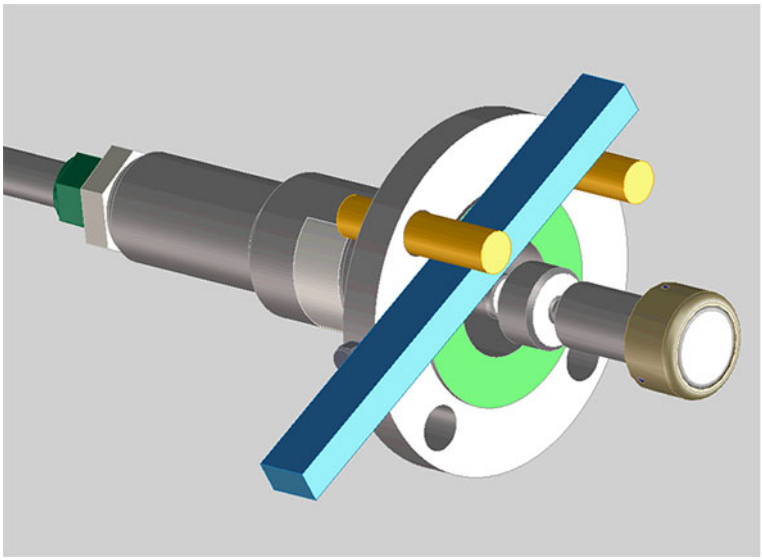


1 Cap nut (self-cutting ring fitting)
2 Self-cutting ring marking
3 Pipe screw fitting
4 Duct probe

Proceed as follows to set the wetted part length and to tighten the self-cutting ring:

1 Loosen the pipe screw fitting.
The pipe screw fitting is screwed hand-tight at the factory. Loosen the pipe screw fitting completely to set the wetted part length.
2 Set the calculated wetted part length wL and check with a length gauge (maximum tolerance: ±1 mm), → Fig. 38.
3 Screw in the pipe screw fitting and tighten with a torque of 150 Nm. Secure the sender/receiver unit in a suitable manner, e.g.
– Screw the retraction nozzle to a suitable flange connection that provides the space required inside for the duct probe (diameter and length of the set wetted part length wL).
– Alternatively, install threaded bolts/screws in the through-holes of the retraction nozzle to prevent slipping. Position a suitable rigid rod between the threaded bolts/screws for countering. Ensure that the duct probe and the flange sealing surface are not damaged.

Fig. 39 Securing the sender/receiver unit (example)



4 First tighten the self-cutting ring fitting hand-tight.

***NOTICE:* Damage due to incorrect position of the self-cutting ring**
The position of the self-cutting ring cannot be changed after tightening! If the self-cutting ring is tightened in the wrong position, the sender/receiver unit must be replaced; for cross-duct versions both sender/receiver units must be replaced.
Before tightening the self-cutting ring, make sure that the wetted part length has been calculated correctly:
► Check the measured values.
► Check that the wetted part length is plausible compared with nozzle length and ball valve length.

5 Now tighten the self-cutting ring fitting tight 1.25 turns.
Counter with a jaw wrench at the pipe screw fitting.
6 Mark the self-cutting ring fitting position, → Fig. 38.
7 Completely loosen the pipe screw fitting again.
8 Loosen the cap nut again and fully retract the sender/receiver unit for transport and installation in the pipeline.

9 The self-cutting ring remains in the fixed position on the duct probe.

10 Then tighten the pipe screw fitting again hand-tight.

WARNING: Leakage hazard

Repeated use may damage the gasket of the pipe screw fitting.

- ► Before reuse, i.e. whenever the pipe screw fitting is to be tightened again, check the gasket of the pipe screw fitting:
- ► Replace the gasket if it has visible deformations, indentations or damage. In this case contact Endress+Hauser Service.

Otherwise there a risk of leakage.

5.6.8.3 Fitting the venting valve

A venting valve is available as an option from Endress+Hauser (Part No. 2108210).

Use a suitable valve with 1/8" NPT thread when the valve available from Endress+Hauser is not used.

WARNING: Hazard through gas in the pipeline

- ► Install the venting valve only when the sender/receiver unit is not yet installed in the pipeline or when the pipeline is free from pressure and dangerous gas.
- ► During installation and operation, adjust the position of the vent so that personnel do not come into direct contact with the medium.
- ► Open the vent slowly.
- ► Small quantities of medium can escape via the spindle in the open position. Take appropriate protective measures for the operating personnel.

1 Remove the dummy plug on the sender/receiver unit, → Fig. 40.

2 Wrap the sealing tape (PTFE) 2.5 layers around the external thread of the venting valve in thread direction.

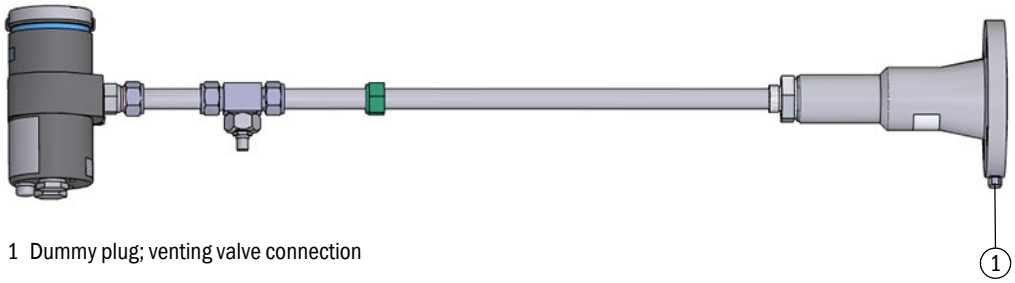
3 Screw the venting valve in.

Pay attention to the alignment of the key surfaces: The valve must not hit the ball valve; align the wrench surfaces as parallel as possible to the flange sealing surface.

4 Tighten the screw plug of the valve so that no gas escapes there.

5 Then carry out a leak tightness check with suitable means.

Fig. 40 Venting valve connection



1 Dummy plug; venting valve connection

5.6.8.4 **Installing sender/receiver units**

WARNING: Hazard through incorrect use of the retraction mechanism

► Observe the information on activating the retraction mechanism, → p. 38, §5.2.5.

1 Make sure the ball valves are closed.
   – If applicable, close ball valves.
   – If applicable, remove blind flanges.
2 Position the flange gasket.
3 Position the sender/receiver unit on the ball valve.
   Make sure the seal does not move during positioning.
   For cross-duct versions, make sure to install the passive sensor (→ Fig. 11) on the nozzle on the downstream side so that the sender/receiver unit points against the flow direction.
4 Insert the 4 bolts with the centering sleeves (→ Fig. 33) and screw the sender/receiver unit on the ball valve.
   Apply a tightening torque according to the installed gasket, → p. 225, §15.6.
5 Completely loosen the pipe screw fitting.
6 Open the ball valve.

WARNING: Danger due to gas leaks

When gas escapes, close the ball valve again and contact Endress+Hauser Service.

7 Push the sender/receiver unit into the pipeline.
8 Check the gasket of the pipe screw fitting for damage.

WARNING: Leakage hazard

Repeated use may damage the gasket of the pipe screw fitting.

► Before reuse, i.e. whenever the pipe screw fitting is to be tightened again, check the gasket of the pipe screw fitting:

► Replace the gasket if it has visible deformations, indentations or damage. In this case contact Endress+Hauser Service.

Otherwise there a risk of leakage.

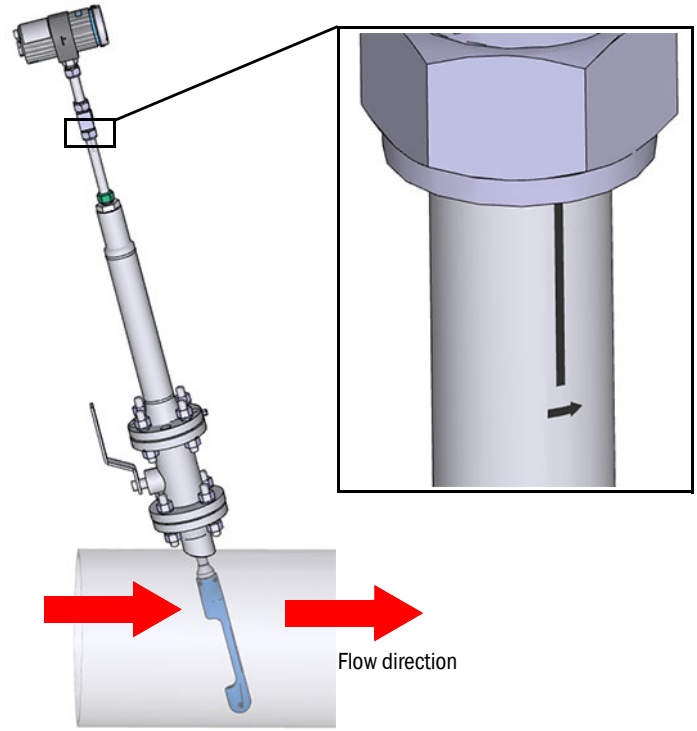
9 Screw in the pipe screw fitting and tighten with a torque of 150 Nm.
10 Push the sender/receiver unit to the stop.
11 On probe version F1F-P, now align the measuring path correctly before securing the self-cutting ring fitting.
   Align the probe version as described in the following section, → "Observe when aligning the probe version".
   For cross-duct versions, proceed with the next step.
12 Tighten the self-cutting ring fitting tight 1.25 turns.
   Make sure the markings for the self-cutting ring fitting are next to each other again, → Fig. 38.
13 For cross-duct versions, install the active sensor on the nozzle on the upstream side so that the sender/receiver unit points in the flow direction.
14 Connect potential equalization of the sender/receiver units FLSE-XT.

Observe when aligning the probe version

Before securing the self-cutting ring fitting again, align probe version F1F-P correctly:

The measuring path must be aligned in flow direction, i.e. the arrow shown must point in flow direction.

Fig. 41 Marking on probe version F1F-P



► Align the measuring path of probe version F1F-P as shown, see → Fig. 41. The maximum deviation of the rotation angle of the probe to the flow direction may be ±3°.

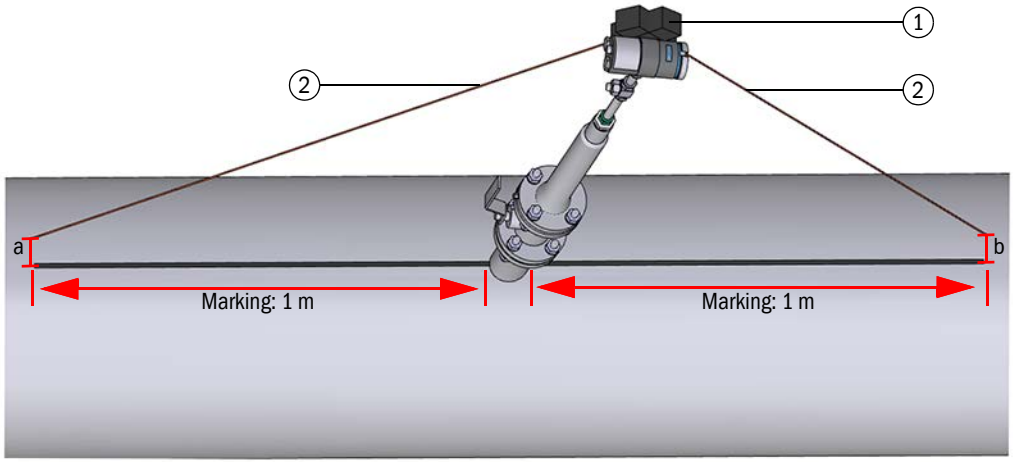
To ensure this, use a laser to align probe version F1F-P:

Alignment of the device to the flow direction using a laser

WARNING: Risk of explosion
The laser may only be used if no Ex atmosphere is present. Use of the laser is not permitted under Ex conditions.

1 Mark the pipe center one meter before and after probe version F1F-P, e.g. with chalk or a felt pen, see → Fig. 42.
2 Place a laser on the side of the electronics housing and let the laser beam hit the pipe at the level of the end of the first marking.
3 Measure the distance between the point of impact of the laser and the marking on the pipeline.
4 Repeat the procedure for the second marking.
5 Align the electronics housing so that distance a corresponds approximately to distance b.
   The maximum permissible difference between value a and value b is 10 mm.
6 After alignment, tighten the self-cutting ring fitting 1.25 turns.
   Make sure the markings for the self-cutting ring fitting are next to each other again, → Fig. 38.

Fig. 42 Alignment of probe version F1F-P



1 Laser
2 Laser beam

5.6.8.5 **Leak tightness check**

NOTICE:

- ► Perform a leak tightness check with suitable means after completion of the installation work.
- ► Also perform a leak tightness check with suitable means after completion of the installation work with spool piece. No leakage check has been made at the factory.

► After a successful leak tightness check, connect the sender/receiver units electrically, → p. 87, §5.7.

NOTICE:

Proceed as follows when leak tightness is not established:

- ► Pull the sender/receiver units back and disconnect them from the process by closing the ball valve, → p. 83, §5.6.9.
- ► Contact Endress+Hauser Service.

5.6.9 Pulling the sender/receiver units back

WARNING: Hazard through incorrect use of the retraction mechanism
► Observe the information on activating the retraction mechanism, → p. 38, §5.2.5.

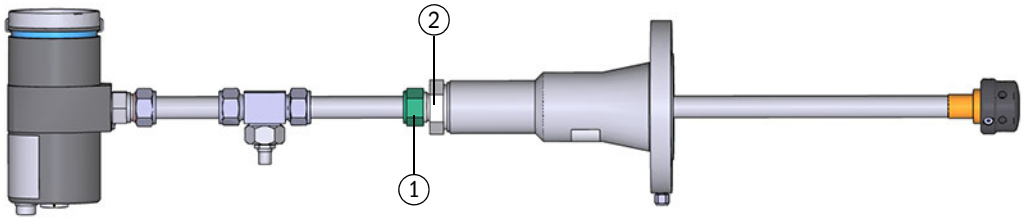
1 Completely loosen the cap nut of the self-cutting ring fitting, → Fig. 43.
2 Completely loosen the pipe screw fitting, → Fig. 43.
3 Pull the sender/receiver unit back completely to the stop.
4 Close the ball valve.

NOTICE:
The ball valve must close without resistance.
If this is not possible:
► Make sure the sender/receiver unit has been pulled back completely.

NOTICE:
Do not use force when the sender/receiver unit cannot be pulled back.
► Tighten the pipe screw fitting again with a torque of 150 Nm.
► Contact Endress+Hauser Service.

NOTICE:
No additional loads may act on the electronics unit and on the cable outlet of the sender/receiver units. Especially in the retracted position, no additional force (except in the direction of the duct probe) may act on the electronics unit.

Fig. 43 Cap nut



1 Cap nut (self-cutting ring fitting)
2 Pipe screw fitting

WARNING: Hazardous gas (possibly explosive or toxic)
Consider the gas trapped in the retraction nozzle, → p. 38, §5.2.5.

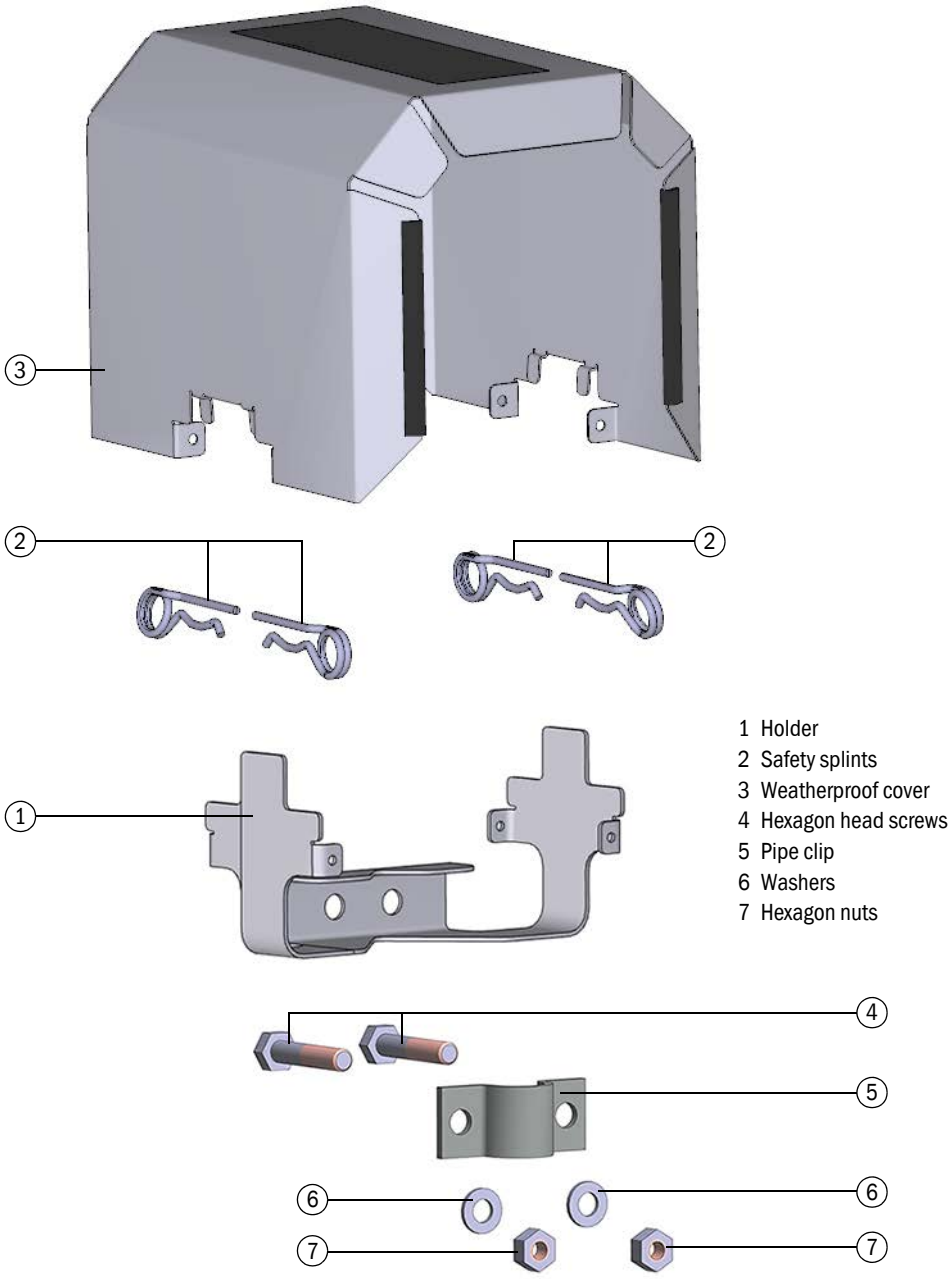
5.6.10 Fitting the weatherproof cover for the sender/receiver unit

The weatherproof cover (Part No. 2105581) serves to shield the electronics of the sender/receiver unit from sunlight and weather influences.

> ***NOTICE:***
> Apart from the Endress+Hauser weatherproof cover, no other loads may be mounted on the devices.

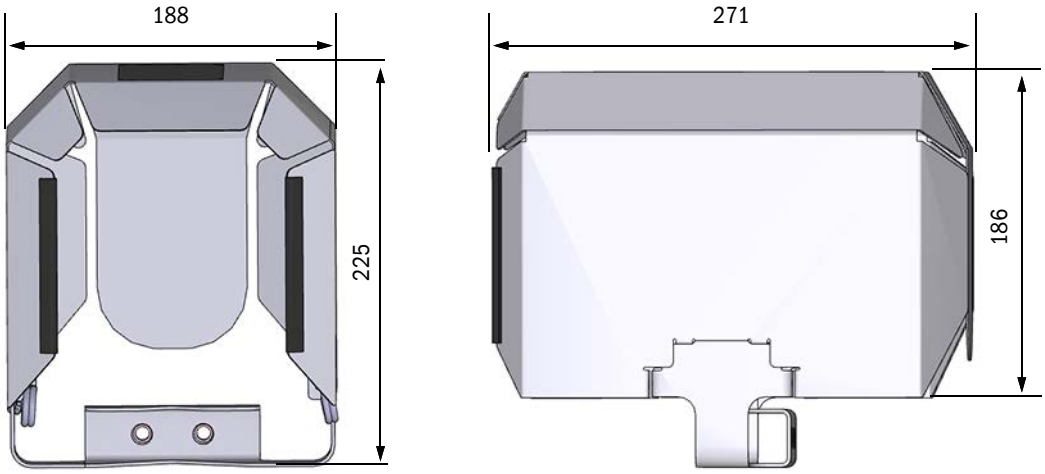
5.6.10.1 Overview

Fig. 44 Weatherproof cover overview



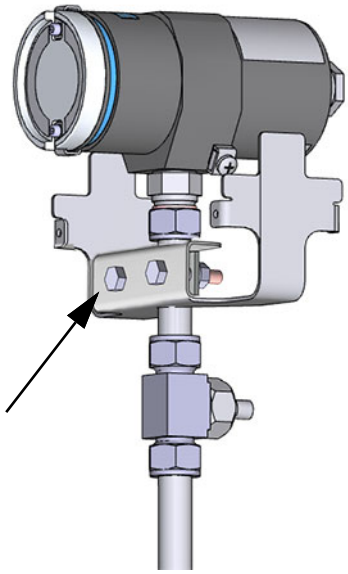
1 Holder
2 Safety splints
3 Weatherproof cover
4 Hexagon head screws
5 Pipe clip
6 Washers
7 Hexagon nuts

Fig. 45 Dimensions [mm]

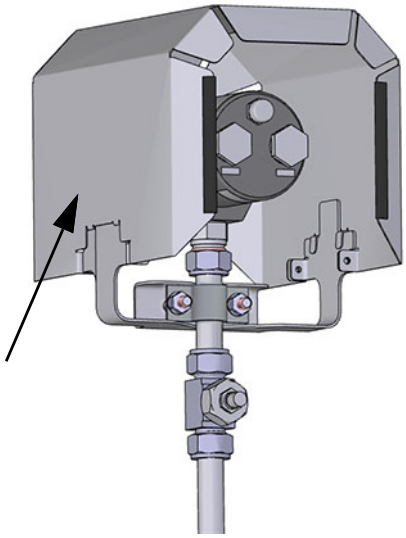


5.6.10.2 **Fitting the weatherproof cover**

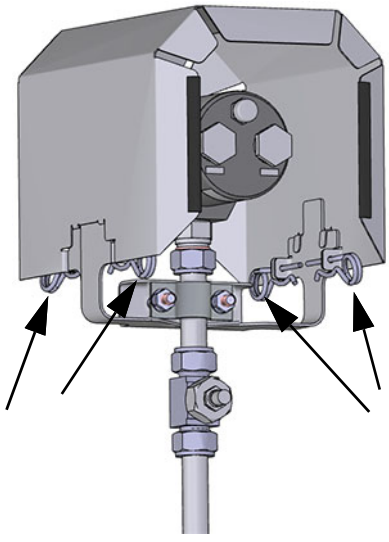
1 Fasten the holder on the sender/receiver unit:
- ► Fasten the holder with the pipe clip to the probe neck of the sender/ receiver unit using hexagon head screws with nuts and washers.
- ► Apply a tightening torque of 18 Nm. Make sure the holder is correctly aligned and the probe is not damaged. See the adjacent Figure.



2 Push the weatherproof cover into the holder.



3 Fix the weatherproof cover with the four safety splints.



5.7 Electrical installation

5.7.1 General instructions, prerequisites

All assembly work previously described must be completed (as far as applicable) before starting installation work. Unless otherwise agreed with Endress+Hauser or an authorized representative, all of the installation work must be carried out by the plant operator. This includes laying and connecting the power supply and signal cables and installing switches and power fuses.

WARNING: Electrical hazard

Incorrect cabling can cause serious injuries, device malfunctions or failure of the measurement system.

- ► Observe the relevant safety regulations as well as the safety notices in → p. 36, §5.2 during all installation work.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.

5.7.2 Cable specification

The following cable specifications correspond to the standard Endress+Hauser cables. Special requirements on cabling in the Ex zone are not considered here. The plant operator is responsible that all cables used comply with valid regulations and guidelines for cabling in hazardous areas at the plant.

Standard connection cables between sender/receiver units

The standard connection cables between sender/receiver units are included in the scope of delivery.

- Connection cable between sender/receiver units of device types F1F-M, F1F-S

  Cable type: Exi, coaxial, RG62, connection TNC with safeguard against pulling off, length 3 m

- Connection cable between sender/receiver units of device type F1F-H

  Cable type: Armored cable with certified flameproof cable glands including separating seal, completely mounted, length 5 m

Connection cable between sender/receiver units and higher level control system

The connection cable between sender/receiver units and the higher level control system must comply with the following standard and can optionally be ordered from Endress+Hauser:

Cable type: Li2YCYv(TP) 2x2x0.5 mm^2, with reinforced outer sheath, from Lappkabel

The cable must fulfill the following requirements for function of the device:

- Operating capacity < 150 pF/m
- Wire cross-sectional area at least 0.5 mm^2 (AWG20 to AWG16 max.)
- Screen with Cu wire mesh

The maximum cable length for the RS485 interface is defined as 1000 m total length, i.e. 500 m each for 2-path installations with two sender/receiver units connected in parallel.

When designing the cable cross-section for the power supply of the sender/receiver units, the voltage drop across the cable due to the line resistance must be taken into account.

The supply voltage on the sender/receiver unit must be at least 20 V.

With a supply voltage of 24 V (as e.g. also from a mains-supplied Interface Unit) and a current consumption of 40 mA for a sender/receiver unit, the following maximum line resistance results:

$$\frac{(24\,V - 20\,V)}{40\,mA} = 100\,\Omega$$ in total for the plus and minus lines

For 1000 m and a cable cross-section of 0.5 mm^2, the following calculation results:

$$\frac{35\,\Omega}{km} \cdot 1000\,m \cdot 2 = 70\,\Omega$$

This value is thus below the limit value of 100 Ω.

With smaller cable cross-sections or a lesser lower supply voltage limit, there may therefore be restrictions on the maximum cable length.

5.7.3 Cable glands

The enclosure inputs are closed with certified sealing plugs. Cable glands are not included in the scope of delivery, except for the completely installed connection cables between the sender/receiver units type F1F-H.

Only use installation material approved for the applied hazard zone.

The user is responsible for correct selection.

5.7.4 Requirements for installation in the Ex zone

WARNING: Risk of explosion

- ► Do not open the enclosures while energized.
- ► Do not connect or disconnect the circuits unless the voltage has been turned off or the area is safe.
- ► When using alternative connection of devices not belonging to the system, especially external power supply devices, power supply units, etc., ensure that the maximum voltage at the connections does not exceed 125 V even if a fault occurs.
- ► Do not use the device when cables or terminals are damaged.

General information

- The documentation for zone classification according to EN 60079-10 must be available.
- The devices to be used must be checked for suitability for the application area.
- After installation, an initial test of the device and the plant according to EN/IEC 60079-17 must be performed.

Cables

- Cables must fulfill the requirements according to EN 60079-14.
- Protect cables especially endangered by thermal, mechanical or chemical stress, e.g. by laying in protective tubes.
- Cables must be flame-retardant according to DIN VDE 0472 Part 804. The fire behavior according to B / IEC 60332-1 must be approved.
- Observe the clamping range of the cable glands for cable selection.
- Ex-d cable gland must be suitable for the intended cable type (e.g. cables with or without armoring).
- Cables and lines for Ex-d cable glands must comply with the requirements in EN 60079-14.

- Protect the wire ends with connector sleeves against fraying.
- Replace unused cable glands with certified Ex-d sealing plugs.
- Connect or safeguard unused wires to ground so that a short circuit with other conductive parts is excluded.
- Carry out potential equalization in accordance with EN 60079-14 (see also the following Section).
- “Conduit” systems must comply with the requirements in EN 60079-14 9.4 and 9.6. In addition, compliance with national and other relevant standards is required.
- “Conduits” according to IEC 60614-2-1 or IEC 60614-2-5 are not suitable.
- “Conduit” systems must be protected against vibration.
- Use thread sealant according to EN/IEC 60079-14, Section for threads with ½" NPT.

The following applies additionally for intrinsically safe cable connection with intrinsically safe ultrasonic transducers/probes for the F1F-M, F1F-P, F1F-S sender/receiver units:

- The device marking must at least include the information Ex ia.
- Use only cables delivered by Endress+Hauser.

  The connections of the intrinsically safe ultrasonic probes are designed so that the individual circuits are safely separated from other intrinsically safe and non-intrinsically safe circuits.

  If the transducer circuits are disconnected while energizing, it still must be observed that the safe separation from other intrinsically safe and non-intrinsically safe circuits is not overridden and thus intrinsic safety endangered. For this reason, the associated connection cable should be disconnected at both ends, i.e. unplugged individually and successively, first from the electronics and then, if required, from the ultrasonic probes, or suitably attached to prevent uncontrolled movement of the cable with the unprotected, open cable connector. The cables for the intrinsically safe components are marked either with “Exi” or a blue cable covering or with blue shrink sleeves on the cable ends or with the Endress+Hauser item number, at least on the associated packaging. The technical safety data are shown in the Type Examination Certificate.
- Operation of the sender/receiver units type F1F-M, F1F-P, F1F-S with sensors and components not belonging to the system and sensors from other manufacturers is not permitted. See the Type Examination Certificate for the technical safety data.

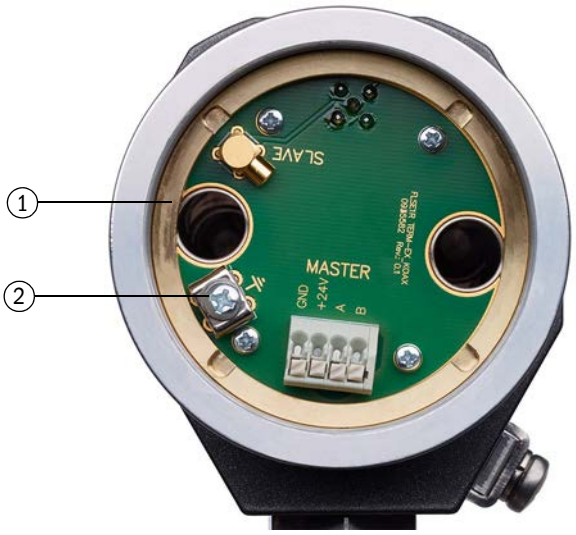
Specific requirements for installation in the USA and Canada

- Installations in USA must be carried out according to NEC (ANSI/NFPA70).
- Installations in Canada must be carried out according to CEC part 1.

5.7.5 Connection overview

Pin assignment in the terminal compartment of the sender/receiver units

Fig. 46 Terminal compartment FLSE100-XT sender/receiver with electronics (active sensor)



1 Terminal compartment open
2 Grounding terminals

Table 9 Connection of the sender/receiver units

Terminals	Description				
Designation in Terminal box	Active sensor				Passive sensor
	B	A	+24 V DC	GND	MCX connector
External connection **	yellow	green	white	brown	
Assignment	IF1	IF1	+24 V DC	GND	

**: Applicable only for cables with wire color code according to DIN 47100
IF1: Communication between FLSE active sensor and a higher level control system (Interface 1)
MCX: Signal for FLSE passive sensor

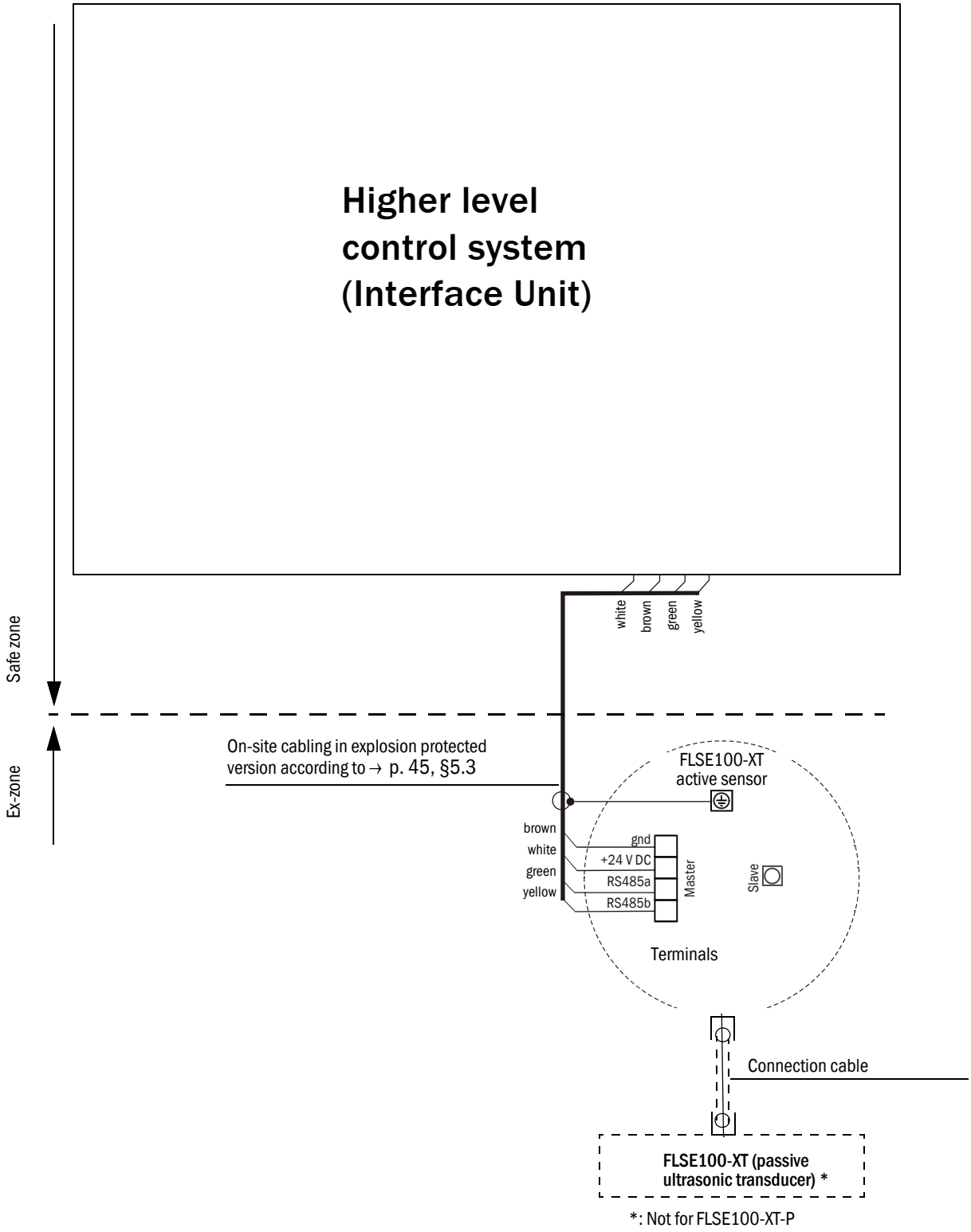
> ***NOTICE:***
> Self-locking terminals for wire sizes 0.5 .. 1.5 mm² (AWG20 ... AWG16).

Interconnection of sender/receiver units

- ► For the F1F-H device, use a coax plug-on aid to connect the passive sensor to the active sensor.
- ► Support and fix the connection cables accordingly so that no significant additional forces can act on the duct probe ends.

5.7.6 Connection diagrams

Fig. 47 Cabling of the sender/receiver units



FLOWSIC100 Flare-XT

6 Installation Interface Unit

Intended use
Safety information
Product description
Installation
Electrical installation

6.1 Intended use

The Interface Unit is a device for recording, processing and transferring of measured values. For example, the Interface Unit can be used for controlling the sender/receiver units

FLSE100-XT as well as for the calculation, evaluation, output and display of measured value data.

Using the device for purposes other than those intended can lead to safety-critical conditions. The manufacturer bears no responsibility for any other use.

6.2 Safety information

6.2.1 Hazard through electrical equipment

WARNING: Danger through main voltage

- ► Disconnect power supply lines before working on power connections or parts carrying main voltage.
- ► Refit any contact protection removed before switching the main voltage back on again.
- ► The device may only be operated with the cover closed.
- ► Before opening the cover, the device must be disconnected from the power supply.
- ► The device must not be used if the electrical wiring (cables, terminals, ...) is damaged.

6.2.2 Hazard through electromagnetic interference

NOTICE:

According to EN55011:2009, the Interface Unit is a device of group 1, class A. It is intended for operation in an industrial environment. In other environments, especially in living areas, it could possibly be difficult to ensure electromagnetic compatibility due to the occurring conducted as well as radiated interferences. In this case, the operator may be required to take appropriate measures.

Should conditions which exceed the usual level for such areas prevail at the place of use, additional measures may be necessary to reduce electromagnetic interference.

6.2.3 Hazards through explosive or ignitable gases

The Interface Unit may be used in potentially explosive atmospheres only according to the respective specifications.

WARNING: Hazards through explosive or ignitable gases

- ► In potentially explosive atmospheres, only use the version of the Interface Unit specified for such use (→ p. 95, §6.2.5).

6.2.4 Hazards through electrostatic discharges

The electronic housing is painted in the factory with a layer thickness of max. 0.2 mm. Special paintwork can have a higher layer thickness.

WARNING: Ignition hazard through electrostatic discharge

The plastic display surface dimensions of the display flap and of the display exceed the allowable value for ignition group IIC. The user must take appropriate precautions to avoid ignition hazards through electrostatic discharge.

Ignition hazards through electrostatic discharges exist when gas flow meters with special paintwork and a layer thickness >0.2 mm are used in applications with ignition group IIC in accordance with ATEX and IECEx.

- ► For installation, the risk of electrostatic charging of the surface must be reduced to a minimum.

  Therefore, the device should not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. change previous text
- ► Use appropriate caution when performing maintenance and cleaning work.

  For example, the surfaces should only be cleaned with a damp cloth. The respective devices will be identified by the manufacturer with a warning sign.

6.2.5 Operation in potentially explosive atmospheres

The Interface Unit is designed for use in potentially explosive atmospheres according to the respective device version:

Table 10 Device versions

Version	FCF-A	FCF-C
Zone 2/ Div. 2	ATEX: II 3G Ex ec ia IIC T4 Gc IECEx: Ex ec ia IIC T4 Gc	NEC/CEC (US/CA): Ex ec ia IIC T4 Gc Class I Zone 2, AEx ec ia IIC T4 Gc Class I Division 2, Groups A, B, C and D, T4
Zone 1 / Div. 1	ATEX: II 2G Ex db eb ia IIC T4 Gb II 2G Ex db ia IIC T4 Gb IECEx: Ex db eb ia IIC T4 Gb Ex db ia IIC T4 Gb	CEC (CA): Ex db ia IIC T4 Gb NEC (US): Class I, Zone 1, AEx db ia IIC T4 Gb Class I, Division 1, Groups B, C and D T4

Operation in potentially explosive atmospheres

This is a hazardous area in which an explosive atmosphere exists under the following normal atmospheric conditions:

- Specified ambient temperature -40 … +60 °C, optional maximum ambient temperature of +65 °C
- Ambient pressure 80 kPa (0.8 bar) to 110 kPa (1.1 bar)
- Air with normal oxygen content, typically 21 percent by volume.

Specific conditions of use (denoted by X after the certificate number)

- Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.
- For “Ex ec ia” models: Opening the unit is only permitted if it is disconnected from the power supply.
- For “Ex db ia” and “Ex db eb ia” models: Opening the unit is only permitted if an explosive atmosphere can be excluded.
- In order to maintain the IP54 protection suitably certified glands must be fitted.

***NOTICE:* Requirements for cable glands**
For requirements for cable glands, see → p. 124, §6.5.3 “Cable glands”.

6.2.6 Warning information on device

WARNING: Danger identification on device
The following symbol draws attention to important dangers directly on the device:

► Consult the Operating Instructions in all cases where the symbol is attached to the device or shown on the display.

6.2.7 Requirements on the personnel's qualification

► Read the Operating Instructions before putting the Interface Unit into operation.
► Observe all safety information.
► If anything is not clear: Please contact Endress+Hauser Customer Service.

Designated users

All operators of the Interface Unit should be specifically trained on this device, knowledgeable of relevant regulations, and able to assess potential hazards related to its operation. Skilled persons are persons according to DIN VDE 0105, DIN VDE 1000-10 or IEC 60050-826 or directly comparable standards.

The named persons must have exact knowledge of operational hazards caused, e.g., by low voltage, hot, toxic, explosive gases or gases under pressure, gas-liquid mixtures or other media as well as adequate knowledge of the measuring system gained through training.

Specific requirements for use of devices in hazardous areas

- ► Cabling/installation, device setup, maintenance and testing may only be carried out by experienced persons familiar with the rules and regulations for hazardous areas, in particular:
  - – Degree of protection
  - – Fitting instructions
  - – Area definition
- ► Regulations to be applied:
  - – IEC 60079-14
  - – IEC 60079-17

  or comparable national regulations.

6.2.8 Restrictions on use

WARNING: Hazard through pressure/temperature

► Only use the Interface Unit within the pressure and temperature limits as specified in these Operating Instructions as well as on the type plate.

WARNING: Dangerous voltage

- ► Do not open the enclosure while energized.
- ► Only operate internal switches if the device is not live or the area is safe.
- ► Do not connect or disconnect the circuits unless the power has been turned off or the area is safe.
- ► It must be ensured that the rated voltage U_M 60 V is not exceeded when connected to devices not belonging to the system, in particular external power supply devices, power supply units, etc.; except for the main power supply with U_M < 253 V.
- ► A suitable main power switch must be provided.
- ► Do not use the device when cables or terminals are damaged.

WARNING: Risk of explosion

In a closed enclosure, degree of contamination 2 according to IEC 60664-1 is assumed. Opening the enclosure is only permitted when the environment does not endanger degree of contamination 2 inside the enclosure (e.g. through penetration of conductive dust or moisture).

WARNING: Device restrictions/high risk use

The device firmware is not designed for any use requiring fail-safe performance in which the failure of the computer system could lead to death, serious personal injury, or severe environmental damage, and therefore must not be used in such areas.

NOTICE:

The use of the analog output in real-time control loops is not recommended because its output value may deviate beyond the specified tolerance level during a disturbance due to burst and surge events.

6.3 Product description

6.3.1 Product identification

Product name:	Interface Unit
Manufacturer	Endress+Hauser SICK GmbH+Co. KG Bergener Ring 27 01458 Ottendorf-Okrilla Germany
Type plate	The type plate is located on the right side of the device.

Fig. 48 Type plate IECEx/ATEX Zone 2 (example)

AC -Version

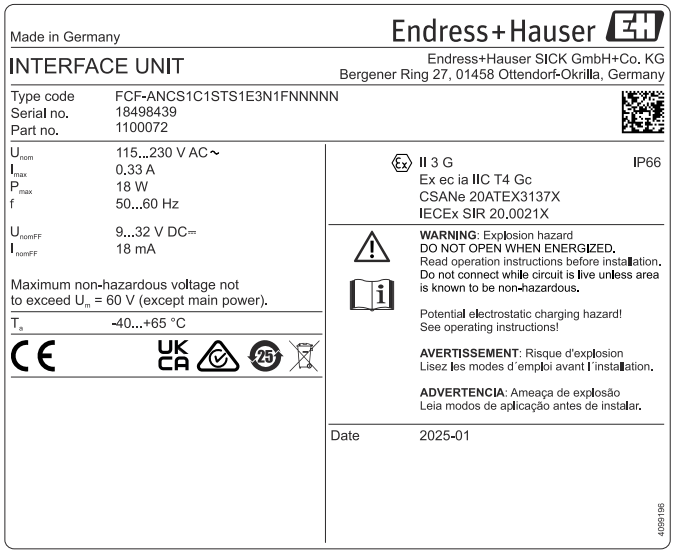


Fig. 49 Type plate IECEx/ATEX Zone 1 (example)

Ex d

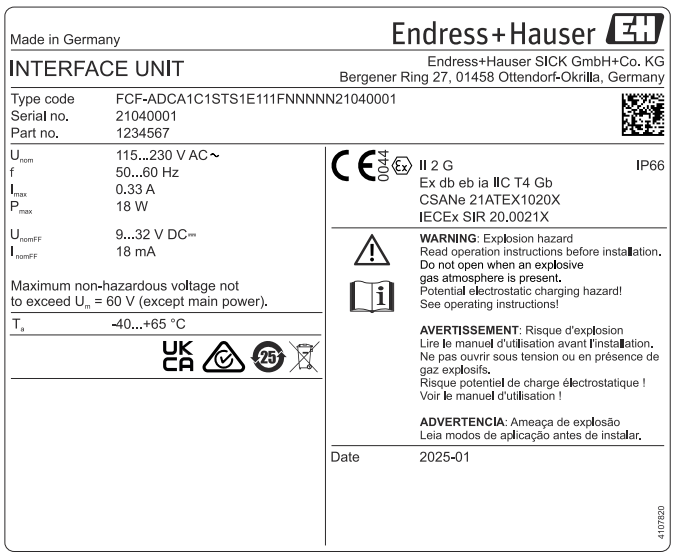


Fig. 50 Type plate CSA Div 2 (example)

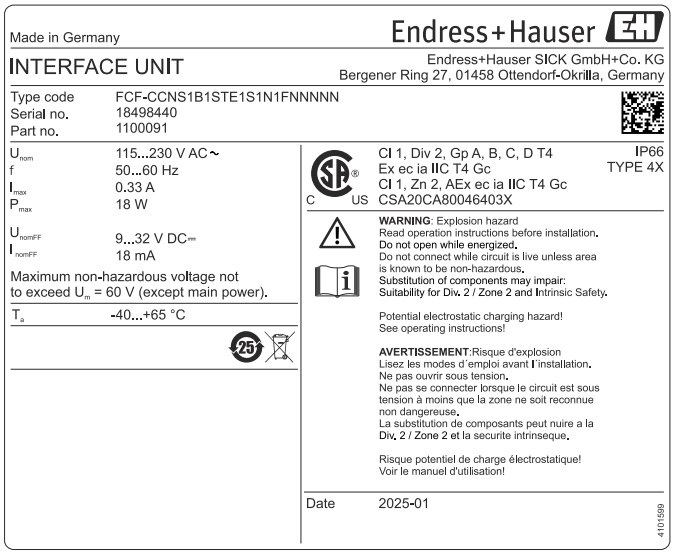
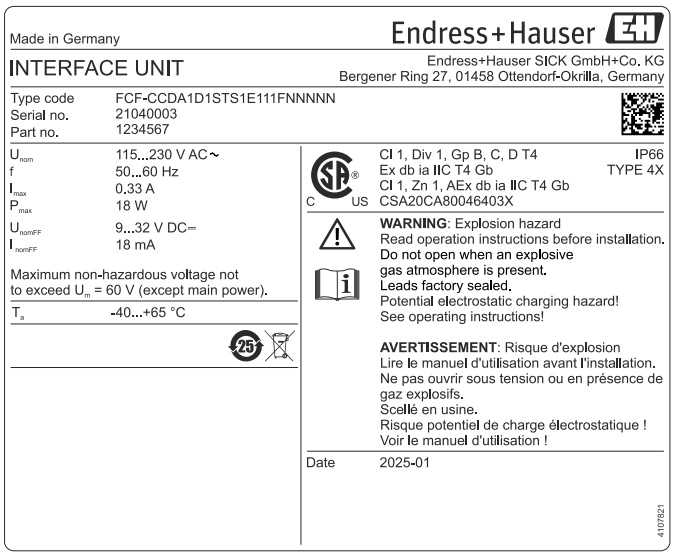


Fig. 51 Type plate CSA Div 1 (example)



6.3.2 Device versions

Fig. 52 Zone 2/Div. 2 resp. Non-Ex

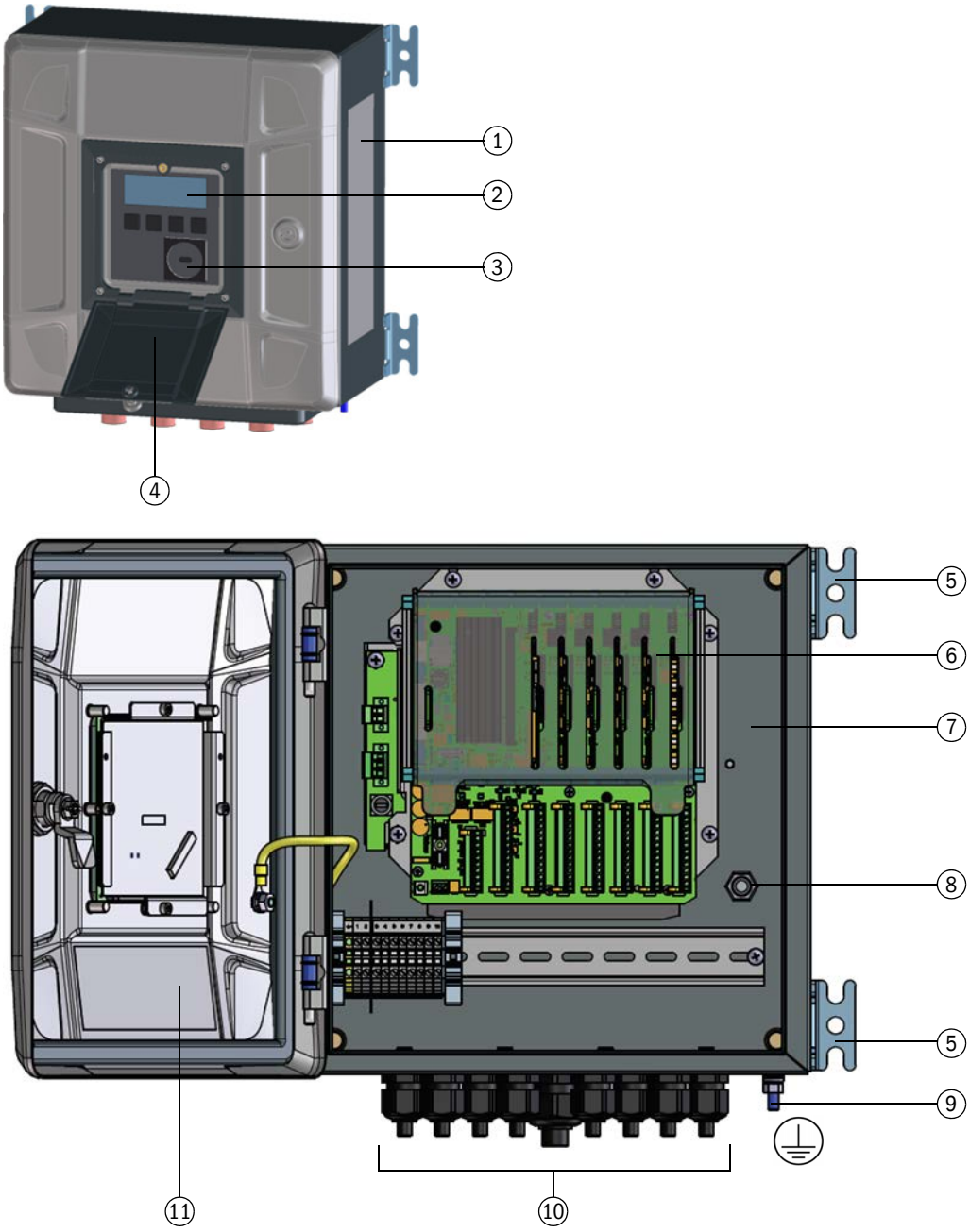
Fig. 53 Zone 1/Div. 1 Ex d

Fig. 54 Zone 1/Div. 1 Ex d e

6.3.3 Device components

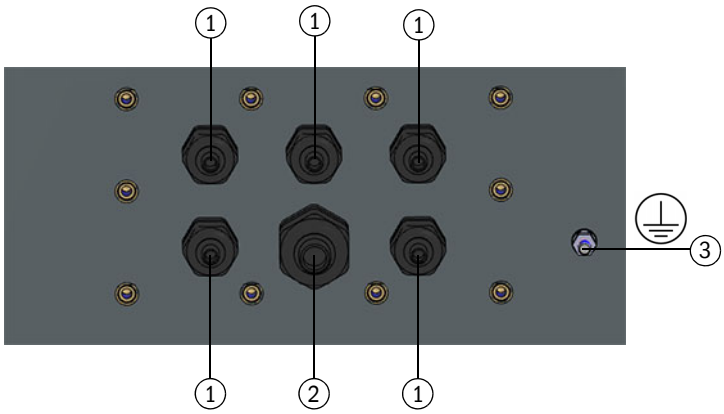
6.3.3.1 Device components, Interface Unit, Zone 2/Div. 2 resp. Non-Ex

Fig. 55 Overview



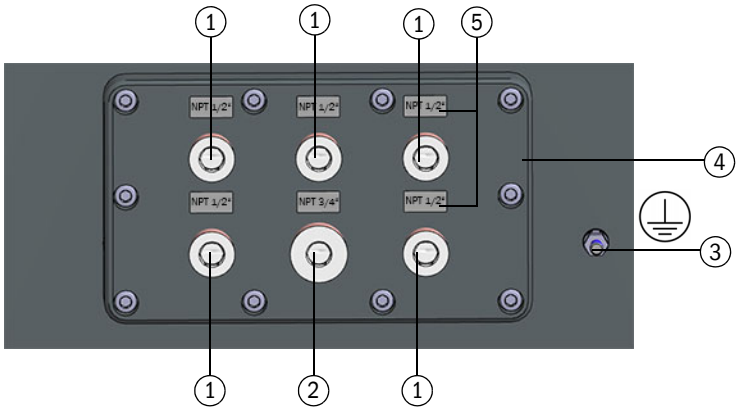
1 Type plate
2 Display
3 Infrared interface
4 Display flap
5 Screw-on tabs
6 Electronics cover
7 Enclosure base
8 Pressure compensation element
9 Exterior ground terminal
10 Cable inlets
11 Enclosure door

Fig. 56 Metric cable glands (optionally available with 9 cable glands)



1 Metric cable gland M20
2 Metric cable gland M25
3 Exterior ground terminal

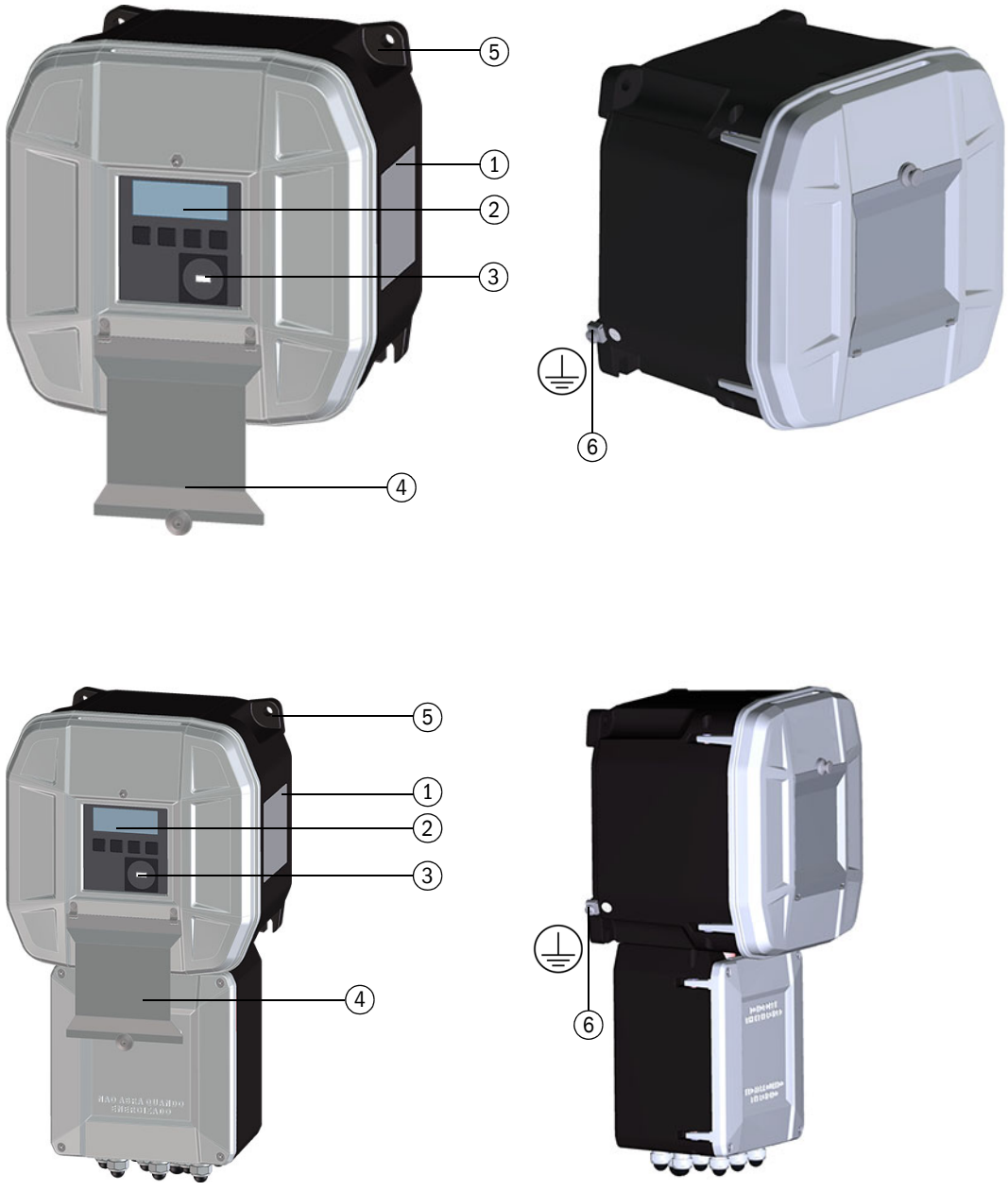
Fig. 57 Sealing plugs NPT (optionally available with 9 cable inlets)



1 Sealing plugs NPT 1/2"
2 Sealing plugs NPT 3/4"
3 Exterior ground terminal
4 Flange plate
5 Identification plates for thread size

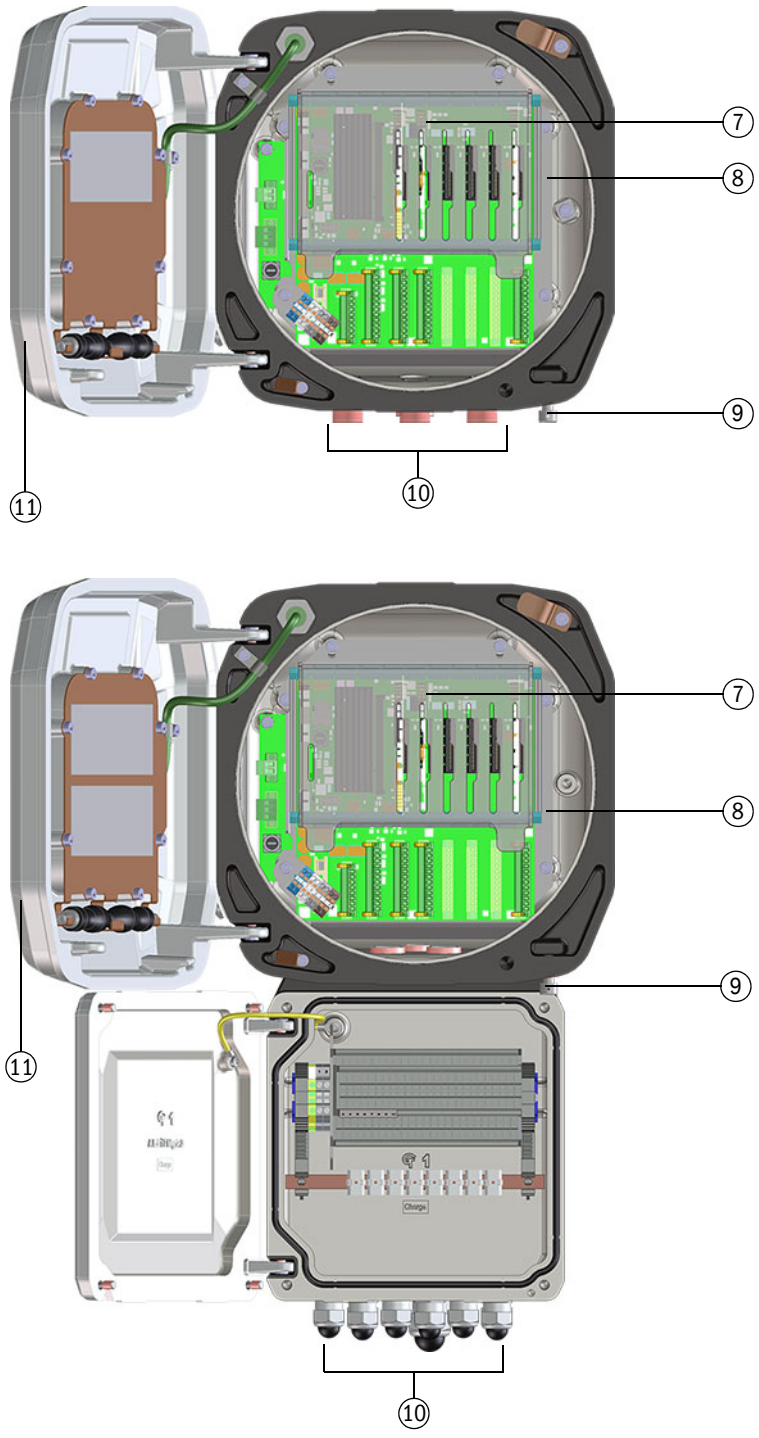
6.3.3.2 Device components, Interface Unit, Zone 1/Div. 1

Fig. 58 Overview, Ex d and Ex d e



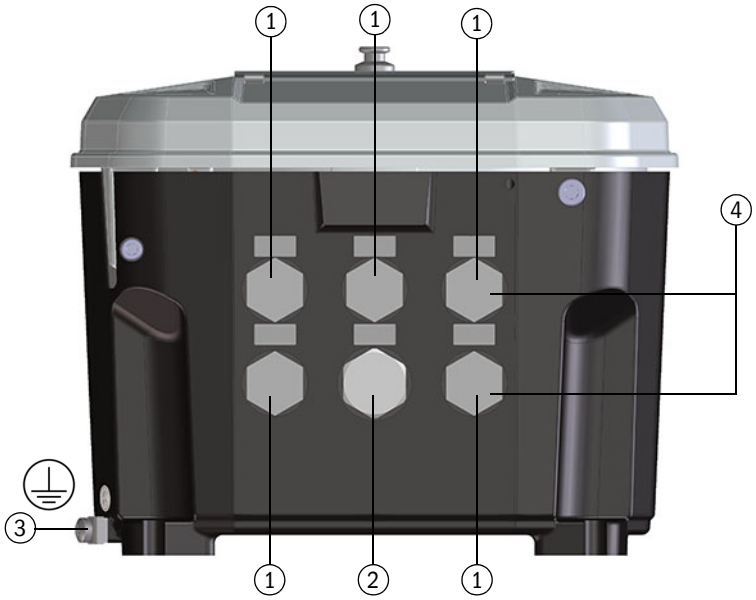
1 Type plate
2 Display
3 Infrared interface
4 Display flap
5 Screw-on tabs
6 Exterior ground terminal

Fig. 59 Overview, Ex d and Ex de - enclosure open



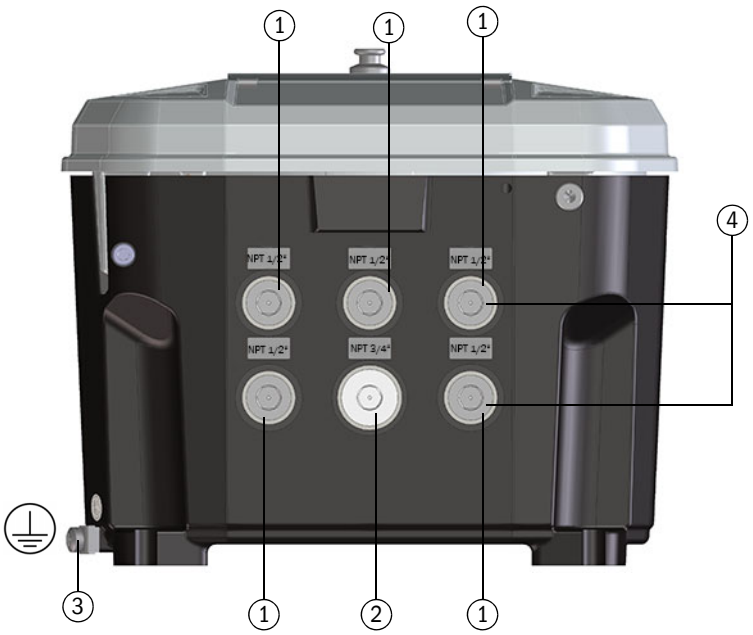
7 Electronics cover
8 Enclosure base
9 Cylinder screw
10 Cable inlets
11 Enclosure door / display flap)

Fig. 60 Ex d enclosure, sealing plugs, metric (optionally available with 9 sealing plugs)



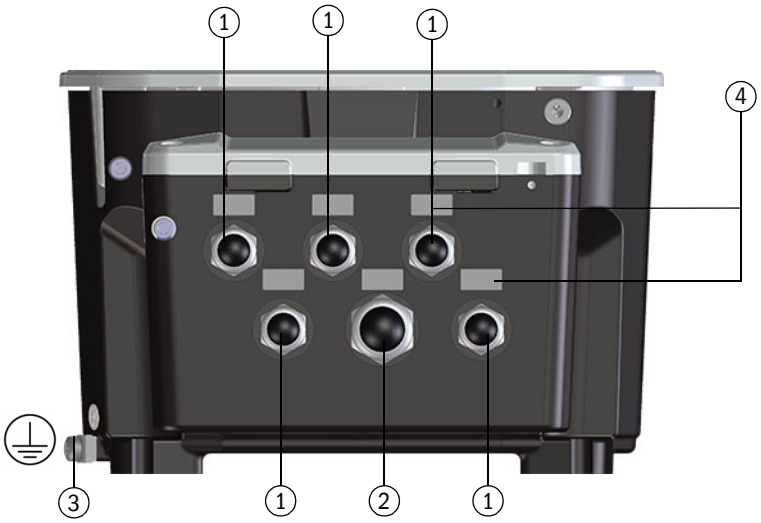
1 Sealing plugs, metric, M20
2 Sealing plugs, metric, M25
3 Exterior ground terminal
4 Identification plates for thread size

Fig. 61 Ex d enclosure, sealing plugs NPT, metric (optionally available with 9 sealing plugs)



1 Sealing plugs NPT 1/2"
2 Sealing plugs NPT 3/4"
3 Exterior ground terminal
4 Identification plates for thread size

Fig. 62 Ex d e enclosure, cable glands, metric (optionally available with 9 cable glands)



1 Metric cable gland M20
2 Metric cable gland M25
3 Exterior ground terminal
4 Identification plates for thread size

6.3.4 Device description

The Interface Unit is used for the acquisition, processing and output of measured values and serial data. A multitude of different digital, analog and serial sensors can be connected to the Interface Unit.

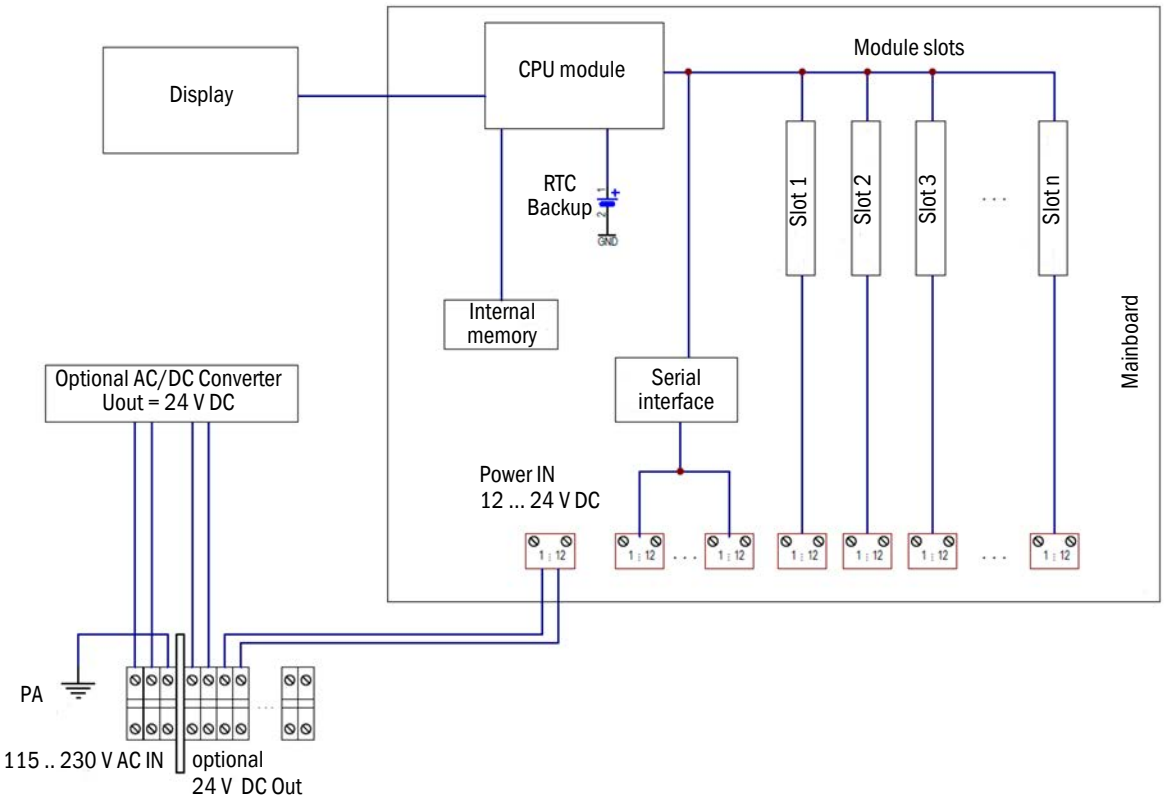
As a modular expandable system, the Interface Unit contains a processor board on its mainboard as well as a basic set of serial interfaces. In addition, module slots are available for connecting up to six I/O modules (depending on the device variant). Up to six slots with pluggable terminal strips are available on the mainboard to connect the field-side interfaces of the I/O modules.

Up to nine cable inlet openings, either NPT or with metric cable glands, are available for routing all connection cables (depending on the device variant). The internally installed real-time clock also has a replaceable backup battery.

The Interface Unit is optionally supplied via DC voltage 12 ... 24 V DC or by an internally installed SELV wide range power supply with 24 V DC output voltage for the connection range from 115 ... 230 V AC.

It is possible to connect additional sensors to the Interface Unit. These can be connected to the internal terminal blocks. The sensors are supplied either via the internally generated 24 V DC or by routing the external supply voltage. The data connection between sensors and Interface Unit runs via the internal RS485. Additional terminal blocks provided can be used to connect several sensors.

Fig. 63 Layout



6.3.5 Interfaces

6.3.5.1 Basic equipment of mainboard

The mainboard is available in two versions: Standard and Extended

The following interfaces are provided:

- 1 Ethernet interface (Modbus TCP) for the Standard variant
  2 Ethernet interfaces (Modbus TCP) for the Extended variant
- 3 RS485 interfaces (Modbus RTU / ASCII)
- 1 RS232 interface, for firmware updates

6.3.5.2 I/O module definition

Analog module, type 1 (2AI/2AO)

- Two analog inputs, switchable as voltage input or 4 ... 20 mA current input
- The first analog input also has a serial HART® Host interface
- Two analog outputs (4 ... 20 mA)
- The first analog output also has a serial HART® Field Device interface, optionally configurable as HART® Host
- Two electrically isolated auxiliary voltages for supplying up to two current loops; the module can be operated both passively and actively with two auxiliary voltages per module

Analog module, type 2 (2AO)

- Two analog outputs 4 ... 20 mA
- The first analog output also has a serial HART® Field Device interface, optionally configurable as HART® Host
- Two electrically isolated auxiliary voltages for supplying up to two current loops; the module can be operated both passively and actively with two auxiliary voltages per module

Digital module, type 1

- Two switching outputs, individually switchable as digital input
- 4 digital outputs, one of which can be used as frequency output

Interface module FOUNDATION™ Fieldbus (FF)

- One serial FOUNDATION™ Fieldbus Field Device interface

Detailed descriptions of the MODBUS, HART® and FOUNDATION™ Fieldbus protocols are available as separate documents at *www.endress.com* or from Endress+Hauser Service.

6.4 Installation

6.4.1 Safety information

WARNING: Risks during installation

- ► Observe the safety information in → p. 94, §6.2.
- ► Observe and comply with regulations of the plant operator.

Otherwise hazards are possible and safe operation is not ensured.

CAUTION: Accident risk through inadequate fastening of the device

- ► Consider the device weight specifications when planning the mounting supports.
- ► Ensure sufficient stability:
  - When fitting the device on a wall, ensure that the wall construction is sufficiently stable.
  - When fitting the device on a pipe, ensure sufficient stability of the pipe.
- ► Use suitable fasteners to secure the device and optional accessories.
- ► Take the vibration load into account.

NOTICE:

The plant operator is responsible for the safety of the system under mechanical load.

NOTICE:

The Interface Unit is only suitable for vertical installation.

6.4.2 Scope of delivery

- ► Check that delivery includes all ordered parts.
- ► Check parts for possible transport damage.

NOTICE:

Do not put the interface Unit into operation if you notice any damage!

6.4.3 Tools required

- Allen keys, sizes 5, 6 and 8
- Jaw wrenches, sizes 13, 17, 19, 22 and 30
- Phillips screwdriver, size 3
- Slotted screwdrivers, sizes 2.5 and 3.0
- Drill and tools for wall fitting

6.4.4 Fitting the Interface Unit

Fit the Interface Unit in an easily accessible and protected position. Carry out all assembly work on-site. The following must be taken into account:

- Maintain the ambient temperature range in accordance with the Technical Data under consideration of possible radiant heat (shield when necessary).
- Protect the Interface Unit against direct sunlight and atmospheric conditions (weatherproof cover available as option).
- Select an installation location free from vibrations when possible and stabilize vibrations when necessary.
- Provide sufficient clearance for cables and opening the front panel.
- Select an installation location free of chemical influence.

Additional information for the installation of the Interface Unit Zone 1/Div. 1

- Due to the high weight, at least two persons or suitable lifting/carrying devices are required for installation.
- To simplify the installation process, the enclosure is designed so that the two lower retaining points of the enclosure can be hooked onto pre-mounted screws on the wall or bracket.

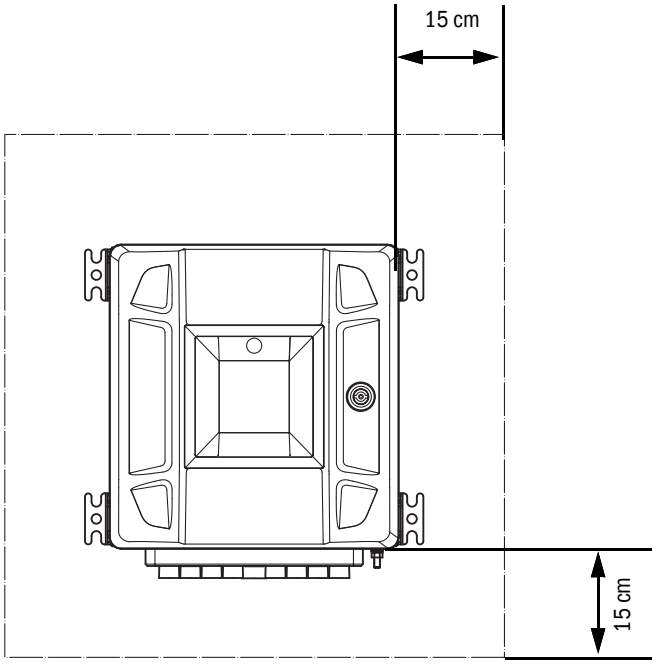
6.4.4.1 **Wall fitting**

NOTICE:

- ► Use suitable fixing material for mounting.
- ► Observe the total weight of the Interface Unit as well as local and legal regulations for the design of the wall construction and fastening material.

- ► Ensure sufficient assembly clearance.
  Dimension drawing, see → p. 199, §12.8.2.
- ► Maintain a general clearance of 15 cm around the enclosure to ensure better heat circulation.
- ► The distance between enclosure base and wall must be 10 mm; the wall must be flat. The air circulation behind the Interface Unit must not be obstructed.

Fig. 64 General clearance, Interface Unit (valid for all device versions)

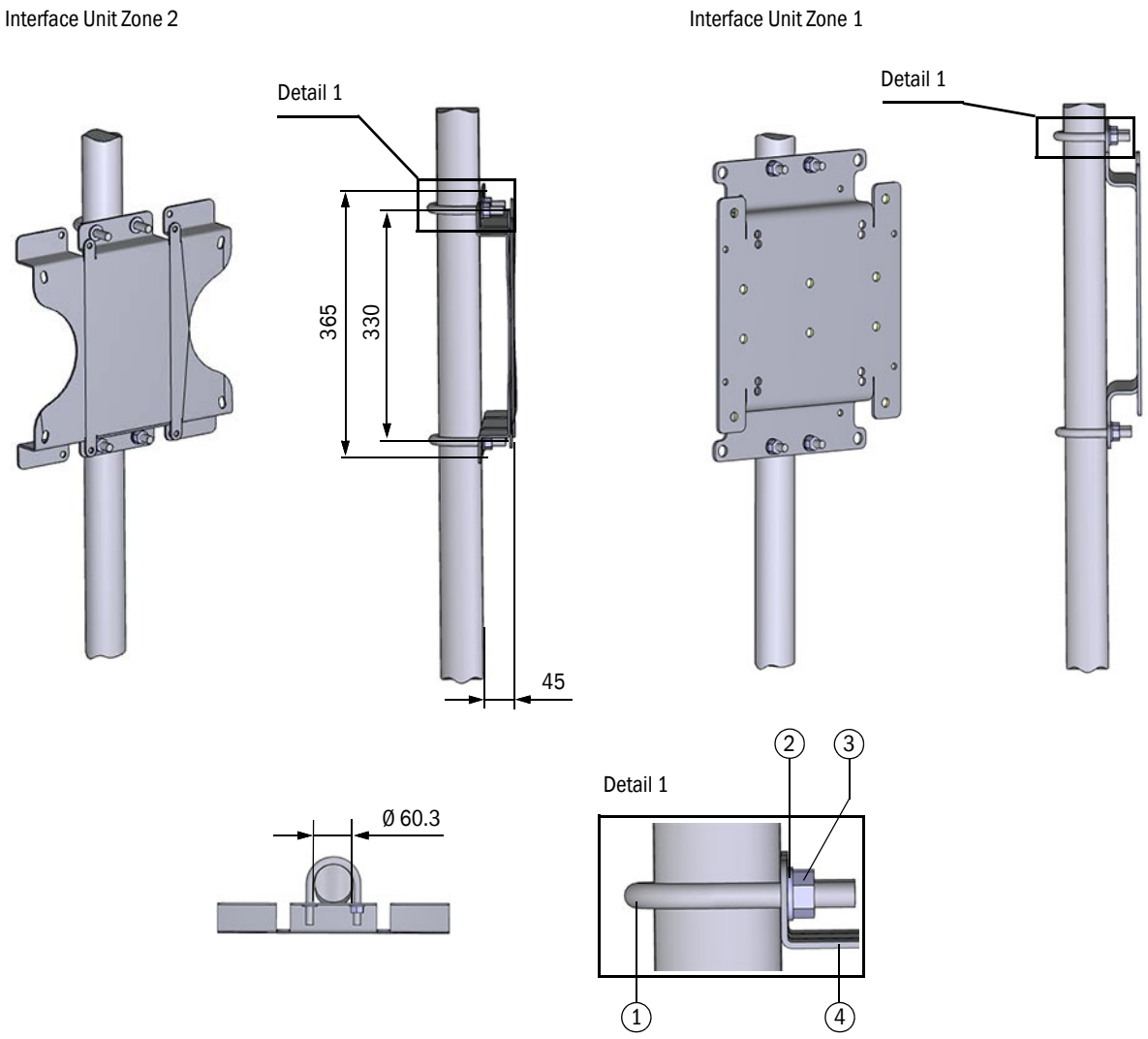


6.4.2 Option “Mounting kit, 2-inch pipe mounting”

Part numbers for the “Mounting kit, 2-inch pipe mounting”, see → p. 206, §14.2.

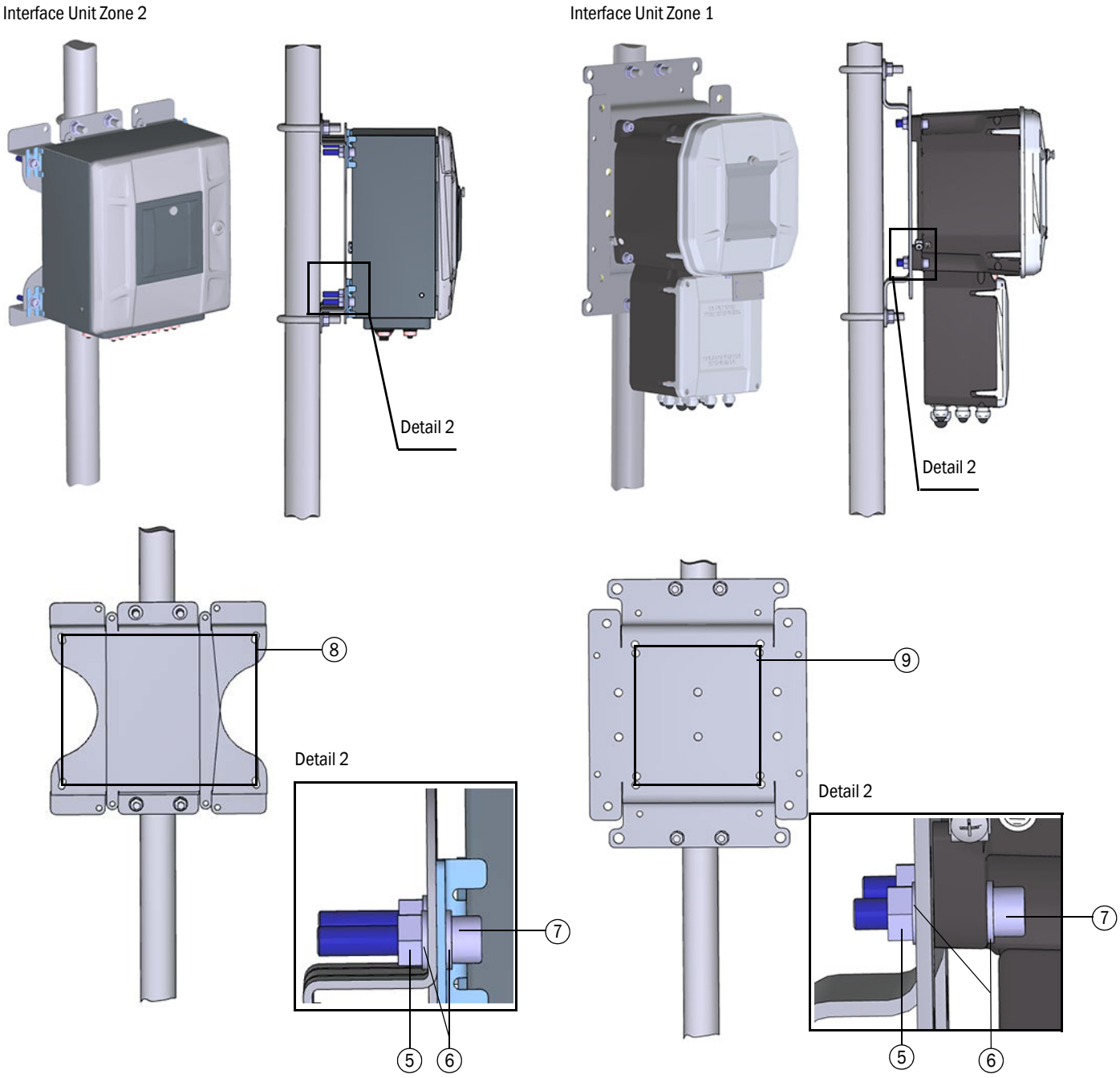
- ► Use two round steel bows (1), associated nuts (2) and washers (3) to fasten installation plate (4) on the 2-inch pipe, → Fig. 65.
- ► Use nuts (5), washers (6) and screws (7) to fasten the Interface Unit on the installation plate through the 4 marked openings, → Fig. 66.

Fig. 65 Fitting the installation plate on the 2-inch pipe (dimensions in mm)



1 Round steel bow DIN3570
2 Washer A13 -A4
3 Nut M12 -A4
4 Installation plate

Fig. 66 Fitting the Interface Unit on the installation plate



5 Nut M10 DIN934
6 Washer B10.5 DIN125
7 Screw M10 DIN912
8 Holes for fitting the Interface Unit Zone 2
9 Holes for fitting the Interface Unit Zone 1

6.4.5 Fitting the weatherproof cover

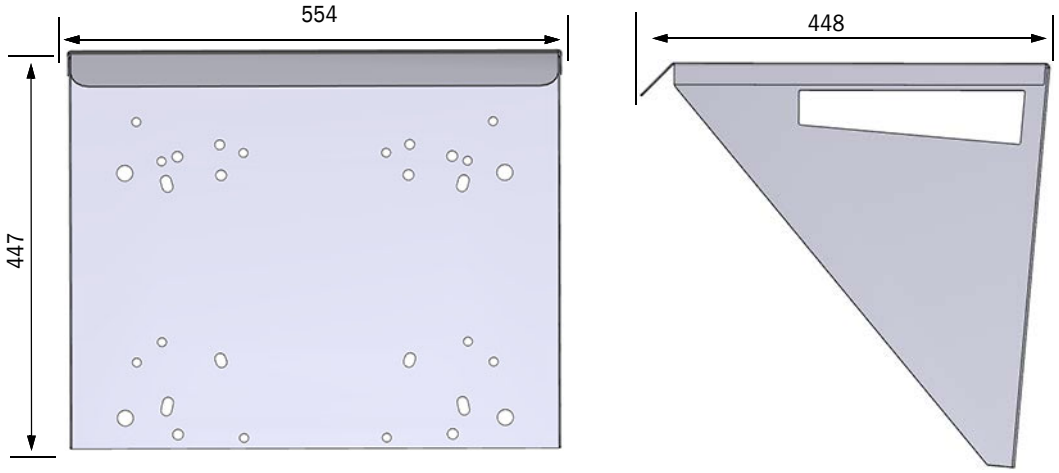
6.4.5.1 Weatherproof cover for Interface Unit for wall fitting

NOTICE:

The weatherproof cover for wall fitting (Part No. 2108970) is delivered without fastening material.

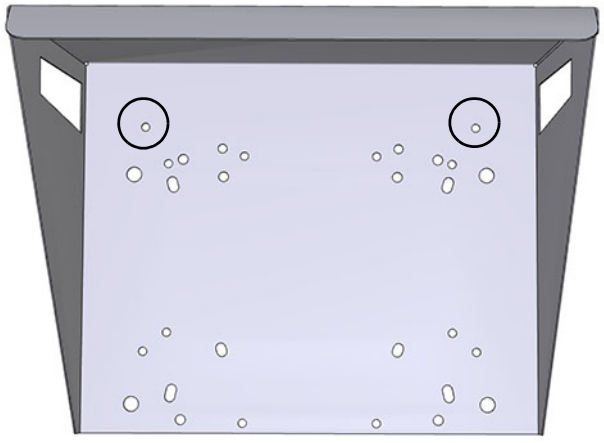
- ► Use suitable fastening material to fit the weatherproof cover on the wall.
- ► Observe the total weight of the Interface Unit together with the weatherproof cover as well as local and legal regulations for the design of the wall construction and fastening material. Weight of Interface Unit and weatherproof cover, see Technical Data → p. 187, §12.3.

Fig. 67 Dimensions [mm]



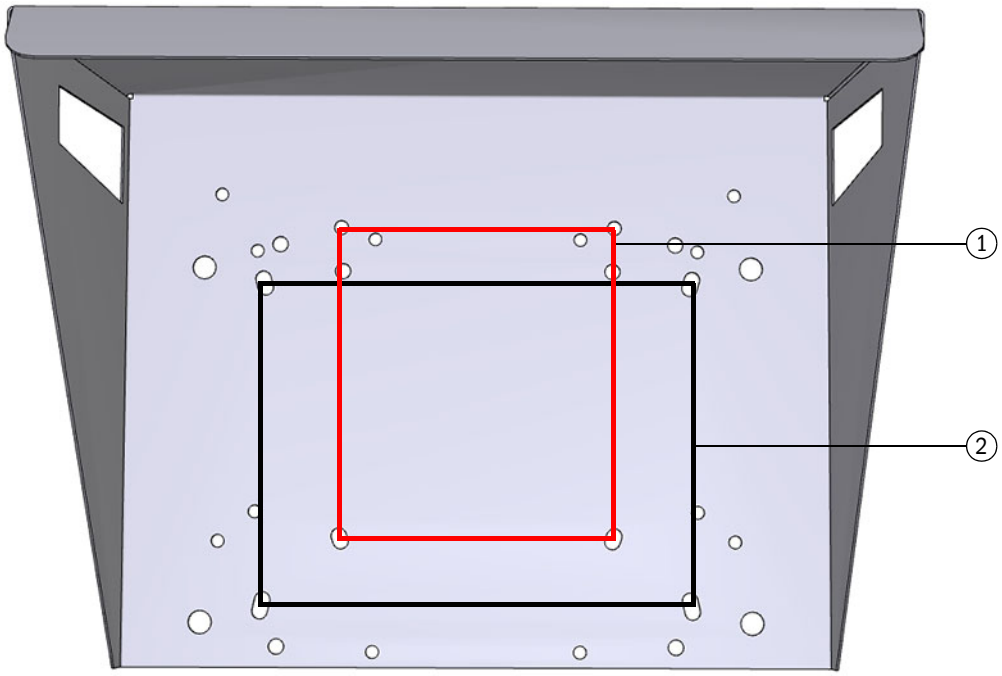
1 First screw the weatherproof cover to the wall through the two holes marked in → Fig. 68.

Fig. 68 Fitting the weatherproof cover on the wall



2 Then screw the Interface Unit also to the wall through the four holes in the weatherproof cover as marked in → Fig. 69.

Fig. 69 Fitting the Interface Unit on the weatherproof cover



1 Holes for fitting the Interface Unit Zone 1
2 Holes for fitting the Interface Unit Zone 2

6.4.5.2 **Weatherproof cover for Interface Unit for fitting on a 2-inch pipe**

The weatherproof cover for fitting on a 2-inch pipe is delivered as a set comprising the following components:

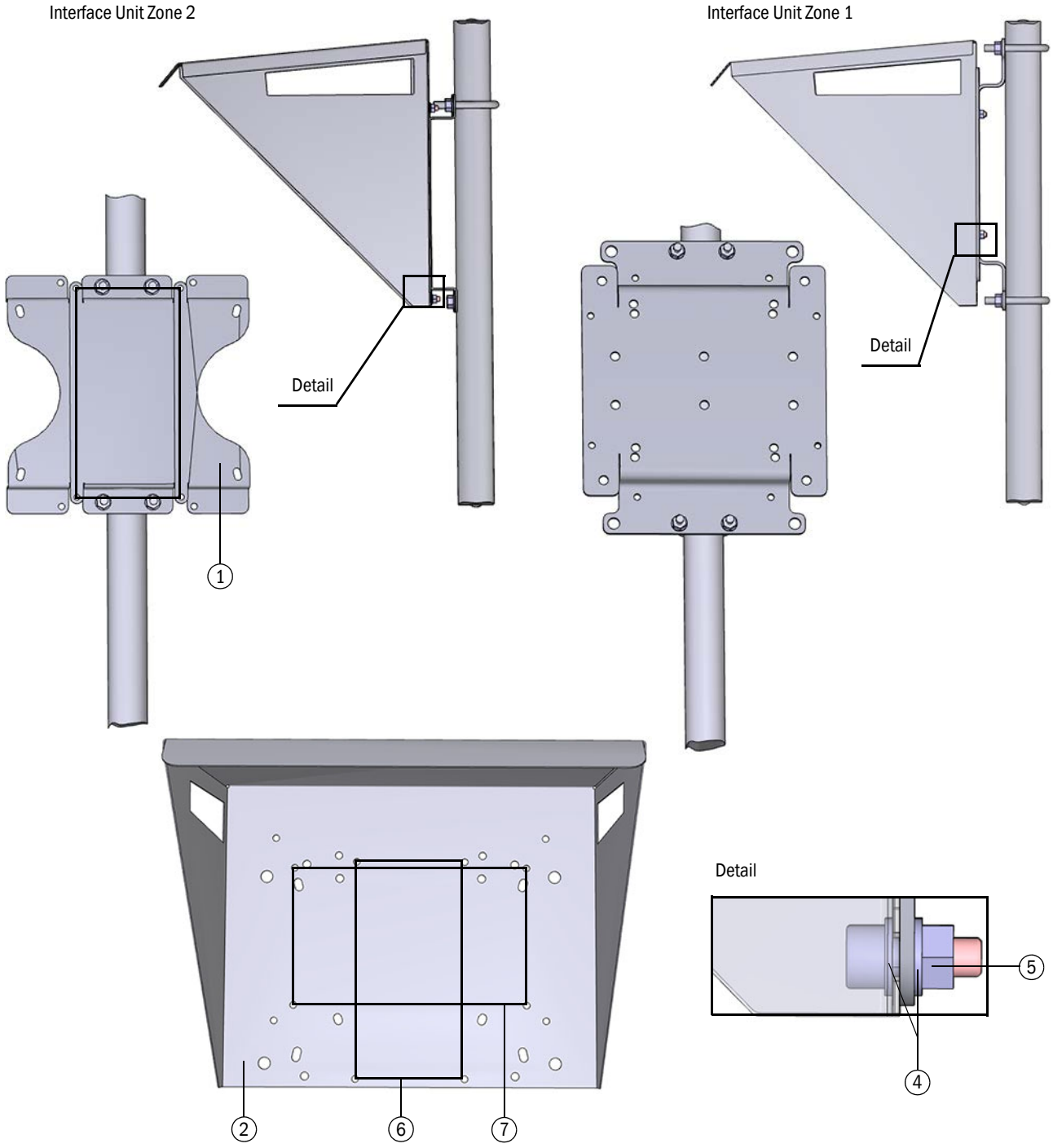
- Mounting plate
- Weatherproof cover
- Fastening material (round steel bow, screws, washers, nuts)

Part numbers for the “Mounting set, weatherproof cover”, see → p. 206, §14.2.

Fitting the weatherproof cover

1 The installation plate for the Interface Unit is screwed with the weatherproof cover for transport. For fitting on the 2-inch pipe, first dismount the mounting plate from the weatherproof cover.
2 Fasten the installation plate to the 2-inch pipe according to → p. 112, §6.4.4.2 and → Fig. 65.
3 Screw the weatherproof cover with the supplied fastening material through the four holes marked on the mounting plate, → Fig. 70.

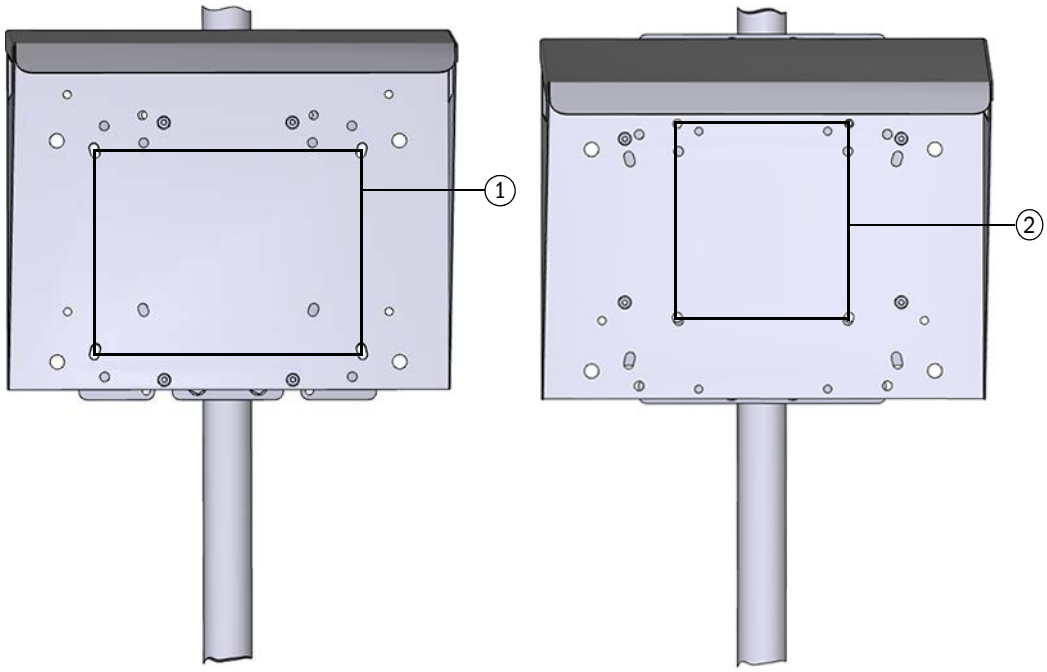
Fig. 70 Fitting the weatherproof cover on the installation plate



1 Installation plate
2 Weatherproof cover
3 Screw M8 DIN912
4 Washer A 8,4 DIN125
5 Nut M8 DIN934
6 Holes for fitting on the installation plate for Zone 2
7 Holes for fitting on the installation plate for Zone 1

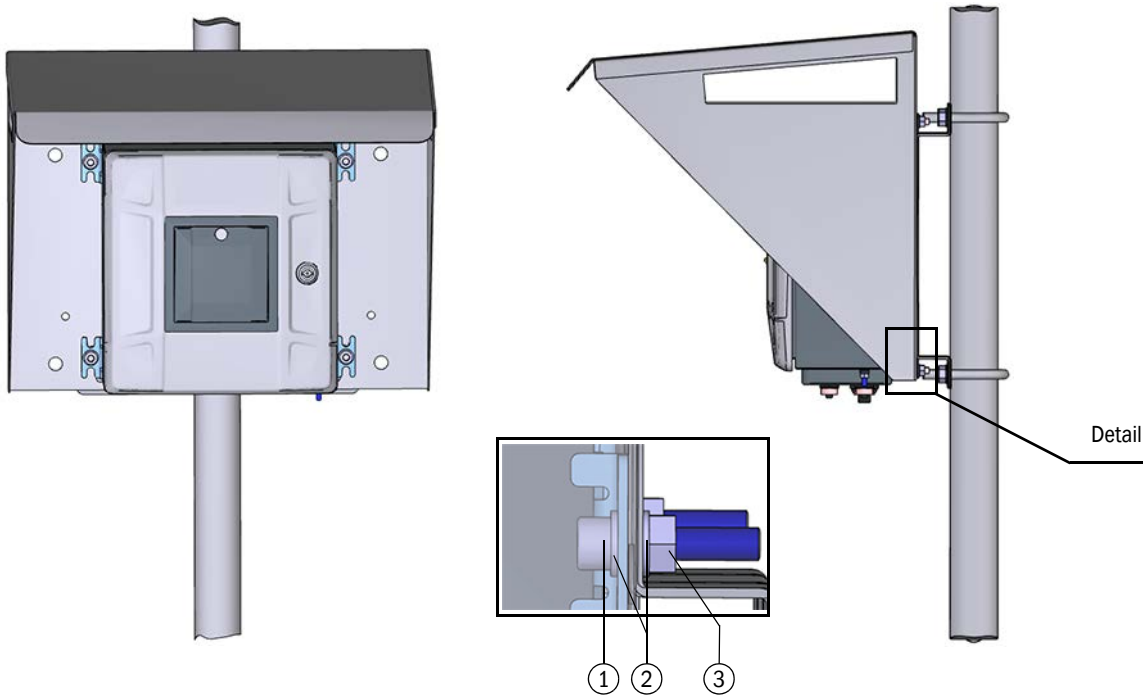
4 Also screw the Interface Unit to the installation plate through the four holes of the weatherproof cover using the supplied assembly material, → Fig. 71.

Fig. 71 Fitting the Interface Unit on the weatherproof cover



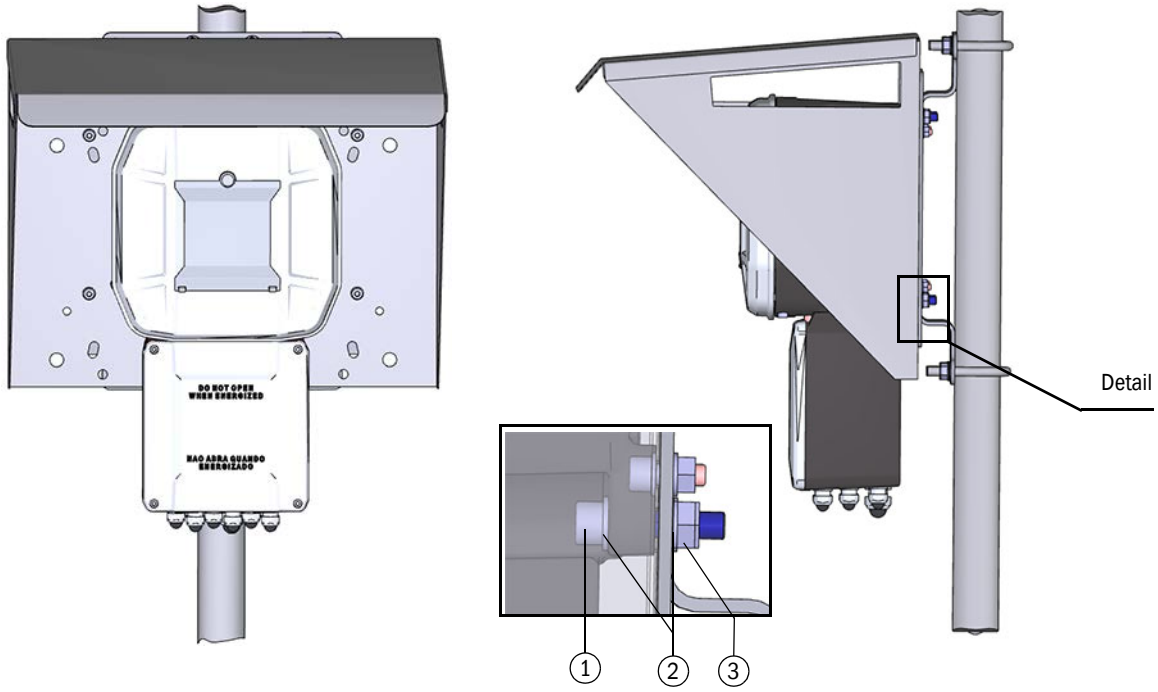
1 Holes for fitting the Interface Unit Zone 2
2 Holes for fitting the Interface Unit Zone 1

Fig. 72 Interface Unit, Zone 2, with weatherproof cover fitted



1 Screw M10 DIN912
2 Washer B10.5 DIN125
3 Nut M10 DIN934

Fig. 73 Interface Unit, Zone 1, with weatherproof cover fitted



1 Screw M10 DIN912
2 Washer B10.5 DIN125
3 Nut M10 DIN934

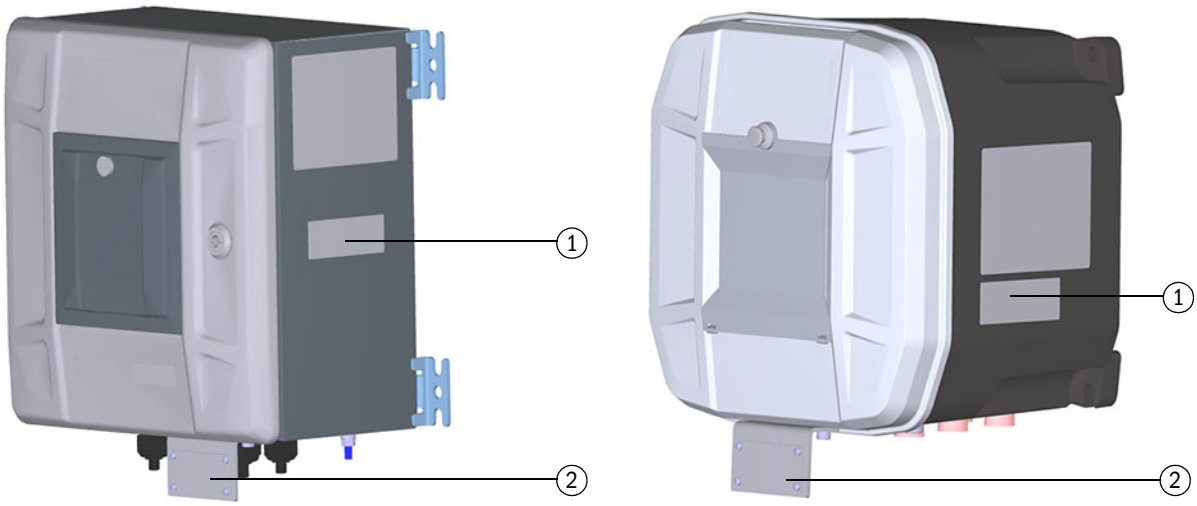
6.4.6 Fitting the tag plate (available as option)

Two versions of the tag plate are available:

- As label
  The label with the tag number is already glued on at the factory when this variant is selected.
- As label with an additional stainless steel tag plate
  The label with the tag number is already glued on at the factory when this variant is selected and the additional stainless steel tag plate then attached after electrical installation. This Section describes fitting the stainless steel tag plate.

> ***NOTICE:***
> ► Fit the tag plate after the electrical installation in → p. 121, §6.5.

Fig. 74 Overview



1 Label with tag number
2 Stainless steel tag plate

> ***NOTICE:***
> Before fitting the tag plate ensure it is the correct tag plate. Compare the tag plate with the tag number on the Interface Unit.

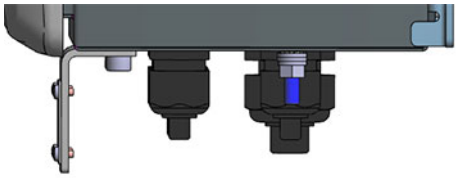
6.4.6.1 Fitting the stainless steel tag plate for Interface Unit Zone 2

► The tag plate assembly kit comprises 4 screws with different lengths (2 short, 2 long) and one contact disc:

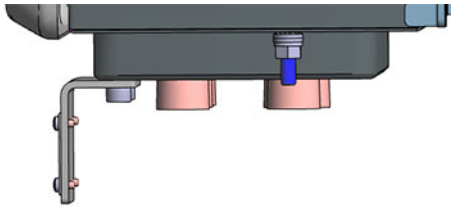
> **WARNING: Hazard through electrostatic discharge**
> Fit the contact disc provided with one of both screws.
> The contact disc ensures the stainless steel tag plate is securely earthed via the screw-on point.

– Use both longer screws for the Interface Unit with NPT cable entries (with flange plate): For fitting the tag plate, first unscrew two screws from the flange plate and replace these with the longer screws. Fit the contact disc with one of the two screws between the screw head and tag plate; align the contact disc teeth in tag plate direction.
– Use both shorter screws for the Interface Unit with metric cable entries (without flange plate): Fit the contact disc with one of the two screws between the screw head and tag plate; align the contact disc teeth in tag plate direction.

Fig. 75 Tag plate fitted



Interface Unit with metric thread



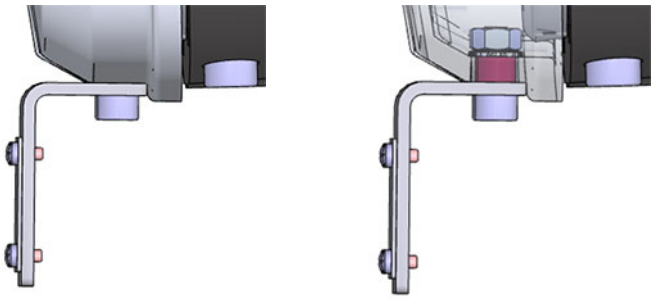
Interface Unit with NPT thread

6.4.6.2 Fitting the stainless steel tag plate for Interface Unit Zone 1

WARNING: Hazard through electrostatic discharge
Fit the contact disc provided with one of both screws.
The contact disc ensures the stainless steel tag plate is securely earthed via the screw-on point.

► Open the enclosure door (display flap):
  – Unscrew the cylinder screw slightly until the flap lifts.
  – Open the flap.
► Fit the tag plate with the supplied fastening material:
  Use both of the short screws from the assembly kit.
  Insert the plastic bushings as a centering aid.
  Fit both contact washers on the two screws between the nut and the enclosure; align the teeth of the contact disc in enclosure direction.
► Close the enclosure door again.
► Tighten the cylinder screw again.

Fig. 76 Tag plate fitted



6.5 Electrical installation

6.5.1 Safety information

All assembly work previously described must be completed (as far as applicable) before starting installation work. Carry out all installation work on-site unless otherwise explicitly agreed with Endress+Hauser or authorized representatives. This includes laying and connecting the power supply and signal cables and installing switches and power fuses.

WARNING: Electrical hazard

Incorrect cabling can cause device malfunctions, failure of the measurement system or serious injuries.

- ► Observe the relevant safety regulations as well as the safety notices in → p. 94, §6.2 during all installation work.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.
- ► All work may only be carried out when the device is disconnected from the power supply.
- ► Before opening the cover, the device must be disconnected from the power supply.

WARNING: Danger due to missing fuse protection of the power supply line

An external line fuse must be provided during installation. Internally, the main power supply lines are designed for an overcurrent protection device up to max. 16 A.

Requirements for the external main power switch:

- ► A main power switch must be provided in the installation.
- ► The main power switch must be located at a suitable position and must be easily accessible.
- ► The main power switch must be marked as disconnecting device for the device.

Additional information for Interface Unit Zone 1/Div. 1

WARNING: Risk of ignition through impacts or friction

The enclosure of the flameproof Zone 1/Div 1 version is made of aluminium. In rare cases, ignition sources could arise due to impact or friction sparks.

- ► The user must ensure that the enclosure is suitably protected against danger from impacts or friction.
  This is particularly important when the FLOWSIC100 Flare-XT is installed in Zone 0 (see § 8.3 EN 60079-0).

6.5.2 Cable specification

WARNING: Electrical hazard

- ► The cables and wires must be permanently installed. The plant operator must provide adequate strain relief.
- ► Cables must have a permitted operating temperature of min. 70 °C.

***NOTICE:* Requirements on cables and installation**

- ► Pay attention to the requirements in EN 60079-14 when selecting the cables and during installation!
- ► Further legal requirements must be observed for use in explosive atmospheres.
- ► Only copper wires may be used.

Cables

- ► Protect cables especially endangered by thermal, mechanical or chemical stress, e.g. by laying in protective tubes.
- ► Cables must be flame-retardant according to DIN VDE 0472 Part 804. The fire behavior according to B / IEC 60332-1 must be approved.
- ► The existing air and creepage paths according to EN 60079-7 or EN 60079-15 may not be reduced by cable connections in the terminal box.
- ► Protect the wire ends with connector sleeves against fraying.
- ► Connect unused wires to ground or safeguard so that a short circuit with other conductive parts is excluded.
- ► Carry out potential equalization in accordance with EN 60079-14 (see also the following Section).

Specific requirements for installation in the USA and Canada

- ► Installations in USA must be carried out according to NEC (ANSI/NFPA70).
- ► Installations in Canada must be carried out according to CEC part 1.

Special features, Zone 1/Div.1 Ex d e 230V version

When connecting the mains connection cables, pull the supplied insulating sleeve over the phase conductors and neutral conductors. The insulating sleeve must extend from connector J2 to the terminal block and must be secured against slipping with a cable tie on connector J2. It serves as safe isolation to intrinsically safe circuits.

Power supply

- DC version
  Max. 30 VDC, max. 1 A, recommended cable cross-section: 1 … 2.5 mm^2
- AC version
  Max. 253 VDC, max. 0.5 A, recommended cable cross-section: 0.75 … 2.5 mm^2

Switching outputs

Max. 30 VDC, max. 70 mA, switching frequency max. 50 Hz, recommended cable cross-section: min. 0.5 mm^2

Digital output

Max. 30 VDC, max. 70 mA, switching frequency max. 10 kHz, recommended cable cross-section: min. 0.5 mm^2, twisted pair, shielded

Analog output

Max. 30 VDC, max. 24 mA, recommended cable cross-section: min. 0.5 mm^2, twisted pair, shielded

Analog input

Max. 30 VDC, max. 24 mA, recommended cable cross-section: min. 0.5 mm^2, twisted pair, shielded

RS485

EIA -485, max. 57.6 kbit/s, termination 150 Ohm switchable, recommended cable cross-section: min. 0.5 mm^2. twisted pair, shielded

Maximum cable length: 1000 m total length, for 2-path installations with two sender/ receiver units connected in parallel 500 m each

Ethernet

10/100 Mbit/s, Modbus TCP protocol, cable specification: Cat 5 or higher

The clamping range of the cable glands supplied or installed at the factory is suitable for the following outer diameters of the cables:

Table 11 Outer diameter of the cables:

Device version	Cable gland	Permissible clamping range
Zone 2 resp. Non-Ex	M20	7 … 13 mm
	M25	10 … 17 mm
	Shielding terminals	2 … 9 mm [1]
Zone 1 Ex d e	M20	7 … 12 mm [1]
	M25	14 … 18 mm
	Shielding terminals	2 … 9 mm

[1] The customer can use own shield connection options for other diameters.

6.5.3 Cable glands

NOTICE: **Requirements for cable glands**

- ► Pay attention to the requirements in EN 60079-14 when selecting the cable glands and during installation.
- ► For devices with Ex-approval, the cable entries must have the following Ex-approval:
  - – Zone 2 / Div 2 variant: Minimum Ex ec IIC
  - – Zone 1 / Div 1 in Ex db version: Minimum Ex db IIC
  - – Zone 1 with a separate Ex eb terminal compartment: Minimum Ex eb IIC
- ► All cable entries or cable sealing plugs must be approved for the following temperature range, depending on the design variant:
  - – from -40 °C ... + 60 °C
  - – resp. -40 °C ... +65 °C
- ► Cable glands must be certified for IP66 or better.

- ► Depending on the device version, the device inputs are installed with certified cable glands or with certified sealing plugs. Only installation material approved for the applied hazard zone may be used. The user is responsible for correct selection.
- ► Observe the clamping range of the cable glands for cable selection.
- ► Use thread sealant according to EN 60079-14, Section 9.4 for threads with ½" NPT.
- ► Specific requirements for Zone 2 and Non-Ex version:
  - – Unused cable glands must be sealed with the plugs already fitted at the factory.
- ► Specific requirements for Zone 1 Ex db eb version:
  - – Metric cable glands are factory tightened to the following torque and should be tightened to the torque as required:

M20	7 Nm
M25	10 Nm

6.5.4 Requirements for installation in the Ex zone

WARNING: Dangerous voltage

- ► It must be ensured that the rated voltage U_M 60 V is not exceeded when connected to devices not belonging to the system, in particular external power supply devices, power supply units, etc.; except for the main power supply with U_M < 253 V.
- ► For the power supply of the DC variant, power supplies categorized as “CLASS 2” and “SELV” according to the Canadian Electrical Code, C22.1 and the National Electrical Code NFPA 70 must be used for the DIV systems.
- ► For IECEx and ATEX applications, SELV power supplies or power supplies conforming to the IEC 60950 or IEC 61010-1 series of standards must be used.
- ► A suitable main power switch must be provided.
- ► Take the device out of operation immediately and do not switch it on again when cables, terminals, the enclosure or Ex components are damaged.

WARNING: Dangerous voltage - Interface Unit Zone 2/Div. 2

- ► Do not open the enclosure while energized.
- ► Only operate internal switches if the device is not live or the area is safe.
- ► Do not connect or disconnect the circuits unless the power has been turned off or the area is safe.

WARNING: Dangerous voltage - Interface Unit Zone 1/Div. 1

- ► Do not open the enclosure when an explosive atmosphere is present.

WARNING: Ignition hazard through electrostatic discharge

The plastic display surface dimensions of the display flap and of the display exceed the allowable value for ignition group IIC. The user must take appropriate precautions to avoid ignition hazards through electrostatic discharge.

Ignition hazards through electrostatic discharges exist when gas flow meters with special paintwork and a layer thickness >0.2 mm are used in applications with ignition group IIC in accordance with ATEX and IECEx.

- ► For installation, the risk of electrostatic charging of the surface must be reduced to a minimum.

  Therefore, the device should not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. change previous text
- ► Use appropriate caution when performing maintenance and cleaning work.

  For example, the surfaces should only be cleaned with a damp cloth. The respective devices will be identified by the manufacturer with a warning sign.

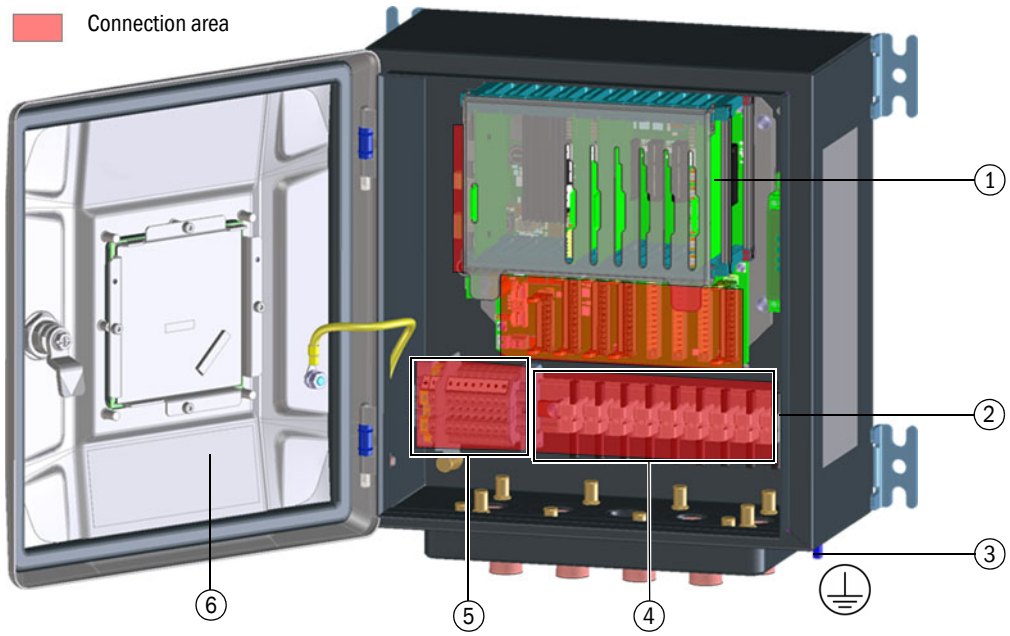
General information

- The documentation for zone classification according to EN 60079-10 must be available.
- The devices to be used must be checked for suitability for the application area.
- After installation, an initial test of the device and the plant according to EN/IEC 60079-17 must be performed.

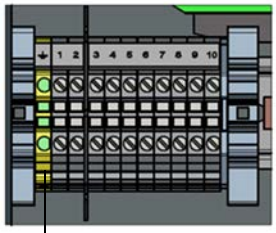
6.5.5 Electrical connections of the Interface Unit

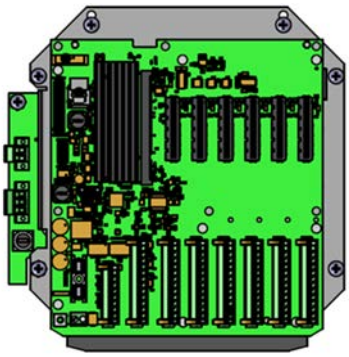
6.5.5.1 Overview, electrical connections, Zone 2/Div 2 and Non-Ex

Fig. 77 Connection area and inner electronics of the Interface Unit



Terminal blocks



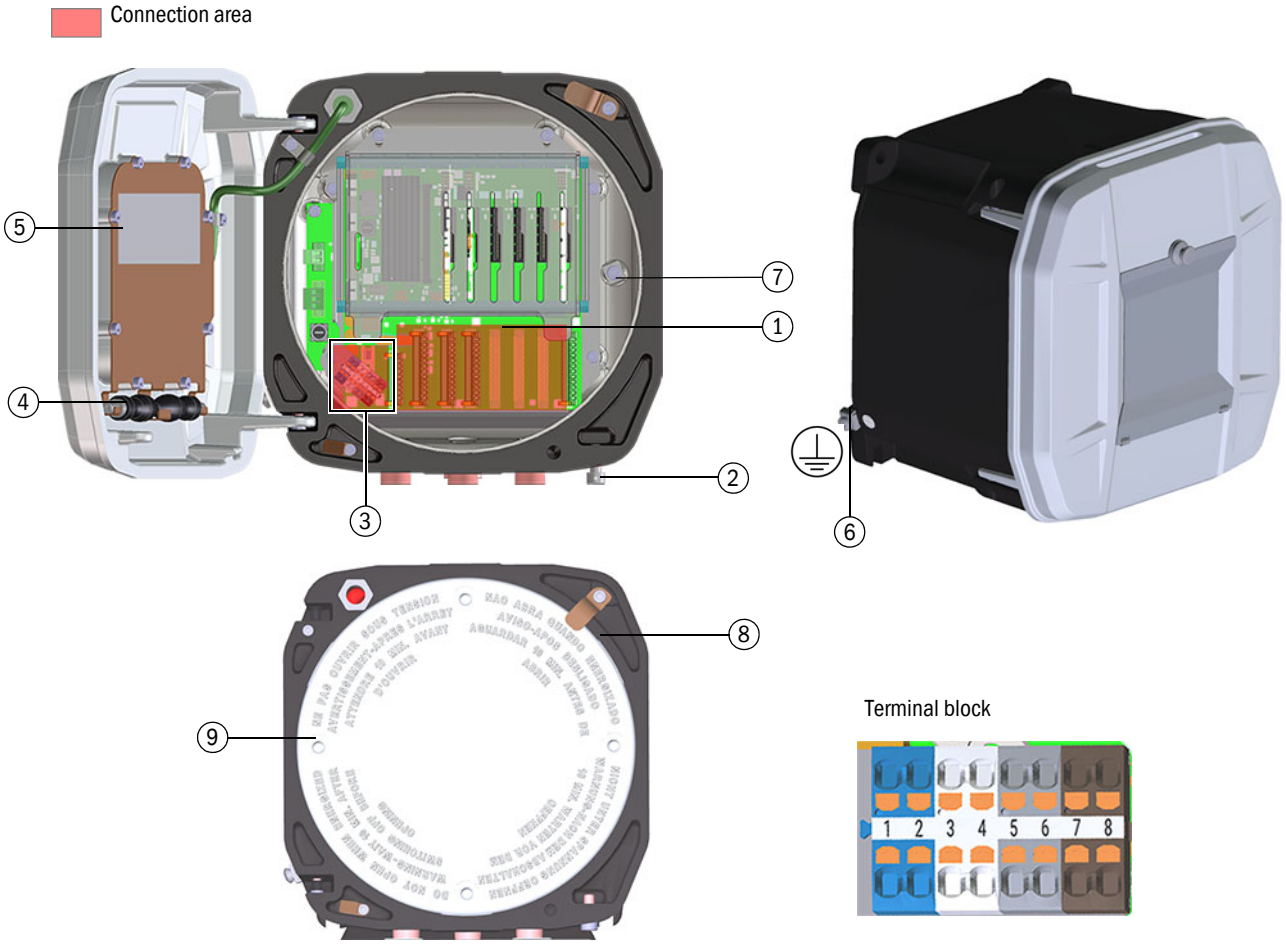


1 Mainboard, → p. 129, §80
2 DIN rail
3 Exterior ground terminal (connected with GND)
4 Shielding terminals
5 Terminal blocks
6 Terminal assignment sticker
7 Terminal block grounding

NOTICE:
Ensure neither the seal nor the sealing surfaces are damaged when opening and closing.

6.5.5.2 Overview, electrical connections, Interface Unit Zone 1

Fig. 78 Connection area and internal electronics of the Interface Unit Zone 1 Ex d



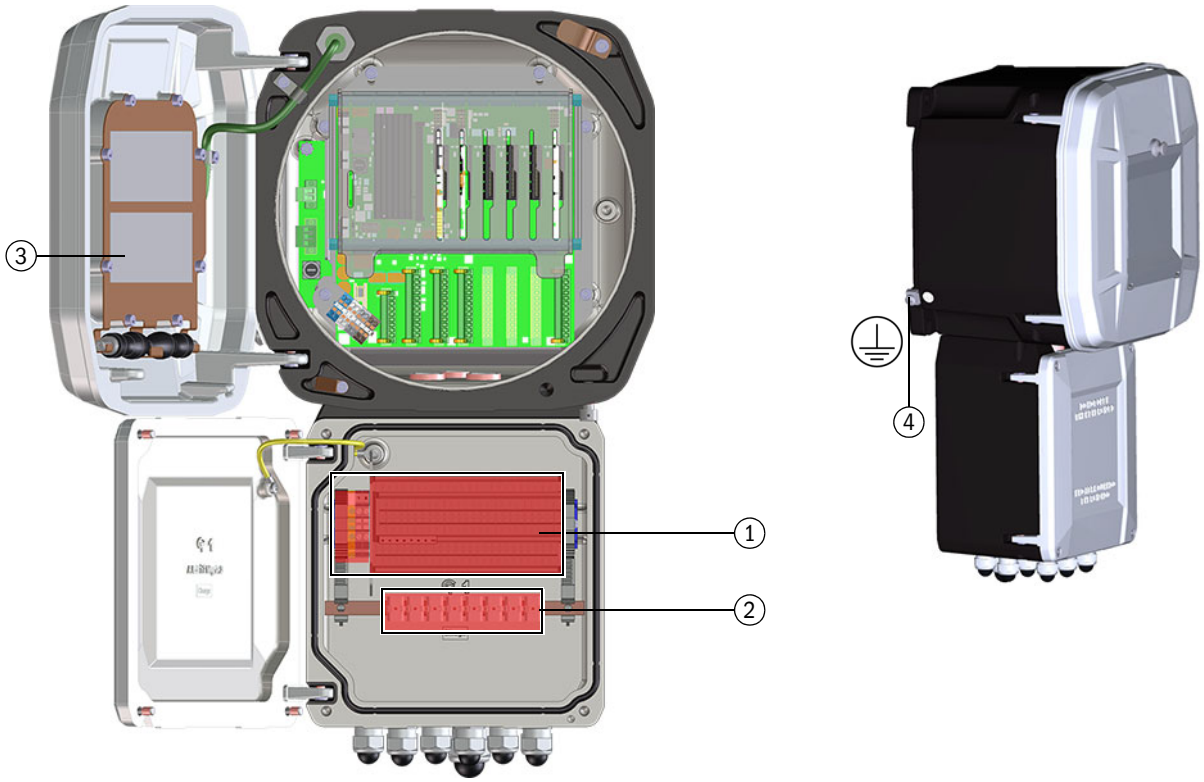
1 Mainboard, → p. 129, §80
2 Cylinder screw
3 Terminal block
4 Tool for opening the Ex d terminal compartment (handles)
5 Terminal assignment label, Ex d
6 Exterior ground terminal (connected with GND)
7 Internal ground connection
8 Safeguard, Ex-d terminal compartment cover
9 Ex d terminal compartment cover

To open the enclosure door, loosen the cylinder screw on the bottom right of the enclosure.
As tools for opening and closing the terminal compartment cover, handles are supplied.
The terminal compartment cover can be unscrewed and closed using the handles supplied.
The handles are stored inside in the designated place below the display, see → Fig. 78.

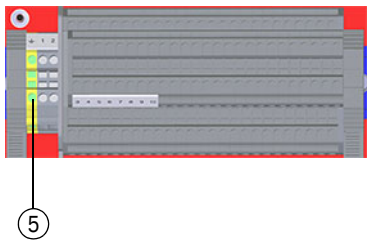
► Remove the handles and insert them into the recesses of the terminal compartment cover.
Ensure when using:
- Both threads must not be damaged
- O-ring must not be damaged
- Keep thread free of dirt (clean).
- There must be enough assembly paste on the thread when closing.

Fig. 79 Terminal area and internal electronics, Interface Unit Zone 1 Ex d e

Connection area



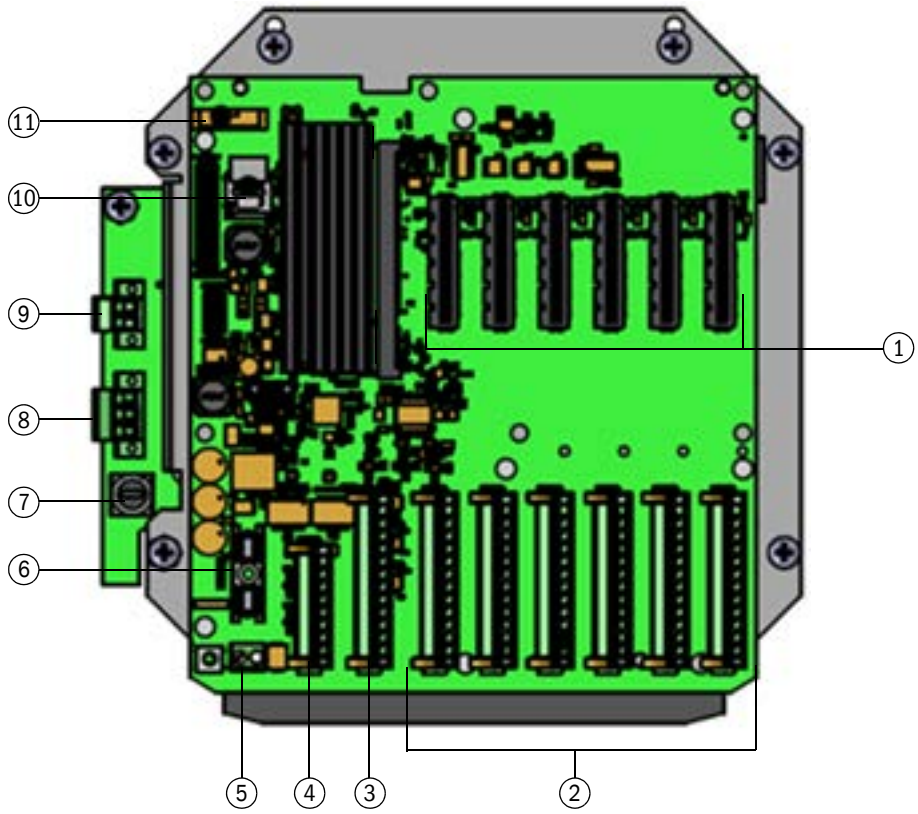
Terminal blocks



1 Terminal blocks
2 Shielding terminals
3 Terminal assignment label, Ex d e terminal compartment
4 Exterior ground terminal (connected with GND)
5 Terminal block grounding

NOTICE:
Ensure neither the seal nor the sealing surfaces are damaged when opening and closing.

Fig. 80 Mainboard

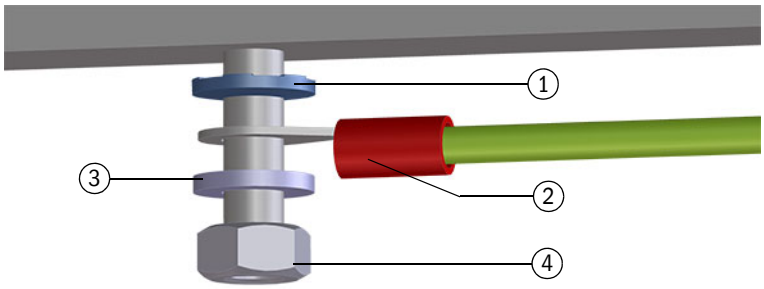


1 Slots for I/O modules 1-6
2 Field connections for I/O modules P4 - P9 – direct connection to module slots 1-6
3 Field connection for ultrasonic sensors P3 – external serial bus
4 Field terminal connector P2 – Ethernet
5 Field terminal connector P1 – Power In 24 V DC
6 Fuse F1
7 Fuse F2
8 Field connection J2 – power supply connection of the internal power supply unit
9 Field connection J1 – 24 V output voltage of the internal power supply unit
10 Memory card (MIcro SD)
11 Backup battery for real-time clock (RTC)

6.5.5.3 **Exterior ground terminal**

Interface Unit Zone 2/Div. 2

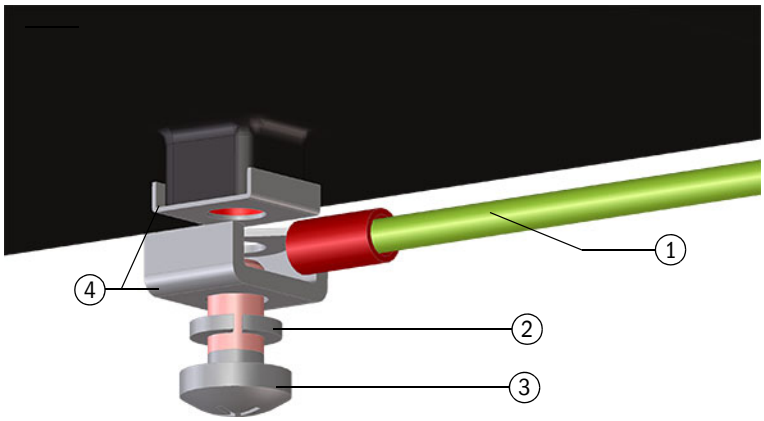
Fig. 81 Protective ground connection



1 Contact disc (ensure correct alignment)
2 Line
3 Washer
4 Nut (torque: 6.0 Nm for M6)

Interface Unit Zone 1/Div. 1

Fig. 82 Protective ground connection



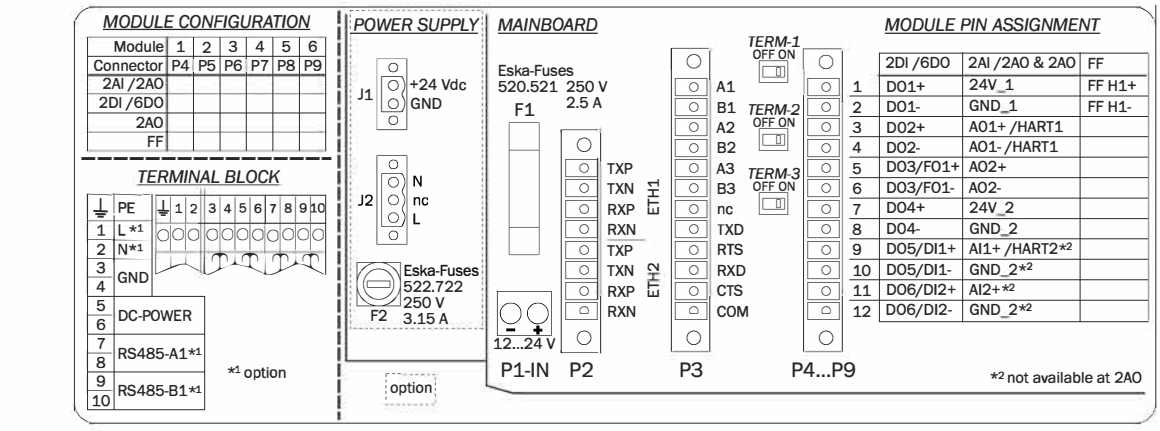
1 Line
2 Lock washer
3 Screw (torque: 8.0 Nm)
4 C-profile

6.5.6 Terminal assignment

The pin assignment is shown on the sticker on the inside of the door:

- Device module configuration
- Connection area for field-side wiring
- Termination resistors of serial RS485 lines
- Identification of fuses and fuse characteristics

Fig. 83 Terminal assignment



6.5.6.1 Device module configuration

The module configuration of the respective device is marked on the sticker on the inside of the enclosure door:

Fig. 84 Module configuration (example; the first line designates module slots 1-6)

MODULE CONFIGURATION

Module	1	2	3	4	5	6
Connector	P4	P5	P6	P7	P8	P9
2AI /2AO		●				
2DI /6DO	●					
2AO			●			
FF						

6.5.7 Connection area for field-side wiring

For the exemplary wiring of a complete measuring point, e.g. connection of 1-path and 2-path sender/receiver units, see → p. 211, §15.2.

6.5.7.1 Terminal block, Interface Unit for Zone 2 /Div. 2 resp. Non-Ex version

Fig. 85 Terminal block, Zone 2 /Div 2 resp. non-Ex

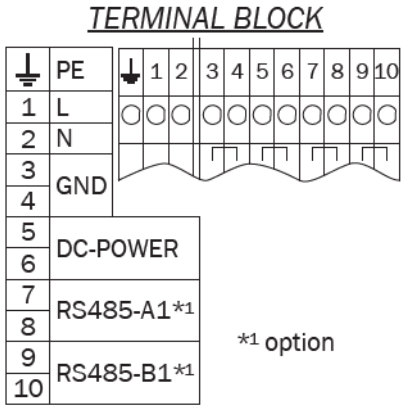


Table 12 Terminal assignment for terminal block, Zone 2 /Div. 2 resp. Non-Ex

Terminal No.	Short name	Function	Comment	Conductor size
⏚	Ground symbol	Grounding	Connected with GND	0.5 … 2.5 mm²
1	L1	Phase conductor	Optional - AC variant	
2	N	Neutral conductor		
Separator / partition plate				
3	GND	Minus pole - DC	Variant-dependent wiring *DC variant* – Connection of ext. power supply unit – Routing of external power supply to FLSE100-XT sender/receiver units *AC variant:* – Internal 24 VDC power supply unit is connected – FLSE100-XT sender/receiver units connection to their power supply GND is connected electrically with the exterior ground terminal	0.5 … 2.5 mm²
4				
5	DC power	Positive pole - DC		
6				
7	RS485-A1	Serial interface	Installation option for connection of two FLSE100-XT sender/receiver units, connection from P3 to the terminal blocks must be made on-site	
8				
9	RS485-B1			
10				

6.5.7.2 Terminal block, Interface Unit for Zone 1 Ex d

Fig. 86 Terminal block, Zone 1 Ex d

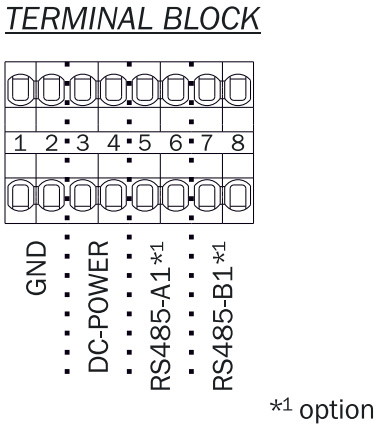
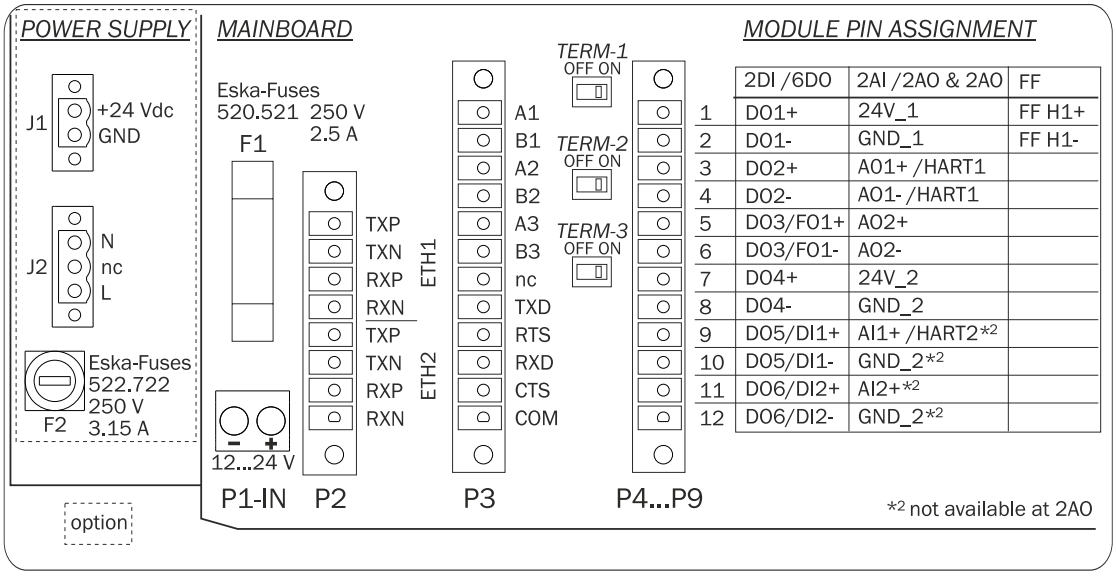


Table 13 Terminal assignment of the terminal blocks Zone 1 Ex d

Terminal No.	Short name	Function	Comment	Conductor size
1	GND	Minus pole - DC	Variant-dependent wiring *DC variant* – Connection of ext. power supply unit – Routing of external power supply to FLSE100-XT sender/receiver units *AC variant:* – Internal 24 VDC power supply unit is connected – FLSE100-XT sender/receiver units connection to their power supply GND is connected electrically with the exterior ground terminal	0.25 ... 1.5 mm²
2				
3	DC power	Positive pole - DC		
4				
5	RS485-A1	Serial interface	Installation option for connection of two FLSE100-XT sender/receiver units, connection from P3 to the terminal blocks must be made on-site	
6				
7	RS485-B1			
8				

6.5.7.3 Overview of field connections mainboard and 115 ... 230 VAC power supply

Fig. 87 Field connections



	2DI /6DO	2AI /2AO & 2AO	FF
1	DO1+	24V_1	FF H1+
2	DO1-	GND_1	FF H1-
3	DO2+	AO1+ /HART1	
4	DO2-	AO1- /HART1	
5	DO3/FO1+	AO2+	
6	DO3/FO1-	AO2-	
7	DO4+	24V_2	
8	DO4-	GND_2	
9	DO5/DI1+	AI1+ /HART2*2	
10	DO5/DI1-	GND_2*2	
11	DO6/DI2+	AI2+*2	
12	DO6/DI2-	GND_2*2	

Plug/terminal name	Pin identification	Function	Comment	Conductor size
P1	1	Minus pole – DC, GND	Power supply of electronic unit, prewired at the factory to terminal block 3 to 6	0.5 ... 1.5 mm²
	2	Positive pole - DC		
P2	TXP – ETH1	Data line of first Ethernet interface	100Base-TX or 10Base-T full and halfduplex Ethernet	0.14 ... 1.5 mm²
	TXN – EHT1			
	RXP - ETH1			
	RXP - ETH1			
	TXP – ETH2	Data line between of second Ethernet interface	100Base-TX or 10Base-T full and halfduplex Ethernet	
	TXN – EHT2			
	RXP – ETH2			
	RXP – ETH2			
P3	A1	Serial RS485	internal COM5, Connection FLSE100-XT	0.5 ... 1.5 mm²
	B1			
	A2	Serial RS485	internal COM2, Connection Scada, Service PC or Gas chromatograph	
	B2			
	A3	Serial RS485	internal COM3, Connection Scada, Service PC or Gas chromatograph	
	B3			
	nc	Not connected		
	TXD	Transmit data	Serial RS232 Internal COM1, Connection Scada, Service PC or Gas chromatograph	
	RTS	Request to send		
	RXD	Receive data		
	CTS	Clear to send		
	COM	Common Ground – connected electrically with GND		

Plug/terminal name	Pin identification	Function	Comment	Conductor size
P4 to P9	1	Directly connected to I/O module slots 1 to 6, example: P4 connected to slot 1 etc. Exact pin assignment depending on the module, see →Table 14		0.5 … 1.5 mm²
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
J1	+24V DC	Positive pole - DC	24V output voltage of internal power supply unit *optionally available	0.5 … 2.5 mm²
	GND	Minus pole – DC, GND		
J2	N	Neutral conductor	Power supply connection of internal power supply unit, prewired to terminal blocks 1 and 2 *optionally available	0.5 … 2.5 mm²
	nc	Not connected		
	L	Phase conductor		

6.5.7.4 **Terminal assignment in Ex d e terminal compartment**

The valid terminal compartment identification is always located on the label on the back of the enclosure door of the Ex d enclosure.

Example of terminal designation:

– P5: AO2

  P5 is the identification of the module slot in the Ex d e terminal compartment

  AO2 denotes the respective signal, see → p. 132, §6.5.7.1,

> ***NOTICE:***
> There are different versions depending on which wiring variant was ordered for the Ex d e terminal compartment.
> The possible versions are described in the type code of the Interface Unit (feature 20), → p. 222, §15.4.2.
> For an example of an AC configuration, see→ Fig. 88; for an example of a DC configuration, see → Fig. 89.

– Connection cross-section for the terminals in the Ex d e terminal compartment:

  For one conductor: 0.14 … 2.5 mm²

  For two conductors with same cross-section: 0.14 … 1.5 mm²

Fig. 88 AC configuration example (variant A)

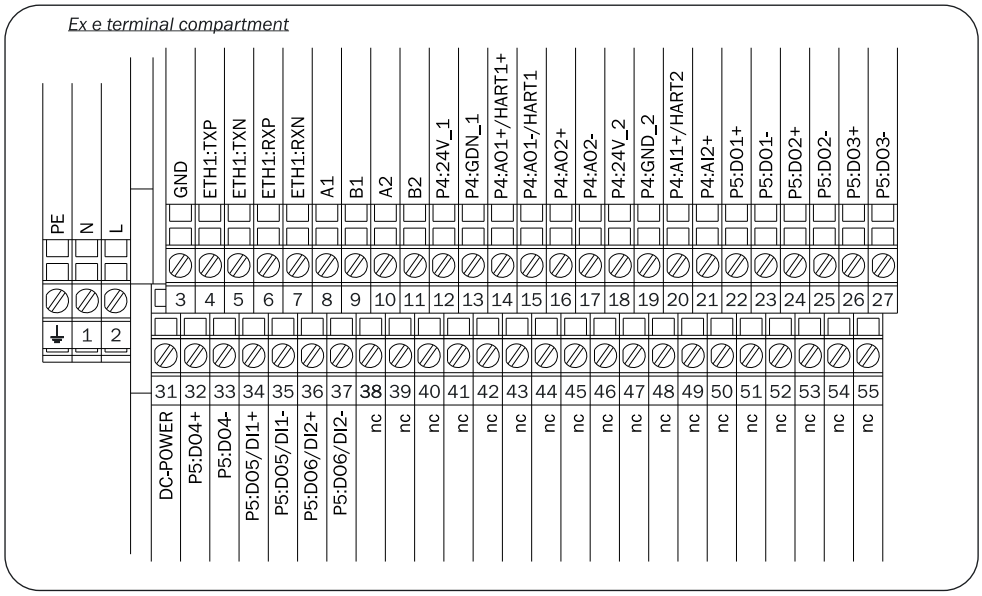
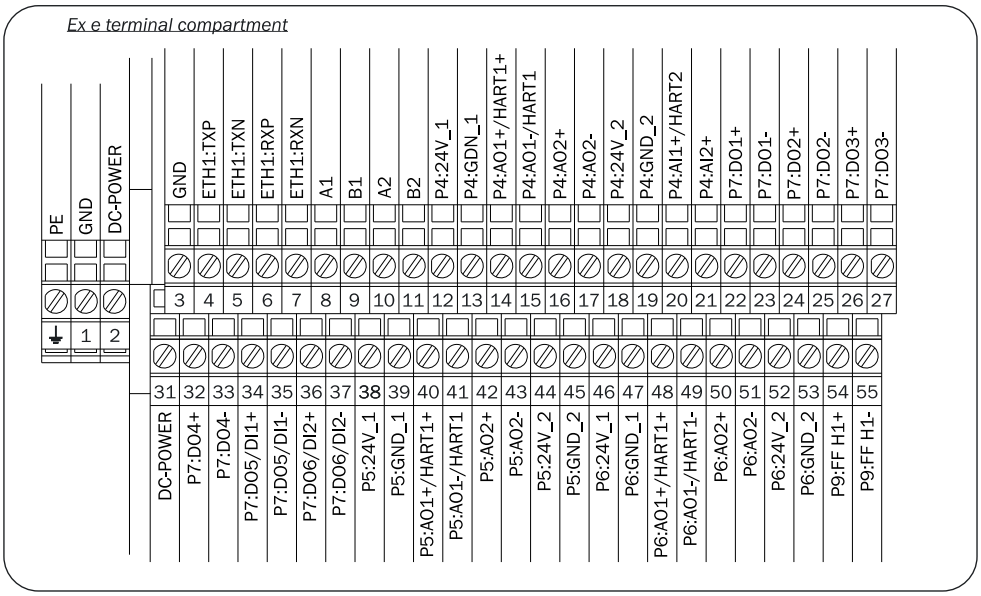


Fig. 89 DC configuration example (variant L)



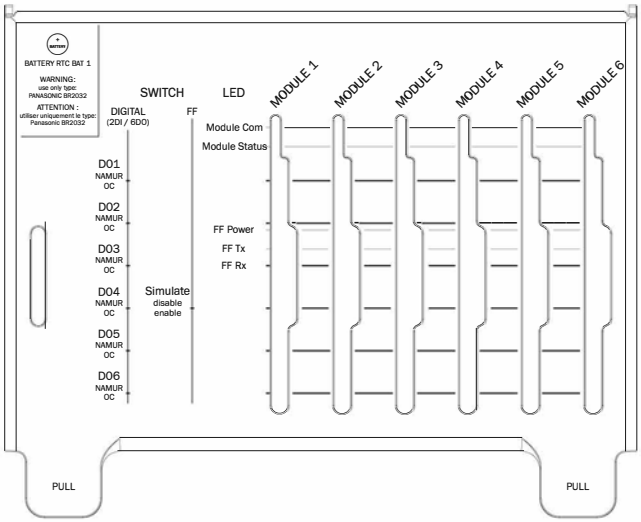
6.5.8 Connection assignment of I/O modules

Table 14 Signal definition of individual modules

Pin ident.	I/O module							
	Analog module type 1 (2AI/2AO)		Analog module type 2 (2AO)		Digital module type 1 (2DI/6DO)		Interface module FOUNDATION™ Fieldbus (FF)	
1	24V_1	Auxiliary voltage for up to two current loops, max. 60 mA	24V_1	Auxiliary voltage for up to two current loops, max. 60 mA	DO1+	Digital output	FF H1+	FOUNDATION™ Fieldbus
2	GND_1		GND_1		DO1-		FF H1-	
3	AO1+/ HART1	Analog output; HART® Field Device	AO1+/ HART1	Analog output; HART® Field Device	DO2+	Digital output		
4	AO1-/ HART1		AO1-/ HART1		DO2-			
5	AO2+	Analog output	AO2+	Analog output	DO3+	Digital output		
6	AO2-		AO2-		DO3-			
7	24V_2	Auxiliary voltage for up to two current loops, max. 60 mA	24V_2	Auxiliary voltage for up to two current loops, max. 60 mA	DO4+	Digital output		
8	GND_2		GND_2		DO4-			
9	AI1+/ HART2	Analog input; HART® Host			DO5+/ DI1+	Switching output/ digital input		
10	GND_2				DO5-/ DI1-			
11	AI2+	Analog input			DO6+/ DI2+	Switching output/ digital input		
12	GND_2				DO6-/ DI2-			

6.5.9 Electronics cover

Fig. 90 Electronics cover



The electronics cover serves to protect the internal electronics from contamination.
The labeling on the electronics cover refers to the module slots.

Fig. 91 Electronics cover labeling

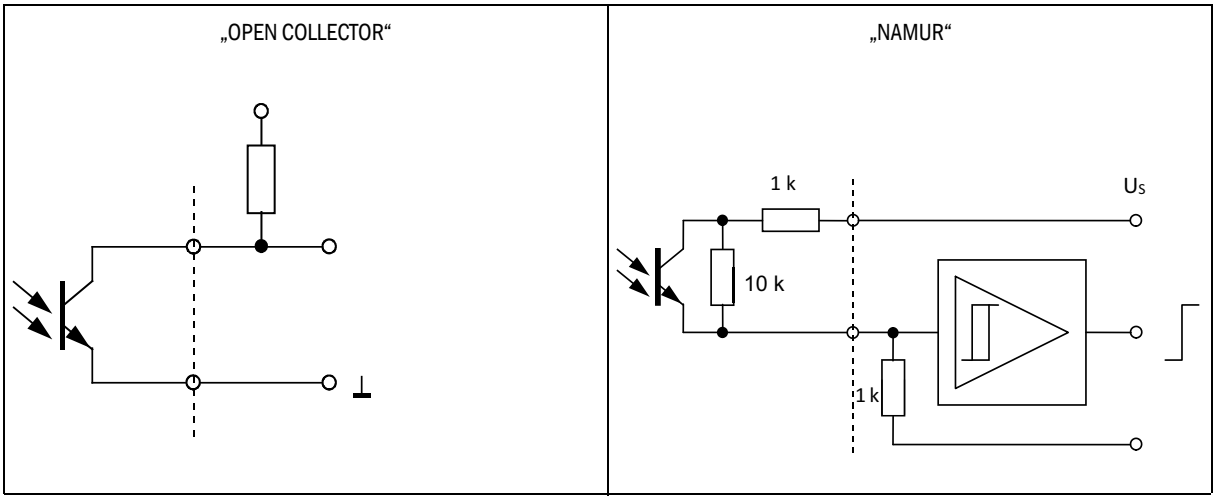
Labeling	Description	
Digital	Switch for NAMUR/OC changeover, for digital modules	Switching between Open Collector and Namur, see → p. 139, §6.5.10.
FF	Simulate switch, only for FOUNDATION™ Fieldbus	● Disable: Measured and process values available via FOUNDATION™ Fieldbus ● Enable: Simulated values available via FOUNDATION™ Fieldbus
LED	Module communication signaling	
	Module COM	Communication via backplane bus active
	Module Status	● Flashing: I/O module synchronization (once per I/O cycle, e.g. 500 ms) ● Blinking: Short-term I/O or communication error; check I/O module status ● Static on: Permanent I/O or communication error; check I/O module status
	FF Power	Bus performance available via FOUNDATION™ Fieldbus H1
	FF Tx	● Flashing/blinking: Internal communication response of the I/O module[1)] ● Static on: No communication
	FF Rx	● Flashing/blinking: Internal communication response of the I/O module[1)] ● Static on: No communication

1) Independent of external communication via FOUNDATION™ Fieldbus H1

6.5.10 Switching (Open Collector - Namur) on digital modules

> ***NOTICE:***
> Electrical parameters, see Technical Data, → p. 187, §12.3 “Digital outputs”.

Figure 92 DO circuitry (Open Collector - Namur)



6.5.11 Termination resistors of serial RS485 lines

For all three serial RS485 lines, termination resistors can be optionally connected via switches (Term-1...3).

The termination network is structured as follows:

Fig. 93 Termination

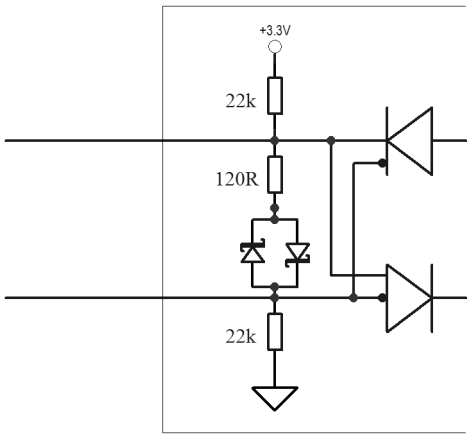
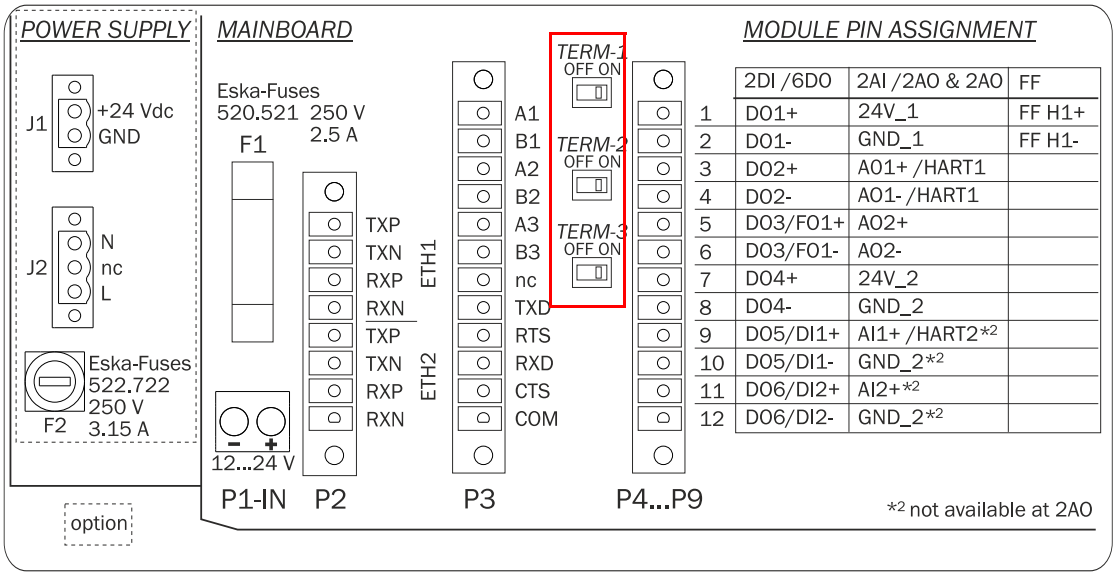


Fig. 94 Position of termination switches



	2DI /6DO	2AI /2AO & 2AO	FF
1	DO1+	24V_1	FF H1+
2	DO1-	GND_1	FF H1-
3	DO2+	AO1+ /HART1	
4	DO2-	AO1- /HART1	
5	DO3/FO1+	AO2+	
6	DO3/FO1-	AO2-	
7	DO4+	24V_2	
8	DO4-	GND_2	
9	DO5/DI1+	AI1+ /HART2*2	
10	DO5/DI1-	GND_2*2	
11	DO6/DI2+	AI2+*2	
12	DO6/DI2-	GND_2*2	

6.5.12 Internal fuses

WARNING: Danger through main voltage
► Disconnect the power supply line before replacing the fuse.

The device has two internal fuses.

- Fuse F1 - protection of the DC supply for the complete electronic unit
  Fuse characteristics:
  Manufacturer: Eska Fuses
  Part No.: 520.521
  Endress+Hauser Part No.: 2104408
  D5 * 20; 2.5 A; quick-blow; with extinguishing agent
- Fuse F2 - depending on variant for securing the AC supply line
  Fuse characteristics:
  Manufacturer: Eska Fuses
  Part No.: 522.722
  Endress+Hauser Part No.: 2105350
  D5 * 20; 3.15 A; slow-blow; with extinguishing agent

NOTICE:
To prevent the fuse from blowing repeatedly, the user must determine the cause and take appropriate precautions before restarting the device.

6.5.13 Torque values for screw connections

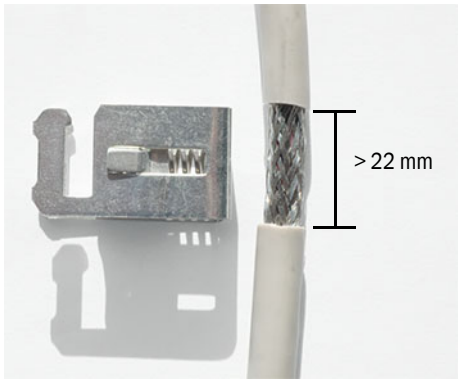
All screw connections have to be tightened with a specific torque value:

Table 15 Torque values

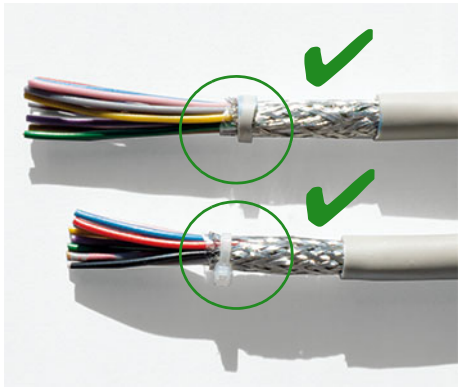
Electrical connection	Definition of torque value
Terminal block	0.5 - 0.6 Nm
Terminal P1	0.5 - 0.6 Nm
Terminal P2 ... P9	0.22 - 0.25 Nm
Terminal J1, J2	0.5 - 0.6 Nm
Exterior ground terminal, Zone 1	8 Nm
Exterior ground terminal, Zone 2	6 Nm

6.6 Connecting shielding terminals

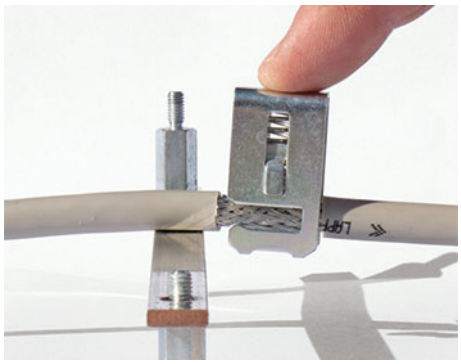
1 Strip the cable > 22 mm.



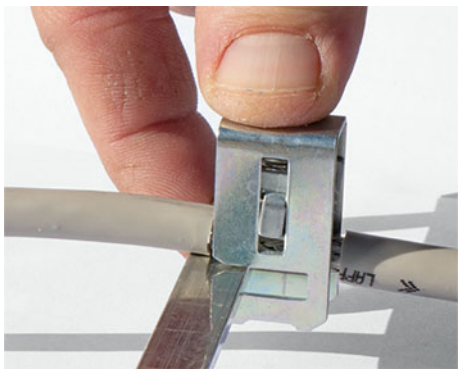
2 Leave a piece of the sheath in place to hold the wires together. As an alternative, use a cable strap.



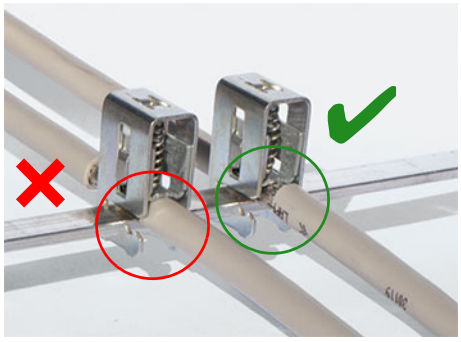
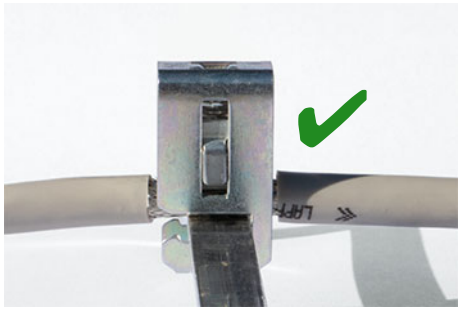
3 Before securing the cable with the terminal, attach the associated plug-in connector.
Then connect the terminal to the shield.



4 Press the terminal down and slide it onto the rail to secure the cable.



WARNING: Danger due to incorrect use of the shielding terminal
The insulation of the cable must not be clamped under the shielding terminal. Otherwise there is no electrical contact and shielding is not guaranteed.

5 Ensure the insulation of the cable is not clamped under the shielding terminal.	
6 Check that the cable is correctly seated.	

FLOWSIC100 Flare-XT

7 Commissioning FLOWSIC100 Flare-XT

General information
Opening the display protective flap
Setting the display language
Commissioning with the FLOWgate™ operating software
Field setup wizard
Function checks after commissioning

7.1 General information

- Before commissioning, the sender/receiver units and the Interface Unit must be installed and electrically connected.
- The display language can be set directly on the device via the display, → p. 147, §7.3.
- The field setup wizard in the FLOWgate™ operating software supports commissioning, → p. 148, §7.4.

NOTICE:
User administration is only available via an Ethernet connection to the FLOWSIC100 Flare-XT.

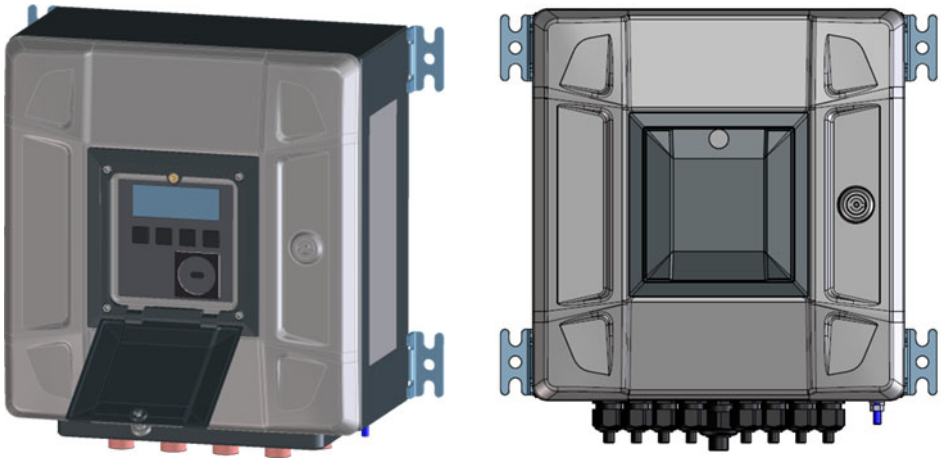
7.2 Opening the display protective flap

Interface Unit Zone 2/Div.2

► Loosen the screw on the display protective flap.
► Swivel the display protective flap down.

***NOTICE:* Display protective flap**
Do not remove the display protective flap.
► Always keep the display protective flap closed when the display is not in use!
► Screw the display protective flap tight after finishing work.

Fig. 95 Display protective flap, Interface Unit Zone 2/Div. 2



Interface Unit Zone 1/Div.1

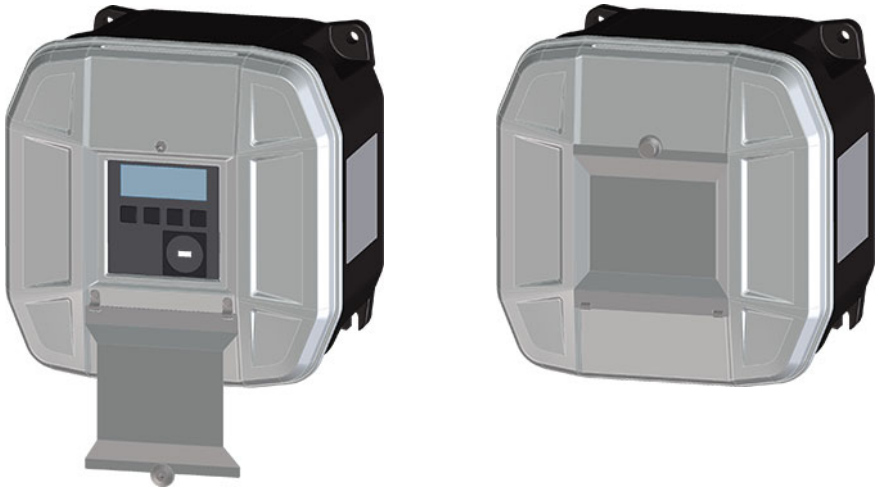
The display protective flap of the Interface Unit Zone 1/Div. 1 is closed by a snap lock.

► Pull the handle to open the display protective flap.

► To close the flap, press on the plate next to the handle.
Do not press on the handle!

> ***NOTICE:*** **Display protective flap**
> Do not remove the display protective flap.
> ► Always keep the display protective flap closed when the display is not in use!
> ► Close the display protective flap after finishing work.

Fig. 96 Display protective flap, Interface Unit Zone 1/Div. 1



7.3 Setting the display language

The display language can be set directly on the display without login.

Available: English, German, Russian

1 Press ESC to go to the main menu.
2 Using the arrow buttons, navigate to the “Language” menu.
3 Press ENTER to open the “Language” menu.
4 Using the arrow buttons, navigate to the desired language.
5 Press ENTER to confirm the language selection.
The display language is changed.

7.4 Commissioning with the FLOWgate™ operating software

7.4.1 Connect to the device

A data connection can be established with the device using the optical data interface and the infrared/USB adapter HIE-04 (Part No. 6050602).

This interface serves to configure the FLOWSIC100 Flare-XT. The infrared/USB adapter has a USB 2.0 interface. This interface provides the connection to the PC and transfers the FLOWSIC100 Flare-XT data.

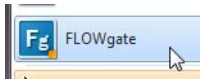
A device driver software must first be installed to operate the adapter on a PC. The device driver software is on the delivered product CD.

1 Install the device driver software before connecting the USB plug to the PC.
2 Connect the USB plug to the PC.
3 Fit the infrared/USB adapter to the infrared interface as shown (Fig. 97), a magnet integrated in the reading head retains the adapter.

Fig. 97 Aligning the infrared/USB adapter

Correct alignment

4 Install the FLOWgate™ operating software.
The FLOWgate™ operating software and the associated Manual are available via the following link: *www.endress.com*

5 Click on the FLOWgate™ icon to start FLOWgate™: 

6 Add the FLOWSIC100 Flare-XT to the Device Manager of the FLOWgate™ operating software and create a connection to the device.

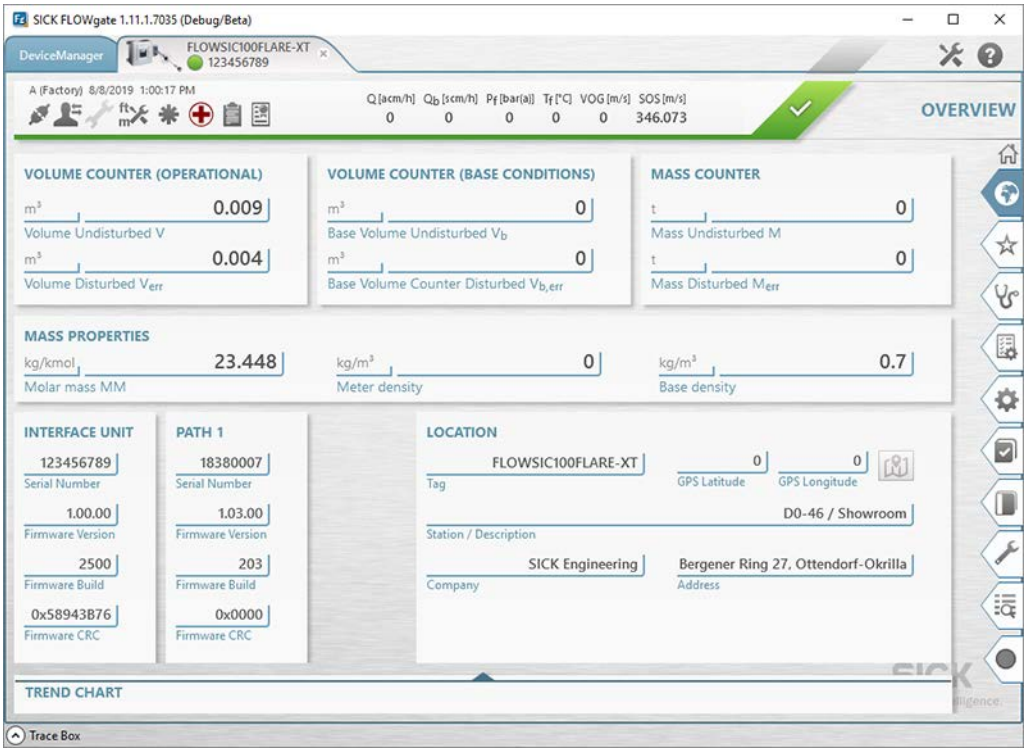
Standard settings for connection with the infrared/USB adapter:
- Protocol: Modbus RTU
- Baud rate: 38400
- Modbus address: 1

7 Login to the device with the default user “Operator”.

Standard password for the “Operator”: flaregas

8 Start the field setup wizard and follow the step-by-step instructions.

Fig. 98 Connection with FLOWgate™ - Overview



7.5 Field setup wizard

The field setup wizard leads step by step through the necessary parameterization of the FLOWSIC100 Flare-XT and ensures no important settings are forgotten. The respective parameters are written to the Interface Unit and the FLSE-XT sender/receiver unit after every step.

► Switch to Configuration mode to start commissioning.
The Interface Unit signals a warning as long as the Configuration mode is active.

Fig. 99 Starting Configuration mode

7.5.1 Path setup

The connected device is automatically recognized for a 1-path installation.

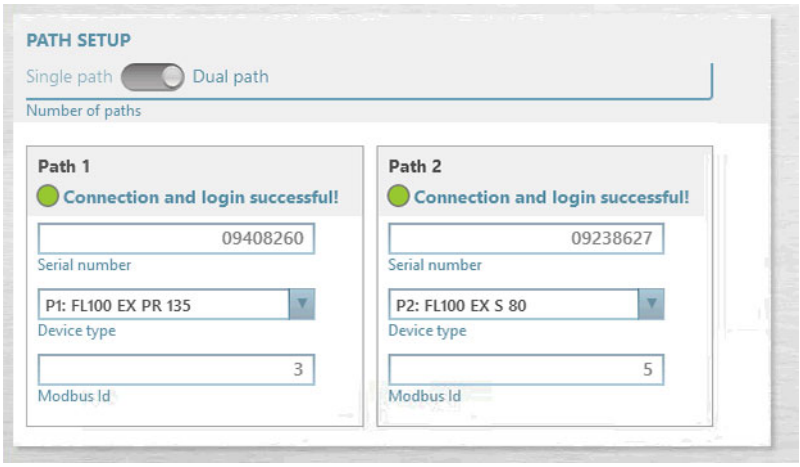
Proceed as follows for a 2-path installation:

► Push the slider control to “2 path”.

► Enter the serial numbers of the connected active sensors. The assignment of the two paths in the pipe is such that the upper path is “Path 1” and the path below it is number 2.
The FLSE100-XT active sensor always has the lower number and the FLSE100-XT passive sensor has the higher number.

► Click “Use path setup”.
The connection to the sender/receiver units is created.

Fig. 100 Path setup (2-path installation)



7.5.2 Identification

- ► Compare the serial numbers with the type plates.
- ► Enter a device name: The device name is freely selectable.
- ► Enter the location.

7.5.3 System/archives

Date and time

- ► Enter the date and time or synchronize with the PC.

Units

- ► Select the unit system for the display in FLOWgate™.
- ► Set whether pressure values are to be shown as absolute or relative pressure.

Data archive settings

- ► Determine the storage intervals for the data archives.

For details on the archives see, → p. 24, §3.6.
The recording intervals can be configured according to requirements.
As soon as the interval is more than 24h, the time of the archive entry can be determined.

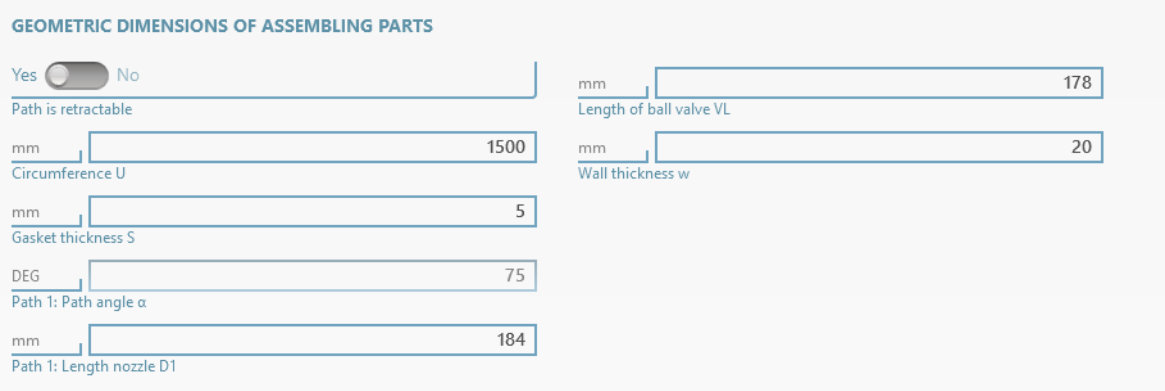
7.5.4 Installation

NOTICE:
Systems consisting of Interface Unit, FLSE-XT sender/receiver units and spool piece are preconfigured at the factory. Do not change the configurations for these systems and skip the “Installation”.step.

The dimensions of the components can be taken from the report generated during assembly.

► For installations with ball valves, set slider “Path is retractable” to “Yes”.

Fig. 101 Installation parameters



► Enter the dimensions determined during installation:
  – Wall thickness w, circumference U
    → p. 62, §5.6.7.2 for cross-duct versions and → p. 64, §5.6.7.3 for the probe versions
  – Nozzle length D1; and the length of the second nozzle D2 for cross-duct versions, → p. 65, §5.6.7.4
  – Gasket thickness S, length of ball valve VL → p. 70, §5.6.8
► Click “Calculate probe offset”.
  The probe offset is calculated.
► Click “Calculate parameter values”.
  The parameter values are calculated.

7.5.5 Pressure/temperature sensor

► Select source of pressure and temperature measured values.

Table 16 Settings for connected pressure or temperature sensors

Selection		Parameter	Description
pT sensor settings			
Single/dual source	Single		One sensor connected
	Dual		Two sensors connected
Fall back type	Last good value		Last valid measured value of connected sensor
	Fixed value		Value set under “Fixed value”
Fixed value	Entry field		Fixed value for pressure or temperature If “Fixed value” was selected under “Source selection” or when a sensor fails.
Dual mode	Auto transmitter A		The value of transmitter A is used by default
	Auto transmitter B		The value of transmitter B is used by default
	Average		An average is created from both measured sensor values
Deviation limit	Entry field		Maximum allowed deviation of the measured values of both transmitters from each other
Deviation failed mode	Transmitter failure		If the configured "Maximum deviation" is exceeded, an error message is displayed
	Use transmitter A value		If the configured "Maximum deviation" is exceeded, the value of transmitter A is used
	Use transmitter B value		If the configured "Maximum deviation" is exceeded, the value of transmitter B is used
pT transmitter A/B			
Source selection	Fixed value		Value set under “Fixed value”
	Analog input		Pressure value read in via an analog input.
		Analog input channel	Assignment via which analog input the measured value is read in
	HART		Measured value read in via HART
		Analog input channel	Assignment via which analog input the measured value is read in
		ID	Address of the pressure or temperature sensor
		Freeze mode	Activates the freeze mode of the transmitter; if the freeze mode is activated, the measured values are frozen at the requested time and can be queried one after the other.
		HART value selection	Selection which of the dynamic variables should be used as process input: Primary, Secondary, Tertiary or Quaternary variable.
	External live value		Measured value read in via the Modbus register
P Absolute/Gauge			
P Source Abs Gauge		Absolute	The connected sensor is an absolute pressure sensor
		Gauge	The connected sensor is a gauge pressure sensor

7.5.6 I/O configuration

In the I/O configuration step, the parameters can be set for the interfaces available in accordance with the ordered configuration. Depending on the configuration, several modules of one type may be available.

The designation Px behind the interface designation describes the position of the module, for arrangement see → p. 126, §6.5.5.

7.5.6.1 Ethernet

The MAC address can be read out in this view.

- ► Enter IP address, network mask and gateway.
- ► When no gateway is used, enter “0.0.0.0” as gateway.

Factory settings:

- Ethernet port 1:
  - IP address: 192.168.1.100
  - Network mask: 255.255.255.0
- Ethernet port 2:
  - IP address: 192.168.2.100
  - Network mask: 255.255.255.0

7.5.6.2 RS485/RS232

Define the communication settings for connected devices, e.g., for connected gas chromatographs.

Table 17 Selection options for connected devices

Selection	Description
Flowgate Modbus Ser	Connection Service PC via RS485-USB Adapter Using Flowgate over greater distances than with infrared adapter
Scada MODBUS Ser	Connection Interface Unit to higher level control system
MCU-P compatible	Interface Unit MODBUS Register mapping analog to MCUP
GC	Connecting a standardized gas chromatograph

7.5.6.3 DI/DO (layout depending on the selected configuration)

Digital outputs DO1, DO2 and DO4 can be activated.

DO3 can be configured as status output or pulse output (PO1). The desired measured value can be assigned to the pulse outputs. The desired function can be assigned to the digital output in the “Function” menus.

DO5 and DO6 can be configured as digital inputs DI1 and DI2.

Example for the configuration of a digital output:

Fig. 102 DO1 (example)

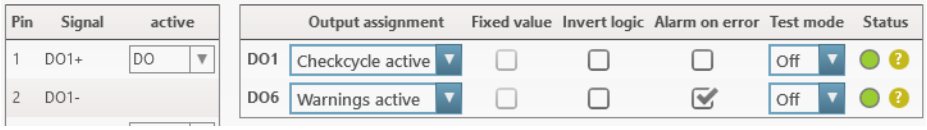


Table 18 Selection options

Selection	Description
Checkcycle active	Check cycle of the sender/receiver units
Warnings active	Warnings are active on the FLOWSIC100 Flare-XT
Alarms active	Alarms are active on the FLOWSIC100 Flare-XT
Flow direction	Flow direction of the gas; positive flow direction (0), return flow (1)

- Invert logic: Inverts the logic of the output signal
- Alarm on error: In case of an error of the digital output, an alarm is displayed in the system status of the FLOWSIC100 Flare-XT
- Test mode:
  - Off: Test mode not active
  - Permanently on: Test of digital output, permanently on
  - Permanently off: Test of digital output, permanently off

Example for the configuration as pulse output:

Fig. 103 PO1 (example)

- Function: Output values of the pulse output; the following measured values can be output (forward = positive flow direction):
  - Indicated volume fwd
  - Base volume fwd
  - Mass fwd
  - CO2 mass fwd
- Factor: The factor indicates how many pulses are output per selected unit; in the example (→ Fig. 103), 3.2 pulses per measured cubic meter of gas are output in the flow direction.
- Alarm on error: In case of an error of the pulse output, an alarm is displayed in the system status of the FLOWSIC100 Flare-XT
- Test mode: Test mode active
- Test value: Impulses per calculation cycle of the application; the default duration of a calculation cycle is 500 ms.

Example for the configuration as digital input:

Fig. 104 DI1 (example)

Table 19 Selection options

Selection	Description
Maintenance	Set maintenance condition
Start probe check cycle	Start check cycle of the sender/receiver units
Start AO check cycle	Start check cycle of the analog outputs
Start AO and probe check cycle	Start check cycle of analog outputs and sender/receiver units
Data valid	Overall status for the measuring point; when the control system signals an incorrect overall status, the Interface Unit increments the error counters, even when there is no error on the FLOWSIC100 Flare-XT

- Invert logic: Inverts the logic of the received signal
- Raw read: Instantaneous value, without debounce
- Debounce: Debounce time (the time a digital input must be constant without status change)
- Alarm on error: In case of an error of the digital input, an error is displayed in the system status of the FLOWSIC100 Flare-XT
- Test mode:
  - Off: Test mode not active
  - Permanently on: Test of digital input, permanently on
  - Permanently off: Test of digital input, permanently off

7.5.6.4 **AI/AO**

► Determine the output values for the analog outputs.

► Determine whether an alarm is to be displayed for analog input errors.

Fig. 105 Output via analog output (example)

- Low scale: Minimum output value of the analog output
- High scale: Maximum output value of the analog output
- Test mode: Test mode active
- Test value: Test of the output in relation to the selected upper and lower output value

AO check cycle

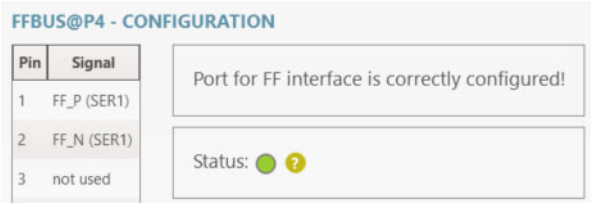
With the "AO Checkcycle" function, freely selectable minimum and maximum current values can be defined at the analog output. The current values are then set by the Interface Unit at a likewise time-selectable interval when the function is activated.

- Activating of the "AO Check Cycle" button in the Commissioning assistant is only possible in Configuration mode and does not generate any current at the corresponding analog output.
- When activating the Configuration mode, the scaled current depending on the assignment will be output.

7.5.6.5 **FFBUS**

The status of the FOUNDATION™ Fieldbus (FF) module is displayed. To view details of the status, click on the “?” symbol.

Fig. 106 Status of the FOUNDATION™ Fieldbus module



The FF-related configuration is necessary to read values from the device, e.g., node address and communication relationship of the FF blocks. This FF configuration can only be accessed via the Fieldbus not via the FLOWgate™ operating software.

The FF address is set to 248 and the physical device tag to “FLOWSIC_IU_____commMod12345678” for example. Here, 12345678 is an I/O module specific serial number and not the serial number of the Interface Unit.

Please use official FOUNDATION™ Fieldbus configuration equipment or a field communicator to set these values according to the standards for your application.

Detailed descriptions of the Modbus, HART® and FOUNDATION™ Fieldbus protocols are available as separate documents at *www.endress.com* or from Endress+Hauser Service.

7.5.7 Molar mass (calculations)

7.5.7.1 Volume flow

Volume flow rate at operating conditions

In general, volume flow rate Q_{ac} is defined by representative cross-sectional area A and mean gas velocity v_A with respect to the cross-section (area velocity):

$$Q_{ac} = v_A \cdot A$$

Path velocity v, the mean value of the flow velocity on the sound path between the two sender and receiver units is determined with the FLOWSIC100 Flare-XT. Especially with small pipe diameters, this is not identical with the area velocity. The correction is done with a polynomial relation

$$k = k(Re, CC_0 \ldots CC_4)$$

under consideration of the flow profile in dependence on Reynolds number Re and a set of 5 coefficients (CC_0 ... CC_4). The coefficients of this function were determined using numerical flow simulation and regression analysis.

The volume flow results from:

$$Q_{ac} = k \cdot v \cdot A$$

The Reynolds number used in the correction is calculated device-internal:

$$Re = \frac{v \cdot D \cdot \rho}{\eta}$$

In addition to measured variable path velocity v and inner pipe diameter D, the process parameters density of medium ρ and viscosity η are used. The density can either be predefined or calculated using a molar mass algorithm, → p. 161, §7.5.7.4 .

The viscosity can be configured as fixed value. Pressure and temperature have a significant influence on accuracy. The best accuracy is achieved when externally installed pressure and temperature sensors are connected to a DCS/SCADA system and then written via MODBUS into the FLOWSIC100 Flare-XT electronics.

In addition to the calculation of the Reynolds number, process values are required to calculate the flow rate at base conditions and the mass flow rate.

> ***NOTICE:***
> The correct evaluation of the Reynolds number is decisive for the determination of the correct calibration function. The Reynolds number must be determined with an accuracy of 20 % in order to achieve the device accuracy offered by Endress+Hauser.

Volume flow rate at base conditions

The volume flow rate is converted from operating conditions to base or standard conditions based on the gas equation

Fig. 107 Calculation of the volume flow at base conditions

$$Q_{sc} = Q_{ac} \cdot \frac{p_{ac}}{p_{sc}} \cdot \frac{T_{sc}}{T_{ac}} \cdot \frac{1}{K}$$

with the parameters pressure in operating conditions p_{ac} and base conditions p_{sc}, the temperature in operating conditions T_{ac} and base condition T_{sc}, as well as compressibility K. Compressibility is the relationship of the compressibility factors in operating and standard conditions $K = Z_{ac}/Z_{sc}$.

For applications < 5 bar, compressibility can always be approximated sufficiently well with value 1. In applications with higher process pressures, constant values for the compressibility factors can be configured.

7.5.7.2 **Mass flow rate**

The mass flow rate $\dot{m}$ is calculated from the measured volume flow rate under operating conditions Q_{ac} and the determined density ρ_{ac} according to equation:

Fig. 108 Calculation of the mass flow rate

$$\dot{m} = Q_{ac} \cdot \rho_{ac}$$

7.5.7.3 **Algorithm for calculating the molar mass**

► Select the desired algorithm for the use of the molar mass:
- Basic
- Hydro Carbon
- Carbon number
- MR113

VOG dependency

When the VOG dependency is activated, different algorithms can be selected for higher and lower gas velocities.

The field “VOG Limit” serves to define at which gas velocity the algorithm should switch over.

Basic algorithm

The basic algorithm is suitable for basically flammable gases with a constant composition and low hydrocarbons content. The basic algorithm is based on the following equation, which can be used to determine the molar mass for ideal gases

Fig. 109 Basic algorithm formula

$$Mm = \frac{\kappa \cdot R \cdot T}{VOS^2}$$

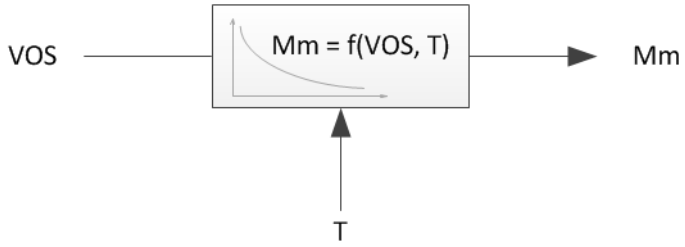
Mm= molar mass
κ = adiabatic coefficient
R = universal gas constant
T = temperature
VOS = velocity of sound

The algorithm requires the adiabatic coefficient κ (mean value) as input value, . Velocity of sound and temperature can be measured by FLOWSIC100 Flare-XT. The algorithm is suitable for all ideal gases with pressures < 5 bar with constant gas composition.

Hydrocarbon algorithm

The hydro-carbon algorithm is suitable for typical hydrocarbon mixtures with inert gases proportion < 10%. On the basis of the velocity of sound, the molar mass is calculated with the assumption of a typical hydrocarbon mixture. Changes in the composition of the hydrocarbon fractions can be taken into account.

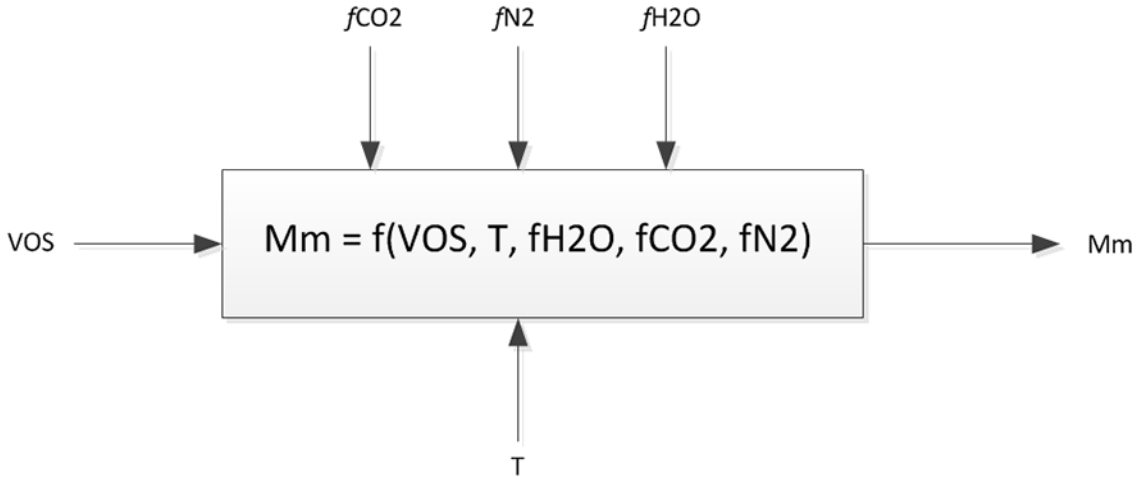
Fig. 110 Hydrocarbon algorithm formula



Carbon number algorithm

The carbon number algorithm is suitable for calculating the molar mass for hydrocarbon mixtures. During the calculation, the carbon-number algorithm can compensate the influence of inert gas components CO_2, N_2, H_2O and uncertainty of the molar mass calculation improves. Fixed values of the inert gas components must be entered when the carbon number algorithm is selected. The portions can be configured in operating software FLOWgate™ as medium constant values.

Fig. 111 Carbon number algorithm formula

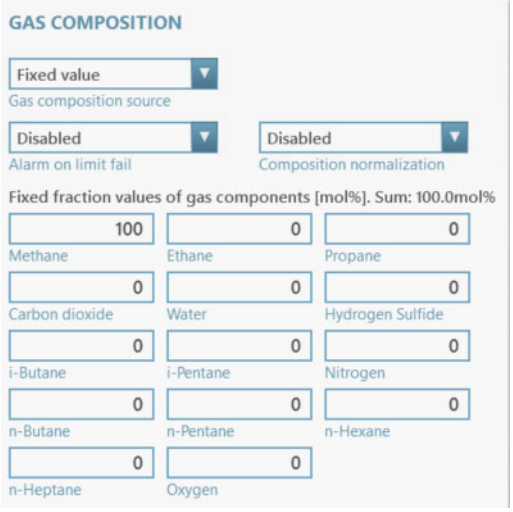


Algorithm MR113n

MR113n is an algorithm for calculating the molar mass and other gas characteristics which is widely used for measurement of associated gas in Russia.

The algorithm is adapted better to the typical application conditions of this industry. The calculation of molar mass, compressibility and other characteristics is based on a known gas matrix with 14 components.

Fig. 112 Gas matrix for algorithm MR113n



The gas composition can be configured with constant values or read in by a gas chromatograph. Various types can be selected in the operating software.

The algorithm provides the most exact results when a gas chromatograph is available.

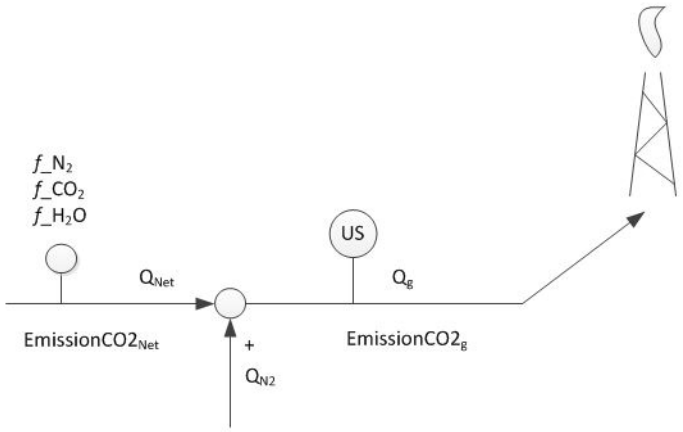
Nitrogen compensation

Nitrogen compensation is available when using the carbon number algorithm.

In applications that inject nitrogen before the measuring device in order to ensure permanent purging, these nitrogen quantities are also recorded.

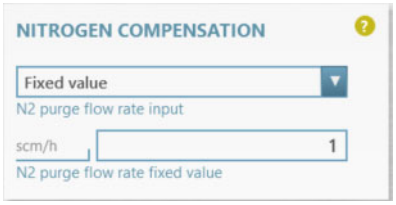
If the quantity of flow rate N_2 is known, FLOWSIC100 Flare-XT can subtract this portion from the total quantity. Without this compensation, the purge air share with the measured molar mass of the combustible gases would be added to the total quantity of CO_2 which leads to higher CO_2 emission values.

Fig. 113 Function of nitrogen compensation



In the Setup wizard, you can select whether the nitrogen quantity should be configured as a constant value or read in via an analog input.

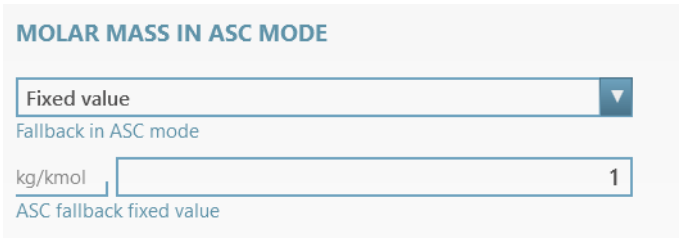
Fig. 114 Nitrogen compensation



Molar mass in ASC mode

A value can be defined for the molar mass with active ASC technology. Either the last good value can be used or a fixed value can be configured.

Fig. 115 Molar mass in ASC mode



7.5.7.4 Density calculation

If the Carbon number algorithm or the MR113n algorithm is selected for the determination of the molar mass, the density is calculated under operating conditions within the algorithm. If the Basic algorithm or the Hydro carbon algorithm is selected, the density is calculated in a separate step according to the real gas equation:

Fig. 116 Calculation of the density

$$\rho_{ac} = \frac{p_{ac} \cdot Mm}{z_{ac} \cdot R_0 \cdot T_{ac}}$$

ρ_{ac} = Density at flowing conditions
P_{ac} = Pressure at flowing conditions
Mm = Molare Masse
z_{ac} = Compressibility factor at flowing conditions
R_0 = Universal gas constant
T_{ac} = Temperature at flowing conditions

7.5.8 Application

7.5.8.1 Flow control

► Configure the flow parameters as desired for the particular application:
- Suppress negative velocity: If you select "Yes", a negative velocity is suppressed and not taken into account.
- Low flow cutoff: If the measured value is less than the value of the low flow cutoff, the output of the gas velocity is zero. Accordingly, the output for the volume flow will also be zero.

7.5.8.2 CO_2 emission calculation

In flare gas applications, unlike CEMS measurements, CO_2 emissions cannot be measured directly because the CO_2 is only created directly at the flare during combustion. Typically, the CO_2 emissions are determined according to a calculation model, which has also been directly implemented in the FLOWSIC100 Flare-XT. Since the measuring device provides an important calculation variable, the mass flow, the calculation of CO_2 emissions can take place directly in the FLOWSIC100 Flare-XT.

The oxidation factor is an installation-dependent fixed value and describes the combustion quality and is provided by the flare manufacturer.

The emission factor describes the flare gas. As there is normally no precise information on the composition of the specific flare gas, an application-dependent fixed value is normally used.

But however, as the FLOWSIC100 Flare-XT can compensate for the components CO_2, N_2 and H_2O which contribute to the generation of CO_2, the measuring system can calculate an emission factor. This allows direct calculation of the real, lower CO_2 emissions.

Fig. 117 Formula for calculating the CO_2 emission

$$emissionCO2 = eCO2 \cdot MFlow \cdot OxydationFactor$$

eCO2 =Emission factor CO_2
MFlow = mass flow rate
OxydationFactor = factor for completeness of combustion (ideal = 1; typically 0.94)

Source: Reporting of greenhouse gas emissions under Directive 2003/87/EC of the European Parliament and of the Council

Fig. 118 CO_2-Emission factor

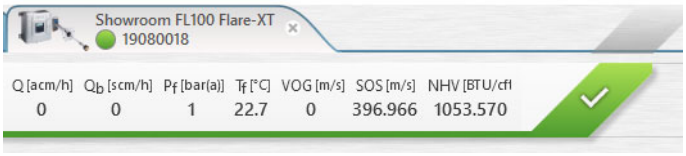
7.5.8.3 **Algorithm for the calculation of the Net Heating Value (NHV)**

The volume-based net heating value (NHV) is calculated in operating software FLOWgate™ as of version 01.23.00 from the measured speed of sound, temperature and pressure.

The source of the measured pressure and temperature values defined during commissioning is used for calculation of the net heating value, see → p. 152, §7.5.5. No further parameterization is required.

The net heating value is displayed in the overview line.

Fig. 119 Net heating value (NHV)



The unit for the net heating value can be adjusted in FLOWgate™.

Click the following icon in the toolbar: 

Then select “Use custom display units” and adjust the unit as desired.

The basis for the net heating value algorithm is a variety of typical gas compositions from the field of flare gas measurement. The calculation of the net heating value is based on ISO 6976:2016.

Fig. 120 Schematic representation of the net heating value

The net heating value algorithm is suitable for typical hydrocarbon mixtures without inert gas components. An uncertainty of 2.3% relative to the determined heating value can be achieved for typical hydrocarbon mixtures without inert gas components.

7.5.9 User management

User management is only available via an Ethernet connection to the FLOWSIC100 Flare-XT.

> ***NOTICE:***
> Endress+Hauser strongly recommends changing the initial password of the device. Please also check your local cybersecurity requirements that may apply.

7.5.10 Completion

- ► If desired, reset meter levels, logbooks and archives.
- ► Create a Parameter report and archive the report with the delivery documentation.
- ► Optionally it is possible to create a Validation Certificate, → p. 171, §9.4.

7.6 Function checks after commissioning

- ► Check the device status, → p. 171, §9.3.2.

FLOWSIC100 Flare-XT

8 Operation

Operating concept
Display and operating elements
Display in the symbol bar

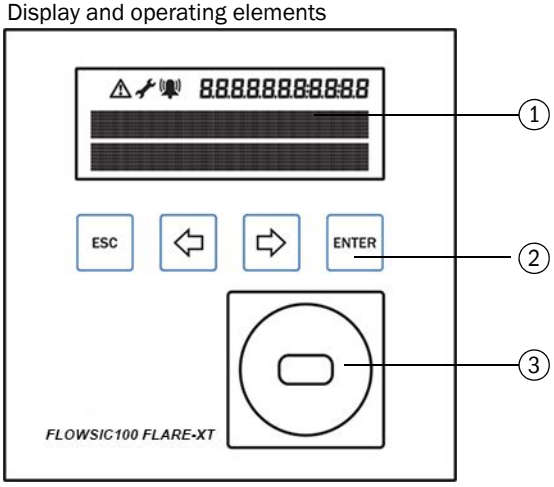
8.1 Operating concept

The Interface Unit display comprises an LCD display for measuring screens and configuring, 4 buttons for menu navigation and an area to attach an infrared/USB adapter (Part No. 6050602) for data communication.

The readability of the display is limited at temperatures below -30 °C. The display is poorly legible to not legible at all.
This will not damage the display. The function of the display is guaranteed again at temperatures above -30 °C.
To read out data or to make settings on the device, please use the serial interfaces of the device.

8.2 Display and operating elements

Fig. 121 Display and operating elements



1 Display
2 Buttons
3 Optical data interface (infrared)

Table 20 Buttons

	In menu
Esc	Returns to next higher level of the operator menu.
⇦	Toggles between single menu entries on one level.
⇨	
ENTER	Calls up a submenu.

8.3 Display in the symbol bar

Table 21 Symbols

Symbol	Significance	Description
	Device status: Malfunction	The device has an error, the measured value is invalid.
⚠	Device status: Warning	The device has a warning, the measured value is still valid.
	Configuration mode	Configuration mode is active, parameters can be changed on the device.

8.4 Menu navigation

Path			Format/unit (metric)	Format/unit (imperial)
Start settings				
	Network			
		Network status	Connected/not connected	
		Network interface IP	x.x.x.x	
		Subnet mask		
		Gateway	x.x.x.x	
		Mac of onboard Eth.	aa:bb:cc:dd:ee:ff	
	Device setup			
		System time	dd.mm.yyyy time (format: 24 h)	
Start of main measured values				
	Velocity of sound		m/s	ft/s
	Flow rate ac		m^3/h	acf/h
	Flow rate sc		sm^3/h	scf/h
	Molar mass		g/mol	lb/lbmol
	Volume ac total		m^3	acf
	Volume sc total		sm^3	scf
	Mass total		kg	lbs
	CO2 total		kg	lbs
	Pressure		bar(a)	psi
	Temperature		°C	°F
	Velocity of gas		m/s	ft/s
Start language				
	English			
	German			
	Russian			

8.5 Status LEDs on the mainboard

The Status LEDs are located at the bottom left on the mainboard, → Fig. 122.

Fig. 122 Position of the Status LEDs

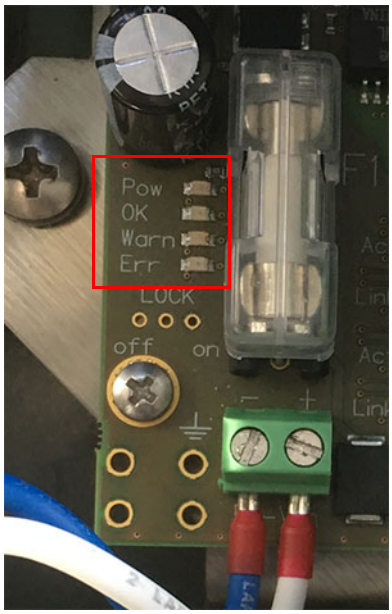


Table 22 Status LEDs description

LED	Description
Pow	Supply voltage present.
OK	Normal operation, neither warnings nor errors exist.
Warn	Device status warning: At least one warning is pending in the device, the measured value is still valid.
Err	Device status error: At least one error is pending in the device, the measured value is invalid.

FLOWSIC100 Flare-XT

9 Maintenance

Safety information
General information
Routine checks
i-diagnostics™ Software-Plug-in (optional)
Cleaning
Exchanging the battery

9.1 Safety information

WARNING: Hazard through improper maintenance work
After all maintenance work, make sure the entire measuring system and any accessories installed are in a safe condition.

9.2 General information

Maintenance strategy

Just like any other electronic measuring system, the FLOWSIC100 Flare-XT requires regular maintenance. By inspecting the system regularly and observing the scheduled maintenance intervals, the service life of the device can be lengthened significantly and ensures measurements are always reliable.

Even though the FLOWSIC100 Flare-XT is often deployed in harsh environments, its design and measuring principle are such that the device requires only minimal maintenance.

Maintenance tasks

The tasks to be carried out are limited to routine checks and cleaning the surfaces of sender/receiver units and Interface Unit.

The FLOWSIC100 Flare-XT provides the option of carrying out i-diagnostics™ instead of extractive maintenance. This consists of “one-click verification” and time analysis of the most important diagnostic values (license for software plug-in required).

After passing the test, a certificate is provided and it is shown whether a field service will probably be required for extractive maintenance in the next period (1 year).

The prerequisite for this presentation is that the device has been used properly in the past 6 months to record the diagnostic data, as these are necessary for determining the trend.

Maintenance intervals

The maintenance interval depends on specific system parameters such as operation, gas composition, gas temperature, gas moisture as well as ambient conditions. By default, the manufacturer's requirement is that, if a verification interval of one year is observed, the measurement is ensured within the manufacturer's specifications.

An optional software plug-in allows the user to perform verification within the FLOWgate™ operating software based on the diagnostic data. This type of regular annual verification allows the interval between extractive field services to be extended up to 5 years.

The respectively issued Verification Certificates and the Annex must be kept. The activities required locally and their completion must be documented by the operator in a Maintenance Manual.

Maintenance agreement

Regular maintenance work can be carried out by the plant operator according to the Service manual when the plant operator has attended an official FLOWSIC100 Flare-XT service training by Endress+Hauser. These activities must be carried out by qualified persons as described in → p. 42, §5.2.8 and → p. 96, §6.2.7. If desired, Endress+Hauser Service or authorized Service support centers can carry out all maintenance work. Any repairs will be made by specialists on-site whenever possible.

9.3 Routine checks

Proper device function can be determined directly on the LC display of the device. The FLOWgate™ operating software provides a user-friendly option for the performance of routine checks.

9.3.1 Function check on the display

If there is a warning or malfunction on the device, the corresponding symbol is shown on the display of the Interface Unit:

Table 23 Symbols

Symbol	Significance	Description
	Device status: Malfunction	The device has an error, the measured value is invalid.
	Device status: Warning	The device has a warning, the measured value is still valid.

► An active error or warning is shown flashing on the LC and details can be retrieved with the FLOWgate™ operating software.

9.3.2 Function check with FLOWgate™

► Check the device status.

Table 24 Signaling the device status in FLOWgate™

Status	Description
	Normal operation, neither warnings nor errors exist
	Device status warning: At least one warning is pending in the device, the measured value is still valid.
	Device status error: At least one error is pending in the device, the measured value is invalid.

► Click on the symbol in the Status bar when warnings or errors exist.
The current Status overview opens and shows details and information on how to proceed.

9.4 i-diagnostics™ Software-Plug-in (optional)

To activate the extended i-diagnostics™ functions, you need an Entitlement ID (Claim ID), which you will receive by e-mail from the manufacturer after ordering the software plug-in.

9.4.1 One-click verification

The system checks itself and protocols its actual status. The one-click verification provides the option of creating a Validation Certificate and generate supporting documentation.

Proceed as follows to create a Validation Certificate:

Click  in the Tool bar:

FLOWgate™ checks critical diagnosis parameters according to manufacturers' specifications.

After the end of the diagnosis, FLOWgate™ creates a Validation Certificate confirming compliance with the standards specified by the manufacturer as relevant for ensuring a valid measurement.

Fig. 123 Validation certificate

FLARE GAS VALIDIERUNGSZERTIFIKAT

FLOWSIC100 Flare-XT

Kunde: SICK Engineering GmbH
Seriennummer: 00007123
Gerätename: FIT-524593

Dieses Zertifikat gibt an, dass das FLOWSIC100 Flare-XT-Messgerät den Test bestanden hat, um die Konformität mit den Standards zu bestätigen, die der Hersteller als relevant für die Gewährleistung einer gültigen Messung angegeben hat.

Datum: 14.05.2019

Nächstes Validierungsdatum: 14.11.2019

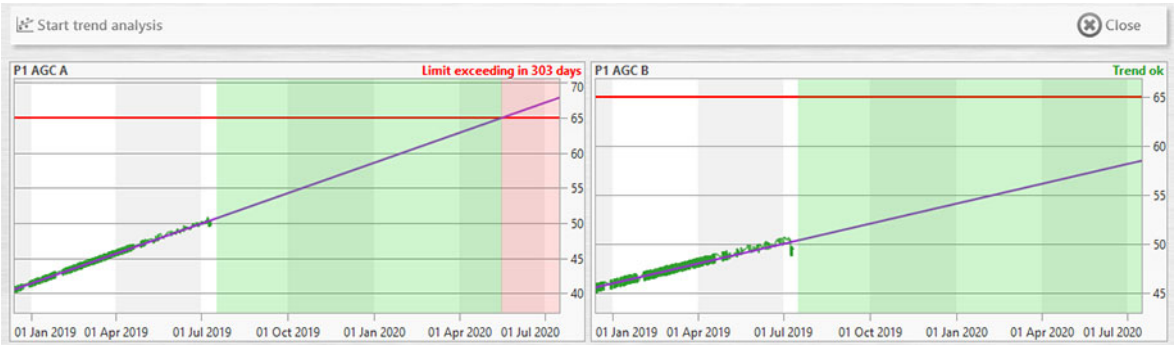
9.4.2 Trend analysis – predictive maintenance

It is also possible to carry out a trend analysis. With the trend analysis, evaluations of various measurement and diagnostic values at past observation points can be made.

If the trend analysis suspects a fault in the future, the manufacturer recommends performing another trend analysis after about 2 months, but at least before reaching the predicted date. This serves to validate the trend in order to then initiate appropriate countermeasures.

The predicted date is based on the assumption of a linear trend and therefore only gives a realistic estimate for linear measurement/diagnostic values.

Fig. 124 Trend analysis



9.5 Cleaning

9.5.1 Cleaning the FLSE100-XT sender/receiver units

- ► Only clean the surfaces of the FLSE100-XT sender/receiver units with a damp cloth.
- ► Only use materials for cleaning which do not damage the surface of the FLSE100-XT sender/receiver units.
- ► Do not use solvents for cleaning.

9.5.2 Cleaning the Interface Unit

Cleaning information

- ► Only clean the Interface Unit with a damp cloth.
- ► Only use materials for cleaning which do not damage the surface of the Interface Unit.
- ► Do not use solvents for cleaning.
- ► Only use cleaning agents free from oil, grease and solvents to clean the display.

9.6 Exchanging the battery

Battery types

WARNING: Hazard for intrinsic safety due to incorrect spare parts

Only PANASONIC batteries type BR2032 are permitted as RTC battery, otherwise intrinsic safety is endangered.

The battery may only be replaced after a Service training by Endress+Hauser or by Endress+Hauser Service!

FLOWSIC100 Flare-XT

10 Troubleshooting

Detecting malfunctions
Error signaling on the display
Contacting Customer Service
Starting a diagnostic session

10.1 Detecting malfunctions

Any deviations from normal operation must be regarded as a serious indication of a functional impairment. These include:

- Warnings displayed (e.g., high contamination)
- Significant drifts in the measuring results.
- Increased power input.
- A rise in system component temperatures.
- Triggering of monitoring devices.
- Smells or smoke emission
- Failure of a measuring path.

NOTICE:

Proceed as follows when a measuring path fails:

► Pull the sender/receiver units back and disconnect them from the process by closing the ball valve, → p. 83, §5.6.9.

► Contact Endress+Hauser Service.

10.2 Error signaling on the display

Pending errors or warnings are signaled on the display, → p. 170, §9.3.

10.3 Contacting Customer Service

Contact Endress+Hauser Customer Service for any malfunctions you cannot clear yourself.

To help Customer Service to understand malfunctions that have occurred, the FLOWgate™ operating software provides the option to create a diagnostics file that can be sent to Customer Service, → p. 176, §10.4.

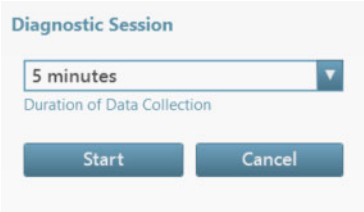
10.4 Starting a diagnostic session

1 Click the icon in the Tool bar to start a diagnostic session.

2 Select the desired data collection duration.

It is recommended to select a data collection duration of at least 5 minutes.

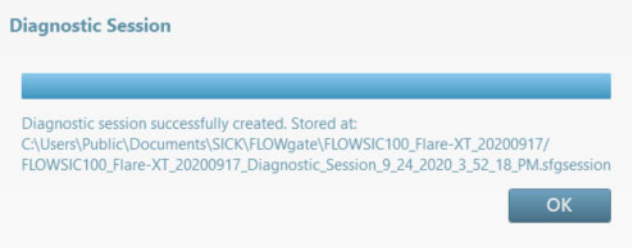
Fig. 125 Data collection duration for the diagnostic session



3 Click “Start” to start recording.

The following message with the current storage location of the data collection is shown after successful creation of the diagnostic session.

Fig. 126 Diagnostic recording completed

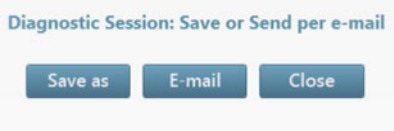


4 Click “OK” to confirm the message.

5 Select the storage location for the diagnostic session:

- Click “Close” to leave the file at the standard storage location.
- Click “Save as” to select a storage location for the diagnostic recording.
- Click “E-mail” to send the file per e-mail. The file is appended to an e-mail when an e-mail client is available.

Fig. 127 Save the diagnostic session



The diagnostic sessions are saved as files with the ending .sfgsession. The files are saved by default under:
C:\Users\Public\Documents\SICK\FLOWgate
The name of the storage folder consists of device type and serial number of the device.

FLOWSIC100 Flare-XT

11 Decommissioning

Safety information on decommissioning
Returning
Disposal information

11.1 Safety information on decommissioning

Ensure that all safety instructions are observed:

- Basic safety information: → p. 13, §2 "For your safety"
- FLSE100-XT: → p. 36, §5.2 "Safety information"
- Interface Unit: → p. 94, §6.2 "Safety information"

11.2 Returning

11.2.1 Contact

Please contact your Endress+Hauser representative for assistance.

11.2.2 Packaging

Make sure the FLOWSIC100 Flare-XT cannot be damaged during transport.

11.3 Disposal information

11.3.1 Materials

- The FLOWSIC100 Flare-XT mainly consists of steel, aluminum and plastic materials.
- It does not contain any toxic, radioactive or other environmentally harmful substances.
- Substances from the pipeline can possibly penetrate, or deposit on seals.

11.3.2 Disposal

- ► Dispose of electronic components as electronic waste.
- ► Check which materials having contact with the pipeline must be disposed of as hazardous waste.
- ► Batteries must not be disposed of with household waste! The battery and the device must be disposed of separately in accordance with the locally applicable waste disposal regulations.

FLOWSIC100 Flare-XT

12 Technical data

System FLOWSIC100 Flare-XT
FLSE100-XT sender/receiver units
Interface Unit
Dimension drawings

12.1 System FLOWSIC100 Flare-XT

> ***NOTICE:***
> The exact device specifications and performance data of the product may deviate and depend on the respective application and customer specification. Only the metrological parameters described in the Application Evaluation Datasheet apply.
> If the delivery documentation of your FLOWSIC100 Flare-XT does not include an Application Evaluation Datasheet, contact your Endress+Hauser partner!
> Example of an Application Evaluation Datasheet: → p. 191, §12.4

Table 25 System FLOWSIC100 Flare-XT

Measuring parameters	
Measured values	Mass flow, volumetric flow s. c. (standard condition), volumetric flow a. c. (actual condition), molecular weight, gas volume and mass, gas velocity, sound velocity
Number of measuring paths	1 path, 2 paths
Nominal pipe size	1-path measurement: 4 ″ ... 86 ″ 2-path measurement: 12 ″ ... 86 ″ * Other nominal sizes on request
Measuring principle	Ultrasonic transit time difference measurement, ASC technology
Measured medium	Typical flare gas
Measuring ranges [1]	0.03 m/s ... 120 m/s
Repeatability	According to ISO 5725-1; JCGM 200:2012): < 0.5% related to the measured value in the range ≥ 1 m/s
Resolution	(According to JCGM 200:2012): + 0.001 m/s
Uncertainty of measurement [1, 2), 3)]	Flow rate a. c. 1% ... 5% Relative to the measured value with ultrasonic technology. (in range ≥ 0.3 m/s to upper measuring range value) 0.5% ... 1.5% with spool piece and flow calibration Relative to the measured value with ultrasonic technology. (in range ≥ 1 m/s to upper calibration range value) [4)]
	Mass flow rate 2% ... 5.5% Relative to the measured value with ultrasonic technology. (in range ≥ 0.3 m/s to upper measuring range value) 1.5% ... 2% with spool piece and flow calibration Relative to the measured value with ultrasonic technology. (in range ≥ 1 m/s to upper calibration range value) [4)]
Uncertainty of measurement ASC technology [1),2), 5)]	Flow rate a. c.: 1% ... 8%
Resolution	+ 0.001 m/s
Ambient humidity	≤ 95% relative humidity
Compliances	ATEX: 2014/34/EU EMC: 2014/30/EU RoHS: 2011/65/EU PED: 2014/68/EU CPA: JJG1030-2007 PCEC: GB 3836.1-2010, GB 3836.2-2010, GB 3836.3-2010, GB 3836.4-2010
Electrical safety	IEC 61010-1 (Non-Ex Interface Unit)

1) Dependent on application conditions such as gas composition, process temperature, device type, pipe diameter, etc.
For mass flow rate, additional selection and configuration of the conversion algorithm as well as uncertainty of the pressure and temperature sensors are required. To be evaluated by Endress+Hauser.

2) With fully developed flow profile. Typically, an upstream 20 D straight pipe section and a downstream 5 D straight pipe section are required.

3) Below a specific limiting Reynolds number, only runtime effects and geometry uncertainties are considered for the specified accuracies, whereby contributions from the flow profile are excluded.

4) Depending on the capabilities of the selected flow test rig.
5) Additional uncertainty of measurement. In the range of 100% ... 130% of the last gas velocity measured with ultrasonic transit time difference measurement .

12.2 FLSE100-XT sender/receiver units

Table 26 FLSE100-XT

Power supply	
Power supply	20...28 VDC 1)
Power	0.04 A (with 24 VDC) A higher switch-on current must be expected (500 mA).
Power	1 W
Inputs/outputs	
Digital data interfaces	1 x RS485, optically isolated
Approvals	
Ex approvals	ATEX, IECEx, NEC/CEC (US/CA)
Certificate numbers	IECEx: IECEx TUN 09.0015X, IECEx TUN 0.0016X ATEX: TÜV 09 ATEX 555321 X, TÜV 09 ATEX 554975 X cCSAus: 2161697
Ambient conditions	
Temperature range	Ignition group IIC T4: -40 °C ... +70 °C -50 °C ... +70 °C (optional)
	Ignition group IIC T6: -40 °C ... +55 °C -50 °C ... +55 °C (optional)
Storage temperature	-40 °C ... +70 °C -50 °C ... +70 °C (optional)
Degree of protection	IP66/67 according to IEC 60529, type 4 according to UL50E
Dimensions	
Dimensions (W x H x D)	Details, see dimension drawings

1) Ensure sufficient supply voltage on the FLSE100-XT input terminals. Performance of the sender/receiver units is restricted when the value falls below the minimum permissible limit. Consider the total cable length between power supply and Interface Unit as well as between Interface Unit and FLSE100-XT when dimensioning the power supply and the cable cross-section, see also → p. 87, §5.7.2.

12.2.1 F1F-S

Table 27 Technical data F1F-S

Measuring conditions	
Operating pressure:[1)]	CL150 device flange: 20 bar (g)
	PN25 device flange (optional): 20 bar (g)
	CL300 device flange (optional). 20 bar (g)
Gas temperature	–196 °C ... +280 °C
Ex approvals	
IECEx	Ex db [ia Ga] IIA T4 Ga/Gb Ex db [Ia Ga] IIB T4 Ga/Gb **Ex db [ia Ga] IIC T6/T4 Ga/Gb** Ex ia IIC T6/T4 Ga
ATEX	II 1/2G Ex db [ia Ga] IIA T4 Ga/Gb II 1/2G Ex db [Ia Ga] IIB T4 Ga/Gb **II 1/2G Ex db [ia Ga] IIC T6/T4 Ga/Gb** II 1G Ex ia IIC T6/T4 Ga
NEC/CEC (US/CA)	Class I, Division 1, Group D, T4; Class I, Zone 1, Ex/AEx d[ia] IIA, T4; Class I, Division 2, Group D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIA, T4 Class I, Division 1, Groups C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB, T4; Class I, Division 2, Groups C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIB, T4 **Class I, Division 1, Groups B, C and D, T4;** **Class I, Zone 1, Ex/AEx d[ia] IIB + H2, T4;** **Class I, Division 2, Groups A, B, C and D, T4;** **Class I, Zone 2, Ex/AEx nA[ia] IIC, T4**
Installation	
Weight	≤ 12 kg (sensor pair)

[1)] Temperature-dependent, for details see → p. 195, §12.7 → "Derating pressure resistance"

12.2.2 F1F-M

Table 28 Technical data F1F-M

Measuring conditions	
Operating pressure:[1)]	CL150 device flange: 20 bar (g)
	PN25 device flange (optional): 20 bar (g)
	CL300 device flange (optional). 20 bar (g)
Gas temperature	–196 °C ... +280 °C
Ex approvals	
IECEx	Ex db [ia Ga] IIA T4 Ga/Gb Ex db [Ia Ga] IIB T4 Ga/Gb Ex db [ia Ga] IIC T6/T4 Ga/Gb Ex ia IIC T6/T4 Ga
ATEX	II 1/2G Ex db [ia Ga] IIA T4 Ga/Gb II 1/2G Ex db [Ia Ga] IIB T4 Ga/Gb II 1/2G Ex db [ia Ga] IIC T6/T4 Ga/Gb II 1G Ex ia IIC T6/T4 Ga
NEC/CEC (US/CA)	Class I, Division 1, Group D, T4; Class I, Zone 1, Ex/AEx d[ia] IIA, T4; Class I, Division 2, Group D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIA, T4 Class I, Division 1, Groups C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB, T4; Class I, Division 2, Groups C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIB, T4 Class I, Division 1, Groups B, C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB + H2, T4; Class I, Division 2, Groups A, B, C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIC, T4
Installation	
Weight	≤ 12 kg (sensor pair)

[1)] Temperature-dependent, for details see → p. 195, §12.7 → "Derating pressure resistance"

12.2.3 F1F-H

Table 29 Technical data F1F-H

Measuring conditions	
Operating pressure:[1)]	CL150 device flange: ATEX/IECEx: 20 bar(g) CSA: 16 bar(g)
	PN25 device flange (optional): ATEX/IECEx: 20 bar(g) CSA: 16 bar(g)
	CL300 device flange (optional): ATEX/IECEx: 20 bar(g) CSA: 16 bar(g)
Gas temperature	–70 °C ... +280 °C
Ex approvals	
IECEx	Ex db IIC T6/T4 Gb
ATEX	II 2G Ex db IIC T6/T4 Gb
NEC/CEC (US/CA)	Class I, Division 1, Groups B, C and D, T4; Class I, Zone 1, Ex/AEx d IIB + H2, T4; Class I, Division 2, Groups A, B, C and D, T4; Class I, Zone 2, Ex/AEx nA IIC, T4
Installation	
Weight	≤ 14 kg (sensor pair)

[1)] Temperature-dependent, for details see → p. 195, §12.7 → "Derating pressure resistance"

12.2.4 F1F-P

Table 30 Technical data F1F-P

Measuring conditions	
Operating pressure:[1)]	CL150 device flange: ATEX/IECEx: 20 bar(g) CSA: 16 bar(g)
	PN25 device flange (optional): ATEX/IECEx: 20 bar(g) CSA: 16 bar(g)
	CL300 device flange (optional): ATEX/IECEx: 20 bar(g) CSA: 16 bar(g)
Gas temperature	–196 °C ... +280 °C
Ex approvals	
IECEx	Ex db [ia Ga] IIA T4 Ga/Gb Ex db [ia Ga] IIB T4 Ga/Gb **Ex db [ia Ga] IIC T6/T4 Ga/Gb**
ATEX	II 1/2G Ex db [ia Ga] IIA T4 Ga/Gb II 1/2G Ex db [ia Ga] IIB T4 Ga/Gb **II 1/2G Ex db [ia Ga] IIC T6/T4 Ga/Gb**
NEC/CEC (US/CA)	Class I, Division 1, Group D, T4; Class I, Zone 1, Ex/AEx d[ia] IIA, T4; Class I, Division 2, Group D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIA, T4 Class I, Division 1, Groups C and D, T4; Class I, Zone 1, Ex/AEx d[ia] IIB, T4; Class I, Division 2, Groups C and D, T4; Class I, Zone 2, Ex/AEx nA[ia] IIB, T4 **Class I, Division 1, Groups B, C and D, T4;** **Class I, Zone 1, Ex/AEx d[ia] IIB + H2, T4;** **Class I, Division 2, Groups A, B, C and D, T4;** **Class I, Zone 2, Ex/AEx nA[ia] IIC, T4**
Installation	
Weight	≤ 10 kg

[1)] Temperature-dependent, for details see → p. 195, §12.7 → "Derating pressure resistance"

12.3 Interface Unit

Table 31 Technical data of Interface Unit

Ambient conditions	
Ambient temperature	-40 °C ... +60 °C -40 °C ... +65 °C optional (maximum number of I/O interfaces available is limited)
Storage temperature	-40 °C ... +70 °C
Ambient pressure	80 kPa (0.8 bar) ... 110 kPa (1.1 bar)
Geographic altitude	Up to 2000 m (above sea level)
Relative humidity	≤ 95% Relative humidity
Installation	Vertical wall or tube installation
Transient overvoltage	Overvoltage category II
Environmental conditions	Degree of contamination 2
Installation location	Indoor, outdoor
Approvals	
Ex approvals	Interface Unit Zone 1 IECEx: Ex db eb ia IIC T4 Gb Ex db ia IIC T4 Gb ATEX: II 2G Ex db eb ia IIC T4 Gb II 2G Ex db ia IIC T4 Gb CEC (CA): Ex db ia IIC T4 Gb NEC (US): Class I, Zone 1, AEx db ia IIC T4 Gb Class I, Division 1, Groups B, C and D T4
	Interface Unit Zone 2 IECEx: Ex ec ia IIC T4 Gc ATEX: II 3G Ex ec ia IIC T4 Gc NEC/CEC (US/CA): Ex ec ia IIC T4 Gc Class I Zone 2, AEx ec ia IIC T4 Gc Class I Division 2, Groups A, B, C and D, T4
Certificate numbers	IECEx: IECEx SIR 20.0021X ATEX: CSANe 21ATEX1020X, CSANe 20ATEX3137X cCSAus: 80046403
Degree of protection	IP66 according to IEC 60529, type 4X according to UL50E
Interfaces	
Serial RS485	✓ Quantity: 3 Electrically isolated, termination switchable Data protocol: TCP, RTU RS-485, ASCII RS-485 Baud rate: 2400...57600
Ethernet	✓ Quantity: Up to 2, variant-dependent Speed: 10 or 100 Mbit/s Full duplex Data protocol: Modbus TCP Auto MDI-X

Serial RS232	✓ Quantity: 1 For firmware updates Supported signals: TXD, RTS, RXD, CTS, COM Data protocol: Modbus RTU/ASCII Baud rate: 2400...57600 (default: 9600)
HART®	✓ HART®-compatible Host (for connection of external pressure and temperature sensors) HART® Field Device (for communication with control system)
FOUNDATION™ Fieldbus	✓ Terminal voltage: 9 ... 32 V DC Power input: 18 mA NAMUR NE 107 compliant
Optical interface	✓ Service interface (IR, in accordance with IEC 62056-21)
Inputs and outputs	
Analog auxiliary voltage supply	Up to two auxiliary voltages per analog module Variant-dependent electrically isolated (→ p. 137, §6.5.8) Output voltage: Approx. 24 VDC, ± 5% Max. output voltage: 60 mA Short-circuit proof, through active current limitation > 60 mA
Analog outputs	Up to 6 outputs when using I/O modules (option) 4 ... 20 mA According to NAMUR NE43, configurable fault current: high 21 mA and low 3.6 mA Terminal voltage: 7 ... 30 V DC Precision: ± 0.07% of fullscale @ 23°C Temperature drift: 7 ppm/K @ 23°C Resolution: 16 bits Reverse polarity protection Electrically isolated Passive Internal update rate 2 Hz
Analog inputs	Up to 6 inputs when using I/O modules (option) Configurable as voltage or current input 24 bits Reverse polarity protection The analog inputs per module and the second auxiliary voltage (→ Table 14 - 24V_2/GND_2) are referred to a ground, they are electrically isolated from the rest of the circuit. Internally supplied Internal update rate 2 Hz Current measurement: 4 ... 20 mA, according to NAMUR NE43 With error evaluation for < 3.6 (low error) and > 21 mA (high error) Precision: ± 0.07% of fullscale @ 23°C Temperature drift: 7 ppm/K @ 23°C Input impedance: 290 Ω Single-ended voltage input: 0 ... 5 V DC Precision: ± 0.002% of fullscale @ 23°C Temperature drift: 45 ppm/K @ 23°C Input impedance: > 100 kΩ

Digital outputs	Switching output Optionally configurable as digital input 2 per module, up to 6 available when using I/O modules Electrically isolated Max. current: 70 mA Max. switching frequency: 50 Hz Max. input voltage: 30 V DC Switchable Namur/Open Collector Reverse polarity protection In Open Collector configuration: Max. switching voltage: 0.5 V DC In Namur configuration at 8.2 V Us supply voltage: Power switch state “On”: 4.2 mA Power switch state “Off”: 0.5 mA	
	Digital output/frequency output: 4 per module, up to 12 available when using I/O modules thereof 3 as frequency output Electrically isolated Max. current: 50 mA Max. switching frequency: 10 kHz Switching frequency: 0 … 10 kHz Max. input voltage: 30 V DC Switchable Namur/Open Collector Reverse polarity protection In Open Collector configuration: Max. switching voltage: 1.8 V DC In Namur configuration at 8.2 V Us supply voltage: Power switch state “On”: 3.7 mA Power switch state “Off”: 0.7 mA	
Digital inputs	2 per module, up to 6 available when using I/O modules Optionally configurable as digital output (switching output) Galvanically isolated For connection of potential-free contacts or active switching outputs Min. switch-on threshold 2 V DC Max. switch-off threshold 2.85 V DC Max. terminal voltage: 30 VDC Reverse polarity protection	
Display	LCD: Measured variables, system information, warnings, maintenance requests, alarms	
Operation	Software FLOWgate ™ or control panel at LCD	
Installation		
Dimensions (W x H x D)	See dimension drawings	
Weight	Non-Ex / Zone 2: 8 kg Zone 1/Div 1 Ex db version: 17.5 kg Zone 1 Ex db eb version: 23 kg Weatherproof cover: 8.75 kg	
Electrical connection		
Operating voltage		
	AC version	DC version
Power supply (nominal)	115 … 230 VAC ± 10%	12 … 24 VDC -10/+20% For installation in system with FLSE100-XT: 20 … 28 VDC[1)]
Frequency	50 … 60 Hz	-
Power	0.33 A A higher switch-on current must be expected	1 A A higher switch-on current must be expected
Power input	≤ 18 W	≤ 12 W

Output supply voltage - 24V-OUT (to supply external sensors)		
	AC version	DC version
Output voltage	24 VDC ± 5%	Equivalent to supply voltage of the Interface Unit, no internal filtering
Max. power output	≤ 2 W	Depending on external supply ≤ 4 W
Battery		
Battery type	Coin cell, type BR2032, manufacturer PANASONIC	
Battery chemistry	Lithium poly carbon monofluoride Li-$(CF)_x$	
General		
Options	Offshore design, sun and weatherproof cover, tag plate	

1) Ensure sufficient supply voltage on the FLSE100-XT input terminals. Performance of the sender/receiver units is restricted when the value falls below the minimum permissible limit. Consider the total cable length between power supply and interface unit as well as between Interface Unit and FLSE100-XT when dimensioning the power supply and the cable cross-section, see also → p. 87, §5.7.2

12.4 Application Evaluation Datasheet (example)

Fig. 128 Application Evaluation Datasheet Page 1 (example)

FLARE Gas Application Evaluation Datasheet
FLOWSIC100 Flare / FLOWSIC100 Flare-XT

General Information

Customer Data

Project Name	**Revamp Project**
Reference (CRM or SAP)	**ZT226635**
TAG Name or Number	**FT2607**

Device Selection

Device Type	**F1F-S**
Nominal Pipe Width [inches]	**12**
Number of Paths	**1**
Installation Type	**Dry-calibrated**
EX Zone	**Zone IIc**

Order Reference

PO Number	
SICK Part Number	
SICK Serial Number	

Process Data

Calculation basis: User-provided Parameters

	min	norm	max
Pressure [bar]	1	1.5	1
Temperature [°C]	20	80	0
Speed of Sound [m/s]	300	410	600

1 / 2

Fig. 129 Application Evaluation Datasheet Page 2 (example)

Computed Results

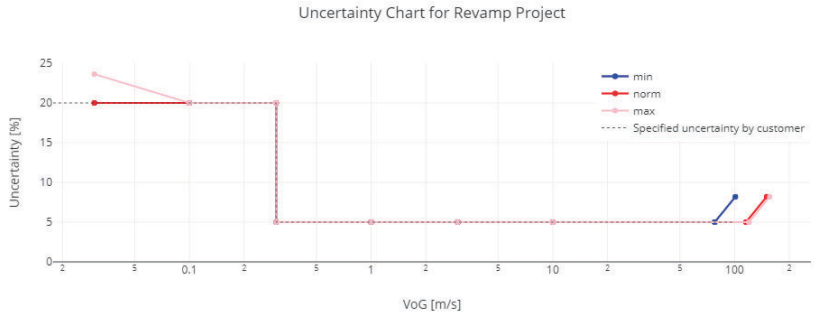
Calculated Flow Ranges

	min	norm	max
Max velocity Vmax [m/s]	77.8	115.6	120
Max flow rate Qmax [m³/h]	20,424.9	30,368.7	31,521.3
Max velocity (ASC) [m/s]	101.1	150.3	156
Max flow rate (ASC) [m³/h]	26,552.4	39,479.3	40,977.6

Measurement Uncertainties

VoG [m/s]	Flowrate [m³/h]	Measurement Uncertainty of Flow (2σ) [%]		
		min	norm	max
0.03	7.9	20	20	23.6
0.1	26.3	20	20	20
0.3	78.8	20	20	20
1	262.7	5	5	5
3	788	5	5	5
10	2,626.8	5	5	5
Vmax	Qmax	5	5	5
Vmax ²	Qmax ²	5	5	5
Vmax, ASC ³	Qmax, ASC ³	8.2	8.2	8.2

1) For fully developed flow profiles; based on ultrasonic transit time measurement.
2) Increased uncertainty at max. VoG when switching to Active Sound Correlation technology (ASC).
3) Extended measuring range based on Active Sound Correlation technology (ASC), 130% of last velocity measured with ultrasonic time difference.



Software-Version

Frontend: 1.5.2, Backend: 0.5.5

Disclaimer

The application evaluation sheet is electronically valid without signature. It is valid for Flare gas applications in compliance with the requirements stated in the latest version of the operating instructions.

Uncertainty of ASC Technology is only valid for densities of 1.2 kg/m³ +/-10 % and if 50 D upstream of the meter no noise generating elements such as temperature wells, flow conditioners, diameter steps >3 % of inner diameter or sharp edges are present.

2 / 2

12.5 Applications of FLOWSIC100 Flare-XT in a regulated environment

The gas flow meter can be used for emission measurements, which may be subject to one or more regulations in some jurisdictions. Compliance with all emission regulations applicable at the site of the installation remains the responsibility of the owner / operator. When correctly designed and applied, Endress+Hauser's ultrasonic flow technology meets or exceeds most regulatory performance requirements. Please contact your Endress+Hauser representative to find out about the right flare measurement solution that meets the currently applicable regulatory requirements.

12.6 Application limits

Fig. 130 Exemplary V_{max} of 1-path and 2-path solutions dependent on the sound velocity (SOS)

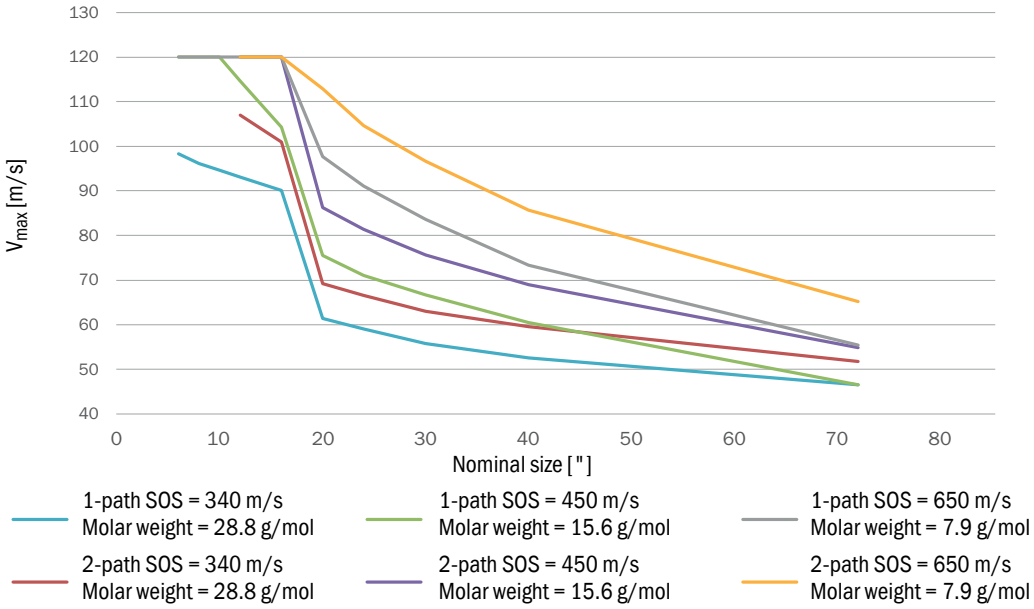


Fig. 131 V_{min} with 20% uncertainty of 1-path and 2-path solutions depending on the speed of sound (SOS)

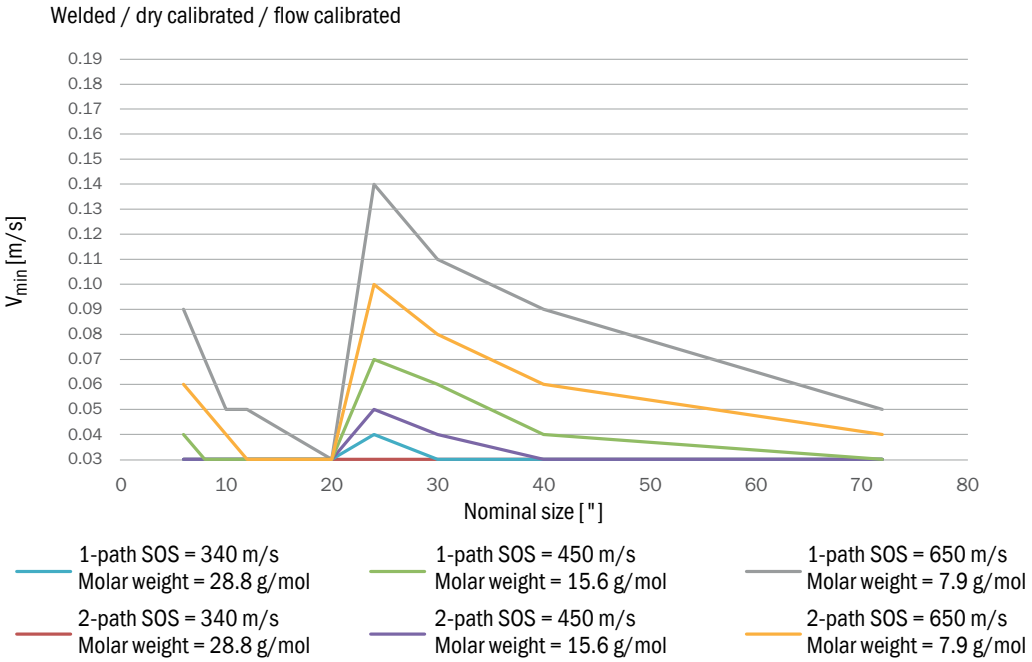
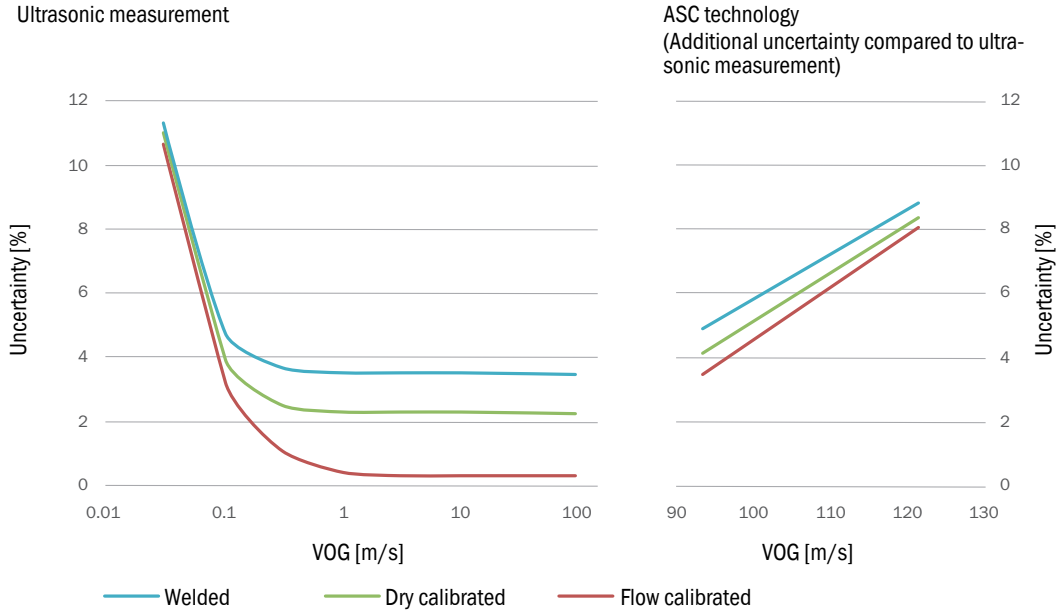


Fig. 132 Uncertainty of flow rate as function of the velocity of gas (VOG)



The exemplary expression of uncertainty according to GUM (Guide to the Expression of Uncertainty in Measurement): ISO/IEC Guide 98-3:2008-09 shows an F1F-S in 1-path, 16" nominal size and assumes a gas temperature of 20 °C, ambient pressure and a typical molecular weight greater than 27 g/mol.

12.7 Derating pressure resistance

NOTICE:
The diagrams apply to the standard variants of the FLSE100-XT sender/ receiver units. Deviations in other versions are possible.
Observe the maximum permissible design values shown on the type plates of the devices.

Fig. 133 F1F-S/-M

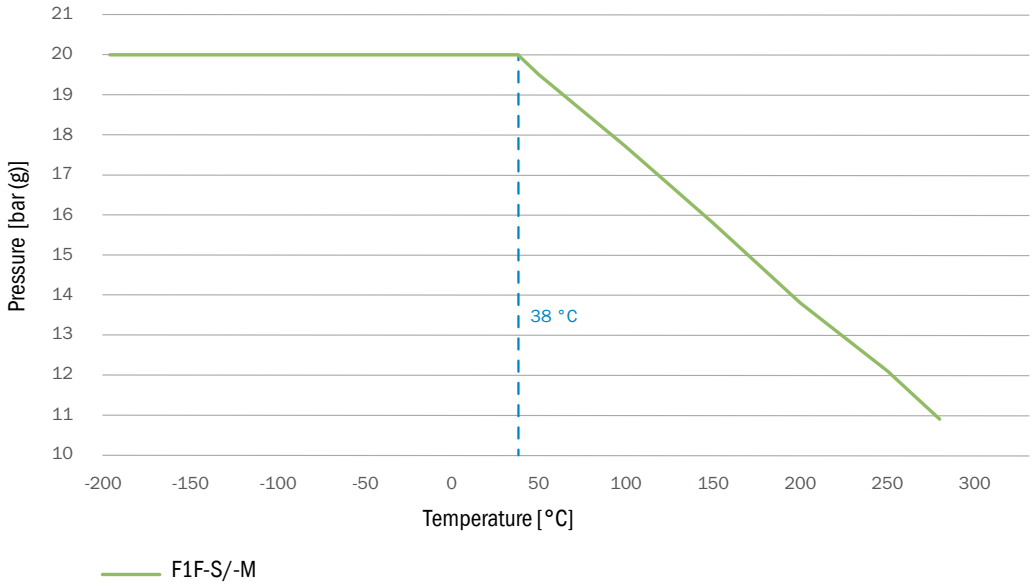


Fig. 134 F1F-H ATEX/CSA

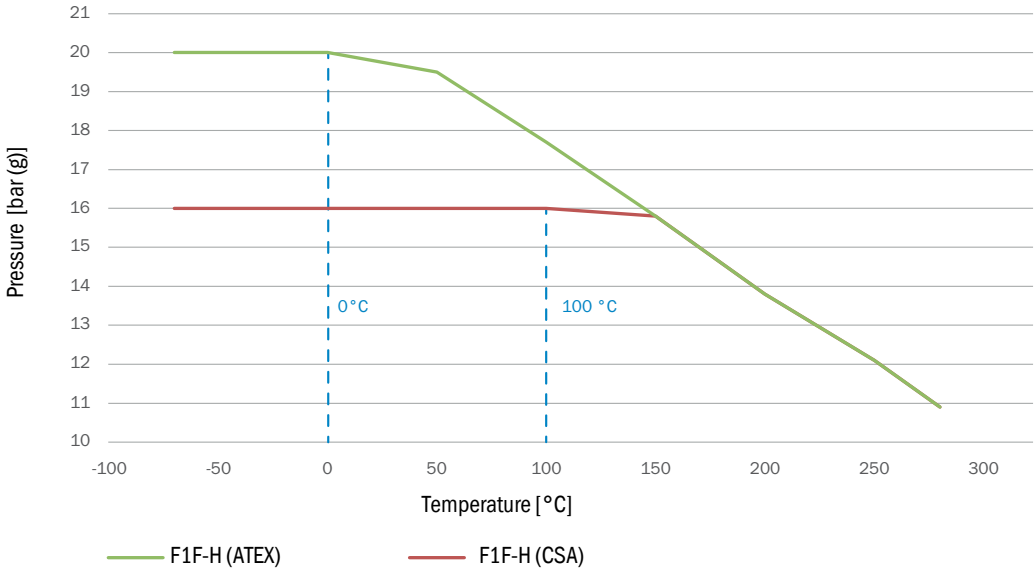
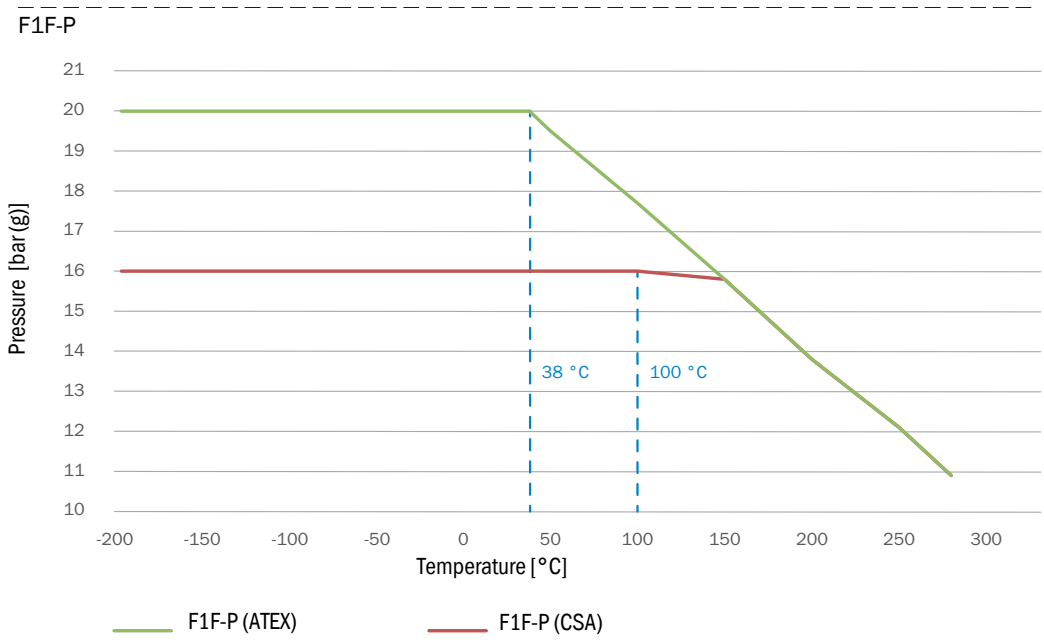


Fig. 135 F1F-P


21
20
19
18
17
16
15
14
13
12
11
10
Pressure [bar (g)]
-200
-150
-100
-50
0
50
100
150
200
250
300
Temperature [°C]
38 °C
100 °C
F1F-P (ATEX)
F1F-P (CSA)

12.8 Dimension drawings

12.8.1 Dimension drawings of FLSE100-XT sender/receiver units

Dimensions for F1F-S/-M/-H CL150, 2"

Fig. 136 F1F-S/-M/-H

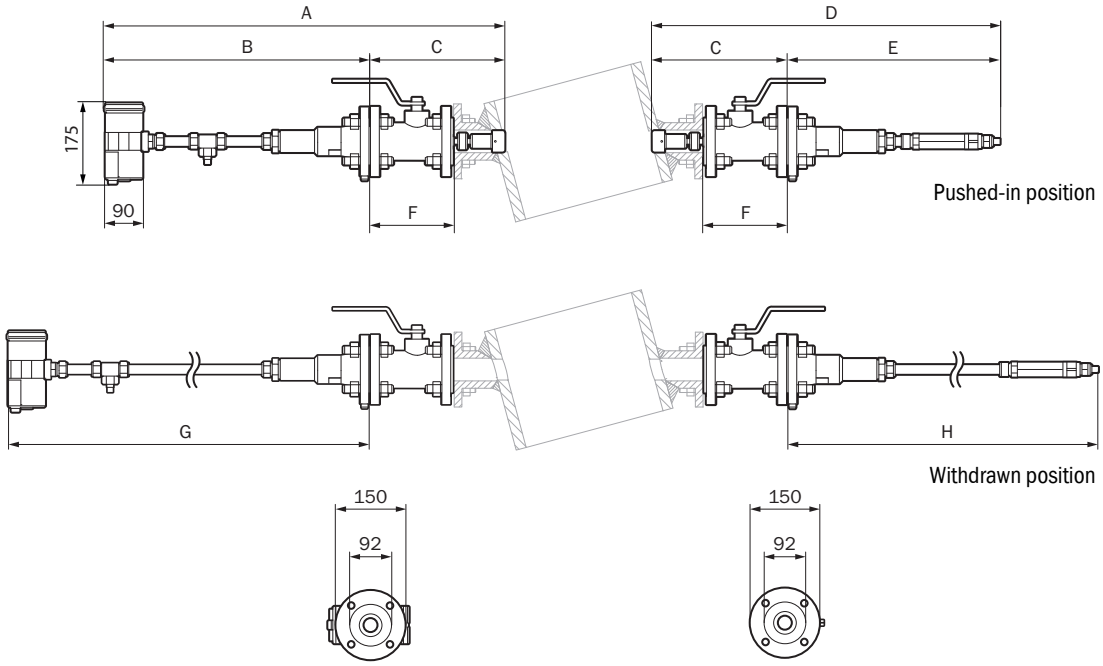


Table 32 Extended version

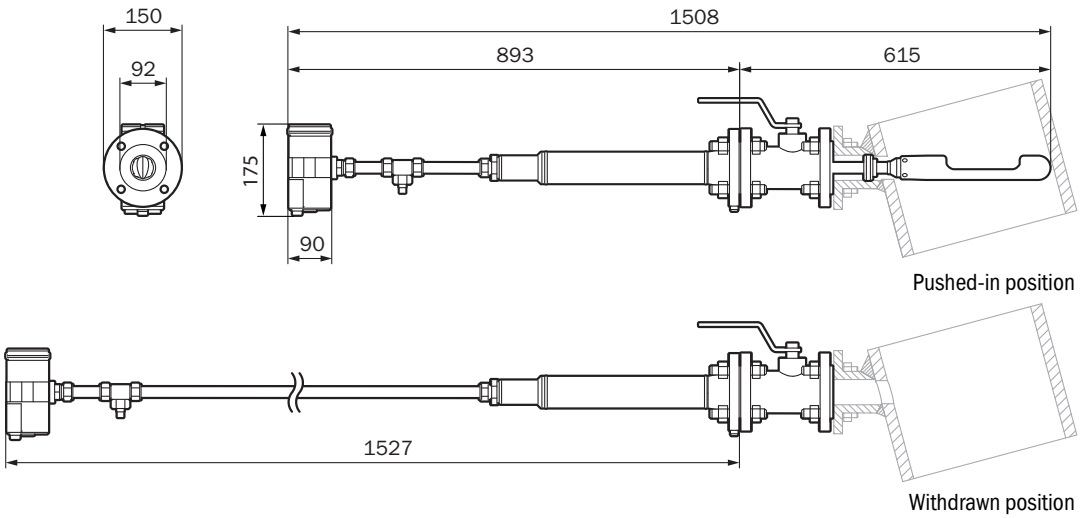
FLSE100-XT	Dimensions of extended version							
	A	B	C	D	E	F	G	H
F1F-S	983	583	400	871	471	178	1055.5	944
F1F-M	980	582	398	869	471	178	984	873
F1F-H	846	448	398	919	518	178	851	917

Table 33 Compact version

FLSE100-XT	Dimensions of compact version							
	A	B	C	D	E	F	G	H
F1F-S	883	583	300	771	471	178	955.5	844
F1F-M	880	582	298	769	471	178	884	773
F1F-H	746	448	298	819	518	178	751.5	817

Dimensions for F1F-P, CL150, 2"

Fig. 137 F1F-P



12.8.2 Dimension drawings Interface Unit

Interface Unit Zone 2/Div 2 resp. Non-Ex version

Fig. 138 Interface Unit Zone 2 (dimensions in mm (in))

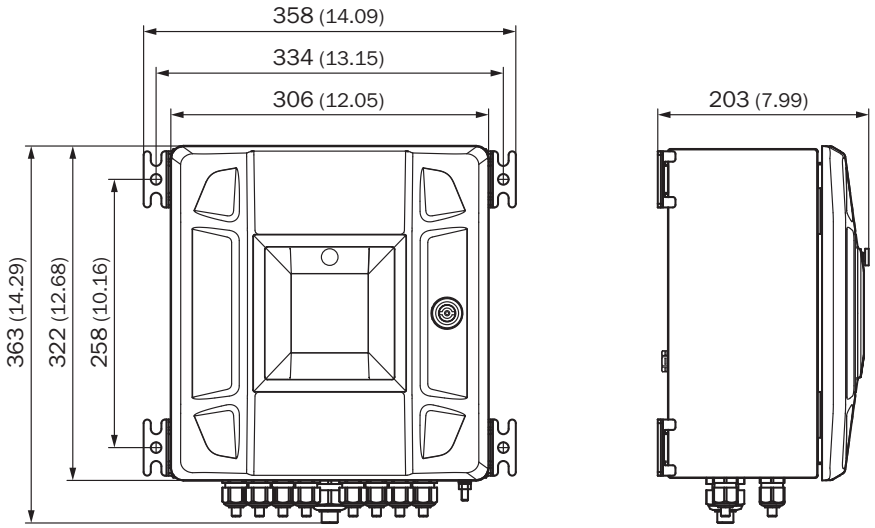
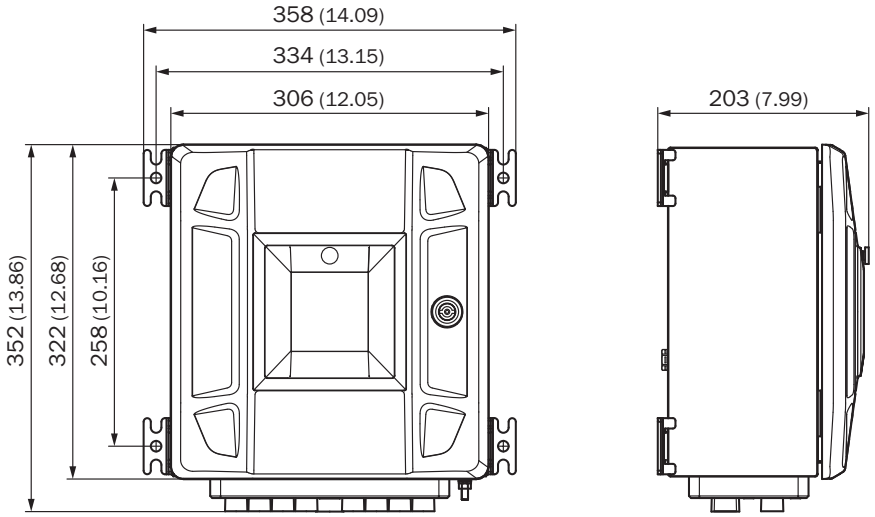


Fig. 139 Interface Unit Cl. 1 Div. 2 (dimensions in mm (in))



Interface Unit Zone 1/Div 1

Fig. 140 Interface Unit Zone 1 Ex d (dimensions in mm (in))

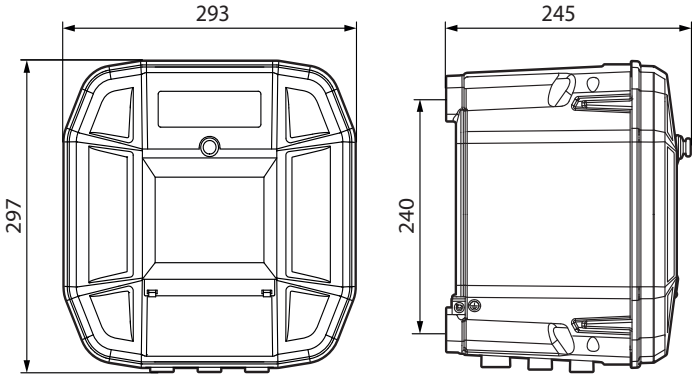
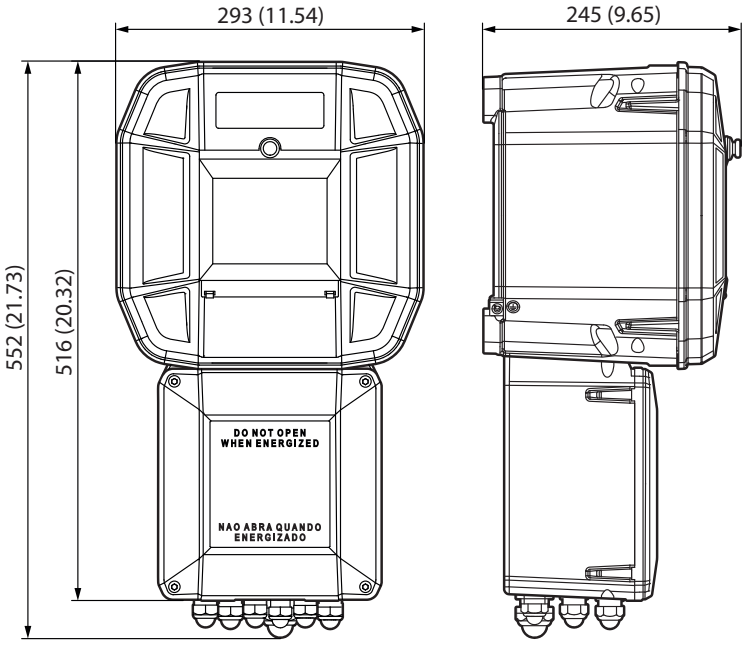


Fig. 141 Interface Unit Zone 1 Ex d e (dimensions in mm (in))



FLOWSIC100 Flare-XT

13 Spare parts

Recommended spare parts for FLSE100-XT sender/receiver units
Recommended spare parts for Interface Unit

13.1 Recommended spare parts for FLSE100-XT sender/receiver units

Part No.	Description	1[1)]	2[2)]
2108048	Assembly kit ANSI150 2Z SS ET	X	X
2108049	Assembly kit ANSI300 2Z SS ET	X	X
2108050	Assembly kit DN50 PN16 M16 SS ET	X	X
2107288	Replacement cover for aluminum EXD M20 housing Contents: Cover, cover lock, cover insulation, O-ring, spring washer, screws, assembly paste, sealing plugs		X
2107289	Replacement cover for stainless steel EXD M20 housing Contents: Cover, cover lock, cover insulation, O-ring, spring washer, screws, assembly paste, sealing plugs		X
2110151	Replacement cover for aluminum EXD NPT housing Contents: Cover, cover lock, cover insulation, O-ring, spring washer, screws, assembly paste, sealing plugs		X
2110152	Replacement cover for stainless steel EXD NPT housing Contents: Cover, cover lock, cover insulation, O-ring, spring washer, screws, assembly paste, sealing plugs		X

1) Recommended spare parts for commissioning

2) Recommended spare parts for 2 years operation

13.2 Recommended spare parts for Interface Unit

13.2.1 Interface Unit, Zone 2/Div. 2

Part No.	Description	1[1)]	2[2)]
2104408	Fuse kit mainboard – for all Interface Units with 24 V DC power supply – 2A5 250V D5*20	X	X
2105350	Fuse kit power supply – for all Interface Units with 115/230 VAC power supply – 3A15 250V D5*20	X	X
2105349	Small Parts Set (screws, nuts, etc.) – for Interface Unit Zone 2 /Cl1 Div2 / non-Ex – screws,nuts – washers – threaded bolts – spacers	X	X
2105364	Electronic installation set – for Interface Unit Zone 2 /Cl1 Div2 / non-Ex – marking strip "ground" – end bracket – marking strip 1-10 – terminals – end covers – separating plate		X

1) Recommended spare parts for commissioning
2) Recommended spare parts for 2 years operation

13.2.2 Interface Unit, Zone 1/Div. 1

Part No.	Description	1[1)]	2[2)]
2104408	Fuse kit mainboard – for all Interface Units with 24 V DC power supply – 2A5 250V D5*20	X	X
2105350	Fuse kit power supply – for all Interface Units with 115/230 VAC power supply – 3A15 250V D5*20	X	X
2122560	– Small parts set – for Interface Unit Zone 1 /Cl1 Div1 – screws,nuts – washers – threaded bolts – spacers	X	X
2122558	Electronic installation set Ex-d – for Interface Unit Zone 1 /Cl1 Div1 – cable harness – terminal block – cables		X
2122559	Electronic installation set Ex-e – for Interface Unit Zone 1 /Cl1 Div1 – marking strip "ground" – end bracket – marking strip 1-60 – terminals – end covers – separating plate – support bracket – busbar		X

1) Recommended spare parts for commissioning
2) Recommended spare parts for 2 years operation

FLOWSIC100 Flare-XT

14 Accessories (optional)

Accessories for FLSE100-XT sender/receiver units
Accessories for Interface Unit

Further accessory parts (cable screw fittings, ball valves, nozzles, etc.) are available on request from Endress+Hauser

14.1 Accessories for FLSE100-XT sender/receiver units

Part No.	Description
2105581	Weather/sun protective cover for electronics of the active ultrasonic sensor
2108210	Venting/drain valve for ultrasonic sensor

14.2 Accessories for Interface Unit

Part No.	Description
2109763	Mounting kit, 2-inch pipe assembly, for Interface Unit Only for Zone 2 and Div 2, incl. adapter plate for 90° Upgrade Kit
2121461	Mounting kit, 2-inch pipe assembly, for Interface Unit Only for Zone 1 and Div 1.
2108970	Weather and sun protective cover, Interface Unit, for wall installation
2109217	Weather and sun protective cover, Interface Unit Zone 2, Incl. mounting kit 2-inch pipe mounting
2121694	Weather and sun protective cover, Interface Unit Zone 1, Incl. mounting kit 2-inch pipe mounting
6050602	Infrared/USB adapter HIE-04

FLOWSIC100 Flare-XT

15 Annex

Compliances
Installation examples
Connection diagrams
Type code
Relationship between IECEx marking and Interface Unit
Gasket installation

15.1 Compliances

> ***NOTICE:***
> Applied European standards and harmonized standards are listed in the valid version of the manufacturer's CE conformity declaration.

15.1.1 Compliances of FLSE100-XT sender/receiver units

15.1.1.1 CE declaration

The FLSE100-XT sender/receiver units have been developed, built and tested according to the following EU Directives:

- ATEX Directive 2014/34/EU
- EMC Directive 2014/30/EC

Conformity with the above Directives has been determined and the CE label attached to the device.

15.1.1.2 Standards compatibility and type approval

The FLSE100-XT sender/receiver units comply with the following Norms, Standards or recommendations:

- IEC 60079-0: 2018, IEC 60079-1: 2014, IEC 60079-7: 2015
- IEC 60079-11: 2011 + Cor. 2012, IEC 60079-26: 2014
- EN IEC 60079-0:2018, EN 60079-1:2014, EN 60079-7:2015, EN 60079-11:2012, EN60079-26:2015
- EN 61326-1:2013 (Electrical equipment - EMC requirements)
- EN 60529: 1991/A1:2000/A2:2013 (IP)

15.1.2 Compliances of Interface Unit

15.1.2.1 CE declaration

The Interface Unit has been developed, manufactured and tested in accordance with the following EU Directives:

- ATEX Directive 2014/34/EU
- EMC Directive 2014/30/EC

Conformity with the above Directives has been determined and the CE label attached to the device.

15.1.2.2 Standards compatibility and type approval

Interface Unit Zone 2 resp. Div. 2

The Interface Unit Zone 2 resp. Div. 2 version conforms to the following standards or recommendations:

- CAN/CSA-C22.2 No. 0-10 (r 2015)
- CSA C22.2 No. 213/ISA 12.12.01: 2017
- CAN/CSA C22.2 No. 94.1-15 Second Edition & ANSI/UL 50-15 (Edition 13)
- CAN/CSA C22.2 No. 94.2-15 Second Edition & ANSI/UL 50E-15 (Edition 2)
- CAN/CSA C22.2 No. 60529: 2016
- CAN/CSA-C22.2 No. 60079-0: 2019
- CAN/CSA C22.2 No. 60079-7: 2016
- CAN/CSA-C22.2 No. 60079-11: 2014
- Harmonized CAN/CSA-C22.2 No. 61010-1-12 (r 2017) & ANSI/UL 61010-1 (2012)
- ANSI/UL 60079-0: 2019
- ANSI/UL 60079-7: 2017

- IEC 60079-0: 2017 Edition:7.0
- IEC 60079-11: 2011 Edition:6.0
- IEC 60079-7: 2015 Edition:5.0

- EN 61010-1: 2010/A1:2019/AC:2019-04
- EN IEC 60079-0: 2018
- EN 60079-7:2015
- EN 60079-11:2012

Interface Unit Zone 1 resp. Div. 1

The Interface Unit Zone 1 resp. Div. 1 version conforms to the following standards or recommendations:

- CAN/CSA-C22.2 No. 0-10 (r 2015)
- CSA C22.2 No. 213/ISA 12.12.01: 2017
- CAN/CSA C22.2 No. 94.1-15 Second Edition & ANSI/UL 50-15 (Edition 13)
- CAN/CSA C22.2 No. 94.2-15 Second Edition & ANSI/UL 50E-15 (Edition 2)
- CAN/CSA C22.2 No. 60529: 2016
- CAN/CSA-C22.2 No. 60079-0: 2019
- CAN/CSA-C22.2 No. 60079-1: 2016
- CAN/CSA-C22.2 No. 60079-11: 2014
- ANSI/UL 1203, 5th Edition.
- ANSI/UL 121201-2017 Ninth Edition
- Harmonized CAN/CSA-C22.2 No. 61010-1-12 (r 2017) & ANSI/UL 61010-1 (2012)
- ANSI/UL 60079-0: 2019
- ANSI/UL 60079-1: 2015

- IEC 60079-0: 2017 Edition: 7.0
- IEC 60079-1: 2014-06 Edition: 7.0
- IEC 60079-11: 2011 Edition: 6.0
- IEC 60079-7: 2015 Edition: 5.0

- EN 61010-1: 2010/A1:2019/AC:2019-04
- EN IEC 60079-0: 2018
- EN IEC 60079-1: 2014
- EN 60079-7: 2015
- EN 60079-11: 2012

15.2 Installation examples

Fig. 142 Interface Unit Zone 2 AC version (example)

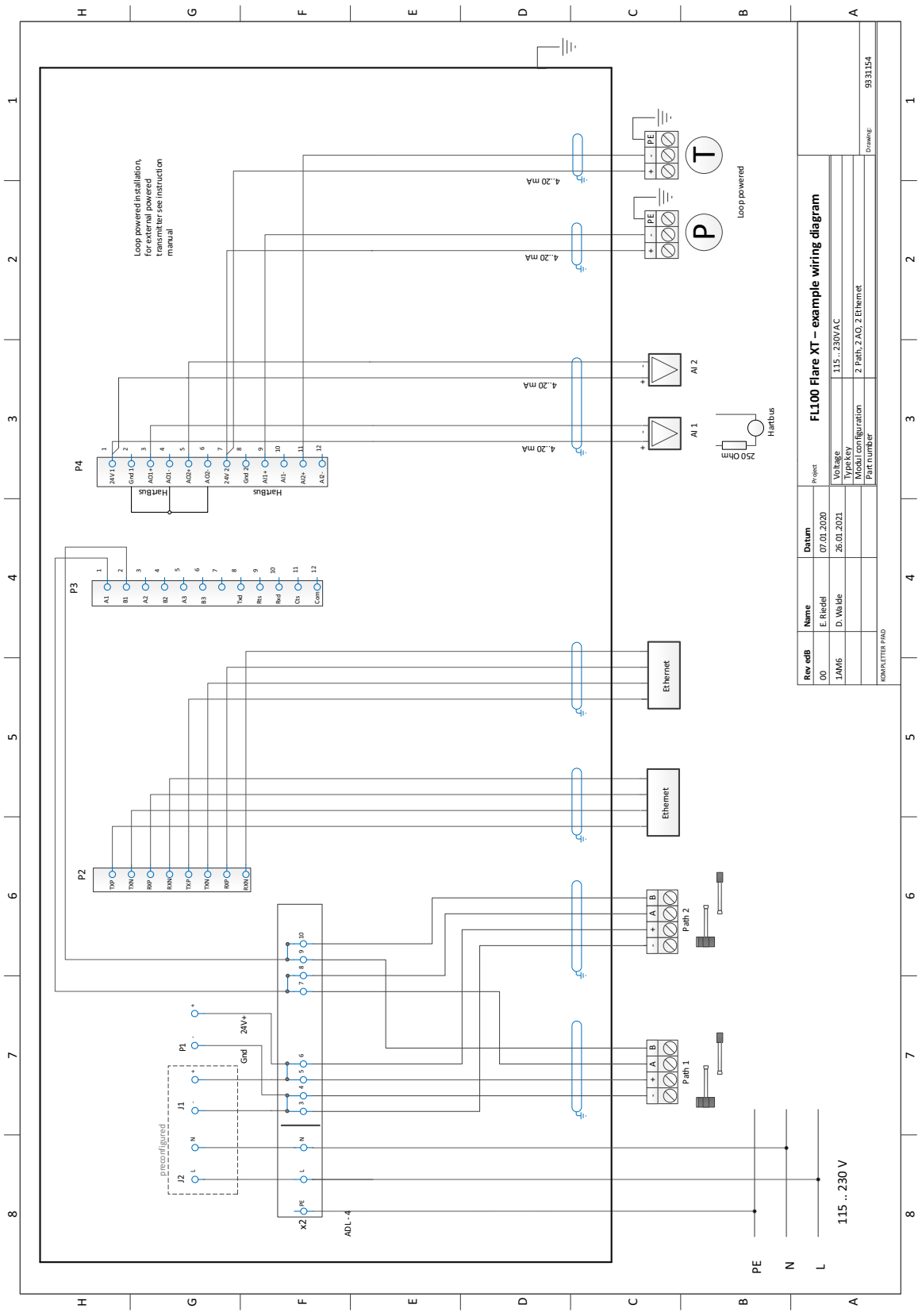


Fig. 143 Interface Unit Zone 2 DC version (example)

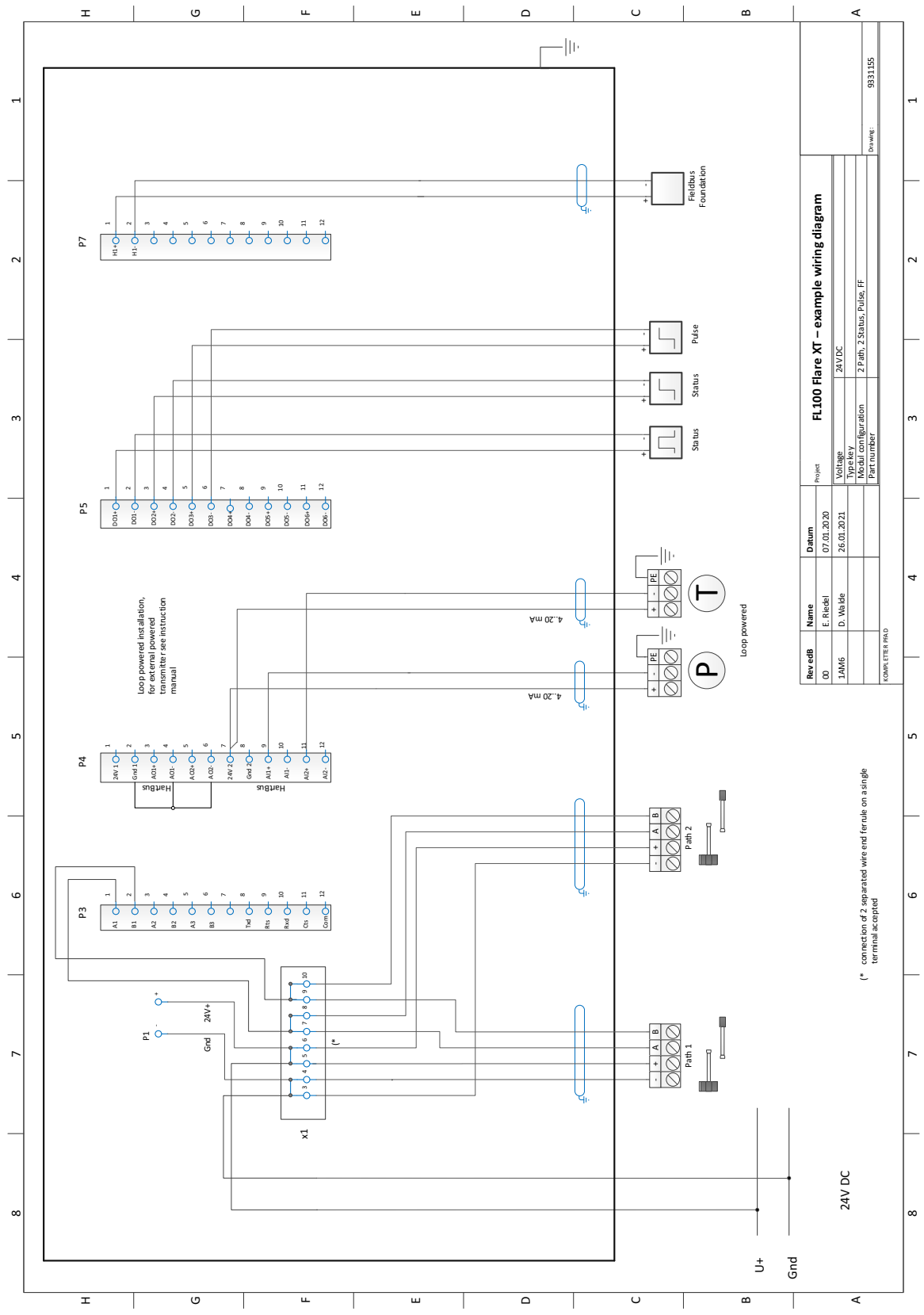


Fig. 144 Interface Unit Zone 1 AC version (example, Ex d version; see delivery documentation for Ex d e versions)

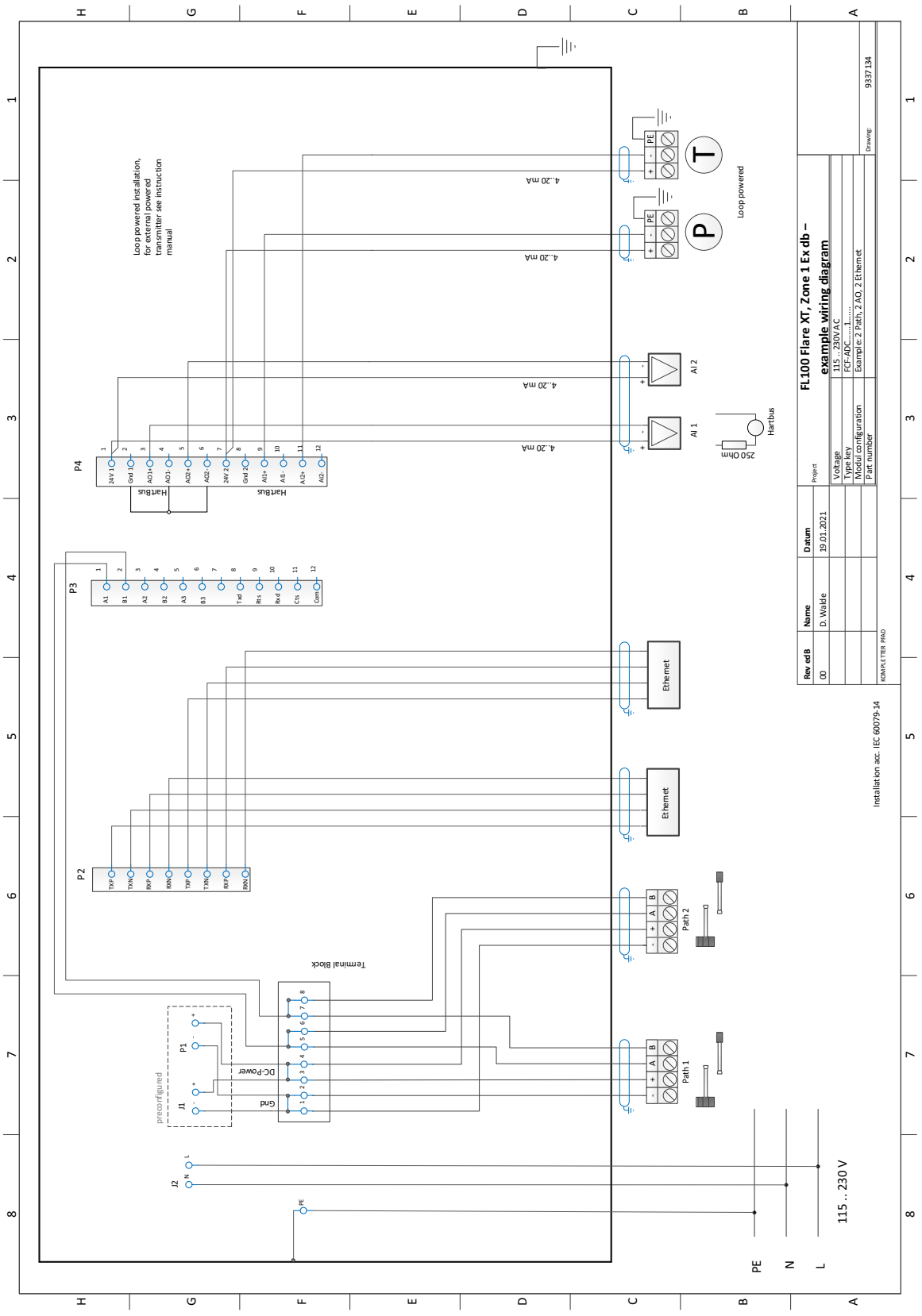
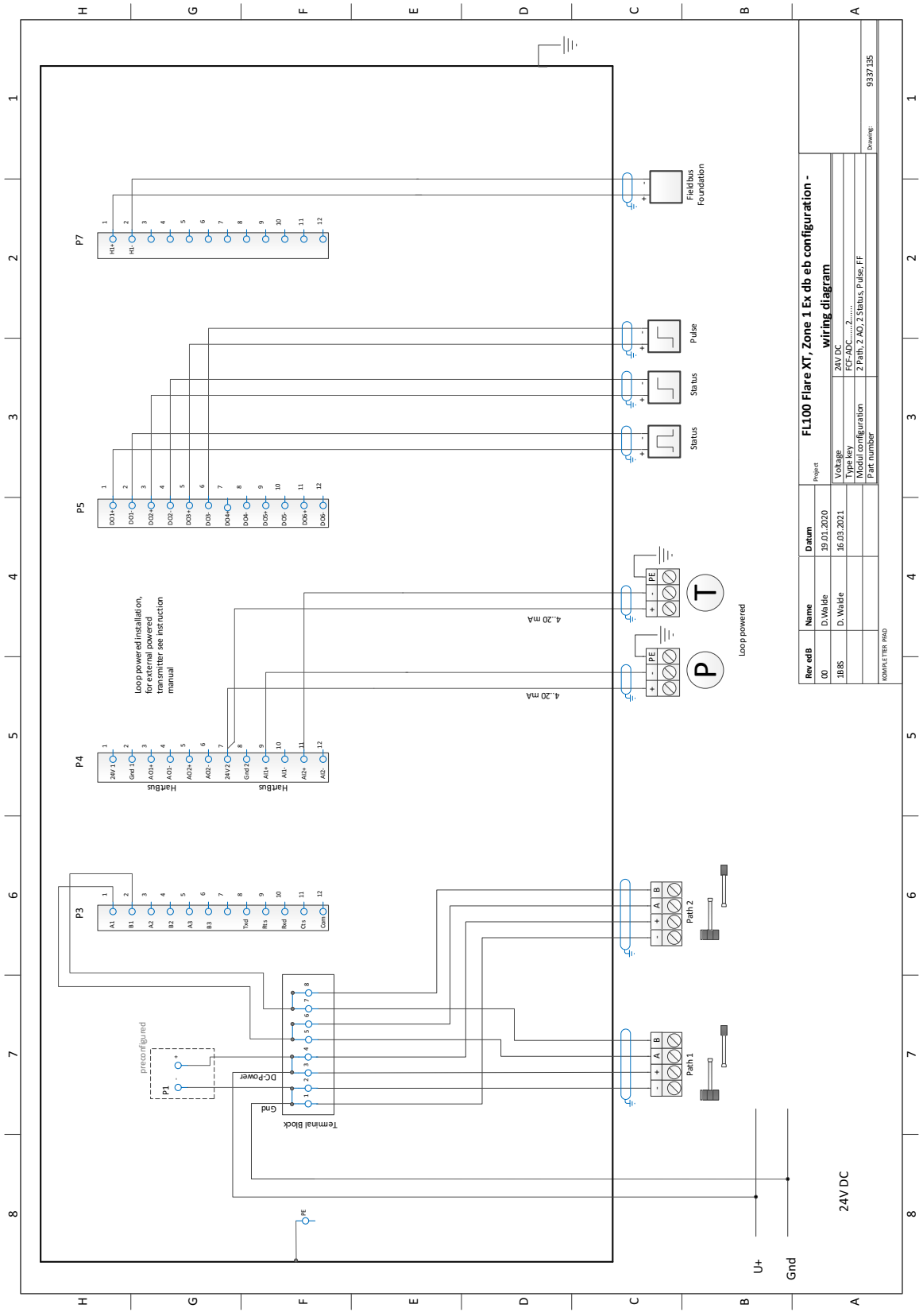


Fig. 145 Interface Unit Zone 1 DC version (example, Ex d version; see delivery documentation for Ex d e versions)



15.3 Connection diagrams

Fig. 146 Connection diagrams, FLSE-XT (page 1 of 5)

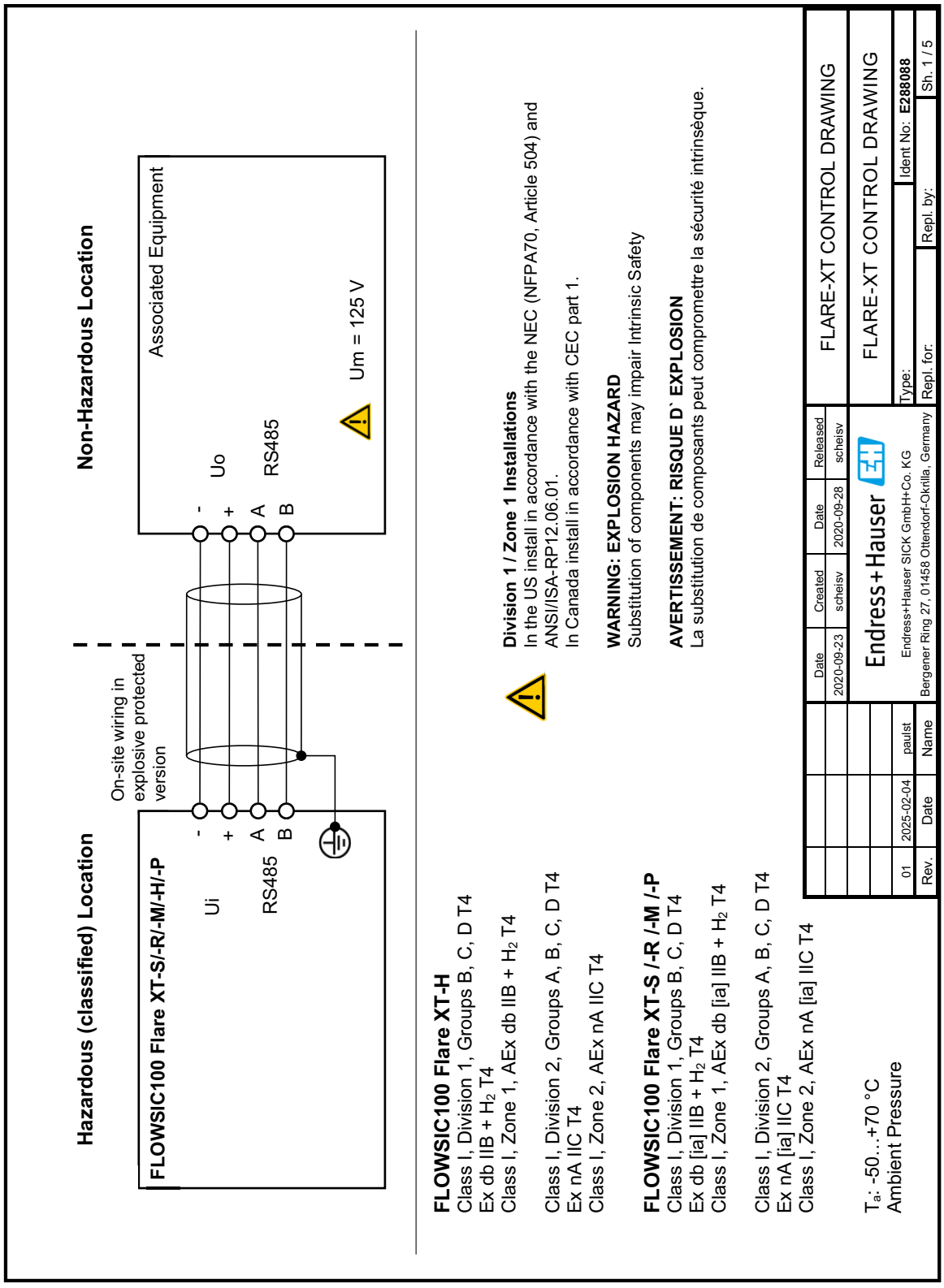


Fig. 147 Connection diagrams, FLSE-XT (page 2 of 5)

Electrical Parameters

Device Type	Ui	I_{max}	Parameter	T_a	T_p
-H	15-28 Vdc	500 mA	CL2/SELV, Type 6, IP 65/67, SINGLE SEAL, MWP 1600 kPa (16 bar)	-50…+70 °C	-70…+280 °C
-S/-R/-M	15-28 Vdc	500 mA	CL2/SELV, Type 4, IP 65, [Ex ia], Um = 125 V	-50…+70 °C	-196…+280 °C
-P	15-28 Vdc	500 mA	CL2/SELV, Type 4, IP 65, MWP 1600 kPa (16 bar), [Ex ia], Um = 125 V	-50…+70 °C	-196…+280 °C

Division 2 / Zone 2 Installations

This equipment is suitable for installation in Class I, Division 2, Group A, B, C, D hazardous locations or nonhazardous locations only.
Cet équipement est conçu pour être installé dans des zones dangereuses de classe I, division 2, groupe A, B, C, D ou dans des endroits non dangereux.

WARNING - Explosion Hazard. Do not connect or disconnect this equipment unless power has been removed or the area is known to be nonhazardous.
AVERTISSEMENT - Risque d'explosion. Ne connectez ou ne déconnectez pas cet équipement à moins que l'alimentation n'ait été coupée ou que la zone soit considérée comme non dangereuse.

			Date	Created	Date	Released	FLARE-XT CONTROL DRAWING		
			2020-09-23	scheisv	2020-09-28	scheisv			
			Endress+Hauser				FLARE-XT CONTROL DRAWING		
01	2025-02-04	paulst	Endress+Hauser SICK GmbH+Co. KG				Type:	Ident No: **E288088**	
Rev.	Date	Name	Bergener Ring 27, 01458 Ottendorf-Okrilla, Germany				Repl. for:	Repl. by:	Sh. 2 / 5

Fig. 148 Connection diagrams, FLSE-XT (page 3 of 5)

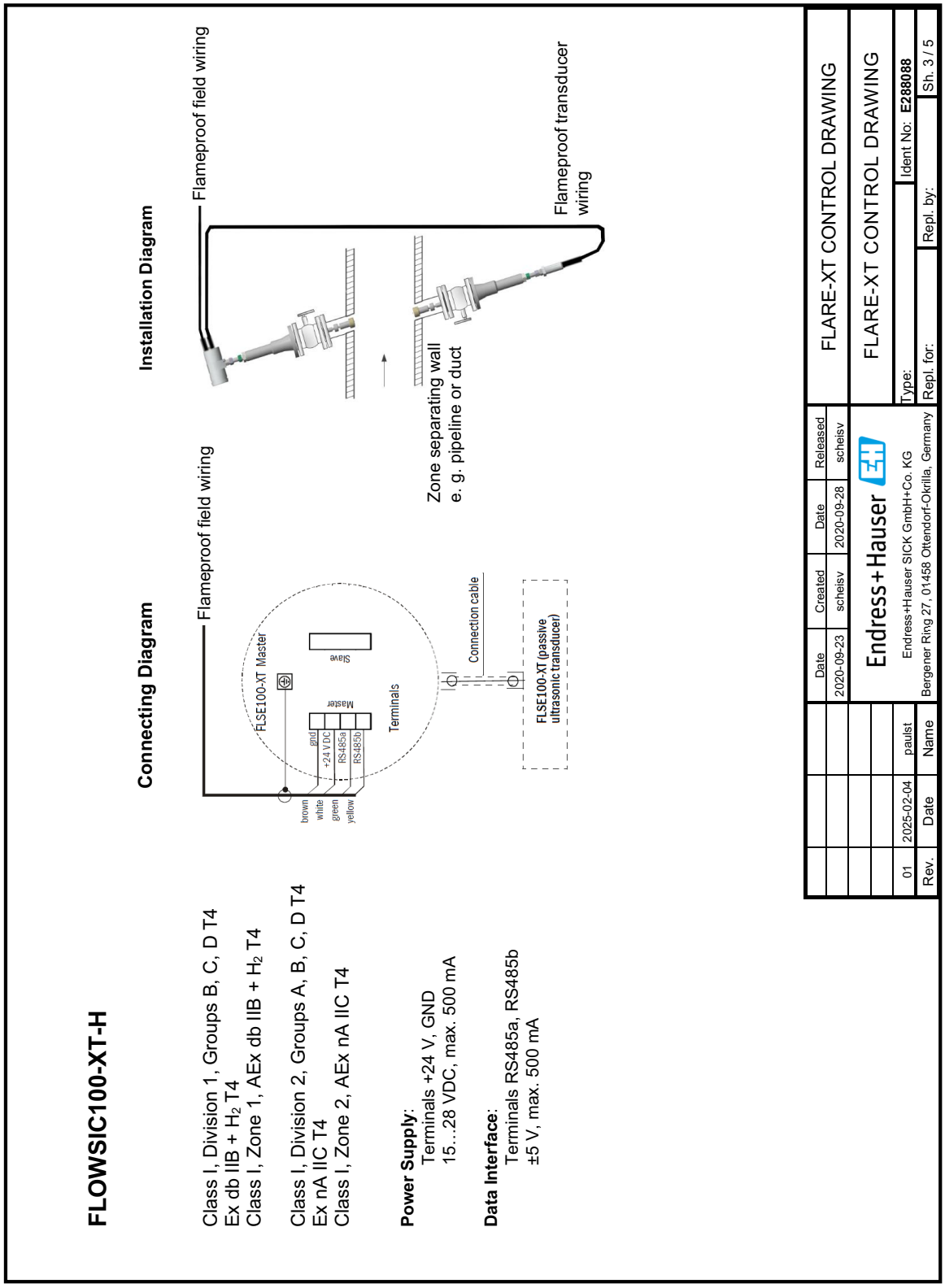


Fig. 149 Connection diagrams, FLSE-XT (page 4 of 5)

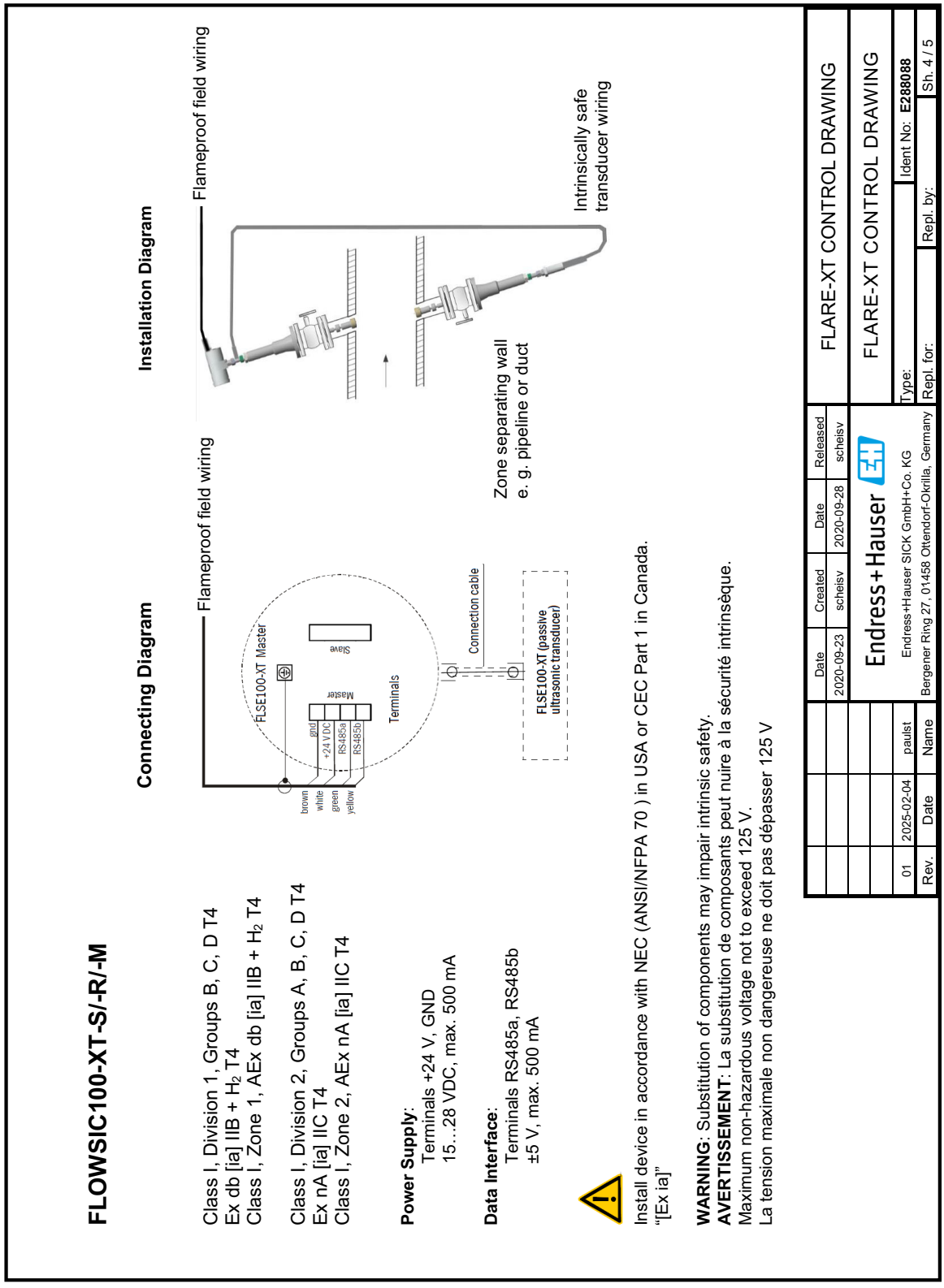
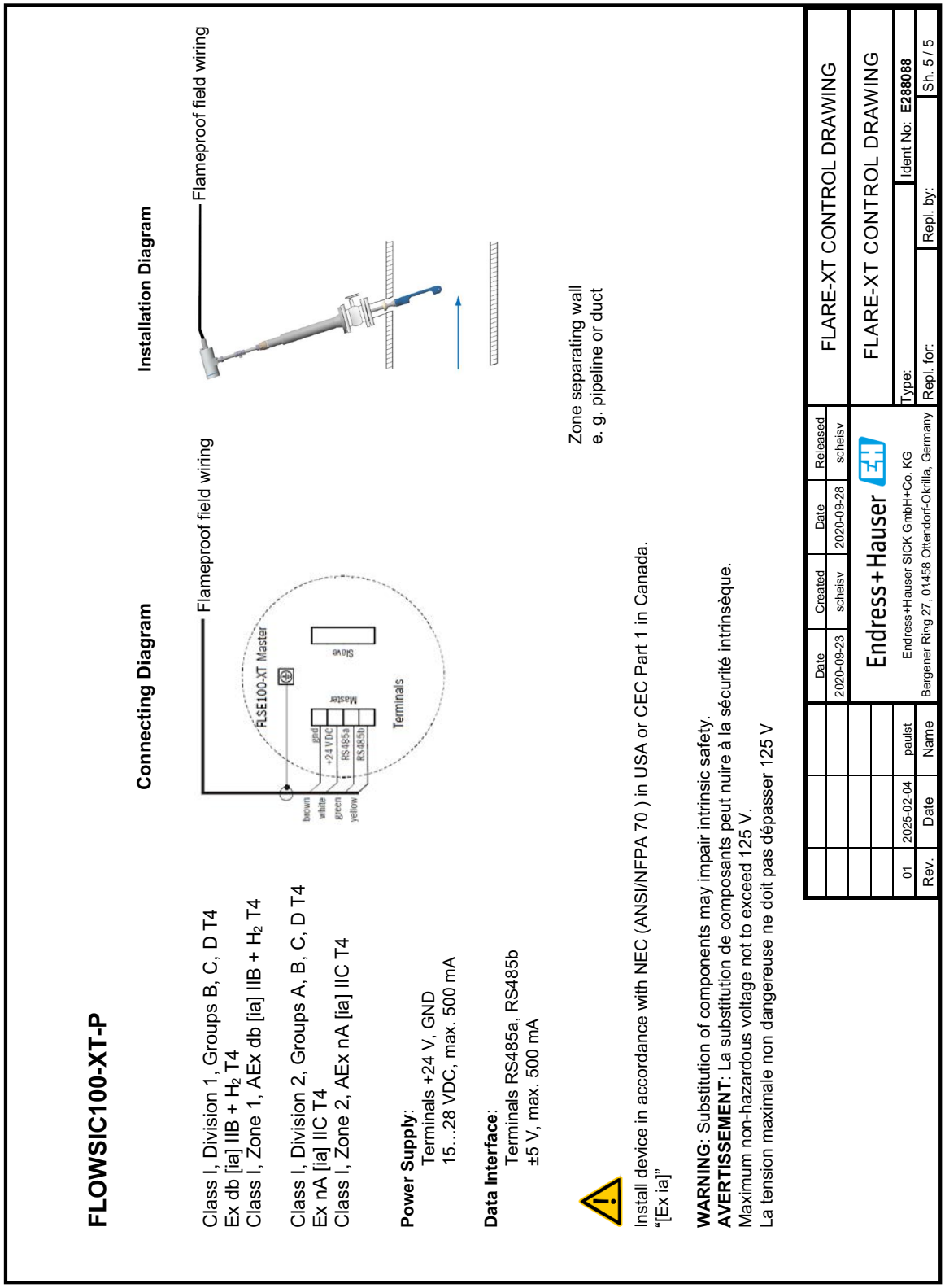


Fig. 150 Connection diagrams, FLSE-XT (page 5 of 5)



15.4 Type code

15.4.1 Type code, FLSE-XT, sender/receiver units

Fig. 151 FLSE-XT, sender/receiver units (overview)

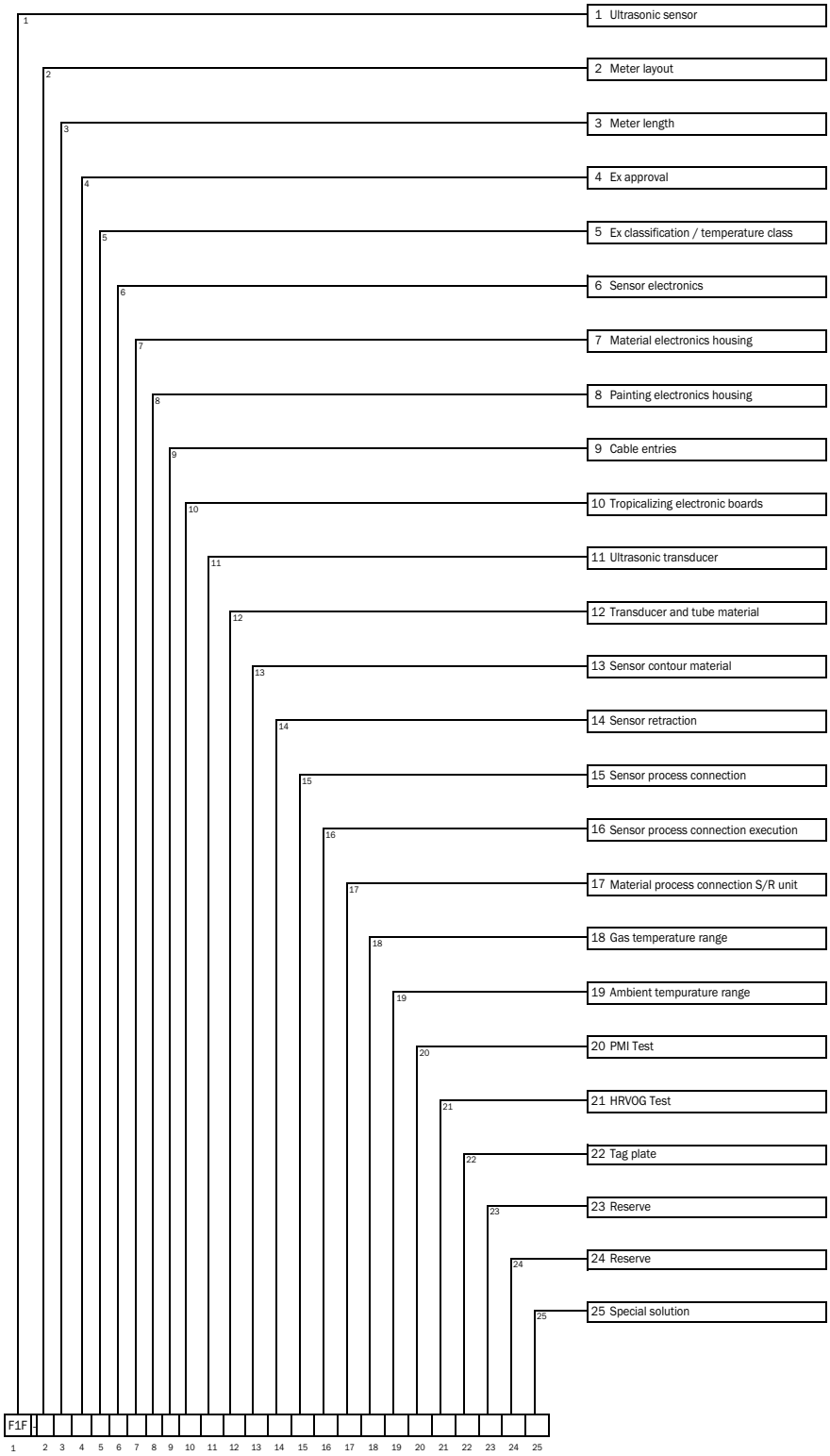


Fig. 152 FLSE-XT, sender/receiver units (explanation)

1	**Ultrasonic sensor**	
	F1F	FLSE100-XT
2	**Meter layout**	
	R	R90
	H	Cross-duct H
	M	Cross-duct M
	S	Cross-duct S
	P	Probe
3	**Installation length**	
	S	Standard
	E	Extended
	2	R90-24
	4	R90-48
	7	R90-72
4	**Ex approval**	
	A	ATEX/IECEx/UKEX
	C	CSA (NEC/CEC)
	I	INMETRO
	P	PCEC/IECEx
5	**Ex classification / temperature class**	
	DA	II 1/2 G Ex db [ia Ga] IIA T4 Ga/Gb Cl I, Div1, Grp.D, T4
	DB	II 1/2 G Ex db [ia Ga] IIB T4 Ga/Gb Cl I, Div1, Grps.CD, T4
	DC	II 1/2 G Ex db [ia Ga] IIC T6 Ga/Gb Cl I, Div1, Grps.BCD, T4
	DD	II 2 G Ex db IIC T6 Gb Cl I, Div1, Grps.BCD, T4
	PA	Ex d [ia Ga] IIA T4 Ga/Gb
	PB	Ex d [ia Ga] IIB T4 Ga/Gb
	PC	Ex d [ia Ga] IIC T6 Ga/Gb
	PD	Ex d IIC T6 Gb
	IC	II 1 G Ex ia IIC T6 Ga
	PI	Ex ia IIC T6 Ga
6	**Sensor electronics**	
	Y	Yes
	N	No
7	**Material electronics housing**	
	A	Aluminium
	B	Stainless steel
8	**Painting electronics housing**	
	1	Sandard painting
	2	Offshore painting
9	**Cable entries**	
	A	Metric
	B	NPT
	C	Connector
10	**Tropicalizing electronic boards**	
	1	Tropicalized - standard
	N	No
11	**Ultrasonic transducer**	
	4I	42 kHz intrinsically safe
	4D	42 kHz flameproof
	1I	135 kHz intrinsically safe
12	**Transducer and tube material**	
	A	Titanium

13	**Sensor contour material**	
	2	Stainless steel
	6	PTFE
14	**Sensor retraction**	
	R	Retractable
15	**Sensor process connection**	
	A	ASME B16.5, CL150 2" RF
	B	ASME B16.5, Cl150 3" RF
	C	ASME B16.5, CL300 2" RF
	D	ASME B16.5, CL300 3" RF
	E	EN 1092-1, PN25 DN50 RF
16	**Sensor process connection execution**	
	S	Seamless retraction flange
	W	Welded retraction flange
17	**Material process connection S/R unit**	
	B	Stainless steel
18	**Gas temperature range**	
	E	-70 ... +280 °C
	F	-196 ... +280 °C
19	**Ambient tempurature range**	
	A	-40...+70 °C
	B	-50...+70 °C
	C	-40...+55 °C T6, -40...+70 °C T4
	D	-50...+55 °C T6, -50...+70 °C T4
20	**PMI Test**	
	P	PMI Test
	N	No
21	**HRVOG Test**	
	H	HRVOG Test
	N	No
22	**Tag plate**	
	A	Tag plate sticker
	B	Tag plate stainless steel + sticker
	N	No
23	**Reserve**	
	N	-
24	**Reserve**	
	N	-
25	**Special solution**	
	N	No
	X	Special Solution
	E	EXRE Upgrade

Characteristic value “X” in the type code denotes a customer-specific version.

15.4.2 Type code, Interface Unit

Fig. 153 Type code, Interface Unit (overview)

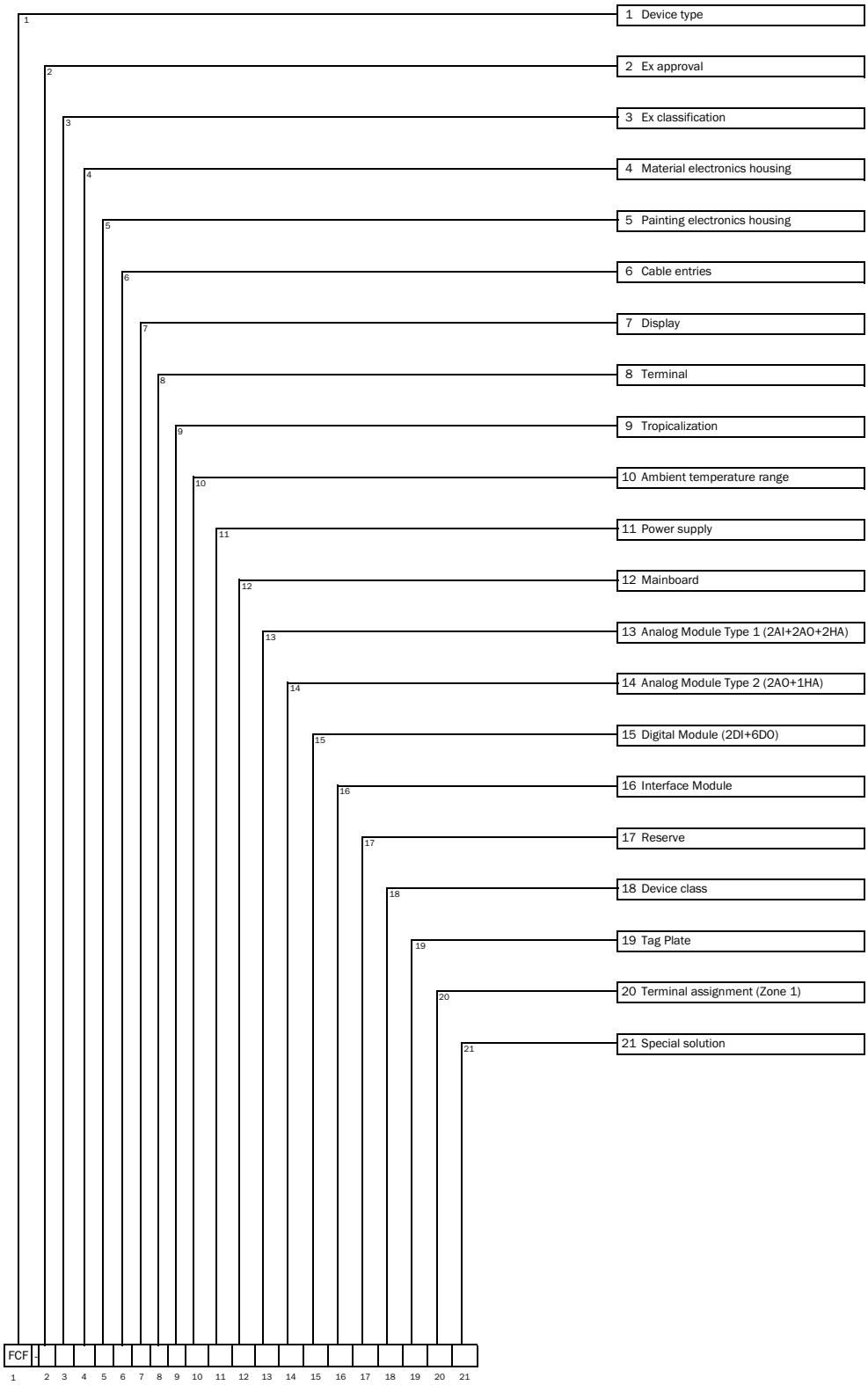


Fig. 154 Type code, Interface Unit (explanation)

1	**Device type**	
	FCF	Flare-XT Interface Unit
2	**Ex approval**	
	A	ATEX/IECEx/UKEX
	C	CSA (NEC/CEC)
	I	INMETRO
	P	PCEC/IECEx
3	**Ex classification**	
	EC	ATEX: II 2G Ex db eb ia IIC T4 Gb IECEx: Ex db eb ia IIC T4 Gb
	DC	ATEX: II 2G Ex db ia IIC T4 Gb IECEx: Ex db ia IIC T4 Gb
	NC	ATEX: II 3G Ex ec ia IIC T4 Gc IECEx: Ex ec ia IIC T4 Gc
	CD	Class I, Division 1, Groups B, C, D, T4 CEC: Ex db ia IIC T4 Gb NEC505: Class I, Zone 1, AEx db ia IIC T4 Gb
	CN	Class I, Division 2, Groups A, B, C, D, T4 CEC: Ex ec ia IIC T4 Gc NEC505: Class I, Zone 2, AEx ec ia IIC T4 Gc
	PE	Ex d e ia IIC T4 Gb
	PD	Ex d ia IIC T4 Gb
	PN	Ex nA ia IIC T4 Gc
4	**Material electronics housing**	
	A	Aluminium (Zone 1)
	S	Stainless steel
5	**Painting electronics housing**	
	1	Standard painting
6	**Cable entries**	
	A	5*M20*1,5; 1*M25*1,5
	B	5*1/2" NPT; 1*3/4" NPT
	C	8*M20*1,5; 1*M25*1,5
	D	8*1/2" NPT; 1*3/4" NPT
7	**Display**	
	1	DOT matrix display
8	**Terminal**	
	S	Screw clamp
9	**Tropicalization**	
	T	Tropicalization
	N	No
10	**Ambient temperature range**	
	E	Extended temp. -40 °C ... +65 °C
	S	Standard temp. -40 °C ... +60 °C
11	**Power supply**	
	1	115 ... 230V AC
	2	12 ... 24V DC
12	**Mainboard**	
	S	Standard
	E	Extended

13	**Analog Module Type 1 (2AI+2AO+2HA)**	
	1	1 x Analog Module Type 1 (2AI+2AO+2HA)
	2	2 x Analog Module Type 1 (2AI+2AO+2HA)
	3	3 x Analog Module Type 1 (2AI+2AO+2HA)
	N	No
14	**Analog Module Type 2 (2AO+1HA)**	
	1	1 x Analog Module Type 2 (2AO+1HA)
	2	2 x Analog Module Type 2 (2AO+1HA)
	N	No
15	**Digital Module (2DI+6DO)**	
	1	1 x Digital Module Type 1 (2DI+6DO)
	2	2 x Digital Module Type 1 (2DI+6DO)
	3	3 x Digital Module Type 1 (2DI+6DO)
	N	No
16	**Interface Module**	
	F	Foundation Fieldbus
	N	No
17	**Reserve**	
	N	-
18	**Device class**	
	N	Standard
	U	Upgrade/substitute
19	**Tag plate**	
	1	Tag plate sticker
	2	Tag plate stainless steel + sticker
	N	No
20	**Terminal assignment (Zone 1)**	
	A	230V 2AI 2AO 2DI/DO 4DO 1ETH 0FF 2RS485
	B	24V 2AI 2AO 2DI/DO 4DO 1ETH 0FF 2RS485
	C	230V 2AI 4AO 2DI/DO 4DO 1ETH 0FF 2RS485
	D	24V 2AI 4AO 2DI/DO 4DO 1ETH 0FF 2RS485
	E	230V 2AI 6AO 2DI/DO 4DO 1ETH 0FF 2RS485
	F	24V 2AI 6AO 2DI/DO 4DO 1ETH 0FF 2RS485
	G	230V 2AI 2AO 2DI/DO 4DO 1ETH 1FF 2RS485
	H	24V 2AI 2AO 2DI/DO 4DO 1ETH 1FF 2RS485
	I	230V 2AI 4AO 2DI/DO 4DO 1ETH 1FF 2RS485
	J	24V 2AI 4AO 2DI/DO 4DO 1ETH 1FF 2RS485
	K	230V 2AI 6AO 2DI/DO 4DO 1ETH 1FF 2RS485
	L	24V 2AI 6AO 2DI/DO 4DO 1ETH 1FF 2RS485
	M	230V 2AI 2AO 0DI/DO 2DO 1ETH 0FF 2RS485
	O	24V 2AI 2AO 0DI/DO 2DO 1ETH 0FF 2RS485
	N	No
21	**Special solution**	
	X	Special solution
	N	No

Characteristic value “X” in the type code denotes a customer-specific version.

15.5 Relationship between IECEx marking and Interface Unit

Fig. 155 Interface Unit Zone 1 Ex d

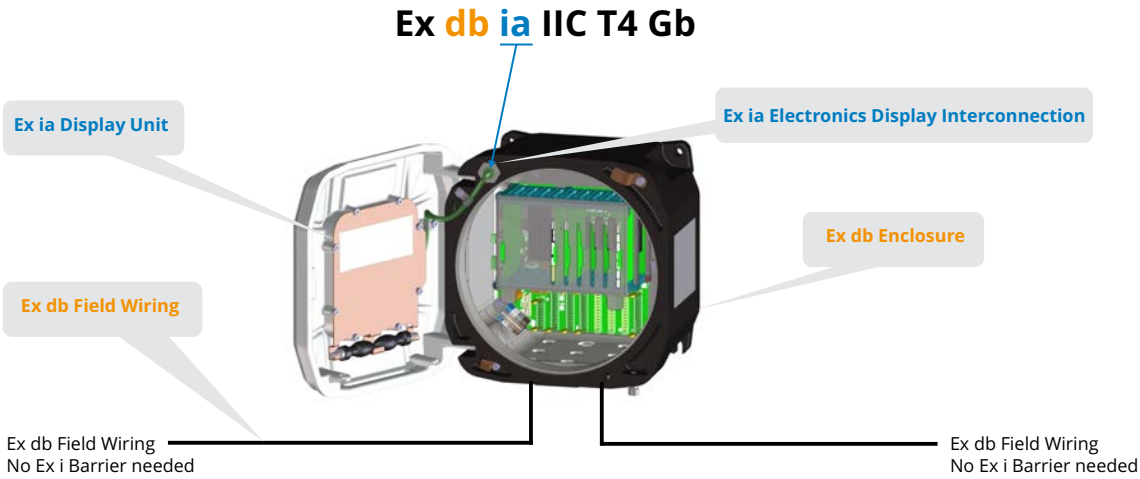


Fig. 156 Interface Unit Zone 1 Ex d e

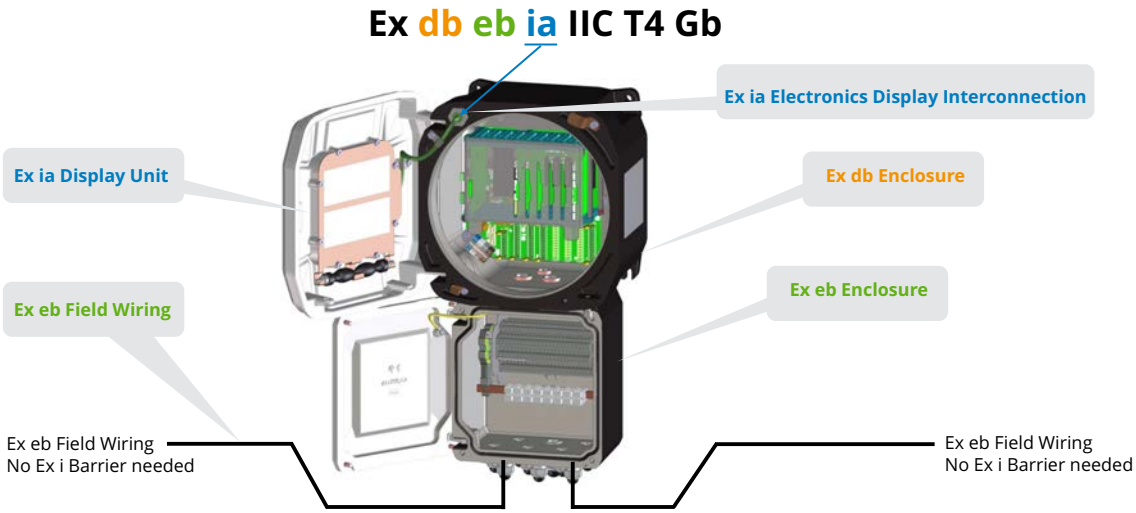
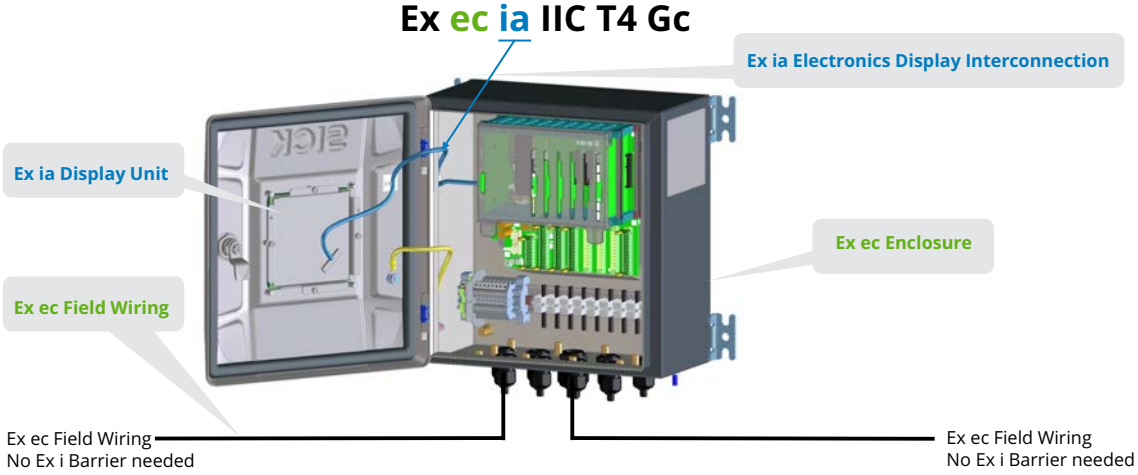


Fig. 157 Interface Unit Zone 2 Ex e



15.6 Gasket installation

Fig. 158 Gasket installation (developed by "pikotek")

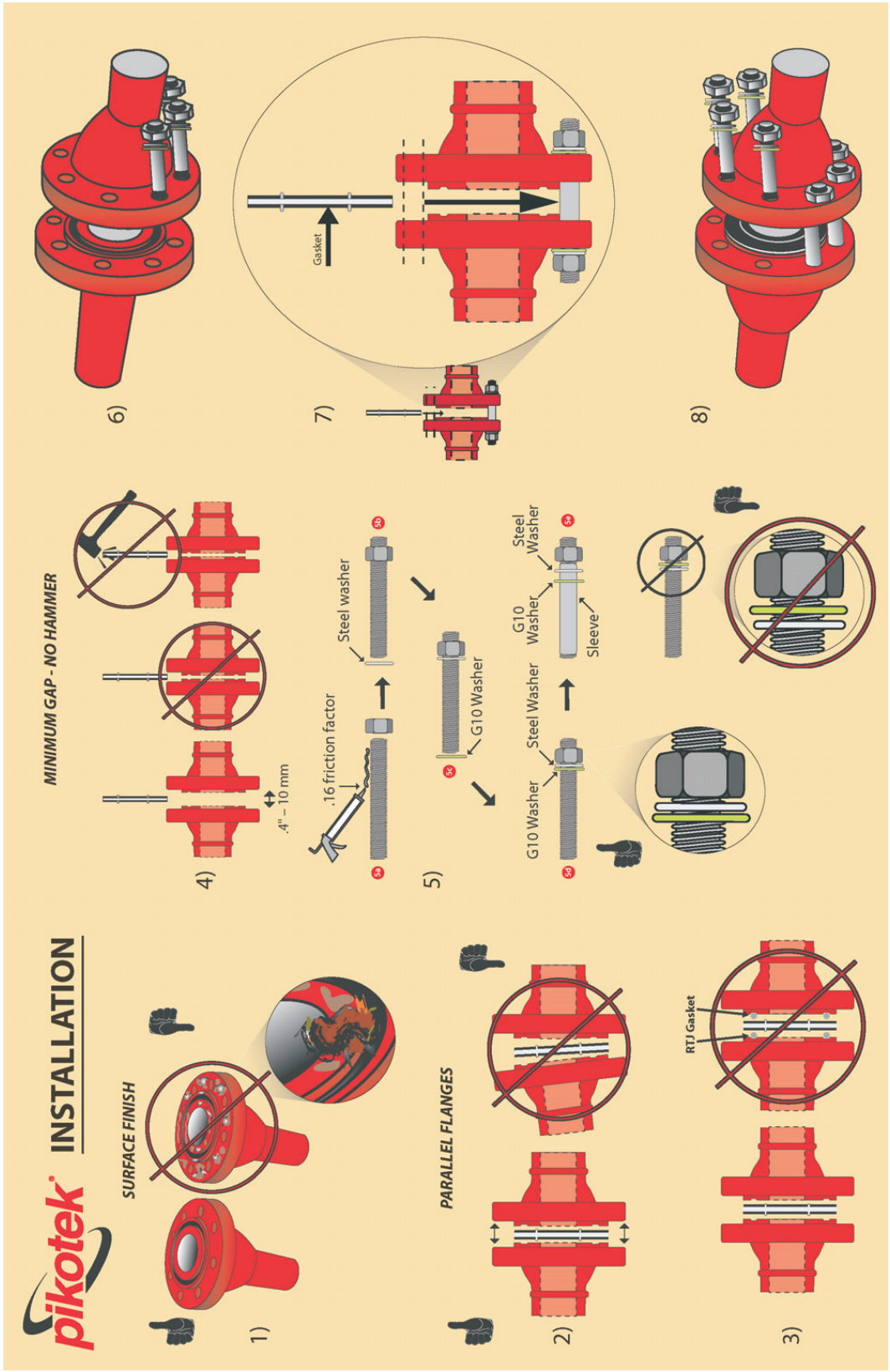
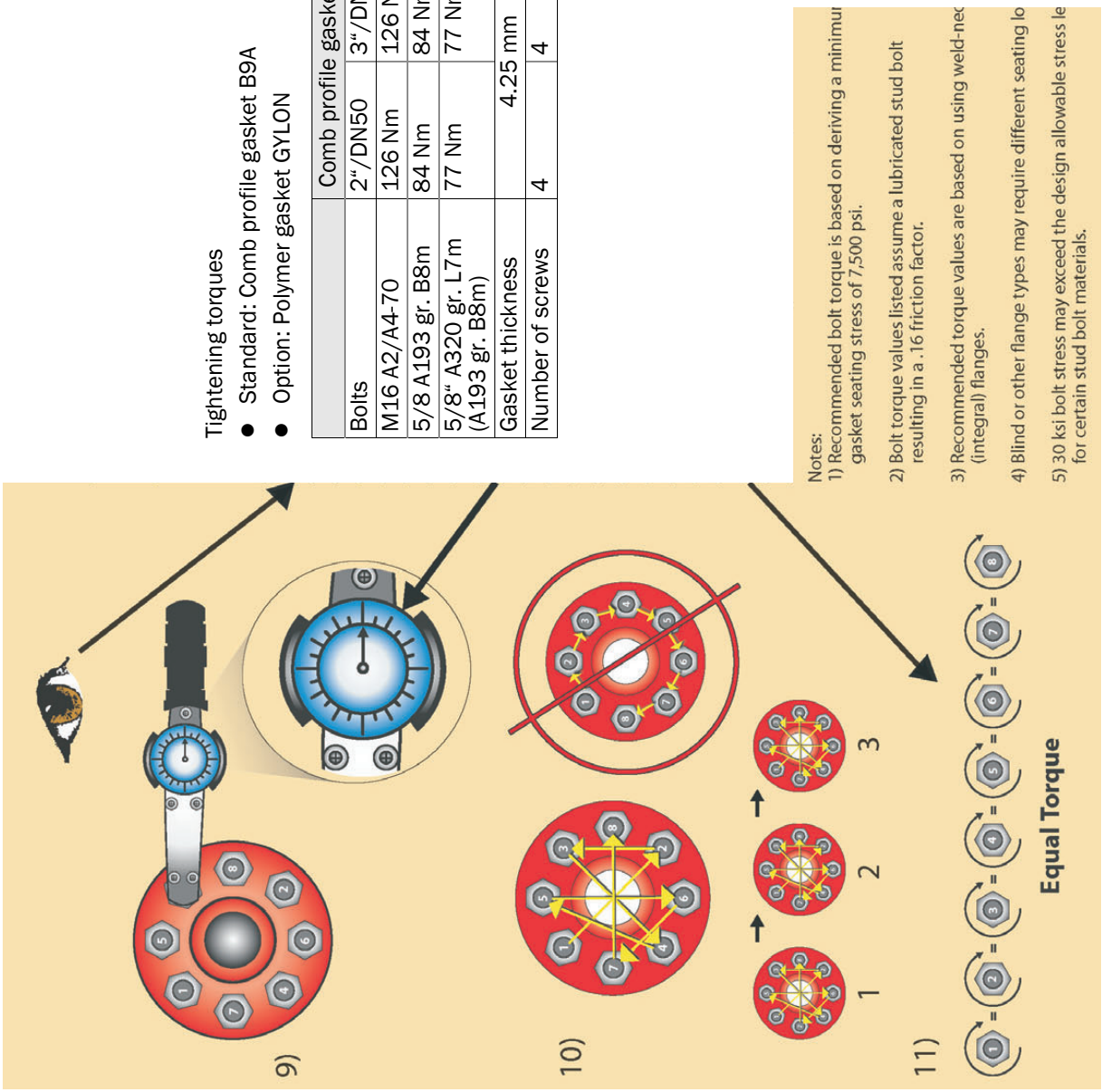


Fig. 159 Gasket installation (developed by ”pikotek”), screw tightening torques for comb profile gasket B9A and polymer gasket GYLON

Tightening torques

- Standard: Comb profile gasket B9A
- Option: Polymer gasket GYLON

	Comb profile gasket B9A		Polymer gasket GYLON	
Bolts	2“/DN50	3“/DN80	2“/DN50	3“/DN80
M16 A2/A4-70	126 Nm	126 Nm	126 Nm	126 Nm
5/8 A193 gr. B8m	84 Nm	84 Nm	118 Nm	118 Nm
5/8“ A320 gr. L7m (A193 gr. B8m)	77 Nm	77 Nm	118 Nm	118 Nm
Gasket thickness	4.25 mm		4.6 mm	
Number of screws	4	4	4/8	4



8029806/AE00/V2-4/2025-04

www.addresses.endress.com

Endress+Hauser

People for Process Automation