Operating Instructions
FLOWSIC100 Flare-XT Transmitter

Ultrasonic Mass Flow Measuring Device

Endress+Hauser
People for Process Automation

Described product
Product name: FLOWSIC100 Flare-XT Transmitter

Manufacturer
Endress+Hauser SICK GmbH+Co. KG
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Germany

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Original document
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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 Transmitter

1 About this document

Function of this document
Scope of application
Target groups
Data integrity
Further information

1.1 Function of this document

These Operating Instructions describe for the FLOWSIC100 Flare-XT Transmitter with FLSE100-XT sender/receiver units:

- 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 Transmitter 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 Data integrity

Endress+Hauser uses standardized data interfaces such as standard IP technology, in its products. The focus here is on the availability of the products and their properties.

Endress+Hauser always assumes that the customer is responsible for the integrity and confidentiality of data and rights involved in connection with using the products.

In all cases, the customer is responsible for the implementation of safety measures suitable for the respective situation, e.g., network separation, firewalls, virus protection and patch management.

1.5 Further information

NOTICE:
Observe all supplied documents.

FLOWSIC100 Flare-XT Transmitter

2 For your safety

Basic safety information
Intended use
Operation in potentially explosive atmospheres
Warning information on device
Requirements on the personnel's qualification
Restrictions on use

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 Transmitter 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 Transmitter 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 Transmitter unless described in this Manual.
- ► Do not modify the FLOWSIC100 Flare-XT Transmitter 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 Transmitter 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.

2.1.1 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. 22, §2.5). 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.

2.1.2 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.

2.1.3 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. 18, §2.3).
- ► Observe the information on → p. 15, §2.1.1 during installation work on running equipment (”hot tapping” method).

2.1.4 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.

2.1.5 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. 76, §6.8.3.

2.2 Intended use

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

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.

2.3 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 1 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

2.3.1 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.

2.3.2 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.

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

Case 1 (see →Table 2):

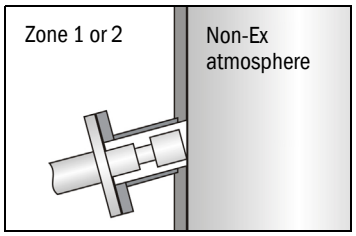
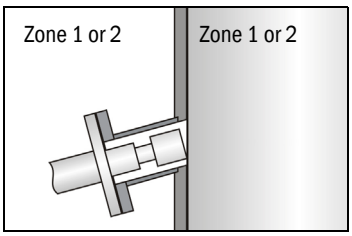
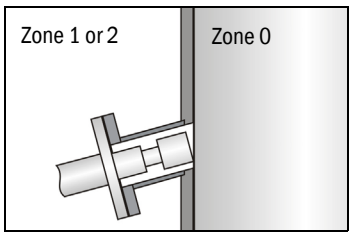
Under normal atmospheric conditions, an explosive atmosphere categorized as Zone 1 or Zone 2 exists outside the pipeline. Process conditions in the pipeline can differ from the atmospheric conditions. Process conditions can be in the range specified on the type plate of the sender/receiver units. In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

Case 2 and 3 (see →Table 2):

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 2 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.

2.4 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.

2.5 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

EX

► 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.

2.6 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 2, 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.

FLOWSIC100 Flare-XT Transmitter

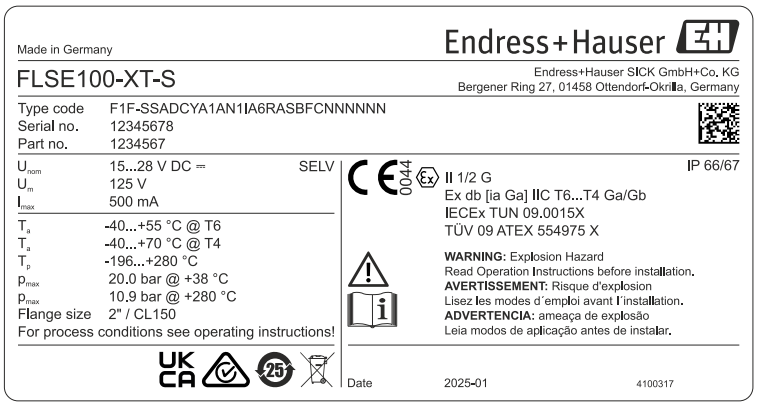
3 Product description

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. 1 Type plate example FLSE100-XT-S



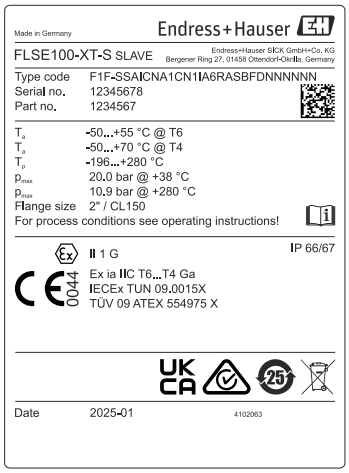
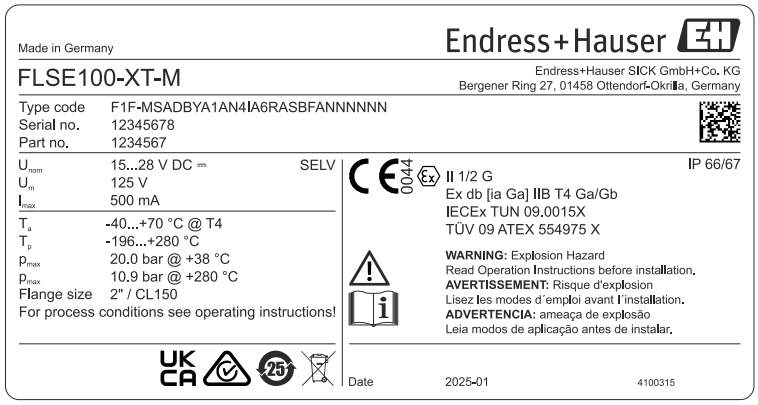


Fig. 2 Type plate example FLSE100-XT-M



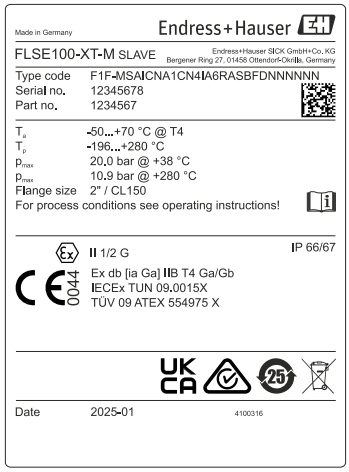
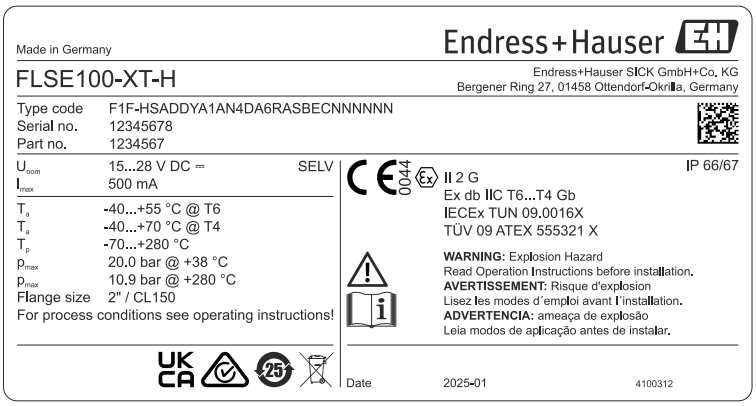


Fig. 3 Type plate example FLSE100-XT-H



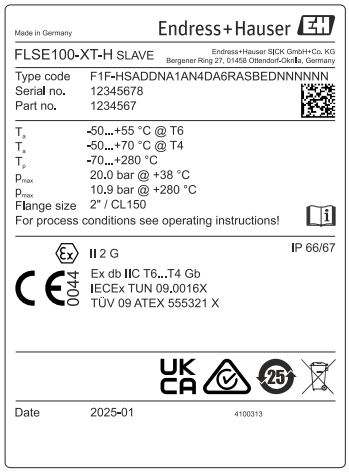
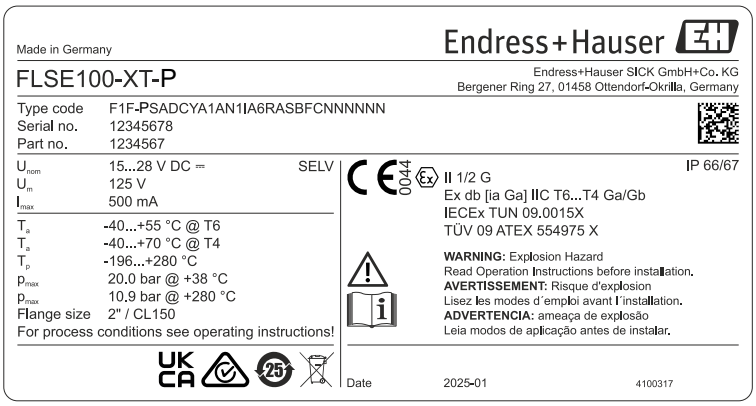


Fig. 4 Type plate example FLSE100-XT-P

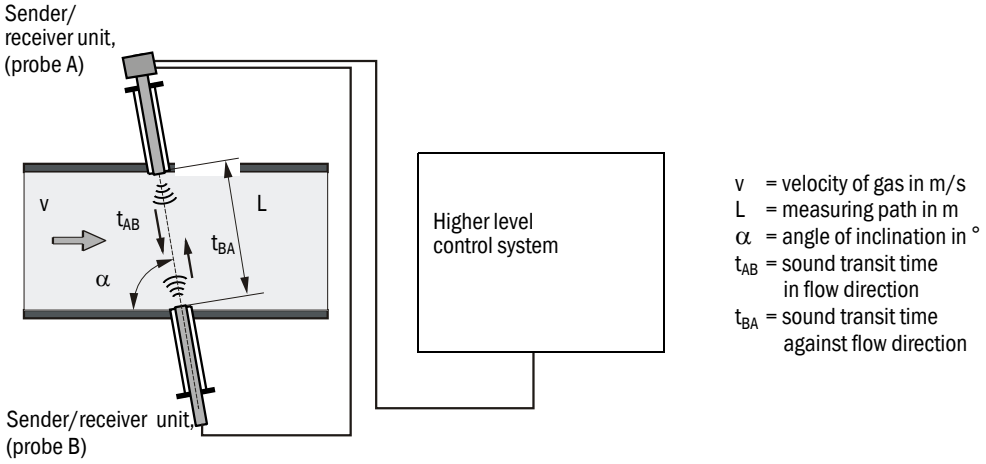


3.2 Functional principle

The FLOWSIC100 Flare-XT Transmitter 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. 5). 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. 5 Functional principle FLOWSIC100 Flare-XT Transmitter



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.

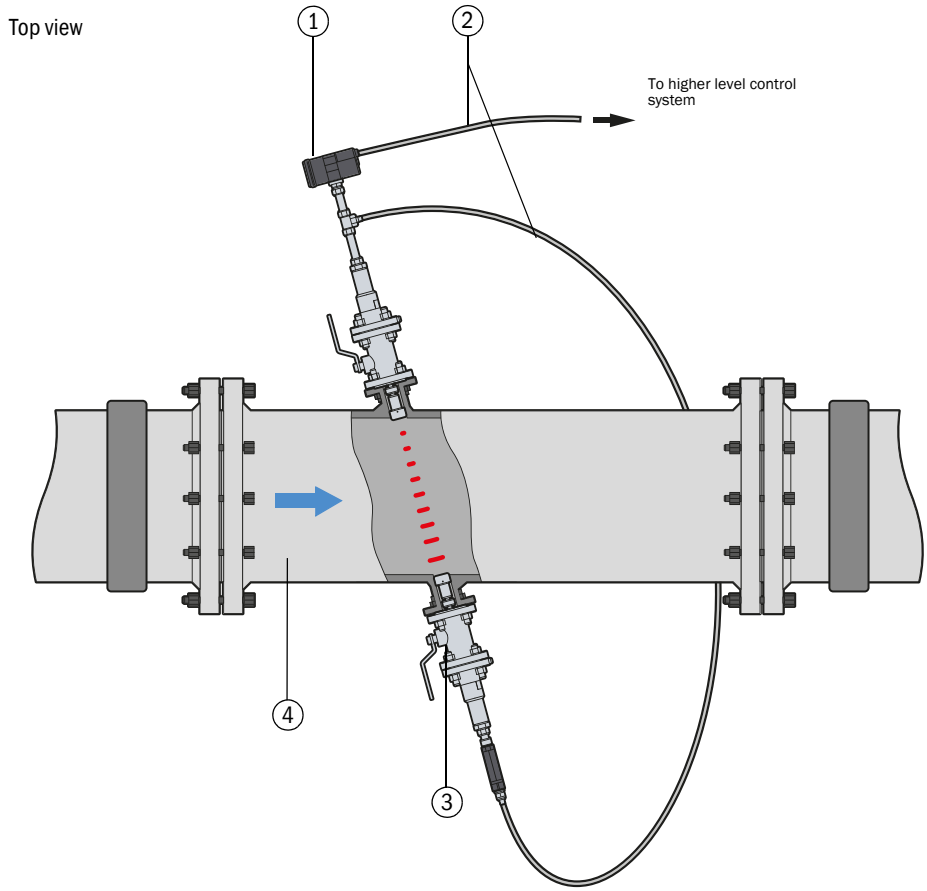
$$c = \frac{L}{2} \cdot \left(\frac{t_{AB} + t_{BA}}{t_{AB} \cdot t_{BA}}\right) \quad (2.4)$$

3.3 System overview

The FLOWSIC100 Flare-XT Transmitter comprises the components:

- FLSE100-XT sender/receiver unit
  For transmitting and receiving ultrasonic pulses, signal processing and controlling the system functions, evaluation and output of data connected via an 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 higher level control system (optionally available)
- 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

Fig. 6 System overview FLOWSIC100 Flare-XT Transmitter

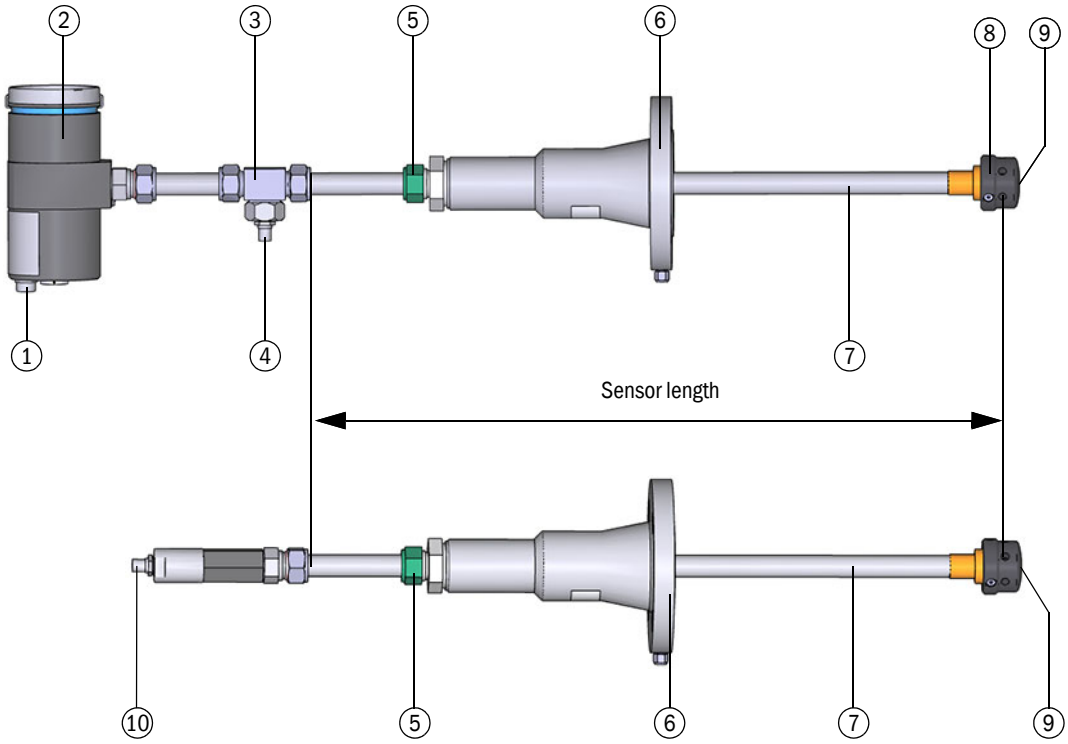


1 Sender/receiver unit, FLSE-XT active sensor
2 Connection cable
3 Sender/receiver unit, FLSE-XT passive sensor
4 Optional spool piece

3.4 Sender/receiver units

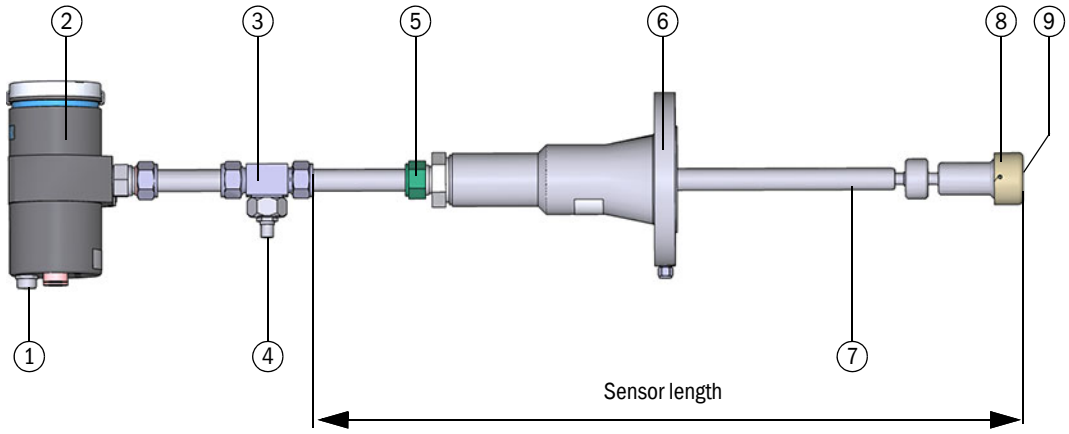
Cross-duct

Fig. 7 F1F-S (active and passive sensor shown as examples)



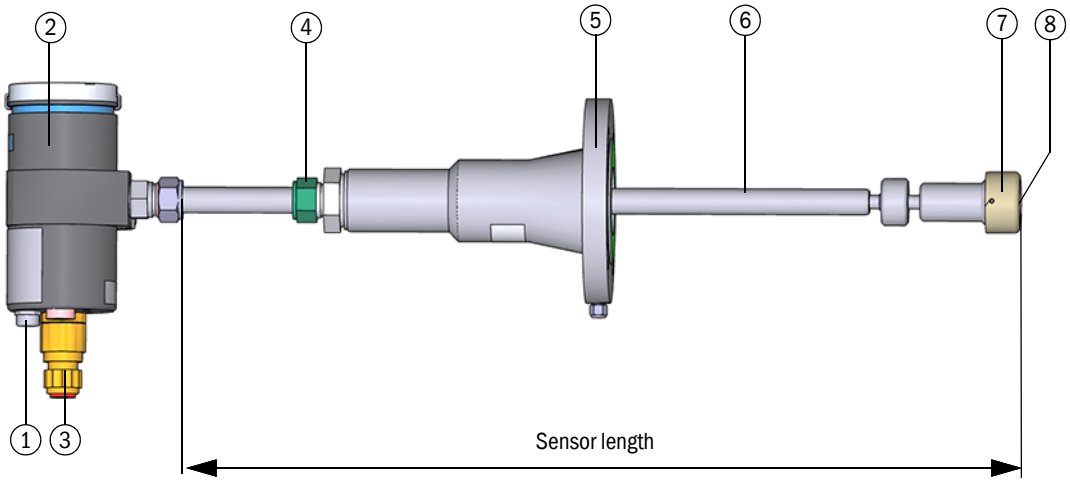
1 Pressure compensation element
2 Electronics unit
3 T-connector
4 TNC connector (connection for passive sensor)
5 Self-cutting ring
6 Retraction nozzle
7 Duct probe
8 Sensor contour
9 Transducer
10 TNC connector (connection for active sensor)

Fig. 8 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

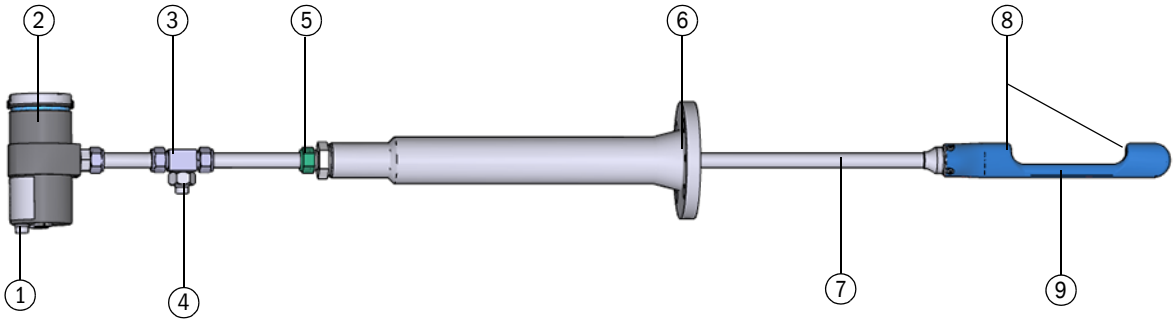
Fig. 9 F1F-H (only active sensor shown)



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. 10 F1F-P

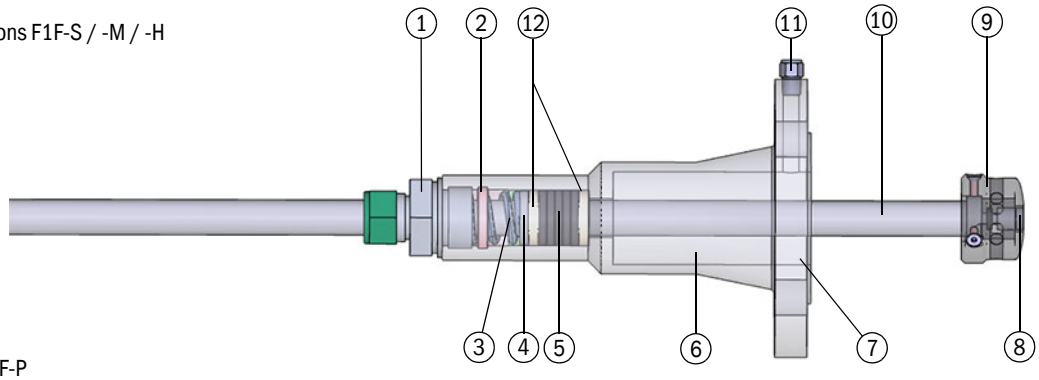


1 Pressure compensation element
2 Electronics unit
3 T-connector
4 Pressure compensation element
5 Self-cutting ring
6 Retraction nozzle
7 Duct probe
8 Transducer
9 Sensor contour

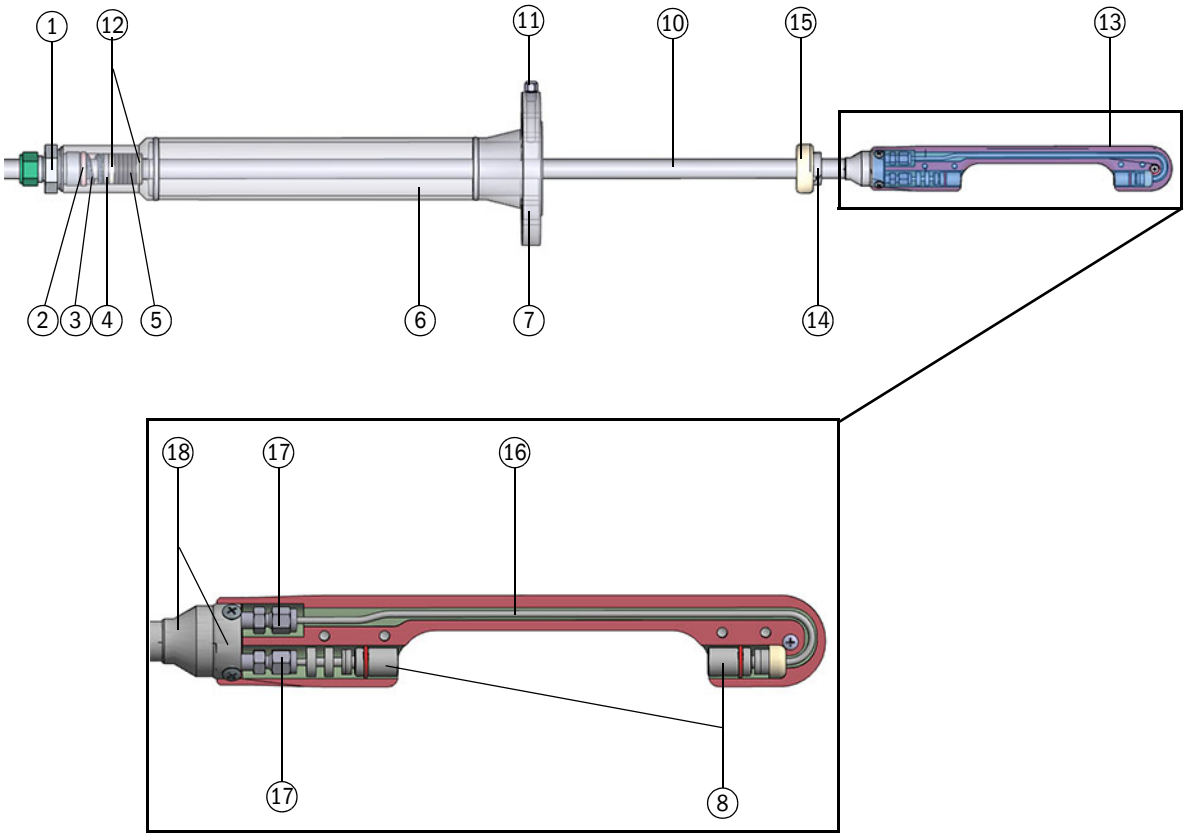
3.5 Material for wetted parts (parts with process gas contact)

Fig. 11 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 3 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

3.6 Spool piece option

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

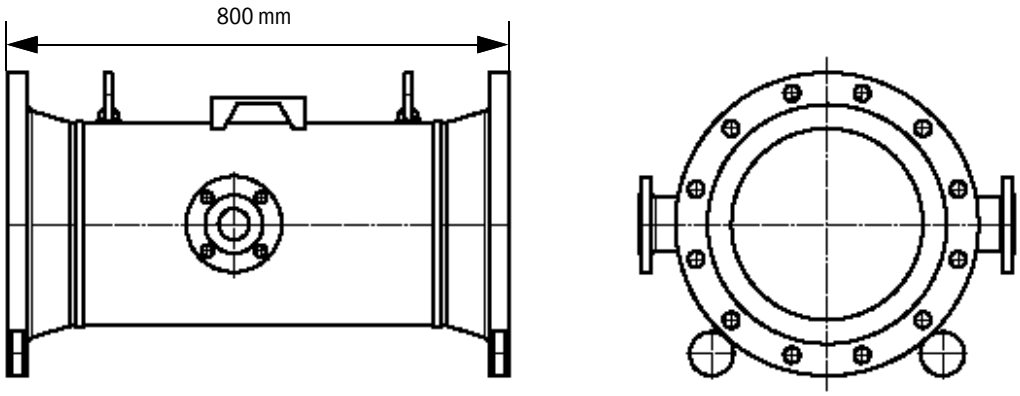
The installation length of the spool piece depends on the nominal diameter of the pipe:

- 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 Transmitter + 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. 12 Spool piece option (example)

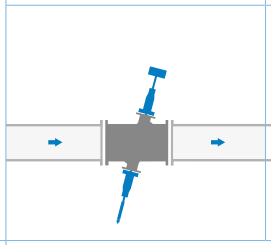
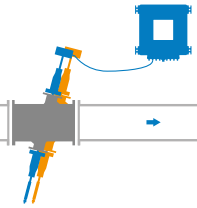
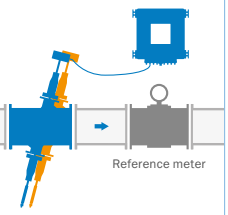


3.7 System configuration

The FLOWSIC100 Flare-XT Transmitter is a basic flare gas measurement system based on ultrasonic technology without additional field electronics. It supports the most important measurement tasks, like volume and mass flow calculation which are needed to meet regulatory compliance. It is mounted into nozzles which 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.

Endress+Hauser offers further flare gas measuring technology with advanced diagnostics, additional IO (e.g. analog out, HART®, Foundation Fieldbus, etc.), a local display as well as counters, logbooks and data archives. Therefore an additional field electronics – the Interface Unit is required. See overview for details.

Fig. 13 Flare Transmitter, Flare Instrument and Flare Meter comparison

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	★	★★	★★★

3.8 ASC technology (patented) – active sound correlation technology

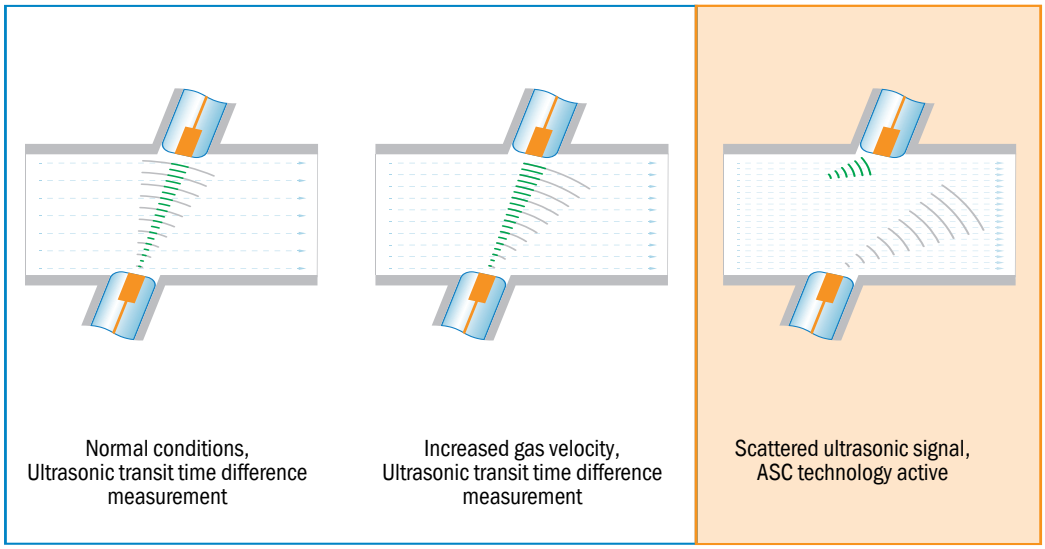
If the ultrasonic signal is scattered due to extreme gas velocity, the ASC technology (active sound correlation technology) takes over.

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.

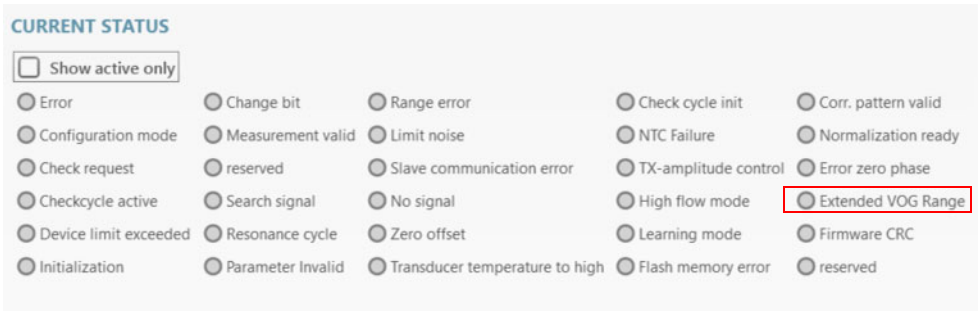
Measurement uncertainty is higher as compared to ultrasonic transit time difference measurement, see technical data, → p. 117, §12.

Fig. 14 ASC technology



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

Fig. 15 Signaling “Extended VOG Range”



FLOWSIC100 Flare-XT Transmitter

4 Project planning

Overview
Recommendations for the installation location of the FLSE100-XT sensors
Additional requirements for optional spool piece

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. 55, §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.

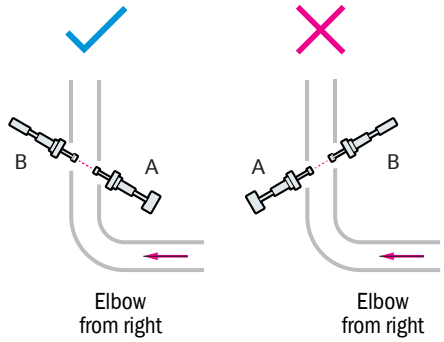
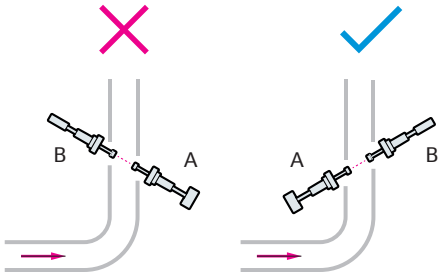
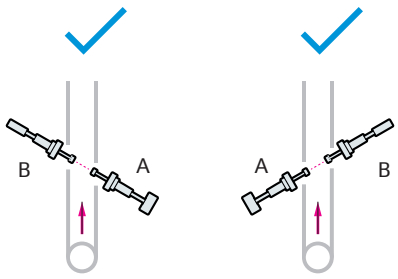
For best possible device performance, it is recommended to analyze the flow profile and determine the optimal measurement location. Detailed procedure for pre-investigations can be found for example in ISO 16911-2 section 8.2.

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.

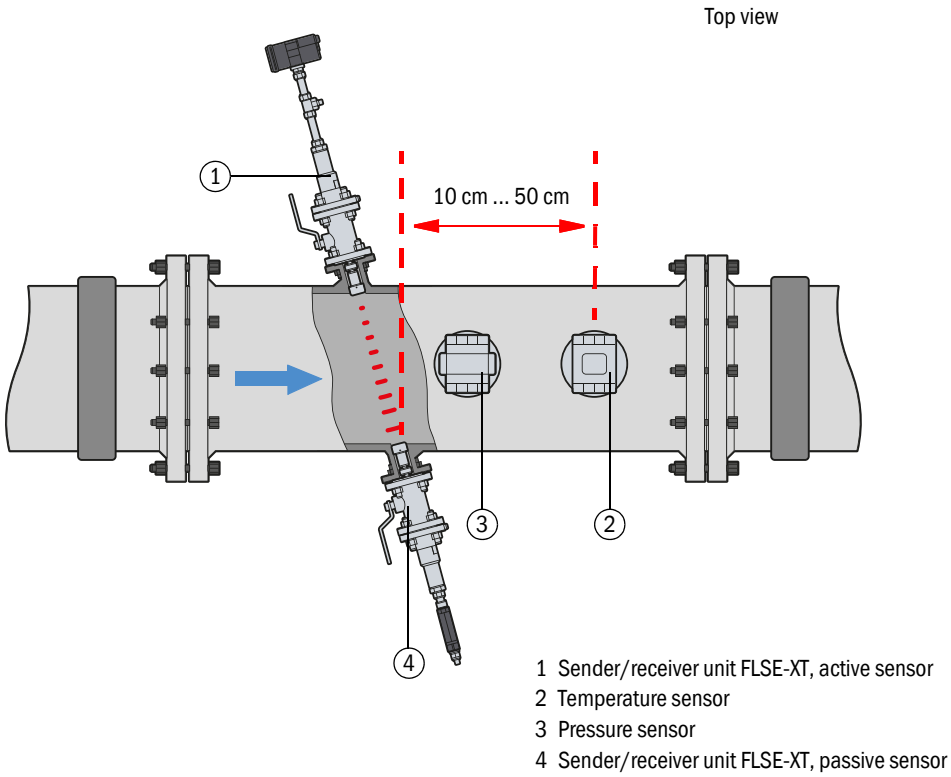
4.2.3 Installation location for external pressure and temperature transmitters (option)

Pressure and temperature transmitters can not be directly connected to the FLOWSIC100 Flare-XT Transmitter, see → p. 92, §7.8.

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. 16 Installation location



1 Sender/receiver unit FLSE-XT, active sensor
2 Temperature sensor
3 Pressure sensor
4 Sender/receiver unit FLSE-XT, passive sensor

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. 129, §12.6.1.

FLOWSIC100 Flare-XT Transmitter

5 Transport and storage

Transport protection
Storage
Special notes for handling the spool piece option

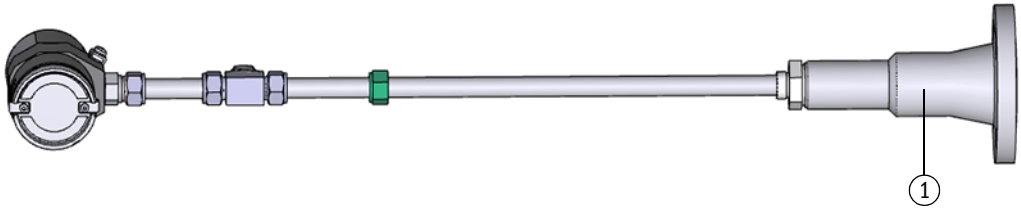
5.1 Transport protection

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

5.2 Storage

Comply with permissible storage conditions (→ p. 117, §12).

5.3 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)

FLOWSIC100 Flare-XT Transmitter

6 Mounting

Safety
Scope of delivery
Fitting the spool piece (option)
Installation sequence
Geometry calculator in FLOWgate™
Installation accessories
Fitting the nozzles on the pipeline (measuring system without spool piece option)
Fitting the sender/receiver units
Pulling the sender/receiver units back
Fitting the weatherproof cover for the sender/receiver unit

6.1 Safety

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”.

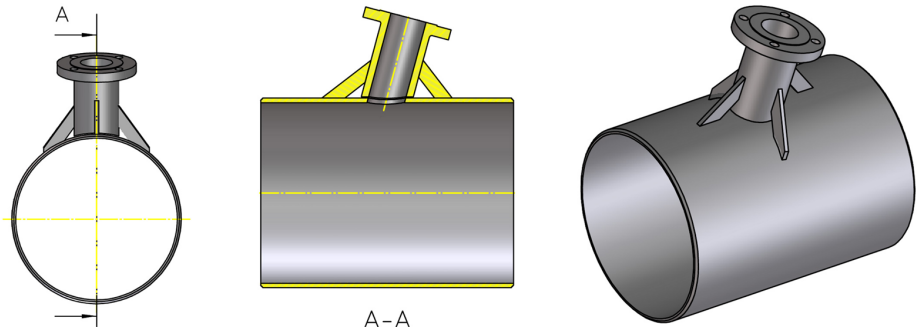
NOTICE:

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”



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.

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 passive sensor of the sender/receiver units for the cross-duct versions are installed according to → p. 30, §3.3.

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

► Observe the transport information in → p. 49, §5.3 !

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. 80, §6.8.5.

NOTICE:

If the sender/receiver units of a measuring system configured as a Flare Meter (→ p. 36, §) 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.

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.

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. 60, §6.7.2.

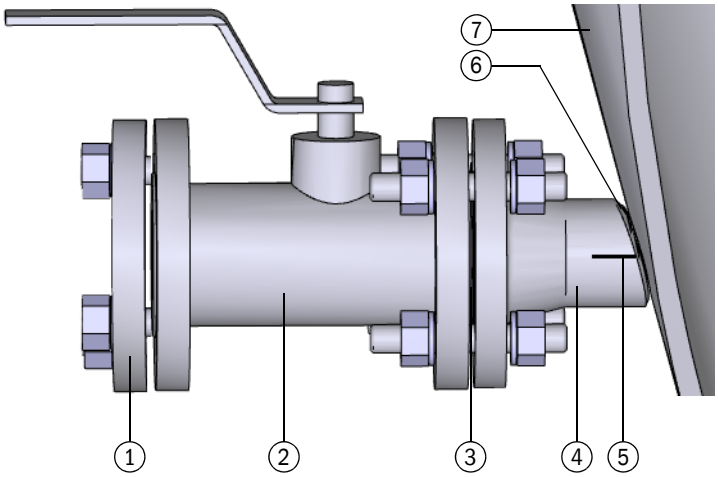
  The following parameters must be determined during installation for calculation of the probe offset:
  – Circumference, wall thickness and nominal nozzle angle
- Wetted part length wL, → p. 71, §6.8.1.

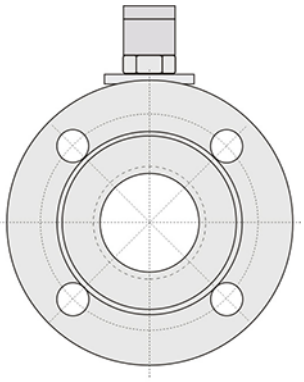
  For installation of the sender/receiver units, the wetted part length is calculated from:
  – Circumference
  – Wall thickness
  – Gasket thickness
  – Nozzle length
  – For retractable installation: Ball valve length
  – Nozzle angle
  – Additionally for cross-duct versions: Probe offset a
- Geometry installation parameters for commissioning the measuring system, → p. 71, §6.8.1.

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:

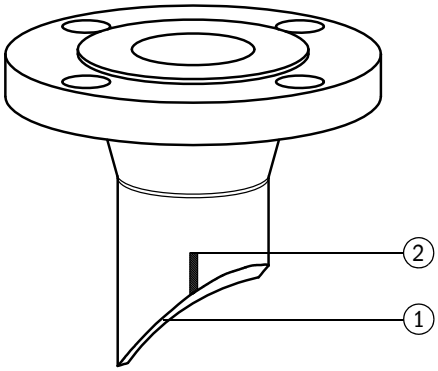
Use of installation accessories for temperature range according to type plate:

- 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. 127, §12.5. 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. 127, §12.5.

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. 127, §12.5.

Table 4 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. 127, §12.5.

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. 68, §6.8.

Seals

> ***NOTICE:***
> Observe the diagrams on → p. 127, §12.5.

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 5 Available seals

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

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. 127, §12.5.

Table 6 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 7 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)

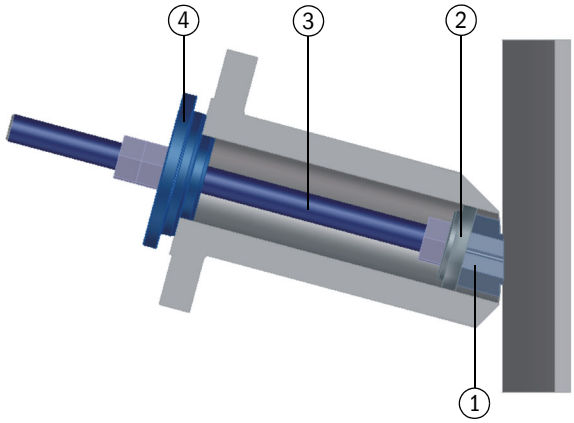
6.6.3 Nozzle installation tool

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



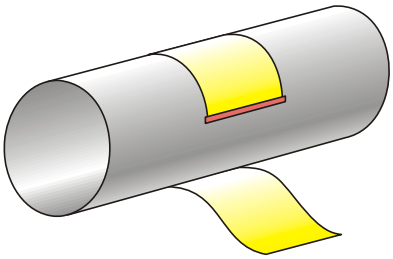
6.7 Fitting the nozzles on the pipeline (measuring system without spool piece option)

6.7.1 General preparation work

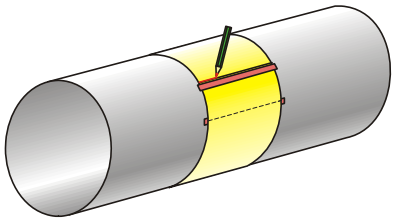
The installation tool (→ p. 58, §6.6.3) contains a foil strip (length approx. 4 times the pipe diameter, width approx. 0.75 of the pipe diameter) as a resource to determine the exact position of the nozzle on the pipeline. The foil strip is prepared with nozzle markings for different pipe diameters.

Fig. 23 General preparation work

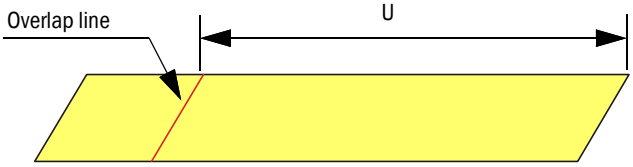
1) Wind the strip around the pipeline at the selected measuring point (ensure exact right-angled alignment) and secure (e.g. with adhesive strips).



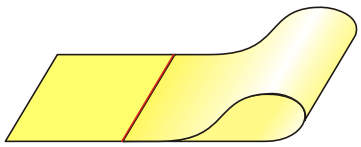
2) Mark the strip where overlapping starts.



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.



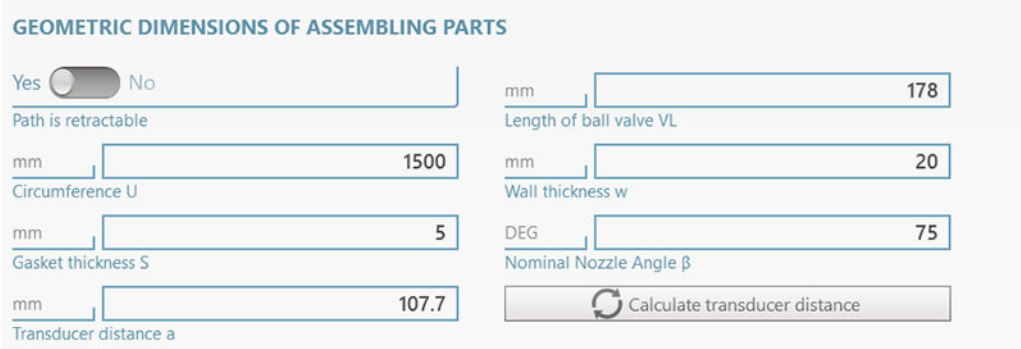
6.7.2 Determining the nozzle position for cross-duct versions

> ***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™

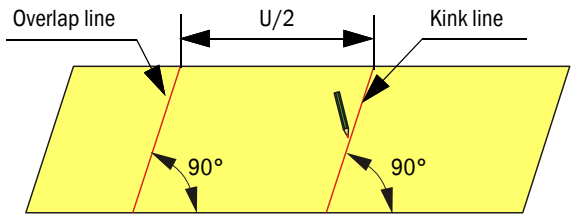
1 Start FLOWgate™ operating software.
2 Create a FL100 Flare-XT Trans offline device.
3 Open the “Geometry calculator” tile in the “Change parameters” menu.
4 Select the “Cross-duct” device type.
5 Enter circumference U and the wall thickness w in the “Dimensions of components” section.
6 Click “Calculate 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
4a) Roll the strip out again and mark the kink line. 
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.

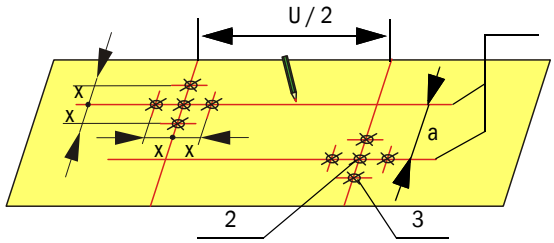
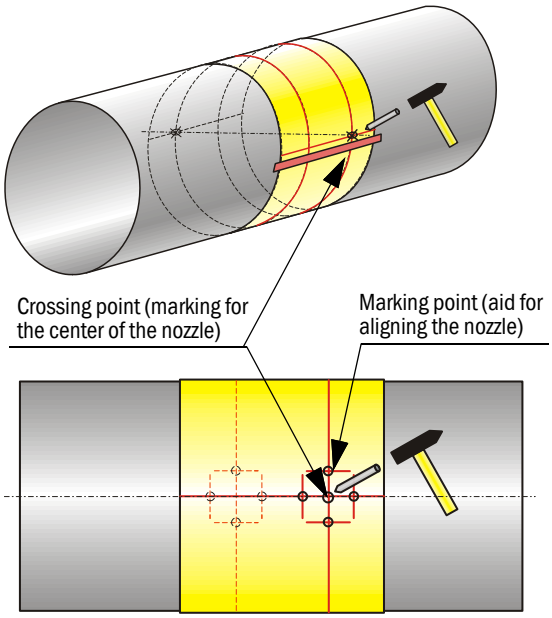


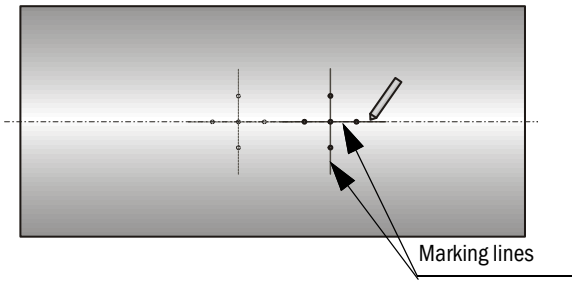
Fig. 26 Marking the nozzle positions on the pipeline for cross-duct versions

1-path measurement

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.



6.7.3 Determining the nozzle position for the probe version

Fig. 27 Determining the nozzle positions on the strip

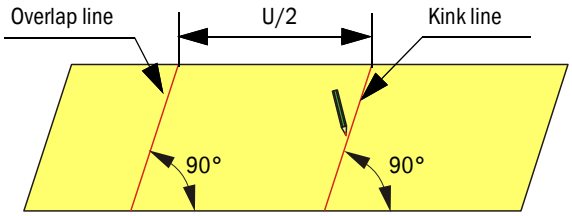
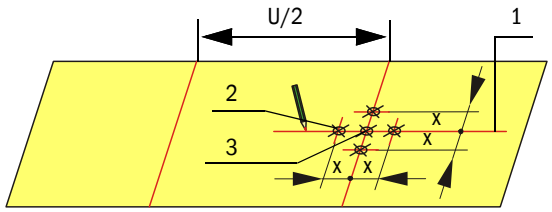
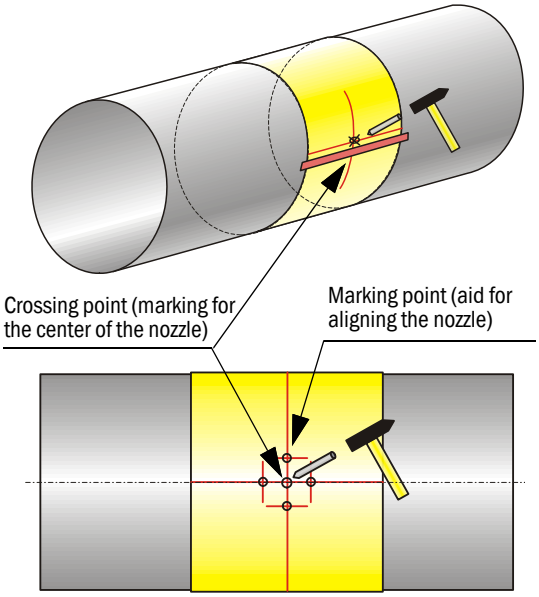
1-path measurement
1) Start preparation work as shown in → p. 59, Fig. 23.
4a) Roll the strip out again and mark the kink line. 
5) Draw a guide line (1) for the nozzle position(s), mark crossing points (2) and draw marking points (3) in distance 80 mm (x) from the crossing points. 

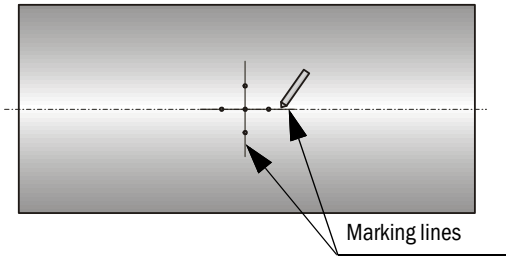
Fig. 28 Marking the nozzle position(s) on the pipeline for the probe version

1-path measurement

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.



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.

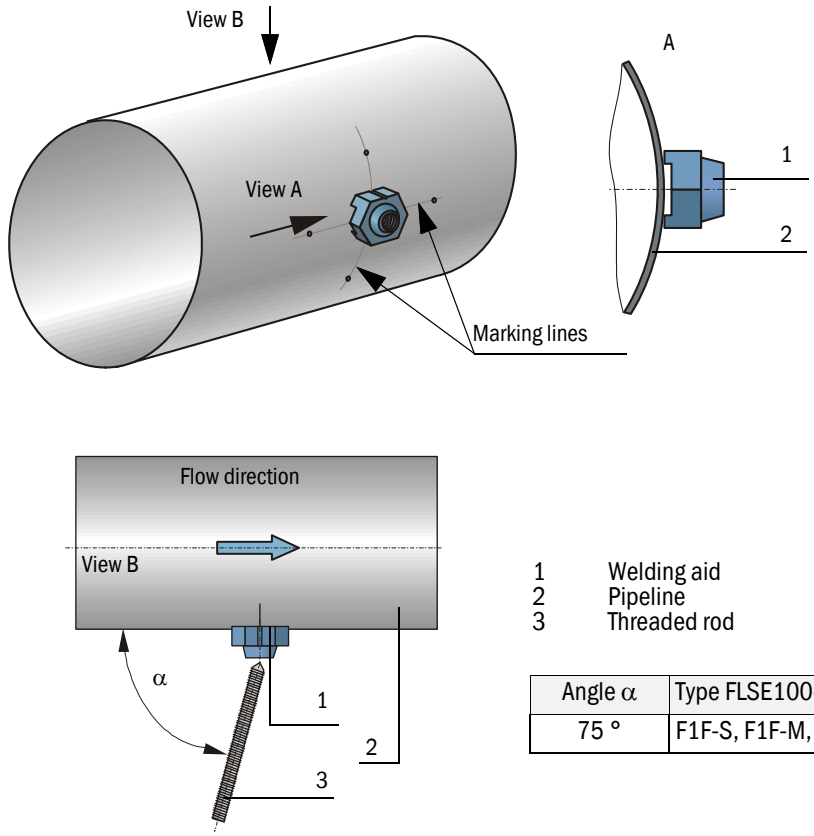
► Position the welding aid (1) on the pipeline (2) as shown in → Fig. 29.

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

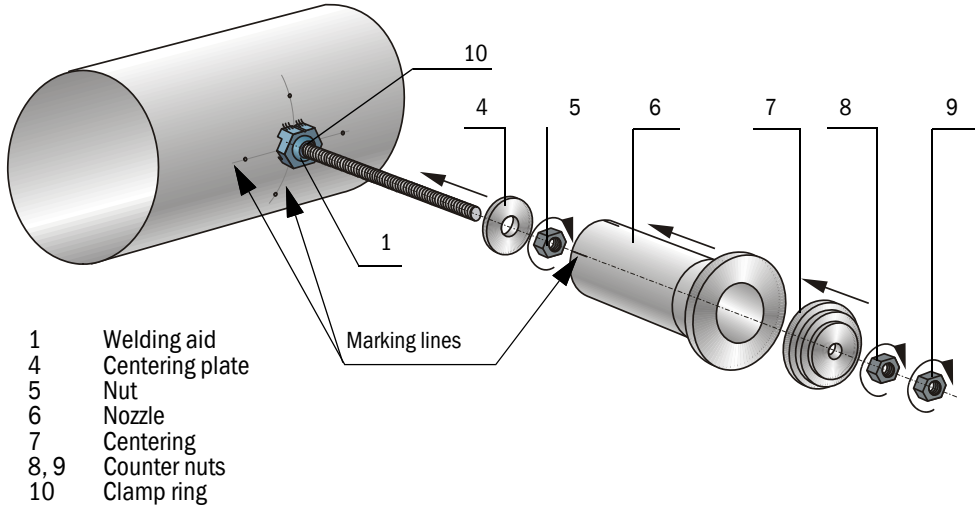
► Slide centering plate (4) on the cone of the welding aid (1) and fasten with the nut (5).
► Slide nozzle (6) over threaded rod and centering plate.

- ► 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

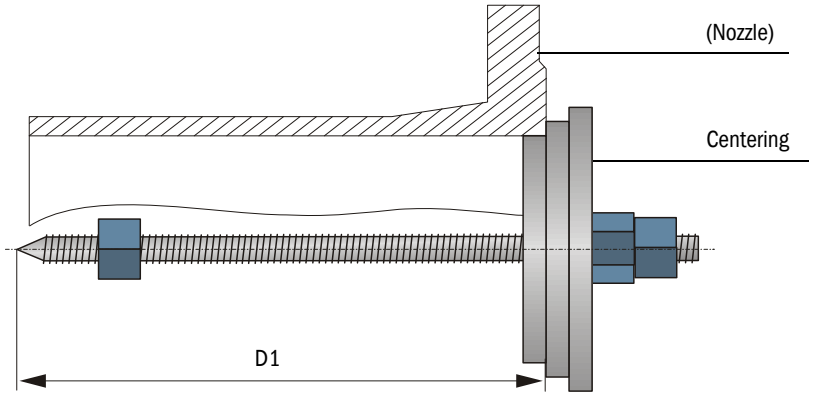


1	Welding aid
4	Centering plate
5	Nut
6	Nozzle
7	Centering
8, 9	Counter nuts
10	Clamp ring

- ► 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. 117, §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 Transmitter (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. 59, §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.

6.8 Fitting the sender/receiver units

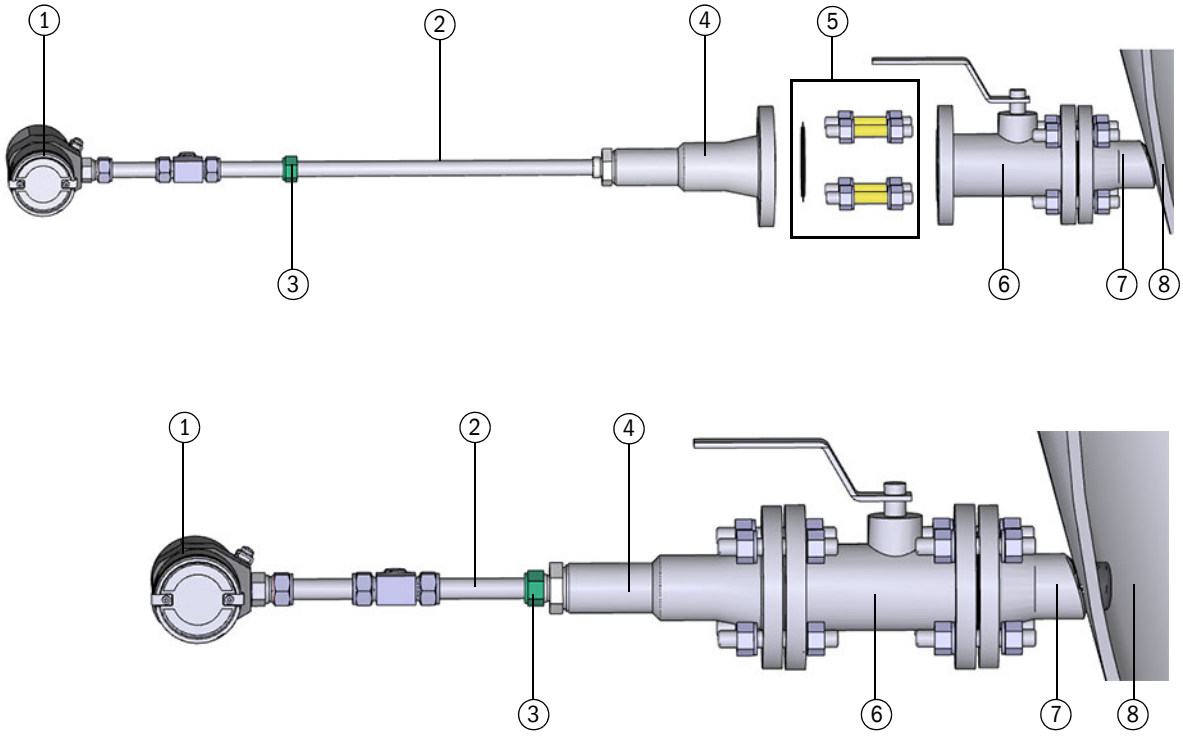
WARNING: General risks during installation

- ► Observe and follow the valid regulations and safety regulations as well as the safety notices in → p. 13, §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



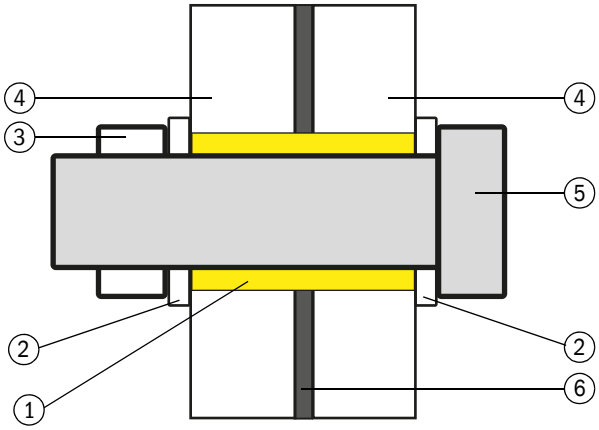
1 Electronics unit
2 Duct probe
3 Cutting ring screw connection
4 Retraction nozzle
5 Mounting kit (gasket, fastening screws, nuts, washers, centering sleeves)
6 Ball valve
7 Nozzle
8 Pipeline

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

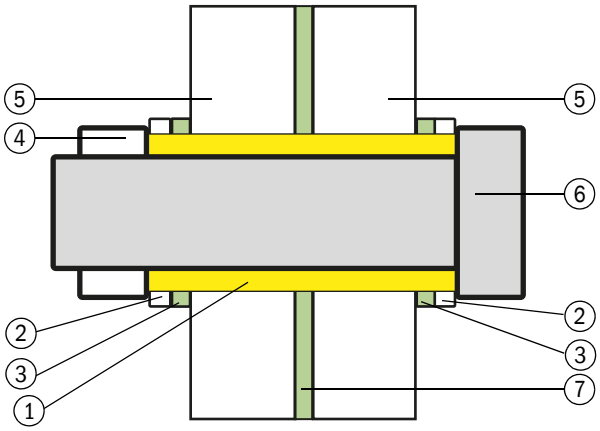


1 Centering sleeve
2 Washer
3 Nut
4 Flange
5 Fastening screw
6 Seal

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. 144, §15.4.

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 FL100 Flare-XT Trans offline device.
1 Open the “Geometry calculator” tile in the “Change parameters” menu.
2 Select the “Cross-duct” or “probe” device type.
3 For installations with ball valve, move the “Path is changeable” slider to “Yes”, for installations without ball valve, move it to “No”.
4 For cross-duct versions, enter the “Probe offset” as determined during nozzle installation, → p. 60, §6.7.2.
5 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°).
6 Click “Calculate parameter values” in “Parameter values”.
   The wetted part length wL is calculated .
7 Click “Create Report” to generate a protocol of the geometry data.

> ***NOTICE:***
> The Geometry Data report is required when commissioning with FLOWgate™ , see §8 "Commissioning".

Fig. 35 Creating a protocol

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

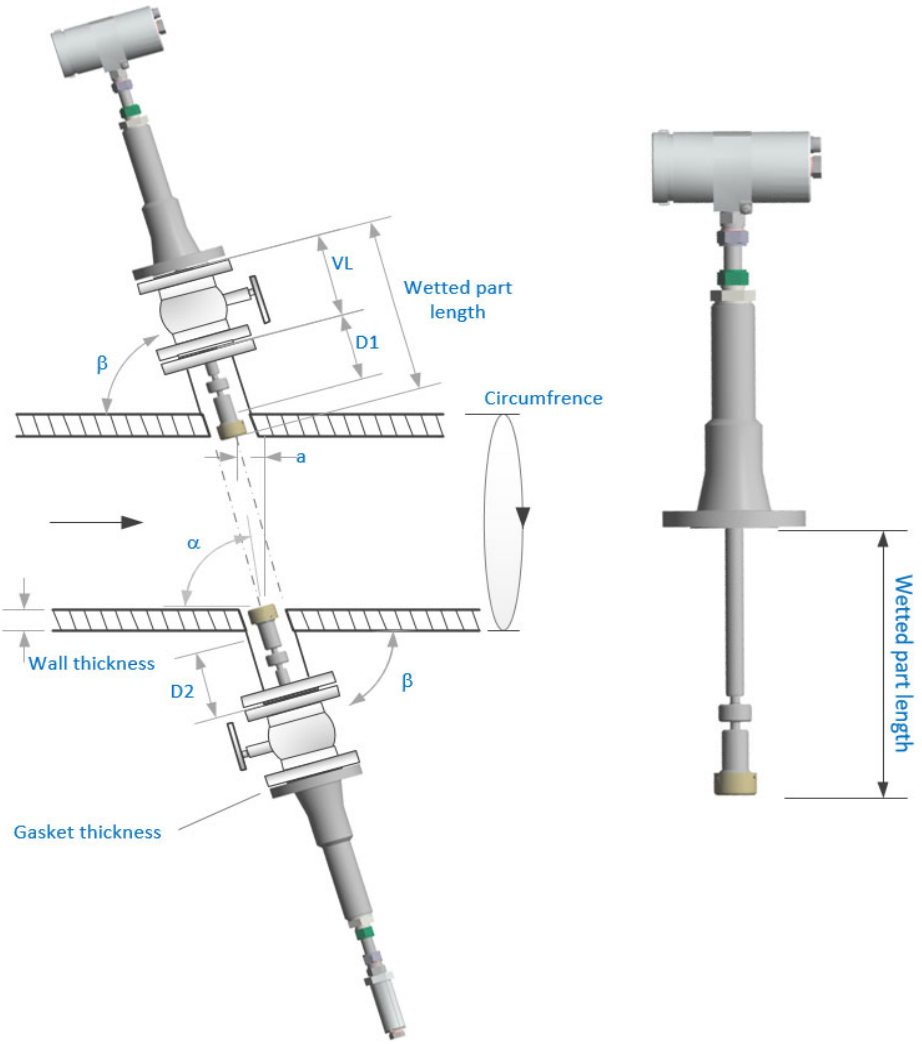
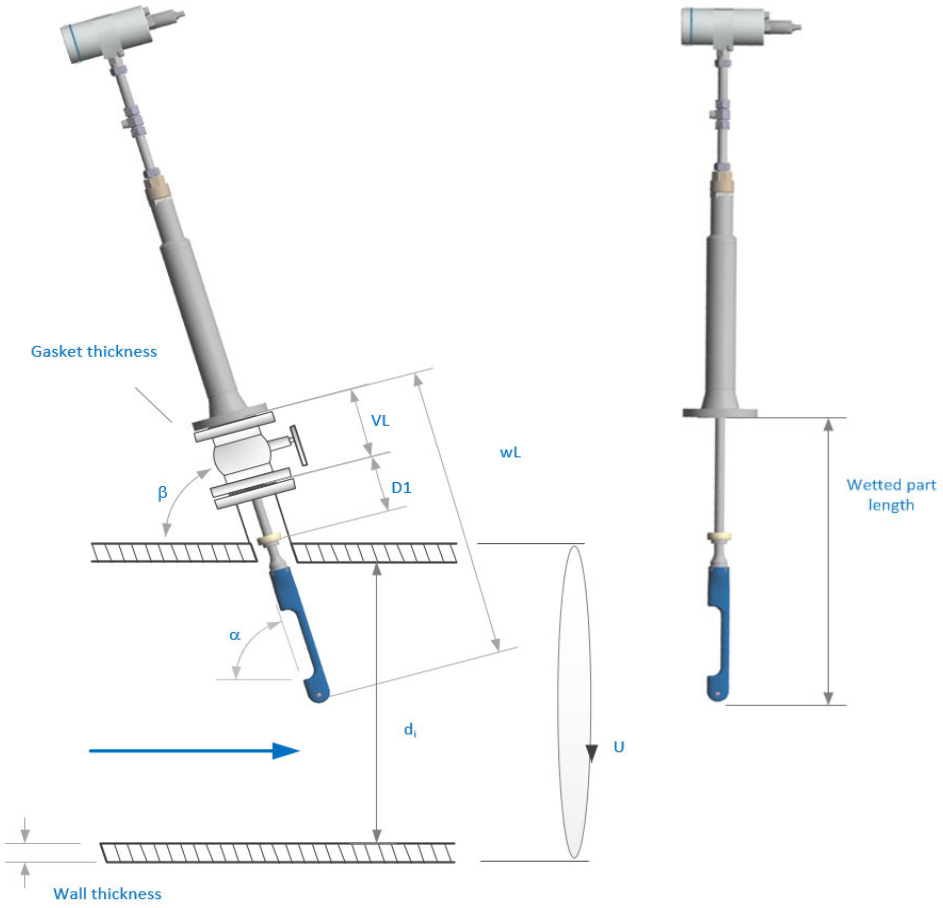


Fig. 37 Installation of F1F-P (probe version)



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.

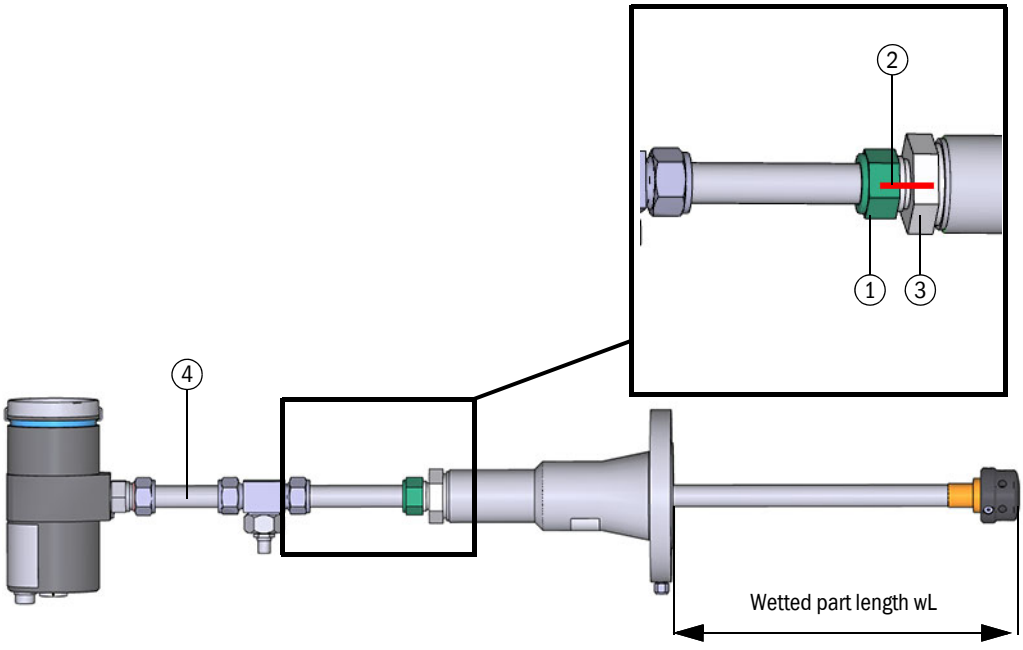
***NOTICE:* Damage due to incorrect position of the self-cutting ring**

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

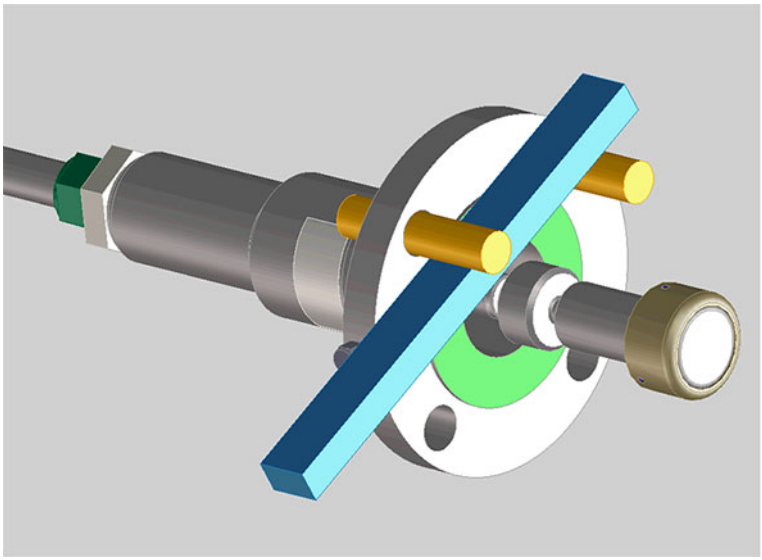
Proceed as follows to set the wetted part length and to tighten the self-cutting ring:

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.

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.

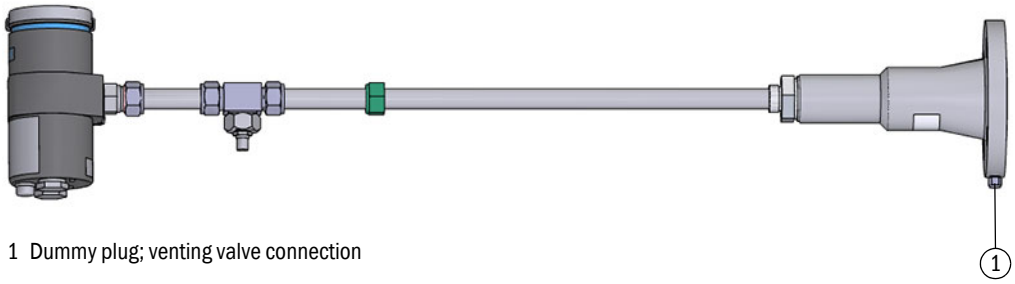
3 Screw the venting valve in.

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

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. 16, §2.1.5.

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. 7) 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. 144, §15.4.
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.

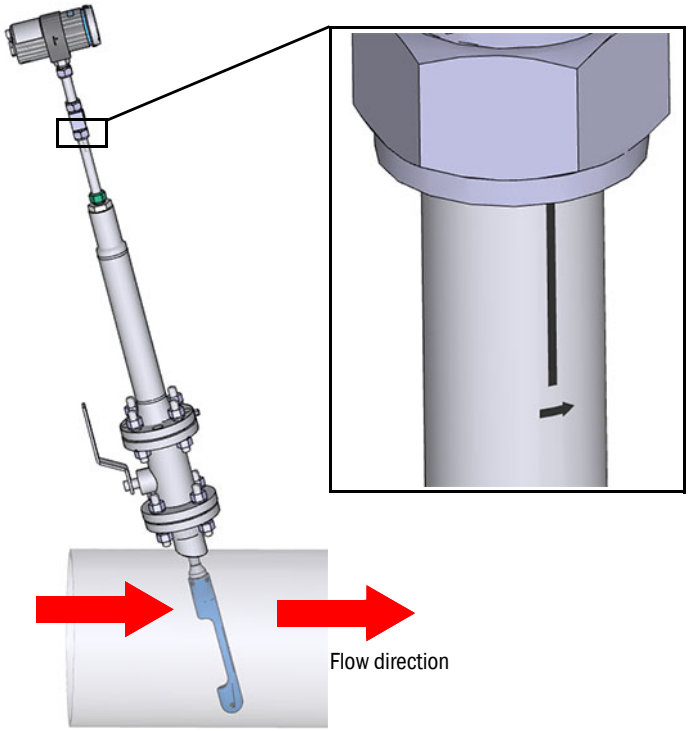
9 Screw in the pipe screw fitting and tighten with a torque of 150 Nm.
10 Push the sender/receiver unit to the stop.
11 On probe version F1F-P, now align the measuring path correctly before securing the self-cutting ring fitting.
   Align the probe version as described in the following section, → "Observe 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°.

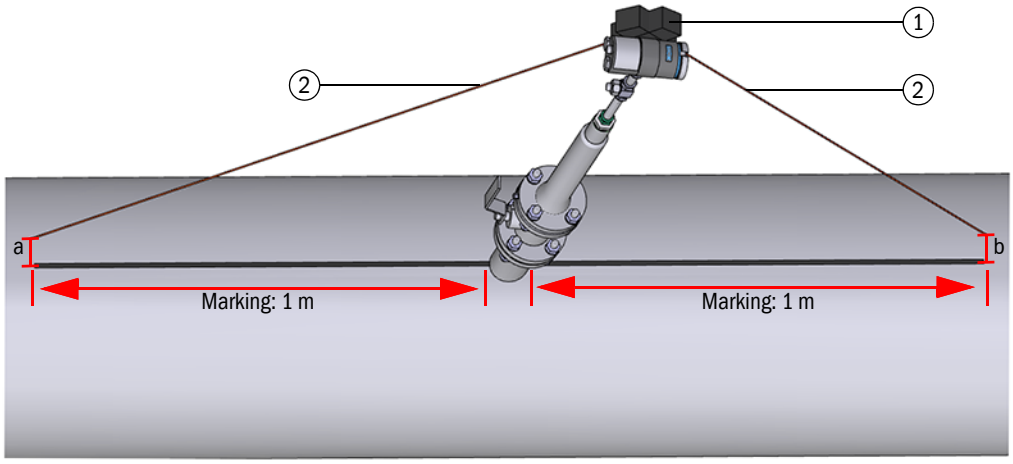
To ensure this, use a laser to align probe version F1F-P:

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

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. 85, §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. 81, §6.9.
- ► Contact Endress+Hauser Service.

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. 16, §2.1.5.

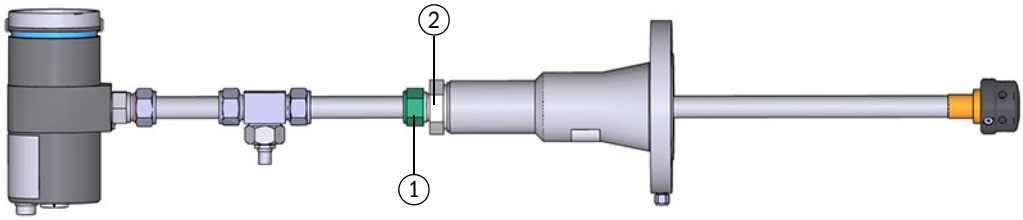
1 Completely loosen the cap nut of the self-cutting ring fitting, → Fig. 43.
2 Completely loosen the pipe screw fitting, → Fig. 43.
3 Pull the sender/receiver unit back completely to the stop.
4 Close the ball valve.

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. 16, §2.1.5.

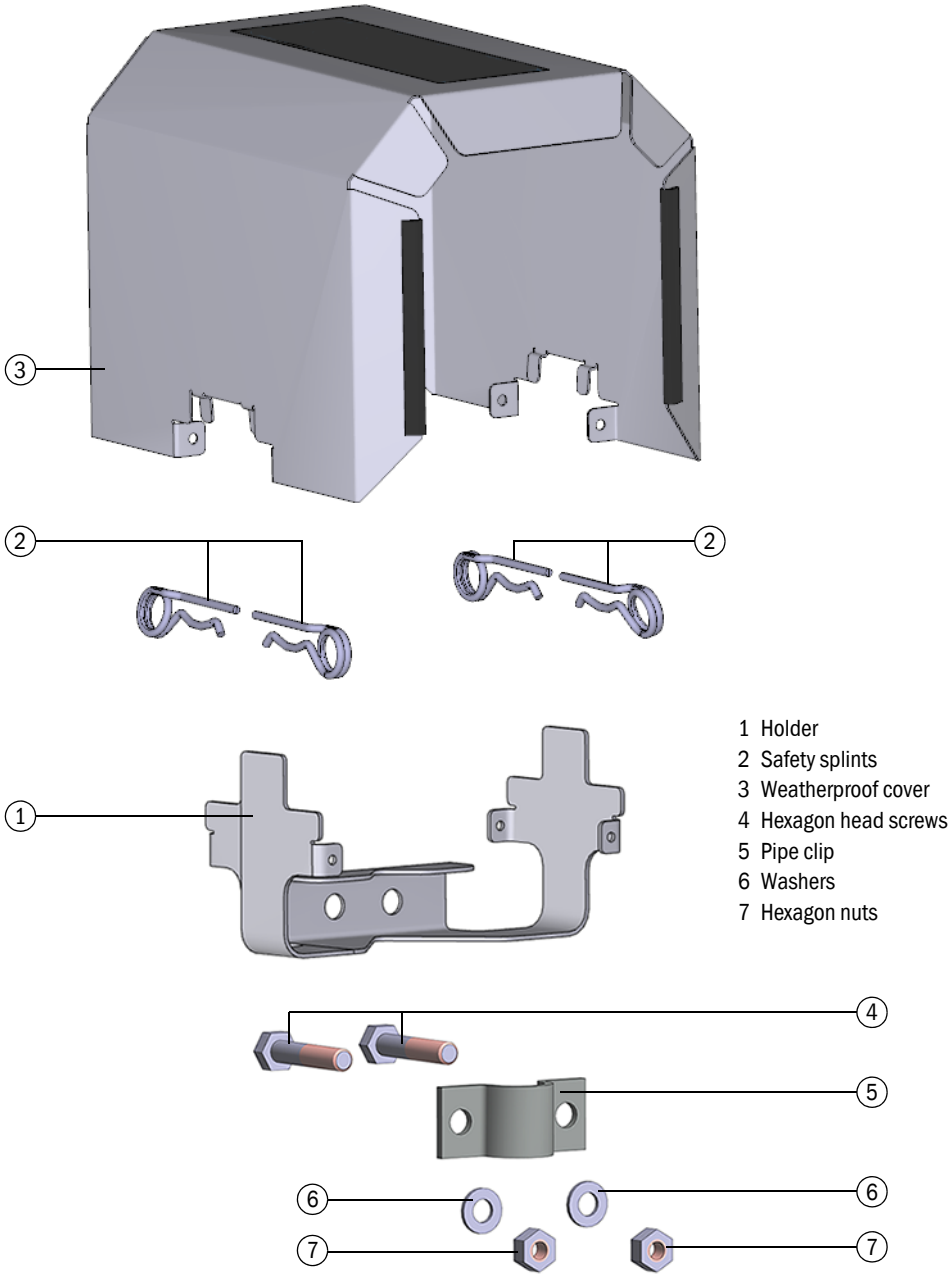
6.10 Fitting the weatherproof cover for the sender/receiver unit

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.

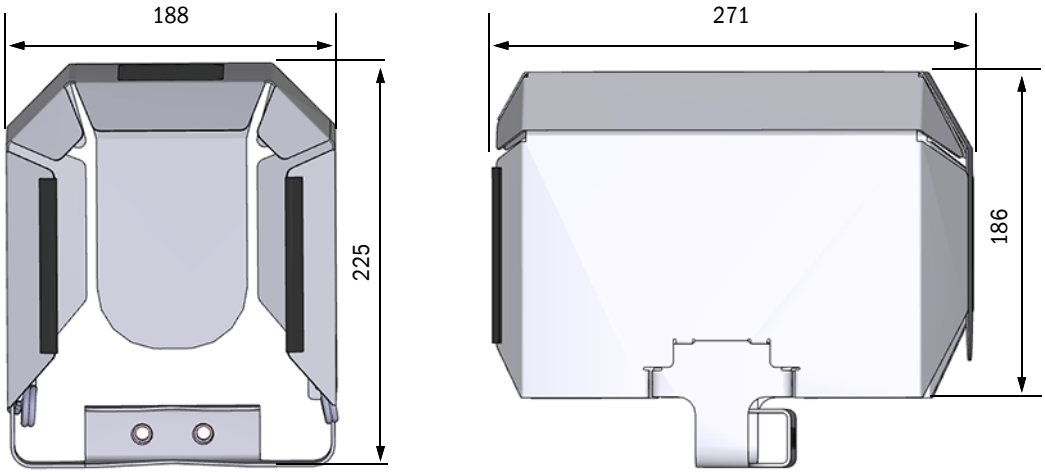
6.10.1 Overview

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

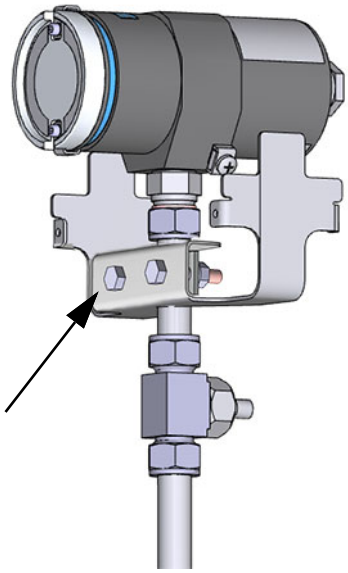
Fig. 45 Dimensions [mm]

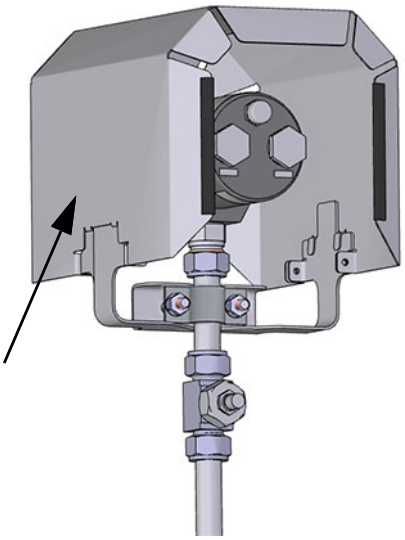
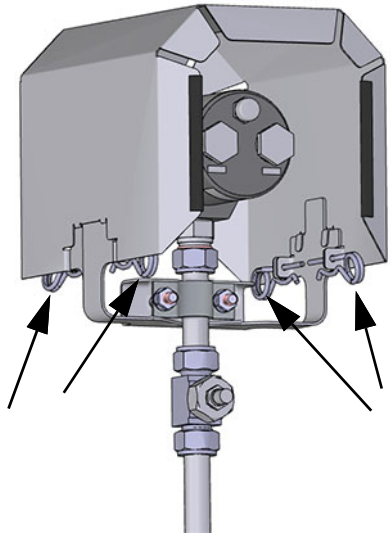


6.10.2 Fitting the weatherproof cover

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.	

FLOWSIC100 Flare-XT Transmitter

7 Electrical installation

7.1 Safety

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. 13, §2 during all installation work.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.

7.2 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.

7.3 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.

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 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.

7.4 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.

7.5 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.

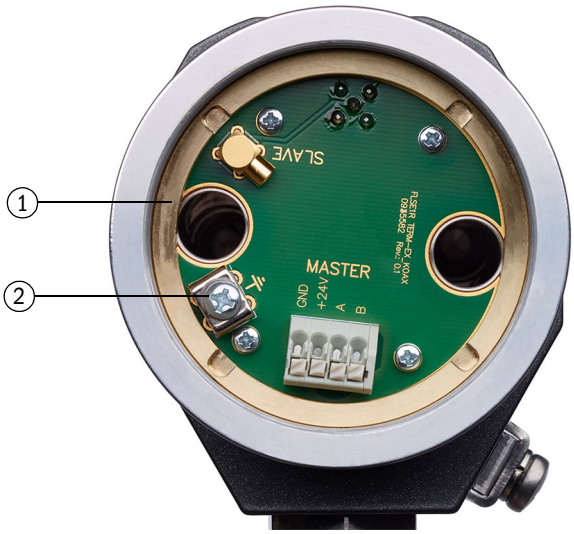
Specific requirements for installation in the USA and Canada

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

7.6 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 8 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: MODBUS communication between FLSE active sensor and a higher level control system (Interface 1)

MCX: Signal for FLSE passive sensor

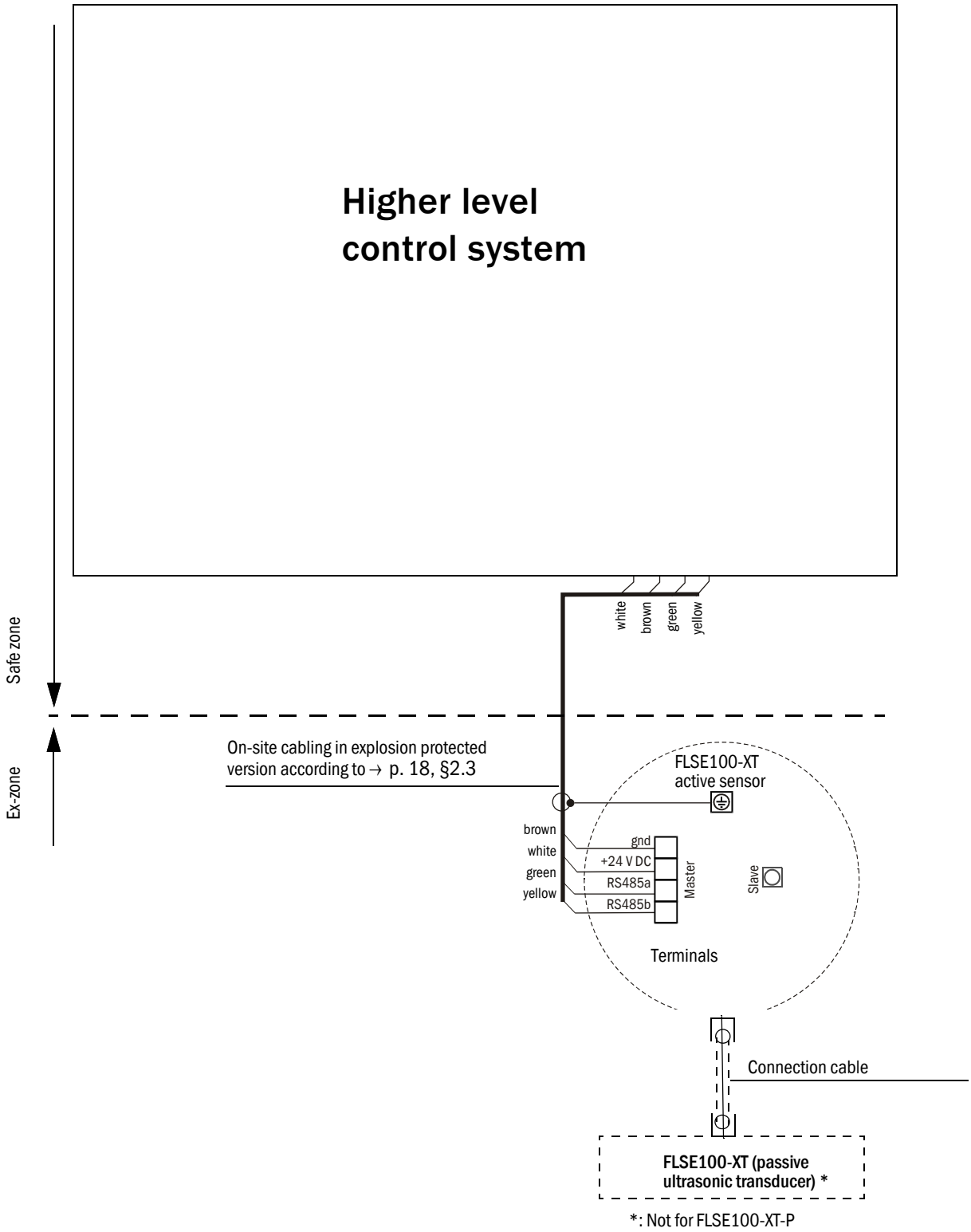
NOTICE:
Self-locking terminals for wire sizes 0.5 .. 1.5 mm² (AWG20 ... AWG16).

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.

7.7 Connection diagrams

Fig. 47 Cabling of the sender/receiver units



7.8 Pressure and temperature values

Fixed values for pressure and temperature are written to the device when the device is powered-up. Since pressure and temperature values have a significant influence on the correct calculation of mass flow rate, molecular weight, gas density and Reynolds number, best accuracy is achieved with actual values. Therefore those values can optionally also be input by a MODBUS client.

See additional MODBUS specification for more information.
The MODBUS specification is available on the product CD delivered with the FLOWSIC100 Flare-XT Transmitter.

When the pressure and temperature transmitters are connected to a DCS / SCADA system and then written via MODBUS into the FLOWSIC100 Flare-XT Transmitter electronics, the initialized fixed values are overwritten and the live values are used.

FLOWSIC100 Flare-XT Transmitter

8 Commissioning

General information
Commissioning with the FLOWgate™ operating software
Connecting to the device
Commissioning wizard
Functionality and plausibility checks

8.1 General information

- Before commissioning, the sender/receiver units must be installed and electrically connected.
- The field setup wizard in the FLOWgate™ operating software supports commissioning, → p. 94, §8.2.

8.2 Commissioning with the FLOWgate™ operating software

8.2.1 Auxiliary means and accessories required

Description	Part No.
MEPA interface set RS485/USB (adapter, USB cable, plug) 	6030669
FLOWgate™, as from version 1.20 	The current FLOWgate™ version is available via the following link: **https://** **www.endress.com** Enter “Flowgate” in the search mask.

NOTICE:
A suitable voltage supply of 24 V DC is required for commissioning of the FLSE-XT sender and receiver units.

8.3 Connecting to the device

If commissioning is performed directly on the sender and receiver unit, a mobile power supply is required and the correct pin assignment must be observed.

WARNING: Electrical hazard

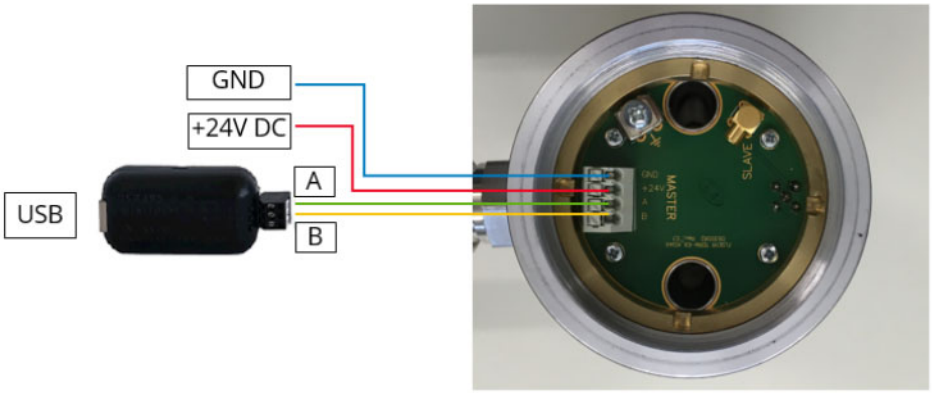
Incorrect cabling can cause serious injuries, device malfunctions or failure of the measurement system.

- ► Observe the relevant safety regulations as well as the safety notices in → p. 13, §2 during all installation work.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.

► Open the cover of the electronics and connect the RS485/USB adapter according to the connection diagram:

- USB-485: A → Sensor RS-485: A
- USB-485: B → Sensor RS-485: B

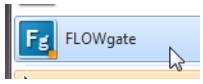
Fig. 48 Connection diagram



8.4 Establishing a connection with FLOWgate™

1 Install the FLOWgate™ operating software.

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



3 Add the FL100 Flare-XT Trans to the Device Manager of the FLOWgate™ operating software and create a connection to the device.

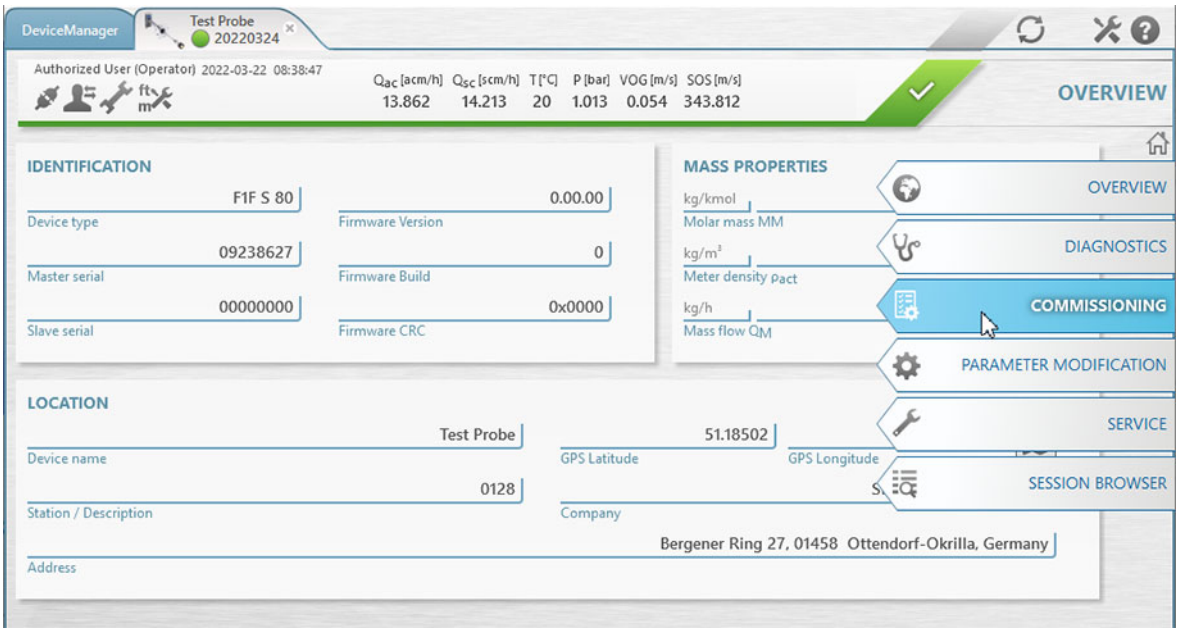
Factory setting of the RS485 interface:
- Protocol: MODBUS RTU
- Transfer rate: 57600 baud
- MODBUS address: 1
- Data format: 8 data bits, N (no parity), 1 stop bit

4 Login to the device with the default user “Authorized user (Operator)”.

Standard password for the “Authorized user (Operator)”: flaregas

5 To start the field setup, open the "Commissioning" menu and follow the step-by-step instructions.

Fig. 49 Commissioning with FLOWgate™ I



8.5 Commissioning wizard

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

► Switch to Configuration mode to start commissioning.

Fig. 50 Starting configuration mode

8.5.1 Identification

The connected device is automatically recognized.

► Compare the serial numbers with the type plates.

► Enter a device name: The device name is freely selectable.

8.5.2 Application

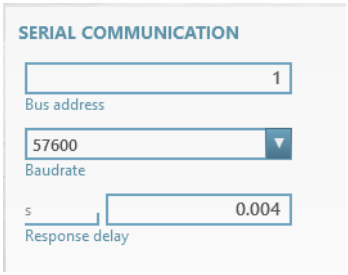
User warnings

► Configure the " Performance warn limit" as desired for the particular application:
If the error rate of the measurements is higher than the set warning limit, a warning is issued. Do not change the default value, if you are unsure which warning threshold is suitable for your application.

Serial communication

► If required, configure the settings for serial communication.

Fig. 51 Settings for serial communication (default)



A MODBUS response will be delayed by the minimum timespan defined in "Response delay". This parameter can be used to limit the communication speed in case of communication issues.

Unit System

► Select the unit system for the display in FLOWgate™.
For the output values in metric or imperial units there are different register ranges in the MODBUS specification.

See additional MODBUS specification for more information.
The MODBUS specification is available on the product CD delivered with the FLOWSIC100 Flare-XT Transmitter.

Flow control

► Configure the flow parameters as desired for the particular application:
  – 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.
  – Suppress negative velocity: If the slider ist set to "Yes", a negative velocity is suppressed and not taken into account.

Base conditions

The volume flow at base conditions is calculated according to → p. 98, §8.5.3.1 .

► To activate the the calculation of the volume flow at base conditions, set the slider to "Yes".

► The reference conditions for the conversion can be configured.

Fig. 52 Calculation of volume flow at base conditions

NOTICE:
The calculation for the volume flow at base conditions does not consider the device status.The volume is always converted, even if the device is in error status.

8.5.3 Mass flow (calculations)

8.5.3.1 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 Transmitter. 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. 100, §8.5.3.3 .

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 Transmitter 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. 53 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.

8.5.3.2 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. 54 Calculation of the mass flow rate

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

8.5.3.3 **Algorithm for calculating the molar mass**

► Select the desired algorithm for the use of the molar mass:
- Fixed value
- Basic
- Hydro Carbon

If no algorithm is selected and the selection is set to "disabled", no molar mass is calculated and the output molar mass is zero.

Fixed value

If "fixed value" is selected, a fixed value for the density can be specified.

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. 55 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.

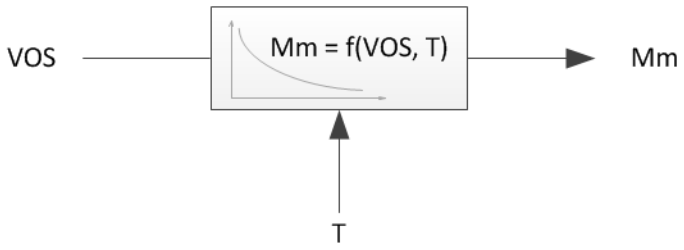
Velocity of sound can be measured by FLOWSIC100 Flare-XT Transmitter.

The algorithm is suitable for all ideal gases with pressures < 5 bar with constant gas composition.

Hydrocarbon algorithm

The hydrocarbon 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. 56 Hydrocarbon algorithm formula



8.5.3.4 **Density calculation**

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. 57 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

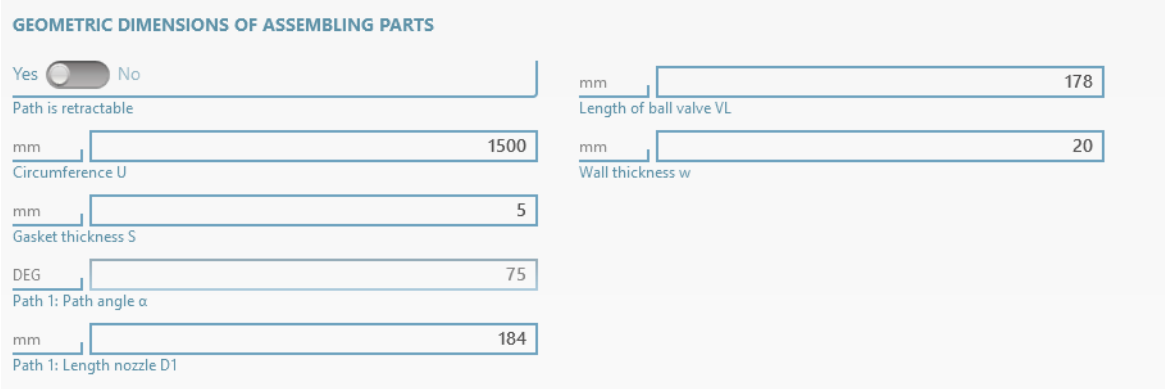
8.5.4 Installation

Geometric dimensions of assembling parts

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. 58 Installation parameters



► Enter the dimensions determined during installation:
  – Wall thickness w, circumference U
    → p. 60, §6.7.2 for cross-duct versions and → p. 62, §6.7.3 for the probe versions
  – Nozzle length D1; and the length of the second nozzle D2 for cross-duct versions, → p. 63, §6.7.4
  – Gasket thickness S, length of ball valve VL → p. 68, §6.8
► Click “Calculate transducer distance”.
  The transducer distance is calculated.
► Click “Calculate parameter values”.
  The parameter values are calculated.

8.5.5 Finalize

Finalize

► If desired, reset the event summary.

Generate reports

► Create a parameter report and archive the report with the delivery documentation.

8.6 Functionality and plausibility checks

After commissioning, reconnect the FLOWSIC100 Flare-XT Transmitter to the host system.

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. 13, §2 during all installation work.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.

When commissioning has been completed with the FLOWgate™ operating software, it is advisable to check the functionality and plausibility of the communication with the DCS or SCADA.

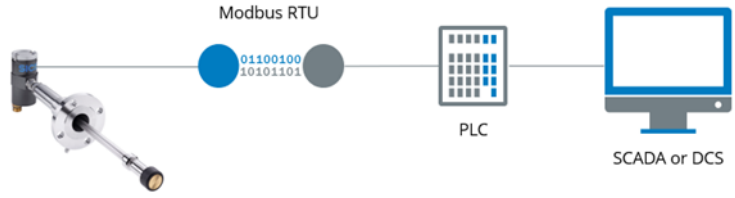
For such a check, it is advisable to use the "Technical Bulletin" MODBUS specification valid for the FLOWSIC100 Flare-XT Transmitter.

See additional MODBUS specification for more information.
The MODBUS specification is available on the product CD delivered with the FLOWSIC100 Flare-XT Transmitter.

The MODBUS specification specifies the electrical interface and serial communication based on MODBUS protocol of the FLOWSIC100 Flare-XT Transmitter.

A function and plausibility check is always possible via the "Guest" user level.

Fig. 59 Example of serial communication to a SCADA or DSC



FLOWSIC100 Flare-XT Transmitter

The FLOWSIC100 Flare-XT Transmitter supports the MODBUS RTU transmission mode.

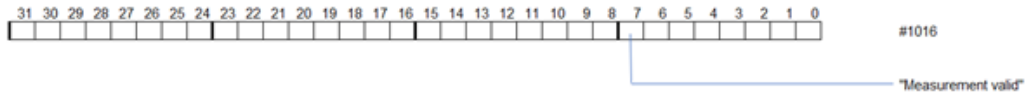
Factory setting of the RS485 interface:
- Protocol: MODBUS RTU
- Transfer rate: 57600 baud
- MODBUS address: 1
- Data format: 8 data bits, N (no parity), 1 stop bit

8.6.1 Check of device status

Register #1016 contains a variety of information representing the current device status.

The device status of the FLOWSIC100 Flare-XT Transmitter shall have the status "Measurement valid" after commissioning. This is true when Bit 7 of register #1016 is "1".

Fig. 60 Register #1016, Bit 7



If the status "Measurement valid" is not reached, it is necessary to determine the possible cause. The Technical Bulletin MODBUS gives detailed explaination of the register #1016 which helps to trouble shooting. A transition to operation is not recommended without the status "Measurement valid".

8.6.2 Overview of most important measured and calculated values

8.6.2.1 Measured values

The FLOWSIC100 Flare-XT Transmitter delivers the following measured values:

- Gas velocity
- Actual volume
- Speed of sound

During the system check, these measured values can now be evaluated and checked for plausibility about the prevailing process and application conditions. The following registers are important for this.

Table 9 Register for measured values

Register	Description	Unit
Metric		
#1000	Volume flow a.c.	m^3 / h
#1002	Velocity of gas	m / h
#1004	Speed of sound	m / h
Imperial		
#1500	Volume flow a.c.	ft^3 / h
#1502	Velocity of gas	ft / s
#1504	Speed of sound	ft / s

8.6.2.2 Calculated values

The FLOWSIC100 Flare-XT Transmitter calculates the following values based on the measured values.

- Standard volume with optional p and T live input reading
- Mass flow
- Molar mass
- Density

During the system check, these calculated values can now be evaluated and checked for plausibility about the prevailing process and application conditions. The following registers are important for this.

Table 10 Standard volume

Register	Description	Unit
Metric		
#1121	Actual used temperature	m^3 / h
#1123	Actual used pressure	m^3 / h
#1133	Volume flow s.c.	m^3 / h
Imperial		
#1506	Actual used temperature	°F
#1508	Actual used pressure	Psi (a)
#1534	Volume flow s.c.	scfh

Mass flow

Calculation see → p. 98, §8.5.3.

Table 11 Mass flow

Register	Description	Unit
Metric		
#1119	Mass flow	kg / h
Imperial		
#1526	Mass flow	lb / h

Molar mass

The molar mass is calculated by the algorithm in use, either Basic or Hydrocarbon or as simple fixed value, → p. 100, §8.5.3.3.

Register	Description	Unit
Metric		
#1065	Molar mass (calculated)	g / mol
Imperial		
#1528	Molar mass (calculated)	lb / lbmol

Density

Calculation see → p. 101, §8.5.3.4.

The density in the operating state is necessary for the calculation of the Reynolds number in the linearization and the calculation of the mass flow. This can either be:

- Fixed value
- Calculated value

Register	Description	Unit
#1071	Density actual	kg / m^3

FLOWSIC100 Flare-XT Transmitter

9 Maintenance

Safety information
General information
Routine checks
Cleaning

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 Transmitter 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 Transmitter 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.

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.

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 Transmitter service training by Endress+Hauser. These activities must be carried out by qualified persons as described in → p. 22, §2.5. 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

The FLOWgate™ operating software provides a user-friendly option for the performance of routine checks.

9.3.1 Checking the device status

► Check the device status.

Table 12 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.

9.3.2 Comparing theoretical and measured speed of sound (SOS)

One of the main criteria for correct operation of an ultrasonic gas flow meter is conformity between the theoretical sound velocity calculated for the actual gas composition, temperature and pressure, and the sound velocity measured by the ultrasonic gas flow meter.

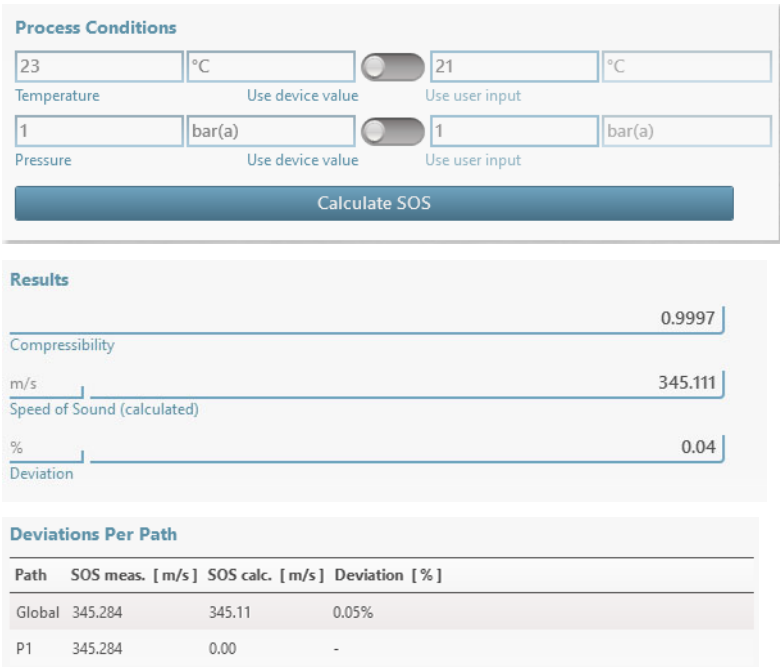
The Speed of Sound Calculator (SOS Calculator) available in the FLOWgate™ operating software calculates a theoretical SOS for a specific gas composition at a specified temperature and pressure. The calculation of thermodynamic properties is based optionally on the “GERG-2008” or “AGA10” algorithm.

1 Connect the FLOWSIC100 Flare-XT Transmitter and FLOWgate™, → p. 95, §8.3.
2 Open “SOS Calculator” in the “Diagnostics” menu.

Fig. 61 SOS calculator

3 Select the gas composition and confirm with “Apply”. The gas composition can be entered manually or loaded as file.
4 Enter the current process conditions and select “Calculate SOS”.
5 Compare the calculated speed of sound with the measured value.

Fig. 62 Comparing the speed of sound



9.4 Cleaning

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.

FLOWSIC100 Flare-XT Transmitter

10 Troubleshooting

Detecting malfunctions
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:

- 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. 81, §6.9.

► Contact Endress+Hauser Service.

10.2 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. 112, §10.3.

10.3 Starting a diagnostic session

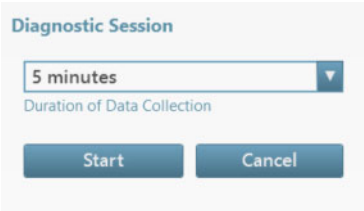
If you would like to start a diagnostic session with FLOWgate™, first connect to the device as described in → p. 95, §8.3.

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.

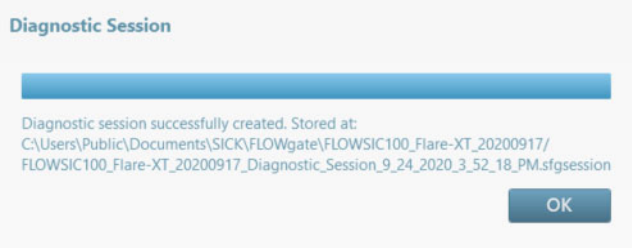
Fig. 63 Data collection duration for the diagnostic session



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. 64 Diagnostic recording completed

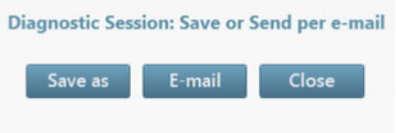


4 Click “OK” to confirm the message.

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. 65 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 Transmitter

11 Decommissioning

Safety information on decommissioning
Returning
Disposal information

11.1 Safety information on decommissioning

Ensure that all safety instructions are observed: → p. 13, §2 "For your safety"

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 Transmitter cannot be damaged during transport.

11.3 Disposal information

11.3.1 Materials

- The FLOWSIC100 Flare-XT Transmitter 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.

FLOWSIC100 Flare-XT Transmitter

12 Technical data

Technical data FLOWSIC100 Flare-XT Transmitter
Application Evaluation Datasheet (example)
Applications of FLOWSIC100 Flare-XT Transmitter in a regulated environment
Application limits
Derating pressure resistance
Dimension drawings

12.1 Technical data FLOWSIC100 Flare-XT Transmitter

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 Transmitter does not include an Application Evaluation Datasheet, contact your Endress+Hauser partner!

Example of an Application Evaluation Datasheet: → p. 123, §12.2

Table 13 FLOWSIC100 Flare-XT Transmitter (FLSE100-XT)

Measuring parameters	
Measured values	Mass flow rate, volumetric flow s. c. (standard condition), volumetric flow a. c. (actual condition), molecular weight, gas velocity, sound velocity
Number of measuring paths	1 path
Nominal pipe size	1-path measurement: 4 ″ ... 86 ″ * Other nominal sizes on request
Measuring principle	Ultrasonic transit time difference measurement, ASC technology
Measured medium	Natural gas, 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. 2% ... 5% Relative to the measured value with ultrasonic technology. (in range ≥ 0.3 m/s to upper measuring range value)
	Mass flow rate 2.5% ... 5.5% Relative to the measured value with ultrasonic technology. (in range ≥ 0.3 m/s to upper measuring range value)
Uncertainty of measurement ASC technology [1),2), 4)]	Flow rate a. c.: 1% ... 8%
Resolution	+ 0.001 m/s
Power supply	
Power supply	20...28 VDC [5)]
Power	0.04 A (with 24 VDC) A higher switch-on current must be expected (500 mA).
	1 W
Inputs/outputs	
Digital data interfaces	1 x RS485 (MODBUS RTU), optically isolated
Approvals	
Conformities	ATEX: 2014/34/EU EMC: 2014/30/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
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

Table 13 FLOWSIC100 Flare-XT Transmitter (FLSE100-XT)

Ambient conditions	
Ambient humidity	≤ 95% relative humidity

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) 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) Additional uncertainty of measurement. In the range of 100% ... 130% of the last gas velocity measured with ultrasonic transit time difference measurement .

5) 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 FLSE100-XT when dimensioning the power supply and the cable cross-section, see also → p. 86, §7.3.

12.1.1 F1F-S

Table 14 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. 127, §12.5 → "Derating pressure resistance"

12.1.2 F1F-M

Table 15 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. 127, §12.5 → "Derating pressure resistance"

12.1.3 F1F-H

Table 16 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. 127, §12.5 → "Derating pressure resistance"

12.1.4 F1F-P

Table 17 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. 127, §12.5 → "Derating pressure resistance"

12.2 Application Evaluation Datasheet (example)

Fig. 66 Application Evaluation Datasheet Page 1 (example)

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

General Information

Customer Data

Project Name	**Example**
Reference (CRM or SAP)	
TAG Name or Number	**100F-XT_Core**

Device Selection

Device Type	**F1F-S**
Nominal Pipe Width [inches]	**16**
Inner Diameter [inches]	**15.25**
Number of Paths	**1**
Installation Type	**Instrument** [1]
EX Zone	**Zone IIc**

[1] Flare gas measuring instrument, tapped installation or loose spool piece from SICK qualified supplier. Sensor integration on customer site.

Order Reference

PO Number
SICK Part Number
SICK Serial Number

Process Data

Calculation basis: User-provided Parameters

	min	norm	max
Pressure [bar]	1	1.2	1.2
Temperature [°C]	10	40	40
Speed of Sound [m/s]	345	380	430

1 / 2

Fig. 67 Application Evaluation Datasheet Page 2 (example)

Project: Example | TAG Name or Number: 100F-XT_Core

Computed Results

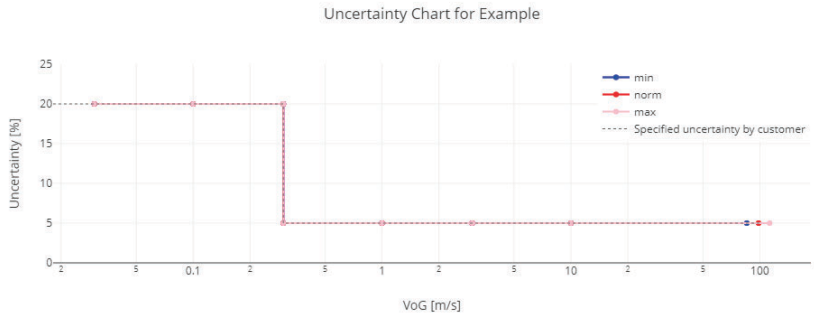
Calculated Flow Ranges

	min	norm	max
Max velocity Vmax [m/s]	85.3	98.5	112.7
Max flow rate Qmax [m³/h]	36,175	41,774	47,803

Measurement Uncertainties

VoG [m/s]	Flowrate [m³/h]	Measurement Uncertainty of Flow (2σ) [%]		
		min	norm	max
0.03	12.7	20	20	20
0.1	42.4	20	20	20
0.3	127.3	20	20	20
1	424.2	5	5	5
3	1,272.7	5	5	5
10	4,242.3	5	5	5
Vmax	Qmax	5	5	5

[1] For fully developed flow profiles; based on ultrasonic transit time measurement.



Software-Version

Frontend: 1.5.7, Backend: 0.5.10

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.

12.3 Applications of FLOWSIC100 Flare-XT Transmitter 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.

12.4 Application limits

Fig. 68 Exemplary V_{max} of of 1-path solutions dependent on the sound velocity (SOS)

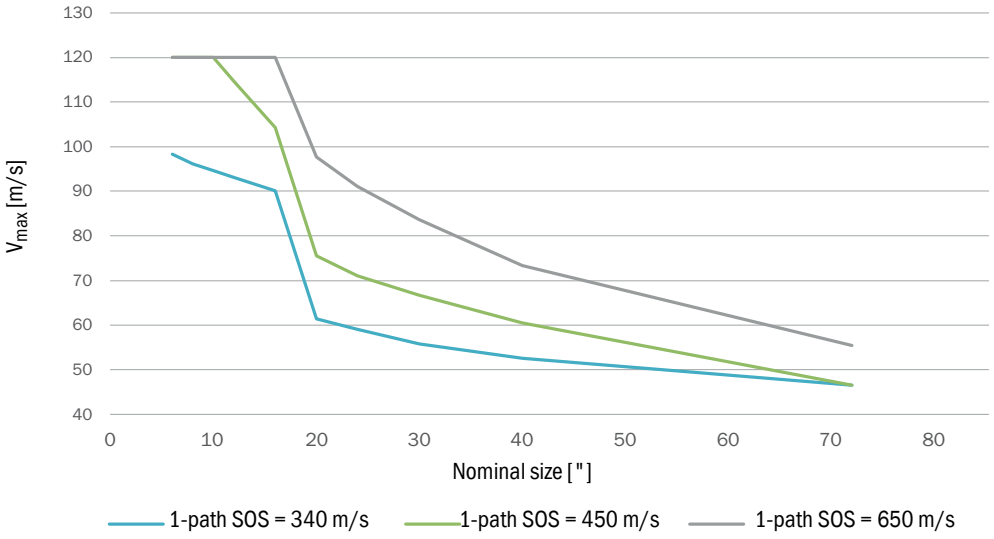


Fig. 69 V_{min} with 20% uncertainty of 1-path solutions depending on the speed of sound (SOS)

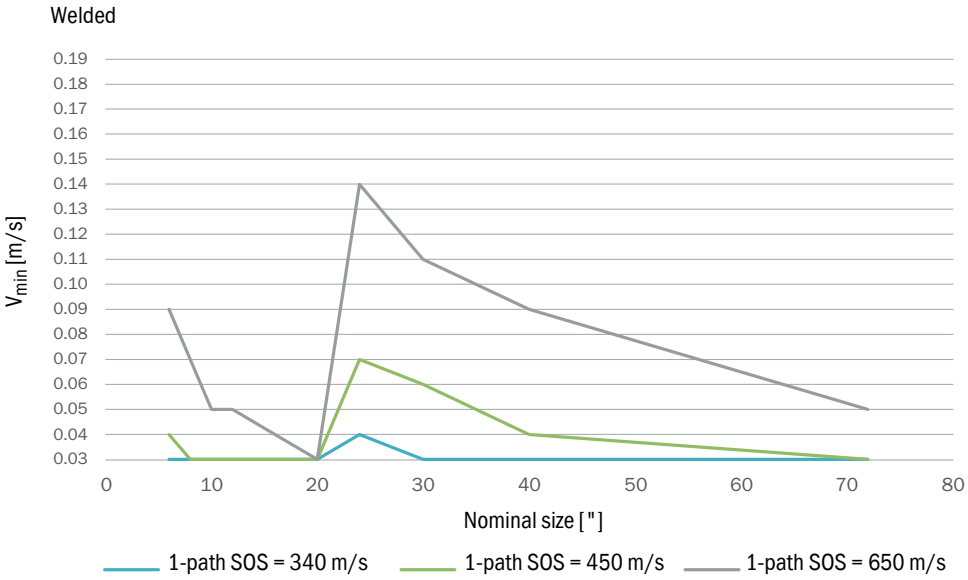
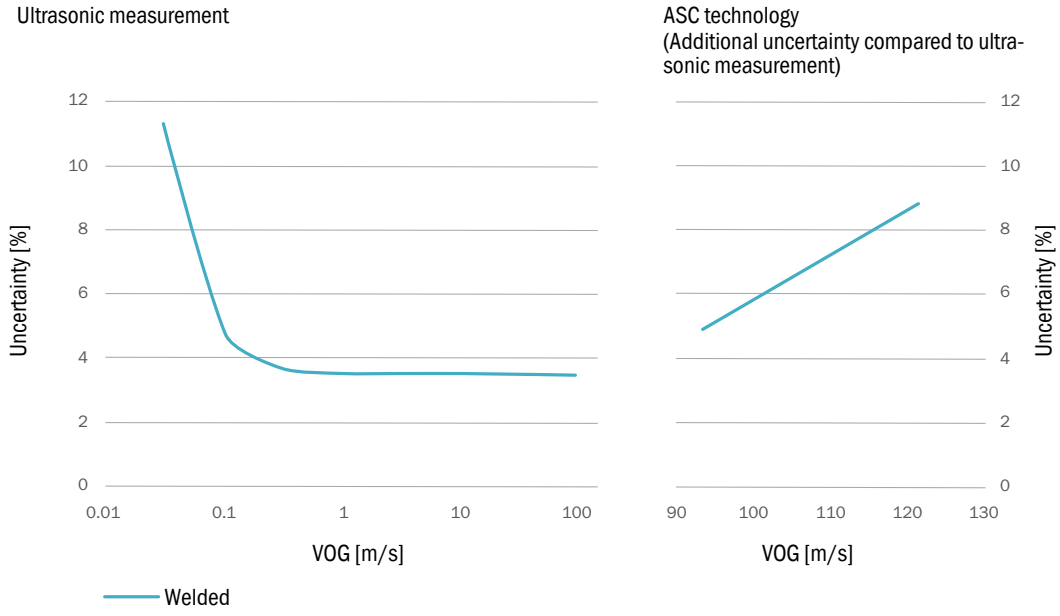


Fig. 70 Uncertainty of flow rate as function of the velocity of gas (VOG)



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.

12.5 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. 71 F1F-S/-M

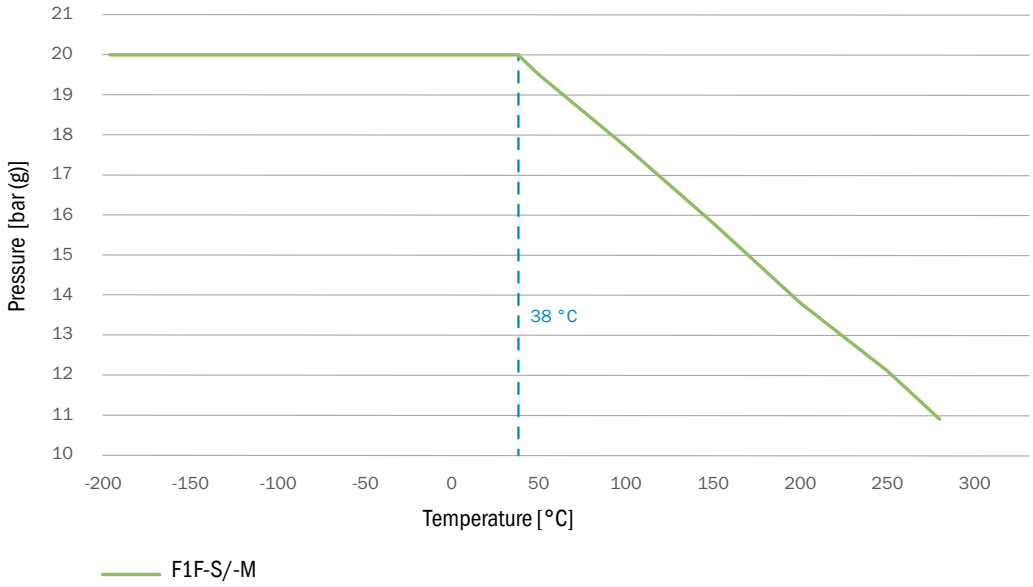


Fig. 72 F1F-H ATEX/CSA

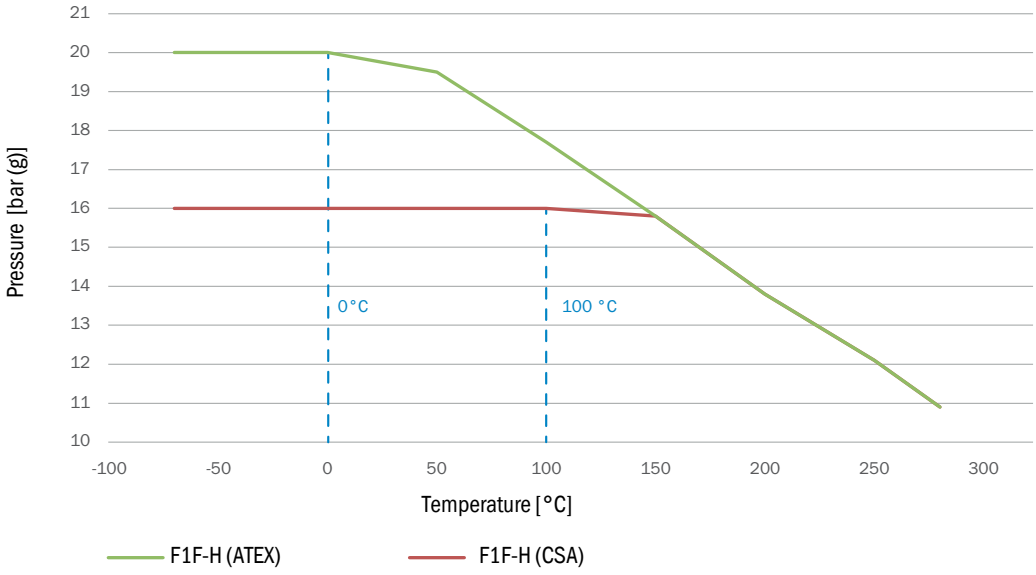
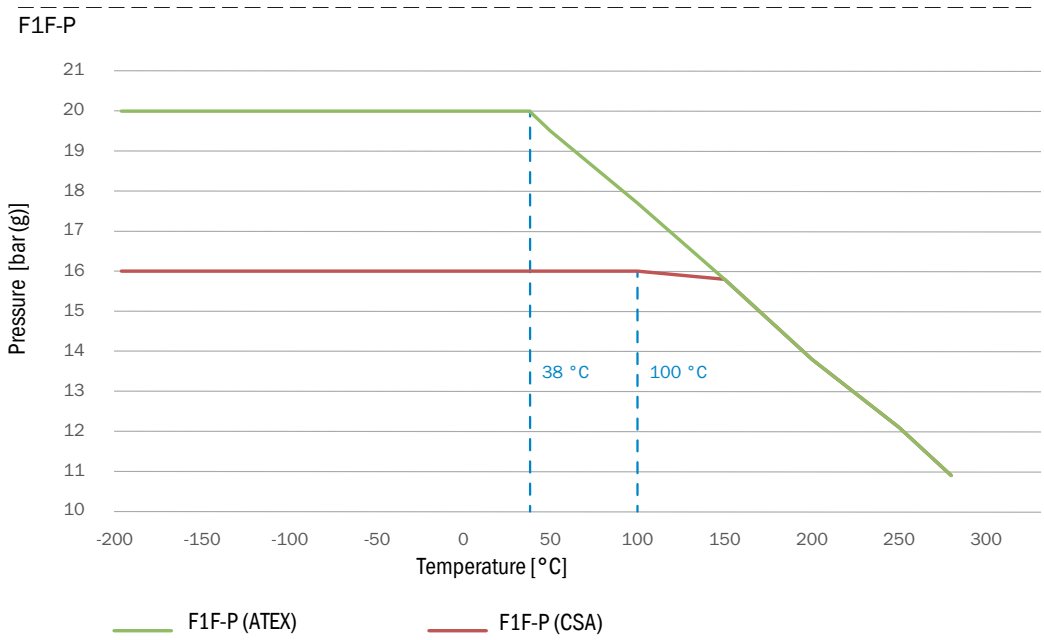


Fig. 73 F1F-P


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

12.6 Dimension drawings

12.6.1 Dimension drawings of FLSE100-XT sender/receiver units

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

Fig. 74 F1F-S/-M/-H

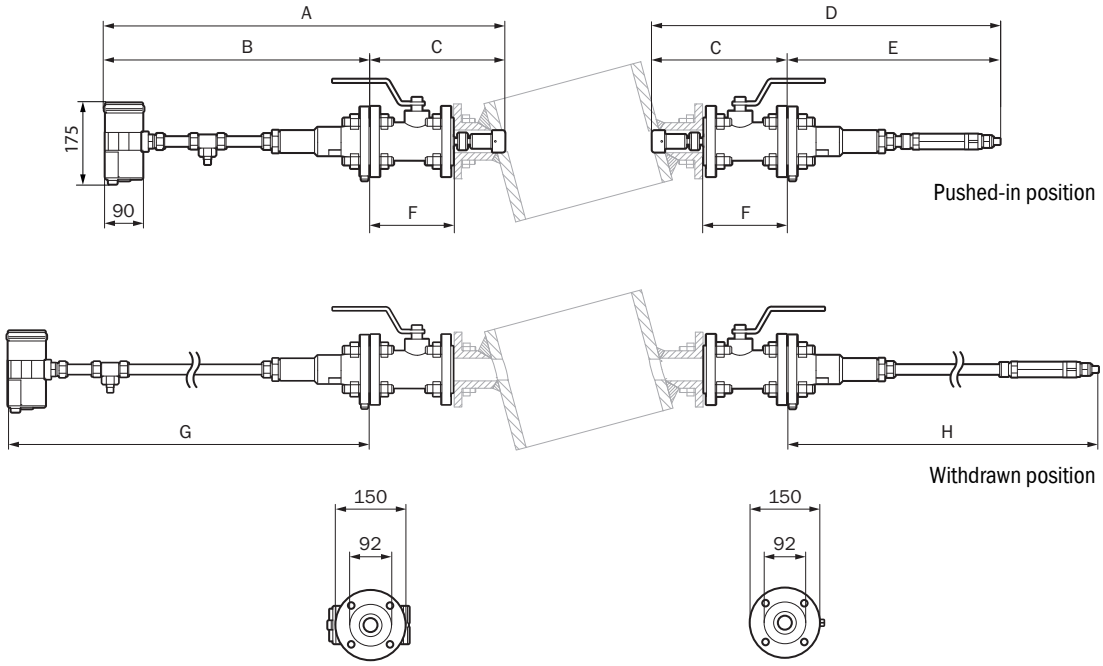


Table 18 Extended version

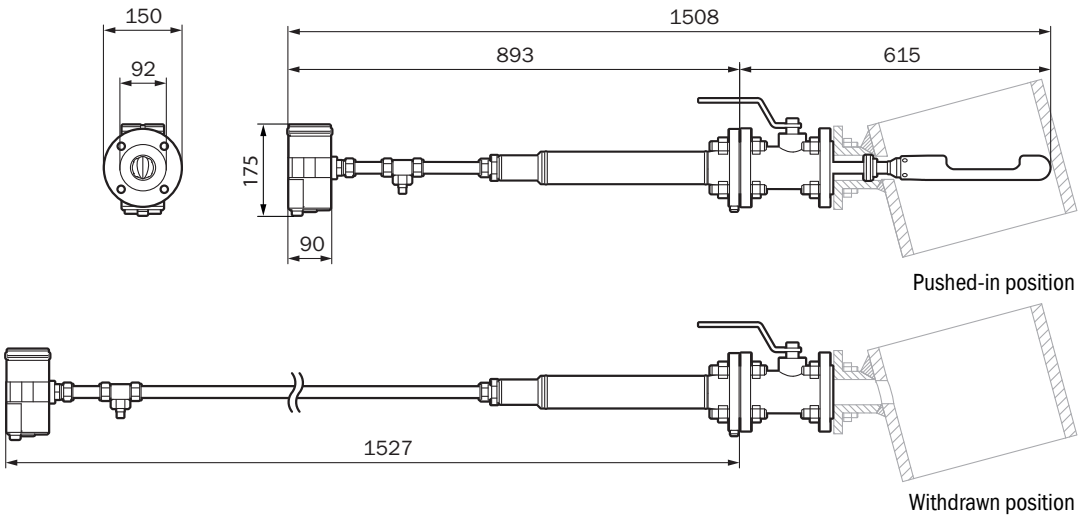
FLSE100-XT	Dimensions of extended version							
	A	B	C	D	E	F	G	H
F1F-S	983	583	400	871	471	178	1055.5	944
F1F-M	980	582	398	869	471	178	984	873
F1F-H	846	448	398	919	518	178	851	917

Table 19 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. 75 F1F-P



FLOWSIC100 Flare-XT Transmitter

13 Spare parts

Recommended spare parts for FLSE100-XT sender/receiver units

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

FLOWSIC100 Flare-XT Transmitter

14 Accessories (optional)

Accessories for FLSE100-XT sender/receiver units

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
6030669	MEPA interface set RS485/USB (adapter, USB cable, plug)

FLOWSIC100 Flare-XT Transmitter

15 Annex

Compliances
Connection diagrams
Type code
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)

15.2 Connection diagrams

Fig. 76 Connection diagrams, FLSE-XT (page 1 of 5)

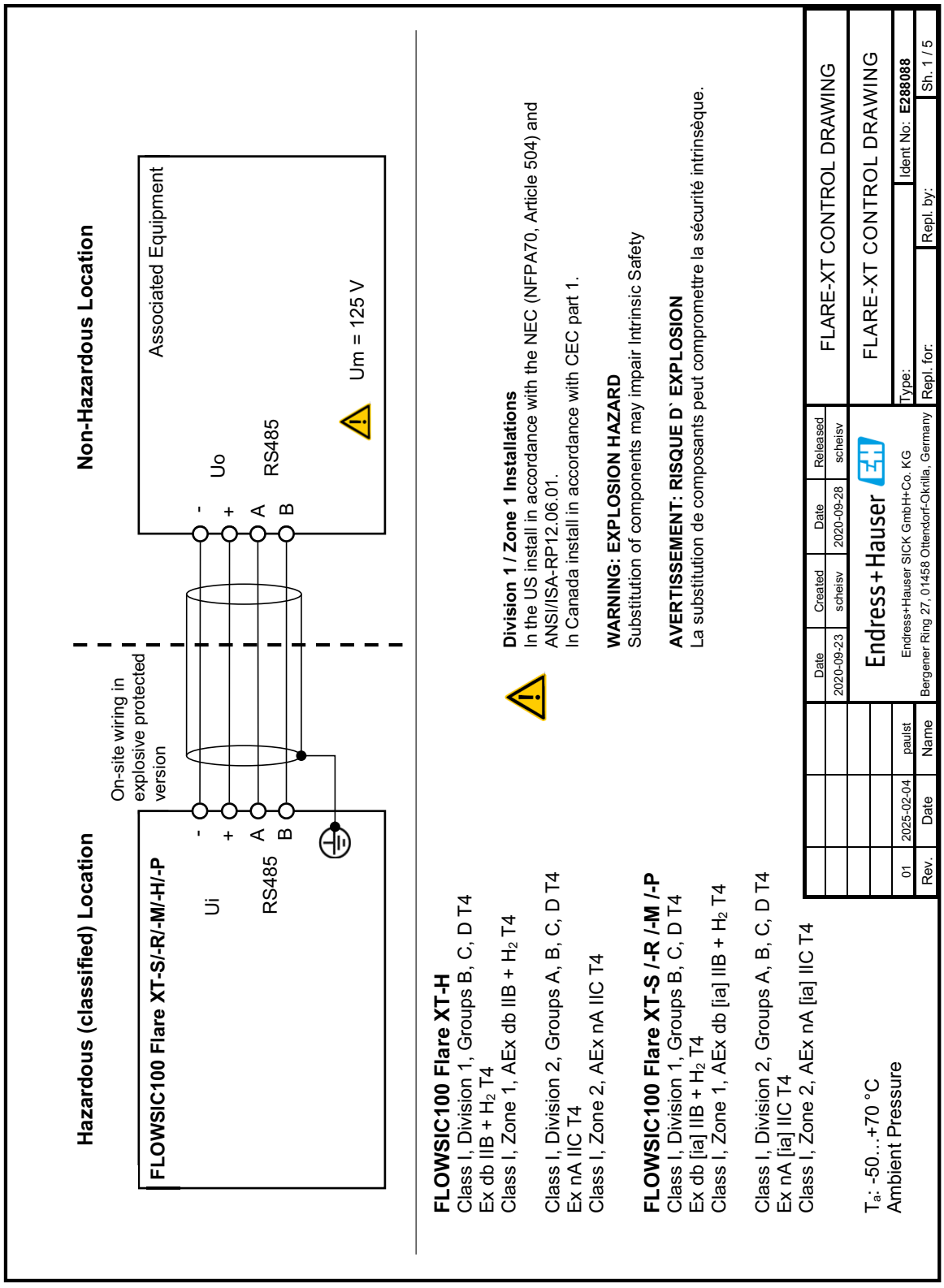


Fig. 77 Connection diagrams, FLSE-XT (page 2 of 5)

?
40

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. 78 Connection diagrams, FLSE-XT (page 3 of 5)

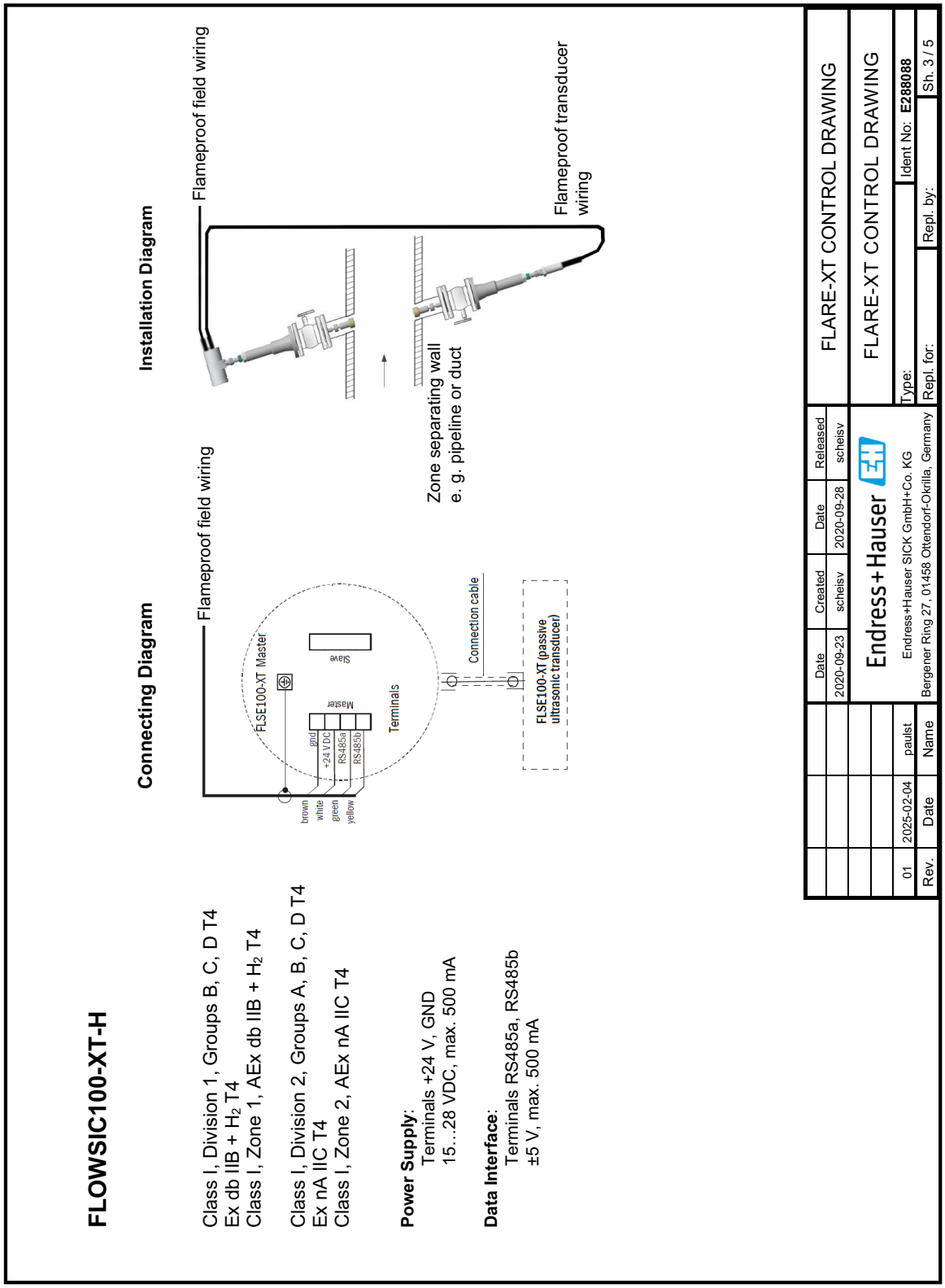


Fig. 79 Connection diagrams, FLSE-XT (page 4 of 5)

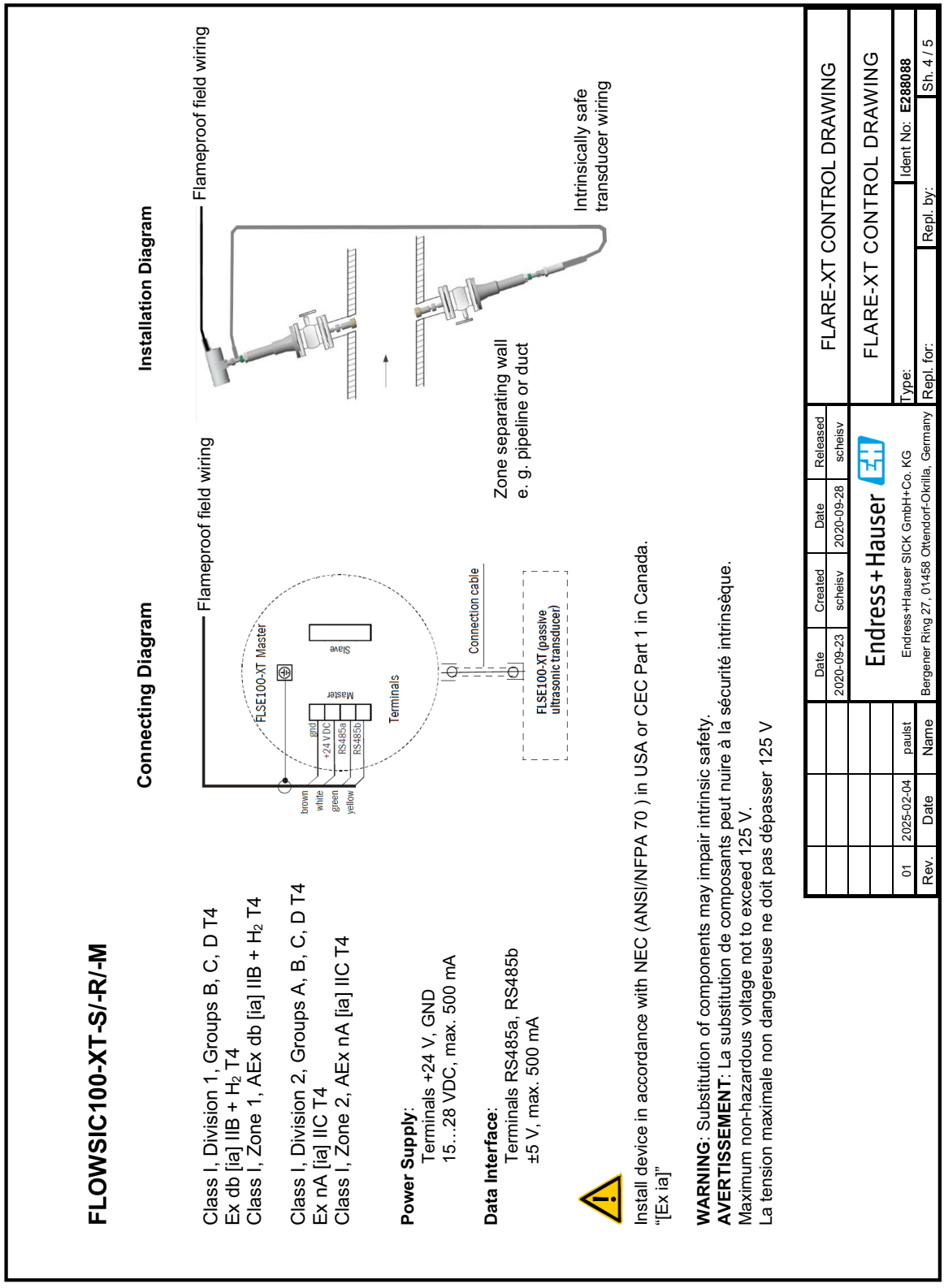


Fig. 80 Connection diagrams, FLSE-XT (page 5 of 5)

FLOWSIC100-XT-P

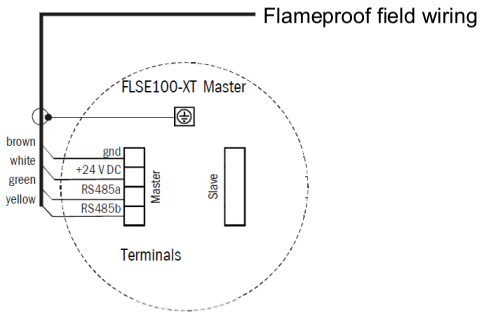
Class I, Division 1, Groups B, C, D T4
Ex db [ia] IIB + H_2 T4
Class I, Zone 1, AEx db [ia] IIB + H_2 T4

Class I, Division 2, Groups A, B, C, D T4
Ex nA [ia] IIC T4
Class I, Zone 2, AEx nA [ia] IIC T4

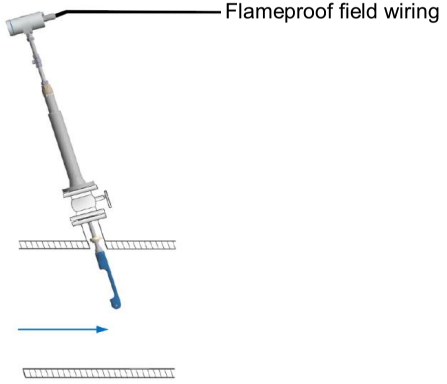
Power Supply:
Terminals +24 V, GND
15…28 VDC, max. 500 mA

Data Interface:
Terminals RS485a, RS485b
±5 V, max. 500 mA

Connecting Diagram



Installation Diagram



Install device in accordance with NEC (ANSI/NFPA 70) in USA or CEC Part 1 in Canada.
“[Ex ia]”

WARNING: Substitution of components may impair intrinsic safety.
AVERTISSEMENT: La substitution de composants peut nuire à la sécurité intrinsèque.
Maximum non-hazardous voltage not to exceed 125 V.
La tension maximale non dangereuse ne doit pas dépasser 125 V

			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. 5 / 5

15.3 Type code

15.3.1 Type code, FLSE-XT, sender/receiver units

Fig. 81 FLSE-XT, sender/receiver units (overview)

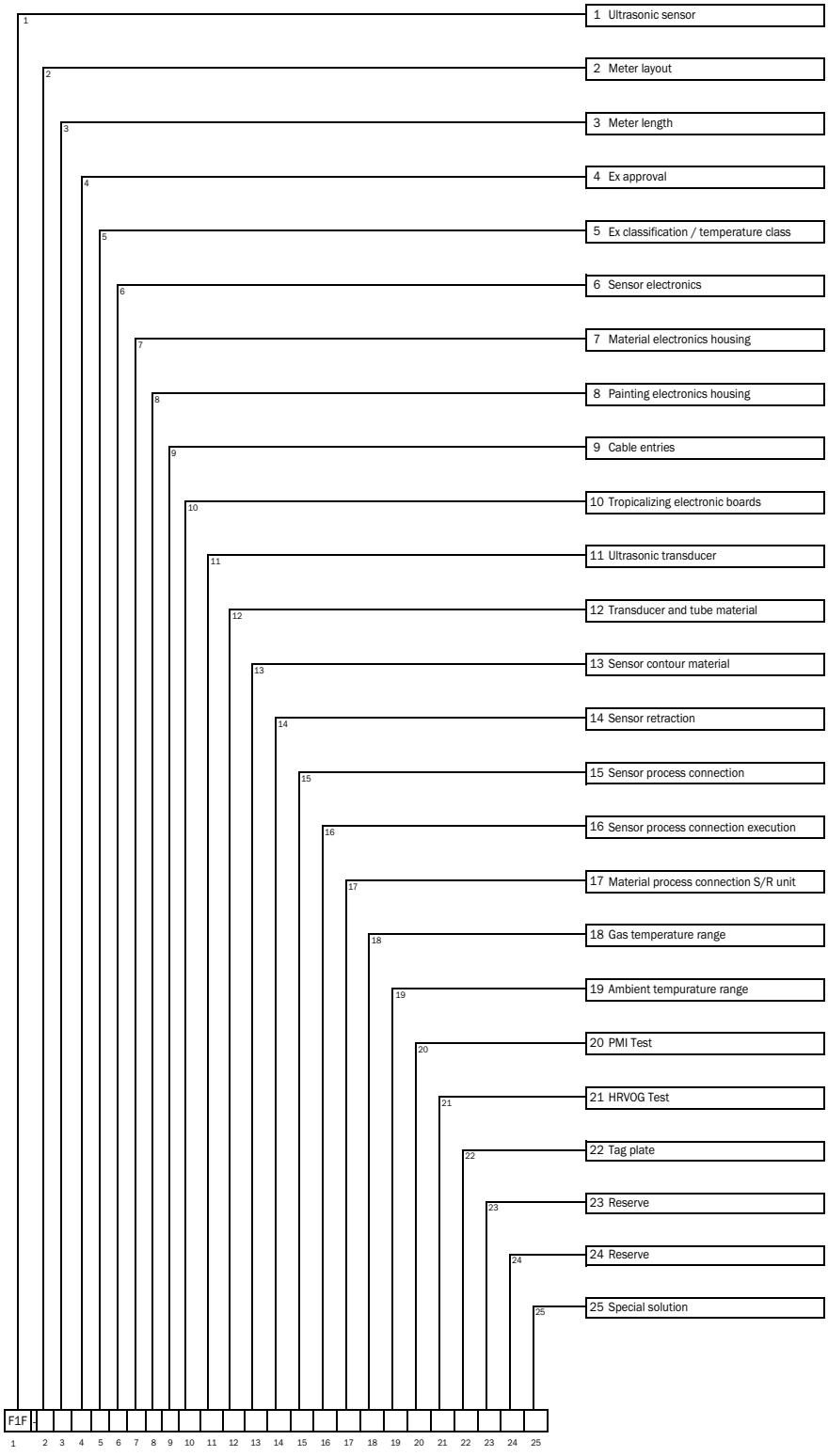


Fig. 82 FLSE-XT, sender/receiver units (explanation)

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 Gasket installation

Fig. 83 Gasket installation (developed by "pikotek")

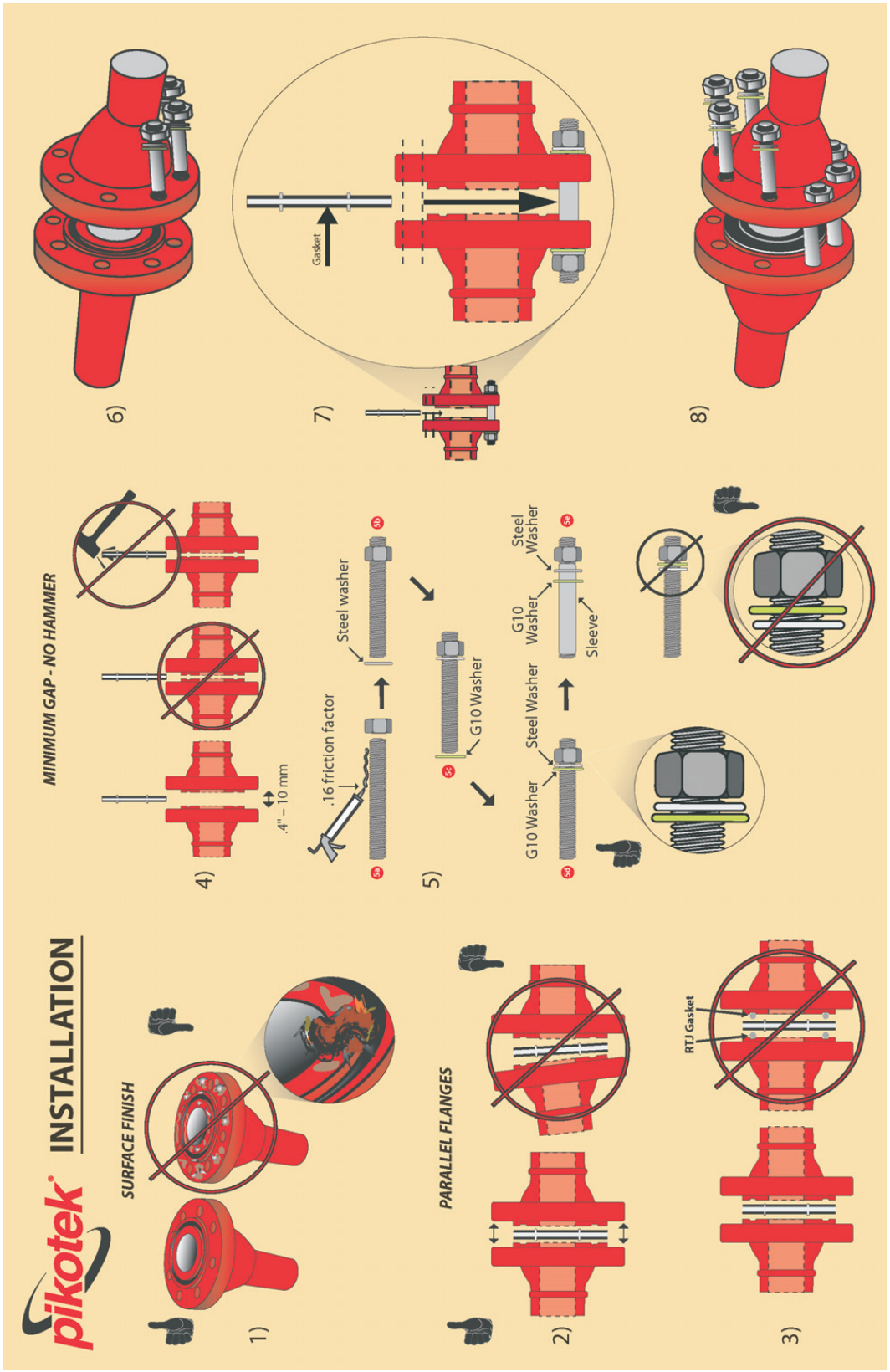


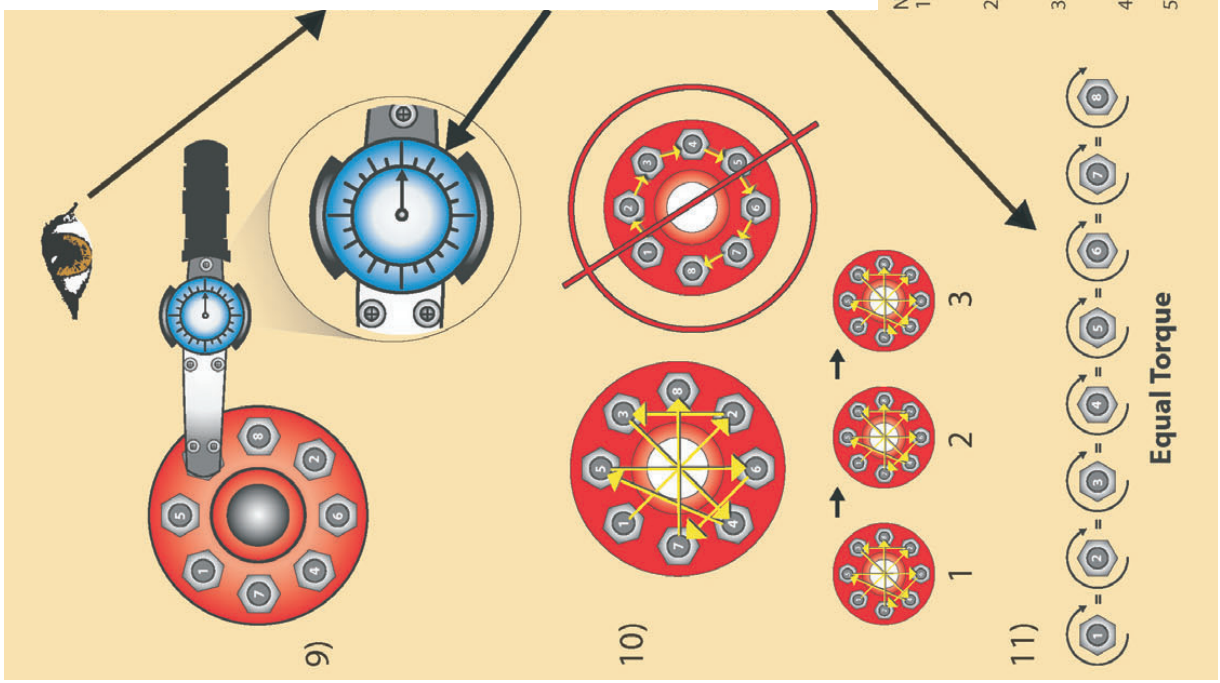
Fig. 84 Gasket installation (developed by ”pikotek”), screw tightening torques for comb profile gasket B9A and polymer gasket GYLON

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

Notes:
1) Recommended bolt torque is based on deriving a minimu gasket seating stress of 7,500 psi.
2) Bolt torque values listed assume a lubricated stud bolt resulting in a .16 friction factor.
3) Recommended torque values are based on using weld-nec (integral) flanges.
4) Blind or other flange types may require different seating lo
5) 30 ksi bolt stress may exceed the design allowable stress le for certain stud bolt materials.



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