OPERATING INSTRUCTIONS

FLOWSIC100 Flare

Description
Installation
Operation

SICK
Sensor Intelligence.

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Warning Symbols


Hazard (general)


Voltage Hazard

Explosive or combustible gas hazard


Noxious substance hazard

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 personal injury or property damage.

NOTICE
Hazard which could result in material damage.

Information Symbols


Information about use in potentially explosive atmospheres.


Important technical information for this product


Supplementary information


Link to information in another place

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FLOWSIC100 Flare

1 Important Information

About this document
Main hazards
Intended use
Responsibility of user
Transport safety device for retractable sender/receiver units

1.1 About this document

These Operating Instructions contain basic information on function, installation, start-up and maintenance.

For detailed information on functional checks/device settings, data backup, software update, malfunction and error handling and possible repairs, see the Service Manual for the FLOWSIC100 Flare measuring system.

NOTICE:
Always read the Operating Instructions before starting any work! The observance of all safety and warning notes is imperative!

1.2 Main hazards

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

The 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 or 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 the "hot tapping" method may fit devices on running equipment (authorized personnel → pg. 20, § 1.4). 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.

1.2.2 Hazards with electrical equipment

WARNING: Mains voltage Danger

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

WARNING: Hazards with electrical equipment

- ► With the use of sender/receiver units FLSE100-EXS and EXPR zone 1 the rated voltage U_M used in the safe area may not exceed 125 V. Higher voltages can jeopardize intrinsic safety of the ultrasonic transducer circuit when errors occur.

  Ensure that the rated voltage U_M used in the safe area does not exceed 125 V.
- ► The FLOWSIC100 Flare is not equipped with a power switch.

  Plan and install a suitable switching off device.
- ► Do not open the enclosure while the device is energized.
- ► Only operate internal switches when the device is not live or when the area is safe.
- ► Do not connect or disconnect the circuits unless the power has been turned off or the area is safe.
- ► Do not use the device when cables or terminals are damaged.
- ► Only components supplied or approved by the manufacturer may be used.

1.2.3 Hazards due to explosive or combustible gases

The FLOWSIC100 Flare measuring system may be used in potentially explosive atmospheres according to the respective specifications.

WARNING: Hazards due to explosive or combustible gases

- ► In potentially explosive atmospheres, only use the version of the FLOWSIC100 Flare specified for such use (→ pg. 14, § 1.3.2).
- ► Observe the information on → pg. 11, § 1.2.1 during installation work on running equipment ("hot tapping" method).

1.2.4 Hazards due to electrostatic discharges

The electronic housing of the FLSE100 and of the optionally available meter body is painted by the manufacturer with a layer thickness of max. 0.2 mm.

WARNING:

Ignition hazards through electrostatic discharges exist when the FLOWSIC100 Flare with special paint and a layer thickness > 0.2 mm is used in applications with ignition group IIC in accordance with ATEX and IECEx.

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

1.3 Intended use

1.3.1 Purpose of the device

The FLOWSIC100 Flare measuring system may only be used for measurements of gas velocity, gas volume, mass flows and molecular weight in pipelines.

1.3.2 Correct use

1.3.2.1 General

- ► Use the device only as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- ► Observe all measures necessary for conservation of value, e.g. for maintenance and inspection and/or transport and storage.
- ► Only components supplied or approved by the manufacturer may be used.
- ⊗ Do not remove, add to or modify any components on the device unless described and specified in the official manufacturer information. Otherwise
  - the device could become dangerous
  - any warranty by the manufacturer becomes void
- ⊗ Do not use damaged components or parts.

1.3.2.2 FLSE100 sender/receiver units for use in ex zones

The sender/receiver units of the FLOWSIC100 EX-S, EX, EX-RE and EX-PR device versions are available as options for use in Ex zone 1 and 2 or as versions for use in Ex zone 2 only.

- Sender/receiver units marked ATEX II 2 G IECEx and CSA Class I Division 1 are approved for use for gases in Ex zones 1 and 2.
- Sender/receiver units marked ATEX II 3 G and CSA Class I Division 2 are suitable for use for gases in Ex zone 2.

1.3.2.3 Use of FLOWSIC100 FLARE depending on temperature class and process temperature

Installation and use of sender/receiver units FLSE100 where electronic parts and transducer parts are 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 % v/v.

1.3.2.4 **Permitted gas temperature depending on temperature code of FLSE100**

Case 1 (see → p. 15, Table 1):

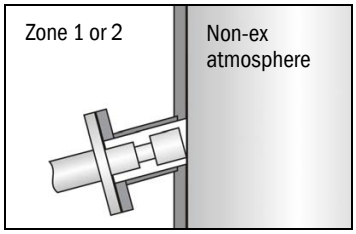
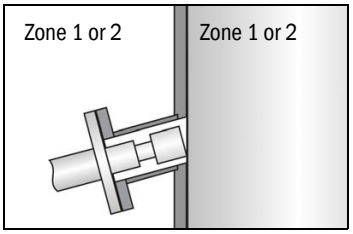
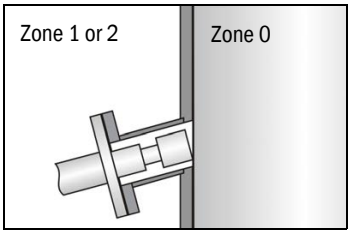
Outside the pipeline an explosive atmosphere exists under normal atmospheric conditions, which is categorized as area zone 1 or zone 2. Inside the pipeline the process conditions can be different from atmospheric conditions. Process conditions can be in the range as specified on the tag of the FLSE100. In this case the gas or gas mixture can be combustible but must not be explosive.

Case 2 and 3 (see → p. 15, Table 1:

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

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

Table 1 Permitted gas temperature for temperature code

	Case 1	**Case 2**	**Case 3**
Requested temp. class for hazardous area	• Ultrasonic transducer 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 transducer 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 transducer in explosive atmosphere zone 0 • Electronics in explosive atmosphere Zone 1 or 2 • Gas pressure atmospheric, gas temperature max +60 °C • For type EX-S and EX-PR only
			
The standard FLSE100 (Temperature Code T4) can be used in the following gas temperatures:			
T4	-70 ... +130 °C[1]	-40 ... +70 °C[2]	-20 ... +60 °C
T3	-70 ... +195 °C[1 3]	-40 ... +70 °C[2]	-20 ... +60 °C
T2	-70 ... +280 °C[1 3]	-40 ... +70 °C[2]	-20 ... +60 °C
FLSE100 with Option T6 (not available for versions with high temperature range):			
T6	-70 ... +80 °C[1]	-40 ... +55 °C[2]	-20 ... +55 °C

1 Option low temperature version with minimum temperature -196 °C (not available for EX/EX-RE Zone 1 and CSA)

2 Option minimum temperature -50 °C

3 Limit for FLSE100 Standard temperature +180 °C, limit for FLSE low temperature version +100 °C

NOTICE:

If the real gas temperature in the pipeline is higher than the ignition temperature marked by the temperature code on the tag of the FLSE100, the possible explosive atmosphere does not contain gases which are classified in a temperature code with a lower ignition temperature than the highest gas temperature respectively the outside surface temperature of the pipeline itself. The possibility for heating up of the ambient air by the pipeline around that must be observed. Ambient temperature around the electronic enclosure must not exceed +70 °C for FLSE100 marked with T4 and must not exceed +55 °C for FLSE100 marked with T6. The compliance with these requirements is the sole responsibility of the user. Particularly the FLSE100 marked with temperature code T6 run the risk of non-resettable switch-off due to the thermal cutoffs inside the electronics enclosure. In this case the FLSE100 must be repaired by the manufacturer only. Warranty will be expired.

Compliance with the above requirements is the sole responsibility of the user.

1.3.2.5 **Sender/receiver unit with probe retraction mechanism**

The retraction mechanism serves to remove and fit complete FLOWSIC100 Flare sender/ receiver units for maintenance or replacement without relieving pressure in the pipeline in which the measuring system is fitted. This allows maintenance work without having to interrupt the process.

WARNING: Specified temperature and pressure ranges

Only operate probe retraction mechanism in the following ranges for gas temperature and operating pressure:

- Device types FL100 EX-S, EX and EX-RE:
  - Gas temperature range -20 °C to +200 °C
  - Upper operating pressure 16 bar at 50 °C (see p-T diagrams in chapter 2.3.1.1 - 2.3.1.6.)
- Device type FL100 EX-PR
  - Gas temperature range -20 °C to +200 °C
  - Upper operating pressure limit is +0.5 bar at whole temperature range.

WARNING: Hazardous gas (possibly explosive or toxic)

Small gas quantities escape during the removal and installation of the transducer assemblies. During proper use, the gas crowd locked up in the retraction space is less than 0.5 dm^3 for device type EX-S, EX and EX-RE and less than 2.5 dm^3 for device type EX-PR.

► Staff performing activities at plants with poisonous or other gases dangerous to health must use suitable safety equipment to prevent personal injuries.

WARNING: Hazardous gas (possibly explosive or toxic)

The retraction flange of the S/R units contains a connection for optional venting (→ Fig. 10, → Fig. 14 and → Fig. 18 - Fig. 24).

► This connection is closed with a blind screw by factory and may not be removed outside factory!

1.3.2.6 **MCUP control unit**

The MCUP control unit is optionally available in the versions for use in Ex zone 1 and 2 **or** for use only in Ex zone 2 **or** not for use in Ex zones.

- Control units with marking ATEX II 2 G Ex de IIC T6 are approved for use in Ex zone 1 and 2.
- Control units with marking ATEX II 3 G Ex nA IIC T4 Gc are approved for use only in Ex zone 2 or for use in safe areas.

WARNING: Explosion hazard

► Install and operate the MCUP control unit without explosion protection only outside Ex zones.

► Use the explosion-protected MCUP control unit only according to the respective Ex marking.

1.3.3 Restrictions of use

WARNING: Pressure/temperature hazard

► Use the measuring system only within the pressure and temperature limits specified in these Operating Instructions and on the device type plate. The selected materials must be resistant to the process gases.

The ultrasonic transducers/probes are preferably 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.

WARNING: Leakage hazard

Operation with leakage is not permitted.

- The metallic and hermetically sealed, fully welded housing 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 housings must be installed in the pipeline gas-tight and pressure-tight. Depending on the design, at least one seal with an O-ring according to DIN 3771 or a standardized sealing flange must be provided.
- 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.
  - ► Regularly check leak-tightness during operation and replace the seal, as required.
- The sealing effect must be checked with suitable methods after installation and every removing and re-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 hazardous area classification Ex zone 1

The following additional regulations are applicable for the use of FLOWSIC100 Flare in applications with 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 housing 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

The use in applications of zone 0 is generally possible only for device types FLOWSIC100 EX-S and EX-PR under consideration of the application limitations specified in these Operating Instructions.

- Ultrasonic probes can also be operated in zone 0 under atmospheric conditions (ambient temperature -20 °C to 60 °C and ambient pressure 0.8 bar to 1.1 bar absolute). The device must be labelled at least with the information II 1/2 G Ex ia.
- Ultrasonic probes made from titanium may be used in zone 0 only if the medium does not contain firm parts (e.g. dust and other particles), and the ultrasonic probes are installed in the zone 0 (e.g. the inside of a pipe) in such a way that the danger of ignition due to impact or friction is excluded. The intrinsically safe ultrasonic transducers with their gas-tight and pressure-proof housings must be installed gas-tight and pressure-tight in the wall separating the zones to zone 0. The wall must be thicker than 3 mm. The requirements in EN 60079-26 section 4.6 must be adhered to.

1.4 Responsibility of user

1.4.1 General information

Designated users

The FLOWSIC100 Flare measuring system 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. Technicians must be skilled according to DIN VDE 0105, DIN VDE 1000-10, or IEC 60050-826 or directly comparable standards.

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

Specific requirements for use of devices in hazardous areas

- Cabling /installation, device set-up, maintenance and check may be only carried out by experienced staff which has knowledge about the rules and regulations for hazardous areas, in particular:
  - type of protection
  - installation rules
  - area definition
- Regulations to be applied:
  - IEC 60079-14
  - IEC 60079-17

  or comparable national regulations.

Special local conditions

- Observe the valid legal regulations as well as the technical rules deriving from implementation of these regulations applicable for the respective equipment during work preparation and performance.
- Special caution and attention is required on equipment with increased hazard potential (pressure pipes, explosion protection zones). Comply with existing special regulations.
- Carry out work according to the local conditions specific for the equipment as well as operational hazards and regulations.
- Suitable protection devices and safety equipment for persons must be available according to the respective hazard potential and be used by the personnel.

Retention of documents

Keep the Operating Instructions belonging to the measuring system as well as equipment documentation on-site for reference at all times. Pass the respective documentation on to any new owner of the measuring system.

Selection of materials

The user must check whether the intended materials of the device components are suitable for the process conditions.

1.4.2 Safety information and protective measures

Protection devices

NOTICE:
Suitable protection devices and safety equipment for must be available according to the respective hazard potential for use by personnel.

Preventive measures for operating safety

NOTICE:
The user must ensure that:
- Neither failures nor erroneous measurements lead to operational states that can cause damage or become dangerous
- The specified maintenance and inspection tasks are carried out regularly by qualified, experienced personnel.

Avoiding damage

NOTICE:
The operator must ensure the following to avoid malfunctions that can directly or indirectly lead to injuries to persons or material damage:
- The responsible maintenance personnel are present at any time and as quickly as possible
- The maintenance personnel are adequately qualified to react correctly to malfunctions of the measuring system and any resulting operational malfunctions (e.g. when used for measurement and control purposes)
- The malfunctioning equipment is switched off immediately in case of doubt and that switching off does not cause collateral malfunctions.

Repairs

NOTICE:
Repairs on explosion-protected system components are possible only by the device manufacturer and, to a limited extent, also by others.

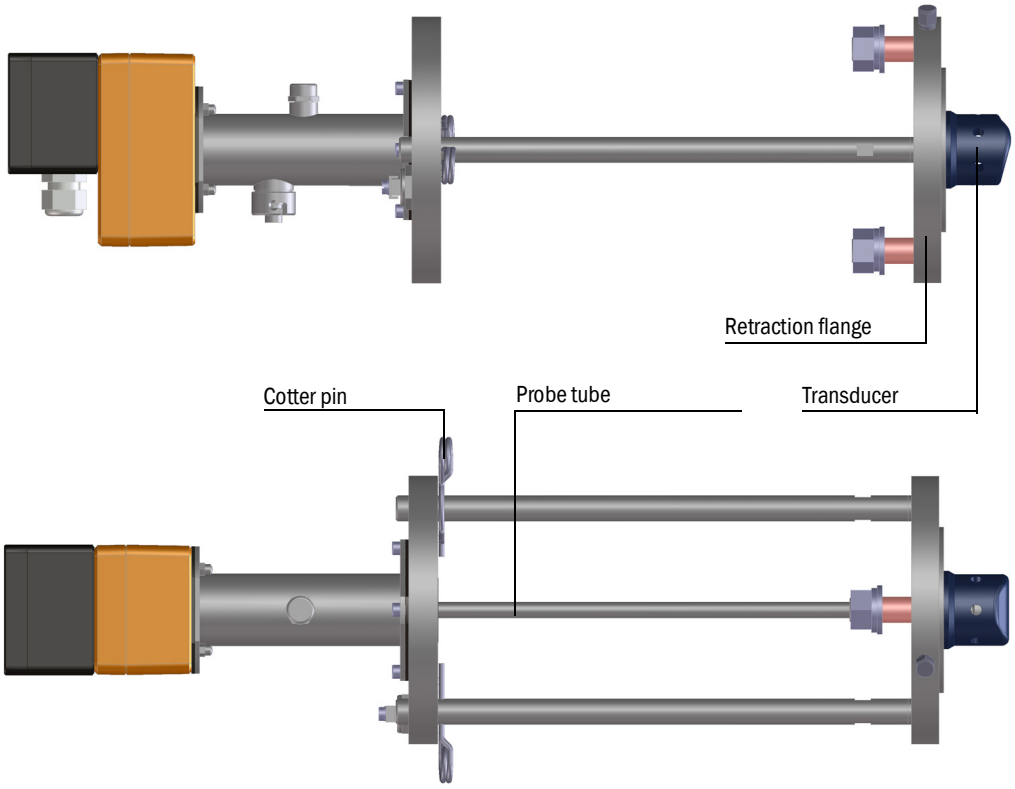
For detailed information about possible repairs and repair instructions see the service manual.

1.5 Transport safety device for retractable sender/receiver units

To prevent transport damage, retractable sender/receiver units must be secured before each transport according to Fig. 1:

- The transducer must be on the retraction flange.
- The probe tube with transducer must be secured with cotter pins.

Fig. 1 Transport safety device for retractable sender/receiver unit (shown semitransparent)



FLOWSIC100 Flare

2 Product Description

System basic information
System components
Computations
Check cycle

2.1 System basic information

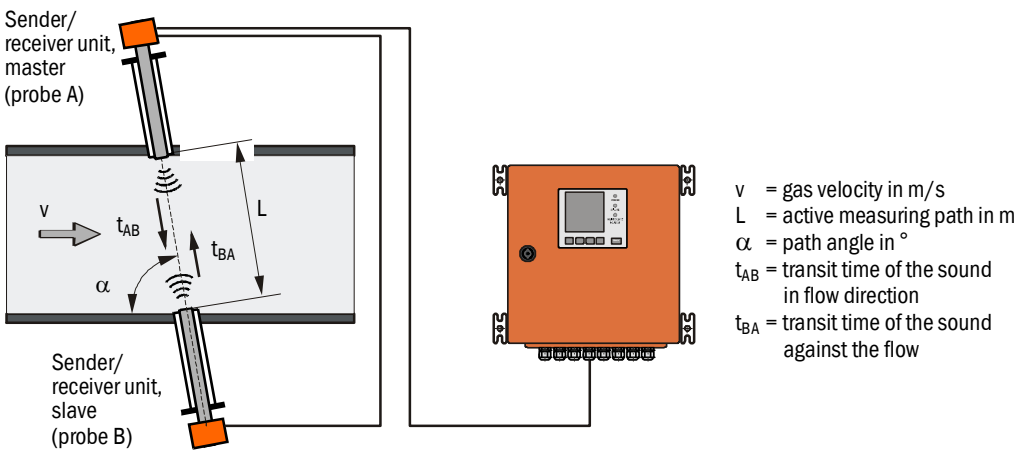
2.1.1 Functional principle ultrasonic transit time difference measurement

The FLOWSIC100 Flare gas velocity measuring devices operate according to the principle of difference measurement in ultrasonic transit times. On both sides of a pipeline, the sender/receiver units are installed in a certain path angle to the gas flow (→ Fig. 2).

The sender/receiver units contain piezoelectric ultrasonic transducers which operate alternately as senders and receivers. The sonic pulses are beamed at angle α to the gas flow direction. Depending on angle α and gas velocity v, different transit times for the respective sound direction (formulas 2.1 and 2.2) result from "acceleration or brake 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 velocity v is determined from the difference of both transit times, irrespective of the value of the sound velocity. 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. 2 Functional principle of FLOWSIC100 Flare



Determination of gas velocity

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

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

Valid against the flow is:

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

Resolving for v results in:

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

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

Determination of sound velocity

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

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

Based on the dependencies according to formula 2.5, the sound velocity can be used for the determination of the gas temperature, of the molecular weight and for diagnostic purposes.

$$c = c_0 \cdot \sqrt{1 + \frac{\vartheta}{273\,°C}} \qquad (2.5)$$

c_0 denotes the speed of sound at the reference temperature 0 °C and ϑ the gas temperature in °C.

Volume flow determination

The volume flow in operating mode is calculated from the gas velocity and the geometric dimensions of the pipeline.

→ pg. 71, §2.3.2 describes the calculations for volume flow in standard state, mass flow and molecular weight.

2.1.2 ASC-technology (patented) – active sound correlation technology (optionally available)

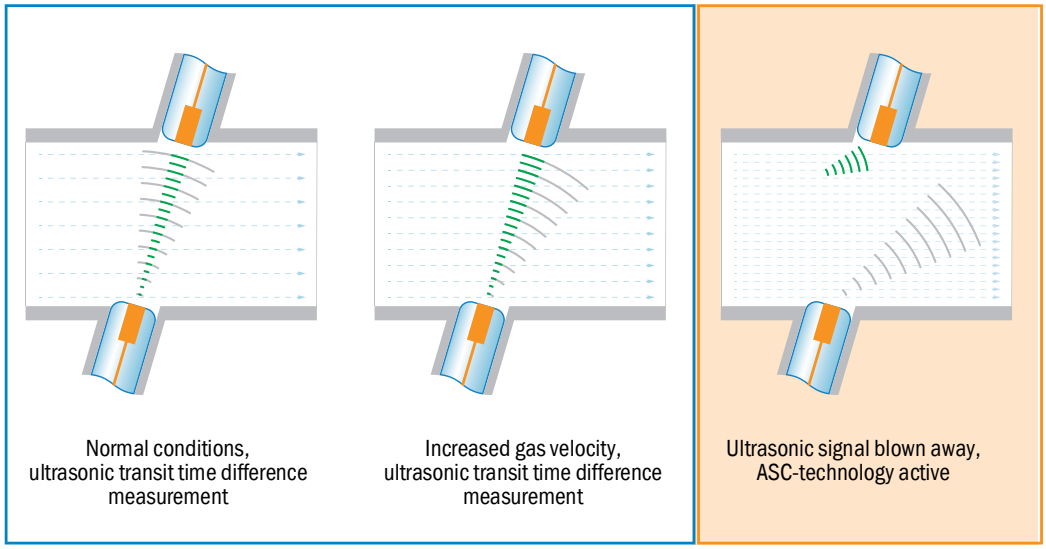
If the ultrasonic signal is blown away due to extreme gas velocity, the ASC-technology (active sound correlation technology) takes over.

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 events.

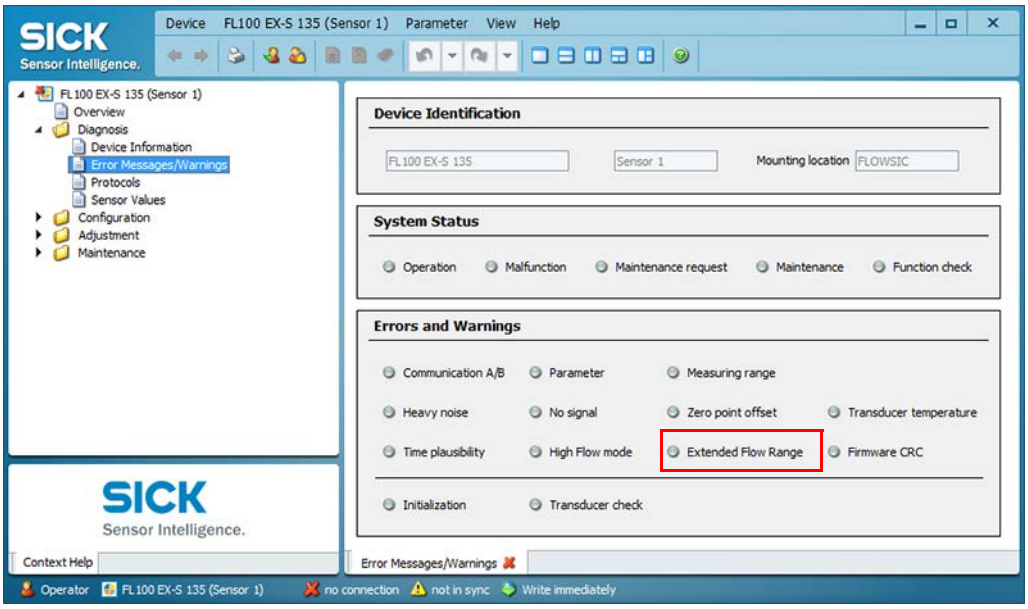
Measurement uncertainty is higher as compared to ultrasonic transit time difference measurement, see technical data, → pg. 212, § 6.1.

Fig. 3 ASC-technology



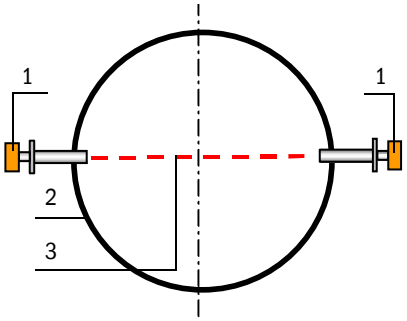
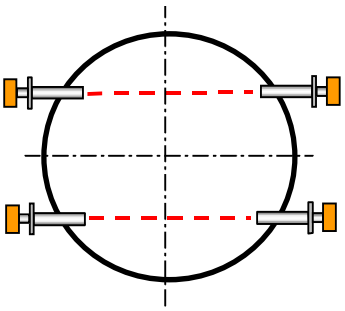
"Extended Flow Range" is signaled in SOPAS when ASC-technology is active, → Fig. 4.

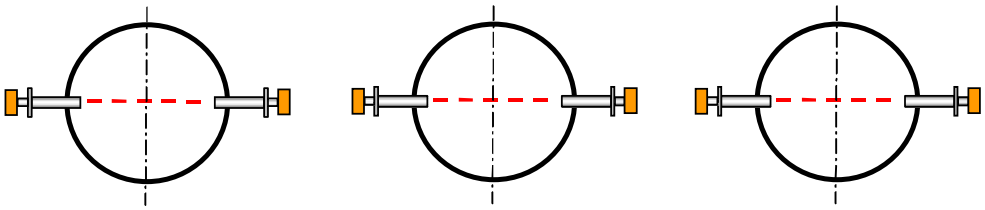
Fig. 4 ASC-technology active



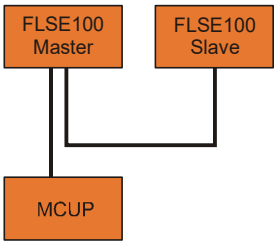
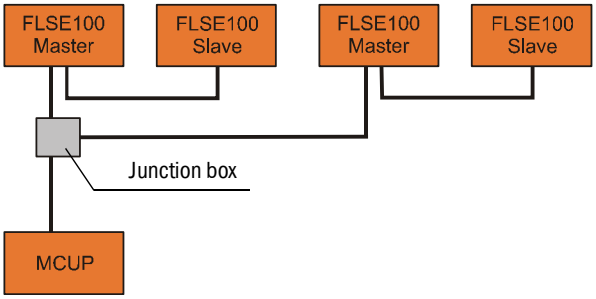
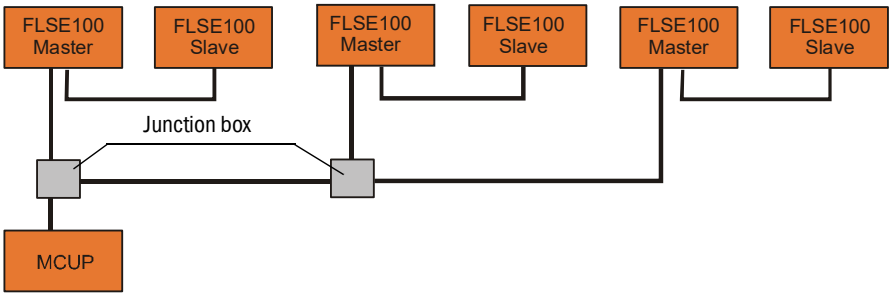
2.1.3 System configuration

The following figures show cross-duct installations (FLOWSIC100 EX/ EX-RE, EX-S). In principle, the configuration is also valid for single side installations (FLOWSIC100 EX-PR).

Configuration	Description
1-path measurement	2 sender/receiver units (1) are mounted on the pipeline (2). The measurement path (3) is positioned across the center of the pipeline. Special application conditions can require a path positioning outside the center of the pipeline (shortening of active measuring path). Instead of 2 sender/receiver units also a probe version can be used (type EX-PR). 
2x1-path measurement	In this configuration the control unit MCUP serves two independent 1-path measurement systems. Both pairs of sender/receiver units are connected to the same control unit MCUP. Separate processing and output of the measuring results for both measuring points is performed by the MCUP. Preferably both measurements are installed like standard 1-path measurements in the center of the pipeline.
2-path measurement	Two pairs of sender/receiver units are installed at the same measuring location and are connected to the same control unit MCUP. Both measurement paths should preferably be positioned outside the center of the pipeline and run parallel to one another. Computation of both measuring paths to one measuring result is performed via the MCUP.  Two-path measurement is used to achieve higher measuring precision or for complicated flow conditions. **Path compensation** The device is uses an integrated algorithm for path compensation in the case of a path failure. In trouble-free function, the system learns the relation of gas velocity and sound velocity between both measurement paths. In case of a path failure, the system can calculate theoretical values on basis of the learned path relations and can replace the invalid values against them. In this way the path failure can be temporarily compensated and the measurement is continued with slightly increased uncertainty. Under such conditions, the measurement system automatically signals "Maintenance request".

Configuration	Description
3x1-path measurement	Three individual measuring paths from different measuring points can be connected to one control unit with this variant. Separate processing and output of the measuring results for all three measuring points are performed by the MCUP. 

2.1.4 Communication between sender/receiver units and control unit

Configuration	Description
1-path measurement - connection of one measuring point to the MCUP	Two sender/receiver units (type EX-S, EX und EX-RE) are connected to the MCUP and work as master and slave. The FLSE master has a second interface in the terminal box to enable unique separation of the communication to the FLSE slave and to the MCUP. The master triggers the slave and takes over the measuring regime. The MCUP can independently query the measured values from the master units (asynchronous to the measuring cycle). 
	The master-slave communication of the device type EX-PR is realized internally in the single sender/receiver unit. The sender/receiver unit is directly connected to the MCUP.
2-path and 2x1-path measurement - connection and computation of two measuring paths of a measuring point to the MCUP	The master-slave communication is realized using the same principle as for the single path measurement. The connection of both measuring paths is usually carried out with bus cabling. 
	An approved explosion-protected junction box (SICK option) is to be used for cabling in Ex zone 2. Cabling in hazardous areas Ex zone 1 may be carried out only with an approved "Exe" junction box or "Ex-d" junction box (not included in SICK scope of delivery).
3x1-path measurement - connection of three measuring paths of different measuring points to the MCUP	The master-slave communication is realized using the same principle as for the single path measurement. The connection of all measuring paths have to be carried out with bus cabling. An approved explosion-protected junction box (SICK option) is to be used for cabling in Ex zone 2. Cabling in hazardous areas Ex zone 1 may be carried out only with an approved "Exe" junction box or "Ex-d" junction box (not included in SICK scope of delivery). 

2.1.5 System overview

The measuring system consists of the following components:

- FLSE100 sender/receiver unit (details → pg. 32, § 2.2.1)
  For sending and receiving ultrasonic pulses, for signal processing and control of system functions
- Nozzle (details → pg. 56, § 2.2.2.1)
  For mounting the sender/receiver units on the pipeline
- Nozzle installation tool
  For precise positioning and alignment of nozzles
- Ball valve (details → pg. 58, § 2.2.2.2)
  For mounting retractable sender/receiver units on the pipeline
- MCUP control unit (details → pg. 60, § 2.2.4)
  For control, evaluation and output of the sensor data connected via the RS485 interface
- Connection cable between the sender/receiver units
- Connection cable between sender/receiver units and MCUP
- Meter body option (spool piece)
  Spool piece ready for mounting in an existing pipeline (flange connection or welded connection); including installation materials to fit the sender/receiver units.
- External temperature and pressure transmitters available on request

Component		Device type			
		FLOWSIC100 EX-S	FLOWSIC100 EX	FLOWSIC100 EX-RE	FLOWSIC100 EX-PR
Sender/receiver unit		FLSE100-EXS (master)	FLSE100-EX (master)	FLSE100-EXRE (master)	FLSE100-EXPR
		FLSE100-EXS (slave)	FLSE100-EX (slave)	FLSE100-EXRE (slave)	
Installation material	non-retractable FLSE100	ANSI CL150 2" or DN50 PN16 nozzle			ANSI CL150 3" or DN80 PN16 nozzle
	retractable FLSE100	Nozzle, ball valve, blind flange ANSI CL150 2"/CL150 3" or DN50 PN16/DN80 PN16			
MCUP	without explosion protection	MCUP 90-250 V a.c. or 24 V d.c.			
	explosion-protected	FLSE100 certified for Ex zone 1:		● MCUP Zone 1 (90 ... 250 V a.c. or 24 V d.c.) ● MCUP Zone 2 (24 V d.c., 115/230 V a.c.automatically controlled)	
		FLSE100 with suitability for Ex zone 2:		MCUP Zone 2 (24 V d.c. or 115/230 V a.c. automatically controlled)	
Connection cable FLSE100 (master)-FLSE100 (slave)		Scope of delivery			Not relevant

Measuring systems with meter body option can be provided additionally as:

- Dry calibrated (3D measured measurement system. Geometric uncertainties are minimized.)
- Flow calibrated (Complete measurement system calibrated on a flow test bench.)

Both variants reduce the measurement uncertainty (→ pg. 212, § 6.1).

System overview of cross-duct version (example: FLOWSIC100 EX-S)

Fig. 5 System overview, horizontal installation, FLOWSIC100 EX-S, MCUP without explosion protection

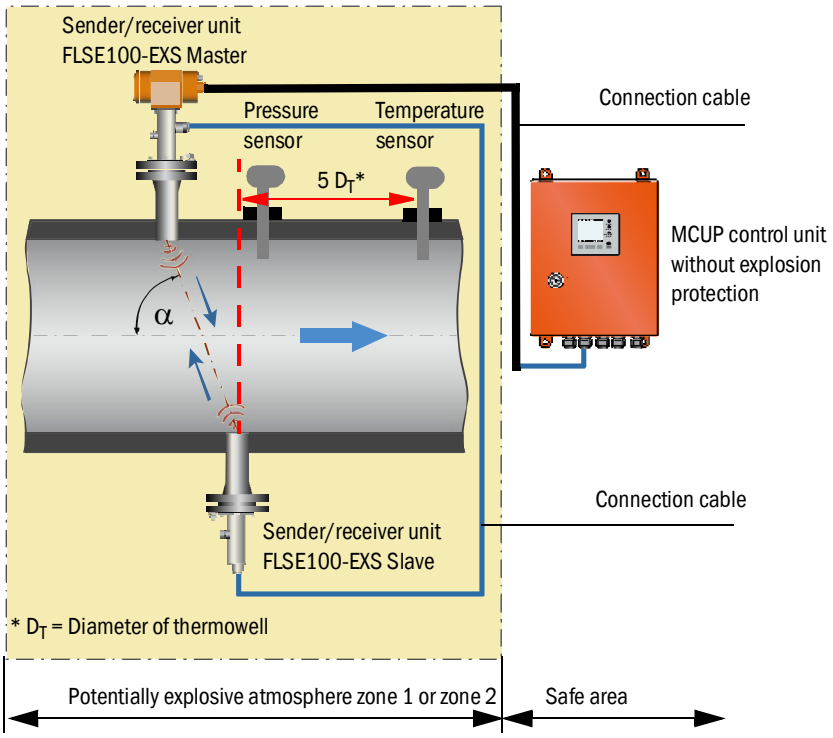
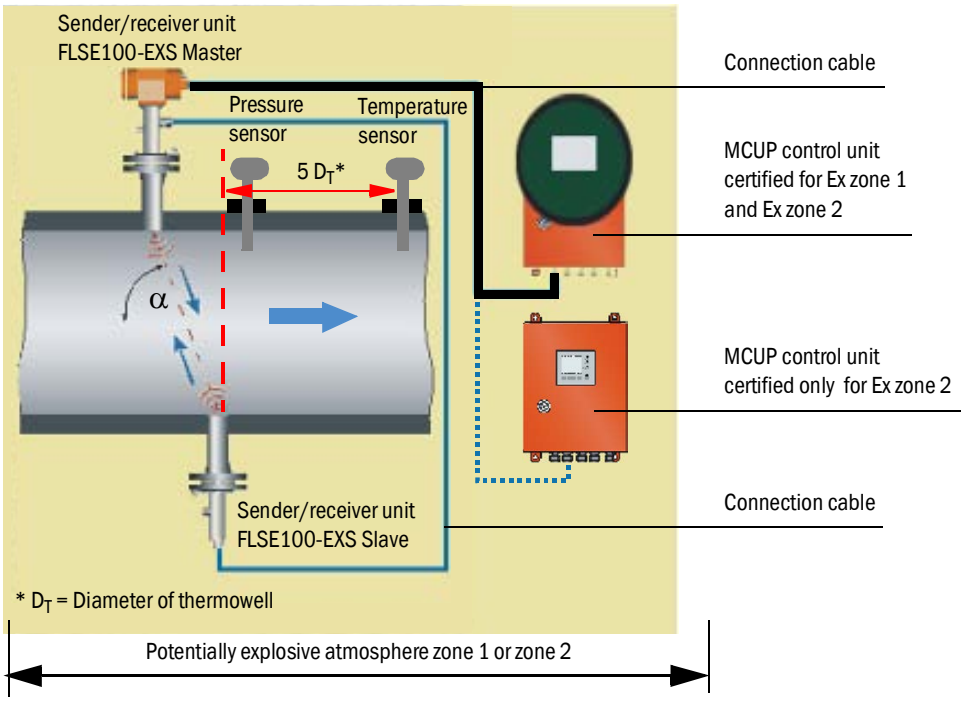


Fig. 6 System overview, horizontal installation, FLOWSIC100 EX-S, MCUP explosion protected



2.2 System components

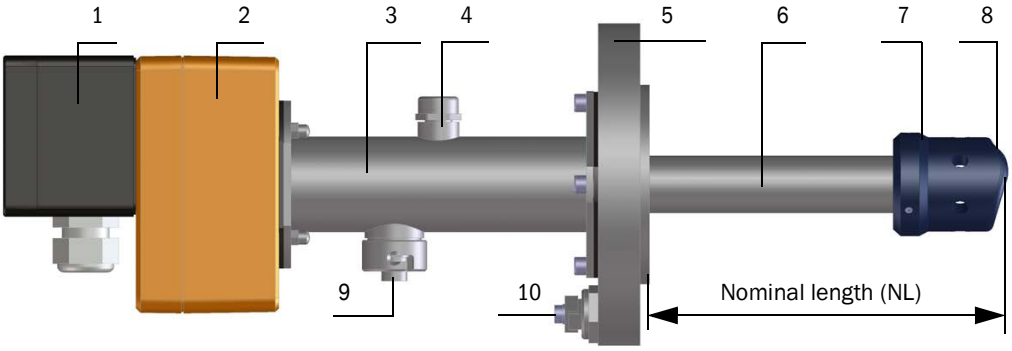
2.2.1 FLSE100 sender/receiver unit

The sender/receiver units consist of the electronic unit (slave probe of type FLOWSIC100 EX-S without electronic unit), connecting piece and duct probe with transducer module.

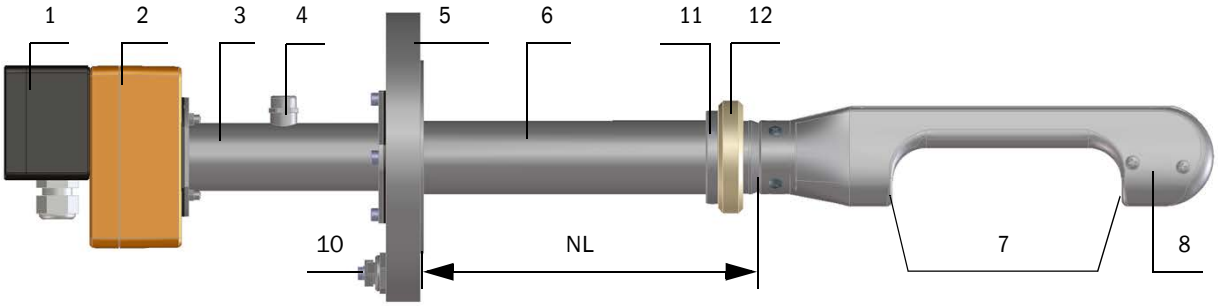
The individual modules of the sender/receiver unit are firmly interconnected at the factory to comply with the ex protection and thus form a unit which cannot be disassembled.

Fig. 7 Schematic diagram of the modules of the sender/receiver unit

Cross-duct version



Probe version



1 Exe terminal compartment
2 Electronic unit
3 Connection
4 Pressure balance element (not removable)
5 Connection flange
6 Duct probe
7 Transducer
8 Flow-optimized probe contour
9 Connection for slave probe (only for FLOWSIC100 EX-S)
10 Ground terminal
11 Fixing ring
12 Supporting ring

Assignment device type - type of sender receiver unit

Device type	Name of sender/receiver unit
FLOWSIC100 EX-S	FLSE100-EXS
FLOWSIC100 EX	FLSE100-EX
FLOWSIC100 EX-RE	FLSE100-EXRE
FLOWSIC100 EX-PR	FLSE100-EXPR

Sender/receiver unit versions

- Non-retractable sender/receiver units
  Cannot be installed or removed while the plant is in operation.
- Retractable sender/receiver units
  Can be installed or removed while the plant is in operation. Installation on the pipeline is performed with nozzle and ball valve (→ pg. 114, § 3.6.2).

Option: Venting ball valve for sender/receiver unit

Retractable sender/receiver units can be delivered with optional "venting valve" equipment (ball valve) at the retraction flange.

- The venting ball valve must be installed by the manufacturer. Installation outside the factory is not possible.
- The connection for the venting valve is closed with a blind screw by the factory.

WARNING: Danger of leakage

► Do not remove the blind screw at the connection for the venting valve!

WARNING: Danger in case of incorrect use

Retractable sender/receiver units without optional venting may only be used for non-hazardous gases (not aggressive/toxic/explosive, low temperatures) or otherwise only when the plant operator takes suitable protective measures and safety precautions for safe venting.

► Venting is only permitted if the process ball valve of the system is closed tightly!

Option: Connection for condensation drain at sender/receiver unit

Optional connection for condensation drain can be used under consideration of following restrictions only:

- Drain only over closed drain system. Drain system (piping etc.) is not included as part of delivery SICK.
- Drain system must be designed considering the process conditions (pressure, temperature, gas composition).

All relevant safety regulations, standards and guidelines must be considered when using the condensation drain. The use of the condensation drain is the sole responsibility of the plant operator.

Selection criteria

Criteria	Design	Remark
Gas temperature / EX certification	Standard version up to max. 180°C	Device certified for gases according to ATEX/IECEx in zone 1 and 2 and CSA Class 1 Division 1/Division 2
	High-temperature version up to max. 280°C	
	Standard version up to max. 180°C	Devices with suitability for gases in zone 2 only
	High-temperature version up to max. 260°C	
Gas composition	Material for duct probe with transducer: stainless steel or titanium	Selection according to corrosion resistance with respect to the measuring medium
Type of installation	Two-sided installation	one sender/receiver unit on each of the opposite pipe walls
	One-sided installation	single sender/receiver unit (probe version)
	Installation with nozzle	non-retractable sender/receiver units
	Installation with nozzle + ball valve	retractable sender/receiver units
Pipe diameter	4" ... 24"	FLOWSIC100 EX-S, one path
	12" ... 24"	FLOWSIC100 EX-S, two path
	8" ... 72"	FLOWSIC100 EX /EX-RE, one path
	12" ... 72"	FLOWSIC100 EX /EX-RE, two path
	12" ... < 48"	FLOWSIC100 EX-PR, one path, short version
	18" ... < 48"	FLOWSIC100 EX-PR, two path, short version
	48" ... 72"	FLOWSIC100 EX-PR, one path/two path, long version
Flange connection	prepared for mounting on counter flange 2" CL150 RF acc. to ASME B16.5 or counter flange DN50 PN16 form B1 acc. to EN 1092-1	FLSE100-EXS, EX and EXRE
	prepared for mounting on counter flange 3" CL150 RF acc. to ASME B16.5 or counter flange DN80 PN16 form B1 acc. to EN 1092-1	FLSE100-EXPR

All sender/receiver units can be used for internal pipe pressure up to max. 16 bar.
If requested by the customer, the sender/receiver units are also available in other versions.

Material for gas-affected parts (standard configuration)

Material	Component	Type FLSE100					
		EXS	EX	EXRE	EXPR	non-retract.	retract.
Stainless steel 1.4571	Duct probe, transducer, connection flange		x			x	
	Connection for optional venting, retraction flange		x			N/A	x
	Duct probe, connection flange, sensor contour, fixing ring				x	x	
Titanium	Duct probe, transducer		x			x	
	Transducer, transducer holder (inside sensor contour)				x	x	
FFKM, EPDM, PTFE	Sealings in retraction mechanism (not for high temperature versions)	x		x	x	N/A	x
FFKM, PTFE	Sealings in retraction mechanism (high temperature versions only)	x		x		N/A	x
PTFE	Centering			x		N/A	x
PTFE, conductive	Sensor contour		x			x	
	Supporting ring				x	x	

2.2.1.1 Type code for sender/receiver units ATEX Zone 1, IECEX and Zone 2

The sender/receiver units are defined by a type code as follows:

Parameter	Code	Design/Description	Type of sender/receiver unit
FLSE100 identification	EXS	Transducer with small dimensions	
	EX	Transducer with medium dimensions	
	EXRE	Transducer with medium dimensions, retractable version of sender/receiver unit	
	EXPR	Transducer with small dimensions, probe version	
NL (→ pg. 32, Fig. 7)	148	148 mm	FLSE100-EXS, non-retractable[1]
	176	176 mm	FLSE100-EXS, non-retractable[2]
	198	198 mm	FLSE100-EX, non-retractable[1]
	220	220 mm	FLSE100-EXPR, non-retractable, short version[3]
	226	226 mm	FLSE100-EX, non-retractable[2]
	330	330 mm	FLSE100-EXS, retractable[4]
	350	350 mm	FLSE100-EXPR, non-retractable, long version[3]
	380	380 mm	FLSE100-EXRE, retractable[4]
	400	400 mm	FLSE100-EXPR, retractable, short version[3]
	530	530 mm	FLSE100-EXPR, retractable, long version[3]
Material of transducer with probe tube	S	Stainless steel 1.4571, 1.4404, 316L, 316 Ti	not for FLSE100-EXPR
	T	Titanium	
	A	Hastelloy	
	F	Full titanium execution	
Connection flange	A2	see footnote [1]	FLSE100-EXS/EX/EXRE
	D5	see footnote [2]	
	A3	see footnote [5]	FLSE100-EXPR
	D8	see footnote [6]	
Probe design	1	High flow center path	
	2	High flow outer path (secant)	
Transducer	4	42 kHz preferably	FLSE100-EX and EXRE
	8	80 kHz preferably	FLSE100-EXS
	1	135 kHz preferably	FLSE100-EXS and EXPR
Sealing material in retraction mechanism	V	FKM	
	E	EPDM	
	K	FFKM	
	P	PTFE	

1 Flange connection prepared for mounting on counter flange 2" CL150 RF acc. to ASME B16.5
2 Flange connection prepared for mounting on counter flange DN50 PN16 form B1 acc. to EN 1092-1
3 Flange connection prepared for mounting on counter flange 3" CL150 RF acc. to ASME B16.5 or counter flange DN80 PN16 form B1 acc. to EN 1092-1
4 Flange connection prepared for mounting on counter flange 2" CL150 RF acc. to ASME B16.5 or counter flange DN50 PN16 form B1 acc. to EN 1092-1
5 Flange connection prepared for mounting on counter flange 3" CL150 RF acc. to ASME B16.5
6 Flange connection prepared for mounting on counter flange DN80 PN16 form B1 acc. to EN1092-1

Type code for sender/receiver units ATEX Zone 1, IECEX and Zone 2 (continued)

Parameter	Code	Design/Description	Type of sender/receiver unit
	S	Standard range -70 ... +180°C	
	H	High temperature range -70 ... +280 °C	only for ATEX Zone 1/IECEX and CSA versions
	L	Low temperature range -196 ... +100 °C	use in zone 1 only for FLSE100-EXS and EXPR - Titanium version
Gas temperature	Z	High temperature range -70 ... +260 °C	only for ATEX zone 2 versions
	N	Non-retractable	
	R	Retractable (welded retraction flange)	
Probe retraction mechanism	V	Retractable with vent (welded retraction flange)	
	N	Without retraction flange	
Material of retraction flange	S	Stainless steel 1.4571, 1.4404, 316L, 316 Ti	non-retractable FLSE100
	N	Without electronics	FLSE100-EXS (slave probe)
	4	1-channel F42	FLSE100-EX and EXRE
	8	2-channel F80	FLSE100-EXS
Probe electronics	1	2-channel F135	FLSE100-EXS and EXPR
	1	ATEX/IECEx zone 1	(IECEx not for FLSE with junction box)
Explosion protection	2	ATEX zone 2	
	4	INMETRO Zone 1	
	A	IIA T4	
	B	IIB T4	
	C	IIC T4	
Ex group	6	IIC T6	not for gas temperature > 80°C
	N	No electronics	only valid for FLSE100-EXS slave probe
	S	Standard housing	not for sender/receiver units for use in zone 1
Electronic housing	D	Ex-d housing	
	N	No electronics	FLSE100-EXS (slave probe)
	A	Aluminium	
Housing material	S	Stainless steel	not for ATEX zone 2 versions
	N	No electronics	FLSE100-EXS (slave probe)
	P	Plug connection	Not for Ex devices
	M	Metric cable gland	
Housing cable entry	T	NPT cable gland	
	N	Without junction box	
Junction box	Y	With junction box	not suitable for armored cables, not for IECEX

Type code for sender/receiver units ATEX Zone 1/IECEX and Zone 2 (continued)

Parameter	Code	Design/Description	Type of sender/receiver unit
	N	None	
	1	Ambient temperature range -50 ... +70°C	
	2	Tropicalized electronics	
	3	Offshore painting	
	4	Offshore (housing/outer parts SS, standard offshore painting)	
	5	Offshore (housing/outer parts SS, standard offshore painting) and tropicalized electronic	
Miscellaneous	S	Special	

Type code for sender/receiver units with certification CSA Cl I, Div1/Div2 → pg. 259, §6.10.

Application area, configurations

Type of sender/ receiver unit	Gas temperature [°C]		Pressure [barg]	Active measuring path [mm]	Pipe diameter [mm]	NL [mm]
	standard range	high temperature range				
FLSE100-EXS	-70 ... +180	-70 ... +280°C -70 ... +260°C for zone 2	16	105 ... 620	100 ... 600 (4" ... 24")	148 / 176
FLSE100-EXS retractable						330
FLSE100-EX		-70 ... +280°C -70 ... +260°C for zone 2		205 ... 1850	200 ... 1800 (8" ... 72")	198 / 226
FLSE100-EXRE						380
FLSE100-EXPR		-70 ... +280°C -70 ... +260°C for zone 2	16	150 (fixed)	300 ... 1800 (12" ... 72")	220 [3] / 350 [4]
FLSE100-EXPR retractable			16 [1] 0.5 [2]			400 [3] / 530 [4]

[1]: in measuring operation
[2]: when retraction mechanism is being used
[3]: for pipe diameter 300 mm ... 1200 mm (12" ... 48")
[4]: for pipe diameter >1200 mm ... 1800 mm (> 48" ... 72")

Versions for low-temperature range -196 ... +100 °C on request

For information about permissible sample gas pressure/temperature range, see also → pg. 42, Fig. 9, → pg. 43, Fig. 11, → pg. 44, Fig. 13, → pg. 45, Fig. 15.

Suitability of materials for probe with transducer and seal

NOTICE:

- "The suitability rating for sealing materials and transducer/probe materials given in the tables below refer to the specifications of the material manufacturer at room temperature. Finally the suitability of sealing material and transducer/probe material must be checked by the user considering the overall application conditions. Stainless steel configurations are suitable for non-aggressive and dry gas only.
- "Since the retraction flange is outside the pipeline behind ball valve and is not directly flowed through by the medium, it can be assumed that, as a result of the temperature drop, the permitted temperature limit for the seals are not exceeded when the temperature of the media is between min -196 °C and max +280 °C (temperature range of standard/high/low temperature version have to be considered).

Medium [1]	Ultrasonic transducer material		
	SS	Ti	HS [2]
Air / like air	+++	+++	+++
HF	–	–	+++
O_2	+++	+	+++
Water steam up to 100 °C	+++	+++	+++
Water steam up to 280 °C	+++	+++	+++
CH_4 / Natural gas	+++	+++	+++
Sour gas	+	+++	+++
CO_2	+++	+++	+++
Flare gas	+++	+++	+++
CL_2	+	–	+++
H_2	+++	+	+++
NH_4	+++	+++	+++

1: Rated gas temperature and MWP see marking plate
2): Available on request
+++: very good ++: good +: conditional good –: not suitable
SS: stainless steel group 4 Ti: titanium grade 2 / grade 5 HS: hastelloy

Medium [1]	Sealing material in the retraction flange [2]			
	FKM Viton ™ temp. range -40 ... +180 °C	EPDM Vistalon ™ temp. range -50 ... +100 °C	FFKM Kalrez ™ temp. range -15 ... +280 °C	PTFE Teflon ™ temp. range -196 ... +280°C
Air / like air	+++	+++	+++	+++
HF	+++	–	+++	+++
O_2	++	+	+++	+++
Water steam up to 100 °C	–	+++	+++	+++
Water steam up to 280 °C	–	–	+++	+++
CH_4 / Natural gas	+++	–	+++	+++
Sour gas	+	+++	+++	+++
CO_2	+++	+	+++	+++
Flare gas	+++	+++	+++	+++
CL_2	++	–	+++	+++
H_2	+++	+++	+++	+++
NH_4	–	+++	+++	+++

1: Rated gas temperature and MWP see marking plate

2): For retractable ultrasonic transducers only. indicated in the type code
Leaking O-rings may only be changed by SICK service.

+++: very good ++: good +: conditional good –: not suitable

2.2.1.2 **FLSE100-EXS sender/receiver units**

Transducers: small version

Process connection: prepared for mounting on counter flange 2" CL150 RF acc. to ASME B16.5 or counter flange DN50 PN16 form B1 acc. to EN 1092-1

I) **FLSE100-EXS sender/receiver units according to ATEX for use in zone 2 only**

Explosion protection: ATEX II 3 G Ex nA IIC T4 Gc

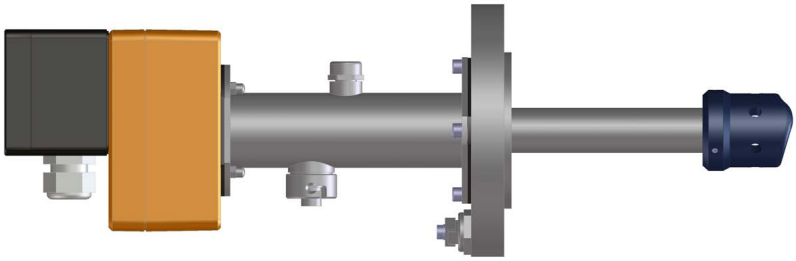
Applied standards: EN 60079-0, EN 60079-15

> ***NOTICE:***
> Future devices will also be labelled according to EN 60079-0:2012. The previous label is still valid.

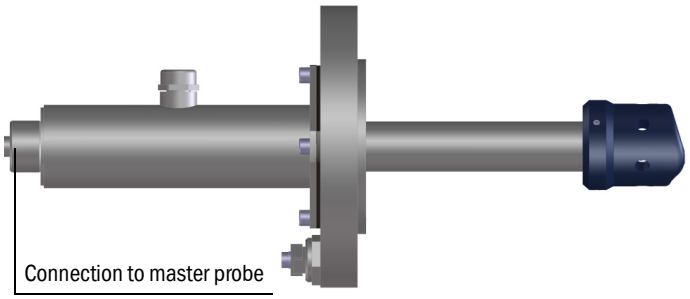
1 Non-retractable version

Fig. 8 FLSE100-EXS sender/receiver units, non-retractable version

Probe with 2-channel electronics (master)

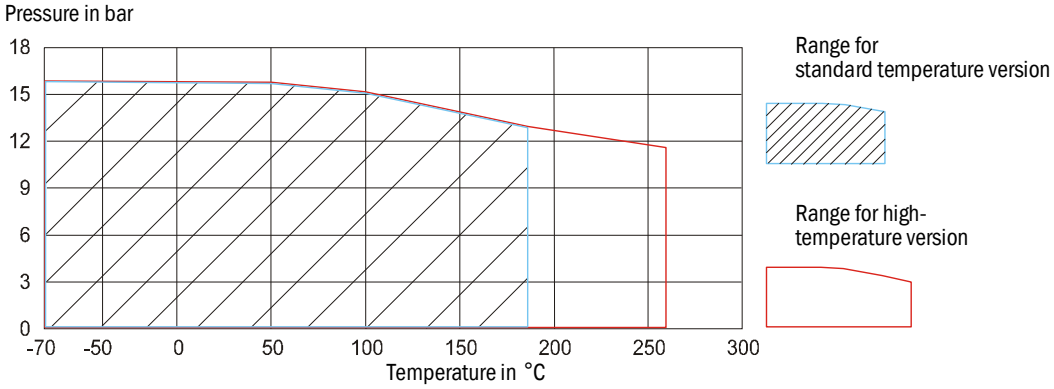


Probe without electronics (slave)



Modules/parts not named:
→ pg. 32, Fig. 7

Fig. 9 Permissible sample gas pressure/temperature range

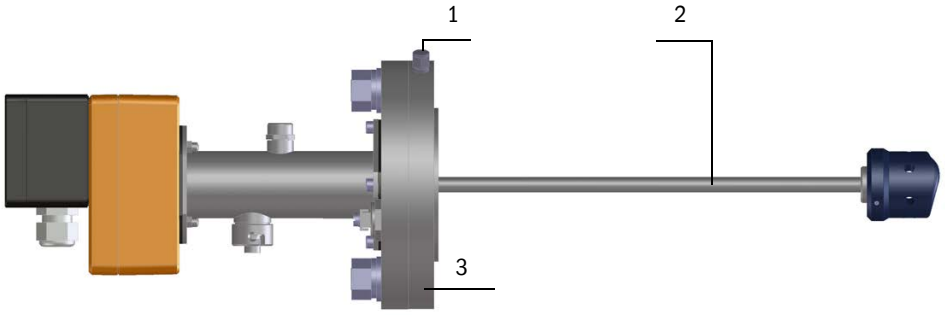


> ***NOTICE:*** **Range for low temperature version see p. 46, Fig. 16.**

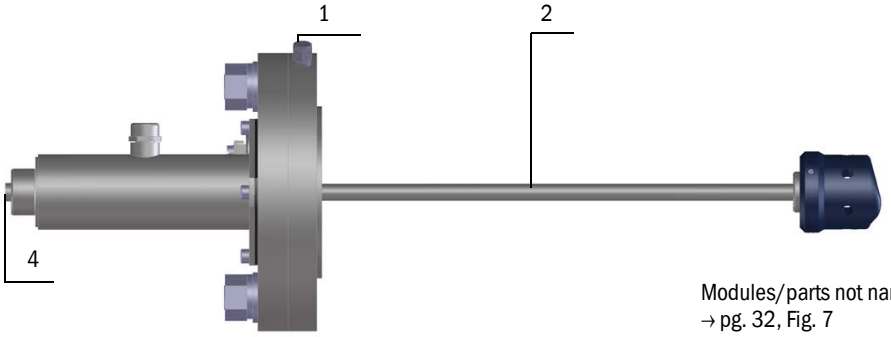
2 Retractable version

Fig. 10 FLSE100-EXS sender/receiver units, retractable version (guide rods not shown)

Probe with 2-channel electronics (master)



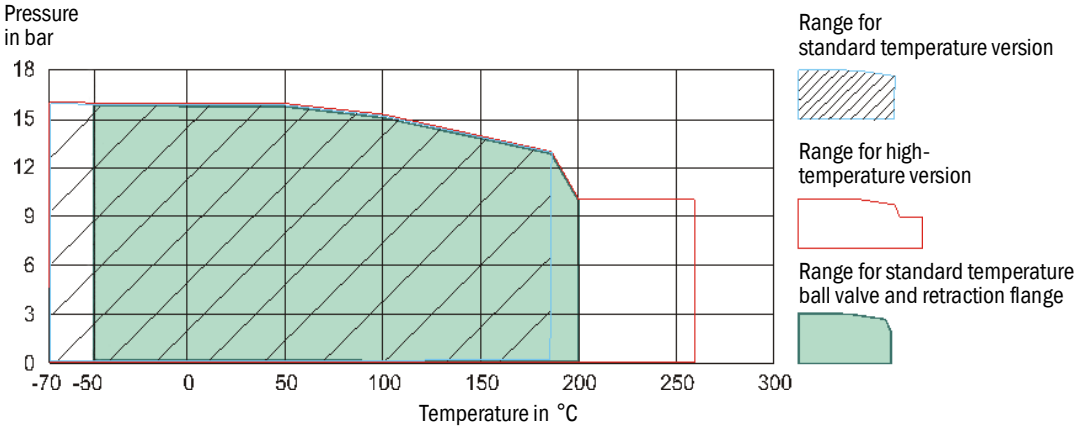
Probe without electronics (slave)



Modules/parts not named:
→ pg. 32, Fig. 7

1 Connection for optional venting2 Duct probe RE
3 Retraction flange4 Connection to master probe

Fig. 11 Permissible sample gas pressure/temperature range



NOTICE: Range for low temperature version see p. 46, Fig. 16.

II) FLSE100-EXS sender/receiver units certified according to ATEX for use in zone 1 and 2

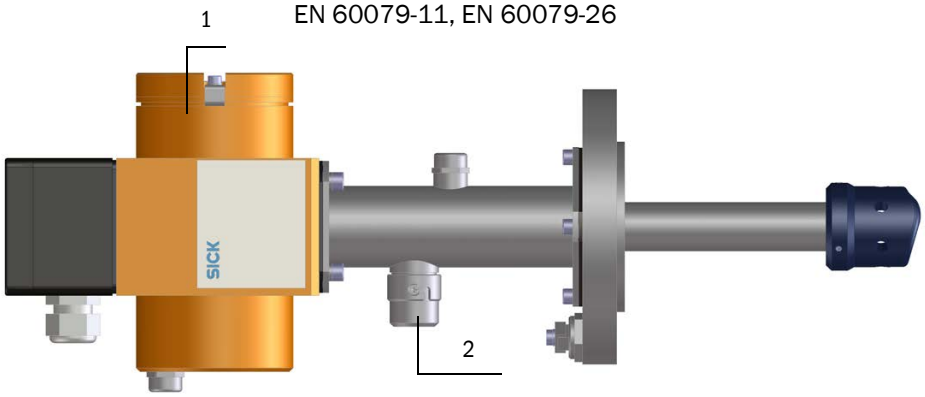
Explosion protection: ATEX II 1/2 G Ex d e [ia Ga] IIC T4 Ga/Gb, optionally T6 with reduced ambient temperature range (→ pg. 212, §6.1)

1 Non-retractable version

Fig. 12 FLSE100-EXS sender/receiver units, non-retractable version

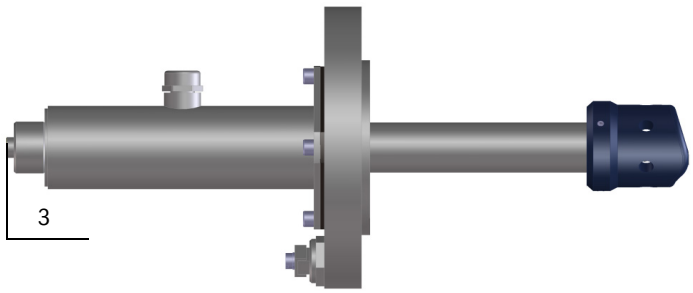
Probe with 2-channel electronics (master)

Applied standards: EN 60079-0, EN 60079-1, EN 60079-7, EN 60079-11, EN 60079-26



Probe without electronics (slave)

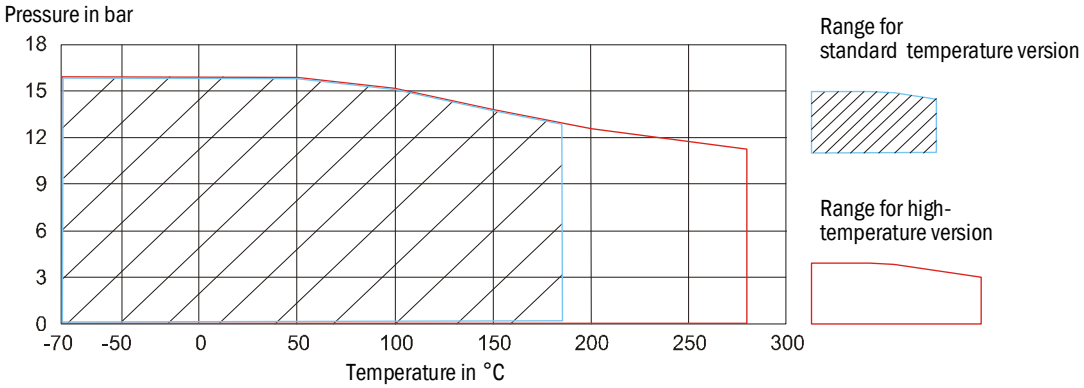
Applied standards: EN 60079-0, EN 60079-11, EN 60079-26



1 Electronic unit in Exd housing
2 Connection Ex ia to slave probe
3 Connection Ex ia to master probe

Modules/parts not named:
→ pg. 32, Fig. 7

Fig. 13 Permissible sample gas pressure/temperature range



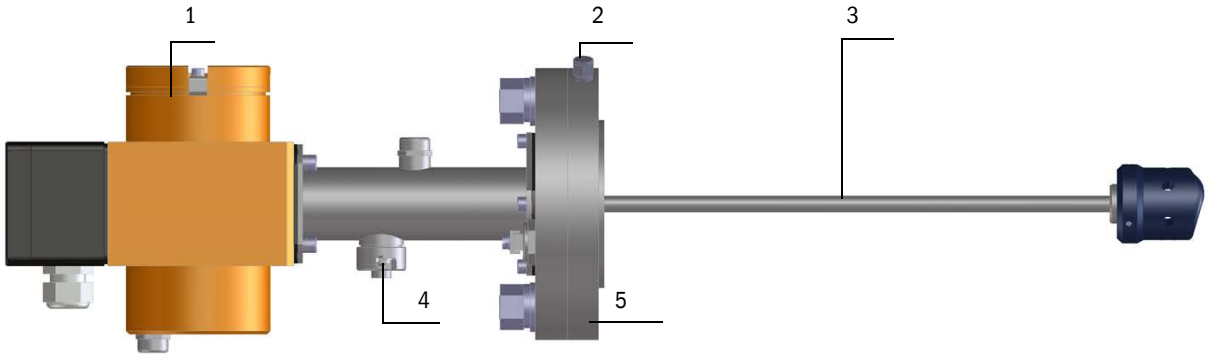
NOTICE: **Range for low temperature version see p. 46, Fig. 16.**

2 Retractable version

Fig. 14 FLSE100-EXS sender/receiver units, retractable version (guide rods not shown)

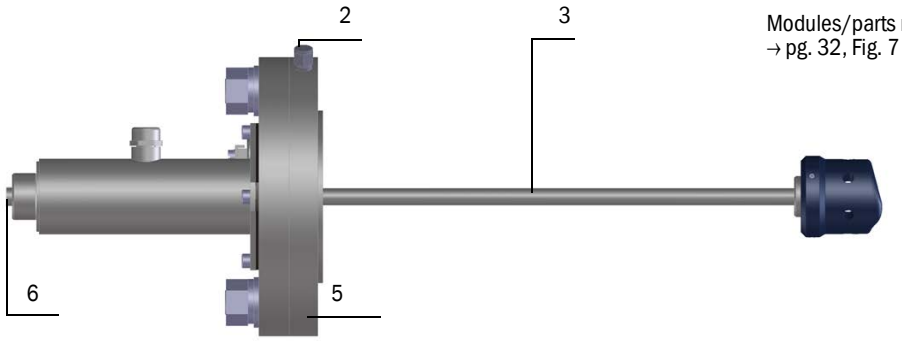
Probe with 2-channel electronics (master)

Applied standards: EN 60079-0, EN 60079-1, EN 60079-7, EN 60079-11, EN 60079-26



Probe without electronics (slave)

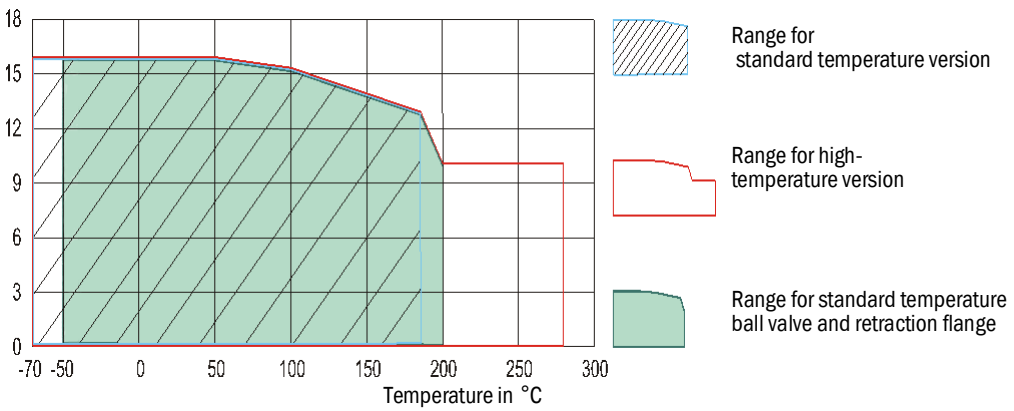
Applied standards: EN 60079-0, EN 60079-11, EN 60079-26



Modules/parts not named: → pg. 32, Fig. 7

1 Electronic unit in Exd housing
2 Connection for optional venting
3 Duct probe RE
4 Connection Ex ia to slave probe
5 Retraction flange
6 Connection Ex ia to master probe

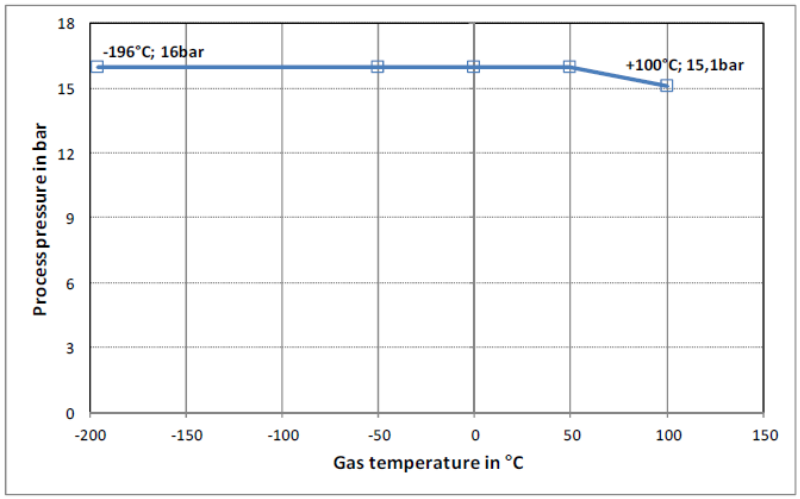
Fig. 15 Permissible sample gas pressure/temperature range



> ***NOTICE:*** **Range for low temperature version see p. 46, Fig. 16.**

Low temperature versions

Figure 16 Permissible sample gas pressure/temperature range for sender/receiver units in low temperature version, retractable and non-retractable versions



III) FLSE100-EXS sender/receiver units certified according to ATEX and IECEx for use in zone 1 and 2 and CSA approved Cl I Div1/Div2

Explosion protection: ATEX II 1/2 G Ex d [ia Ga] IIC T4 Ga/Gb,
CSA Cl I, Div1/Div2 groups BCD T4,
IECEx Ga/Gb Ex d[ia]IIC T4, optionally T6 with
reduced ambient temperature range (→ pg. 212, § 6.1)

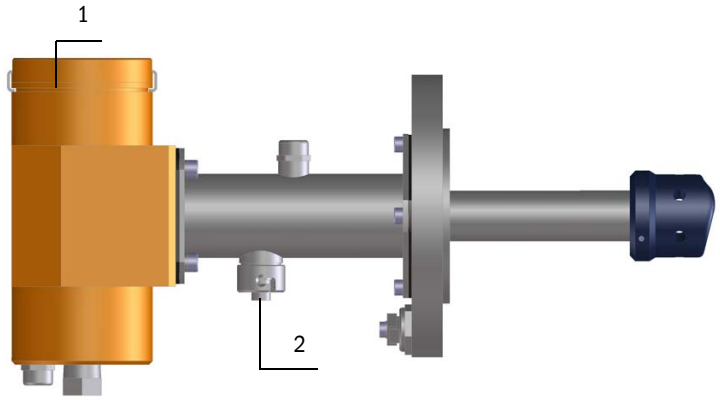
Applied standards: EN 60079-0, EN 60079-1,
EN 60079-11, EN 60079-26, respective IEC standards
C/UL standards

1 Non-retractable version

Permissible sample gas pressure/temperature range: → pg. 44, Fig. 13

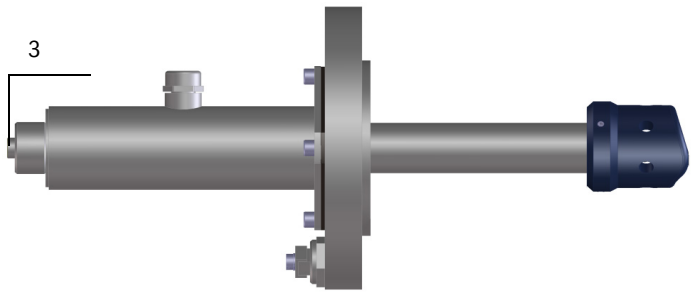
Fig. 17 FLSE100-EXS sender/receiver units

Probe with 2-channel electronics (master)



Probe without electronics (slave)

Applied standards: EN 60079-0, EN 60079-11, EN 60079-26



1 Electronic unit in Exd housing
2 Connection Ex ia to slave probe
3 Connection Ex ia to master probe

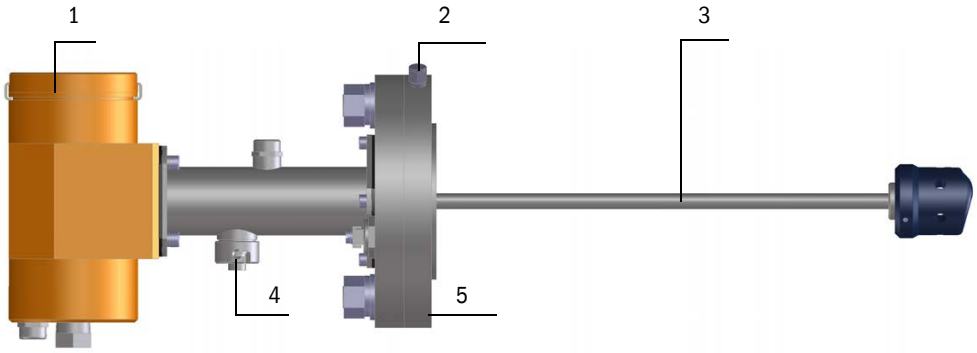
Modules/parts not named:
→ pg. 32, Fig. 7

2 Retractable version

Permissible sample gas pressure/temperature range: → pg. 45, Fig. 15

Fig. 18 FLSE100-EXS sender/receiver units, retractable version (guide rods not shown)

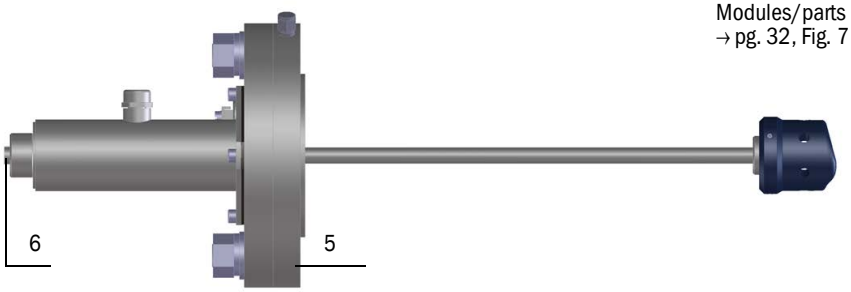
Probe with 2-channel electronics (master)



Probe without electronics (slave)

Applied standards: EN 60079-0, EN 60079-11, EN 60079-26

Modules/parts not named:
→ pg. 32, Fig. 7



1 Electronic unit in Exd housing
2 Connection for optional venting
3 Duct probe RE
4 Connection Ex ia to slave probe
5 Retraction flange
6 Connection Ex ia to master probe

2.2.1.3 **FLSE100-EX and FLSE100-EXRE sender/receiver units**

Transducers: medium dimensions

Process connection: prepared for mounting on counter flange 2" CL150 RF acc. to ASME B16.5 or counter flange DN50 PN16 form B1 acc. to EN 1092-1

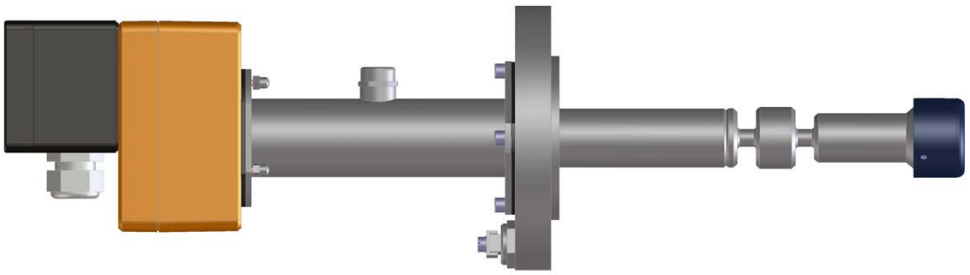
I) FLSE100-EX and FLSE100-EXRE sender/receiver units according to ATEX for use in zone 2 only

Explosion protection: ATEX II 3 G Ex nA IIC T4 Gc

Applied standards: EN 60079-0, EN 60079-15

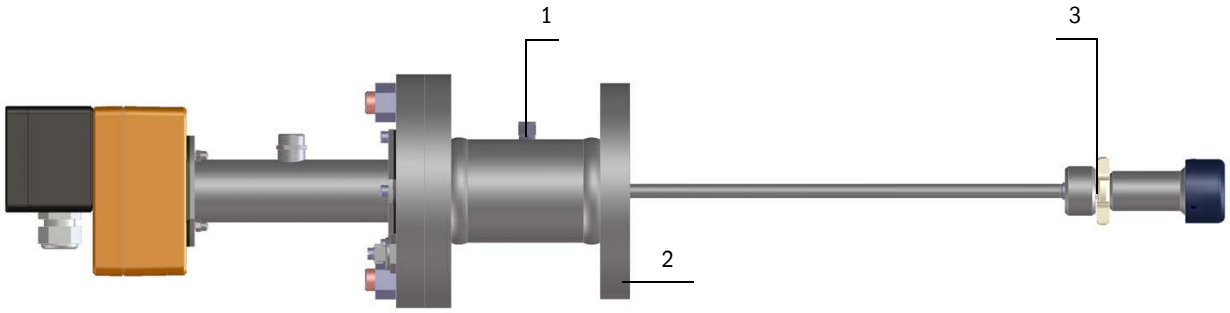
Fig. 19 FLSE100-EX and FLSE100-EXRE sender/receiver units

FLSE100-EX sender/receiver unit, non-retractable version



Permissible gas pressure/temperature range: → pg. 42, Fig. 9

FLSE100-EXRE sender/receiver unit, retractable version (guide rods not shown)



Permissible gas pressure/temperature range: → pg. 43, Fig. 11

1 Connection for optional venting
2 Retraction flange
3 Centering

Modules/parts not named:
→ pg. 32, Fig. 7

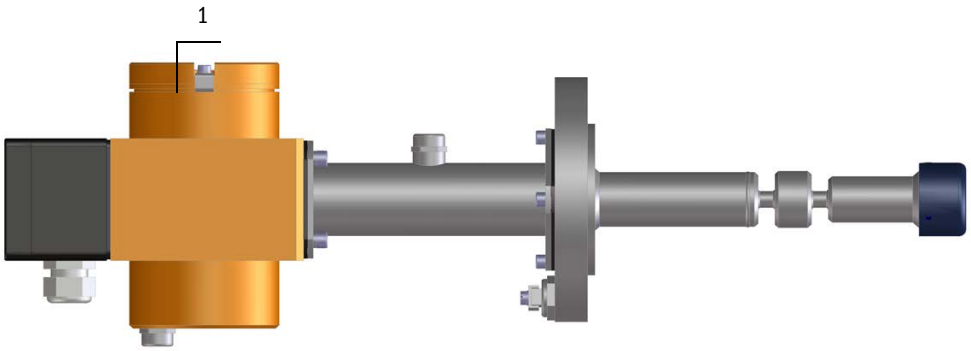
II) FLSE100-EX and FLSE100-EXRE sender/receiver units certified according to ATEX for use in zone 1 and 2

Explosion protection: ATEX II 2 G Ex d e IIC T4 Gb, optionally T6 with reduced ambient temperature range (→ pg. 212, §6.1)

Applied standards: EN 60079-0, EN 60079-1, EN 60079-7

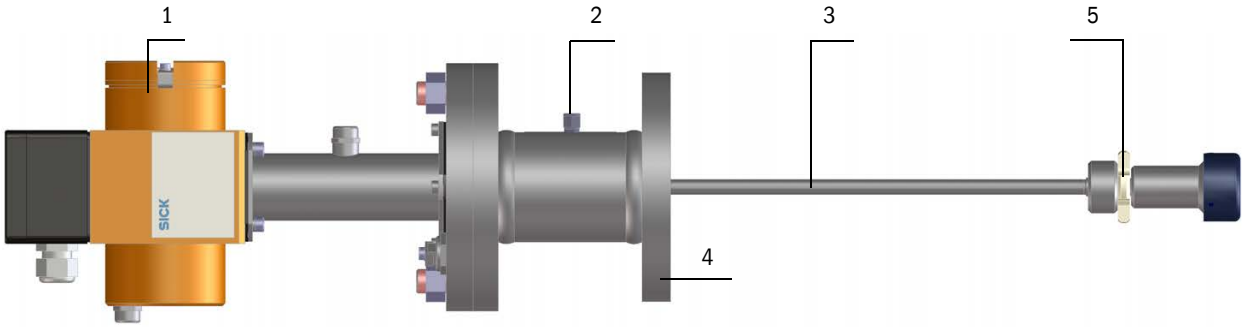
Fig. 20 FLSE100-EX and FLSE100-EXRE sender/receiver units

FLSE100-EX sender/receiver unit, non-retractable version



Permissible gas pressure/temperature range: → pg. 44, Fig. 13

FLSE100-EXRE sender/receiver unit, retractable version (guide rods not shown)



Permissible gas pressure/temperature range: → pg. 45, Fig. 15

1 Electronic unit in Exd housing
2 Connection for optional venting
3 Duct probe RE
4 Retraction flange
5 Centering

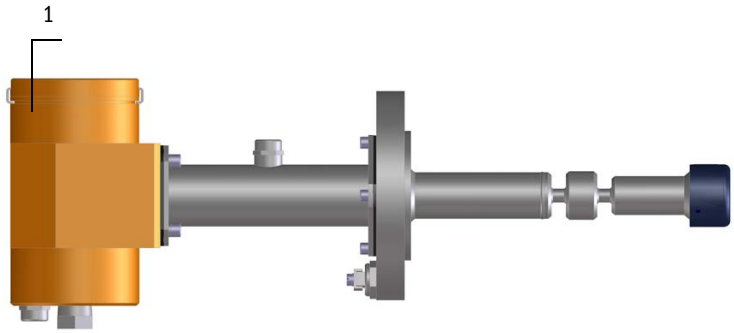
Modules/parts not named: → pg. 32, Fig. 7

III) Sender/receiver units certified according to ATEX and IECEx for use in zone 1 and 2 and CSA approved Cl I Div1/Div2

Explosion protection:	ATEX II 2 G Ex d IIC T4 Gb, CSA Cl I, Div1/Div2 groups BCD T4, IECEx Ex d IIC T4, optionally T6 with reduced ambient temperature range (→ pg. 212, §6.1)
Applied standards:	EN 60079-0, EN 60079-1, resp. IEC standards C/UL standards

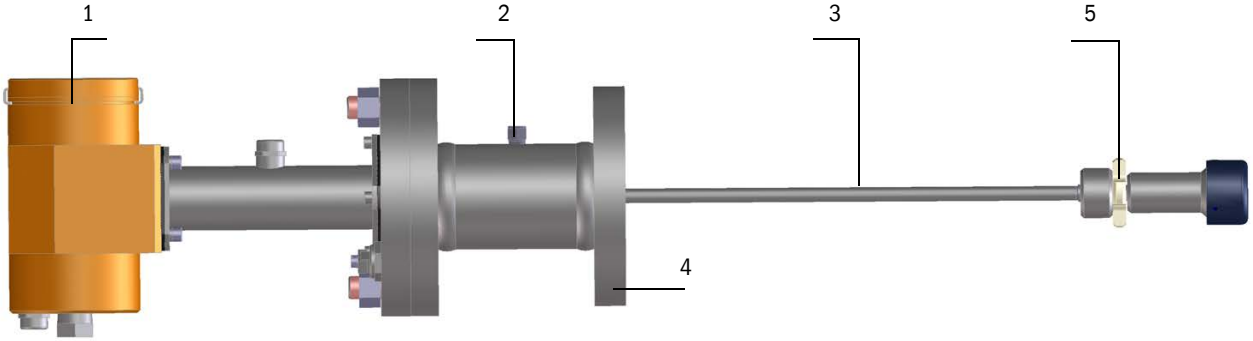
Fig. 21 FLSE100-EX and FLSE100-EXRE sender/receiver units

FLSE100-EX sender/receiver unit, non-retractable version



Permissible gas pressure/temperature range: → pg. 44, Fig. 13

FLSE100-EXRE sender/receiver unit, retractable version (guide rods not shown)



Permissible gas pressure/temperature range: → pg. 45, Fig. 15

1 Electronic unit in Exd housing
2 Connection for optional venting
3 Duct probe RE
4 Retraction flange
5 Centering

Modules/parts not named: → pg. 32, Fig. 7

2.2.1.4 **FLSE100-EXPR sender/receiver units**

Transducers: small size

Process connection: prepared for mounting on counter flange 3" CL150 RF acc. to ASME B16.5 or counter flange DN80 PN16 form B1 acc. to EN 1092-1

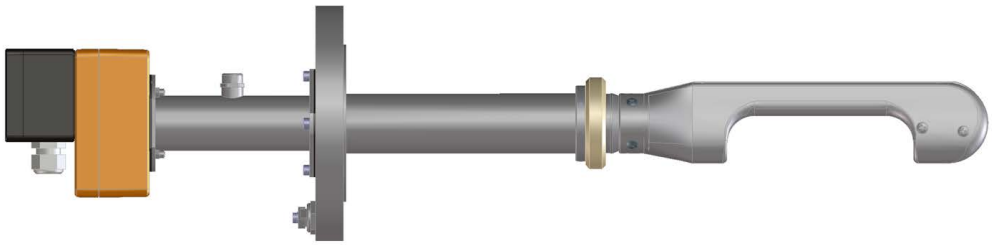
I) **FLSE100-EXPR sender/receiver unit according to ATEX for use in zone 2 only**

Explosion protection: ATEX II 3 G Ex nA IIC T4 Gc

Applied standards: EN 60079-0, EN 60079-15

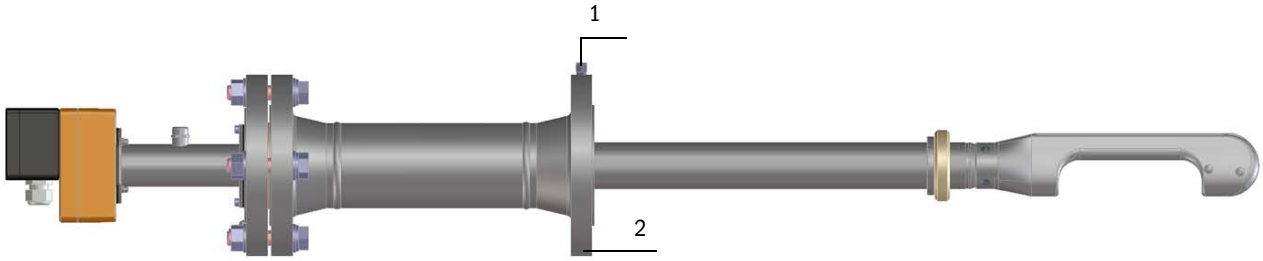
Fig. 22 FLSE100-EXPR sender/receiver units

Non-retractable version



Permissible gas pressure/temperature range: → pg. 42, Fig. 9

Retractable version (guide rods not shown)



Permissible gas pressure/temperature range: → pg. 43, Fig. 11).

NOTICE:
Maximum pressure for use of retraction mechanism: 0.5 barg

1 Connection for optional venting
2 Retraction flange

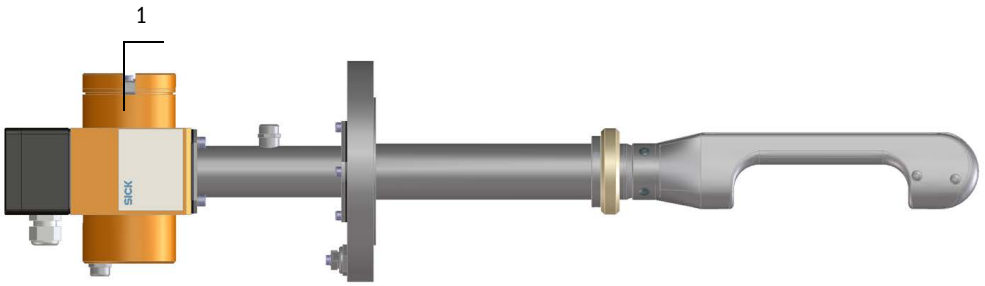
Modules/parts not named:
→ pg. 32, Fig. 7

II) FLSE100-EXPR sender/receiver unit certified according to ATEX for use in zone 1 and 2

Explosion protection:	ATEX II 1/2 G Ex d e [ia Ga] IIC T4 Ga/Gb, optionally T6 with reduced ambient temperature range (→ pg. 212, §6.1)
Applied standards:	EN 60079-0, EN 60079-1, EN 60079-7, EN 60079-11, EN 60079-26

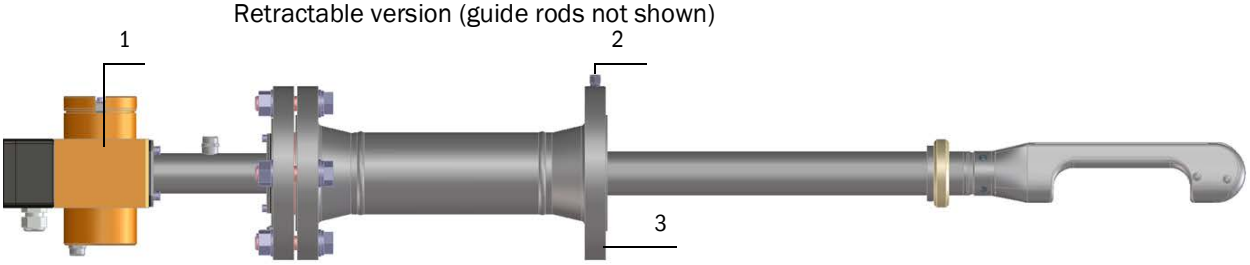
Fig. 23 FLSE100-EXPR sender/receiver unit for ATEX zone 1 and 2

Non-retractable version



Permissible gas pressure/temperature range: → pg. 44, Fig. 13

Retractable version (guide rods not shown)



Permissible gas pressure/temperature range: → pg. 45, Fig. 15).

NOTICE:
Maximum pressure for use of retraction mechanism: 0.5 barg

1 Electronic unit in Exd housing
2 Connection for optional venting
3 Retraction flange

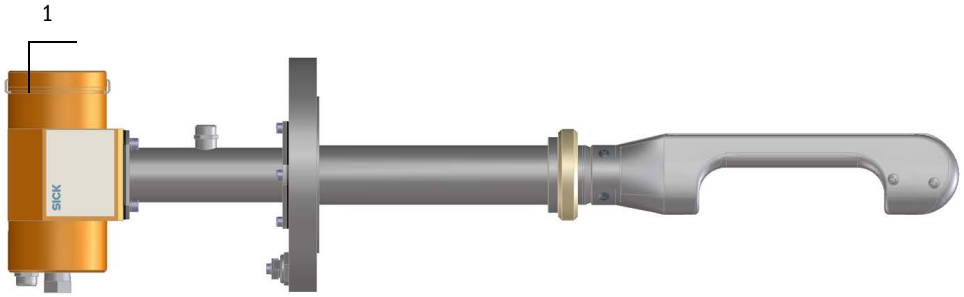
Modules/parts not named:
→ pg. 32, Fig. 7

III) FLSE100-EXPR sender/receiver unit certified according to ATEX and IECEx for use in zone 1 and 2 and CSA approved Cl I **Div1/Div2**

Explosion protection:	ATEX II 1/2 G Ex d [ia Ga] IIC T4 Ga/Gb, CSA Cl I, Div1/Div2 group BCD T4, IECEx Ga/Gb Ex d[ia]IIC T4, optionally T6 with reduced ambient temperature range (→ pg. 212, §6.1)
Applied standards:	EN 60079-0, EN 60079-1, EN 60079-11, EN 60079-26, respective IEC standards C/UL standards

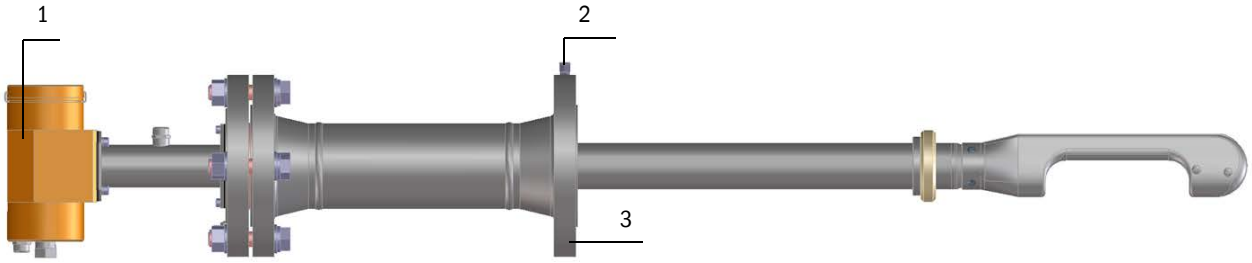
Fig. 24 FLSE100-EXPR sender/receiver unit for ATEX, CSA and IEC

Non-retractable version



Permissible gas pressure/temperature range: → pg. 44, Fig. 13

Retractable version (guide rods not shown)



Permissible gas pressure/temperature range: → pg. 45, Fig. 15).

> ***NOTICE:***
> Maximum pressure for use of retraction mechanism: 0.5 barg

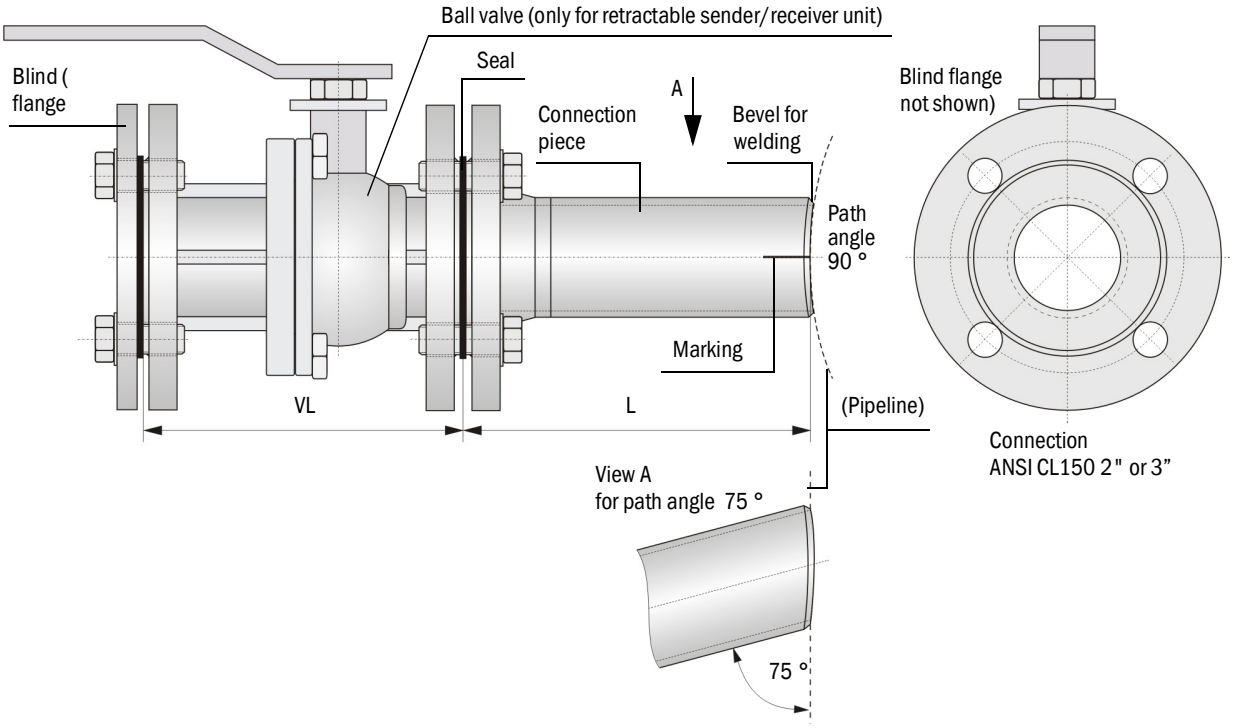
1 Electronic unit in Exd housing
2 Connection for optional venting
3 Retraction flange

Modules/parts not named:
→ pg. 32, Fig. 7

2.2.2 Mounting accessories

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

Fig. 25 Mounting accessories (according to ANSI CL150; example with nozzle 2" Long Welding Neck")



NOTICE:

Use of mounting accessories for standard temperature range -70...+180 C:

- The ball valve must not be insulated for media temperatures below -40 °C or higher than +160°C.
- For gas temperatures below -40 °C or higher than +180°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 as listed in → p. 56, 2.2.2.1. Material for use outside this specification is available as option or on request.

2.2.2.1 Nozzles, blind flanges and seals

The nozzles are an integrated part of the measurement system depending on the type:

- For FLOWSIC100 EX-S/EX/EX-RE: Nozzles of type "Long Welding Neck"
- For FLOWSIC100 EX-PR: Nozzles of type "Long Welding Neck"

Other nozzle types (latro, heavy barrel) are available as an option.

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

Nozzle, blind flange and seal according to ANSI

Component	Connection	Material (ASTM)	max. pressure [4]	L [mm] [1]	Use for
Nozzle					
Nozzle CL150 2" CS 90°	CL150 2"	Carbon steel A105	16 bar @ -10 ... +100 °C	133,5	FLSE100-EXS
NozzleCL150 2" CS 75°				181,0	FLSE100-EX/EXRE
Nozzle CL150 3" CS 75°	CL150 3"			182,0 [2]	FLSE100-EXPR
Blind flange					
Blind flange CL150 2" CS	CL150 2"	Carbon steel A105	16 bar @ -10 ... +100 °C	-	FLSE100-EXS, EXRE/EX
Blind flange CL150 3" CS	CL150 3"				FLSE100-EXPR
Seal 2"					
Seal B9A 2" 150 1.4571 [3]	CL150 2"	Stainless steel 316 L or 316 Ti, graphite	16 bar @ -196 ... +280 °C	-	FLSE100-EXS, EX, EXRE
Seal 3"					
Seal B9A 3" 150 1.4571 [3]	CL150 3"	Stainless steel 316 L or 316 Ti, graphite	16 bar @ -196 ... +280 °C	-	FLSE100-EXPR

[1]: Take into account additional 3 mm "welding space" for nozzles of type "Long Welding Neck"

[2]: Nozzle length 212,0 mm for pipe size 12"

[3]: Other sealing material on request

[4]: According to diagrams of pressure/temperature ranges (e.g. → pg. 42, Fig. 9)

- Seals must be chosen in accordance with application conditions (gas temperature).
- An optional insulation set with polymer seals and sleeves for bolts is available

Nozzle, blind flange and seal according to DIN

Component	Connection	Material	max. pressure [4]	L [mm] [1]	Use for
Nozzle					
Nozzle PN16 DN50 CS 90°	PN16 DN50	Carbon steel P350GH	16 bar @ -10 ... +100 °C	161,5	FLSE100-EXS
Nozzle PN16 DN50 CS 75°				209,0	FLSE100-EX/EXRE
Nozzle PN16 DN80 CS 75°	PN16 DN80	A105 (ASTM)		205,0 [2]	FLSE100-EXPR
Blind flange					
Blind flange PN16 DN50 CS	PN16 DN50	Carbon steel P350GH	16 bar @ -10 ... +100 °C	-	FLSE100-EXS, EXRE/EX
Blind flange PN16 DN80 CS	PN16 DN80				FLSE100-EXPR
Seal 2"					
Seal B9A PN16 DN50 1.4571 [3]	PN16 DN50	Stainless steel 316 L or 316 Ti, graphite	16 bar absolute @ -196 ... +280 °C	-	FLSE100-EXS, EX, EXRE
Seal 3"					
Seal B9A PN16 DN80 1.4571 [3]	PN16 DN80	Stainless steel 316 L or 316 Ti, graphite	16 bar absolute @ -196 ... +280 °C	-	FLSE100-EXPR

[1]: Take into account additional 3 mm "welding space" for nozzles of type "Long Welding Neck"

[2]: Nozzle length 235 mm for pipe size 12"

[3]: Other sealing material on request

[4]: According to diagrams of pressure/temperature ranges (e.g. → pg. 42, Fig. 9)

2.2.2.2 Ball valve

Ball valves are only required for retractable sender/receiver units.

Ball valve according to ANSI

Component	Connection	Material (ASTM)	Gas temperature range	Max. pressure	VL [mm]	Use for
Standard Temperature						
Ball valve CL150 2" SS	CL150 2"	Stainless steel 1.4408 (CF08M)	-100 ... +200 °C	16 bar @ -10 ... +150 °C	178	FLSE100-EXS, EXRE
Ball valve CL150 3" SS	CL150 3"				203	FLSE100-EXPR
High Temperature						
Ball valve CL150 2" SS	CL150 2"	Stainless steel 1.4408 (CF08M)	-50 ... +350 °C	16 bar @ -10 ... +150 °C	178	FLSE100-EXS, EXRE
Ball valve CL150 3" SS	CL150 3"				203	FLSE100-EXPR
Low temperature						
Ball valve CL150 2" SS	CL150 2"	Stainless steel 1.4408 (CF08M)	-196 ... +100 °C	16 bar @-196 ... +20 °C	178	FLSE100-EXS, EXRE
Ball valve CL150 3" SS	CL150 3"				203	FLSE100-EXPR

Ball valve according to DIN

Component	Connection	Material (ASTM)	Gas temperature range	Max. pressure	VL [mm]	Use for
Standard Temperature[1]						
Ball valve PN16 DN50 SS	PN16 DN50	Stainless steel 1.4408	-50 ... +200 °C	16 bar @ -10 ... +150 °C (acc. EN 1092-1, table 4.4.1-4)	150	FLSE100-EXS, EXRE
Ball valve PN16 DN80 SS	PN16 DN80				180	FLSE100-EXPR

[1] High and low temperature ball valves acc. to DIN on request.

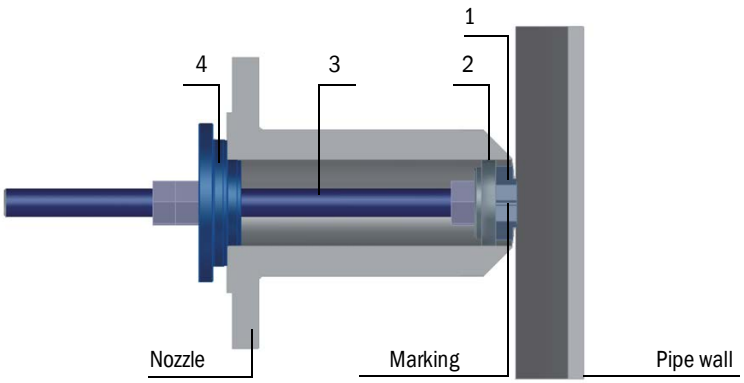
2.2.3 Nozzle installation tool

The installation tool serves to align and weld the nozzle on the pipeline. It consists of:

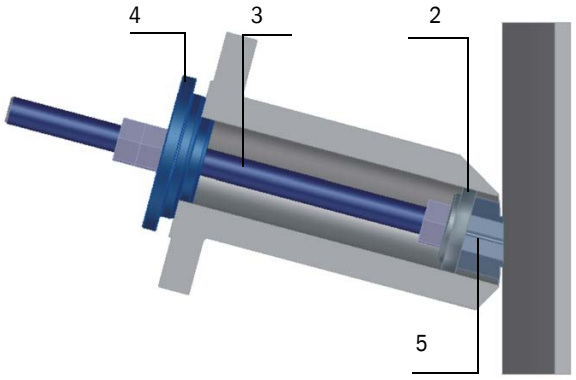
- welding aid M16 75 °(1) or welding aid M16 90 °(5),
- centering plate 2" (2) or centering plate 3" (6),
- threaded rod M16 length 290 mm (3),
- centering 2"/3" (4),
- installation paper strip as tool to determine the exact nozzle position on the pipeline.

Fig. 26 Nozzle installation tool

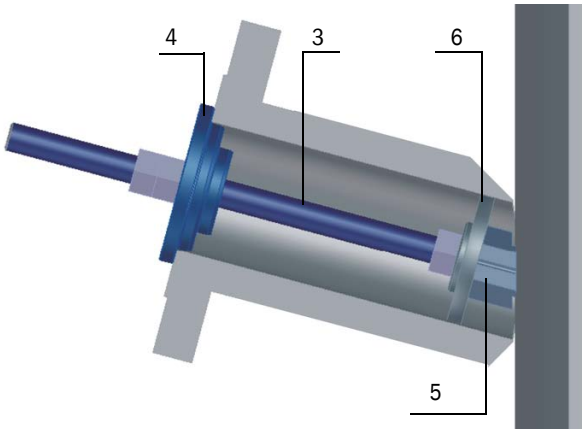
Design for FLOWSIC100 EX-S



Design for FLOWSIC100 EX / EX-RE



Design for FLOWSIC100 EX-PR



2.2.4 MCUP control unit

The control unit has the following functions:

- Control of the data transfer and processing of the sender/receiver unit data connected via the RS485 interface.
- Signal output via analog output (measured value) and relay outputs (device status)
- Signal input via analog and digital inputs
- Voltage supply of the connected sender/receiver units
- Communication with higher level control systems via optional modules

Plant and device parameters can be set easily using a laptop and user friendly operating program via:

- Service interface USB 1.1 or RS232
- Service interface RS485 (standard for ex-protected MCUP)

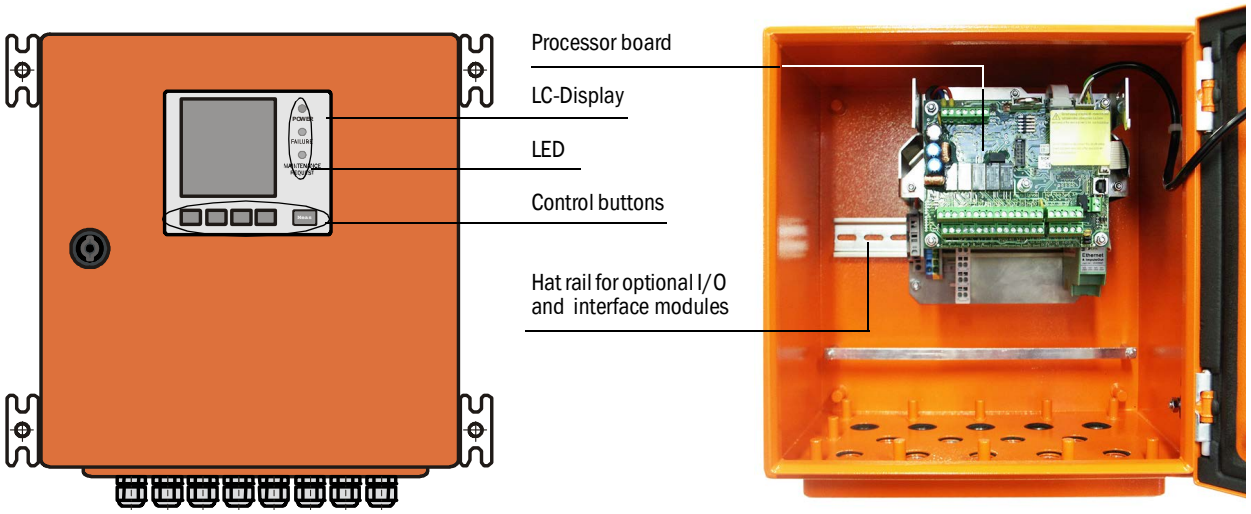
The parameters are stored reliably even in case of power failure.

Versions

Version	Explosion protection / applied standards	Housing type	Power supply	Cable entries	Options
MCUP non-Ex	-	Wall housing, compact size, painted steel	24 V d.c. 90 ... 250 V a.c.	4 x M20, 1x M16 (cable glands included); 1 x M25 (plug)	-
		Wall housing, Medium size, painted steel		9x M20, 5x M25 (3 measuring points)	NPT cable entries and flange plate connection, cable glands, painted stainless steel housing
		19" rack, aluminium		Terminals	-
MCUP ATEX[1)]	II 3 G Ex nA IIC T4 Gc	Wall housing, Medium size, painted steel	24 V d.c. 115/ 230 V a.c. automatically controlled	9 x M20, 5 x M25 (3 measuring points)	NPT cable entries and flange plate connection, cable glands, painted stainless steel housing
	II 2 G Ex de IIC T6	Wall housing Ex-d with Ex-e terminal compartment, size 4 (type STAHL), painted aluminum	24 V d.c. 90 ... 250 V a.c.	9 x M20, 5 x M25 (1 or 2 measuring points), flange plate connection	NPT cable entries, 3 measuring points, cable glands, painted stainless steel housing
		Wall housing Ex-d with Ex-e terminal compartment, size 6 (type STAHL), aluminum			
MCUP CSA	CSA Cl I, Div 1	Wall housing Exd, size 4 (type STAHL), painted aluminum	100 ... 240 V a.c. 24 V d.c.	3x3/4" NPT, 6x1/2" NPT	Cable glands
		Wall housing Exd, size 6 (type STAHL), painted aluminum		5x3/4" NPT, 9x1/2" NPT	
	CSA Cl I, Div 2; Cl I, zone 2	Wall housing, Medium size, painted steel	24 V d.c. 115/ 230 V a.c. automatically controlled	9 x 1/2" NPT, 5 x 3/ 4" NPT (3 measuring points), flange plate connection	Painted stainless steel housing, cable glands

1): not applicable for USA and Canada

Fig. 27 MCUP control unit (example medium size wall housing)



Standard interfaces (without optional modules)

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
1 output 0/2/4 ... 22 mA (active) for optional output of measured variables: ● Velocity ● Volume flow a.c. ● Volume flow s.c. ● Temperature ● Mass flow ● Molecular weight Resolution 10 bits	2 inputs 0 ... 20 mA (standard; without electric isolation) for optional input of computation variables (temperature, pressure, humidity) Resolution 10 bits	5 changeover contacts 30 V a.c./d.c., 1 A) Status signals: ● Operation/malfunction ● Maintenance ● Check cycle ● Maintenance requirement ● Limit value/direction	2 potential-free contacts for: ● Connection of a maintenance switch ● Triggering of a complete check cycle	● Service interface: – USB 1.1 + RS232 (on terminals) for MCUP non ex-protected – USB 1.1 + RS485 (on terminals) for MCUP ex-protected for measured value queries, setting of parameters and software updates ● RS485 for sensor connection

Display module

Module to display measured values and status information of the connected sender/receiver unit(s), selection via control buttons.

– Displays

The graphic display shows two main measured values preselected at the factory of a connected pair of sensors by means of a bar graph. Alternatively, up to 8 single measured values of a sender/receiver unit can be displayed.

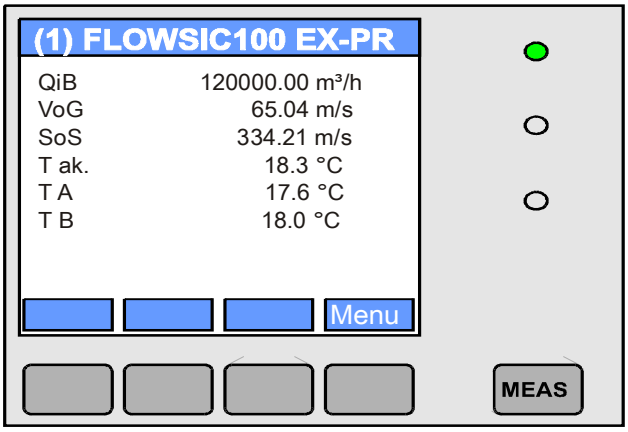
Type		Display
LED	Power (green)	Power supply OK
	Failure (red)	Function fault
	Maintenance request (yellow)	Maintenance requirement

LC-Display	Graphic display (main screen)	Displayed values: – Volume flow in actual state (Q.act.), – Volume flow in standard state (Q.std.), – Gas velocity (VoG), – Speed of sound (SoS), – Transducer temperature A (T A), – Transducer temperature B (T B), – Signal-noise ratio A (SNR A), – Signal-noise ratio B (SNR B), – Mass flow – Molecular weight
	Text display	Max. 8 measured values (see graphic display)

– Control buttons

Button	Function
Meas	– Select the single measured value to be shown – Toggle between text and graphic display – Display the contrast setting (after 2.5 s)
Arrows	Select next/previous measured value page
Status	Display alarm or fault message
Menu	Display main menu

Fig. 28 LC-Display



Optional modules

Module type	MCUP non Ex		MCUP ATEX Ex zone 2	MCUP ATEX Ex zone 1	MCUP CSA Cl I, Div2 / zone 2	MCUP CSA Cl I, Div1
	Compact or medium housing	19” rack				
Analog output module	max. 3 pcs.; with two outputs 0/4 ... 22 mA of each one (max. load 500 Ω)					
Analog input module	max. 2 pcs.; with two inputs 0/4 ... 22 mA of each one					
Digital output module	max. 1 pc.; with 2x changeover contacts (load of 30 V a.c./d.c., 5 A; 30 V d.c., 2 A for Ex zone 2)					
Accessories required for analog or digital modules	1 pc. module carrier per module	1 pc. module carrier 19” for up to 8 modules	1 pc. module carrier per module			
	1 pc. connection cable					
Interface module (max. 1 pc.)	Pulse, Ethernet + pulse, Ethernet triplex + pulse, MODBUS TCP + pulse, MODBUS RS485 + pulse, HARTBUS AO + pulse, PROFIBUS RS485 + pulse, Foundation Fieldbus + pulse					

NOTICE:
The maximum number of analog modules is 4.

Module carriers (MCUP non Ex with compact or medium housing) have to be positioned on hat rail (→ pg. 62, Fig. 27).

- Profibus DP-V0 for transmission via RS485 according to DIN 19245, Part 3 as well as IEC 61158.
- The Modbus module supports MODBUS ASCII and MODBUS RTU according to "Modbus Application Protocol Specification V1.1b".
- Detailed specification for Modbus RS485 and HART® bus modules is contained on the Product CD (can be provided on request before system delivery).
- The pulse output is part of the interface modules to output the measuring values for actual volume, standard volume and mass (connection as "NAMUR" or "Open Collector" → pg. 148, Fig. 85; configuration → pg. 176, § 4.3.5).

Type code of Control Unit MCUP

The following type codes define the various configuration options:

		Type code for control unit process															
Parameter	Design/Description	MCUP-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Supply voltage	90 ... 250 V a.c.		W														
	115/230 V a.c. (zone 2 only)		S														
	Optional 24 V d.c.		2														
Purge air supply	Not integrated			N													
Case variant	Wall housing Compact, painted, SICK orange, SS 1.4016 or equivalent **)				A												
	Wall housing Medium, painted, SICK orange, SS 1.4016 or equivalent, type 4				B												
	Housing Ex-d/Exe, painted, Al/St, size 4 (type STAHL) *)				D												
	Housing Ex-d, painted, Al, size 4 (type STAHL)				K												
	Housing Ex-d, painted, Al, size 6 (type STAHL)				L												
	19" rack **)				F												
Number of measuring points	1 measuring point (1x1-path, 1x2-path)					1											
	2 measuring points (2x1-path)					2											
	3 measuring points (3x1-path)					3											
Housing cable entry	No cable entries						N										
	Cable entries with metric thread						M										
	Cable entries with NPT thread						C										
Ex-protection	without Ex-Certification							N									
	ATEX Zone 1, IIC T6							A									
	ATEX Zone 2 IIC T4							B									
	CSA Cl I, Div 1, T6							D									
	CSA Cl I, Div2, T4							E									
	INMETRO Zone 1							F									
	INMETRO Zone 2							G									
Analog input option (additional to 2 AI's incl. in standard)	Without optional module, 2 x AI on board								0								
	1 analog input module								1								
	2 analog input modules								2								
Analog output option (2 outputs per module)	Without optional module, 1 x AO on board									0							
	1 analog output module									1							
	2 analog output modules									2							
	3 analog output modules									3							
	Digital transmitter interface (HART)									5							
	1 analog input module, digital transmitter interface (HART)									6							
	2 analog input modules, digital transmitter interface (HART)									7							
Digital input option (4 inputs per module)	Without optional modules, 2 x DI on board										0						
	1 digital input module (not yet available)										1						
	2 digital input modules (not yet available)										2						

Digital output W option (2 change-over contacts per module)	Without optional modules, 5 x relay contacts on board		0					
	1 digital output module		1					
Digital output S option (4 make-contacts per module)	Without optional module			0				
	1 digital output module (not yet available)			1				
Optional Interface module	without interface				N			
	T/P-MOD RS485,MODBUS ASCII/ RTU,pulse				M			
	T/P-MOD AO,HARTBUS,pulse				H			
	T-MOD CONV HART FF,pulse (on request)				F			
	T/P-MOD RS485,PROFIBUS,pulse				P			
	T/P-MOD pulse				A			
	T/P-MOD Ethernet V1,COLA-B, tri-plex,pulse				V			
	T/P-MOD Ethernet V2,MODBUS TCP,pulse				Q			
	T-MOD CONV IF FF,pulse (on request)				B			
	T-MOD CONV IF FF,PID,pulse (on request)*)				C			
Remote Interface	Reserve					R		
	RS485, COLA-B/MODBUS ASCII/ RTU					S		
	T-MOD Ethernet V2,COLA-B, Service					W		
	T-MOD Ethernet V2,MODBUS TCP, Service					Q		
Special Solution	On request							

*): not applicable for CSA approved versions
**): no explosion protection

Example: MCUP-W N D 1 M A 0 1 0 0 0 M R N

- Power supply 90 ... 250 V a.c.
- no integrated purge air supply
- Ex-d housing
- one measuring point
- metric cable glands
- ATEX zone 1 T6
- without analog input module
- with 1 analog output module
- without digital input module
- without digital output module W
- without digital output module S
- Modbus RS485 with pulse output module
- reserve
- without additional features

2.2.5 Connection cables and cable glands

Connection cables serve communication between sender/receiver units FLSE100 and between sender/receiver units and control unit MCUP. SICK offers standard cables and cable glands:

- Connection between sender/receiver units:
  - cable UNITRONIC® Li2YCYv (TP) with reinforced black outer sheath, fixed cable length
  - cable glands metric M20, NPT ½", material brass and stainless steel
- Connection between sender/receiver unit master and MCUP:
  - cable UNITRONIC® Li2YCYv (TP) with reinforced black outer sheath, meter good with free selectable lengths in steps of 5 m
  - cable glands metric M20, M25, NPT ½", NPT ¾", material brass and stainless steel

Other connection cables for MCUP (power supply, outputs MCUP etc.) are not in the SICK scope of delivery.

NOTICE: **Factory pre-installed cable glands at S/R units and MCUP**

- ► Install only fixed cables and wires in the cable glands. The plant operator must ensure an appropriate strain relief.
- ► The cable and conduit entries must be installed with mechanically protection against inadmissible impact energy according to EN 60079-0 section 26.4.2.

NOTICE: **Suitability of factory pre-installed plastic cable glands at MCUP ATEX Zone 2**

- ► In accordance with EN 60079-0, section 26.4.2 the pre-installed PA plastic cable glands at MCUP ATEX zone 2 are suitable for equipment group II with low degree of mechanical hazard (impact energy “low”, tested with drop height 0.4m or 4J).
- ► If there is a risk of higher mechanical stress, especially at low temperatures, the use of metal cable glands is recommended (available on request).

Cable type	Connection	Length	Use for device type	Remark
Cables for interconnection FLSE100 master - FLSE100 slave				
Analog cable Exi	TNC at both ends	3 m	FLOWSIC100 EX-S	for analog connection
UNITRONIC Li2YCYv(TP), 2x2x0.5 mm² twisted pair	single wires, tinned leads at both ends	5 m 10 m	FLOWSIC100 EX, FLOWSIC100 EX-RE	Ex-d cable glands must be fitted to cables for sender/receiver units without an Exe terminal compartment.
Cables for interconnection FLSE100 master - MCUP				
UNITRONIC Li2YCYv(TP), 2x2x0.5 mm² twisted pair	single wires, tinned leads at both ends	5 m 10 m	FLOWSIC100 EX-S, FLOWSIC100 EX, FLOWSIC100 EX-RE, FLOWSIC100 EXPR	Ex-d cable glands must be fitted to cables for sender/receiver units without an Exe terminal compartment.
	single wires at both ends	yard good		Maximum length 500 m

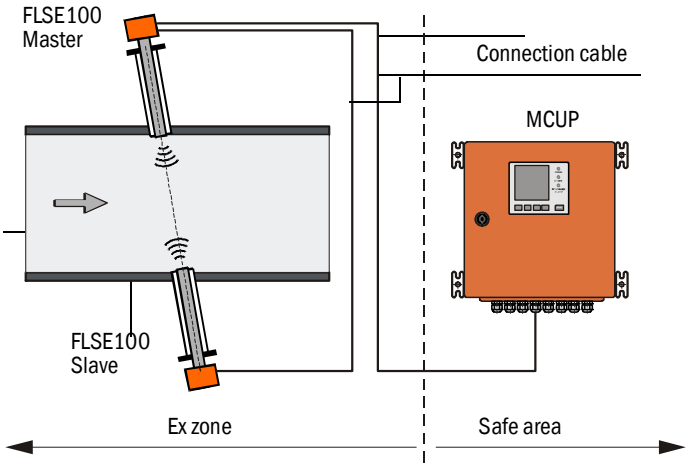
The maximum overall length of all cables of a measuring system (installation of 1 pair of s/r units) is up to 1,000 m. For cabling of 2-path or 3x1 path systems (installation with 2 pairs and 3 pairs of s/r units) the maximum possible cable length is reduced according to the number of pairs of s/r units (500 m for 2 pairs of s/r units, 300 m for 3 pairs of s/r units).

Specific requirements for selection and use of cables (esp. in hazardous areas) → pg. 121, § 3.8.1.

NOTICE:

- Only analog cable Exi of device type FL100 EX-S is approved for ATEX and CSA versions (interconnection of master and slave unit).
- All other cables offered by SICK are only for ATEX/IECEx versions for use in ATEX zone 1 or zone 2 applications.
- All cable glands offered are only for ATEX/IECEx versions for use in ATEX zone 1 or zone 2 applications.
- Cables, cable glands and other installation material for CSA Cl I, Div 1 versions must be provided by the customer. Solutions for CSA Cl I, Div2/zone 2 versions are available on request.

Fig. 29 Connection cables



2.2.6 Meter body option (spool piece)

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

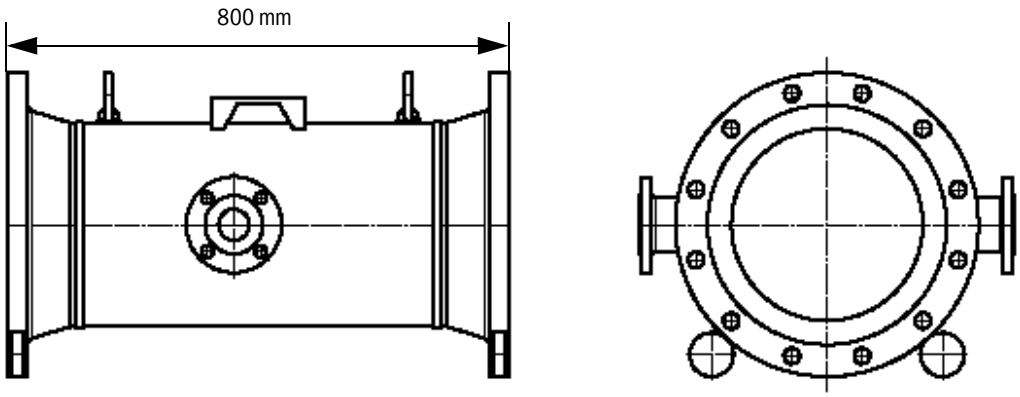
The installation length of the spool piece depends on the nominal diameter of the pipe:

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

System solutions (FLOWSIC100 Flare + spool piece) are available as options with pressure and temperature transmitters. For the positioning of pressure and temperature transmitters the following configurations are available:

- Spool piece, standard length with integrated pressure tapping and temperature sensor; thermowell: downstream with distance $5\,D_T$ (= 5 *diameter of thermowell), measured from the middle of the measuring path, on top of pipeline
- Spool piece, extended length with integrated pressure and temperature tapping.

Fig. 30 Spoolpiece option (example)



2.3 Computations

2.3.1 Calculation and calibration of volume flow

Volume flow in operating state

Generally, the devices of the FLOWSIC100 Flare family are used to determine the volume flow in closed pipelines. The volume flow Q_{ac} is defined by the representative cross-sectional area A and the mean gas velocity v_A with respect to cross-section (area velocity):

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

FLOWSIC100 Flare, however, determines the representative average value of the flow velocity on a sound path v (path velocity) between the two sender/receiver units.

Since the average values of path and area velocity are not identical, especially for small pipe diameters, a functional, systematic relation between the determined path velocity v and the average area velocity v_A was introduced.

This functional relation is implemented by a calibrating function in the FLOWSIC100 Flare. The coefficients of this function are determined by computational fluid dynamics and regression analysis and stored in the MCUP. The correct coefficients are activated when following the procedure in → pg. 170, § 4.3.2 “Configuration of application-specific parameters in the MCUP“. In order to calculate the correct calibration function value, the Reynolds number has to be determined according to → pg. 194, § 4.3.14 “Entering process parameters“.

The coefficients can be specified and entered into the measuring system by an optional flow calibration, and the measuring precision thereby improved even further.

Calculation of volume flow in the standard state

The volume flow can be converted as follows to the standard state:

$$Q_{sc} = Q_{ac} \bullet \left(\frac{p_{pipe} \bullet T_{normal}}{p_{normal} \bullet T_{pipe}} \right) \bullet \frac{1}{\kappa}$$

Q_{ac}: Volume flow in actual state

Q_{sc}: Volume flow in standard state

p_{pipe}: Absolute pipeline pressure; usually entered as constant/default value typical for the equipment.
If an optional analog module is used as an analog input for connection of a separate pressure transducer, the volume flow can be normalized with current plant values.

p_{normal}: 1013 mbar

T_{pipe}: Gas temperature (in K): In FLOWSIC100 Flare, a choice can be made here whether to use a substitute constant temperature determined with ultrasonic measurement or the substitute temperature read in via the optional analog input (to increase precision).

T_{normal}: Standard temperature. In Europe 273 K, in the USA 293 K

κ: Compressibility (=1 for ideal gases); can be configured as a constant

2.3.2 Mass flow and molecular weight determination

The mass flow of the gas is computed from flow speed and sound velocity, pressure and further measured variables.

The molecular weight of the gas is computed from sound velocity and further measured variables.

The operating software uses three different algorithms to calculate mass flow and molecular weight:

a) Basic algorithm:
   Uses a constant value for substance-dependent coefficient κ (adiabatic coefficient).
b) Hydrocarbon algorithm:
   Determines κ according to the function relation to the standard sound velocity.
   Standard algorithm of FLOWSIC100 Flare for flaregas applications.
c) Algorithm MR-113:
   Determines κ under consideration of the actual gas composition for hydrocarbon mixture.

2.3.3 Necessity for using external pressure and temperature transmitters

The following table shows what live calculations require use of external pressure and temperature transmitters.

Calculation of	External pressure transmitter	External temperature transmitter
Volume flow in standard state	x	x
Mass flow	x	x
Molecular weight	—	x
Reynolds number	x	x

General requirements

- Temperature transmitter:
  Pt100, 3- or 4-wires connection, head mounted transmitter, 2-wires Smart transmitter, explosion protected, output 4 ... 20 mA
- Pressure transmitter:
  Absolute pressure type, 1 ... 16 bar, 2-wires Smart transmitter, explosion protected, output 4 ... 20 mA

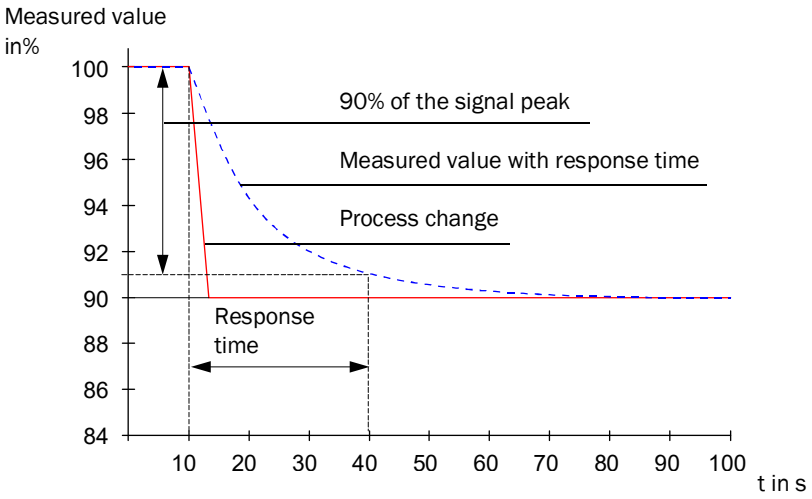
2.3.4 Response time

The response time is the time the measuring device requires to attain 90% of the end value after an abrupt change of the measured value (→ Fig. 31). Typical values are 60 to 90 s.

The response time is freely adjustable in the range 1...600 s. A higher response time causes higher damping of short-term measured value fluctuations and interference and thus a "smoothed" output signal.

Separate response times exist for the measurement of gas velocity and gas temperature. Volume flow and gas velocity have the same response time.

Fig. 31 Response time



The response time must be understood as a guide value only. If the signal quality of the ultrasonic pulses is low, FLOWSIC100 Flare requires more measured values for an output signal of the same precision. This increases the response time within certain limits as compared with the set time.

2.4 Check cycle

The FLOWSIC100 Flare is equipped with an integrated check cycle for automatic functional check of all device components. This check cycle is an approved tool for periodic device inspection according to valid regulations of Continuous Emission Monitoring.

The check cycle can be triggered time-controlled (setting of interval time by means of an operating program) and/or manually via the digital input (→ pg. 60, §2.2.4). Any deviations from normal behavior that may occur are signaled as warnings or errors.

A check cycle initiated manually can help to localize possible error causes should a device malfunction or a warning occur (see Service Manual).

The check cycle comprises zero point control and span test. The control values can be output via the analog output. The sequence of a check cycle is indicated by the status output on the corresponding relay and, if the Display module option is available, simultaneously on the display by the clear text message "Check cycle".

- If the check cycle is not output on the analog output, the last measured value is output for the duration the check cycle duration (approx. 20 s in an error-free sequence).
- For initiation of zero point control and span test as well as a check cycle via the digital input, a contact at the respective terminals must be closed for at least 2 s.
- Time-controlled check cycles start periodically according to parameter setting of the desired time interval at the entered time until the time interval is changed (or a reset is performed). If a reset is made (or there is an operating voltage failure), the check cycle starts at the time the device is put into operation again at the set time.
- If a time-controlled check cycle and a check cycle initiated by digital contacts overlap, only the check cycle initiated first becomes effective.

2.4.1 Zero point control

With a special circuit configuration in the sender/receiver units, the send-signals of the transducers can be read back without delay and in their original form. These send-signals are received, demodulated and computed as receive-signals. If the device functions correctly, the exact zero point must be calculated here. This control comprises the complete check of all system components including the transducers. For deviations of more than approx. 0.25 m/s (depending on active measuring path and gas temperature), a warning is output. Transducers and electronics must be checked in this case. If signal amplitude or form does not match the expected values, transducers or electronics are defective and an error message is output.

2.4.2 Span test

For the electronic zero check, a time difference from both transfer directions is determined and computed with the air temperature, active measuring path and sound velocity installation parameters into a velocity offset at the zero point. This offset is then added to the selected span value and output. The span value can be set with the SOPAS ET operating program in the range from 50 to 70% in steps of 1% (standard setting ex factory 70%). If all system components are intact, the entire measuring system reacts as intended.

2.4.3 Analog output of check cycle

The check cycle‘s output is as follows:

- 90 s zero value (live zero)
- 90 s span value

- The output duration of 90 s each time is the standard setting ex factory. It can be changed in the SOPAS ET program.
- The output is suitable for velocity-dependent measured values only (gas velocity, volume flow act., volume flow std.).

FLOWSIC100 Flare

3 Assembly and Installation

Project planning
Assembly
Installing non-retractable sender/receiver units
Installing the sun roof for the sender/receiver units

3.1 Project planning

The following table provides an overview of the project planning work necessary as prerequisite for trouble-free assembly and subsequent device functionality. You can use this table as a checklist and check off the completed steps.

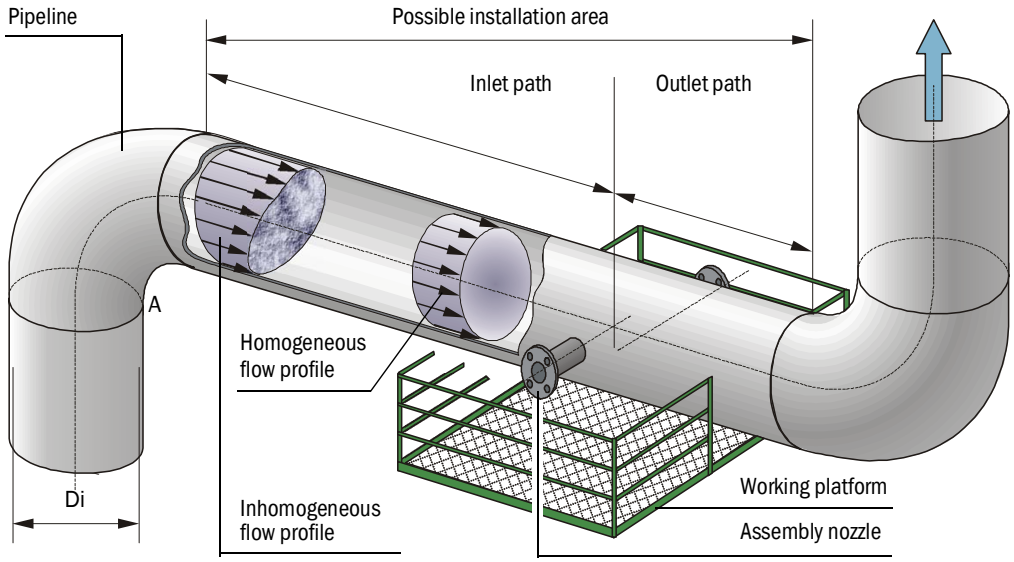
Ensure that all safety warnings and notes in chapter 1 are observed.

Task	Requirements		Work step	✔
Determine measuring and installation locations (→ pg. 77, §3.1.1)	Flow distribution, inlet and outlet paths	Lowest possible influence on the measuring precision	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	Acceleration < 1 g	Eliminate/reduce vibrations through suitable measures	☐
	Ambient conditions	Limit values according to Technical Data in → pg. 212, §6.1	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 Configuration Tables and Notes in → pg. 32, §2.2.	☐
	Gas temperature	Sender/receiver unit type (standard or high temperature version)		
	Gas composition	Material of duct probe and transducer		
	Fitting locations	Cable lengths		
Plan power supply	Operating voltage, power requirements	According to Technical Data in → pg. 212, §6.1	Plan adequate cable cross-sections and fuses	☐

3.1.1 Determining the measuring and installation location

Measuring precision is influenced, among other things, by flow behavior and the position of the measuring axis. Large cross-section variations, curved pipes, fittings, air flaps or inlets can cause profile deformations or turbulences with a negative effect on the measuring result.

Fig. 32 Measuring and installation location



3.1.1.1 General requirements

Criteria		Requirements
Measuring location	Flow behaviour	Position with essentially homogenous gas flow 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 measuring point are most important for determining the required upstream and downstream piping and should be investigated carefully. ● Manufacturer SICK offers expertise support for an optimal adjustment of the meter for the given inlet and outlet piping conditions. ● Predisturbances causing swirl such as double elbows out of plane are not recommended.
Installation location		Pipelines with vertical, horizontal or inclined direction
		Installation free of vibrations, acceleration < 1 g
		Largest possible distance to control valves or other noisy fixtures
		With electrical connections and lighting
Working platform		Easy and safe access for installation and maintenance work of the sender/receiver units
		Platform secured by a railing to prevent accidents if necessary
		Sufficient clearance to fit/remove the sender/receiver units
Wall and insulation thickness		● Maximum wall thickness 15 mm, maximum insulation thickness 100 mm. Larger wall and insulation 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 SICK for support). Nozzles may only be isolated if the gas temperature is < 100 °C.

Follow specifications for new equipment; select best possible location for existing equipment.
Contact SICK for optimal installation of the FLOWSIC100 Flare.

NOTICE:
The plant operator is responsible for observing the valid Accident Prevention and Industrial Safety Regulations.

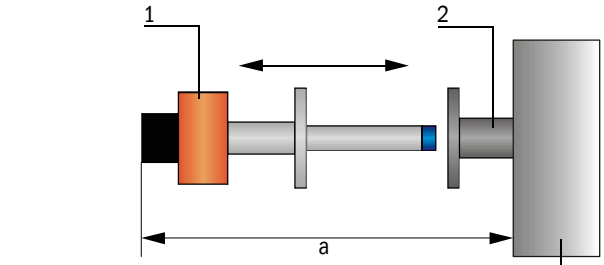
3.1.1.2 Additional requirements for meter body option (spool piece)

Criteria	Requirements
Pipeline design	● Same nominal size of adjacent pipes and meter body ● Differences of internal diameters of inlet pipe and meter body < 1%. ● No welding beads and burs on the flanges of the inlet pipe
Installation	Pipelines with horizontal or vertical direction ● Horizontal installation: The meter body shall be aligned so that the planes formed by the measuring paths are in a horizontal position. 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.
Gas flow	Free from any foreign material, dust and liquids. Otherwise, filters and traps shall be used.
Seals between meter body and pipeline	Must not protrude into the pipeline. Any protrusion into the flowing gas stream may change the flow profile and thus the measuring accuracy may be adversely affected.
Pressure transmitter	Connection at the pressure tap provided with ⅛", ¼"or ½" NPT (female) port, depending on meter size and customer demand.
Fastening and sealing material	Bolts, nuts and flange seals used must be suited to the operational conditions and comply with legal regulations and relevant standards.

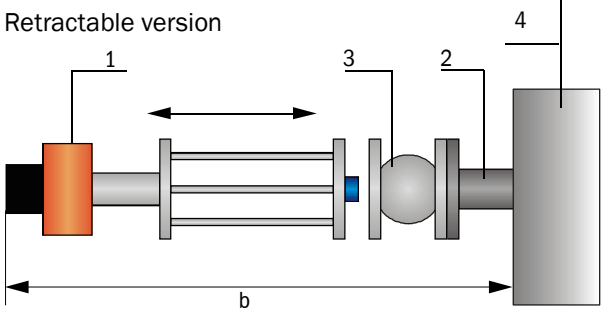
3.1.1.3 Clearance for fitting/removing the sender/receiver units

Fig. 33 Clearance for fitting/removing the sender/receiver units

Non-retractable version



Retractable version



1 Sender/receiver unit
2 Nozzle
3 Ball valve
4 Pipeline

Sender/receiver units designed to fit counter flange CL150 RF acc. ASME B16.5 (Standard temperature version)

Type	NL	Non-retractable	Retractable	a		b	
				mm	inch	mm	inch
FLSE100-EXS	148	x		700	27.5		
	330		x			1040	40.9
FLSE100-EX	198	x		750	29.5		
FLSE100-EXRE	380		x			1250	49.2
FLSE100-EXPR short	220	x		1070	42.1		
	400		x			1900	74.8
FLSE100-EXPR long	350	x		1200	47.2		
	530		x			2050	80.7

Sender/receiver units designed to fit counter flange DN PN16 (Standard temperature version)

Type	NL	Non-retractable	Retractable	a		b	
				mm	inch	mm	inch
FLSE100-EXS	176	x		750	29.5		
	330		x			1040	40.9
FLSE100-EX	226	x		800	31.5		
FLSE100-EXRE	380		x			1250	49.2
FLSE100-EXPR short	220	x		1070	42.1		
	400		x			1900	74.8
FLSE100-EXPR long	350	x		1200	47.2		
	530		x			2050	80.7

3.1.2 Further notes for project planning

Applications with specific conditions or installation in vertical pipelines

- Applications with wet gas

  Condensate can accumulate in the nozzle pipes. The following solutions can help to prevent measurement problems (malfunctions caused by solid-borne noise, see Service Manual), or damages when removing the sender/receiver unit (condensate runs out).

  – Use a nozzle position which prevents accumulations of condensates in nozzle pipes.

  – Use a closed continuous or periodical condensate drain with backflow to the pipeline. Technical solutions are available on request depending on operating conditions (pressure, temperature).

  > Installation of condensate drains always requires the approval of the plant operator.

  – Isolate the nozzle pipe to reduce dew point underruns (only for low gas temperatures < 100 °C).

- Short inlet and outlet paths (→ pg. 77, Fig. 32)

  – Use the best possible positioning for the measurement path (consult SICK for support).

- Vertical ducts with flow direction from top to bottom

  The measured value gets a negative sign (output LC display).

  – Set a negative linear regression coefficient (→ pg. 200, §) to change it.

Installation location for external pressure and temperature transmitters (option)

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

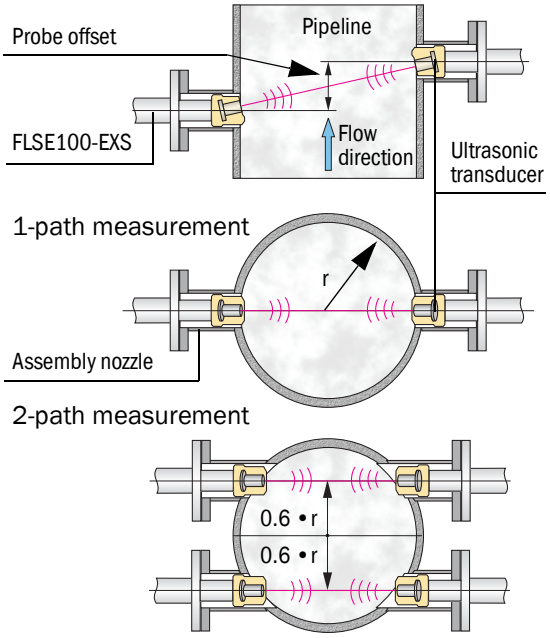
- Pressure tapping: direct at measurement point, on top side of pipeline
- Thermowell: downstream with distance $5\,D_T$ (= 5 *diameter of thermowell), measured from the middle of the measuring path, on top of pipeline

3.1.3 Notes for installation of sender/receiver units in 1-path, 2-paths or 3x1 path configuration

Cross-duct version

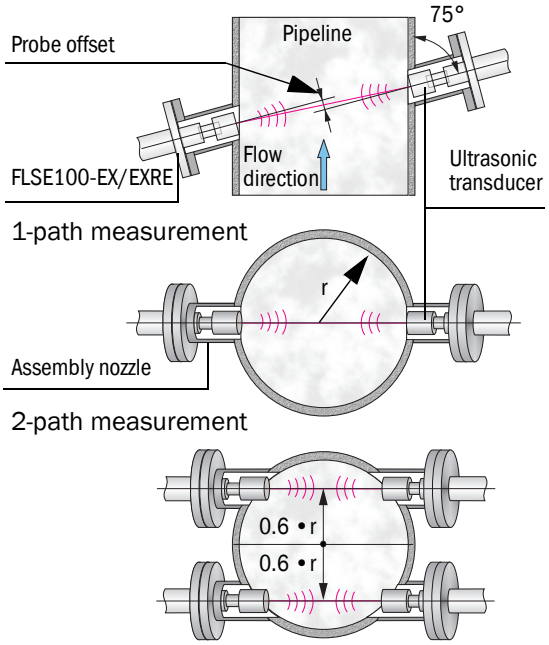
Weld the assembly nozzles vertically (FLSE100-EXS) or at an angle of 75° (FLSE100-EX) with parallel offset onto the pipeline.

FLSE100-EXS



Special alignment of the ultrasonic transducer provides the angle to the flow axis required for measurement.
Ensure that the sensors are facing each other.
The parallel offset depends on the pipe diameter.

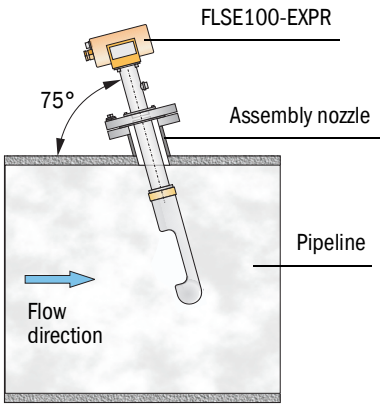
FLSE100-EX/EXRE



The installation angle of the assembly nozzle and the parallel offset provide the angle to the flow axis required for measurement. The parallel offset depends on the pipe diameter.

Probe version (FLSE100-EXPR)

In order to capture a representative part of the flow, select the sender/receiver unit in a short or long version depending on the pipeline diameter (§2.2.1 Part „Application area, configurations“) and fit it as follows.



3.2 Preparation work

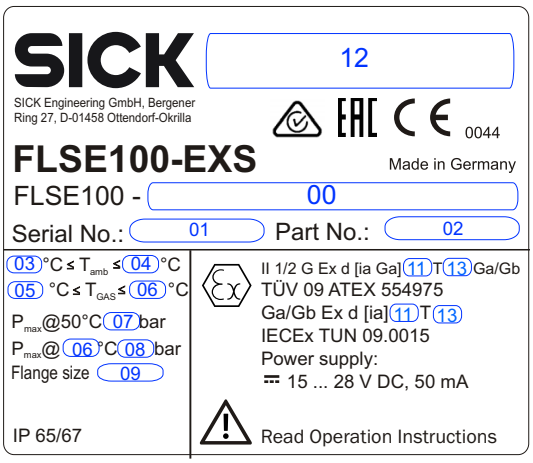
3.2.1 General notes

- Check that the shipment contains all components ordered.
- Check the components for possible transport damages. Pay particular attention to transducer surfaces, sealing surfaces on the flanges and, if delivered, the interior of the meter body (spool piece).
- Immediately document and reported damages to the manufacturer.

> ***NOTICE:***
> To guarantee safe and reliable operation of the measuring equipment, make sure that the actual site conditions match the information provided on the labels on sender/receiver units and control unit (→ Fig. 34).

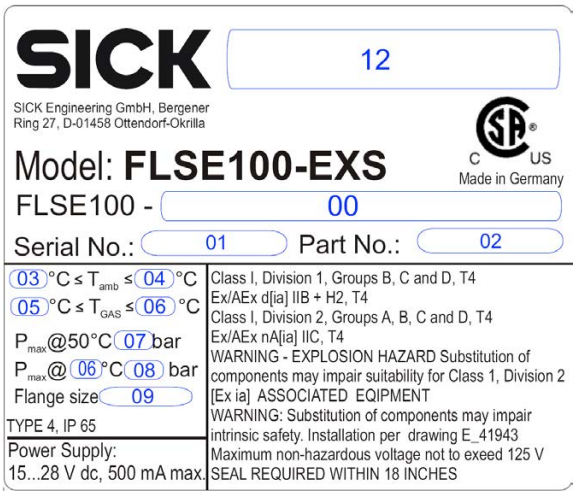
Fig. 34 Main type plate on sender/receiver units

Example device type FLSE100-EXS ATEX zone 1/IECEx



Variable	Name
00	Device type code
01	Serial No.
02	Part No.
03	Min. ambient temperature
04	Max. ambient temperature
05	Min. gas temperature
06	Max. gas temperature
07	Max. operating pressure at 50 °C
08	Max. operating pressure at $T_{gas\ max.}$ (variable 06)
09	Flange size
10	Not relevant
11	Ignition group
12	Bar code
13	Temperature class

Example device type FLSE100-EXS CSA Cl I, Div1 Group D



Variable	Name
00	Device type code
01	Serial No.
02	Part No.
03	Min. ambient temperature
04	Max. ambient temperature
05	Min. gas temperature
06	Max. gas temperature
07	Max. operating pressure at 50 °C
08	Max. operating pressure at $T_{gas\ max.}$ (variable 06)
09	Flange size
10	Not relevant
11	Not relevant
12	Bar code

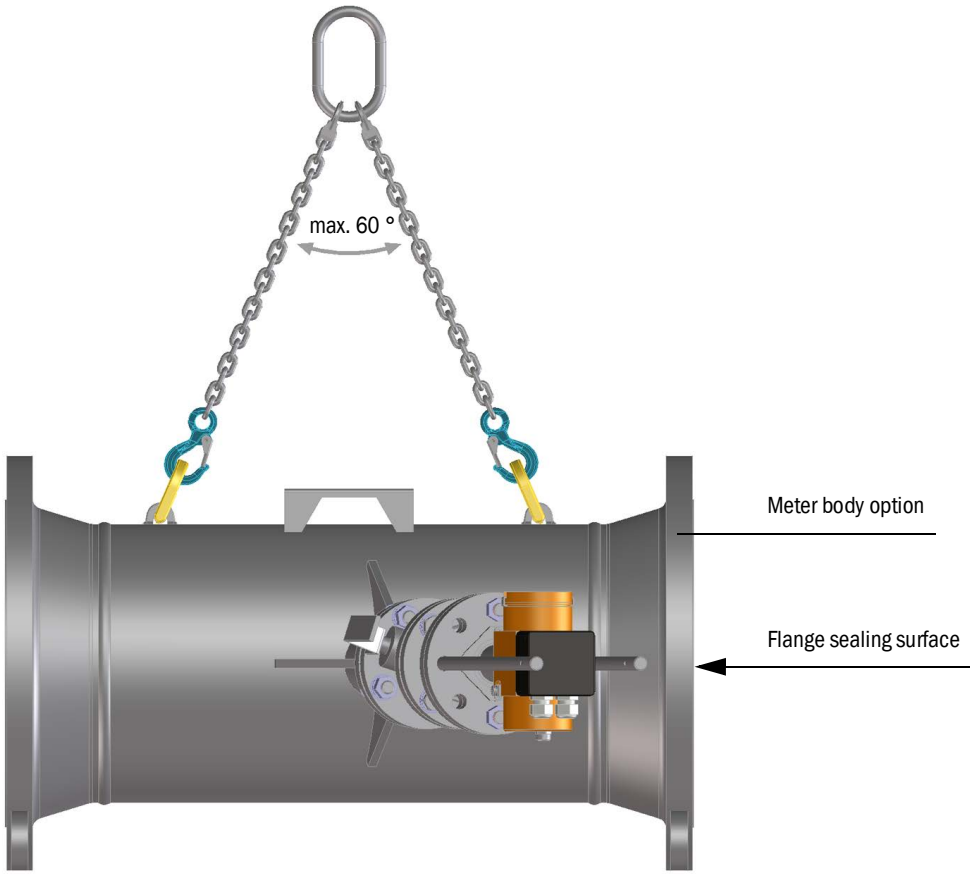
3.2.2 Special notes for handling the meter body option

Transport and storage

- ► Secure for all transport and storage operations that:
  - the meter body is firmly secured at all times
  - measures are taken to avoid mechanical damage
  - ambient conditions are within the specified limits (→ pg. 212, § 6.1).
- ► Protect sealing surfaces of the flanges and the interior of the meter body if it must be stored outside for more than one day, e.g. with Anticorit spray (not required for meter bodies from stainless steel). Do the same if the meter must be stored in dry condition, but for more than a week.

Lifting requirements

Fig. 35 Lifting requirements



WARNING: Danger due to size and mass of the meter body

- ► 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 meter body.

3.3 Assembly

Carry out all assembly work on-site. This includes:

- ► Fitting the nozzle
- ► Installing ball valves on retractable versions
- ► Installing the meter body (option)
- ► Installing the control unit.
- ► Installing the sun roof.

WARNING:

- ► Observe the relevant safety regulations as well as the safety notices in Section 1 during all assembly 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.

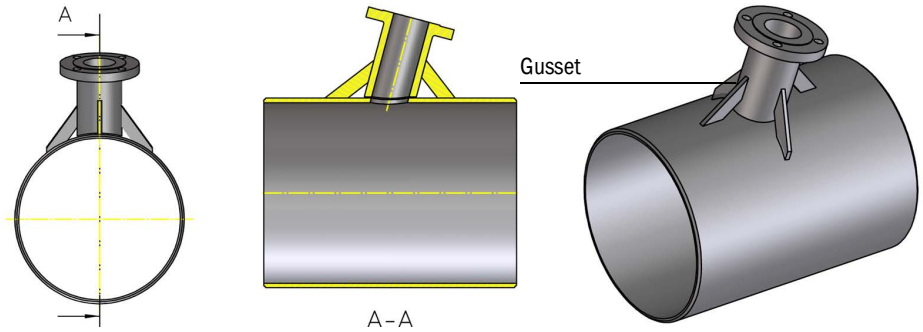
  Fitting when the equipment is running is only possible using the "hot tapping method". Such work may only be carried out by a specialized contractor authorized by the plant operator (→ pg. 20, § 1.4).
- ► Take suitable protection measures against possible local hazards or hazards arising from the plant.

WARNING: Mechanical burden

The static load moment of all parts to be installed at the pipe can be up to approx. 600 Nm (retractable device types). Strong pipe vibrations can cause damages and can lead to dangerous situations.

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

Fig. 36 Option mechanical support for nozzle "gusset plates"



NOTICE:

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

3.3.1 Fitting the nozzles on the pipeline (measuring systems without meter body)

The nozzles are manufactured precisely at the factory according to customer specifications for fitting on the pipeline.

> ***NOTICE:***
> The exact positioning of the nozzles is prerequisite for low measuring uncertainty.
> Maximum tolerances for nozzle positions and fitting angle of the nozzles:
> – Maximum tolerance ± 1 mm / ± 1 °
> – Tolerance for best uncertainty results ± 0.1 mm / 0.1 °

Notes for installations in existing pipelines (hot tapping)

- For calculation of the precise inner diameter of the pipeline the wall thickness have to be determined very exactly. Schedule information alone is not sufficient.
- All exact geometric dimensions for fitting the nozzles in the pipeline (see following instructions) have to be documented during nozzle installation. At commissioning of the FLOWSIC100 Flare the geometric dimensions from the nozzle installation are needed for correct parameterization of the device.

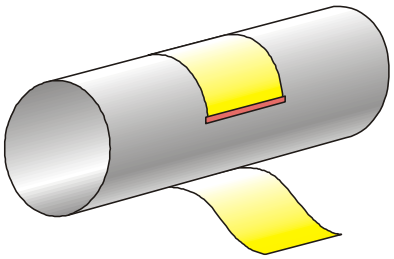
3.3.1.1 Determining the nozzle positions and marking on the pipeline

General preparation work

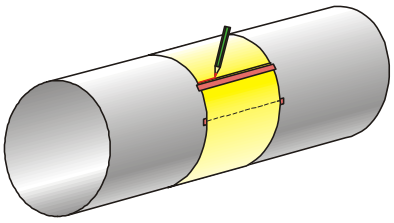
The installation tool (→ pg. 59, §2.2.3) contains a foil strip (length approx. 4 times the pipe diameter, width approx. 0.75 of the pipe diameter) as a resource to determine the exact position of the nozzle on the pipeline. The foil strip is prepared with nozzle markings for different pipe diameters.

Fig. 37 General preparation work

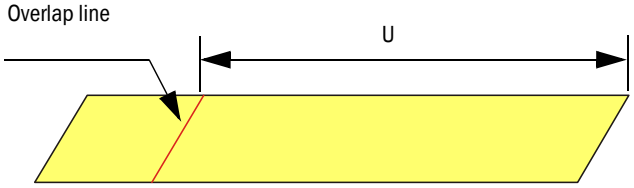
1) Wind the strip around the pipeline at the selected measuring point (ensure exact right-angled alignment) and secure (e.g. with adhesive strips).



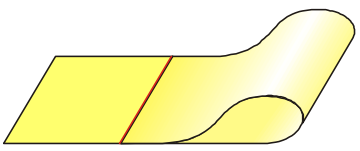
2) Mark the strip where overlapping starts.



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

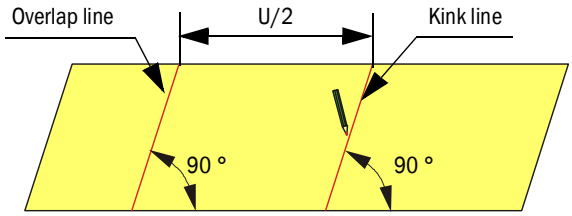
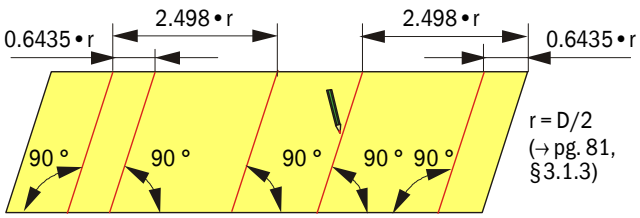
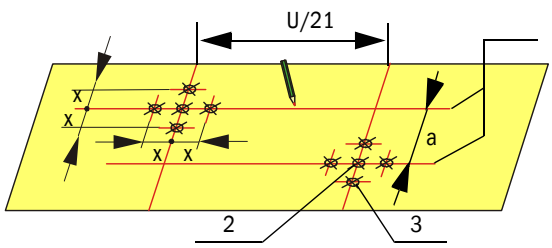
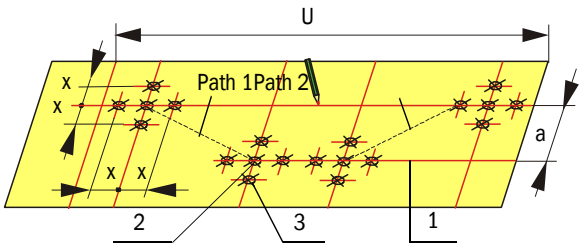


For 1 path measurements, fold the strip to the overlap line so that the part matching pipe circumference (U) is halved.



Determining the nozzle position and marking on the pipeline for cross-duct types FLSE100-EXS and EX/EXRE

Fig. 38 Determining the nozzle positions on the strip

1-path measurement	2-path measurement
4a) Roll the strip out again and mark the kink line. 	4b) Roll the strip out again and mark the lines as follows: 
5) Draw guide lines (1) for the nozzle positions in a distance (see Table 2 or the corresponding formula), mark the crossing points (2) and draw marking points (3) in distance 60 mm (x) from the crossing points. 	
6a)Measure and note values a and U/2 (needed to calculate the path angle and path length).	6b) Measure and note values a and U (needed to calculate the path angle and path length).

Nozzle offset

NOTICE:

The values in Table 2 apply under the following conditions:

- path angle 77.5°
- nozzle angle 75°
- wall thickness 9.53 mm
- for 2-path measurement: secant position of the path: 0.6 * Ri

SICK recommends a wall thickness gauge with ultrasound (echo measurement) to determine the wall thickness.

For deviating conditions, calculate the nozzle distance according to the corresponding formula, see →Fig. 39 for 1-path measurement and →Fig. 40 for 2-path measurement.

Tabelle 2 Nozzle offset for standard requirements

1-path measurement					
Outside diameter		Nozzle offset a			
		FLSE100 -EXS		FLSE100-EX	
inch	mm	mm	inch	mm	inch
4	114	30.85	1.21		
5	141	36.83	1.45		
6	168	42.82	1.69		
8	219	54.13	2.13	49.43	1.95
10	273	66.10	2.60	61.40	2.42
12	324	77.40	3.05	72.71	2.86
14	356	84.50	3.33	79.80	3.14
16	406	95.58	3.76	90.89	3.58
18	457	106.89	4.21	102.20	4.02
20	508	118.20	4.65	113.50	4.47
22	559	129.50	5.10	124.81	4.91
24	610	140.81	5.54	136.12	5.36
26	660			147.20	5.80
28	711			158.51	6.24
30	762			169.81	6.69
32	813			181.12	7.13
34	864			192.43	7.58
36	914			203.51	8.01
42	1067			237.43	9.35
48	1219			271.13	10.67
52	1321			293.74	11.56
56	1422			316.13	12.45
60	1524			338.74	13.34
64	1626			361.36	14.23
68	1727			383.75	15.11
72	1829			406.36	16.00

2-path measurement					
Outside diameter		Nozzle offset a			
		FLSE100 -EXS		FLSE100-EX	
inch	mm	mm	inch	mm	inch
4	114				
5	141				
6	168				
8	219				
10	273				
12	324	63.88	2.52	60.36	2.38
14	356	69.56	2.74	66.05	2.60
16	406	78.43	3.09	74.93	2.95
18	457	87.47	3.44	83.98	3.31
20	508	96.52	3.80	93.03	3.66
22	559	105.56	4.16	102.09	4.02
24	610	114.61	4.51	111.14	4.38
26				120.01	4.72
28				129.06	5.08
30				138.10	5.44
32				147.15	5.79
34				156.20	6.15
36				165.07	6.50
42				192.21	7.57
48				219.17	8.63
52				237.26	9.34
56				255.18	10.05
60				273.27	10.76
64				291.36	11.47
68				309.28	12.18
72				327.37	12.89

Formulas for the calculation of the nozzle offset

Fig. 39 Formulas: 1-path measurement

EX-S:

$$a = \frac{D_i}{\tan(\alpha)} + 2 \cdot d$$

EX:

$$a = \frac{D_i}{\tan(\alpha)} + t \cdot \left(\frac{1}{\tan(\beta_1)} + \frac{1}{\tan(\beta_2)}\right)$$

a: Nozzle offset
D_i: Internal diameter
d: Off-center probes distance (4.9 mm)
α: Path angle (Standard: 77,5 °)
t: Wall thickness (Standard: 9.53 mm)
$\beta_{1/2}$: Nozzle angle of the first/second nozzle (Standard: 75°)

Fig. 40 Formulas: 2-path measurement

EX-S:

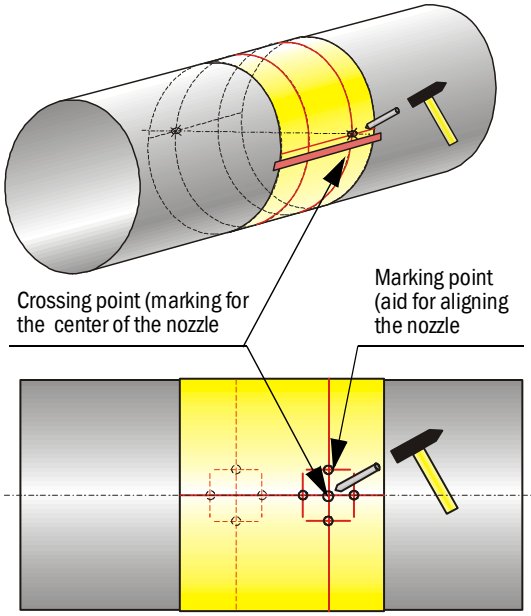
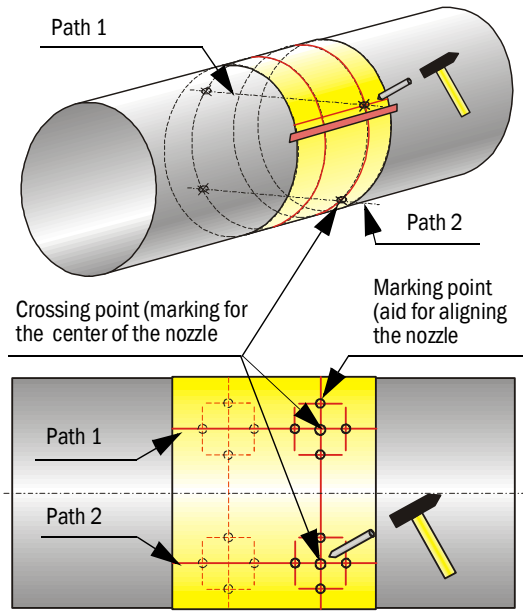
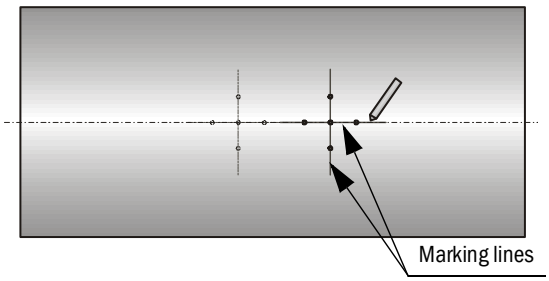
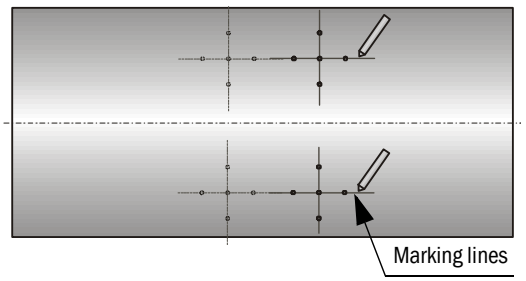
$$a = \frac{D_i\left(1 - \left(\frac{r}{R_i}\right)^2\right)^{\frac{1}{2}}}{\tan(\alpha)} + 2 \cdot d$$

EX:

$$a = \frac{D_i\left(1 - \left(\frac{r}{R_i}\right)^2\right)^{\frac{1}{2}}}{\tan(\alpha)} + \frac{1}{2}\left(D_a\left(1 - \left(\frac{r}{R_i + t}\right)^2\right)^{\frac{1}{2}} - D_i\left(1 - \left(\frac{r}{R_i}\right)^2\right)^{\frac{1}{2}}\right) \cdot \left(\frac{1}{\tan(\beta_1)} + \frac{1}{\tan(\beta_2)}\right)$$

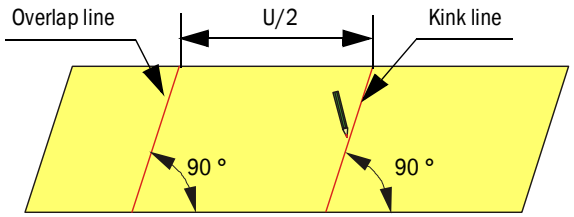
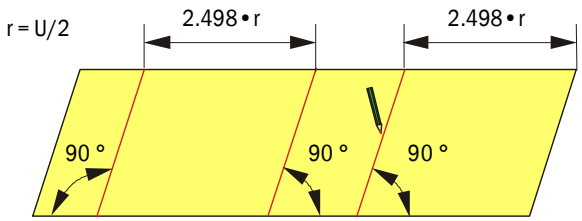
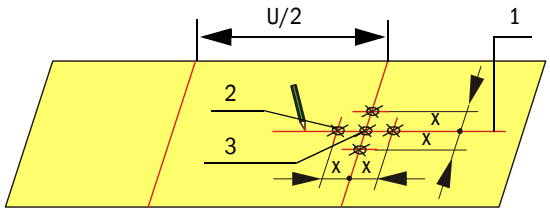
a: Nozzle offset
D_i: Internal diameter
R_i: Internal radius
d: Off-center probes distance (4.9 mm)
R_a: Outer radius
α: Path angle (Standard: 77.5 °)
t: Wall thickness (Standard: 9.53 mm)
$\beta_{1/2}$: Nozzle angle of the first/second nozzle (Standard: 75°)
r: Secant position of the path (Standard for 2-path devices: 0.6*R_i)

Fig. 41 Marking the nozzle positions on the pipeline

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

Determining the nozzle position(s) and marking on the pipeline for probe type FLSE100-EXPR

Fig. 42 Determining the nozzle position(s)

<table>
<tr><th>1-path measurement</th><th>2-path measurement</th></tr>
<tr><td colspan="2">1) Start preparation work as shown in → pg. 85, Fig. 37.</td></tr>
<tr><td>2a) Roll the strip out again and mark the kink line.
 
</td><td>2b) Roll the strip out again and mark the lines as follows:
 
</td></tr>
<tr><td colspan="2">3) Draw a guide line (1) for the nozzle position(s), mark the crossing points (2) and draw marking points (3) in distance 80 mm (x) from the crossing points.
 

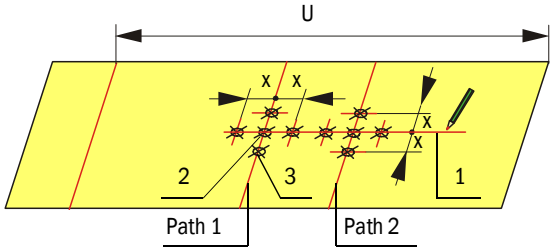
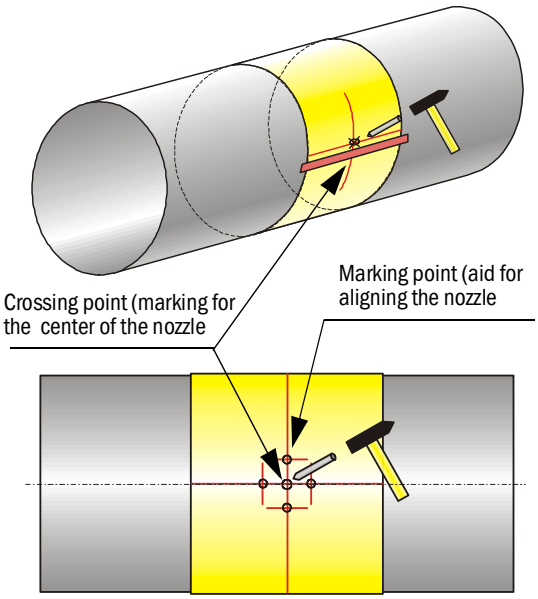
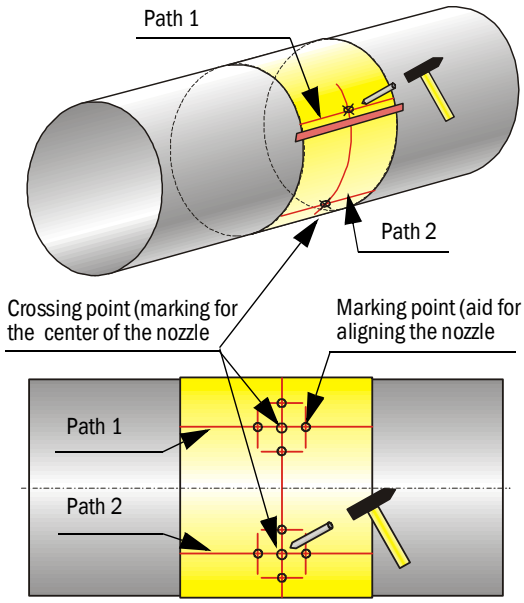
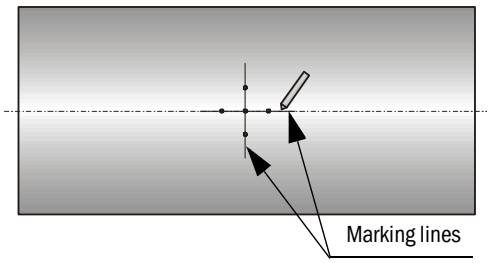
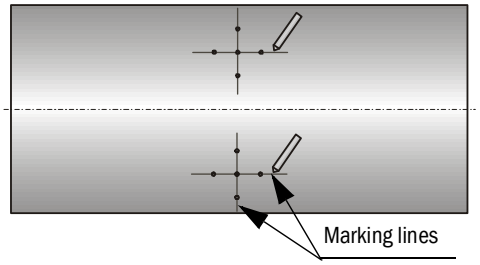

</td></tr>
</table>

Figure 43 Marking the nozzle position(s) on the pipeline

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

3.3.1.2 **Weld on nozzles for non-retractable sender/receiver units**

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

WARNING: Hazards due to combustible gases or high pressure
Depressurize the pipe line and make free of flammable gases before starting any operation.

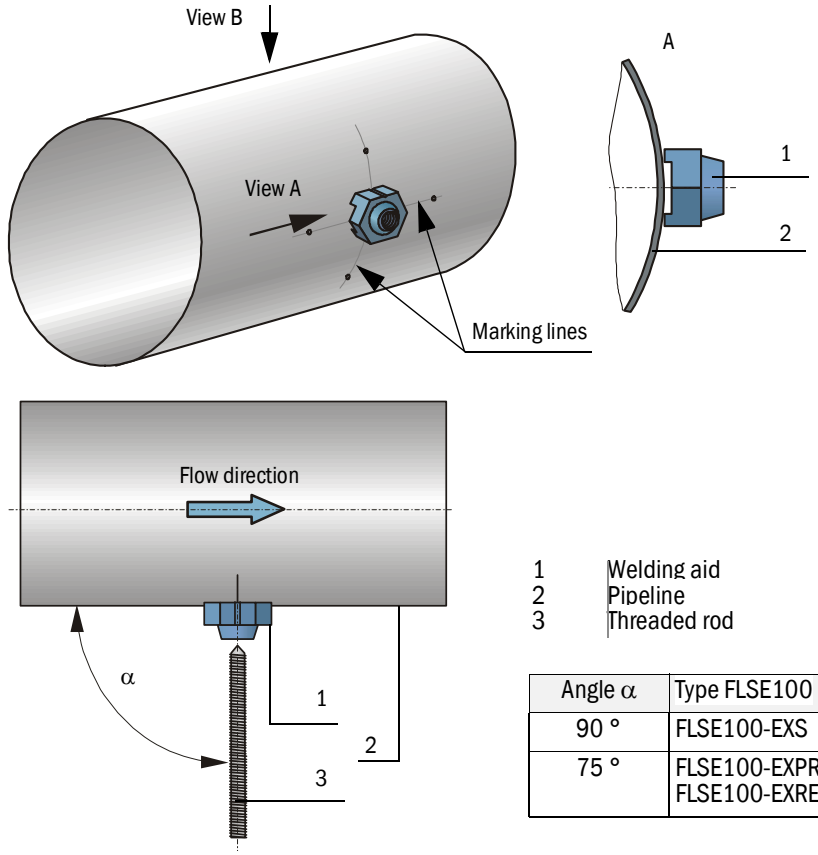
WARNING: Risk of explosion/health hazard
A faulty welding seam can allow gas to escape from the pipeline. This can immediately lead to a dangerous situation.
- ► Ensure welding seams are gas-tight.
- ► Check strength and durable tightness of the welding seams.

NOTICE:
Welding work may only be carried out by qualified personnel acc. to qualified and approved procedures. Inspections of the welded seam regarding correctness and pressure tightness of the design need to be made. The general safety requirements of relevant regulations, general standards and guidelines as well as plant operator instructions concerning execution and inspections of welding must be observed.

Work steps

- ► Position the welding aid (1) on the pipeline (2) as shown in the following figure.

Fig. 44 Positioning of the welding aid



1 Welding aid
2 Pipeline
3 Threaded rod

Angle α	Type FLSE100
90 °	FLSE100-EXS
75 °	FLSE100-EXPR, FLSE100-EX, FLSE100-EXRE

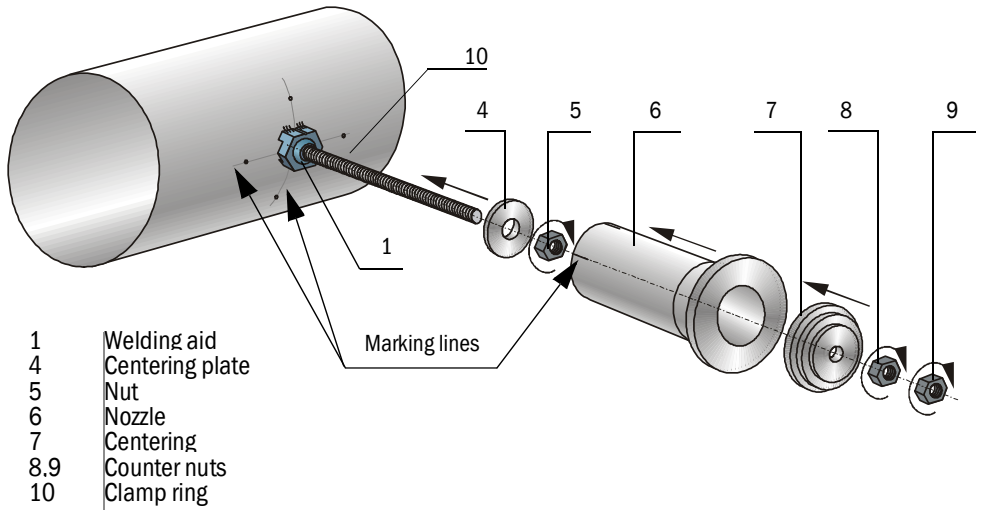
NOTICE:
Check the welding aid position after welding. The deviation from the drawn lines must not be more than 0.5 mm. Otherwise reposition the welding aid.

► 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.

► 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.
► Place the 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 and secure the nozzle at a distance of approx. 2 mm to the pipeline surface (use uncoated wire).
► Align the nozzle so that the marking lines on nozzle and pipe wall are flush and tighten enough so that the nozzle is pressed against uncoated wire and pipeline surface. Make sure the nozzle remains aligned correctly.

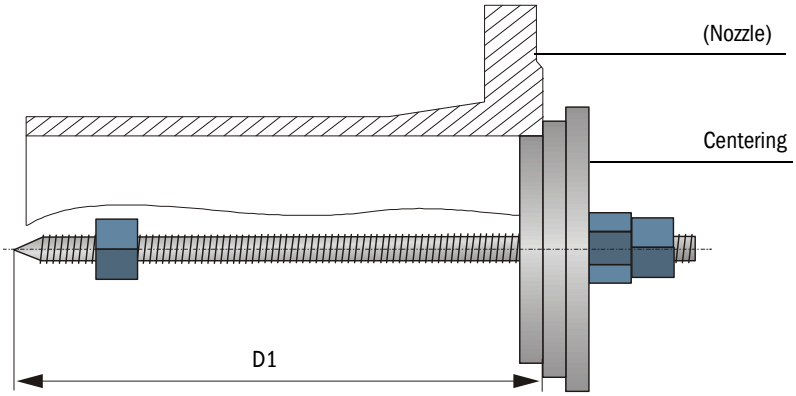
Fig. 45 Fitting the nozzle



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

- ► Weld the nozzle to the pipeline (seam length approx. 15 mm). Wait at least 1 minute after each welding to allow the seam to cool down before welding the next point.
- ► Remove uncoated wire.
- ► Remove threaded rod with nuts and centering by turning the counternut (8) against fastening direction. The centering plate will be removed by the clamp ring.
- ► Finish off each weld seam and allow sufficient time for cooling down to avoid unnecessary strain on the nozzle and pipe wall.
- ► On FLOWSIC100 Flare cross-duct versions (FLSE100-EX and FLSE100-EXS) and after sufficient time for cooling down, determine distance D1 between outer pipe wall and centering.

Fig. 46 Determining of effective nozzle length



- ► On cross-duct versions, weld the nozzle on the opposite pipeline side in the same manner and then determine distance D2.

3.3.1.3 Weld on nozzles for retractable sender/receiver units and drill out the pipeline

Weld on the nozzles for retractable sender/receiver units in the same manner as described previously for non-retractable sender/receiver units and determine the distances D1 and D2 for cross-duct versions.

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

WARNING: Hazards through leaks!

- ► Operation in leaky condition is not allowed and possibly dangerous.
- ► Danger by explosive, toxic and hot gas!

NOTICE:

- 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 (→ pg. 11, § 1.2.1).
- Inspection of welded seams and all other installation regarding correctness and pressure tightness need to be made. The general safety requirements and all other plant operator instructions have to be followed (see notice → pg. 92, § 3.3.1.2).

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 (→ pg. 85, § 3.3.1).

- 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 tap)

- Only once on each nozzle.
- This work requires special tools (e.g. special drilling tool) and special technical knowledge.
- The hole cutter diameter must be 46 ... 48 mm for 2“ nozzles and 73 ... 75 mm for 3” nozzles.
- Mount the drilling tool on the ball valve. Check for installation. Open the ball valve and drill out the holes in the pipeline in the centre of the nozzle position.
- Retract the drilling tool. Dismount drilling tool after ball valve is closed again.
- Mount a blind flange on the ball valve as long as no sender/receiver unit is installed.

WARNING: Hazards during hot tapping!

When sender/receiver units are installed on the pipeline when the pipeline 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.

CAUTION: Accident risk

When the hole is ready:

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.

WARNING: Accident risk

As long as a sender/receiver unit is not 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.

3.3.1.4 **Determine path angle and path length**

Exact values for path angle and length must calculated using the geometric data to keep measuring inaccuracy as low as possible (→ Fig. 47, → pg. 98, Fig. 48). Enter these values in the device as parameters during start-up → pg. 170, §4.3.2(.).

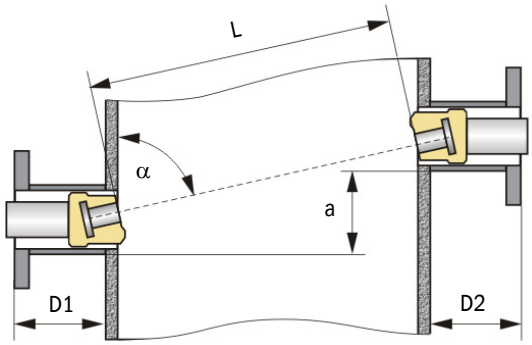
A software to perform the geometry calculations can be found on the Product CD.

Cross-duct versions

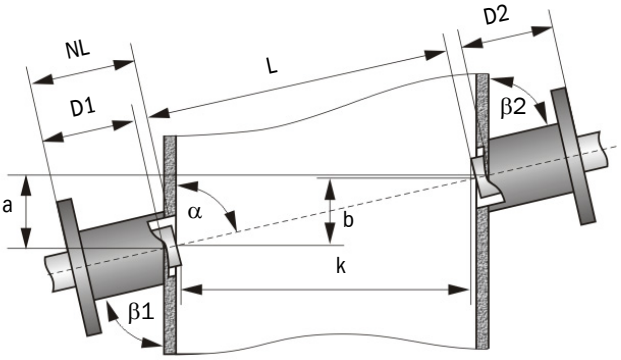
Path angle for exact nozzle assembly 77.5 °

Fig. 47 for non-retractable sender/receiver units

FLSE100-EXS



FLSE100-EX, FLSE100-EXRE



Setpoint value for β1 and β2 = 75 °

$$L = \sqrt{(a - 2 \bullet d)^2 + \left(\frac{U}{\pi} \bullet f + D1 + D2 + 2 \bullet S - 2 \bullet NL\right)^2}$$

$$\alpha = \operatorname{atan}\left(\frac{\frac{U}{\pi} \bullet f + D1 + D2 + 2 \bullet S - 2 \bullet NL}{a - 2 \bullet d}\right)$$

$$b = a - (NL - D1 - S) \bullet \cos\beta 1 - (NL - D2 - S) \bullet \cos\beta 2$$

$$k = \frac{U}{\pi} \bullet f - (NL - D1 - S) \bullet \sin\beta 1 - (NL - D2 - S) \bullet \sin\beta 2$$

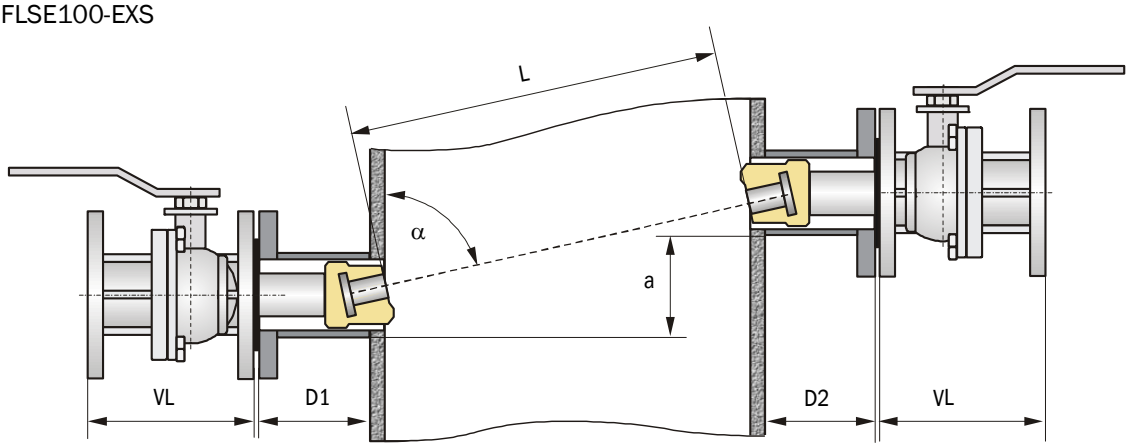
$$L = \sqrt{b^2 + k^2}$$

$$\alpha = \operatorname{atan}\left(\frac{k}{b}\right)$$

d = Off-center probes distance = 4.9 mm (manufacturer's specification)
U = Pipeline circumference at assembly location
S = Seal thickness = 4 mm
NL = Probe nominal length (manufacturer's specification)
D1, D2 = effective nozzle length (→ pg. 94, Fig. 46)
a = Nozzle offset (→ pg. 85, §3.3.1.1)
f = 1 for 1-path measurements, 0.8 for 2-path measurements

Fig. 48 for retractable sender/receiver units

FLSE100-EXS

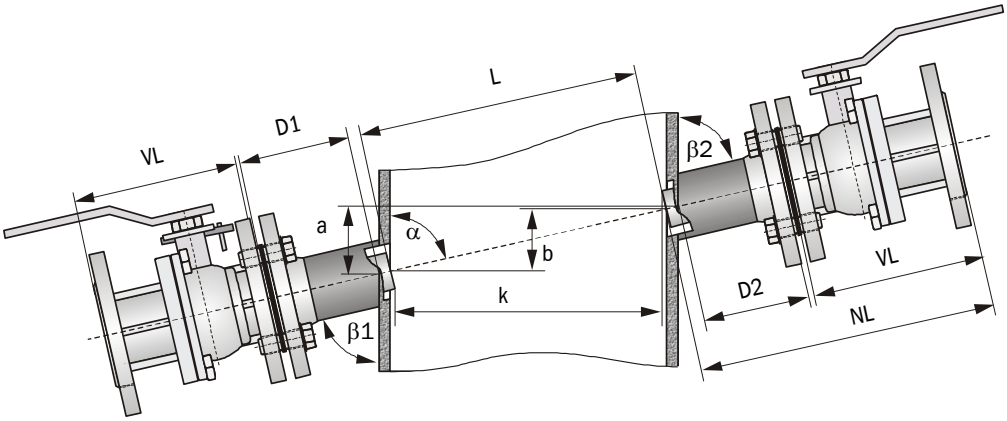


$$L = \sqrt{(a - 2 \bullet d)^2 + \left(\frac{U}{\pi} \bullet f + D1 + D2 + 2 \bullet VL + 4 \bullet S - 2 \bullet NL\right)^2}$$

$$\alpha = \operatorname{atan}\left(\frac{\frac{U}{\pi} \bullet f + D1 + D2 + 2 \bullet VL + 4 \bullet S - 2 \bullet NL}{a - 2 \bullet d}\right)$$

d = Off-center probes distance = 4.9 mm (manufacturer's specification)
U = Pipeline circumference at assembly location
VL = Ball valve length
S = Seal thickness = 4 mm
NL = Probe nominal length (manufacturer's specification)
a = Nozzle offset (→ pg. 85, §3.3.1.1)
f = 1 for 1-path measurements, 0.8 for 2-path measurement

FLSE100-EXRE



$$b = a - (NL - D1 - 2 \bullet S - VL) \bullet \cos\beta1 - (NL - D2 - 2 \bullet S - VL) \bullet \cos\beta2$$

$$k = \frac{U}{\pi} \bullet f - (NL - D1 - 2 \bullet S - VL) \bullet \sin\beta1 - (NL - D2 - 2 \bullet S - VL) \bullet \sin\beta2$$

$$L = \sqrt{b^2 + k^2}$$

$$\alpha = \operatorname{atan}\left(\frac{k}{b}\right)$$

Probe versions

Path angle for exact nozzle assembly 75 °

Use a suitable protractor to determine and register the actual value. The manufacturer measures the path length for each probe and includes this in the Zero Point protocol in the delivery documents.

3.3.2 Installing the meter body (option) in the pipeline

The meter body shall be installed in the pipeline in a way that the arrow marking on it corresponds to the flow direction. The flow will be output from the measuring system as a positive value if the sender/receiver units master and slave for cross-duct versions are mounted according to → pg. 24, Fig. 2.

WARNING: Danger due to size and mass of the meter body

The lifting eyes are designed for transporting the meter only. Flange sealing surfaces, nozzles and blank flanges may be damaged when the lifting gear is not attached properly.

- Do not lift the FLOWSIC100 Flare using these eyes when additional loads (such as blank flanges, filling for pressure tests or piping) are attached (→ pg. 83, Fig. 35).
- If lifting straps are used, wrap them around the meter body.
- The FLOWSIC100 Flare must not turn over or start to swing while being transported.
- Take suitable measures to prevent damage to the meter when carrying out any other work (welding, painting) near the FLOWSIC100 Flare.

Required installation work

- Position the FLOWSIC100 Flare at the desired section of the pipeline using the lifting gear.
- Check for correct seating and alignment of the flange gasket after installing the flange bolts, but prior to tightening.
- Align the meter body of the FLOWSIC100 Flare such that the offsets between inlet pipe, meter body and outlet pipe are minimized.
- Insert the remaining fastening bolts and tighten the nuts cross-wise. The tightening torque applied must not be lower than specified in the project planning.
- Mount the pressure sensing line between pressure tap (option) and pressure transmitter (option).
- Fill the pipeline and check the installed FLOWSIC100 Flare with meter body and piping connections for leaks.

We recommend performing a leak test in accordance with the relevant regulations and standards after completion of the mechanical installation.

For achieving full measuring range and specified accuracies adhere to the geometric tolerances listed in → pg. 85, §3.3.1.

For applications with highest requirements regarding accuracy and measuring range, the meter body may also be delivered by SICK. The manufacturing tolerances are then guaranteed.

The internal diameter Di of the pipeline is required for further configuration of the geometric data (→ pg. 170, § 4.3.2). It can be calculated as follows:

$$Di = \frac{U}{\pi} - 2 \bullet W$$

U = Pipeline circumference at assembly location
W= Wall thickness

We recommend determining the wall thickness by measurement and averaging at 4 positions around the pipe. Suitable ultrasonic measurement techniques can be used for this.

The wall thickness data according to ANSI table can deviate from the actual wall thickness by up to 13%.

3.3.3 Installing the MCUP control unit

3.3.3.1 Version without explosion protection and version for Ex zone 2

Install the control unit in a protected location that is easily accessible. Observe the following points during fitting:

- Maintain the ambient temperature according to the Technical Data; take possible radiant heat into consideration (shield if necessary).
- Protect against direct sunlight.
- Whenever possible, choose an assembly location with minimum vibrations; dampen any vibrations if necessary.
- Leave enough clearance for cables and opening the door.
- Select an installation location free of chemical influence (esp. for use in ex zone 2).

WARNING:
Exposure to some chemicals may degrade the sealing properties of materials used in the following devices:

- Relay (sealed device) type AZ830-2C-12DSE and AZ832-2C-12DSE (manufactured by ZETTLER) assembled on the processor board of the MCU
- Relay (sealed device) type V23092-B1024-A301 (manufactured by SCHRACK) or type FTR-LYRA024Y (manufactured by FUJITSU), assembled in the optional digital output module (SICK part no. 2034659)

Used enclosure material (white plastic [glass fiber reinforced PBT]) and encapsulating material (black or white epoxy resin) may degrade particularly in the presence of hydrocarbons and hydrogen sulfide among others.

Extremely ambient temperatures as well as higher concentrations of the chemicals may expedite the degradation.

► Use long connection cables between the MCUP and the sender/receiver units to install the MCUP in a location with safe conditions.

Named components must be inspected periodically (details → pg. 207, § 5.3).

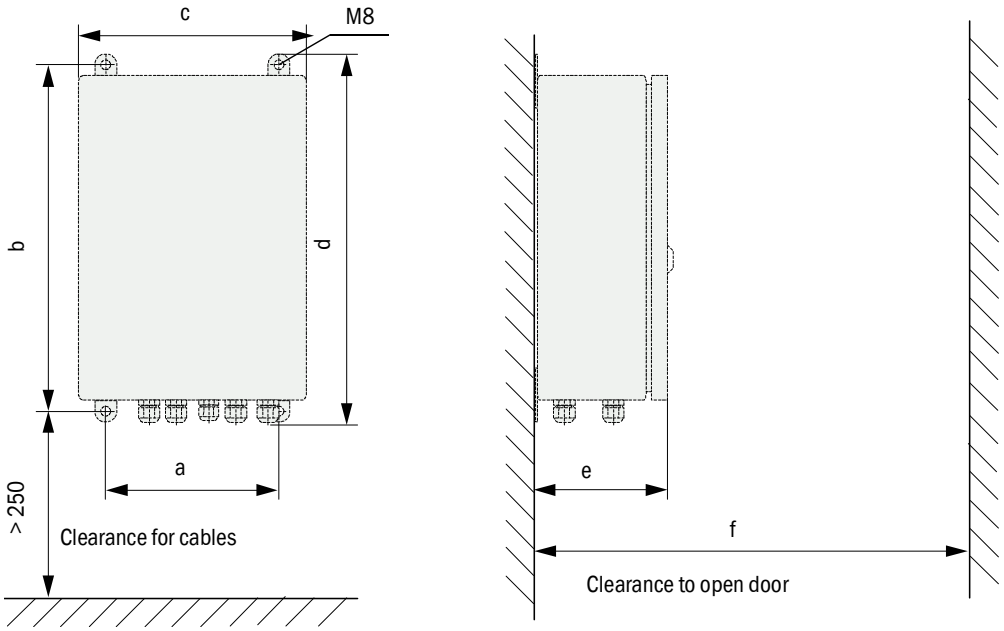
Using suitable cables, the MCUP control unit can be located up to 1000 m away from the sender/receiver units. We therefore recommend fitting the MCUP in a control room (measuring station or similar) to ensure free access to the MCUP. This considerably simplifies communication with FLOWSIC100 Flare in order to set parameters or to locate malfunction or error causes.

It is advantageous to provide weather protection (tin roof or similar), made on-site, for use outdoors.

Assembly dimensions for MCUP in compact and medium size housing

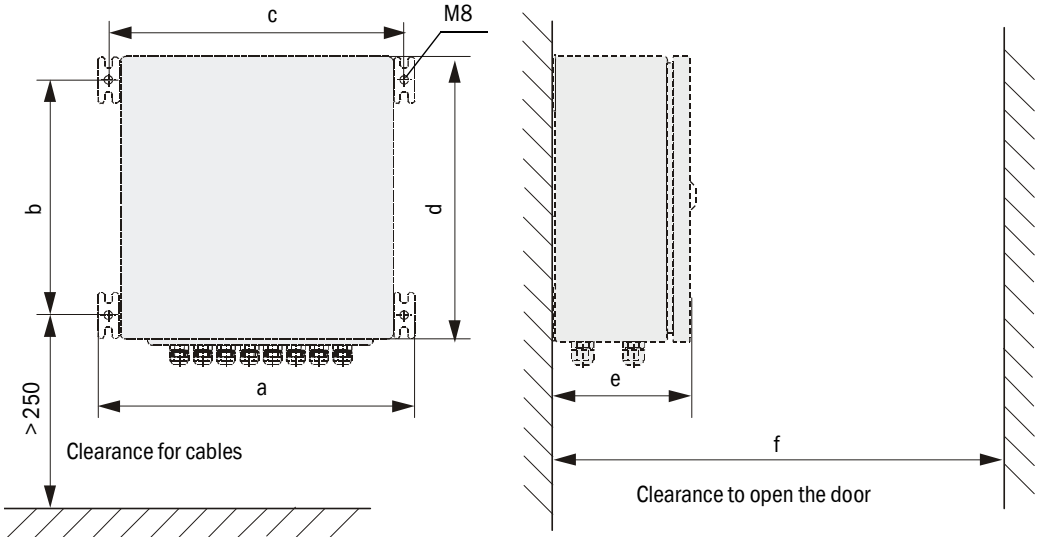
Fig. 49 MCUP assembly dimensions

MCUP in compact size housing



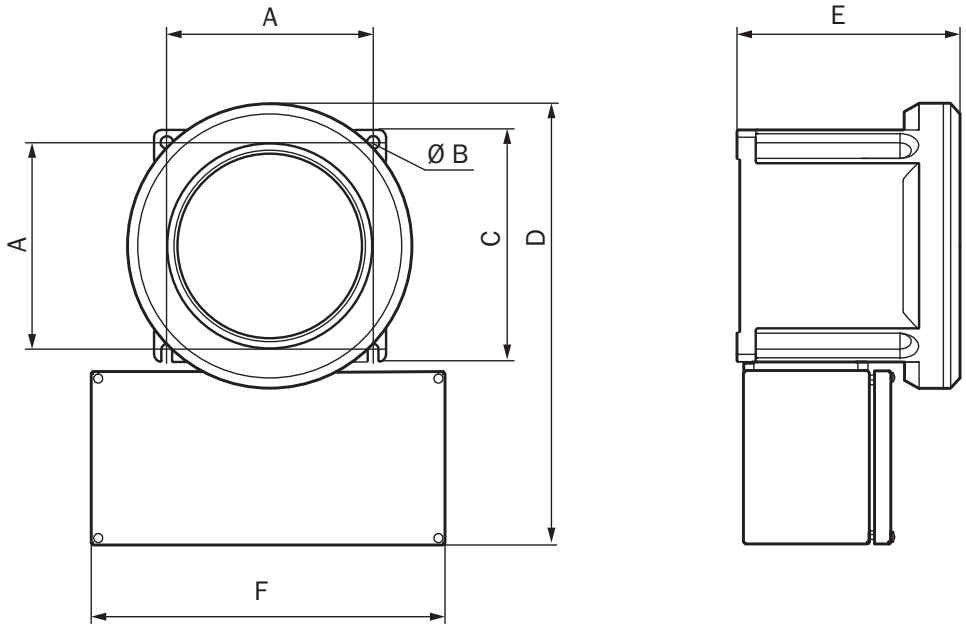
Measure	Dimension in mm	
	MCUP in compact size housing	MCUP in medium size housing
a	160	356
b	320	242
c	210	330
d	340	300 (for ATEX zone 2 version) 320 (for CSA CII Div 2 version)
e	125	215
f	> 350	> 550

MCUP in medium size housing



3.3.3.2 Explosion-protected version for Ex zone 1

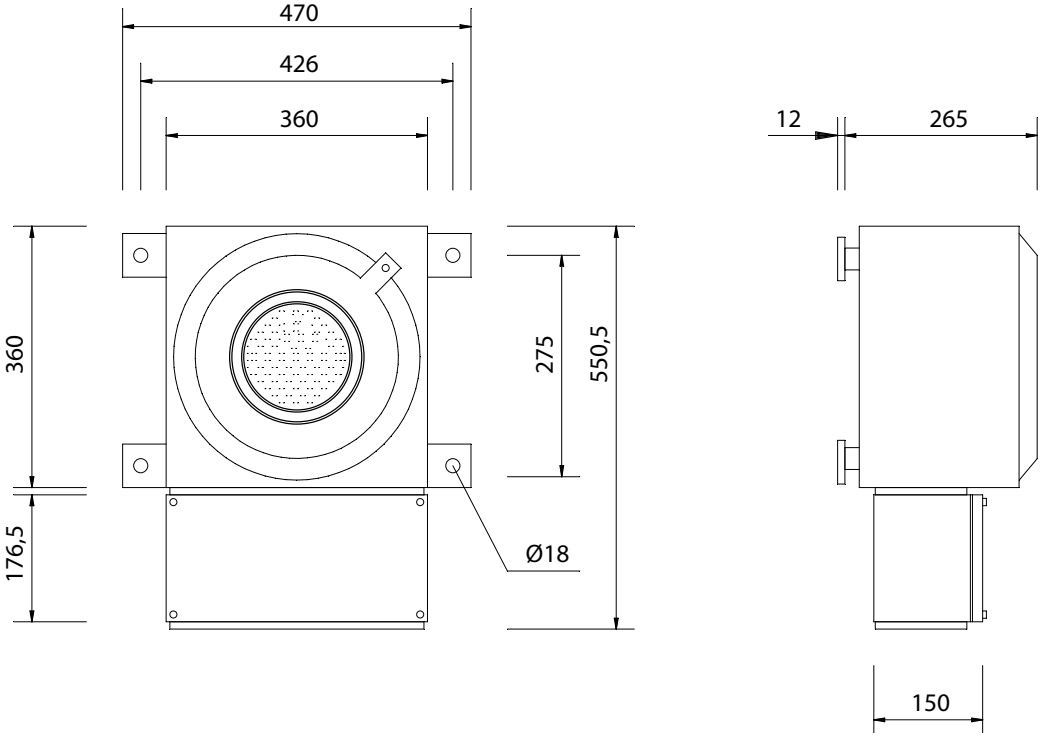
Fig. 50 MCUP in Ex housing for zone 1 [all dimensions in mm]



Housing variant	A	B	C	D	E	F
Size 4	210	11	260	445	227	360
Size 6	312	11,5	335	605	281	360

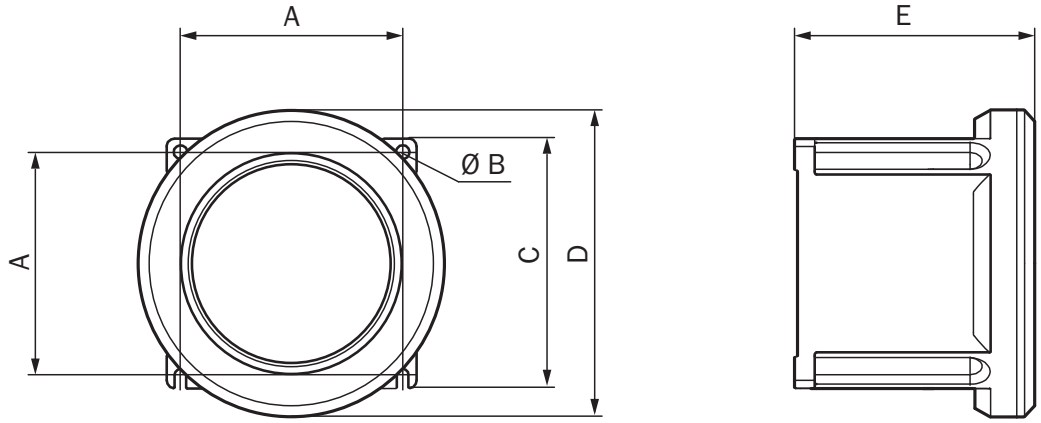
Special housing variant - stainless steel

Figure 51 MCUP in Ex housing for zone 1 - stainless steel [all dimensions in mm]



3.3.3.3 Explosion-protected version for CSA Cl I, Div 1

Fig. 52 MCUP in Ex housing for zone CSA Cl I, Div 1[all dimensions in mm]

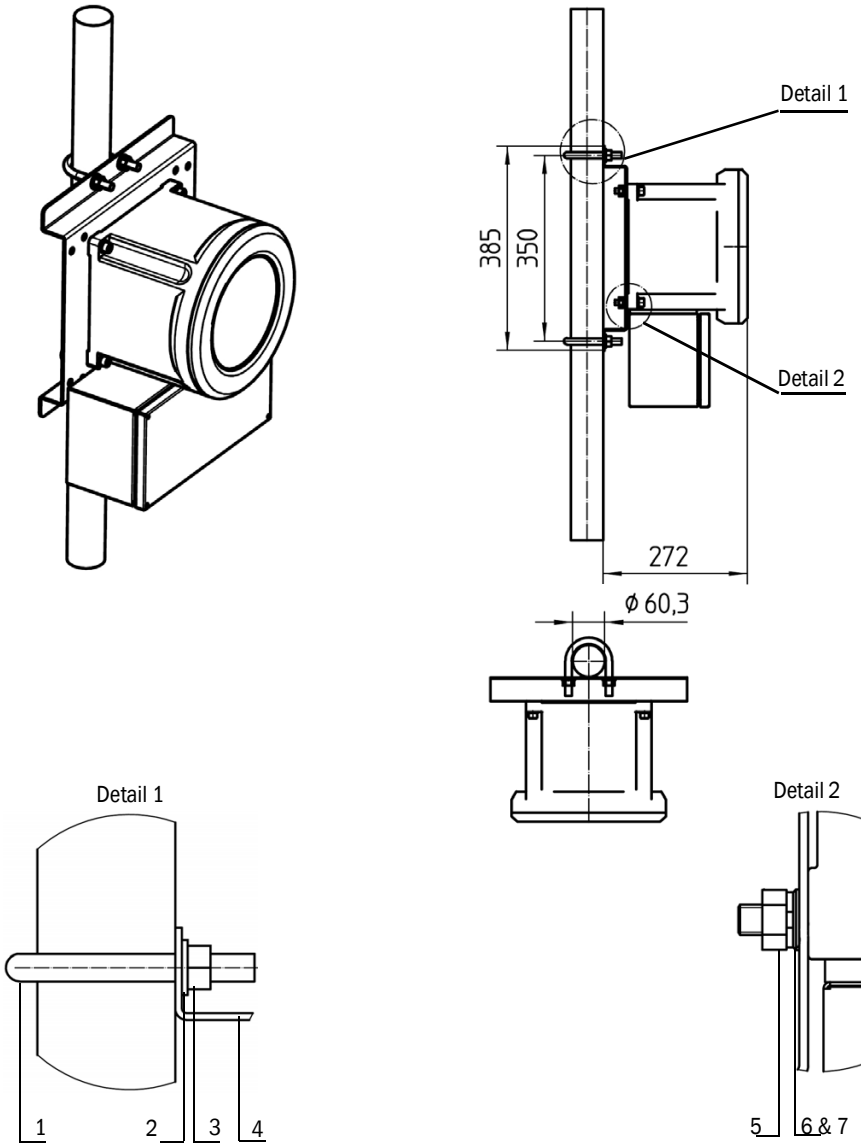


Housing variante	A	B	C	D	E
Size 4	210	11	236	289	227
Size 6	312	11,5	335	410	281

3.4 Installing the MCUP with option "Set fixing plate for 2-inch post"

For Control Unit MCUP an optional set for mounting to a 2-inch post is available (not suitable for MCUP compact size or 19“ rack version).

Fig. 53 MCUP Ex d fixing plate



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

5 Nut M10 DIN934
6 Spr. washer B10 DIN127
7 Washer B10,5 DIN125
8 Screw M10 DIN912

Directions for mounting:

- ► Fix plate (4) to post using round steel bow (1), nut (3) and washer (2)
- ► Mount MCUP to fixing plate using screw (8), washer (7), washer plus spring washer (7) + (6) and nut (5).

3.5 Installing the sun roof MCUP (option)

> ***NOTICE:***
> The sun roof is only to be used to protect the MCUP from direct solar radiation and is not suitable as protection from precipitation.

3.5.1 Sun roof MCUP for wall mounting

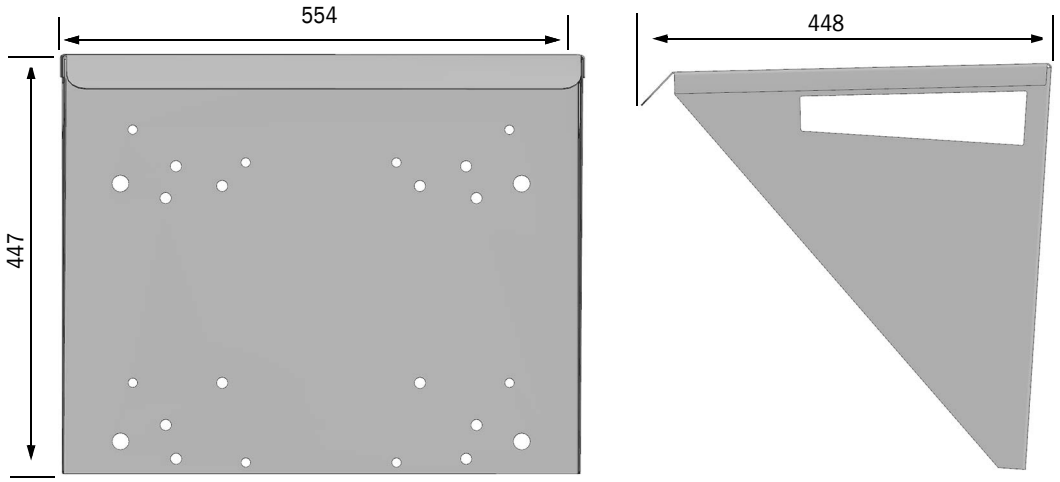
3.5.1.1 Components/scope of delivery

The sun roof MCUP for wall mounting (Part. No. 2069568) is delivered as a set of the following components.

Table 3 Scope of delivery MCUP for wall mounting

Description	Part no.
Sun roof	4075713
Mounting kit sun roof	2072670
Mounting kit MCUP Size A,B,C,D	2072671
Mounting kit MCUP Size E	2072679

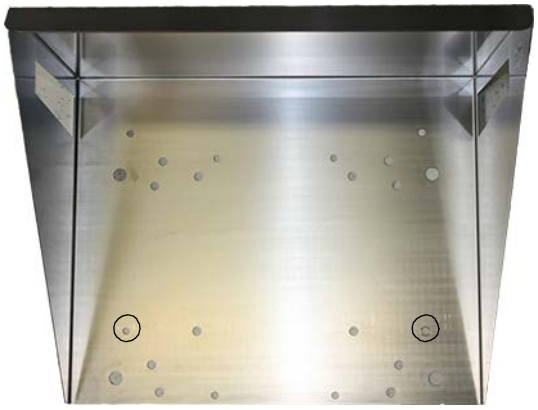
Figure 54 Dimensions [mm]



3.5.1.2 Mounting sun roof MCUP on the wall

- ► Use „mounting kit sun roof" on the wall.
- ► Use the holes marked in Fig. 55.

Figure 55 Mounting sun roof to the wall



3.5.1.3 Mounting MCUP on the sun roof

The appropriate mounting kit for the mounting of the MCUP on the sun roof can be found in Table 4.

Figure 56 Mounting MCUP on the sun roof

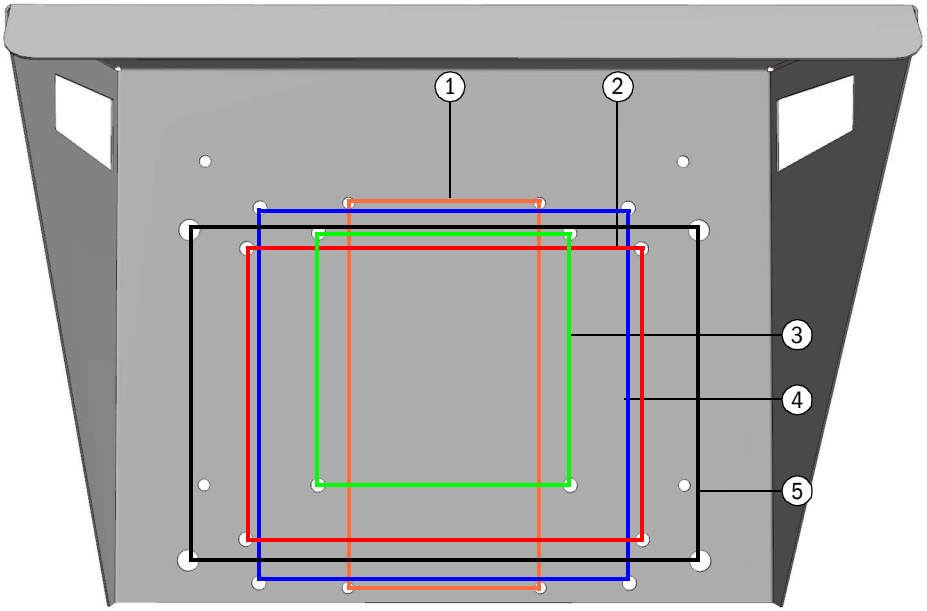
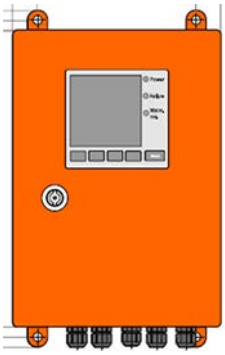
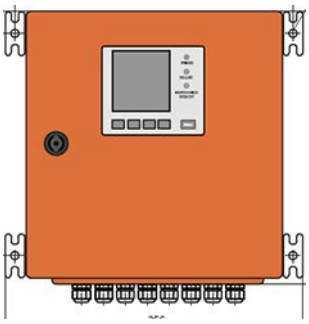
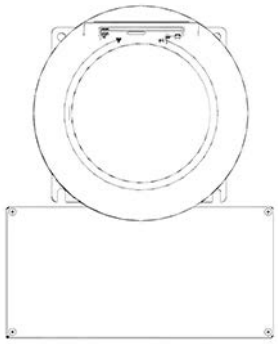
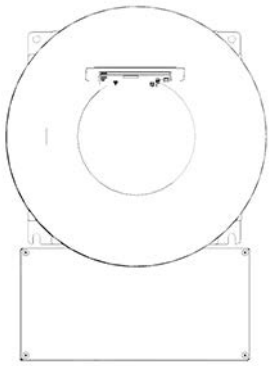
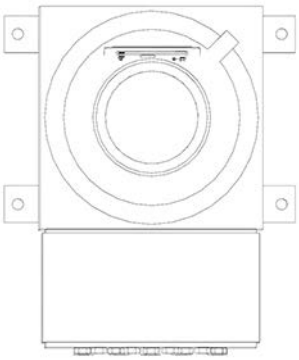


Table 4 Mounting kits for sun roof MCUP

Frame	MCUP type	Mounting kit
Orange (1)	MCUP Compact 	Mounting kit MCUP Size A,B,C,D
Red (2)	MCUP Medium 	Mounting kit MCUP Size A,B,C,D
Green (3)	MCUP STAHL, Size 4 (with or without terminal compartment) 	Mounting kit MCUP Size A,B,C,D

Blue (4)	MCUP STAHL size 6 (with or without terminal compartment) 	Mounting kit MCUP Gr. A,B,C,D
Black (5)	MCUP STAHL Stainless Steel 	Mounting kit MCUP Gr. E

3.5.2 Sun roof MCUP mounting on 2-inch post

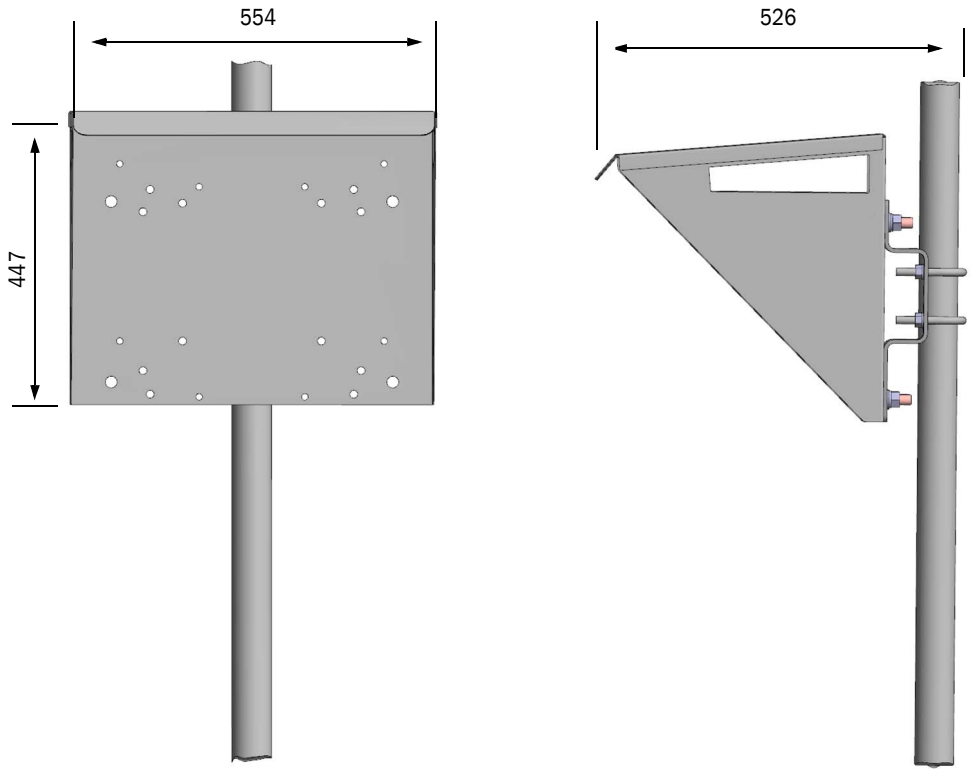
3.5.2.1 Components/Scope of delivery

The sun roof MCUP for mounting on 2-inch post (Part. No. 2069405) is delivered as a set of the following components:

Table 5 Scope of delivery MCUP for mounting on 2-inch post

Description	Part No.
Sun roof	4075713
Mounting plate	4075714
Mounting kit post bracket 2-inch	2061076
Mounting kit sun roof	2072663
Mounting kit MCUP Size A	2072665
Mounting kit MCUP Size B,C,D	2072666
Mounting kit MCUP Size E	2072664

Figure 57 Mounting on 2-inch post [all dimensions in mm]



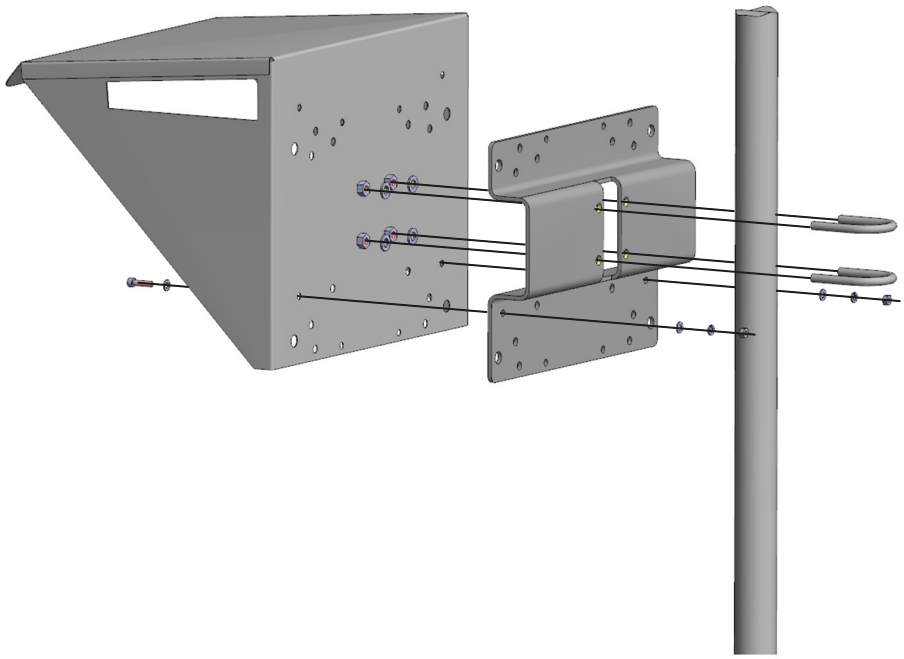
3.5.2.2 Mounting sun roof on 2-inch post

Figure 58 Mounting on 2-inch post

The sun roof for wall mounting is by default delivered with the mounting plate (1) fixed to the inside of the sun roof (2) with the „mounting kit sun roof".

- ► For the mounting on the 2-inch post remove the mounting plate (1) from the sun roof (2).
- ► Then fix the mounting plate (1) to the 2-inch post with the „mounting kit post bracket 2-inch".
- ► Finally fix the sun roof (2) on the mounting plate (1) with the "mounting kit sun roof" according to Fig. 59.

Figure 59 Mounting on 2-inch post



3.5.2.3 Mounting MCUP on sun roof

► Mount the MCUP to the sun roof as outlined on p. 106, §3.5.

3.6 General notes for installation of sender/receiver units

WARNING:

- Observe and follow the valid regulations and safety regulations as well as the safety notices in Section 1.
- Take special precautions for use in plants with increased hazard potential (toxic/aggressive/explosive gases, higher pressure, higher temperature) (risk or serious injuries).
- Use suitable protection measures against possible local hazards or hazards arising from the equipment.
- Observe the permitted operating parameters according to the Figures in → pg. 32, § 2.2.1 during all work.

Check the following before installing:

- Sender/receiver units to be fitted for a particular measuring point must belong to the same system to ensure the maximum measuring precision possible. Exchanging structurally identical sender/receiver units from different measuring systems is not recommended.

  Sender/receiver units can only be exchanged against identical units.
  In this case specific probe parameters must be set using the SOPAS ET program (see Service Manual).

- Sender/receiver units from one system are marked with sequential serial numbers (printed on the device label). The FLSE100 Master always has the lower number and the FLSE100 Slave the higher number.
- Sender/receiver units and nozzles must be compatible (→ pg. 55, § 2.2.2).
- Nozzles must be free from weld 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. SICK recommends:

- Use the same type of gaskets as in original scope of supply only
- Apply a tightening torque according to → pg. 245, § 6.7 „Sealing installation instruction“.

WARNING:

Ball valve and sender/receiver unit do not function correctly following incorrect installation. Both parts can be damaged. Serious injuries are possible.

For installation of seals see instructions of sealing manufacturer in → pg. 245, § 6.7.

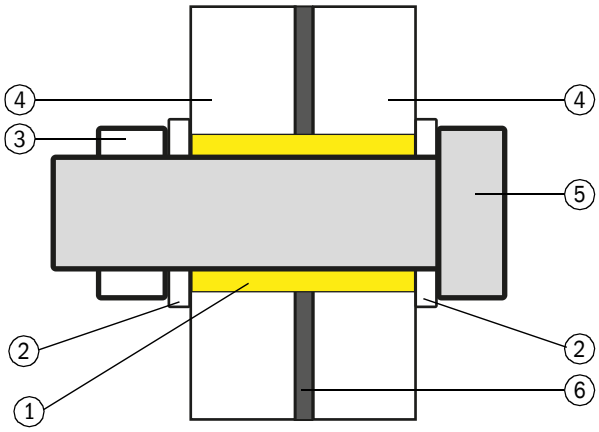
WARNING: Hazards through leaks

Operation in leaky condition is not allowed and possibly dangerous.

Use of the alignment sleeves

The alignment sleeves are included in the mounting kit for the sender/receiver units. The alignment sleeves serve to ensure the centering of the process flanges of the sender/receiver units and are decisive to achieve the uncertainty statements in § 6.1 „Technical Data“.

Fig. 60 Alignment sleeves



1 Alignment sleeve
2 Washer
3 Nut
4 Flange
5 Fastening screw
6 Gasket

3.6.1 Installing non-retractable sender/receiver units

Non-retractable sender/receiver units can be installed/removed on the nozzles if plant is out of operation only. The gas pipeline must be free of any gas/liquid with hazard potential (toxic or aggressive).

Assembly

- ► Place gasket on the nozzle connection. Consider sealing instructions in chapter 6.5.
- ► Carefully insert the sender/receiver unit into the nozzle to stop and screw on with fastening screws.

  Use the alignment sleeves supplied, → Fig. 60.
- ► Check process connection for tightness.

3.6.2 Installing retractable sender/receiver units

Retractable sender/receiver units can be installed/removed on the fitting set with observation of the following information while the plant is in operation.

NOTICE:

- Process ball valve 2”/3” (5 in → p. 99, Fig. 46) is closing the nozzle and prevents that process gas can escape from the pipeline.
- Process ball valve 2”/3” may be opened only if the sender/receiver unit is mounted tightly. Venting connection must be closed tightly with blind screw. Tightness has to be checked by the user.
- Do not dismount sender/receiver unit as long as process ball valve 2”/3” is not closed tightly.
- Retractable sender/receiver units can be equipped with venting valve (option). Do not open venting valve if process ball valve 2”/3” is opened!
- The process ball valve 2”/3” has a non-symmetric design. The short tube side must be connected to the nozzle, the sender/receiver unit must be connected to the long tube side (→ p. 116, Fig. 61)
- Flange gaskets must be replaced at every assembling/disassembling of ball valve and sender/receiver unit.

WARNING:

The gas in the pipeline can be dangerous.

- ► Observe and follow the valid regulations and safety regulations as well as the safety notices in Section 1.
- ► Take special precautions for use in plants with increased hazard potential (toxic/aggressive/explosive gases, higher pressure, higher temperature) (risk or serious injuries).
- ► Use suitable protection measures against possible local hazards or hazards arising from the equipment.
- ► Make sure the 2"/3" ball valve (5 in Fig. 61) is closed.
- ► Observe the permitted operating parameters according to the Figures in § 2.2.1 during all work.
- ► Venting of any gas with hazard potential (toxic, aggressive, explosive etc.) requires always suitable protective measures and safety precautions for safe venting and is in the responsibility of the plant operator (→ p. 32, 2.2.1)

Assembly

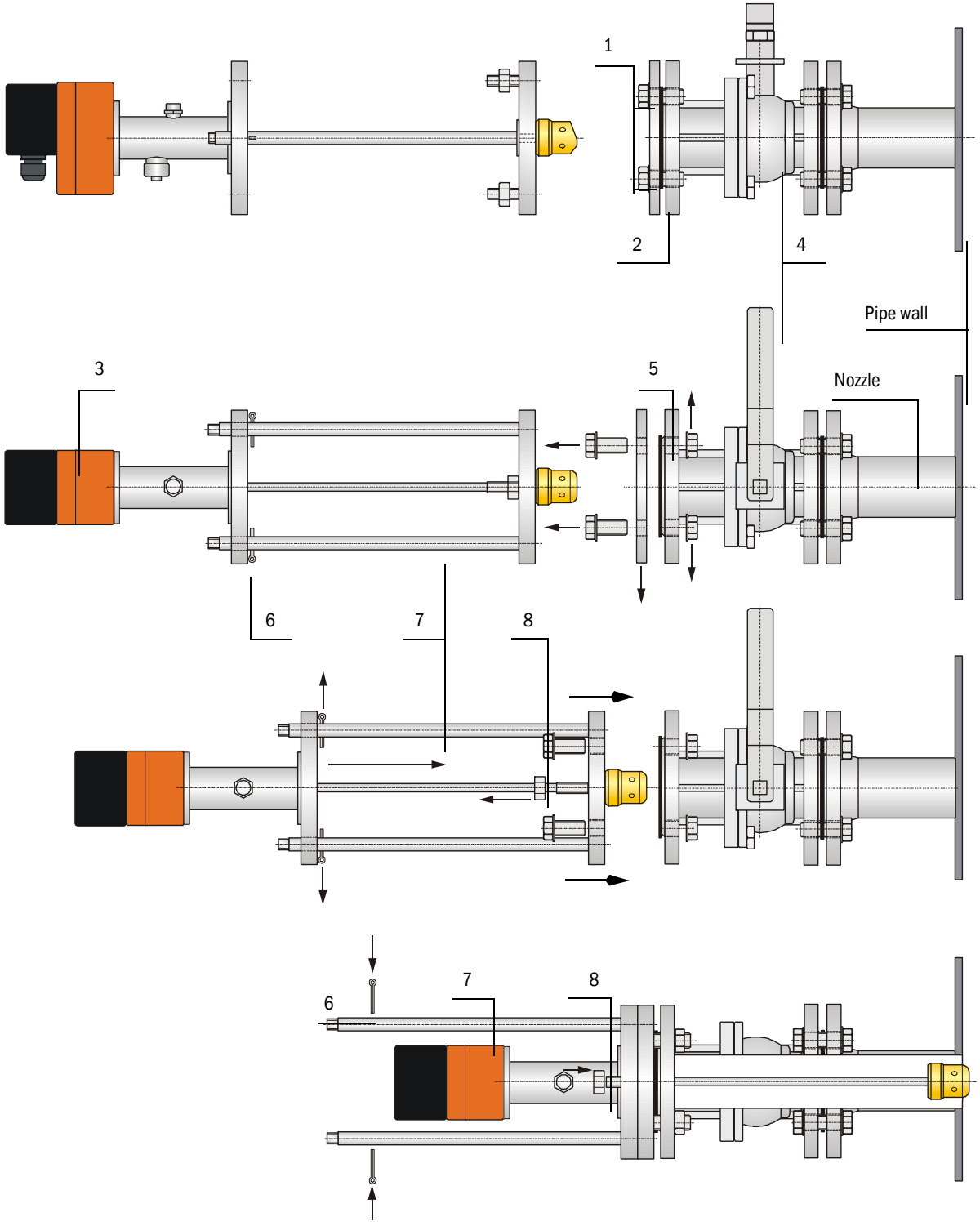
- ► Loosen fastening screws (1) on blind flange (2) and remove the blind flange.
- ► Position the sender/receiver unit (3) on the ball valve (4) and screw on with fastening screws (1).

  Use the alignment sleeves supplied, → Fig. 60.
- ► Remove cotter pins (6) from guide rods (7) and loosen both fastening nuts (8).
- ► Open the ball valve (4).
- ► Carefully insert the sender/receiver unit into the ball valve and nozzle to stop and fasten with nut (8).
- ► Attach cotter pins (6) to guide rods (7).
- ► Check all process connections for tightness.

Installing the nozzle isolation set

To prevent danger of galvanic corrosion a "Nozzle isolation set" can be used (option). For installation see instruction in → pg. 245, § 6.7.

Fig. 61 Retractable sender/receiver units assembly[1]



1 shown without connection for venting, for device type FLSE100-EXS

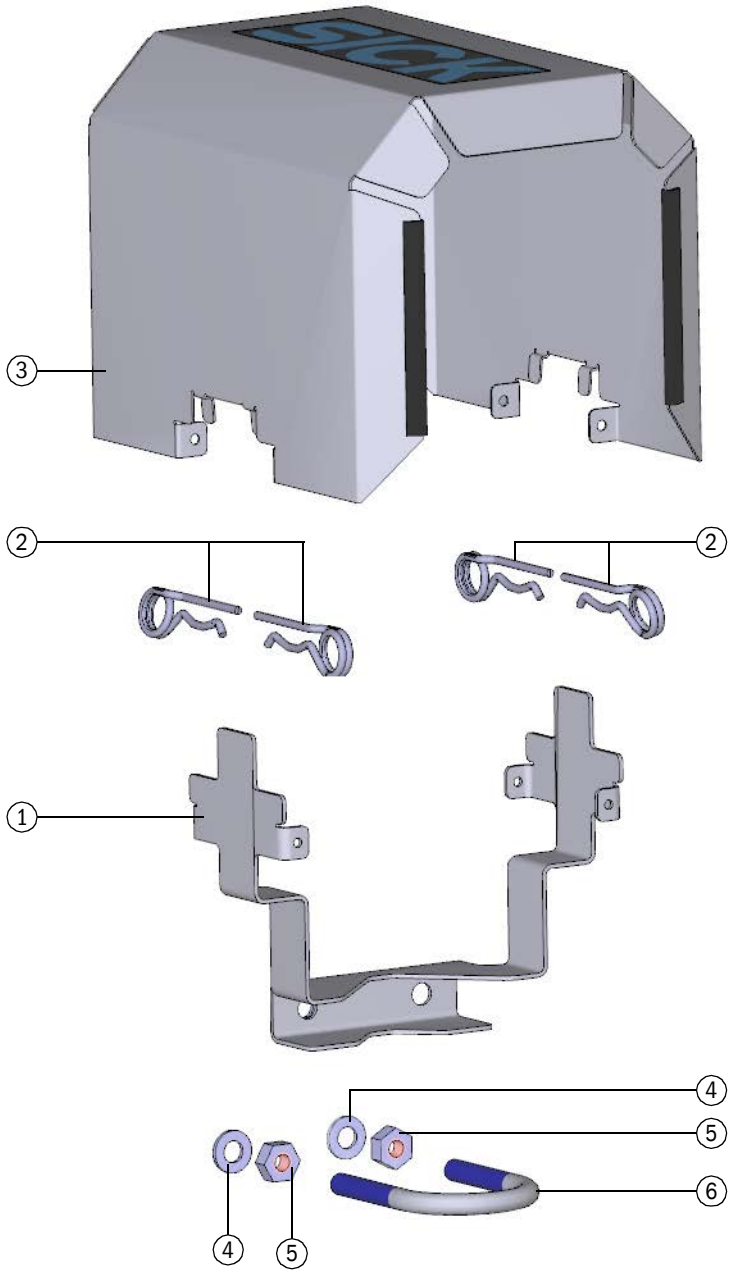
3.7 Installing the sun roof for the sender/receiver units

Intended use

The sun roof (Part No. 2080205) protects the electronics of the sender/receiver units from sunlight.

> ***NOTICE:***
> The sun roof is only to be used to protect the sender/receiver units from direct solar radiation and is not suitable as protection from precipitation.

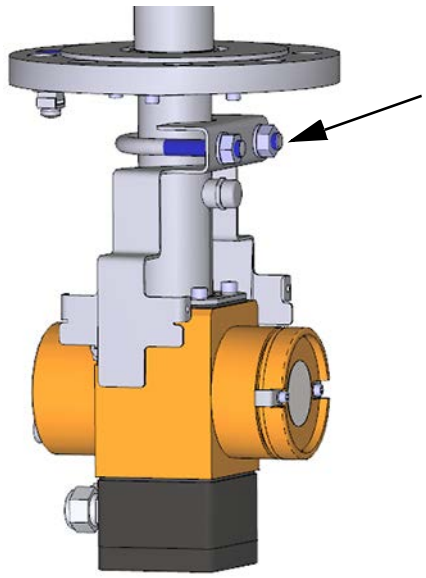
Bild 62 Overview sun roof



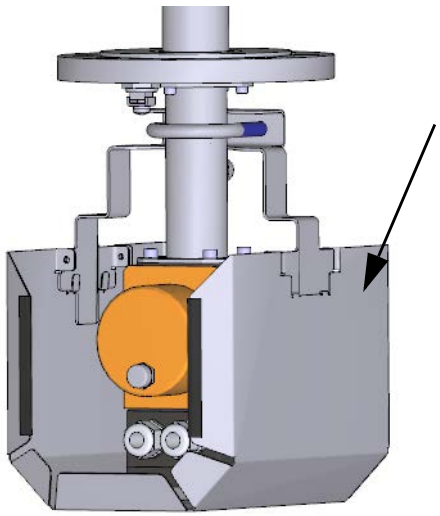
1 Holder
2 Split pins
3 Protective hood
4 Washers
5 Hexagon nuts
6 Round steel bow

3.7.1 Installing the sun roof for the sender/receiver units

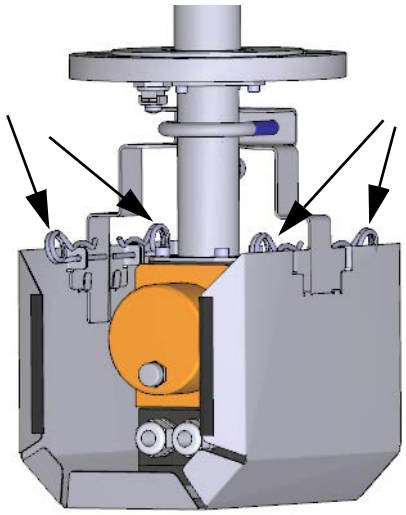
1 Fix the holder to the sender/receiver unit:
- ► Use the hexagon nuts with washers to attach the holder with round steel bow to the probe neck of the sender/ receiver unit.
- ► Pay attention to the correct alignment of the holder and make sure that the probe is not damaged. See adjacent figure.



2 Position the protective hood on the holder.

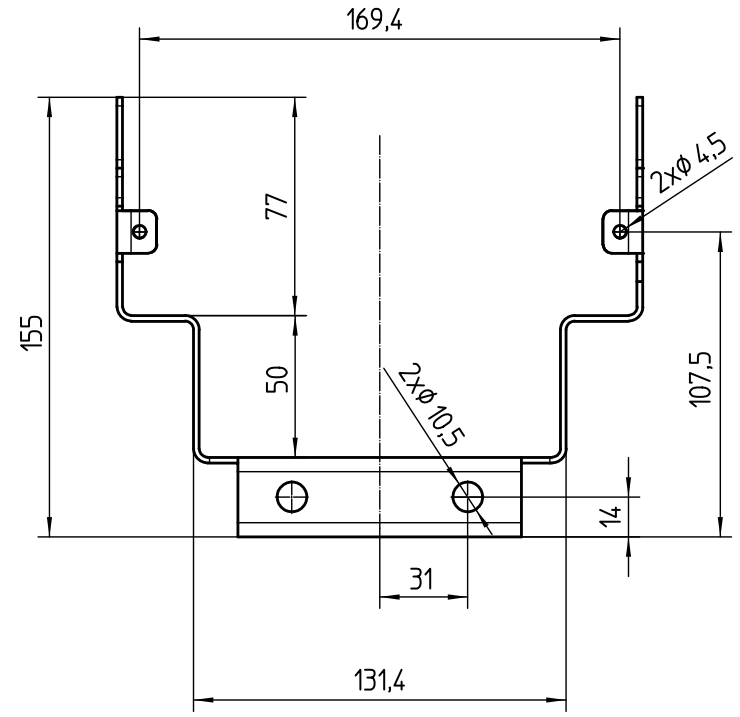


3 Secure the sun roof with the 4 split pins.



3.7.2 Dimensional drawings

Bild 63 Holder



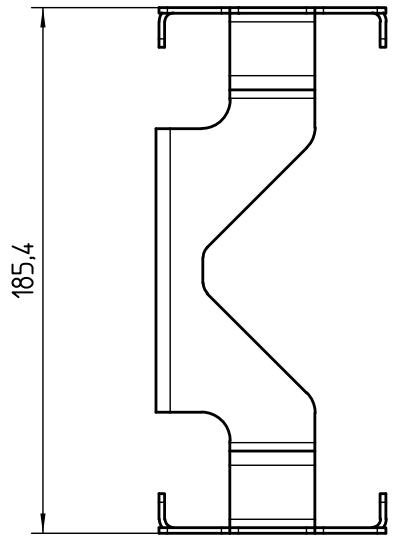
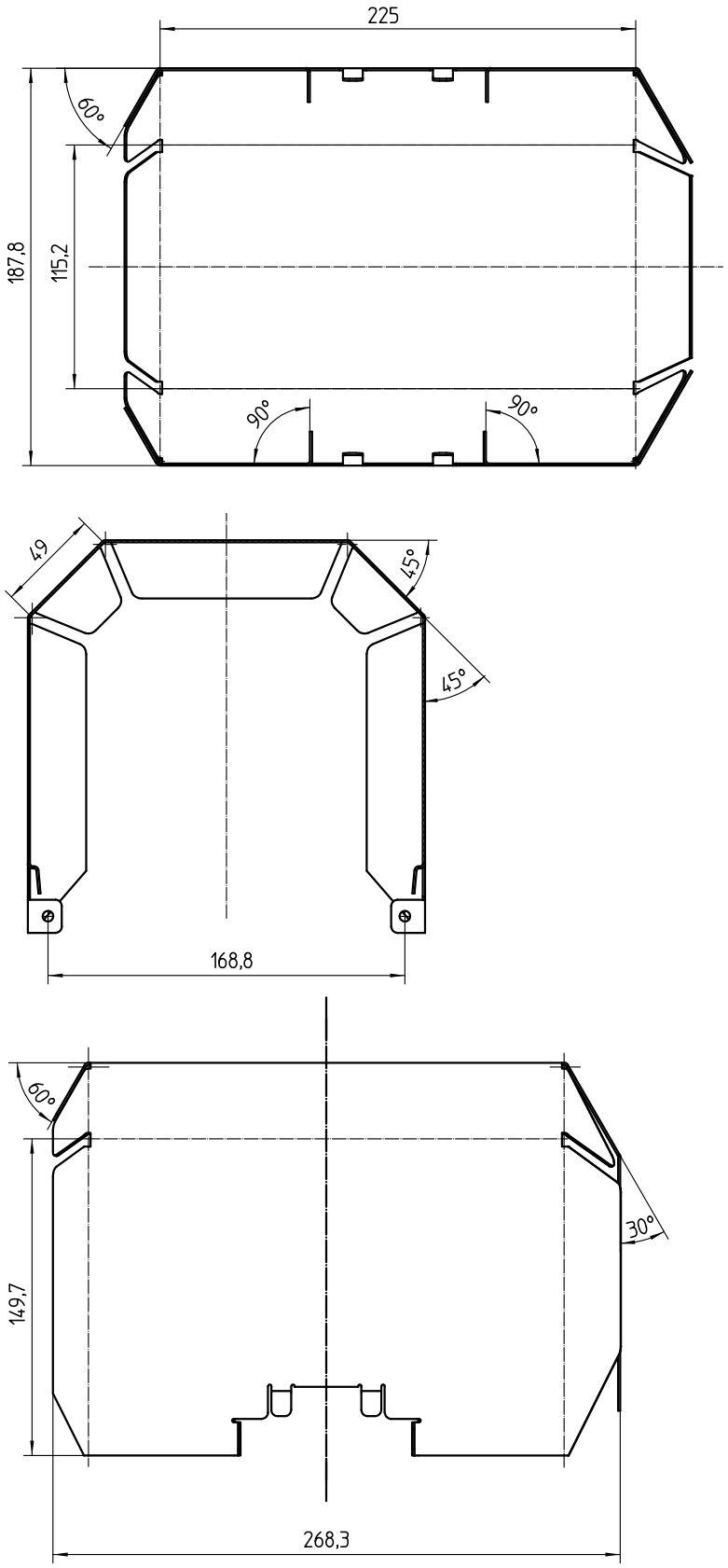


Bild 64 Protective hood



3.8 Electrical installation

3.8.1 General information, prerequisites

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

WARNING: Electrical Hazards

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 Section 1 during all installation work.
- ► Use suitable protection measures against possible local hazards or hazards arising from the equipment.
- ► Only connect sender/receiver units to the MCUP control unit as intended.

3.8.2 Cable requirements

Standard connection cables are part of delivery. Special cables are available on request.

- Cable between s/r units of device type FL100 EX-S
  Cable type: Exi, coaxial, RG62, connection TNC with safety catch
- Cable between s/r units of device type FL100 EX, EX-RE
  Cable type: Li2YCYv(TP) 2x2x0,5 mm^2, with reinforced insulation, 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
- Cable between s/r units and control unit MCUP
  Cable type: Li2YCYv(TP) 2x2x0,5 mm^2, with reinforced insulation, 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 cable specification above represents the SICK standard cables and does not take into account any special requirements for cabling in hazardous areas. The plant operator is responsible, that all used cables comply with valid regulations and guidelines for cabling in hazardous areas at his plant. Special cables for individual requirements are available on request.

Cable glands

- Cable glands for non-ex, ATEX Zone 2 and ATEX Zone 1 are offered by SICK as accessories for the following components:
  - FLSE100 ATEX Zone 1 without junction box
  - FLSE100 CSA Cl I, Div1
  - MCUP Medium size, non-ex, ATEX Zone 2, CSA Cl I, Div2
  - MCUP Ex-d, ATEX Zone 1
- Cable glands are part of delivery for following components:
  - FLSE100 ATEX Zone 1 with junction box (cable glands, metric M20, brass, nickel plated or similar)
  - FLSE100 ATEX Zone 2 with junction box (cable glands, metric M20, brass, nickel plated or similar)
  - MCUP compact size (cable glands, metric, plastic)

NOTICE:
Installation of cable glands must be performed in accordance with the cable gland manufacturer‘s operating instructions.

NOTICE: Factory pre-installed cable glands at S/R units and MCUP

- ► Install only fixed cables and wires in the cable glands. The plant operator must ensure an appropriate strain relief.
- ► The cable and conduit entries must be installed with mechanically protection against inadmissible impact energy according to EN 60079-0 section 26.4.2.

NOTICE: Suitability of factory pre-installed plastic cable glands at MCUP ATEX Zone 2

- ► In accordance with EN 60079-0, section 26.4.2 the pre-installed PA plastic cable glands at MCUP ATEX zone 2 are suitable for equipment group II with low degree of mechanical hazard (impact energy “low”, tested with drop height 0.4m or 4J).
- ► If there is a risk of higher mechanical stress, especially at low temperatures, the use of metal cable glands is recommended (available on request).

NOTICE:

- Only analog cable Exi of device type FL100 EX-S is approved for ATEX and CSA versions (interconnection of master and slave unit).
- All other cables offered by SICK are only for ATEX/IECEx versions for use in ATEX zone 1 or zone 2 applications.
- All cable glands offered are only for ATEX/IECEx versions for use in ATEX zone 1 or zone 2 applications.
- Cables, cable glands and other installation material for CSA Cl I, Div 1 versions must be provided by the customer. Solutions for CSA Cl I, Div2/zone 2 versions are available on request.

Line length

The overall length of all cables must not exceed the following lengths (→ pg. 29, §2.1.4):

- 1-path measurement (standard cabling): 1000 m
- 2-path or 2x1 path measurement (bus cabling): 500 m
- 3x1-path measurement (bus cabling): 300 m

Bus cabling

This type of cabling is preferable for greater distances between sender/receiver units and control unit.

In individual cases it may be possible to terminate the electronics of the sender/receiver unit using a cable termination resistor that is positioned at the end of the bus (no termination in delivery state). Solutions for external terminations are available on request.

3.8.3 Requirements for installation in the Ex zone

General requirements

WARNING: Explosion Hazard

- ► Do not open the enclosures while energized.
- ► Do not connect or disconnect the circuits unless power has been removed or the area is known to be non-hazardous.
- ► 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, and that every single cable core is protected separately with a fuse of max. 1 A.
- ► Do not use the device if cables or terminals are damaged.

General

- The documentation for zone classification according to EN/IEC 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.

Cabling

- The cables must fulfill the requirements according to EN/IEC 60079-14.
- Cables which are especially endangered by thermal, mechanical or chemical stress, must be protected, e.g. by laying in protective tubes.
- Cables must be flame retardant in accordance with DIN VDE 0472 Part 804 Type of Inspection B / IEC 60332-1 must be demonstrated.
- The cross-section of each individual wire must not be smaller than 0.5 mm².
- Observe the clamping range of the cable glands for cable selection.
- Cables for Ex-e cable glands must comply with the requirements in EN 60079-14 Section 11.3.
- The existing clearance in air and creepage according to EN/IEC 60079-07 or EN/IEC 60079-15 may not be reduced by connection of the cables in the terminal compartments.
- Ex-d cable gland must be suitable for the intended cable type (e.g. cables with or without armoring).
- The cables and conductors for Ex-d cable terminals must comply with the requirements in EN/IEC 60079-14, Section 10.4.2 b). The selection there must be made according to Fig. 1.
  - If the explosive gas mixture requires an IIC installation and the installation area belongs to zone 1, pressure-proof cable glands and bushings containing seals filled with potting compound must be used for the individual wires, e.g. series 8163/1-PXSS2K for normal, not armored offshore and onshore cables or series 8163/1-PX2K for various armored offshore and onshore cables, both from R.STAHL GmbH. Potting is done on-site. Observe the manufacturer's description.
  - If the explosive gas mixture requires only an IIB or IIA installation or the installation area belongs to zone 2, suitable pressure-proof cable glands and bushings with a sealing ring can also be used, if the cable is suitable for that.
- Protect the wire ends with connector sleeves against fraying.
- Replace unused cable glands with the enclosed Exe or Ex-d sealing plugs.
- Connect or safeguard unused wires to ground so that a short circuit is excluded with other conductive parts.

- Carry out potential equalization according to EN/IEC 60079-14 (see also the following Section).
- "Conduit" systems must comply with the requirements in EN/IEC 60079-14, Section 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 9.4 for threads with ½" NPT.

The following applies additionally for the FLSE100-EXS intrinsically safe cable connection to intrinsically safe ultrasonic transducers/probe:

- The device marking must at least include the information Ex [ib] or Ex [ia].
- Use only cables delivered by SICK.

  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 SICK item number, at least on the associated packaging. The technical safety data are shown in the Type Examination Certificate.
- Operation of the FLSE100-EXS with sensors not belonging to the system and components and sensors from other manufacturers is not permitted. See the Type Examination Certificate for the technical safety data. See the relevant list in these Operating Instructions for the sensors which may be used with the FLSE100-EXS.

Specific requirements for installation in 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.
- Install sender/receiver units as follows:
  - FLSE100-EXS and FLSE100-EXPR sender/receiver units according to manufacturing drawing E_41943 in the appendix.
  - FLSE100-EX and FLSE100-EXRE see manufacturing drawing E_41944 in the appendix.

Special requirements for use of MCUP control unit in Cl I, Div 1

Wiring that enters or leaves the system enclosure must utilize wiring methods suitable for Class I, Division 1 Hazardous Locations, as appropriate for the installation.

NOTICE:

- ► Keep cover tight while circuits are alive.
- ► Seal required within 18 inches.

Specific requirements for use of MCU-P control unit in zone 2 and CL I, Div2

- Labelling

Symbol	Place	Reason	Activity not allowed or required
	Beside the door lock	Warning for explosion hazard	► Do not open while energized.
	On the fuse terminal locking	Warning for explosion hazard	The pivoting fuse holder is locked by an additional spring locking device. ► Do not overstretch this while opening and closing the fuse holder. ► Using without or with a damaged additional spring locking device is not permitted. ► Ensure that the fuse holder is locked correctly before using. ► Do not disconnect unless power supply has been removed or the area is known to be non-hazardous.
	On the fuse holder	Warning for explosion hazard	► Only replace the fuse with type "sand-filled fuse 2 Amp, 250 V type 522.720, manufactured by ESKA". To prevent repetitive fuse blowing the user shall clarify the causes and shall take appropriate precautionary measures before restarting the equipment.
	On the internal connectors lockingplate	Warning for explosion hazard	Some internal connectors are non self-locking types and must be locked by the additional locking plate against unintentional loosening. Disassemble these connectors before disconnecting and reassemble it after reconnecting. ► Use without or with a damaged additional locking device is not permitted. ► Ensure that all internal connectors and optional modules are locked correctly before using. ► Do not unplug or replug all connectors and subassemblies unless power has been removed or the area is known to be non-hazardous. ► Do not disconnect unless power has been removed or the area is known to be non-hazardous.

Applicable requirements for use in Cl I, Div1 and Cl I, Div2

Table 6 Applicable requirements for use in Cl I, Div1 and Cl I, Div2

Sending / receiving units (FLSE)	Multi control unit (MCUP)
● CAN/CSA Standard C22.2 No. 0-M91 (Reaffirmed 2006) ● CSA Standard C22.2 No. 94.1-07 (First Edition - September 2007) ● CSA Standard C22.2 No. 94.2-07 (First Edition - September 2007) ● CAN/CSA Standard C22.2 No. 60529:05 ● CSA Standard C22.2 No. 142-M1987 (Reaffirmed 2000) ● CSA Standard C22.2 No. 30-M1986 (Reaffirmed 2003) ● CSA Standard C22.2 No. 157-92 (Including update No. 2, June, 2003) ● CSA Standard C22.2 No. 213-M1987 (Reaffirmed 2008) ● CAN/CSA-E60079-0:02 ● CAN/CSA-C22.2 No. 60079-1:07 ● CAN/CSA-E60079-11:02 (March 2002) ● CAN/CSA-E60079-15:02 ● ANSI/UL Standard 50 (Twelfth Edition, September 2007) ● ANSI/UL Standard 50E (First Edition, September 2007) ● ANSI/UL Standard 508 (Seventeenth Edition, Dated January 28, 1999. With revisions through and including July 11, 2005.) ● ANSI/UL Standard 1203 (Fourth Edition, September 2006) ● ANSI/UL Standard 913 (Sixth Edition, Dated August 8, 2002. With revisions through and including August 9, 2004) ● ANSI/ISA-12.12.01-2007 ● ANSI/UL 60079-0 (Fourth Edition, dated August 15, 2005) ● ANSI/UL 60079-1-2005 (Fifth Edition, dated August 15, 2005) ● ANSI/UL 60079-11 (Second Edition, dated March 9, 2007) ● ANSI/UL 60079-15 (First Edition, dated December 2, 2002) ● ANSI/ISA 12.27.01-2003	● CAN/CSA Standard C22.2 No. 0-M91 (Reaffirmed 2006) ● CSA Standard C22.2 No. 94.1-07 (First Edition - September 2007) ● CSA Standard C22.2 No. 94.2-07 (First Edition - September 2007) ● CAN/CSA Standard C22.2 No. 60529:05 ● CAN/CSA-C22.2 No. 61010-1 Second Edition ● CSA Standard C22.2 No. 213-M1987 (Reaffirmed 2008) ● CAN/CSA-C22.2 No. 60079-0:07 ● CAN/CSA-E60079-15:02 ● ANSI/UL Standard 50 (Twelfth Edition, September 2007) ● ANSI/UL Standard 50E (First Edition, September 2007) ● ANSI/IEC 60529-2004 (November 3, 2004) ● ANSI/UL Standard 61010-1-2004 (Second Edition) ● ANSI/ISA-12.12.01-2007 ● ANSI/UL Standard 60079-0 (Fourth Edition, dated August 15, 2005) ● ANSI/UL Standard 60079-15 (First Edition, dated December 2, 2002 with National Differences, Third Edition, dated July 17, 2009) ● CSA Standard C22.2 No 30-M

- Substitutions of components

WARNING: Explosion Hazard

Substitutions of components may impair suitability for Class I, Division 2 / Zone 2. Replace components only by the original types as follows:

- MCUP

  Fuse: sand-filled fuse, 2 Amp. rated, type 522.720, manufactured by ESKA (SICK part no. 2054541)

  Processor board:

  - Relays, type AZ830-2C-12DSE and AZ832-2C-12DSE, manufactured by ZETTLER

  - Back up battery, type BR2032, manufactured by PANASONIC

- Optional modules

  Analog input and output modules as well as digital input modules as listed on p. 244, §6.5.1.

  Interface modules: → pg. 244, §6.5.2

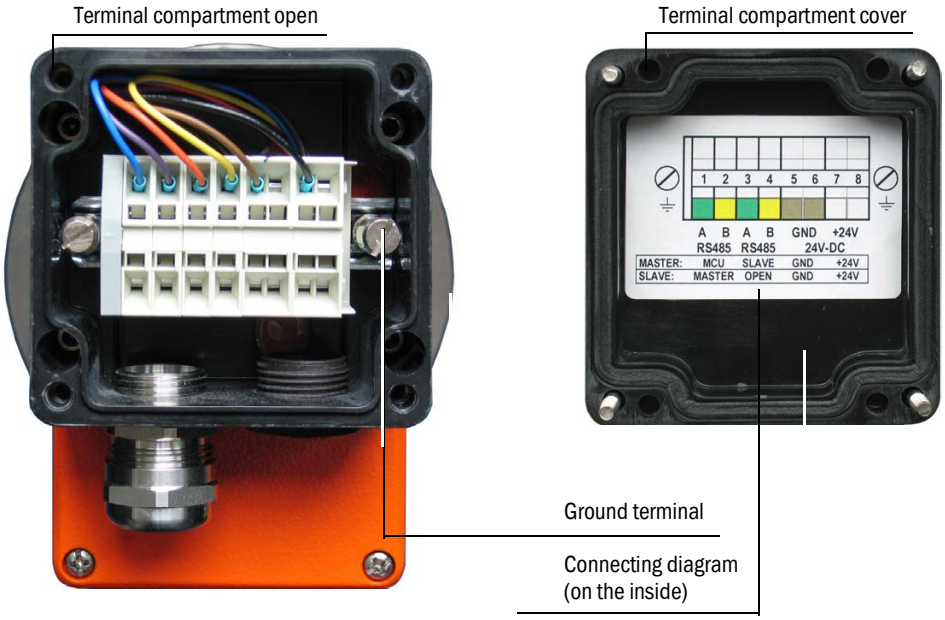
NOTICE:

The replacement of parts (relays and other electrical components) soldered on the processor board is not permitted. The information is given purely in order to check whether a complete board to be replaced matches the requirements (details for exchange see Service Manual).

3.8.4 Connection of sender/receiver units

3.8.4.1 Terminal assignment in the terminal compartment of FLSE100-EXS/EXPR/EX/EXRE sender/receiver units

Fig. 65 Terminal compartment of FLSE100-EXS/EXPR/EX/EXRE sender/receiver unit for zone 2 or for zone 1



Connection of FLSE100-EX/EXRE Master

Internal connection *	1	2	3	4	5	6	7	8
External connection **	Green	Yellow	Green	Yellow	Brown		White	
Assignment	IF1	IF1	IF2	IF2	GND		+24 V d.c.	

Connection of FLSE100-EX/EXRE Slave

Internal connection *	1	2	3	4	5	6	7	8
External connection	Green	Yellow	Green	Yellow	Brown		White	
Assignment	IF2	IF2			GND		+24 V d.c.	

Connection of FLSE100-EXS/EXPR

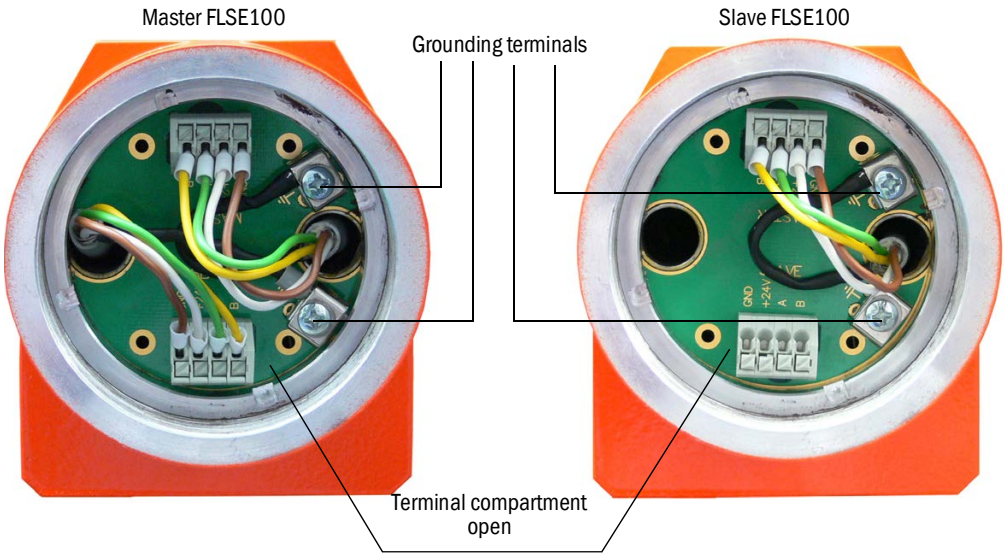
Internal connection *	1	2	3	4	5	6	7	8
External connection **	Green	Yellow	Green	Yellow	Brown		White	
Assignment	IF1	IF1			GND		+24 V d.c.	

*: Cannot be changed
**: Applicable only for cables with wire color code according to DIN 47100
IF1: Communication between FLSE Master and MCUP (interface 1)
IF2: Communication between FLSE Master and FLSE Slave (interface 2)

NOTICE:
Self-locking terminals for wire sizes 0.5 .. 2.5 mm^2 (AWG20 ... AWG12).

3.8.4.2 Terminal assignment in the Exd terminal compartment of FLSE100-EXS/EXPR/EX/EXRE sender/receiver units (Ex zone 1 version without Exe terminal compartment) and CSA version Cl I Div1/Div2

Fig. 66 Terminal compartment FLSE100-EXS/EXPR/EX/EXRE sender/receiver unit



Connection of FLSE100-EX/EXRE Master

Designation in terminal compartment	Master				Slave			
	B	A	+24 V d.c.	GND	B	A	+24 V d.c.	GND
External connection **	Yellow	Green	White	Brown	Yellow	Green	White	Brown
Assignment	IF1	IF1	+24 V d.c.	GND	IF2	IF2	+24 V d.c.	GND

Connection of FLSE100-EX/EXRE Slave

Designation in terminal compartment	Master				Slave			
	B	A	+24 V d.c.	GND	B	A	+24 V d.c.	GND
External connection **	Yellow	Green	White	Brown	n.c.	n.c.	n.c.	n.c.
Assignment	IF2	IF2	+24 V d.c.	GND				

Connection of FLSE100-EXS/EXPR

Designation in terminal compartment	Master				Slave			
	B	A	+24 V d.c.	GND	B	A	+24 V d.c.	GND
External connection **	Yellow	Green	White	Brown	n.c.	n.c.	n.c.	n.c.
Assignment	IF1	IF1	+24 V d.c.	GND				

**: Applicable only for cables with wire color code a.c.cording to DIN 47100
IF1: Communication between FLSE Master and MCUP (interface 1)
IF2: Communication between FLSE Master and FLSE Slave (interface 2)
n.c.: Not connected

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

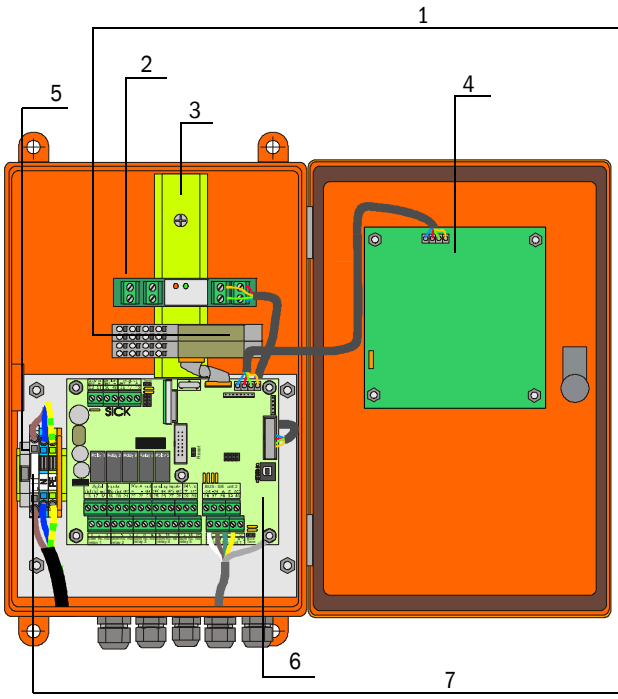
3.8.5 MCUP connections

3.8.5.1 MCUP version without explosion protection and for use in zone 2 and Cl I, Div 2 / zone 2

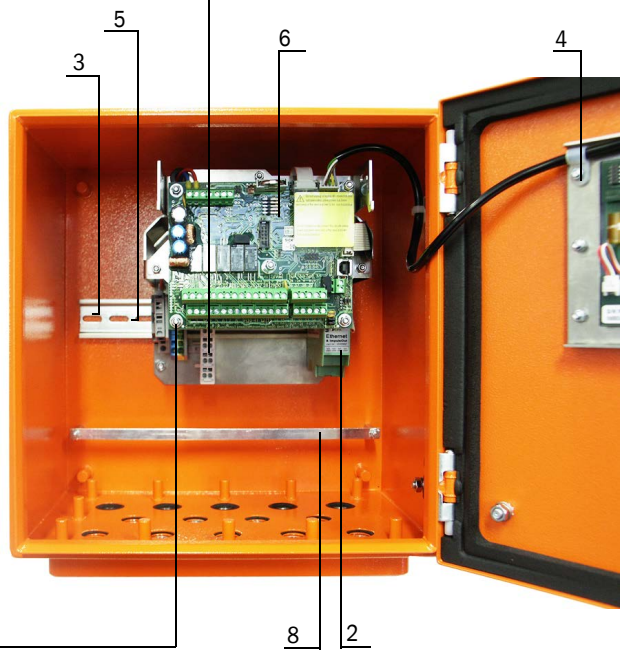
Version in wall housing

Fig. 67 MCUP component layout (with options)

MCUP compact size housing



MCUP medium size housing



1 Optional I/O modules
2 Optional interface module
3 Hat rail
5 Fuse T2A
6 Processor board
7 Terminals for power supply

Terminals for power supply, screw free 0,5 ...2,5 mm2 (AWG 20 up to AWG 12)

Power supply version	Voltage rating	Wattage rating	Terminal no.	Marking	Function
115 ... 230 V a.c. 1)	90...250 V a.c.	max. 30 W	1	L1	Phase conductor
			2	N	Neutral wire
			3	Earth symbol	Earthing
115/230 V a.c. 2)	115/230 V a.c.	max. 30 W	1	L1	Phase conductor
			2	N	Neutral wire
			3	Earth symbol	Earthing
24 V d.c. 3)	24 V d.c.	max. 30 W	1	+24 V d.c.	plus pole
			2	GND	minus pole
			3	Earth symbol	Earthing

1): Wide range, not for Div 2 / zone 2 version
2): Automatic switching
3): It may only be used a power supply with safe mains isolation (PELV).The negative terminal is grounded to the housing of device.

NOTICE:

- Screw terminals for wire sizes 0.5 .. 1.5 mm^2 (AWG20 ... AWG16).
- All cables which are connected to the MCUP must be suitable for a minimum working voltage of 300V.

Exterior ground terminal

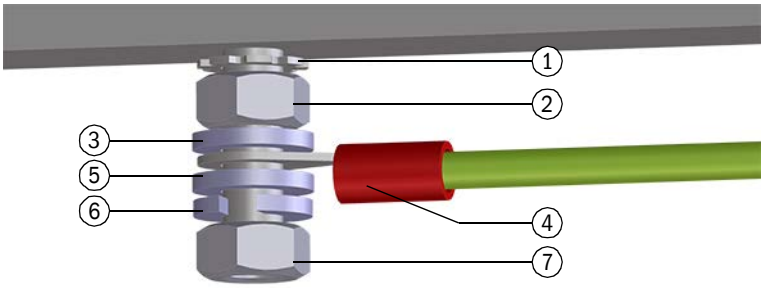
Applies to the following housing variants with exterior ground terminal:

- MCUP in explosion-protected version ex zone 2 and Cl I, Div 2 / zone 2

The exterior ground terminal is marked with the symbol ⏚ on the device.

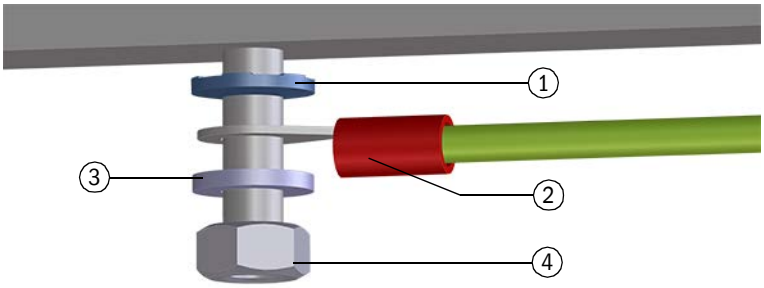
► Depending on the delivered device variant, connect the protective earth according to → Fig. 68 respectively → Fig. 69.

Fig. 68 Connection of the protective earth (version with toothed lock washer)



1 Toothed lock washer
2 Nut (Torque: 6,0 Nm at M6)
3 Washer
4 Cable
5 Washer
6 Spring washer
7 Nut (Torque: 6,0 Nm at M6)

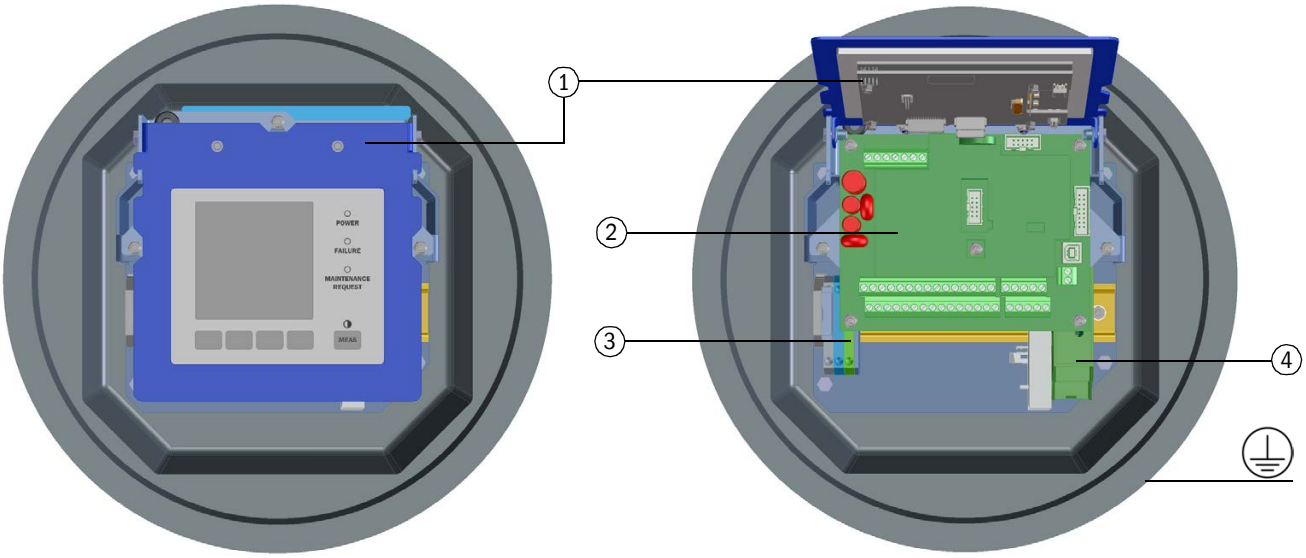
Fig. 69 Connection of the protective earth (version with contact washer))



1 Contact washer (pay attention to the correct alignment)
2 Cable
3 Washer
4 Nut (Torque: 6,0 Nm at M6)

3.8.5.2 MCUP in explosion-protected version for Ex zone 1 and Cl I, Div 1

Fig. 70 MCUP component layout (with options) as explosion-protected version for zone 1 and Cl I, Div 1



1 Display module (collapsible)
2 Processor board
3 Terminals for power supply
4 Option Interface module

Connection diagrams → pg. 256, § 6.9

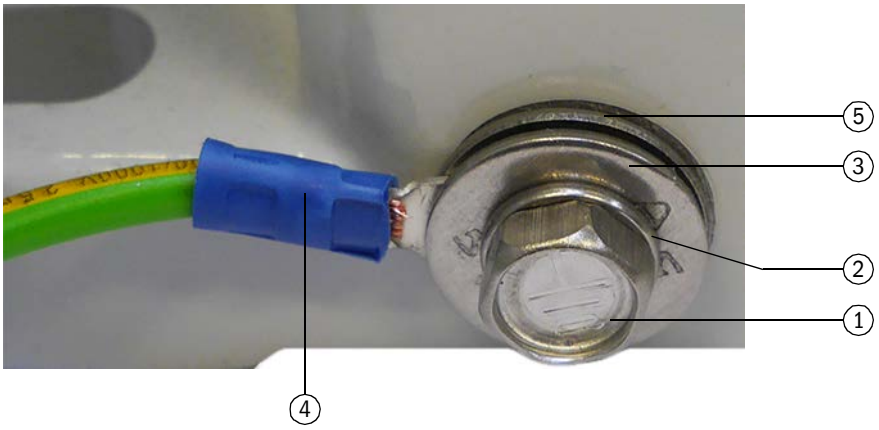
Tabelle 7 Terminals for power supply

Marking	Function
L	Phase conductor
N	Neutral wire
PE	Earthing

Exterior ground terminal

The exterior ground terminal is marked with the symbol ⏚ on the device.

Fig. 71 Connection of the exterior ground terminal



1 M6 screw
2 Spring Washer
3 Washer
4 Cable
5 Washer

Screen connection of control unit MCUP ATEX zone 1 with terminal box

In a limited number of MCUP ATEX zone 1 units shipped, the shield terminal strip is electrically isolated from the housing. In this case the shield terminal strip is mounted on plastic spacers and has no electrical connection to the housing. If in doubt, the isolation can be checked by a electrical continuity test.

At affected devices the screen of the connection cable between sender/receiver unit and MCUP can be grounded at MCUP ATEX zone 1 in two ways:

1 Make connection of cable screen at spring-type terminal (1) in the MCUP terminal box. Connect spring-type terminal strip (1) with PE (2) of the MCUP.

2 Make connection of cable screen at spring-type terminal (1) in the MCUP terminal box. Connect spring-type terminal strip with external PE at site.

Figure 72 Grounding connection

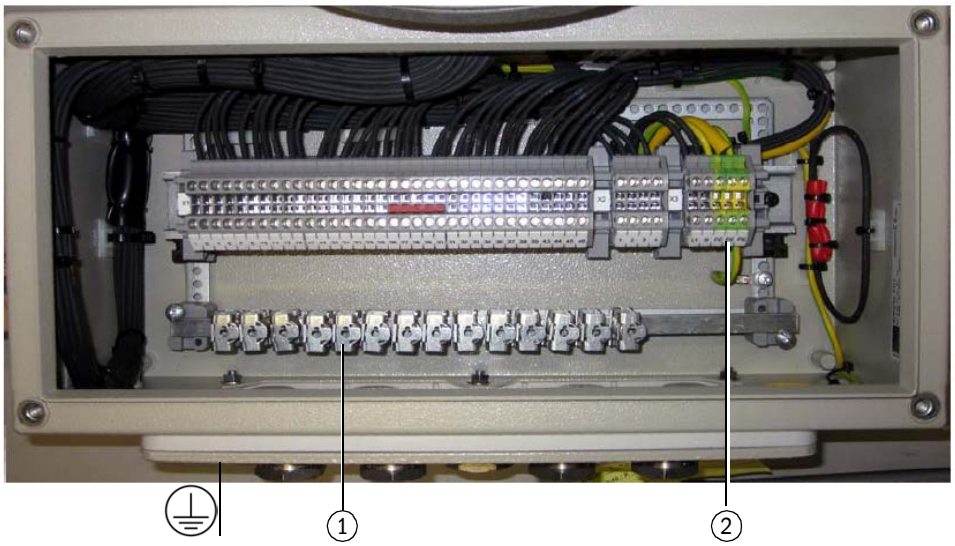
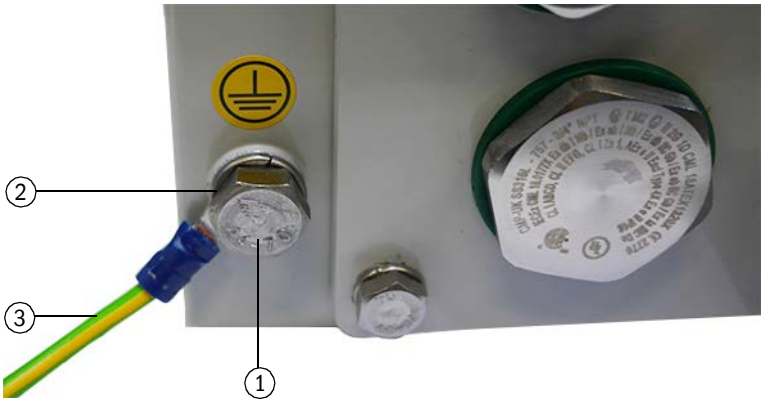


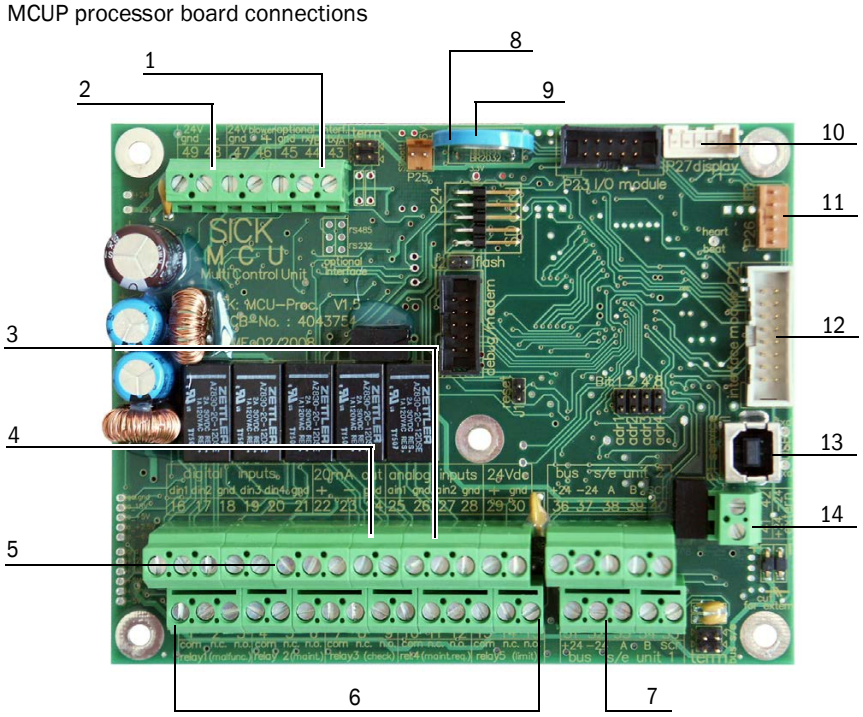
Fig. 73 Connection of the exterior ground terminal



1 M8 screw
2 Spring washer
3 Cable

3.8.5.3 MCUP processor board connections

Fig. 74 MCUP processor board connections



1 RS232 (non-ex MCUP) or RS485 (ex MCUP)
2 Supply voltage 24V d.c.
3 Terminals for analog inputs1 and 2
4 Terminals for analog output
5 Terminals for digital inputs 1 to 4
6 Terminals for relays 1 to 5
7 Terminals for sender/receiver unit master
8 Connection for optional I/O module
9 Backup battery type BR2032
10 Connection for optional display module
11 Connection for LEDs
12 Connection for optional interface module
13 USB plug
14 Terminals 41, 42

Table 8 Terminal data MCUP processor board

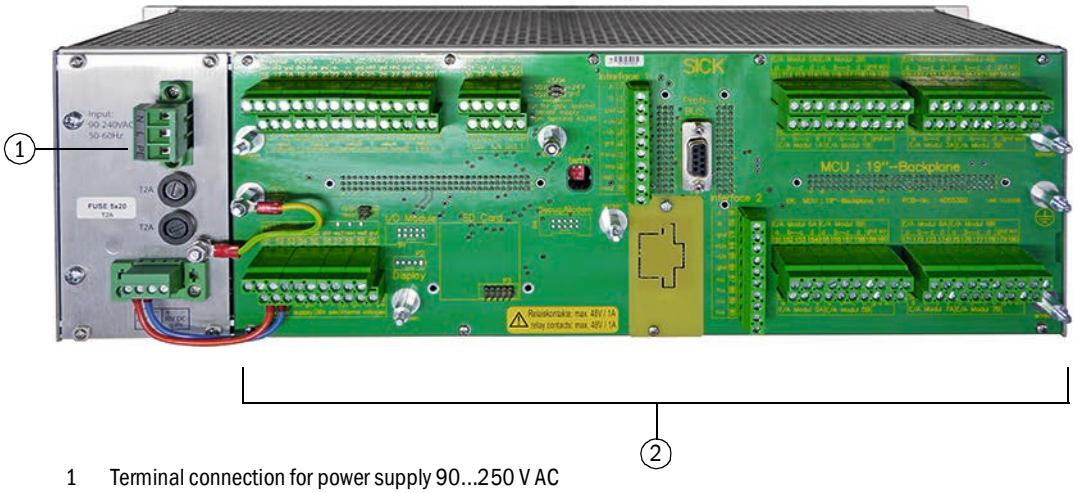
Terminal	Marking on the processor board		Function	Voltage rating	Ampere rating
1, 2, 3	com, n.c.[1], n.o. [2]	relay 1 (malfunc.)	Indication of malfunction	≅ 30 V a.c./d.c.	
4, 5, 6	com, n.c.[1], n.o. [2]	relay 2 (maint.)	Indication of maintenance		
7, 8, 9	com, n.c.[1], n.o. [2]	relay 3 (check.)	Indication of function check		
10, 11, 12	com, n.c.[1], n.o. [2]	relay 4 (maint.requ.)	Indication of maintenance request		
13, 14, 15	com, n.c.[1], n.o. [2]	relay 5 (limit)	Indication of limit violation		1 A
16, 18	din1, gnd		Digital input 1 (active low forced to gnd)		
17, 18	din2, gnd		Digital input 2 (active low forced to gnd)		
19, 21	din3, gnd		Digital input 3 (active low forced to gnd)		
20, 21	din4, gnd		Digital input 4 (active low forced to gnd)	5.5 V d.c.	max. 1 mA
22, 23	+, -		Analog output (20 mA)	20 ... 28 V d.c.	max. 22 mA
24	gnd		Ground		

Terminal	Marking on the processor board	Function	Voltage rating	Ampere rating
25, 26	ain1, gnd	Analog input 1		
27, 28	ain2, gnd	Analog input 2	max. 3 V d.c.	22 mA
29, 30	+, gnd	Output 24 V d.c.	20 ... 28 V d.c.	3)
31, 32	+24, -24	Power supply bus sender/receiver unit 1	20 ... 28 V d.c.	
33, 34	A, B	RS485 interface bus sender/receiver unit 1	± 5 V	max. 100 mA
35	scr.	Screen (gnd)		
36, 37	+24, -24	Power supply bus sender/receiver unit 2	20 ... 28 V d.c.	
38, 39	A, B	RS485 interface bus sender/receiver unit 2	± 5 V	max. 100 mA
40	scr.	Screen (gnd)		
41, 42	+24 -24 extern	Power supply bus sender/receiver units	20 ... 28 V d.c.	
43, 45	tx/A, gnd	Service interface – RS232 (non-ex MCUP) – RS485 (ex-MCUP, option for non-ex MCUP)		
44, 45	rx/B, gnd		- 5 V ... +12 V	3)
46, 47	+ gnd, 24 V in	Output 24 V d.c.	20 ... 28 V d.c.	3)
48, 49	+ gnd, 24 V	Input 24 V d.c.	20 ... 28 V d.c.	3)
P1	P1 service	USB Port		

1): normal closed
2): normal open
3): use only according to consultation with the manufacturer

3.8.5.4 MCUP version in 19" rack

Fig. 75 MCUP connections for 19" variant (without explosion protection)



1 Terminal connection for power supply 90...250 V AC
2 Terminal connection for wiring by customer

Table 9 Terminals for power supply

Marking	Function
N	Neutral wire
L	Phase conductor
PE	Earthing

Table 10 Terminal data MCUP version in 19” rack

Terminal	Marking on the processor board		Function	Voltage rating	Ampere rating
1, 2, 3	com, n.c.[1], n.o. [2]	relay 1 (malfunc.)	Indication of malfunction	≅ 30 V a.c./d.c.	
4, 5, 6	com, n.c.[1], n.o. [2]	relay 2 (maint.)	Indication of maintenance		
7, 8, 9	com, n.c.[1], n.o. [2]	relay 3 (check.)	Indication of function check		
10, 11, 12	com, n.c.[1], n.o. [2]	relay 4 (maint.requ.)	Indication of maintenance request		
13, 14, 15	com, n.c.[1], n.o. [2]	relay 5 (limit)	Indication of limit violation		1 A
16, 18	din1, gnd		Digital input 1 (active low forced to gnd)		
17, 18	din2, gnd		Digital input 2 (active low forced to gnd)		
19, 21	din3, gnd		Digital input 3 (active low forced to gnd)		
20, 21	din4, gnd		Digital input 4 (active low forced to gnd)	5.5 V d.c.	max. 1 mA
22, 23	+, -		Analog output (20 mA)	max. 22 V d.c.	max. 24 mA
24	gnd		Ground		
25, 26	ain1, gnd		Analog input 1		
27, 28	ain2, gnd		Analog input 2	max. 3 V d.c.	22 mA
29, 30	+, gnd		Output 24 V d.c.	22 ... 28 V d.c.	3)
31, 32	+24, -24		Power supply bus sender/receiver unit 1	22 ... 28 V d.c.	
33, 34	A, B		RS485 interface bus sender/receiver unit 1	± 5 V	max. 100 mA
35	scr.		Screen (gnd)		
36, 37	+24, -24		Power supply bus sender/receiver unit 2	22 ... 28 V d.c.	
38, 39	A, B		RS485 interface bus sender/receiver unit 2	± 5 V	max. 100 mA
40	scr.		Screen (gnd)		
41, 42	24 V, gnd		Input voltage supply 24V d.c	22 ... 28 V d.c.	3)
43, 44	24 V, gnd		Output voltage supply 24V d.c.	- 5 V ... +12 V	3)
45, 46	+, -		Input 30 V electr. isolated		
47, 48	12 V, gnd		Internal voltage (not planned for use)		3)
49, 50	5 V, gnd				
51, 52, 53	tx/A, rx/B, gnd		RS232/485		3)
54, 56	res 1, gnd				
55,56	res 2, gnd				
57, 60	res 3, gnd				
58, 60	res 4, gnd				
59, 60	res5, gnd		Reserve (not planned for use)		
71, 73	A, gnd				
72, 73	B, gnd				
74, 76	+Us, gnd				
75, 76	-Us, gnd				
77, 79	imp+, res 1				
78, 80	imp-, res 2		Interface 1		

Terminal	Marking on the processor board	Function	Voltage rating	Ampere rating
81, 83	A, gnd	Interface 2 (reserve, not used)		
82, 83	B, gnd			
84, 86	+Us, gnd			
85, 86	-Us, gnd			
87		Not planned for use		
88				
89				
90				
P1	P1 service	USB Port		
⏚	Distance bolt	Earthing		

1): normal closed

2): normal open

3): Use only according to consultation with the manufacturer

3.8.6 Cabling and connection diagrams

Work to be done

- Connect connection cables according to Fig. 65 (→ p. 129) and Fig. 66 (→ p. 130) and Fig. 76 (→ p. 140) to Fig. 80 (→ p. 144).
- Connect cables for status signals (operation/malfunction, maintenance, check cycle, maintenance requirement, limit value), analog output, analog and digital inputs according to requirements (→ pg. 136, Fig. 74).
- Connect power cable to terminals L1, N, PE (→ pg. 131, Fig. 67)
- Seal cable entries not in use with blind plugs

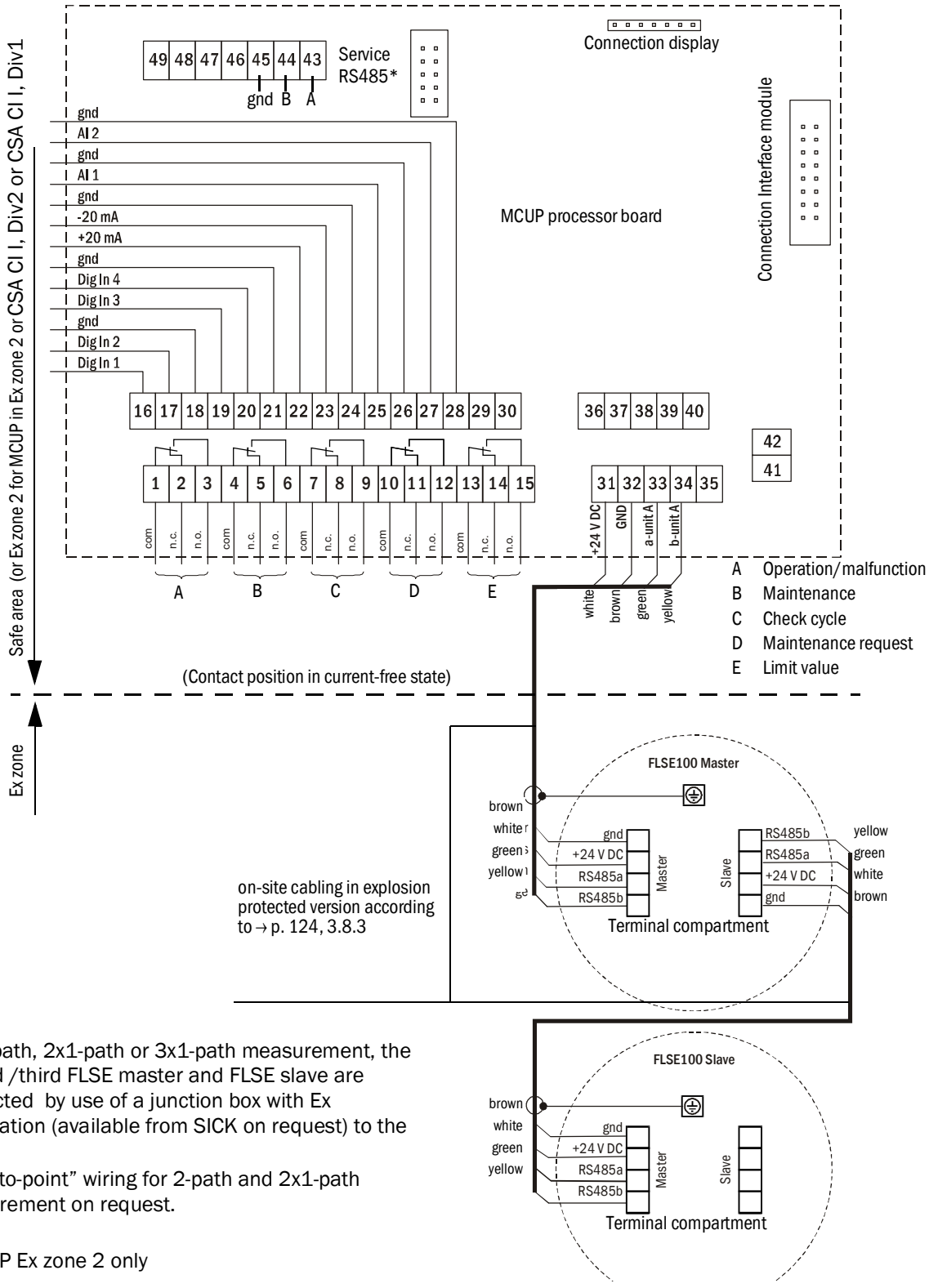
WARNING:

- Be sure to check the wiring before switching the supply voltage on.
- Only modify wiring when disconnected from the mains and potential-free.

Connecting device type FLSE100 EX/EX-RE

- S/R units: Ex zone 1 without Exe terminal compartment, CSA Cl I, Div1/Div2
- MCUP: without explosion protection, Ex Zone 2 or CSA Cl I, Div2 or CSA Cl I, Div1

Fig. 76 FLOWSIC100 EX/EXRE cabling



Note

For 2-path, 2x1-path or 3x1-path measurement, the second /third FLSE master and FLSE slave are connected by use of a junction box with Ex certification (available from SICK on request) to the MCUP.

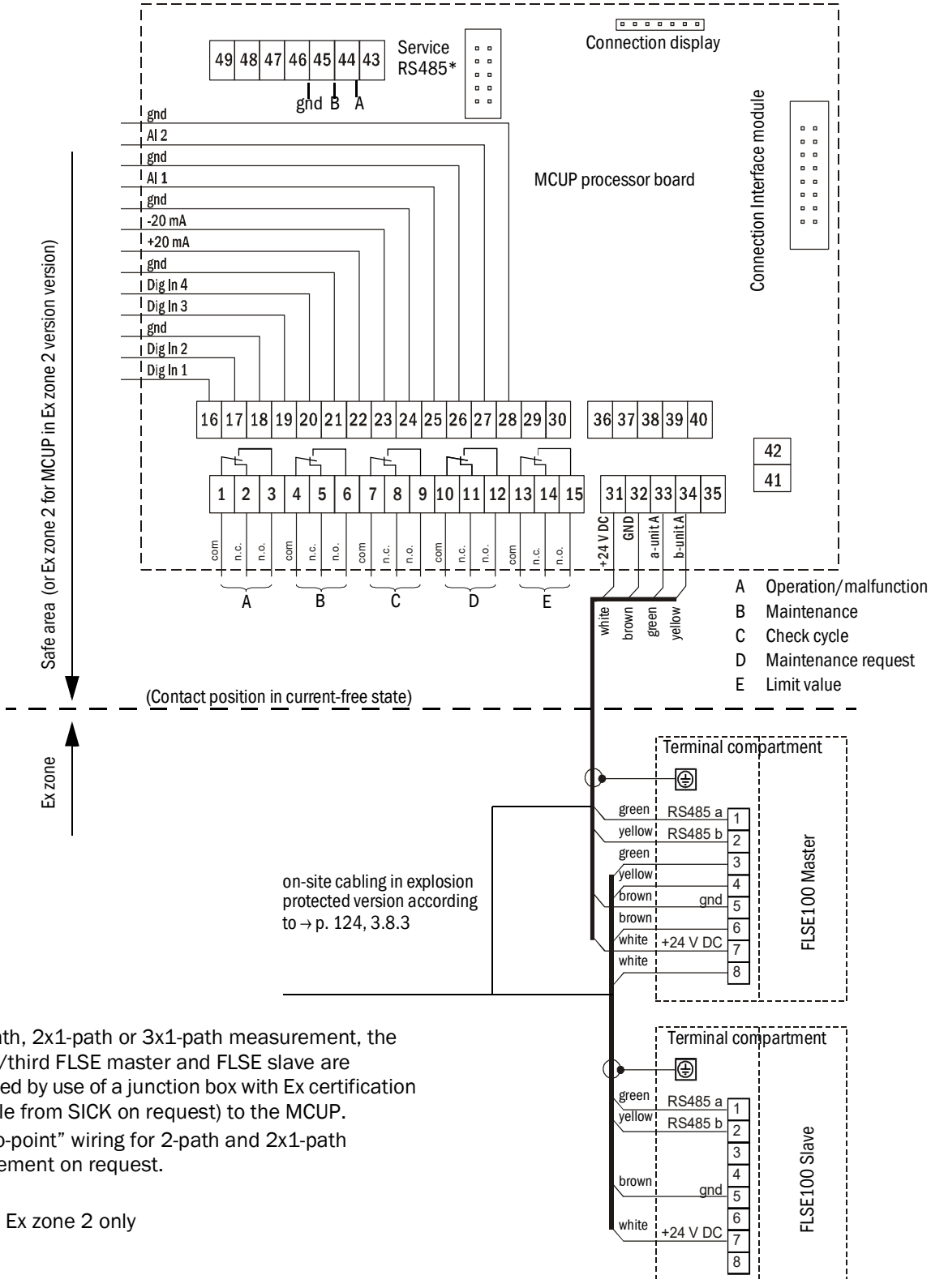
"Point-to-point" wiring for 2-path and 2x1-path measurement on request.

* MCUP Ex zone 2 only

Connecting FLSE100 EX/EX-RE

- S/R units: Ex zone 1 and 2 with Exe terminal compartment
- MCUP: without explosion protection, Ex zone 2

Fig. 77 FLOWSIC100 EX/EXRE cabling



Note

For 2-path, 2x1-path or 3x1-path measurement, the second /third FLSE master and FLSE slave are connected by use of a junction box with Ex certification (available from SICK on request) to the MCUP.

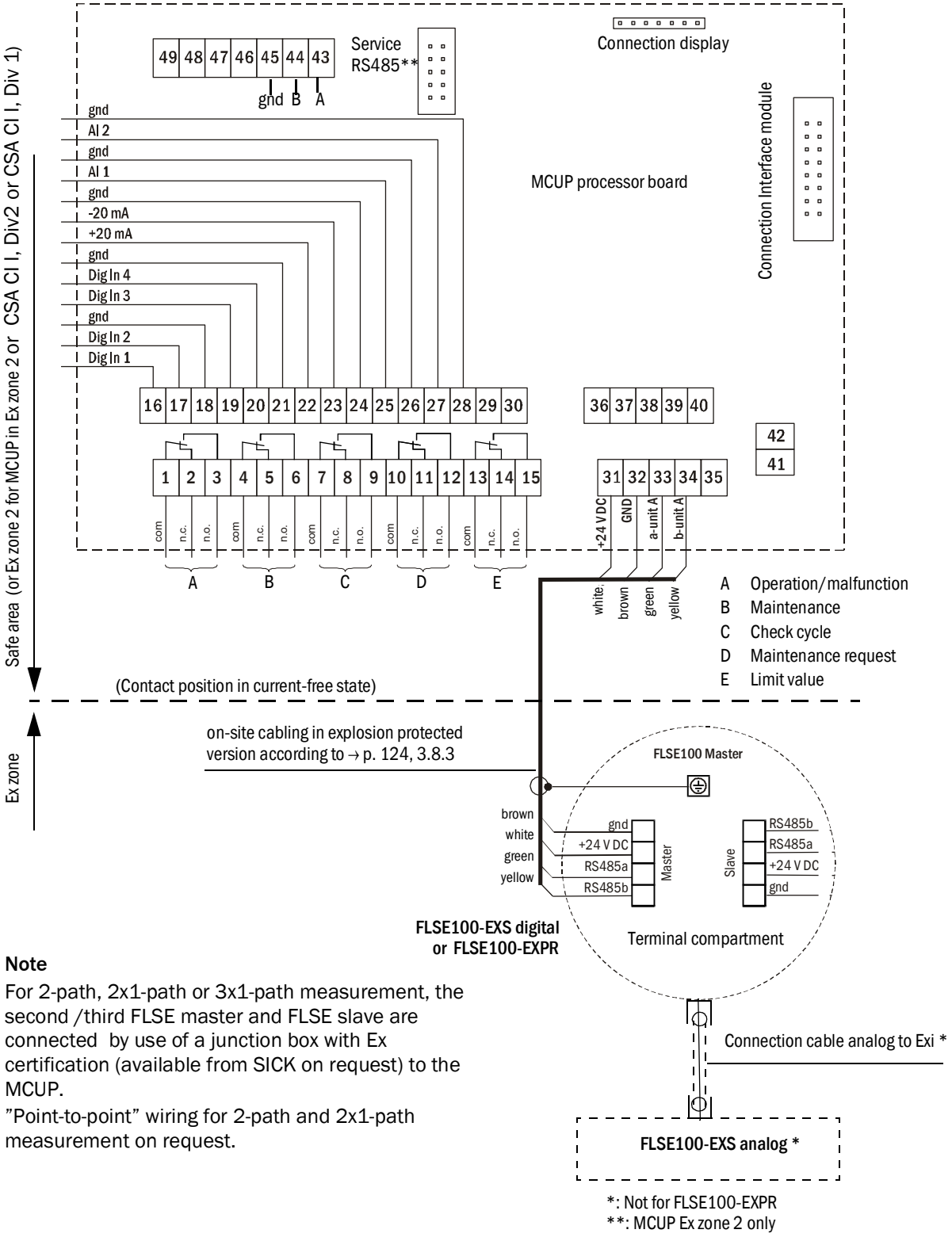
"Point-to-point" wiring for 2-path and 2x1-path measurement on request.

* MCUP Ex zone 2 only

Connecting FLSE100 EX-S/EX-PR

- S/R units: Ex zone 1 without Exe terminal compartment, CSA Cl I, Div1/Div2
- MCUP: without explosion protection, Ex zone 2 or CSA Cl I, Div2 or CSA Cl I, Div1

Fig. 78 FLOWSIC100 EXS/EXPR cabling



Note

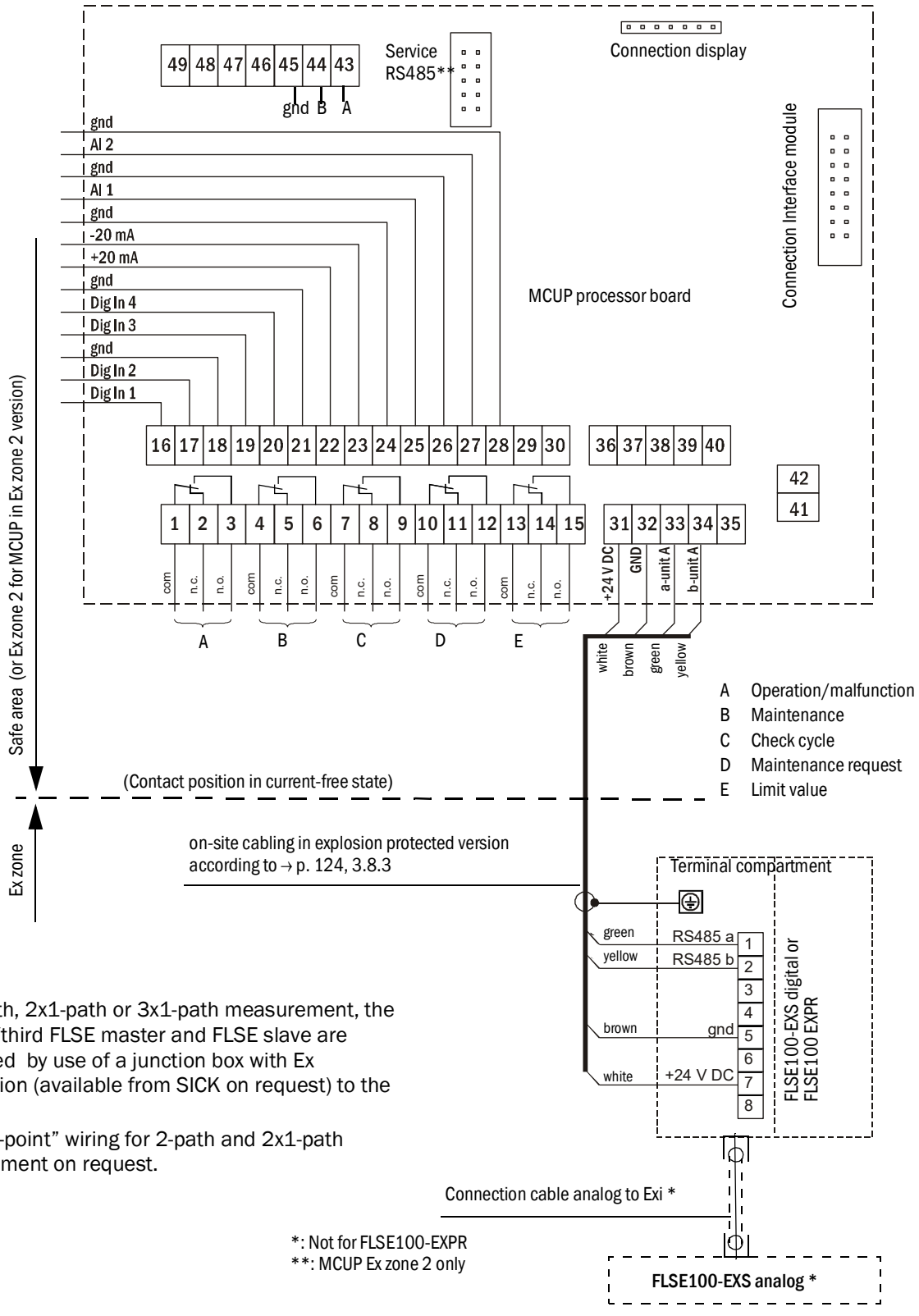
For 2-path, 2x1-path or 3x1-path measurement, the second /third FLSE master and FLSE slave are connected by use of a junction box with Ex certification (available from SICK on request) to the MCUP.

"Point-to-point" wiring for 2-path and 2x1-path measurement on request.

Connecting FLSE100 EX-S/EX-PR

- S/R units: Ex zone 1 and 2 with Exe terminal compartment
- MCUP: without explosion protection, Ex zone 2

Fig. 79 FLOWSIC100 EXS/EXPR cabling



Note

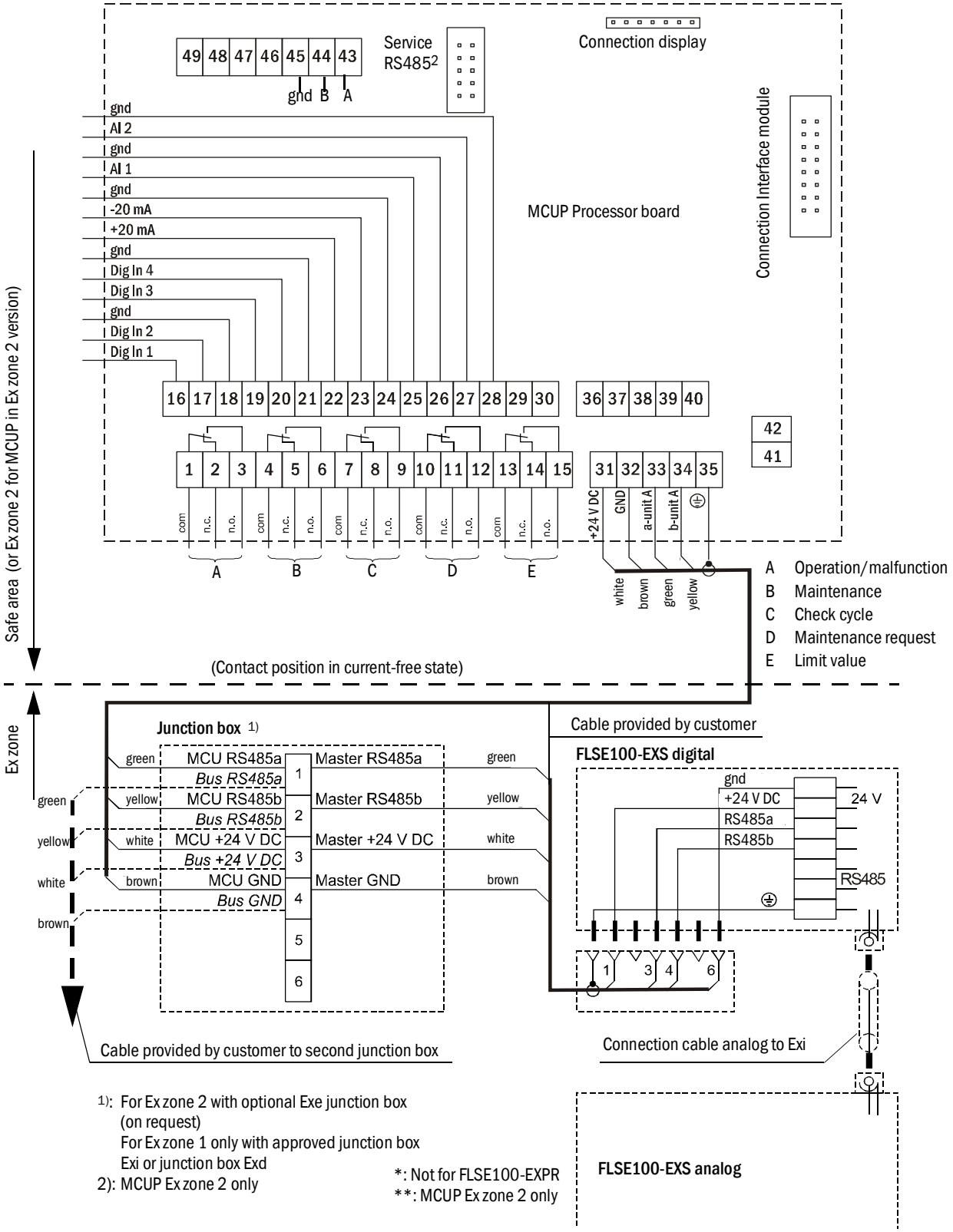
For 2-path, 2x1-path or 3x1-path measurement, the second /third FLSE master and FLSE slave are connected by use of a junction box with Ex certification (available from SICK on request) to the MCUP.

"Point-to-point" wiring for 2-path and 2x1-path measurement on request.

Bus standard cabling (MCUP without explosion protection version or version for Ex zone 2)

- Example for device type FL100 EX-S

Fig. 80 Connection of sender/receiver units to the MCUP (bus standard cabling)



1): For Ex zone 2 with optional Exe junction box (on request)
For Ex zone 1 only with approved junction box Exi or junction box Exd

2): MCUP Ex zone 2 only

*: Not for FLSE100-EXPR

**: MCUP Ex zone 2 only

3.8.6.1 Setting the bus address at sender/receiver unit (bus systems only)

On bus systems (e.g. 2x1-path connected to one MCUP), the required bus address of a sender/receiver unit (master only) have to be assigned by the software. In delivery condition the bus address for every sender/receiver unit is set by hardware to address "0". Hardware addressing is read in with the start of the SOPAS ET program and cannot be changed at site.

NOTICE:

- After a possibly required change of addressing, the respective sender/ receiver units must be started a new (disconnect and reconnect supply voltage). The output assignments in the MCUP then have to be reconfigured (see section 4.2).
- The sender/receiver units must have different addresses. Identical addresses of several units cause the aborting of the communication with the MCUP!

3.8.6.2 Software addressing at sender/receiver units

As standard, the address have to be assigned using the SOPAS ET program. The prerequisite for this addressing is that hardware address 0 is set (delivery condition). To change it, do the following:

- ► Connect the measuring system to a PC/laptop, start the SOPAS ET program and make-contact with the device (see section 4.1.3).
- ► Select the sensor type (e.g. "FL100 EX-S") in the "Scan result" tab and move to the "Project" window.
- ► In the "Login" menu, select the "Service" user level and enter password "service"
- ► Set the measuring system to the "Maintenance" mode
- ► Select the menu "Configuration/Device Parameters" and choose the field "serial interface", set the bus address.

WARNING:

No other parameters or settings may be changed while logged into access level 2 - "Service", except for those described in this section. All other changes to settings may only be carried out using the access levels 0 - "Operator" or 1 - "Authorized client". The manufacturer is not liable for any disruption caused by incorrect settings made by the user in SOPAS.

3.8.7 Fitting and connecting the Interface and I/O module options

For detailed information on the particular module options, see „Interface Documentation FLOWSIC100 Flare“.

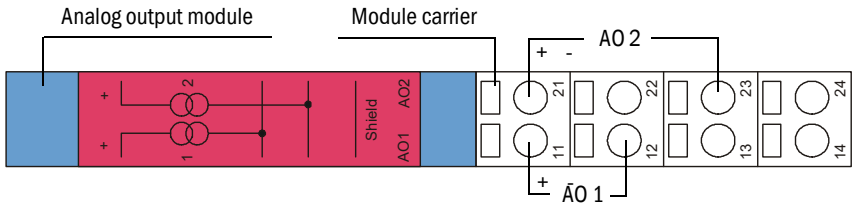
3.8.7.1 MCUP in compact or medium size housing

Plug interface modules and module carriers for I/O modules onto the hat rail in the MCUP (→ pg. 131, Fig. 67) and connect to the associated connection on the processor board with the cable with plug-in connector (→ pg. 136, Fig. 74). Then plug the I/O module on the module carrier.

Connect I/O modules using the terminals on the module carrier (→ Fig. 81, Fig. 82, Fig. 83), the Profibus module using the terminals on the module and connect the Ethernet module via a customer provided network cable.

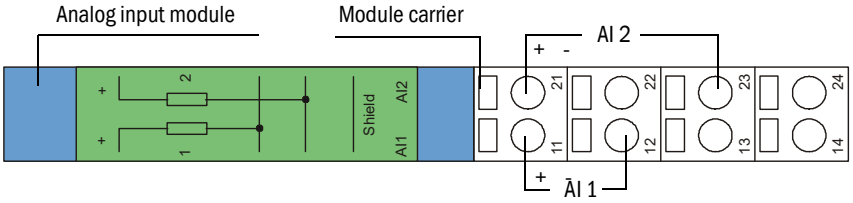
- Terminal assignment AO module

Fig. 81 Analog output module terminal assignment



- Terminal assignment AI module

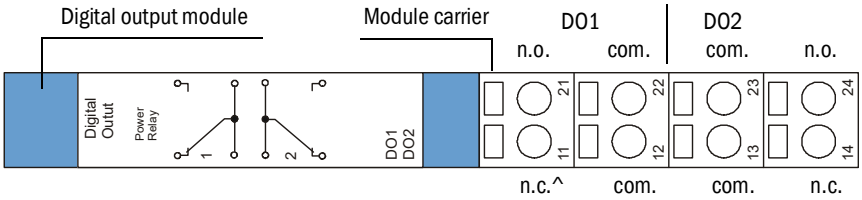
Fig. 82 Analog input module terminal assignment (with external power supply)



WARNING:
The analog input module will be damaged if incorrectly connected.
► Do not connect the terminals 12, 22, 13, 23 of the analog input module to GND or earth if the terminals 11, 21 are connected to the internal supply of the MCUP (delivered configuration) or with another external supply.

- Terminal assignment DO module (2 changeover contacts)

Fig. 83 Digital output module terminal assignment



NOTICE:
Screw-fixed terminals for wire sizes 0.5 .. 1.5 mm² (AWG20 ... AWG16).

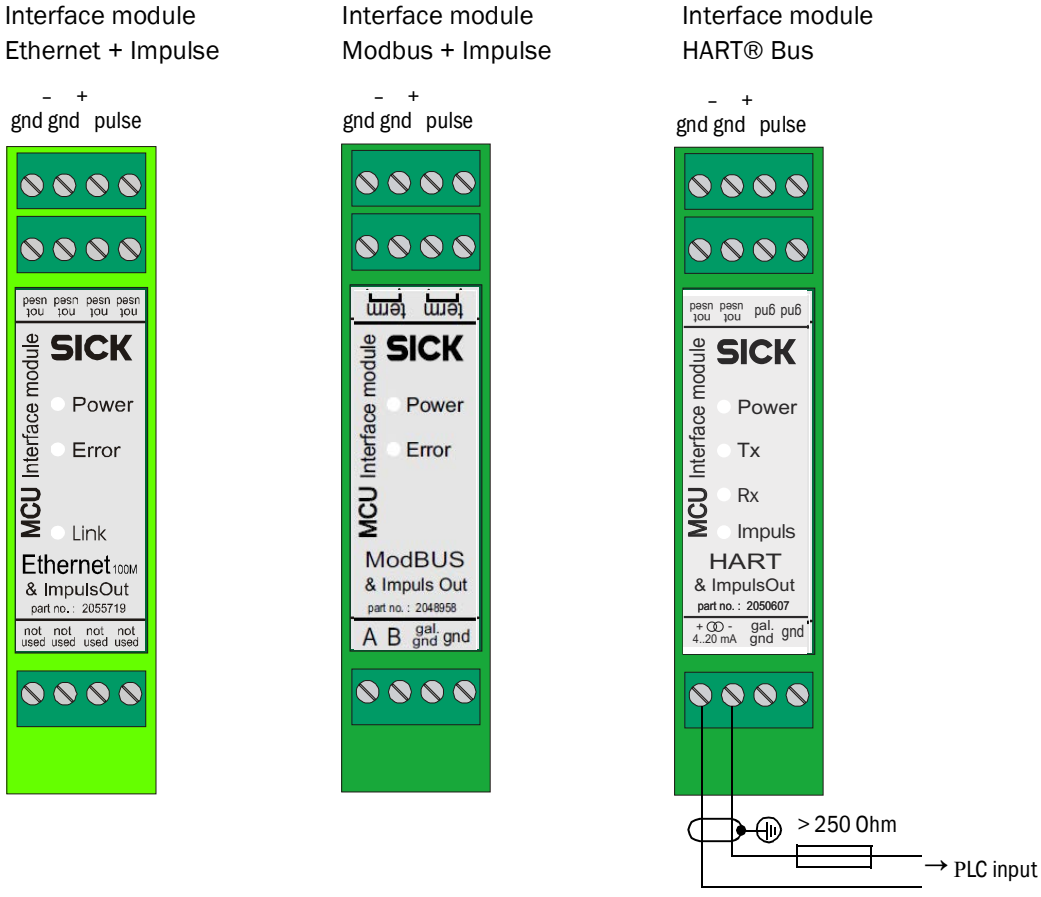
- Terminal data

Terminal	Module type			
	2x Analog input	2x Analog output	2x Digital input	Digital output 2 changeover contacts
	Assignment			
11	AI 1+	AO 1+	DI 1+	n.c. relay 1
12	AI 1-	AO 1-	gnd	com. relay 1
13	AI 2-	AO 2-	gnd	com. relay 2
14	shield (gnd)	shield (gnd)	DI 3+	n.c. relay 2
21	AI 2+	AO 2+	DI 2+	n.o. relay 1
22	AI 1-	AO 1-	gnd	com. rel. 1
23	AI 2-	AO 2-	gnd	com. rel. 2
24	shield (gnd)	shield (gnd)	DI 4+	n.o. relay 2
Rating				
max. voltage	3 V d.c.	15 V d.c.	5.5 V d.c.	30 V a.c./d.c.
max. current	22 mA	22 mA	5 mA	2 A

n.c.: normal closed
n.o. normal open

- Terminal assignment interface modules

Fig. 84 Interface module terminal assignment



Configuration of impulse output:

By default the interface modules are set to OC. To change the impulse output to NAMUR a jumper inside the interface module has to be set.

Fig. 85 Impulse output

> ***NOTICE:***
> Imax (Open collector connection) may not exceed 100 mA. Otherwise the impulse output can be destroyed.
> Calculate RL according to the equation above.

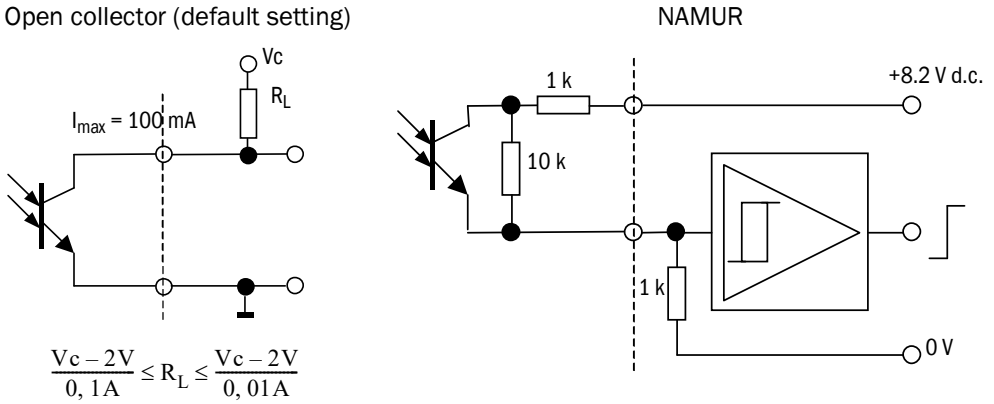


Figure 86 Interface modules mounted on top-hat rail

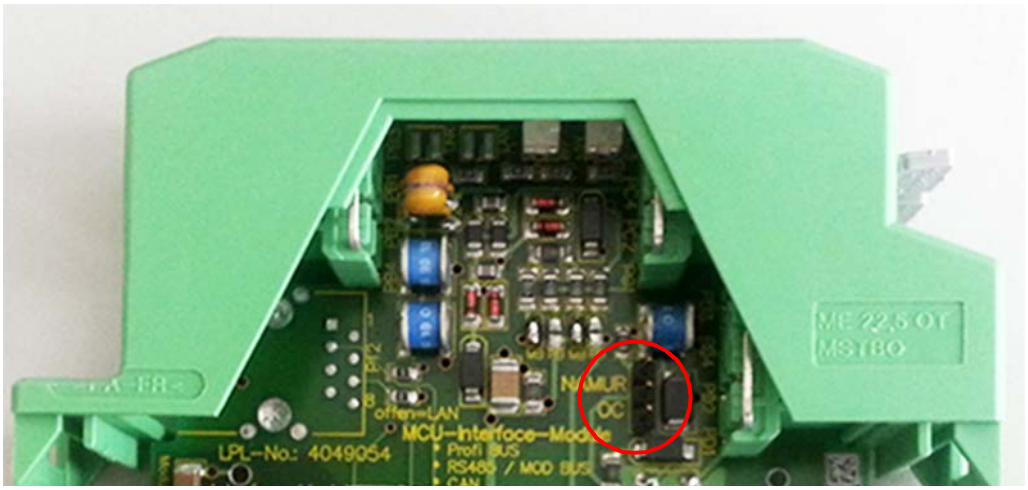


Figure 87 19” rack mounted interface module

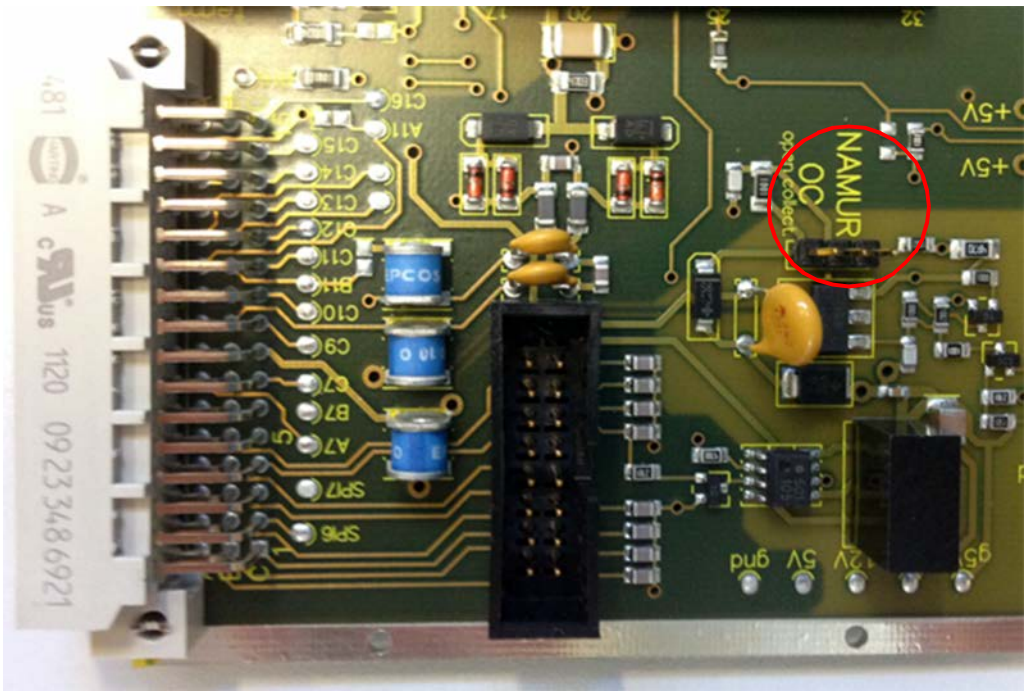
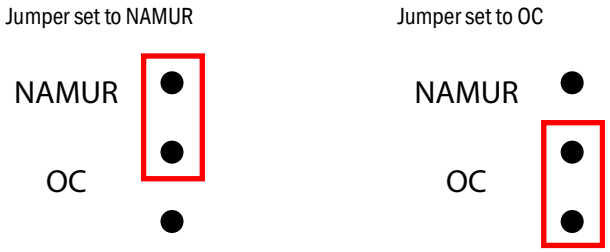


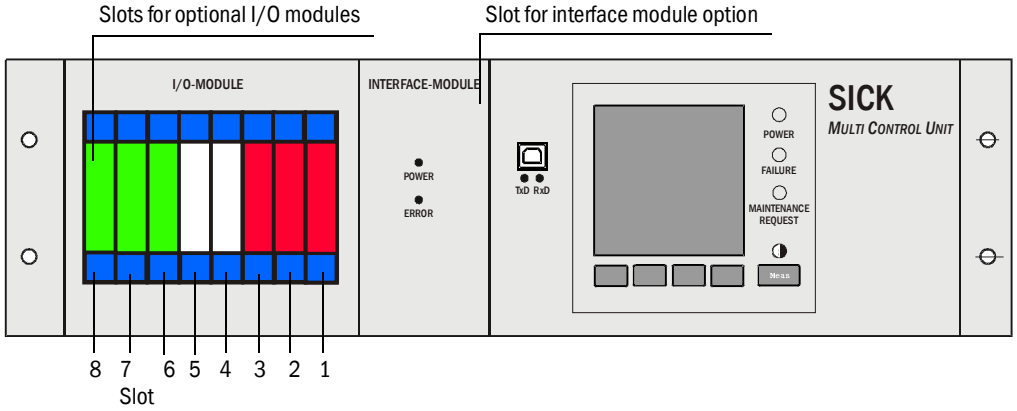
Figure 88 Jumper settings for impulse output



3.8.7.2 MCUP in 19" rack

Plug optional analog and digital modules on the slots in the module carrier beginning with plug-in place 1 in the order AO → AI → DO → DI without gap. If single module types are not available, the next respective one follows according to the order mentioned.

Fig. 89 Slots for optional modules



The MCUP contains 8 slots for optional I/O modules. The connection of these modules (analog and digital types) is carried out at the terminals 101-180.

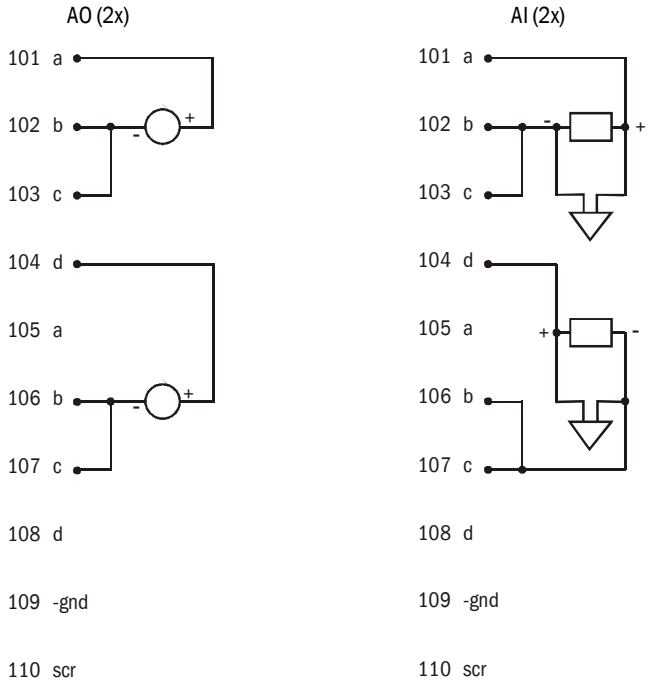
> ***NOTICE:***
> Screw-fixed terminals for wire size 0.5 .. 2.5 mm^2 (AWG20 ... AWG12).

Following this, the connection of the modules is represented exemplarily to slot 1.

The connection of optional modules (analog and digital type) at the other slots 2-8 is carried out in the same way.

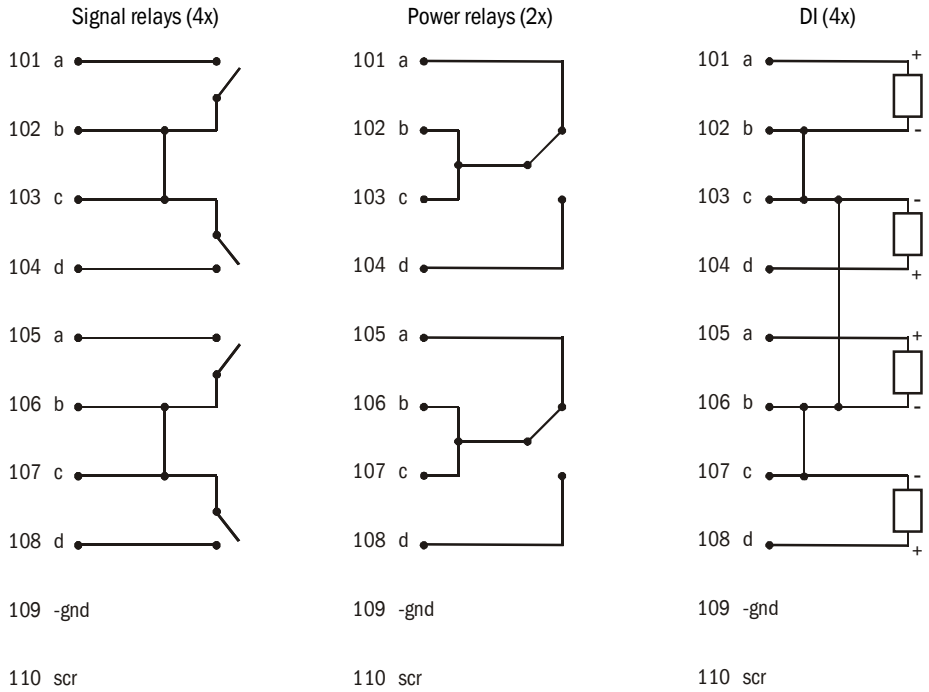
- Connection of analog module

Fig. 90 Analog module on slot 1 (terminals 101 - 110)



- Connection of digital module

Fig. 91 Connection of digital module at plug-in place 1 (terminals 101-110)



3.8.8 Connection of external pressure and temperature transmitters

External pressure and temperature transmitters can be connected to the MCUP control unit with loop powering by the MCUP (active transmitters) or external powering (passive transmitters). Default setting of the MCUP is loop powering (wiring diagram (→ pg. 270, Fig. 211).

Connection

- Loop powering by the MCUP

  Use the internal MCUP backplane PELV power supply, terminals 29 (marked "+24Vdc)" and 30 (marked "gnd"); alternative terminals 46 (marked "+24V") and 47 (marked "gnd"); terminals 43-44 in 19“ MCUP.
- External powering

  Use an external power supply specified according to Class2/SELV or PELV; connection according to p. 271, Fig. 212; for installations using the MCUP for zone 1 see wiring diagrams p. 256, Fig. 197 to p. 229, Fig. 167).

> ***NOTICE:***
> The analog inputs are damaged by incorrect connection (→ pg. 145, §3.8.7.1, Fig. 82)

3.8.9 Connection of relay contacts

All relay contacts must be used in circuits powered by a Class2/SELV or PELV specified power supply only. Two possibilities exist:

- Using the internal MCUP backplane PELV power supply

  Connections:

  Terminals 46 (marked "+24V") and 47(marked "GND") on the MCUP processor board

  The additional input wattage caused by additional devices connected to the relay contacts must not exceed 10W.
- Using an external power supply specified according to Class2/SELV or PELV.

> ***NOTICE:***
> - For MCUP powering the relay contact circuits are connected to earth, which means galvanic isolation is not available.
> - Use an external Class2/SELV specified power supply to fulfill isolation from earthing.

FLOWSIC100 Flare

4 Start-up and Parameter Settings

Basics
Password protection
Standard start-up
Operating/setting parameters via the optional LC-Display

4.1 Basics

4.1.1 General information

Start-up primarily comprises entering equipment data (e.g. measuring path, installation angle), parameter settings for output variables and reaction times and, if required, the check cycle setting (→ pg. 170, § 4.3.2). A zero adjust is not necessary.

The SOPAS Engineering Tool (SOPAS ET) program is included and serves to set the parameters. The Menu structure simplifies changing settings. Further functions are also available (e.g. data storage, graphic displays).

If stable measuring behavior over all equipment states cannot be attained using standard settings (e.g. during device usage at the limits or outside of the specification according to the Technical Data), improvement is possible by optimizing internal device parameters. The settings required for this may only be carried out by sufficiently qualified persons, as the device functionality cannot be ensured if the settings are incorrect. This work should only be carried out by SICK Service. Possible settings are described in the Service Manual.

We recommend to use the SICK Commissioning check list (→ pg. 245, § 6.7) for easy parameter setting.

4.1.2 Installing the operating and parameter program SOPAS ET

Administrator access rights are required to install the software.

Requirements

- Laptop/PC with:
  - Processor: Pentium III (or comparable type)
  - VGA graphics card
  - USB interface (alternative - RS232 via adapter)
  - Working memory (RAM): At least 1 GB
  - Operating system: MS Windows XP, Vista, Windows 7 and Windows 8 (32/64 bit)
- USB interface cable to connect the Laptop/PC to the measuring system (MCUP).
- The operating and parameter program (SOPAS ET) as well as the USB driver (scope of delivery) must be installed on the Laptop/PC.
- The power supply must be switched on.

Start the file "setup.exe" when the start screen does not appear.

Install the SOPAS ET program

Insert the delivered CD in the PC drive, select the language, select "Software" and follow the instructions.

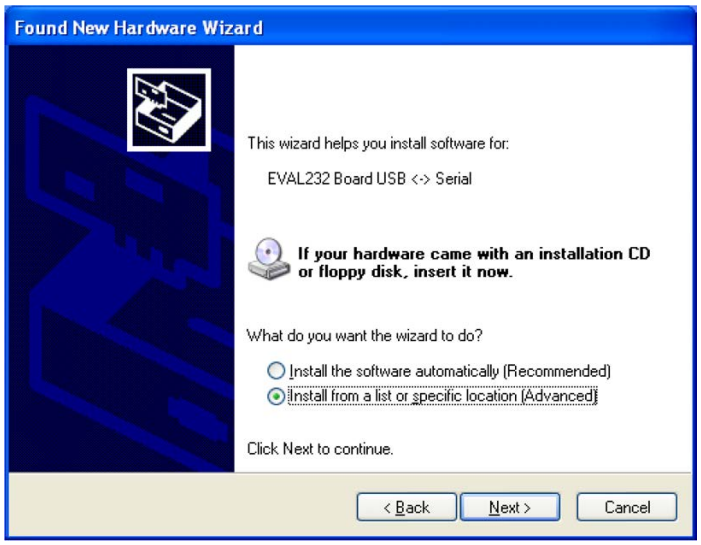
Install the USB driver

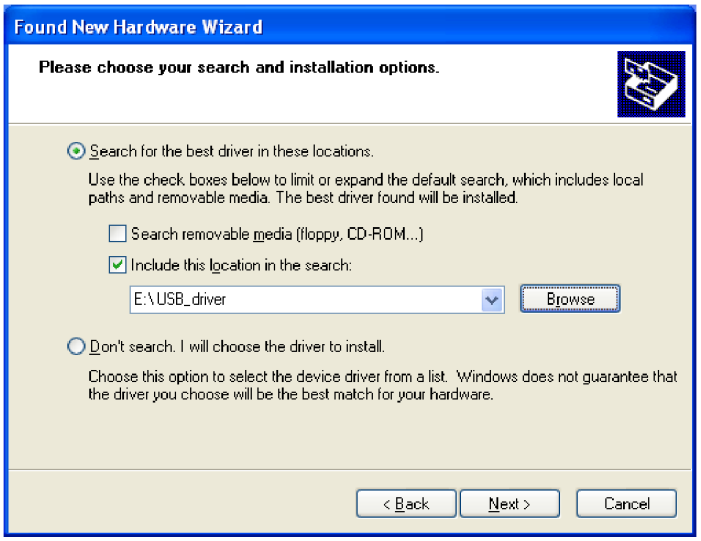
A special software driver is required for communication between the operating and parameter program SOPAS ET and the measuring system via the USB interface. To install on the laptop/PC, connect the MCUP to the supply voltage and then connect to the PC using a USB plug-in connector. A message appears on the display that new hardware has been detected. Now load the delivered CD in the PC drive and follow the installation instructions (→ pg. 156, Fig. 92).

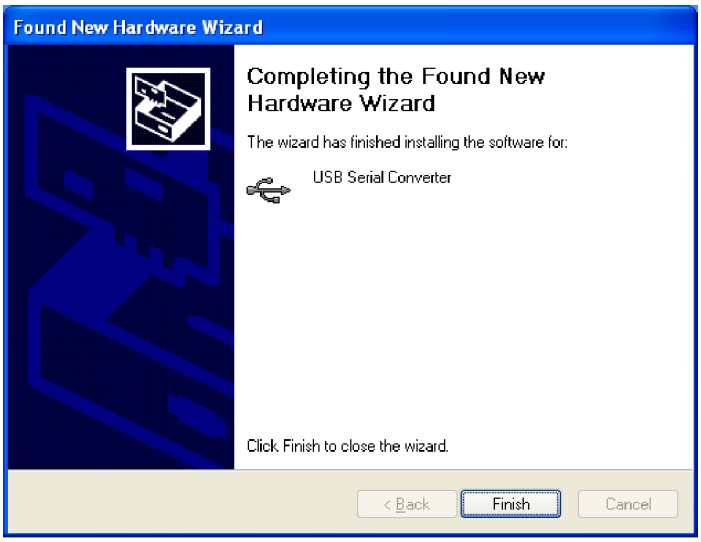
As an alternative, the driver can also be installed in the Windows control panel using the hardware installation program.

NOTICE:
Use only USB cabling which is in scope of SICK supply or cable with identical specification. Maximum cable length is 3 m. Longer cable lengths can lead to communication problems.

Fig. 92 Installing the USB driver







4.1.3 Connecting to the device

► Connect the USB cable to the MCU control unit (→ pg. 131, Fig.) and the laptop/PC.

> ***NOTICE:***
> The MCU(P) is connected via USB to the laptop/PC.
> A serial interface (COM port) is simulated via which the connection is made.

► Start the program in the “SICK\SOPAS” start menu.

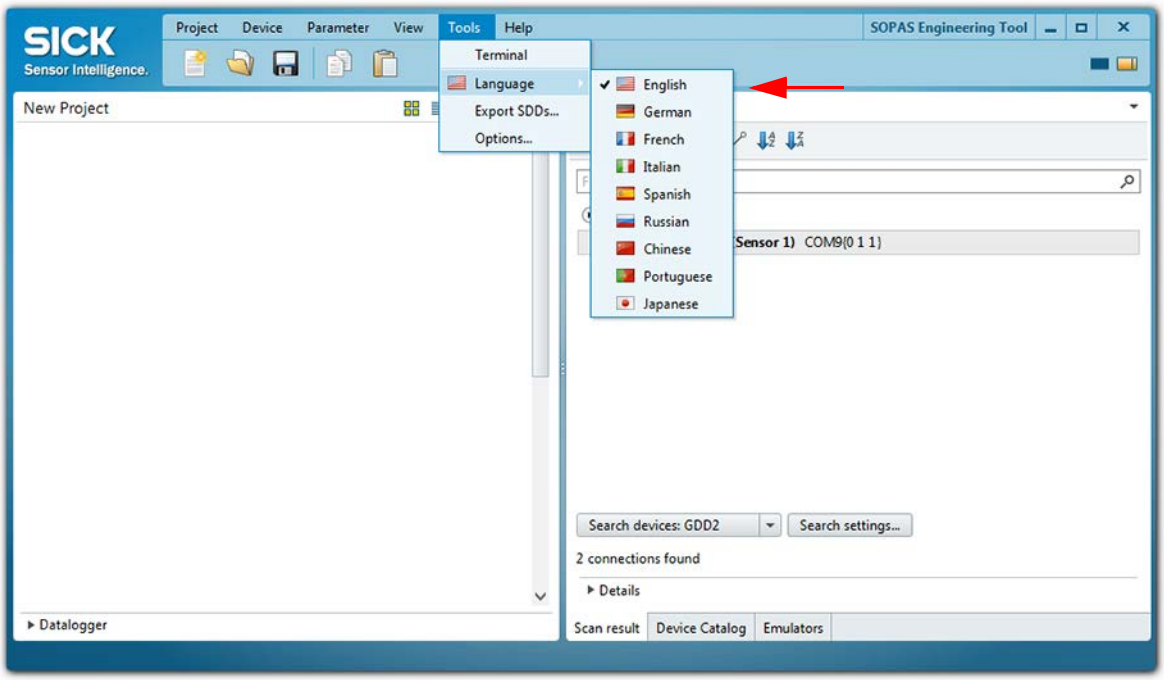
► The start page is displayed.

4.1.3.1 Changing the language

► If required, select the desired language in the “Tools / Language” menu (→ pg. 157, Fig. 93).

► Confirm the dialog shown with “Yes” to restart SOPAS ET with the changed language.

Fig. 93 Changing the language

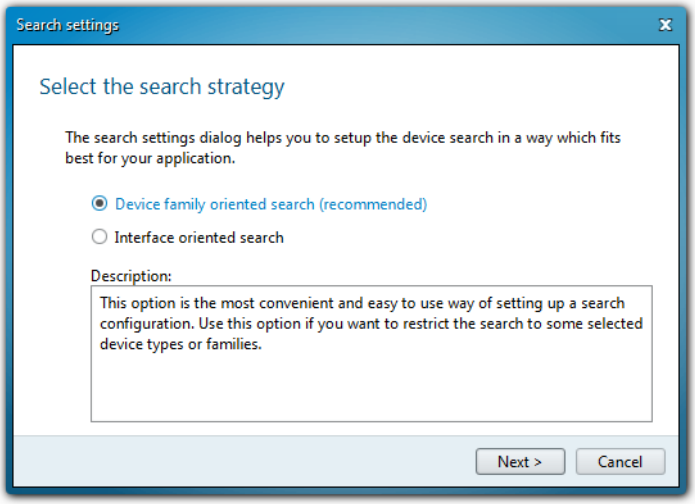


4.1.3.2 **Connecting to the device via the “Device family” mode (recommended search settings)**

1 Click “Search settings”.

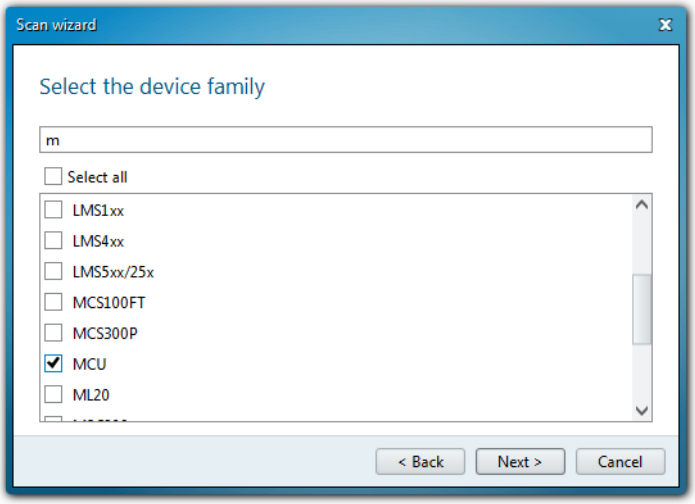
2 Select search mode “Device family oriented search” and click “Next”.

Fig. 94 Selecting the search mode



3 Select device family “MCU” and click “Next”.

Fig. 95 Selecting the device family



4 If devices are to be connected via Ethernet, configure the IP addresses:

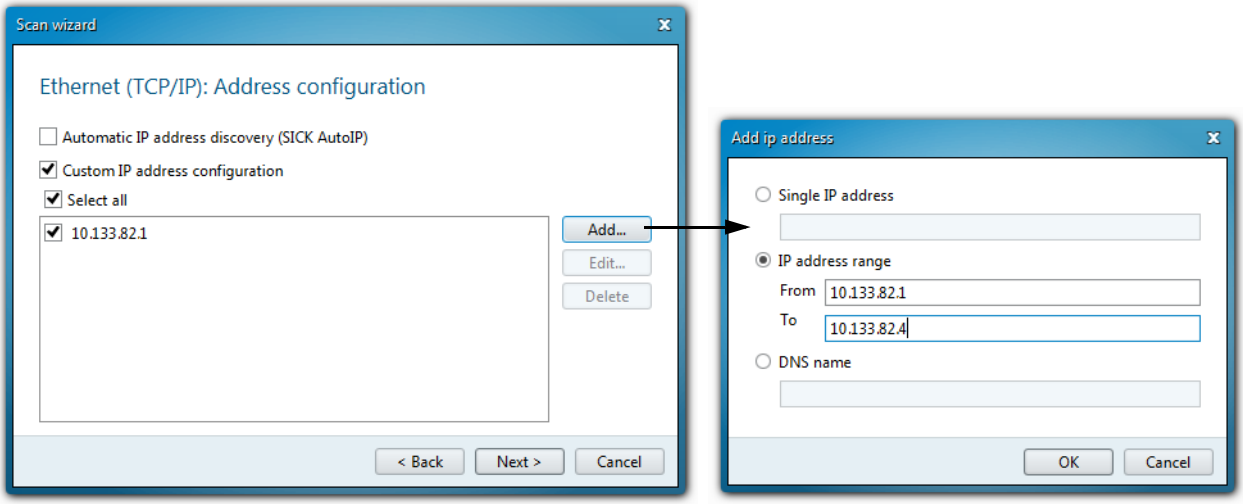
NOTICE:
MCU(P) does not support automatic recognition of IP addresses (SICK AutoIP), the IP addresses therefore have to be configured manually.

► Click “Add”.

An IP address specified by the customer is entered at the factory if the address is available when the device is ordered. If not, standard address 192.168.0.10 is entered.
To change the IP address, see → pg. 198, § 4.3.15.2.

- ► Enter the IP address of the device or the IP address range when several devices are used and confirm with “OK” (→ pg. 159, Fig. 96). The IP addresses shown are exemplary.
- ► Click “OK”.

Fig. 96 Connection settings for connection via Ethernet (example)



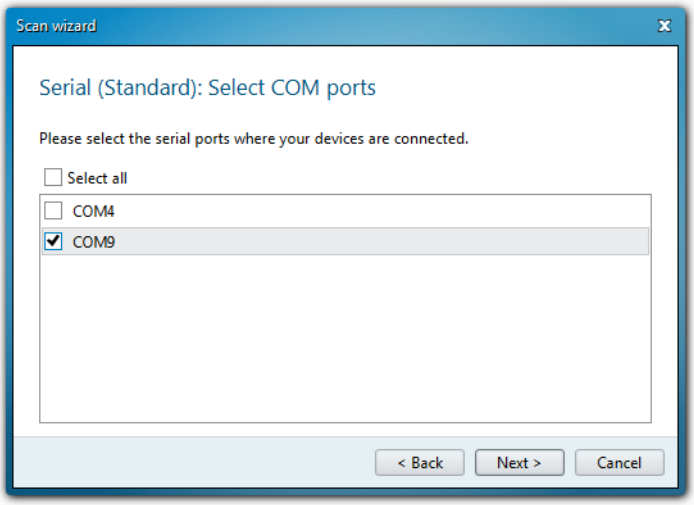
5 Click “Next”.

6 When devices are connected via serial connections (COM ports), select the COM ports used and click “Next”.

> ***NOTICE:***
> The MCU(P) is connected via USB to the laptop/PC.
> A serial interface (COM port) is simulated via which the connection is made.

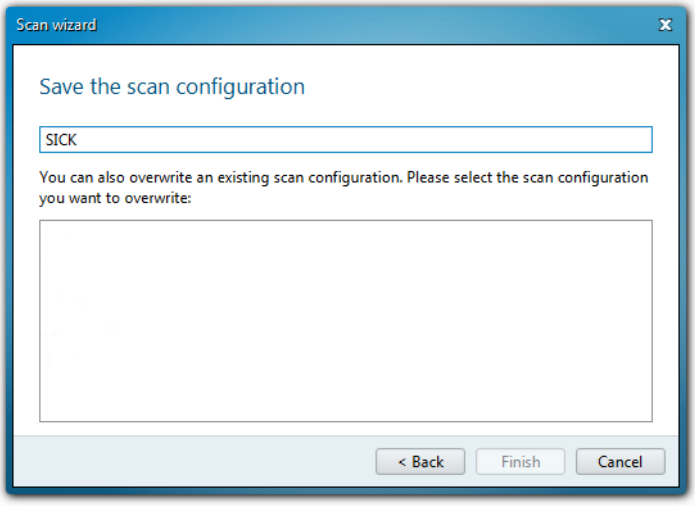
- ► If you are not sure which COM ports are used, select all COM ports.

Fig. 97 Selecting COM ports



7 To save the search settings, enter a name and click “Finish”.
SOPAS ET starts the device search.
The devices found are displayed in the “Device search” area when device search is finished (→ pg. 163, Fig. 104).

Fig. 98 Saving the scan settings



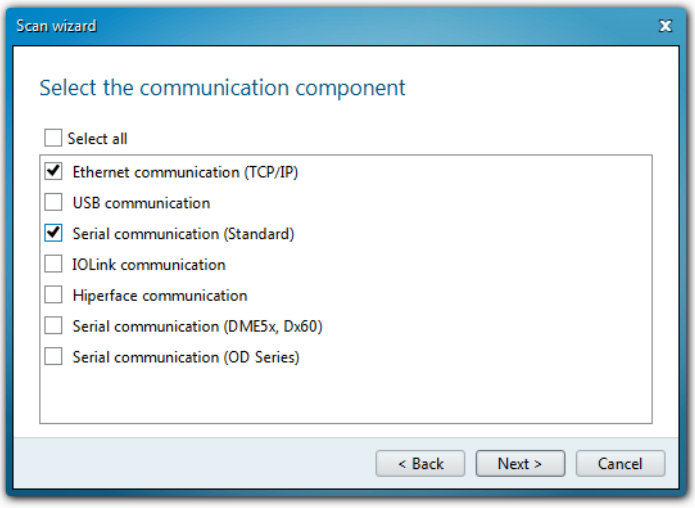
4.1.3.3 **Connecting to the device with advanced mode**

1 Click “Search settings”.

2 Select search mode “Interface oriented search”.

3 Select the communication interfaces where the search is to be made and click “Next”.

Fig. 99 Selecting the communication components

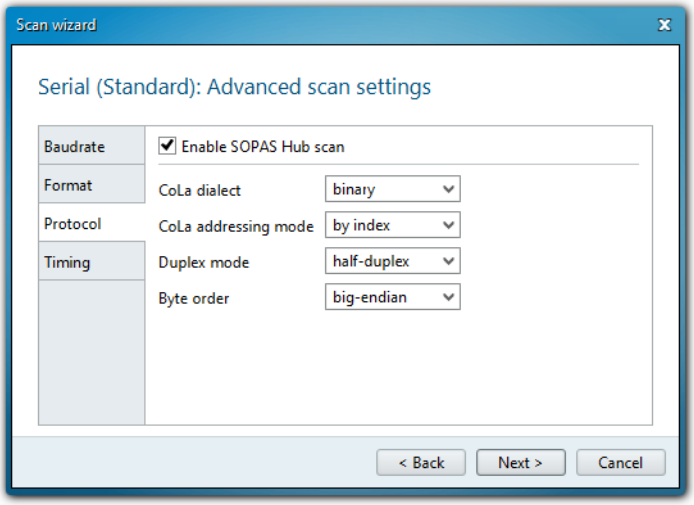


4 Configure the interfaces and click “Next”.

Ethernet communication

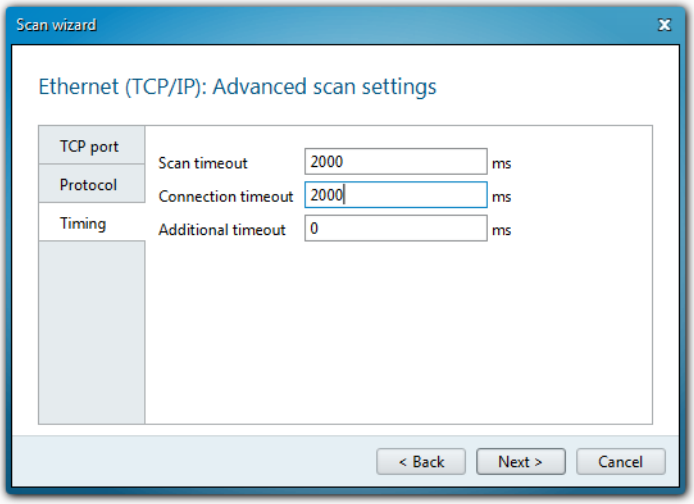
- ► Select “Custom IP address configuration”.
- ► Click “Add”.
- ► Enter the IP address of the device or the IP address range when several devices are used and confirm with “OK”.
- ► Select TCP port 2111 in the “TCP port” directory.
- ► Define the protocol settings in the “Protocol” directory according to → pg. 161, Fig. 100.

Fig. 100 Defining the protocol settings



- ► Define the timeout settings in the “Timing” directory according to → Fig. 101.

Fig. 101 Defining the timeout settings

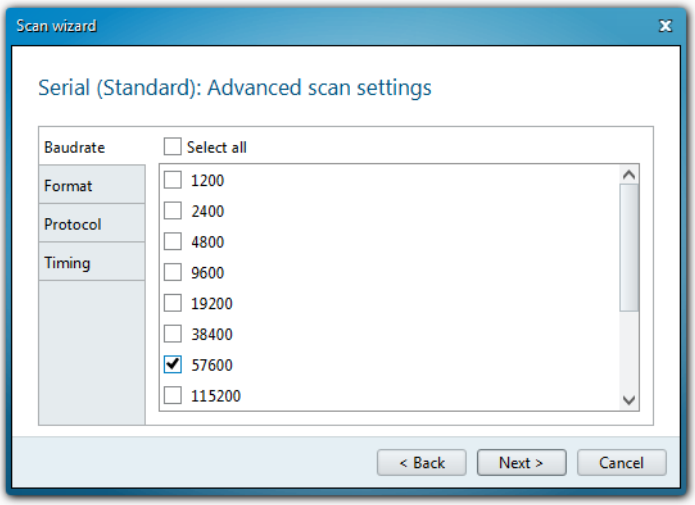


Serial communication (when connected via USB)

> ***NOTICE:***
> The MCU is connected via USB to the laptop/PC.
> A serial interface (COM port) is simulated via which the connection is made.

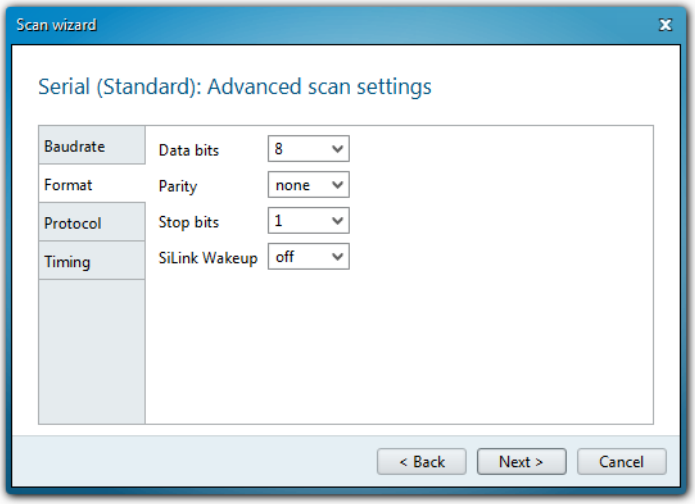
- ► Select the COM ports used.
- ► If you are not sure which COM ports are used, select all COM ports.
- ► Define the baudrate settings in the “Baudrate” directory according to → pg. 162, Fig. 102.

Fig. 102 Defining the baudrate



- ► Configure the data format in the “Format” directory according to → pg. 162, Fig. 103.

Fig. 103 Configuring the data format

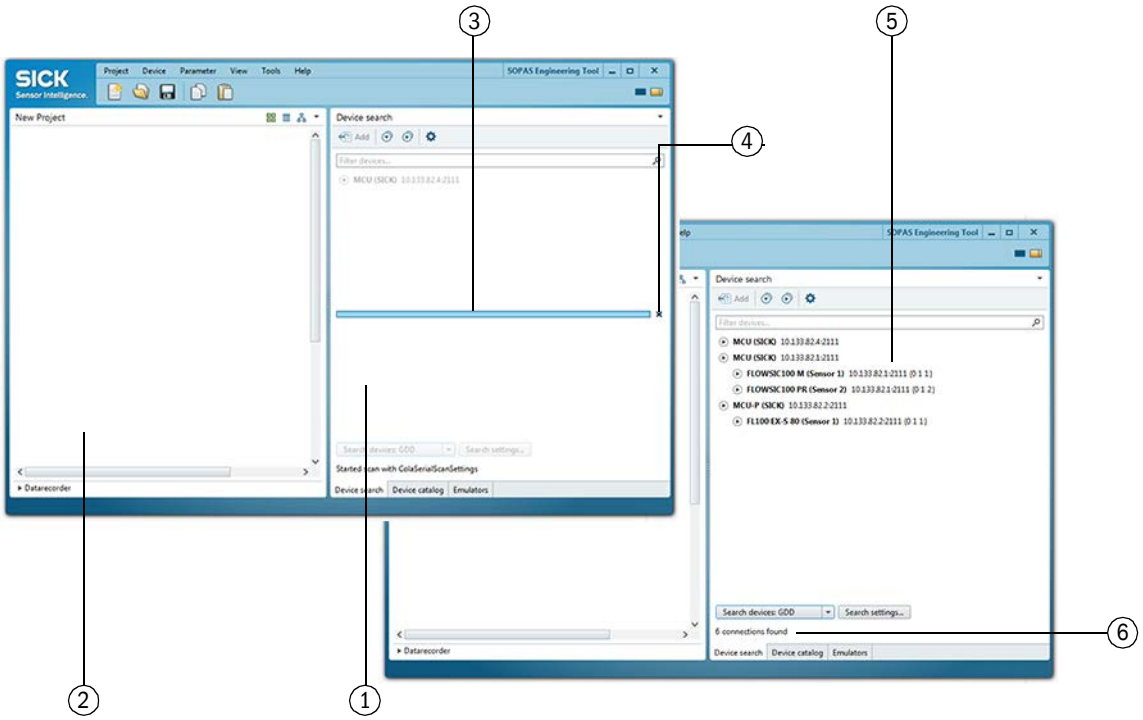


- ► Define the protocol settings in the “Protocol” directory according to → pg. 160, Fig. 99.
- ► Define the timeout settings in the “Timing” directory according to → pg. 161, Fig. 100.

5 To save the scan settings, enter a name and click “Finish” (→ pg. 160, Fig. 98).
SOPAS ET starts the device search. The devices found are displayed in the “Device search” area when device search is finished (→ pg. 163, Fig. 104).

4.1.4 Information on using the program

Fig. 104 Overview



1 Device search
2 Project area
3 Device search progress
4 Device search abort
5 Device search result
6 Number of devices found

Device selection

► Move the required devices with drag-and-drop or a double-click on the required device into the project area.
  – The configuration of the devices is shown in a separate device window.
  – The device windows can be opened by a double-click on the respective device file or the context menu (→ pg. 165, Fig. 106).

Fig. 105 Device selection

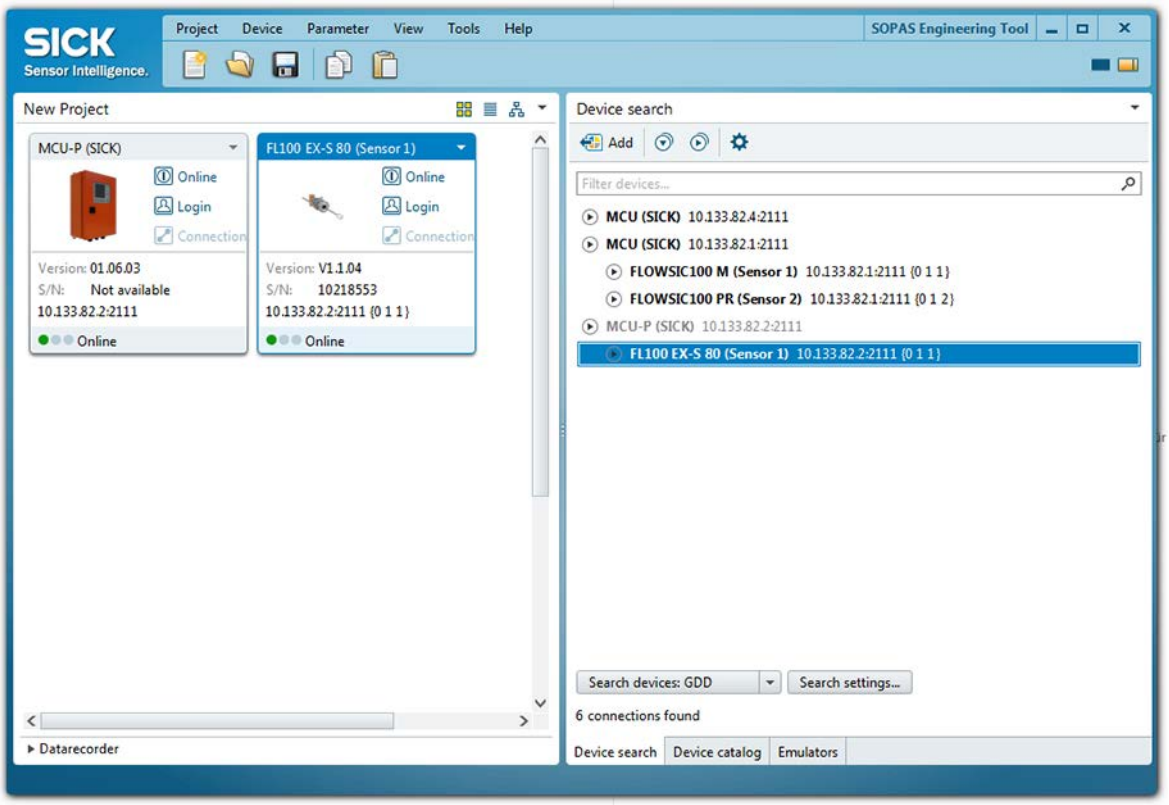


Fig. 106 Device context menu

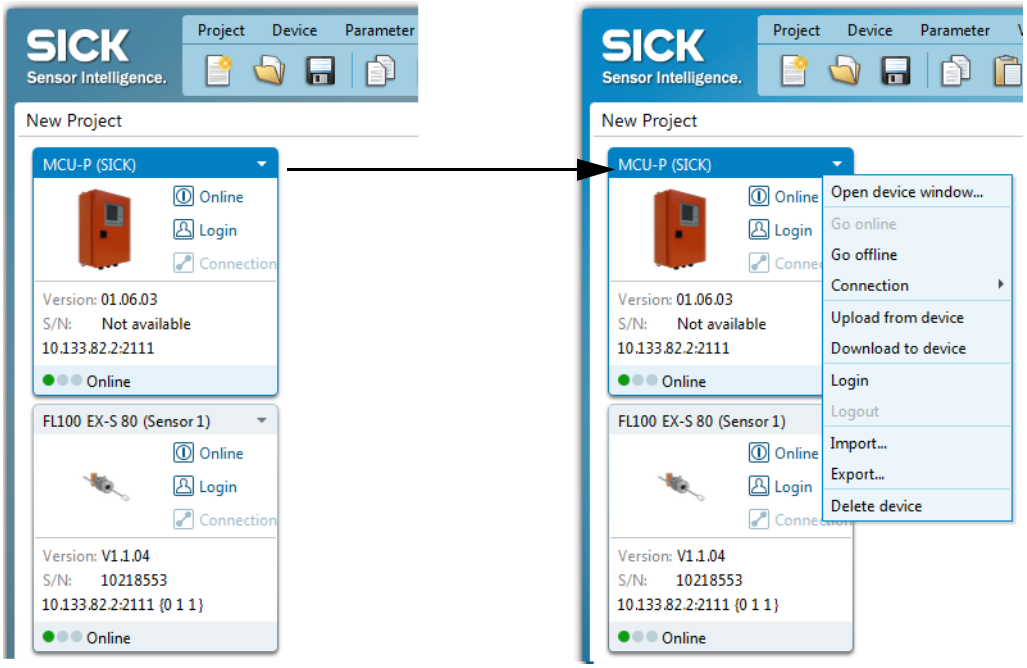


Table 11 Contents of device context menu

Context menu	Description
Go online	Establishes the connection between SOPAS ET and the device.
Go offline	Interrupts the connection between SOPAS ET and the device.
Connection	– Select Connection: Changes the connection settings. – Deselect Connection: Deletes the connection settings.
Upload from device	Uploads all parameter values from the connected device and transfers them to SOPAS ET.
Download to device	Downloads the parameter values from SOPAS ET to the connected device. Only those parameter values are downloaded which can be written at the currently logged in user level.
Login	Opens the login dialog.
Logout	Logs out the user from the device.
Import	Imports a suitable device from the *.sopas file and overwrites the parameter values with the values saved in the *.sopas file. During import to an online device, the parameters are immediately written to the device. Only those parameter values are written which can be written at the currently logged in user level.
Export	Exports the device information and the associated project information and saves them in a *.sopas file.
Delete device	Deletes the device from the project.

4.2 Password protection

Certain device functions are first accessible after a password has been entered (→ pg. 167, §4.3). Access rights are assigned in 3 levels:

User level		Access to
0	“Machine operator”	Displays measured values and system states
1	“Authorized Client”	Displays, inquiries and parameters required for commissioning or adjustment to customer-specific demands and diagnosis
2	“Service”	Displays, inquiries as well as all parameters required for service tasks (e.g., diagnosis and clearance of possible malfunctions)

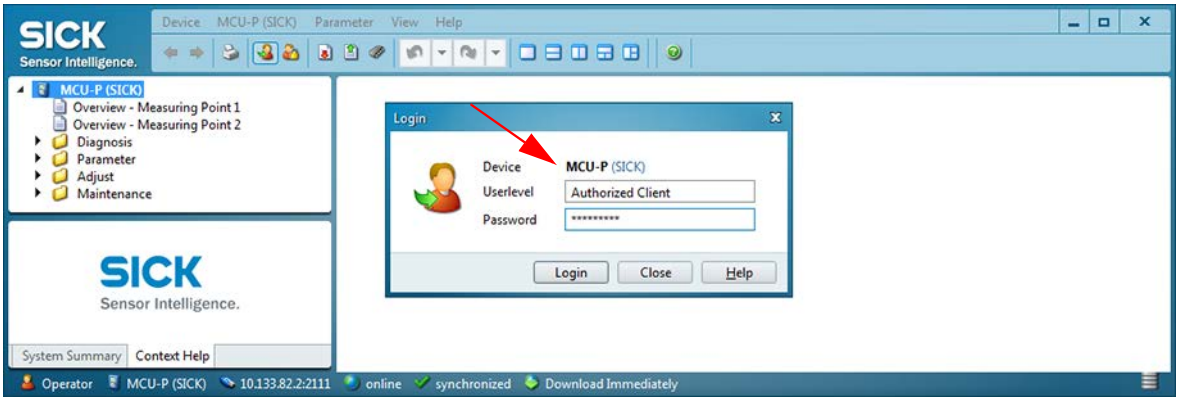
4.2.1 Default password

The level 1 default password is included in the Annex, → pg. 244, §6.6.

A device-specific password is generated for certain device versions. Please refer to the documentation delivered or the label on the device for the device-specific password. If no device-specific password has been set at the factory, the default password is applicable.

SICK recommends changing the password after the first login, → pg. 166, §4.2.2.

Fig. 107 Entering the password



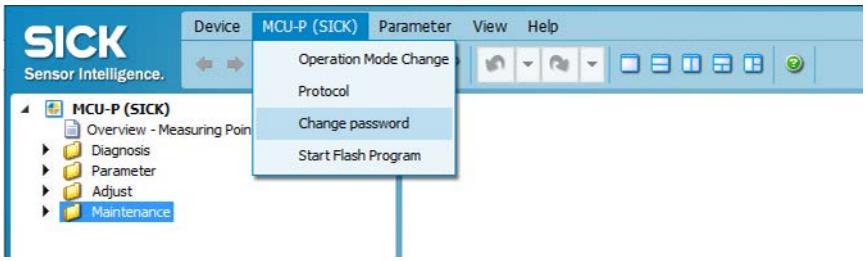
4.2.2 Changing the password

NOTICE:
The passwords of sender/receiver units and MCUP are independent from each other and must be adapted independently.

Proceed as follows to change the password:

1 Connect to the device, → pg. 157, §4.1.3.
2 Login to the device with user level 1 (Authorized Client).
3 In the desired device menu (example: MCU-P), select entry “Change Password”.

Fig. 108 Device menu (example: MCU-P)

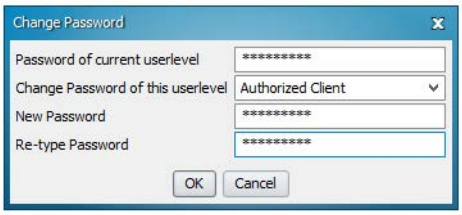


4 First enter the current password in the “Change Password” window.

5 Enter and confirm the new password.

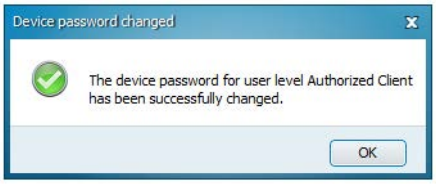
6 Click “OK”.

Fig. 109 Change password



7 The device password is changed. Click “OK” to close the message.
The new password is valid immediately.

Fig. 110 Password changed



Contact SICK Service should you forget your password.

4.3 Standard start-up

This Section describes all the settings essential for device functionality. These include entering equipment data (active measuring path, installation angle) and settings for reaction times, check cycle and standard analog output (calibration settings → pg. 200, §).

NOTICE: **Applications with extremely fluctuating gas compositions**
In applications with extremely fluctuating gas compositions, it is recommended to optimize the device parameters in cooperation with the manufacturer.

Error message "Parameter Error" is output when equipment data input is not complete.

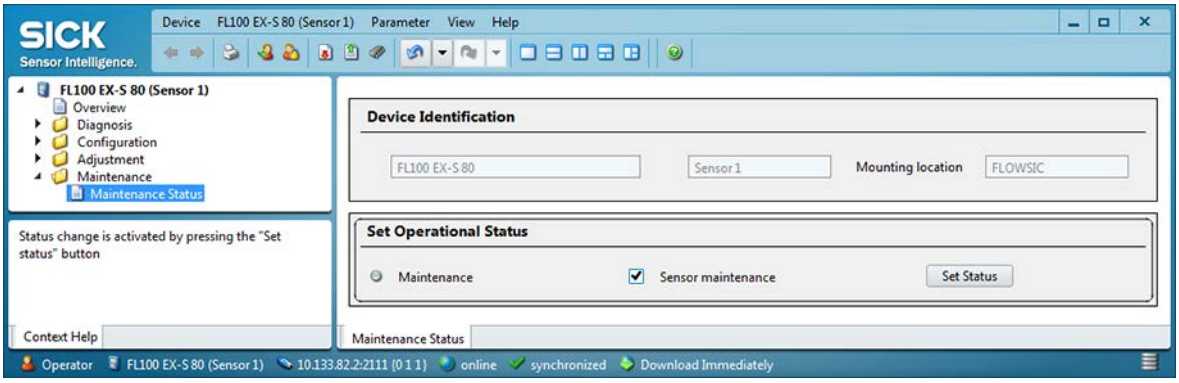
4.3.1 Entering application-specific parameters in the sender/receiver units

- ► Start the SOPAS ET program and connect to the measuring system (→ pg. 157, § 4.1.3).
- ► Select the required device file (FL100-EX xx) and move it to the project window (→ pg. 163, § 4.1.4).

> The respective connected device type is displayed automatically.

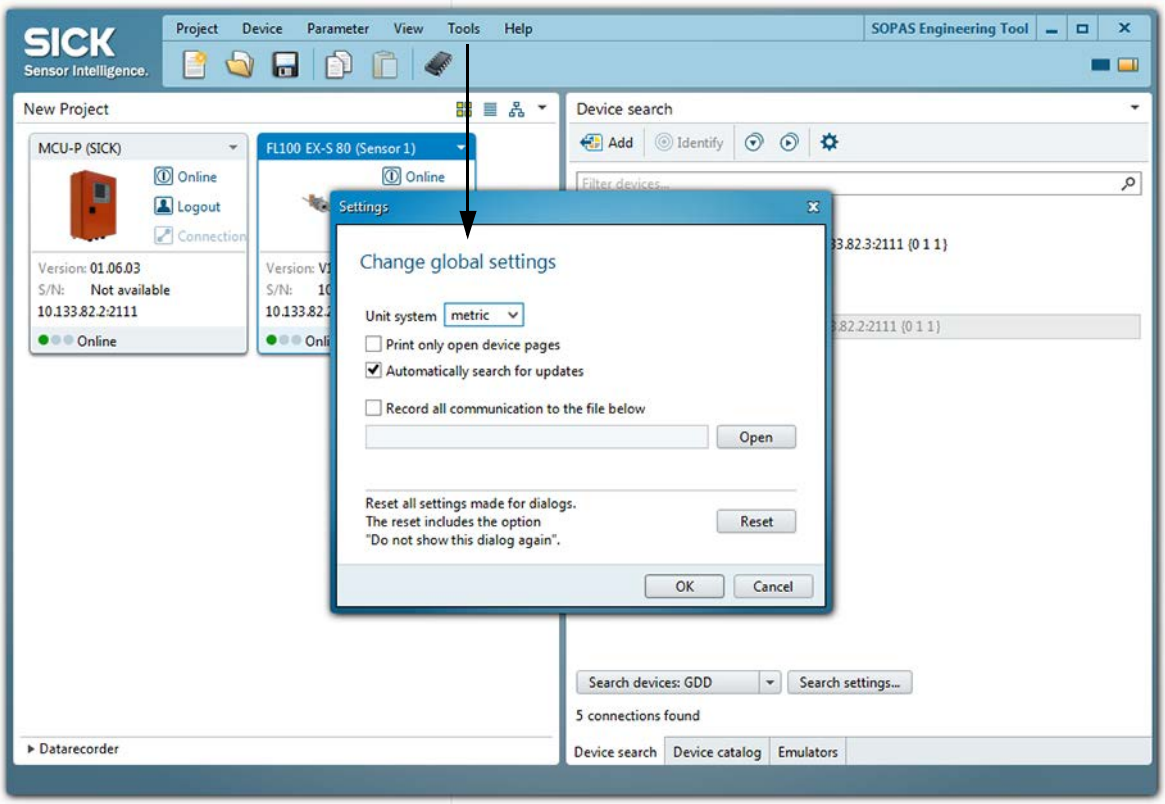
- ► Set the sender/receiver units to "Maintenance" mode and enter the Level 1 password (→ pg. 163, § 4.1.4).

Fig. 111 Setting "Maintenance" mode



- ► Select the unit of measurement to be used in the "Tools / Options" menu on the overview page (metric or US standard), → pg. 168, § 112.

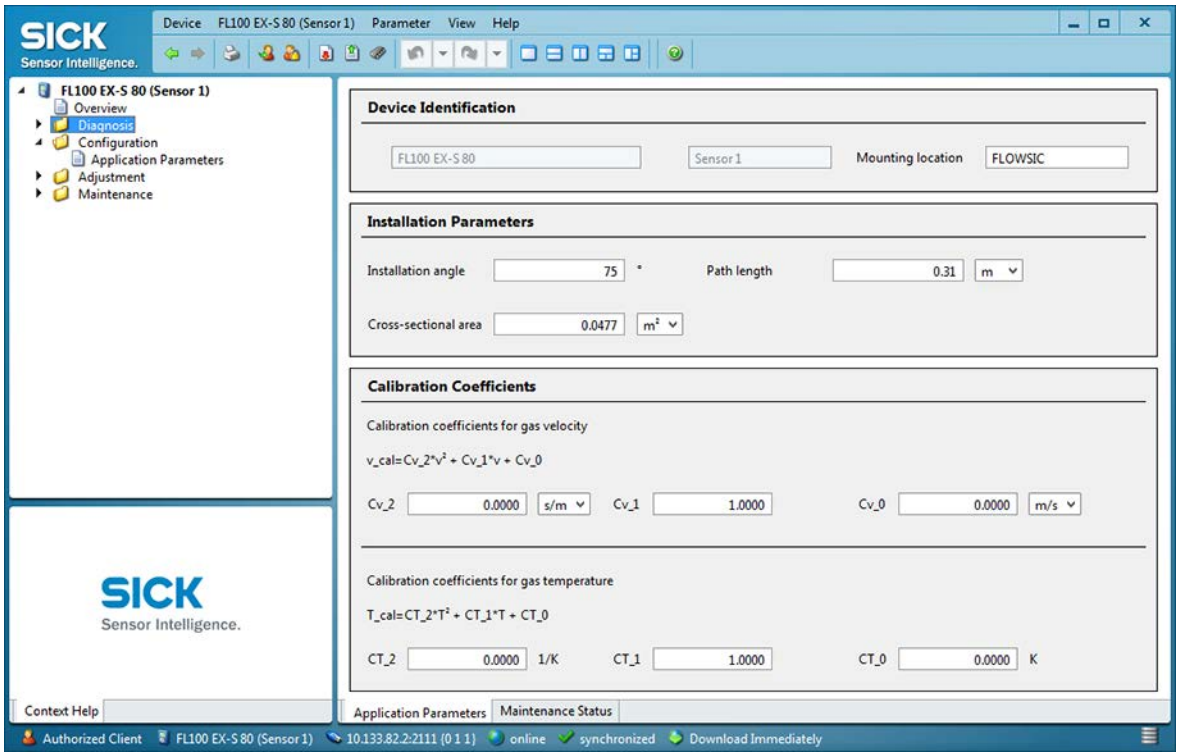
Fig. 112 Selecting the unit of measurements



► Select the "Configuration / Application Parameter" directory (→ pg. 169, Fig. 113) and enter the values determined for path length and angle determined in Section 3.3.1.4 as well as the cross-sectional area.

Installation angle	Angle between measuring axis and main gas flow direction (path angle α, → pg. 97, §3.3.1.4)
Path length	Distance transducer - transducer (path length L, → pg. 97, §3.3.1.4)
Cross-sectional area	Internal diameter of the pipeline (→ pg. 169, Fig. 113)

Fig. 113 Configuration / Application Parameters" directory (example for settings)

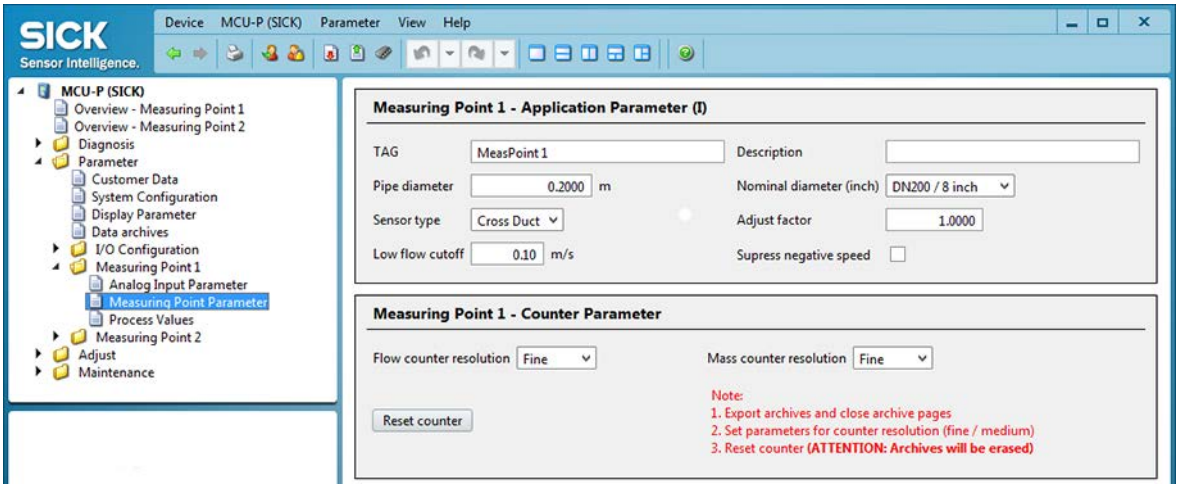


- The parameters entered are saved in the FLOWSIC100 Flare after the switching from "Maintenance" to "Measurement".
- Set installation parameters are converted automatically when the unit of measurement is changed.
- Enter the calibration coefficient for gas velocity Cv_1 ("Calibration Coefficients" group) as a negative value if FLOWSIC100-EXPR is installed at a vertical pipeline (→ pg. 81, §3.1.3).

4.3.2 Configuration of application-specific parameters in the MCUP

- ► Select device file "MCU-P" and move it to the "Project " window.
- ► Set the MCUP to "Maintenance" mode and enter the Level 1 password (→ pg. 163, §4.1.4).
- ► Select the "Parameter / Measuring Point 1(2/3) / Measuring Point Parameter" directory.
- ► Enter the data in the "Measuring Point 1 - Application Parameter (I)" group as listed in the following table.

Fig. 114 "Parameter / Measuring Point 1 / Measuring Point Parameter" directory



Entry field	Parameter	Remark
TAG	Name	TAG No. of the measuring point
Description	Name	Description of measuring point
Pipe diameter	Value	Pipe diameter in m
Nominal diameter (inch)	Value	Select the corresponding value Skip this step if the correction method 'Wide range reynolds number correction' is selected.
Sensor type	Installation version	Select the corresponding type (cross-duct or probe)
Adjust factor	Value	Has to be determined by a comparision measurement; without measurement enter " 1 "
Low flow cut-off	Value	If the measured value is less than the value of the low flow cut-off, the output of the gas velocity is 0 m/s (or 0 ft/s, depending on the unit system). Accordingly, the output for the volume flow will also be 0 m^3/h (or 0 ft^3/h). The default value of the low flow cut-off is 0.03 m/s (or 0.1 ft/s, depending on the unit system).
Suppress negative speed	Active	A negative gas velocity is suppressed
Damping time (T90)	Value in s	Response time of measured value at selected measuring point

NOTICE:
For flow calibrated devices the coefficients CC0 ... CC4 must be the same as those detailed on the calibration certificate. If necessary, set the parameters in SOPAS ET with values from the calibration certificate.

In order to set application-specific parameters for 2-path configurations, log into SOPAS via access level 2 - "Service".

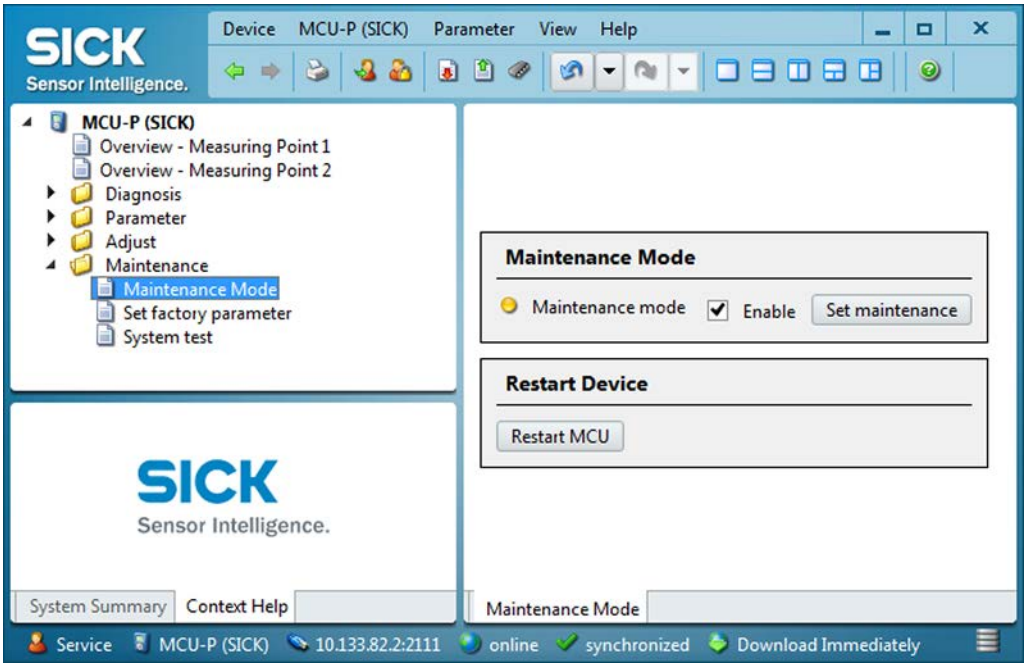
- ► Establish connection between MCUP and SOPAS ET using USB interface.
- ► Select device file "MCU-P" and move it to the "Project " window.
- ► Set the MCUP to "Maintenance" mode and log in as "Service" (password "service").

WARNING:
No other parameters or settings may be changed while logged into access level 2 - "Service", except for those described in this section. All other changes to settings may only be carried out using the access levels 0 - "Operator" or 1 - "Authorized client". The manufacturer is not liable for any disruption caused by incorrect settings made by the user in SOPAS.

Fig. 115 Service Login

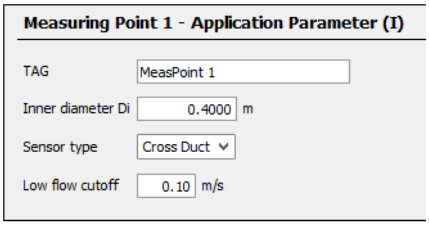
- ► Set SOPAS to maintenance mode.

Fig. 116 Maintenance mode page



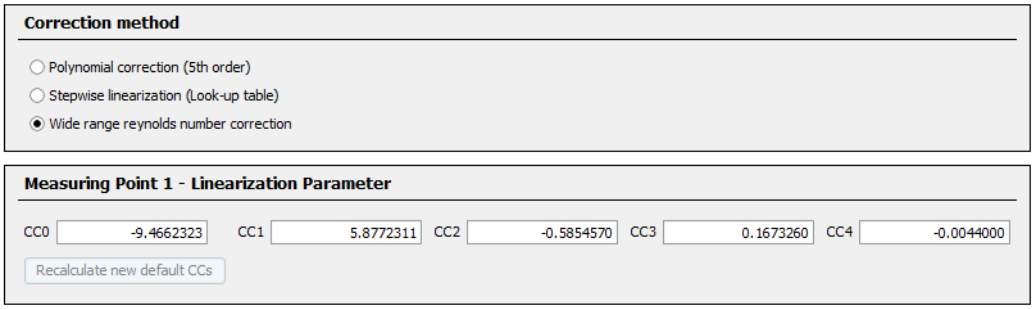
- ► Select the "Parameter / Measuring Point 1(2/3) / Measuring Point Parameter" directory.
- ► Make sure that inner diameter and sensor type are parameterized correctly.

Fig. 117 Check inner diameter and sensor type



- ► Make sure „Wide range reynolds number correction“ is selected.
- ► Then press „Recalculate new default CCs“.

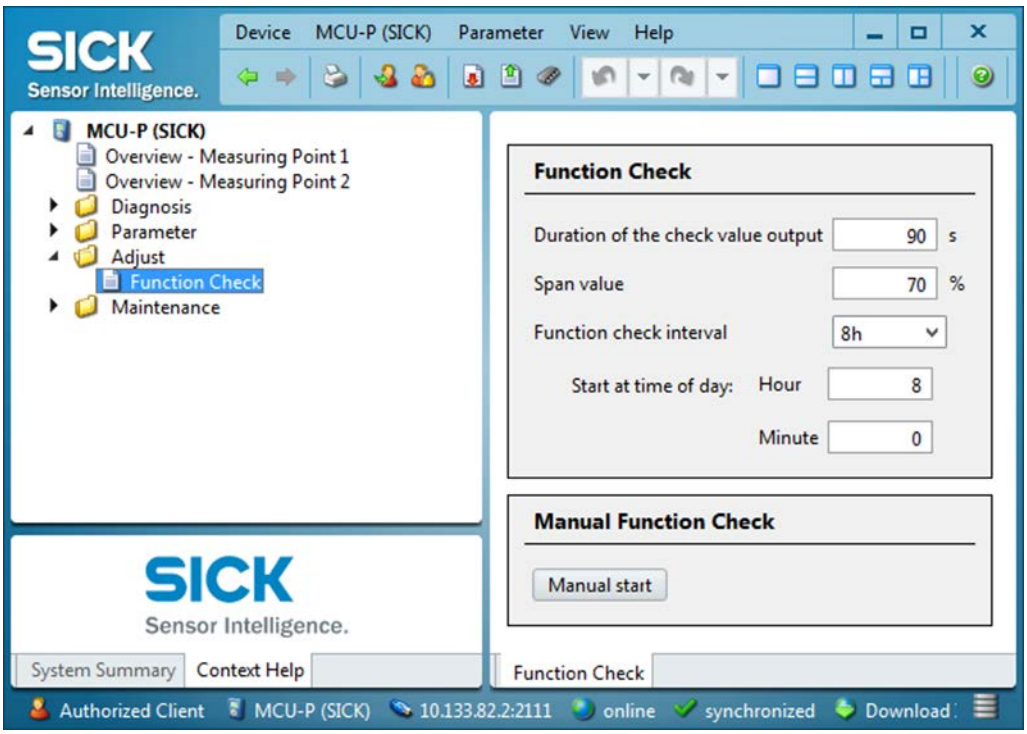
Fig. 118 Recalculate new default CCs



4.3.3 Determining the check cycle

Interval time, control value output on the analog output and the starting time-point for automatic check cycles can be modified in the "Adjust / Function Check" directory ("MCU-P" device file).

Fig. 119 "Adjust / Function Check" directory (example for settings)



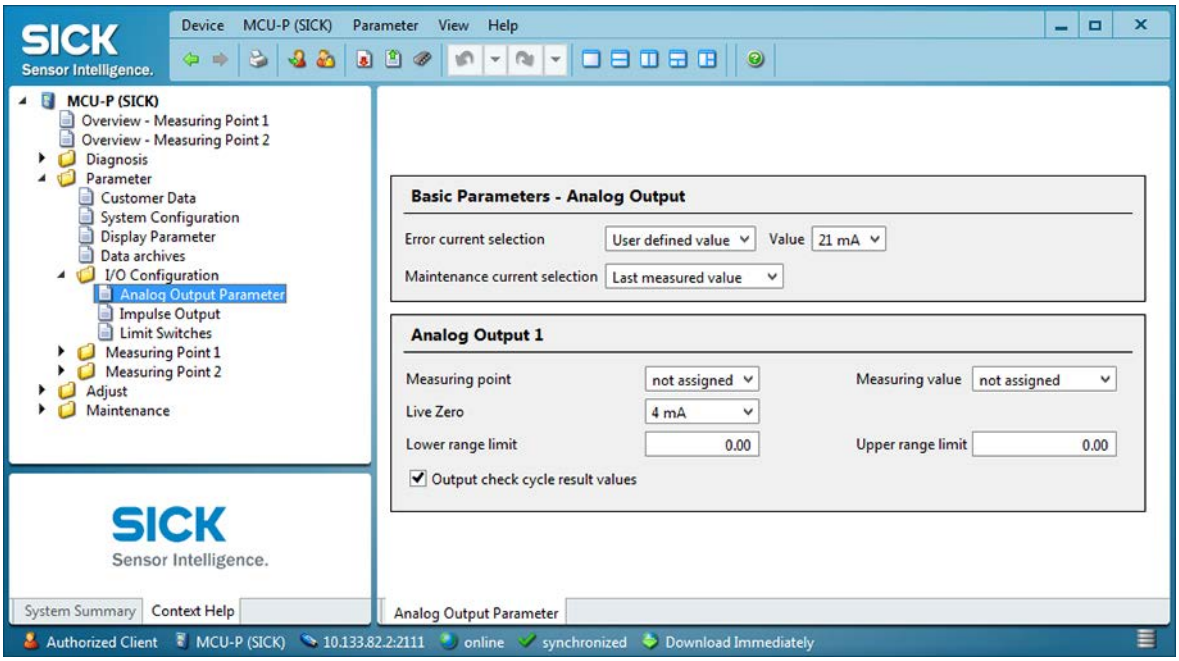
Entry field	Parameter	Remark
Duration of the check value output	Value in seconds	Output duration for control values
Span value	Value in %	Determines the span value level → pg. 73, §2.4
Function check interval	Time between two check cycles	→ pg. 73, §2.4
Start at time of day	Hours	Defining a start time-point in hours, minutes and seconds
	Minutes	

The value measured last is output during check value determination.

4.3.4 Setting the analog outputs parameters

Select the "Parameter / I/O Configuration / Analog Output Parameters" directory ("MCU-P" device file") to set the analog outputs.

Fig. 120 "Parameter / I/O Configuration / Analog Output Parameters" directory



The "Analog output 2(3)" fields only appear when an AO module is plugged in.

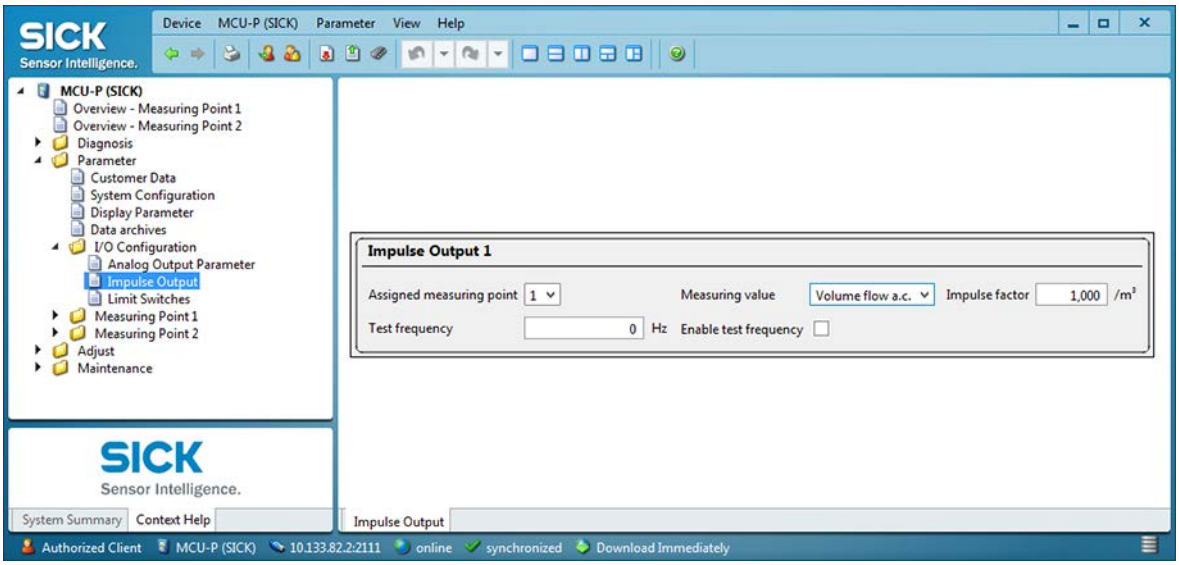
Field		Parameter	Remark	
Basic Parameters - Analog Output	Error current selection	Yes	Fault current is output.	
		No	Fault current is not output.	
	Value	1,2 3 or 21 mA	mA value to be output in "Malfunction" state (error case) (size depends on connected evaluation system).	
	Maintenance current selection	User defined value	The value entered in the "User value" field is output during "Maintenance".	
		Last Measuring Value	The last value measured is output during "Maintenance"	
		Normal measured value output	The current measured value is output during "Maintenance".	
	User value	Value - LZ whenever possible	mA value to be output in "Maintenance" state Entry field appears only after selection of "Used Defined Value".	
Analog Output 1	Measuring point	Measuring point 1, 2 or 3		
	Measuring value	Flow a.c.	Volume flow in actual conditions	The selected measured variables are output on the analog output.
		Flow s.c.	Volume flow in standard conditions	
		Mass flow		
		Molar mass		
		Velocity of gas		
		Velocity of sound		
	Live Zero	Zero point (0, 2 or 4 mA)	Select 2 or 4 mA to ensure being able to differentiate between measured value and switched off device or interrupted current loop.	
	Lower range limit	Lower measuring range limit	Physical value at live zero	
	Upper range limit	Upper measuring range limit	Physical value at 20 mA	
	Output check cycle result values	On/Off	Output of results of check cycle: On No output of results of check cycle: Off	

Set the parameters for fields "Analog output 2(3)" analog to field "Analog output 1".

4.3.5 Setting parameters for the pulse output

Select the "Parameter / I/O Configuration / Impulse Output" directory ("MCU-P" device file) to set the optionally available pulse output.

Fig. 121 "Parameter / I/O Configuration / Impulse Output" directory



Field	Parameter	Remark
Assigned measuring point	Measuring point 1, 2 or 3	
Measuring value	Volume flow a.c.	Volume flow in actual conditions
	Volume flow s.c.	Volume flow in standard conditions
	Mass flow	
Impulse factor	Value	Pulses per m^3 or per kg; maximum frequency 10 kHz
Test frequency	Value	Input of a value for test purposes to be output at the pulse output
Enable test frequency	Measuring point 1, 2 or 3	If activated, the entered test frequency is output at the pulse output

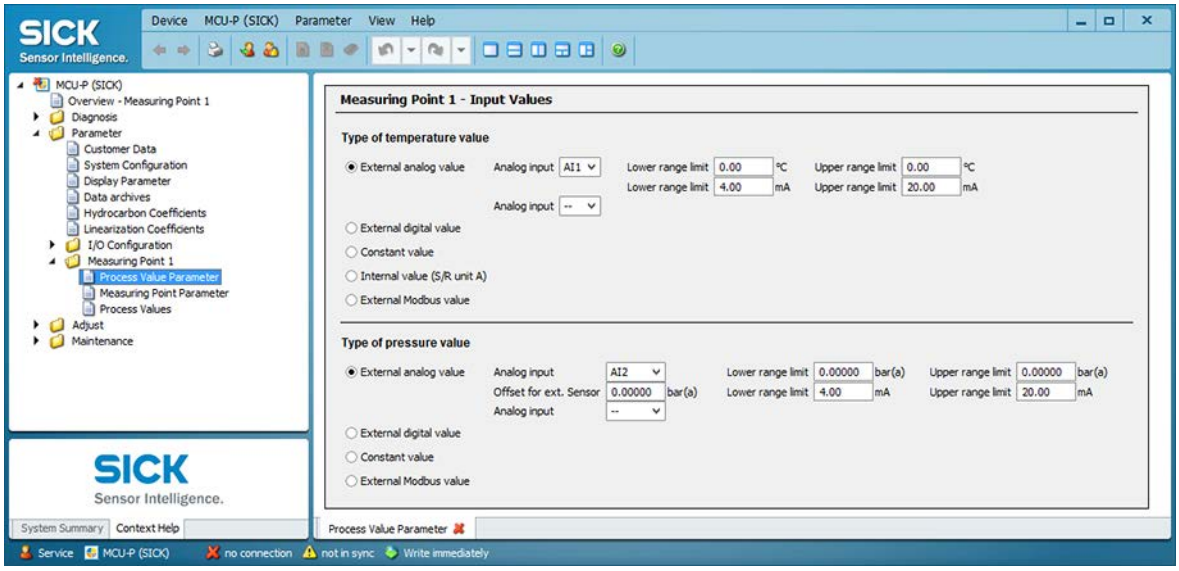
Relation between impulse frequency, volume and impulse factor:

$$\text{Impulse factor [kHz]} = \frac{Q\left[\frac{m^3}{h}\right]}{3600} \bullet \text{Impulse rating}\left[\frac{1}{m^3}\right]$$

4.3.6 Setting the analog inputs parameters

Select the "Parameter / Measure Point 1(2/3) / Analog Input Parameter" directory ("MCU-P" device file) to set the analog inputs.

Fig. 122 "Parameter / Measuring Point 1 / Analog Input Parameter" directory



Field	Parameter	Remark
Type of temperature value	External analog value	The value of one of the external sensors connected to the analog input is used to calculate the value in standard condition. Selecting the parameter opens entry fields to select the analog input, to set parameters for the physical measured value range and to assign range limits to the analog input limits.
	External digital value	For detailed information, see document 8017538 „FLOWSIC100 Flare: MCUP Interfaces“, §4.3 „Starting up the digital transmitter interface“ .
	Constant Value	A constant value to be entered in the adjacent field is used to calculate the value in standard condition.
	Internal value (S/R unit A)	The temperature value determined internally in sender/receiver unit A is used to calculate the value in standard condition
	External Modbus value	Reading in of external tempreature values via Modbus registers; for detailed information see Modbus Specification.
Type of pressure value	External analog value	The value of one of the external sensors connected to the analog input is used to calculate the value in standard condition. Selecting the parameter opens entry fields to select the analog input, to set parameters for the physical measured value range and to assign range limits to the analog input limits.
	External digital value	For detailed information, see document 8017538 „FLOWSIC100 Flare: MCUP Interfaces“, §4.3 „Starting up the digital transmitter interface“ .
	Constant Value	A constant value to be entered in the adjacent field is used to calculate the value in standard condition.
	External Modbus value	Reading in of external pressure values via Modbus registers; for detailed information see Modbus Specification.

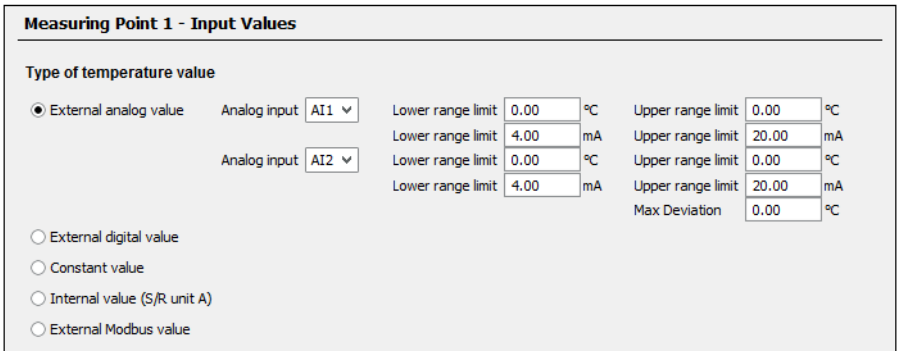
NOTICE:
All pressure values in SOPAS are "absolute pressure".

4.3.6.1 External analog temperature value

The temperature value can be input through external analog transmitters.

- ► To read in a temperature value via external analog transmitter, select the “External analog value” option.
- ► Up to two temperature transmitters can be selected to increase fail-safety. Select the analog input of the required transmitters in the drop-down lists.
- ► Enter your lower and upper range limits in which the transmitter works.
- ► The maximum deviation of both transmitters from each other can be set in the “Max. Deviation” field. A warning message “AI redundancy warning” is output when a larger deviation occurs. If „Max. deviation“ is set to “0.00000“ the deviation warning is disabled and no warning message will occur.

Fig. 123 External analog temperature value



NOTICE:

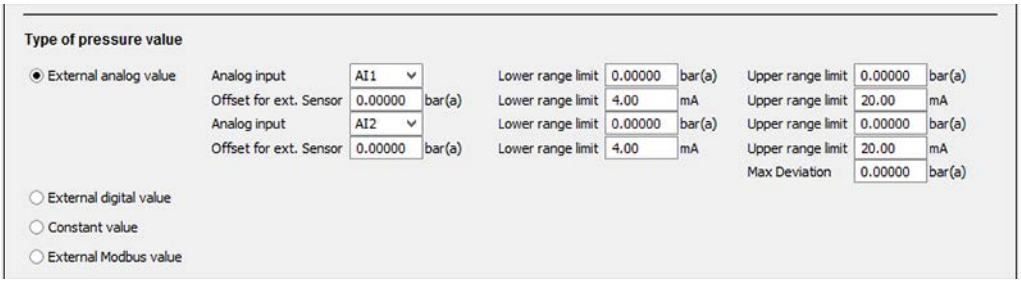
If two transmitters are selected, the mean value is created from both temperature values. If one of the transmitters fails, the value of the remaining transmitter is used. If both transmitters fail, the value measured last is used as constant value until the function of the transmitters is restored.

4.3.6.2 External analog pressure value

The pressure value can be input through external analog transmitters.

- To read in a pressure value via external analog transmitter, select the “External analog value” option.
- Up to two pressure transmitters can be selected to increase fail-safety. Select the analog input of the required transmitters in the drop-down lists.
- Enter your lower and upper range limits in which the transmitter works.
- The maximum deviation of both transmitters from each other can be set in the “Max. Deviation” field. A warning message “AI redundancy warning” is output when a larger deviation occurs. If „Max. deviation“ is set to “0.00000“ the deviation warning is disabled and no warning message will occur.

Fig. 124 External analog pressure value

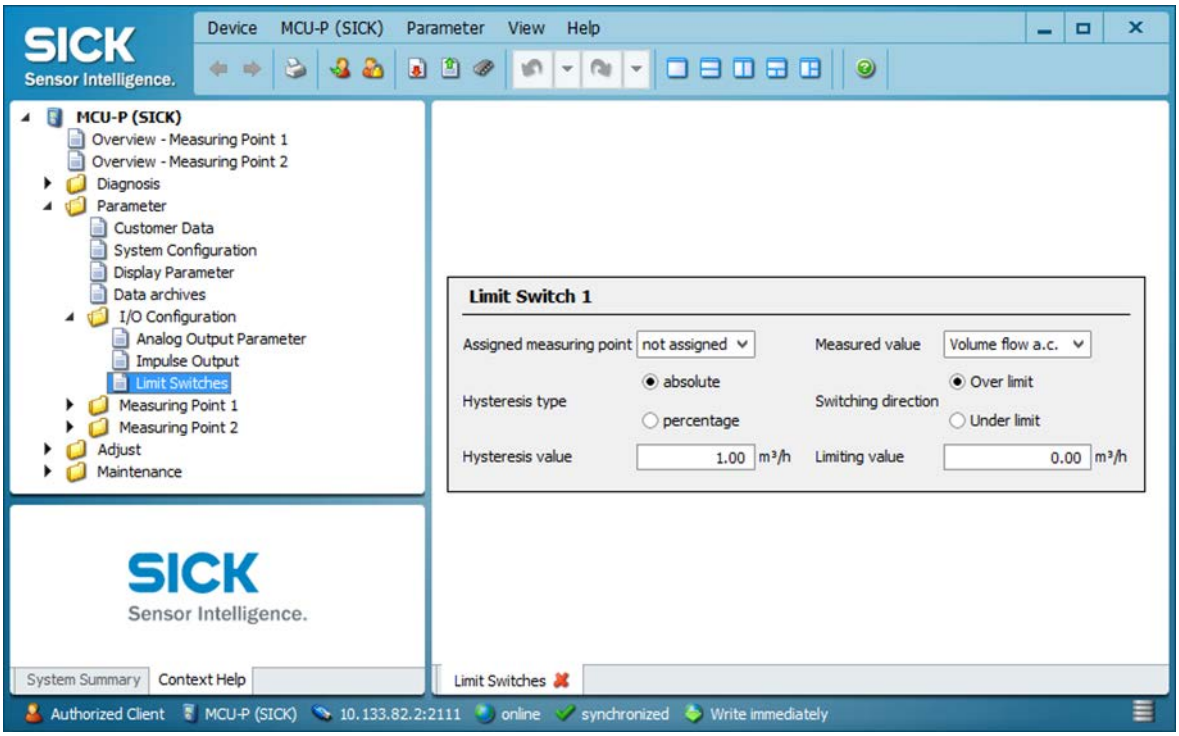


NOTICE:
If two transmitters are selected, the mean value is created from both pressure values. If one of the transmitters fails, the value of the remaining transmitter is used. If both transmitters fail, the value measured last is used as constant value until the function of the transmitters is restored.

4.3.7 Defining the limit value

Select the "Parameter / I/O Configuration / Limit Switches" directory ("MCU-P" device file) to set parameters for limit values.

Fig. 125 "Parameter / I/O Configuration / Limit Switches" directory



Field	Parameter	Remark	
Assigned measuring point	Measuring point 1, 2 or 3		
Measured value	Volume flow a.c.	Volume flow in operating state	The limit value settings are assigned to the selected measured variables
	Volume flow s.c.	Volume flow in normalized state	
	Mass Flow		
	Molar mass		
	Velocity of gas	Gas velocity	
	Velocity of sound	Speed of sound	
	Temperature		
	Pressure		
	Density a.c.		
Hysteresis type	Absolute	Assignment of the value entered in the "Hysteresis Value" field as relative or absolute value of defined limit value	
	Percentage		
Hysteresis value	Value	Defines a tolerance for resetting the limit value relay	
Limiting value	Value	When value > 0, the limit value relay switches when the entered value is exceeded or underflown.	
Switching direction	Over limit	Defines the switching direction	
	Under limit		

4.3.8 Logbook function

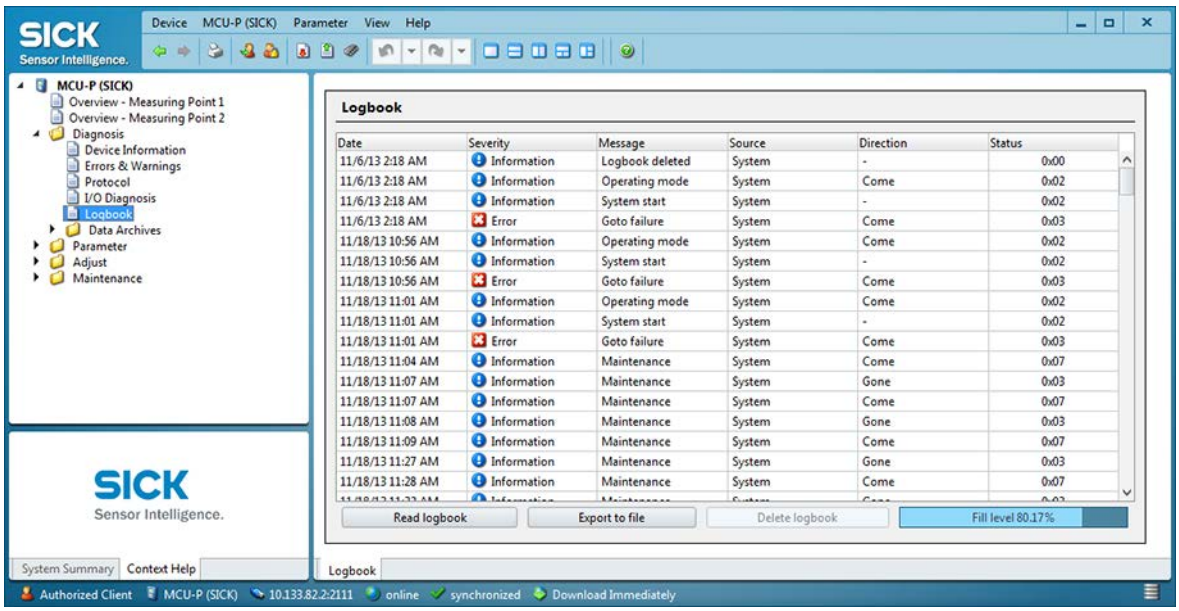
Changes to the device function and in the measuring system are stored in an integrated logbook as event with date and time of recording and resetting. Events recorded:

- Warning measuring point <No.>
- Malfunction measuring point <No.>
- Warning MCUP
- Malfunction MCUP
- Logbook full
- Data archive full
- Measured value limit <No.> exceeded
- Operating mode switched
- Parameter write operation

A Maximum of 200 entries are registered in the logbook. A warning is displayed when this limit is reached and the oldest entry is overwritten when exceeded (FIFO principle).

The logbook can be deleted. Deletion is noted in the logbook as event "Logbook deleted".

Fig. 126 Logbook



4.3.9 Data backup

All parameters relevant for recording, processing and input/output of measured values as well as current measured values can be saved and printed. This allows re-entering set device parameters when necessary without problem, or registering device data or states for diagnostic purposes.

Data can be saved in the following ways:

- Saving as a project
  Data recordings can also be stored separately from device parameters.
- Saving as a device file

Stored parameters can be edited without a connected device and transferred back to the device at a later time.

See the Service Manual for a description.

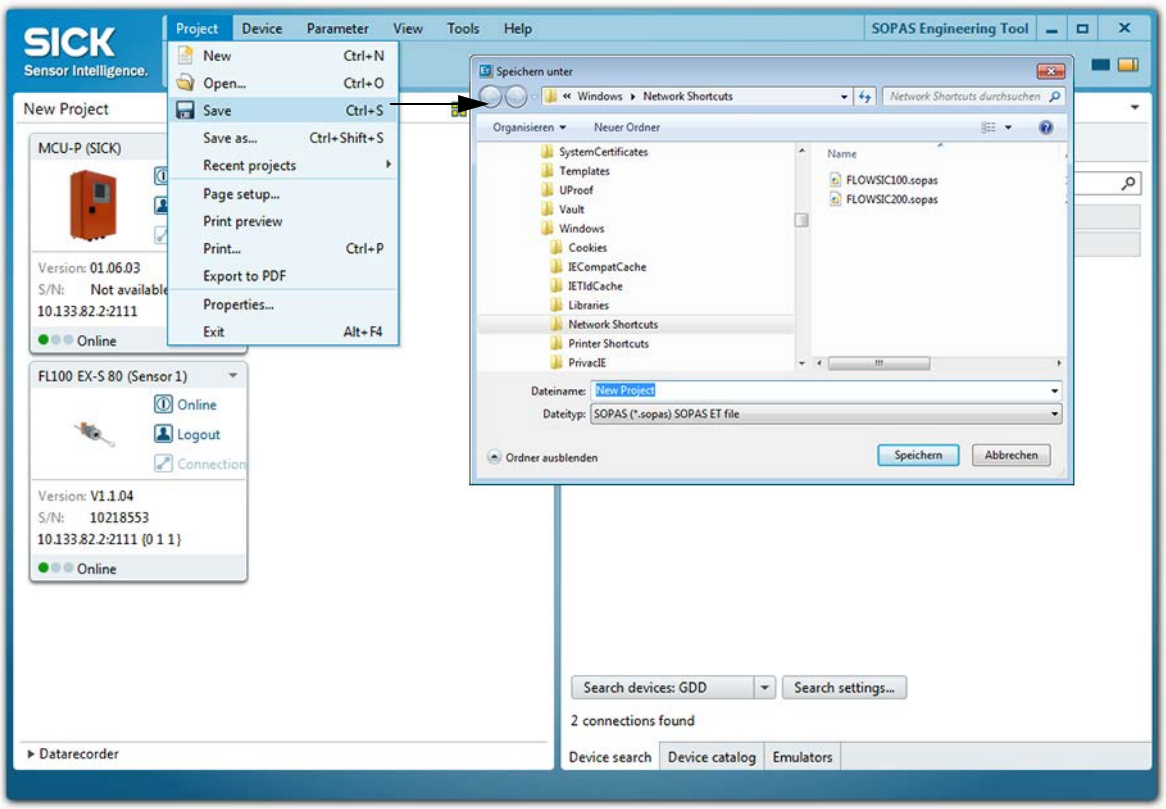
- Saving as a protocol
  Device data and parameters are registered in the Parameter protocol.
  A Diagnosis protocol can be created for analysis of the device function and recognition of possible malfunctions.

Saving as a project

If connections are frequently established, it is advisable to save as a "Project". If connection to the device is to be established again, only this "Project" must be opened. All files previously saved are automatically transferred to SOPAS ET.

To save, select the respective device, call up the "Project / Save“ menu and specify target directory and file name. The name of the file to be stored can be chosen freely. It is useful to specify a name with a reference to the measuring point involved (name of the company, equipment designation).

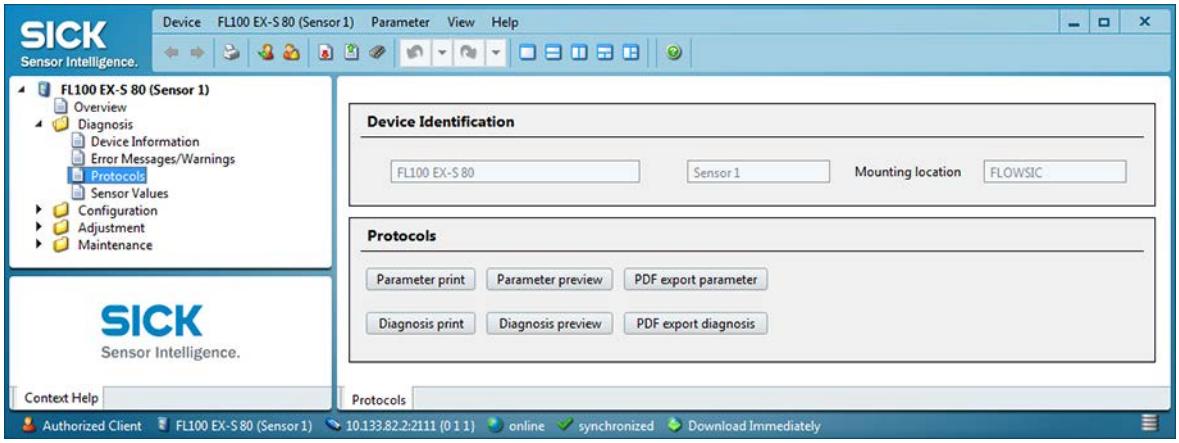
Fig. 127 "Project / Save" menu



Saving as a protocol

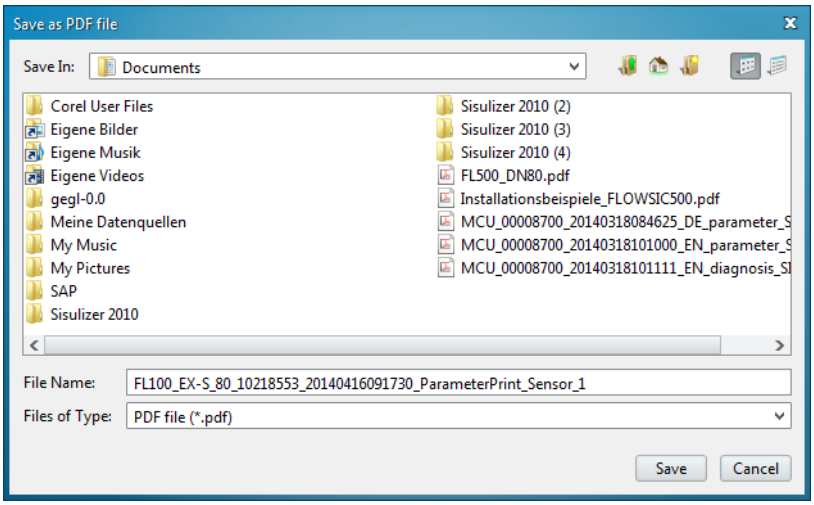
► Select device, select the "Diagnosis / Protocols" menu and click the button for the desired type of registration.

Fig. 128 "Diagnosis / Protocols" menu



The file name and storage location must be specified for export to a PDF file.

Fig. 129 Specifying file names and storage location



Parameter protocol example

Fig. 130 FLOWSIC100 Flare Parameter protocol (example)

FLOWSIC100 - Parameter Protocol

Device type: FL100 EX-S 80
Mounting location: FLOWSIC
Sensor 1

Device Information

Device type	FL100 EX-S 80
Firmware version	21.1.04
Parameter CRC (HEX)	000B
SN S/R-Unit Master	10218553
SN S/R-Unit Slave	10218554

Application Parameters

Path length	0.3100m
Installation angle	75.00°
Cross-sectional area	0.0477m²
Velocity Cv_0	0.0000m/s
Velocity Cv_1	1.0000
Velocity Cv_2	0.0000s/m
Temperature CT_0	0.0000
Temperature CT_1	1.0000
Temperature CT_2	0.0000
Fix temperature	15.56°C
Norm. speed of sound	331.500m/s

Device Parameters

Transmit Parameters	
Transmit frequency 1	80.0kHz
Total periods 1	6.0
Activation periods 1	4.0
Retarding attenuation 1	20.0
Delay 1	2.0
Transmit frequency 2	80.0kHz
Total periods 2	6.0
Activation periods 2	4.0
Retarding attenuation 2	20.0
Delay 2	2.0
Transmit frequency 3	80.0kHz
Total periods 3	12.0
Activation periods 3	9.0
Retarding attenuation 3	30.0
Amplitude	0.9
Sensortype	80kHz
Receive Parameters	
Zerophase A (Master)	11.0rad
Zerophase B (Slave)	11.0rad
System runtime A (Master)	75.6µs
System runtime A (Master)	75.6µs
System runtime CCR A (Slave)	-0.8µs
System runtime CCR B (Slave)	-0.3µs
Signal Processing	
Lower fraction	40%
Upper fraction	60%
Number of averaged signals	10
Median buffer size	51
Average median	70%
CCR active	18dB
Multiburst	1
Measuring cycle	100ms
Transmit delay B (Slave)	30ms
Gain	
Gain level A (Master)	31dB
Gain level B (Slave)	30dB
Target amplitude	60%
Damping	10
Gain control deactivated	no
Receiving Window	
Window size	2000
Precounter	0.00ms
Control deactivated	no
Limits	
Limit warning	80%
Limit malfunction	97%
Limit SNR	12dB
Plausib. threshold	20%
Limit range	150.00m/s
Limit. max. transd. temp.	250.0°C
Low flow cut off	0.0m/s
Limit CCR max	500.0
Serial Interface	
Baud rate	57600baud
Bus address	1
Response delay	10ms

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4.3.10 Starting normal measuring operation

Normal measuring operation is started by deactivating the maintenance state (deactivate checkbox in field "Set Operating State"; → pg. 167, §4.3).

Standard start-up is now completed.

Checking the signal form

Checking the signal form allows making a statement on the quality of ultrasonic signals received. Select the FLOWSIC100 Flare type used and then select operating mode "Measurement" in the "Diagnosis / Sensor Values" menu. The ultrasonic signals of both transducers are then displayed in the "Signal Display" field alternating as raw signal and envelope curve.

Setting the "View Envelope" function shows the envelope curves of both transducers. The signal patterns should correspond to the displays in Fig. 131 to Fig. 132.

Example

Fig. 131 Burst form HF signal Type FLSE100-EXS (raw signal)

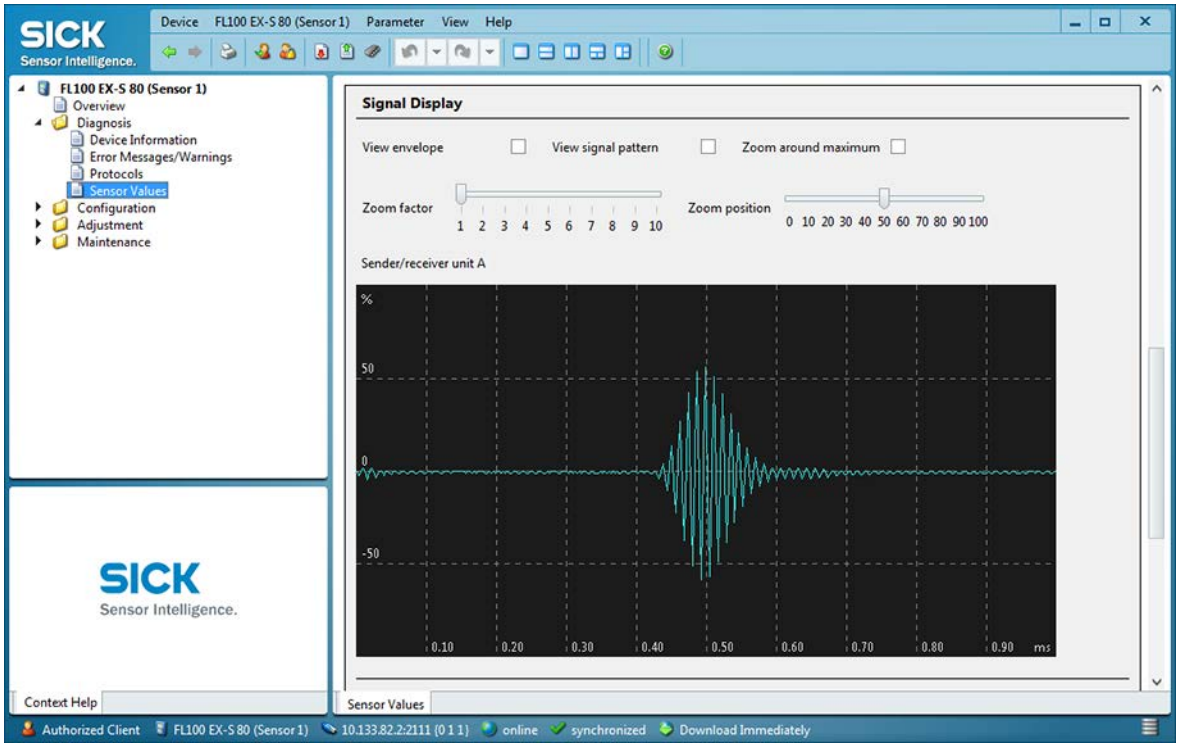
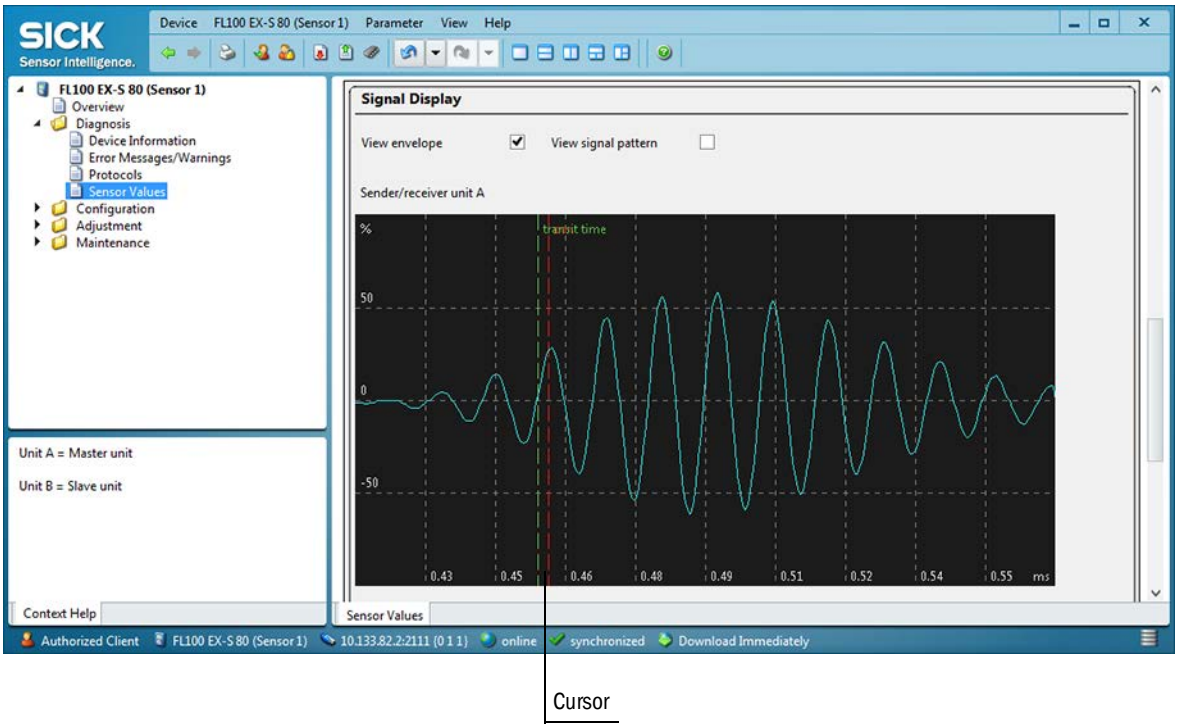


Fig. 132 Burst form demodulated signal Type FLSE100-EXS (envelope curve)

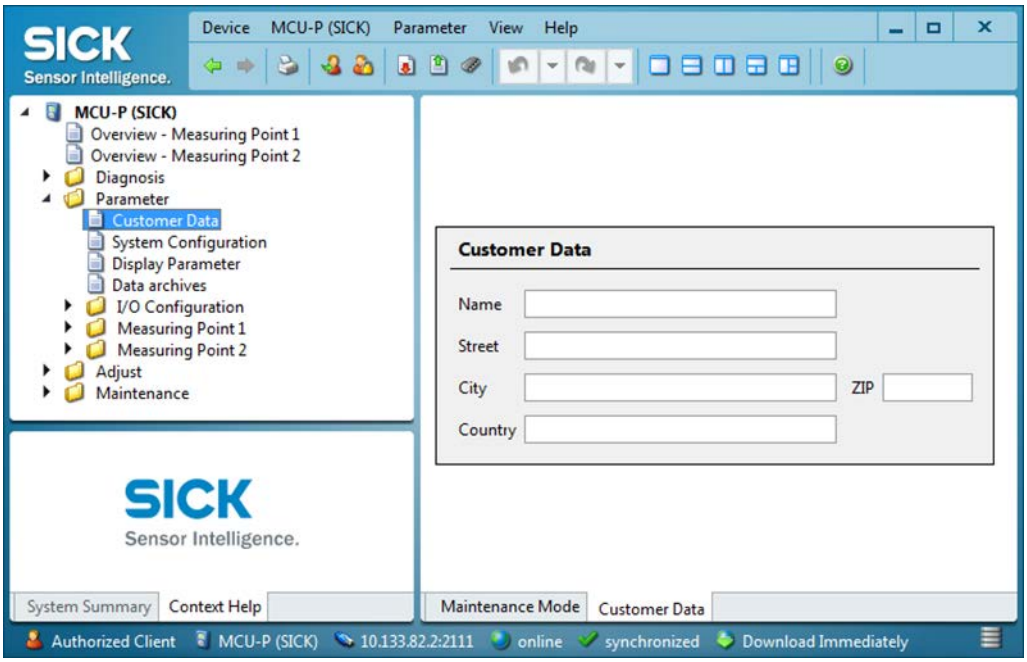


Cursors of both transducers must be at same position.

4.3.11 Entering customer data

Individual customer data can be entered for each measuring point in the "Parameter / Customer Data" directory. To enter, select device file "MCU-P", enter the Level 1 password and set the measuring system to Maintenance mode (→ pg. 163, § 4.1.4).

Fig. 133 "Parameter / Customer Data" directory

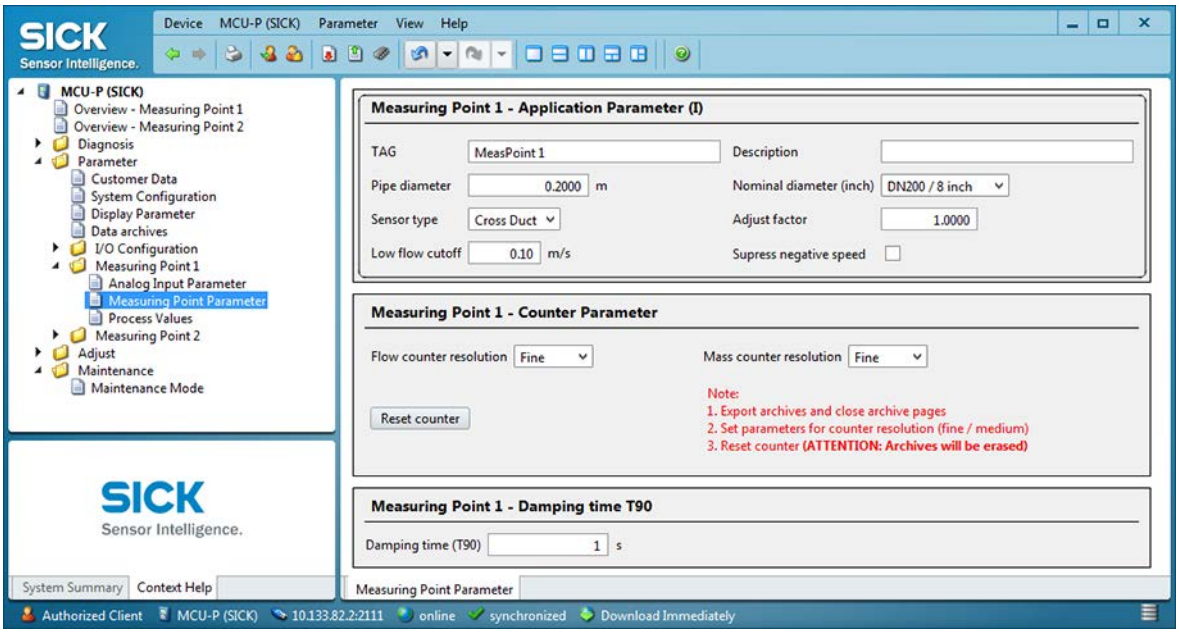


4.3.12 Entering counter function parameters

- ► Select device file "MCU-P", enter the Level 1 password and set the measuring system to "Maintenance" mode (→ pg. 163, § 4.1.4).
- ► Select the "Parameter / Measuring Point 1(2/3) / Measure Point Parameter" directory.
- ► Enter values for volume counter resolution and mass counter resolution in the "Measuring point 1 - Counter Parameter" window.
- ► When the counter resolution has been changed, reset the counter by clicking "Reset counter".

> ***NOTICE:***
> Archives are erased when resetting the counter.

Figure 134 "Parameter / Measuring Point 1 / Measuring Point Parameter" directory



The current counter level (cumulated) can be viewed in the "Overview Measuring Point 1" directory.

4.3.13 Data archives

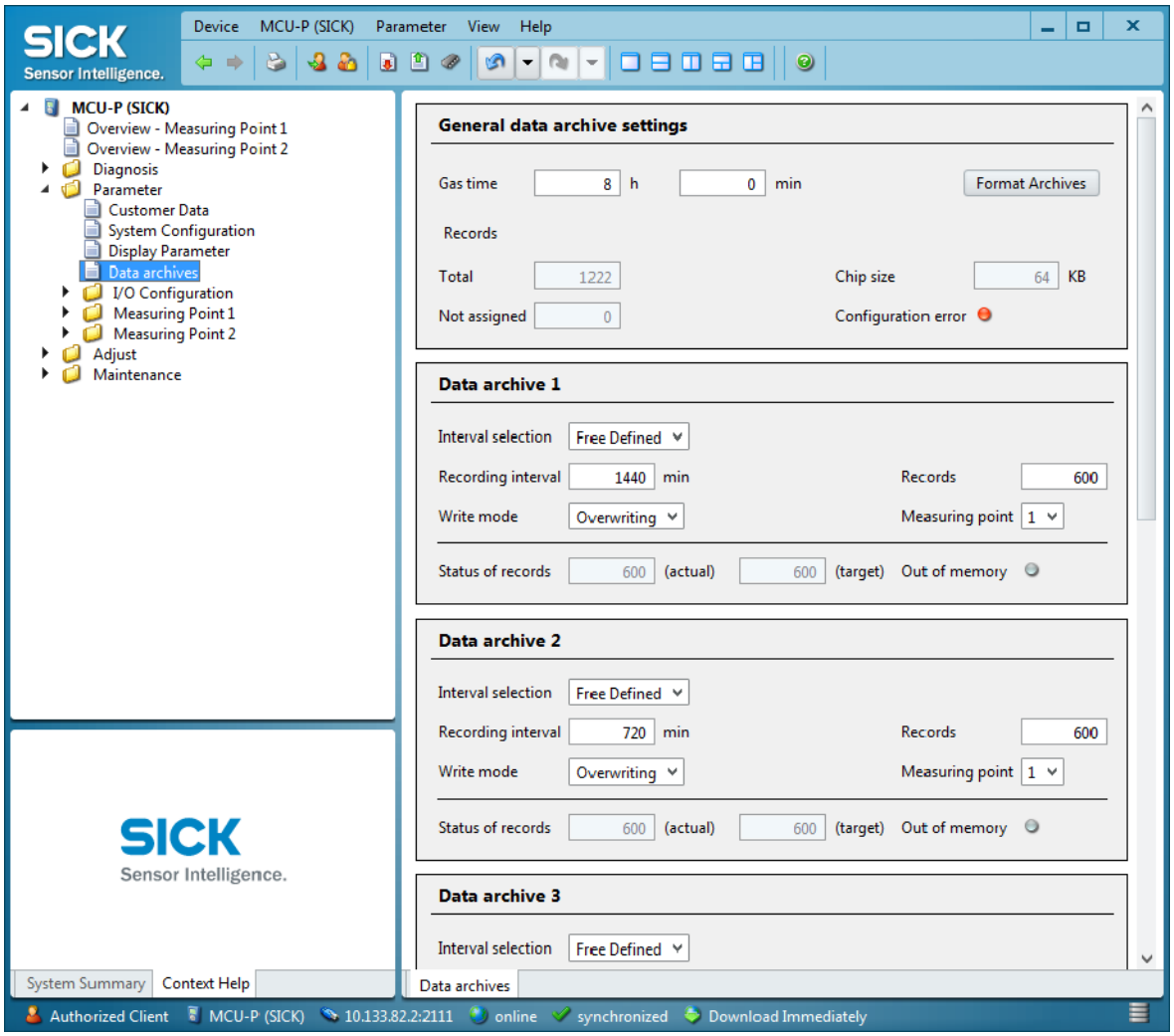
Nine (three per measuring point) non-volatile data archives are implemented in the MCUP control unit to create reports according to defined intervals.

4.3.13.1 Configuring the data archives

The data archives must be configured before being used for the first time.

- Select device file "MCU-P", enter the Level 1 password and set the measuring system to "Maintenance" mode (→ pg. 163, § 4.1.4).
- Switch to the "Parameter / Data archives" directory.
- Enter the parameters for recording interval, entry depth, write mode and reference to measuring point for all 9 archives.

Figure 135 "Parameter / Data archives" directory



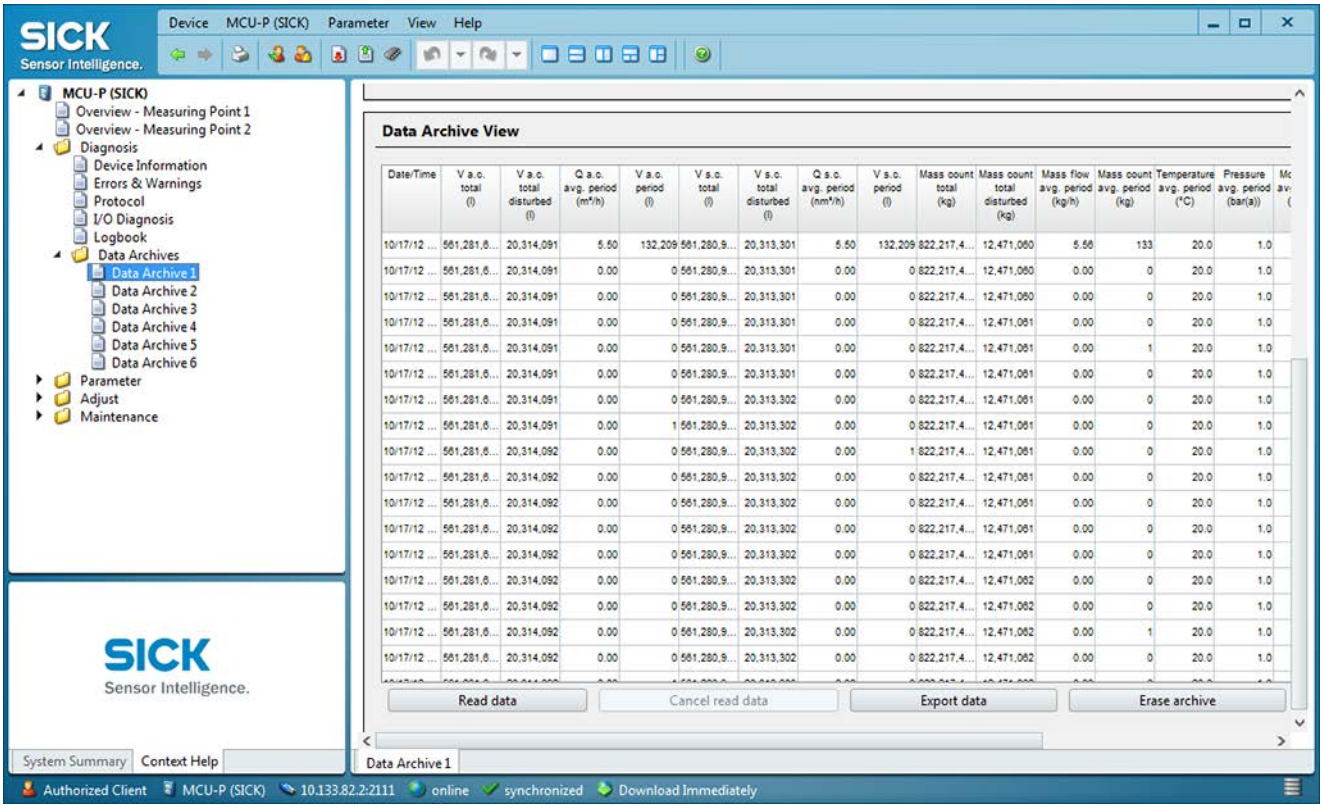
Field	Parameter	Remark
Gas time	Hours, minutes	Defines the daily start-time for writing the archives in order to synchronize the record for multiple devices
Interval selection	Hourly	600 entries are made, max. number of entries is set by the device
	Daily	30 entries are made, max. number of entries is set by the device
	Monthly	12 entries are made, max. number of entries is set by the device
	Free defined	Free number of entries (max. 700) and interval
Write mode	Overwriting, stopping	„Overwriting mode":- all stored data will be overwritten if maximum number of entries is reached; „Stopping mode": data recording is stopped is maximum number of entries is reached
Measuring point	Measuring point 1, Measuring point 2, Measuring point 3	Select measure point to make the settings for the data archive

The data archives can be preset individually. An overall maximum number of 5000 entries can be stored over the 9 data archives, 3 archives per measuring point.

Clicking "Read data" in the "Diagnosis / Data Archives / Data Archive x" displays the corresponding data archive. The display is not refreshed automatically but must be called up again manually. Clicking "Erase archive" deletes the respective archive in order to start a new recording cycle or to use a different cycle.

"Checksum error" is displayed when an error is detected in the data archive. The data archive must then be deleted or formatted to clear the error. Recording stops when "Archive full" is displayed.

Fig. 136 "Diagnosis / Data Archives / Data Archive 1" directory



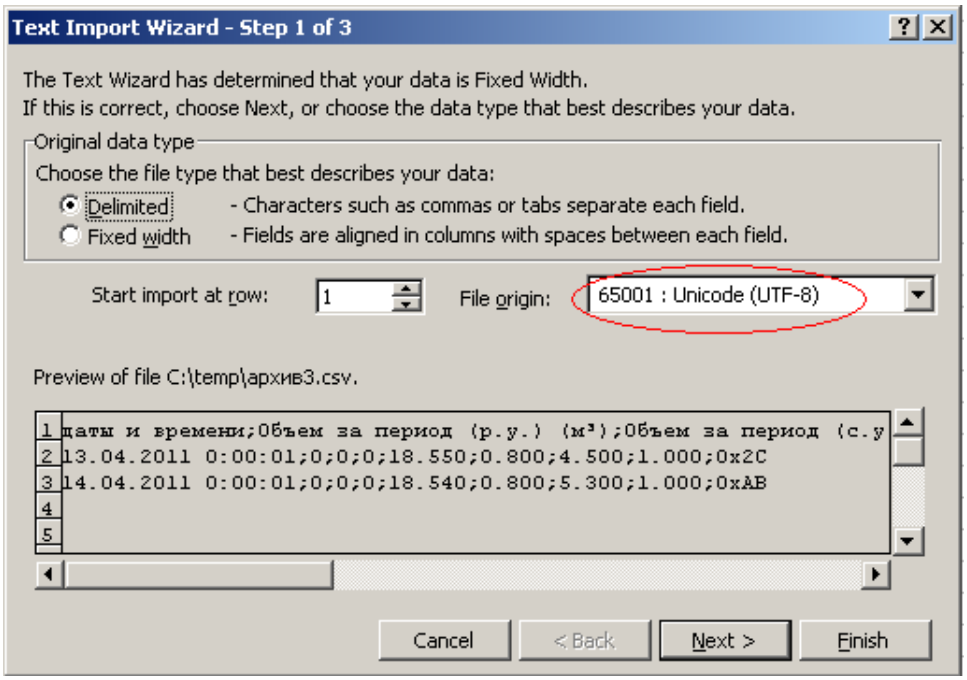
The retrieved data can be exported as ASCII CSV file. These data can then be used in other applications (e.g. MS Excel).
Click "Export data" to export the data and specify the file name and storage location.

4.3.13.2 Import of CSV files containing special characters into Excel

The correct import of special characters found in the header text of the csv report may require a change to the settings in Excel. To change the settings, perform the following steps in Excel:

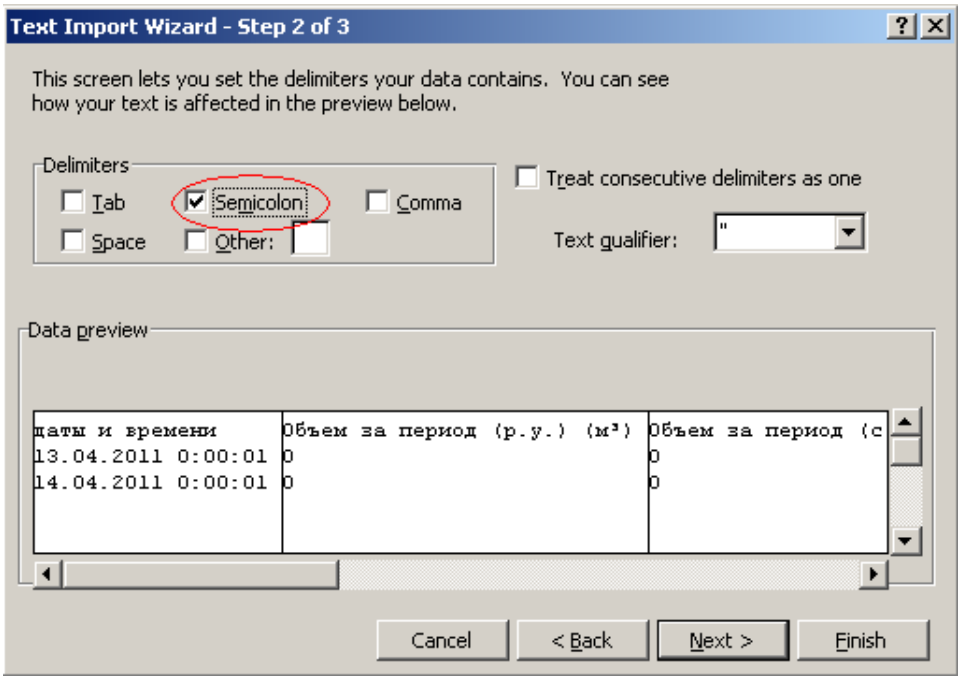
- Open a blank Excel worksheet
- Select Menu: Data/Import external data/Import data
- Navigate to the csv file to be imported, click "Open"
- Select "Delimited" as the original data type
- Select file origin "65001 : Unicode (UTF-8)", click "Next"

Fig. 137 CSV Import settings step 1 (example: Russian header text)



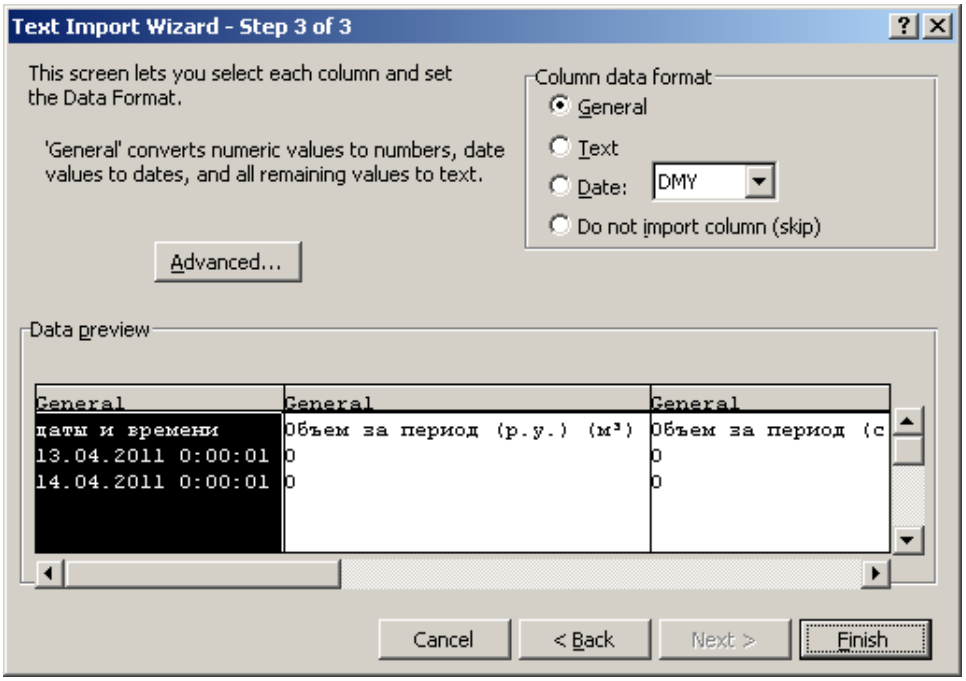
► Choose the option "Semicolon" as the delimiter, click "Next"

Fig. 138 CSV Import settings step 2



► Ensure settings are as shown in Fig. 139 and click "Finish"

Fig. 139 CSV Import settings step 3



The stored values can be exported in small or large format.
Content of file when exporting "Small Format":

- Date & Time
- Counted volume s.c. total [Nm^3]
- Counted mass total [kg]
- Gas temperature, average during last recording period [°C]
- Gas pressure, average during last recording period [bar]
- Molar mass [g/mol]
- AGC (Amplifier gain control), average during last recording period
- Performance, average during last recording period
- Meter status

Content of file when exporting "Large Format":

- Date & Time
- Counted volume a.c. total [m^3]
- Counted error volume a.c. total [m^3]
- Volume flow a.c., average during last recording period [m^3/h]
- Counted volume a.c., collected during last recording period [m^3]
- Counted volume s.c. total [Nm^3]
- Counted error volume s.c. total [Nm^3]
- Volume flow s.c., average during last recording period [Nm^3/h]
- Counted volume s.c., collected during last recording period [Nm^3]
- Counted mass total [kg]
- Counted error mass total [kg]
- Mass flow, average during last recording period [kg/h]
- Counted mass, collected during last recording period [kg]
- Gas temperature, average during last recording period [°C]
- Gas pressure, average during last recording period [bar]
- Molar mass [g/mol]
- Gas density a.c. [kg/m^3]
- AGC (Amplifier gain control), average during last recording period
- Performance, average during last recording period
- Meter status

4.3.14 **Entering process parameters**

Density and molar mass can be calculated using three different algorithms. Those algorithms always deliver molecular mass and density taking into account the measured temperature and pressure, however differ in their input values:

- Basic algorithm:
  Calculation of molar mass and density using the real gas law with a given compressibility. For precise results, precise knowledge of the input parameters is necessary.
- MR113-03:
  Calculation of molar mass and density from a given gas matrix. Most precise results, however limited to the parameterized gas matrix.
- Hydrocarbon algorithm:
  Calculation of molar mass and density using the speed of sound and a physical correlation between molecular mass of hydrocarbons and speed of sound. Needs no input parameters, however results are typically precise for hydrocarbon mixtures, only.

Fig. 140 Basic algorithm

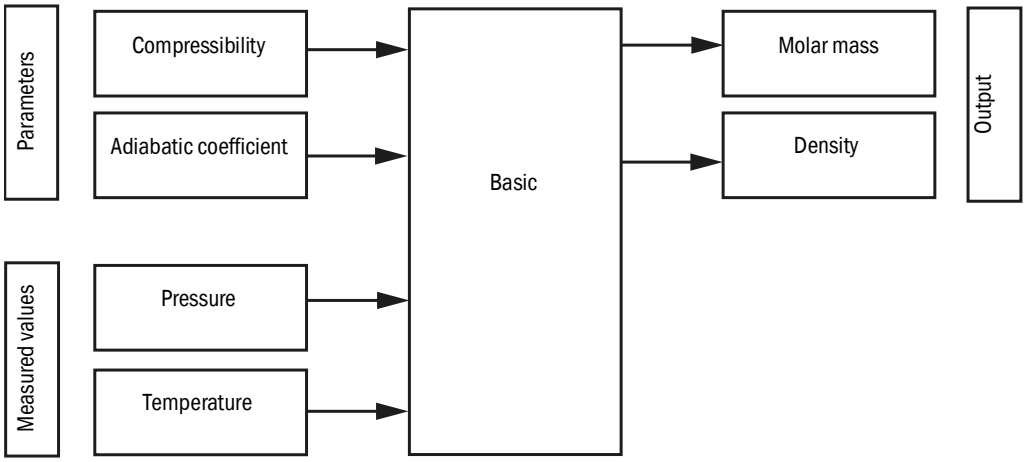


Fig. 141 MR113-03

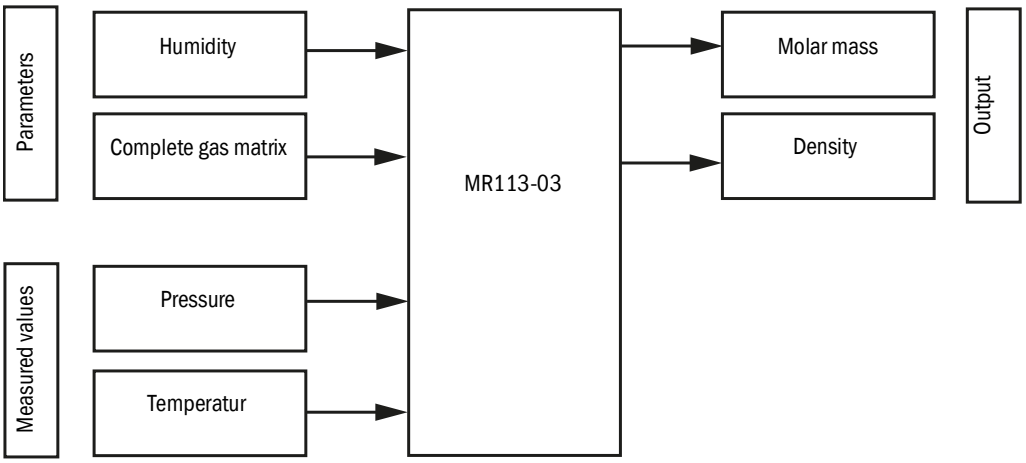
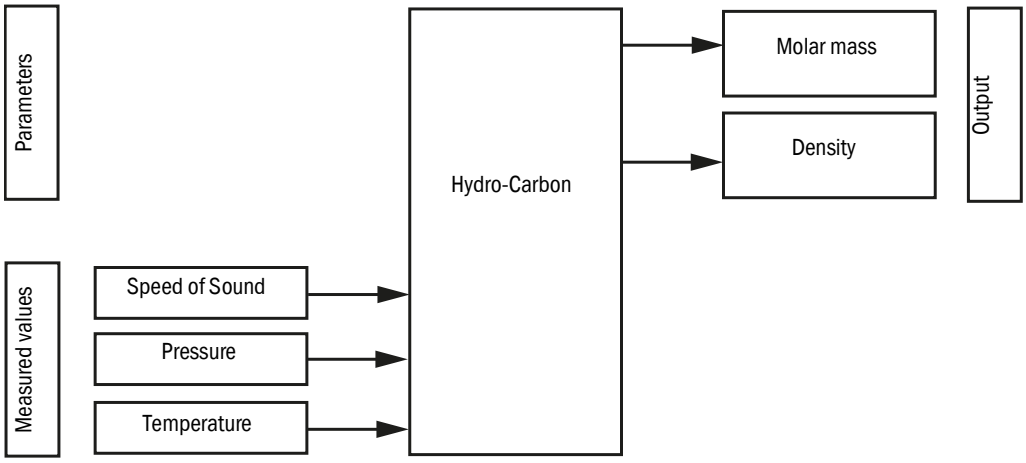


Fig. 142 Hydrocarbon algorithm



Further process parameters must be entered to calculate mass flow, molecular weight, gas density and Reynolds number.

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

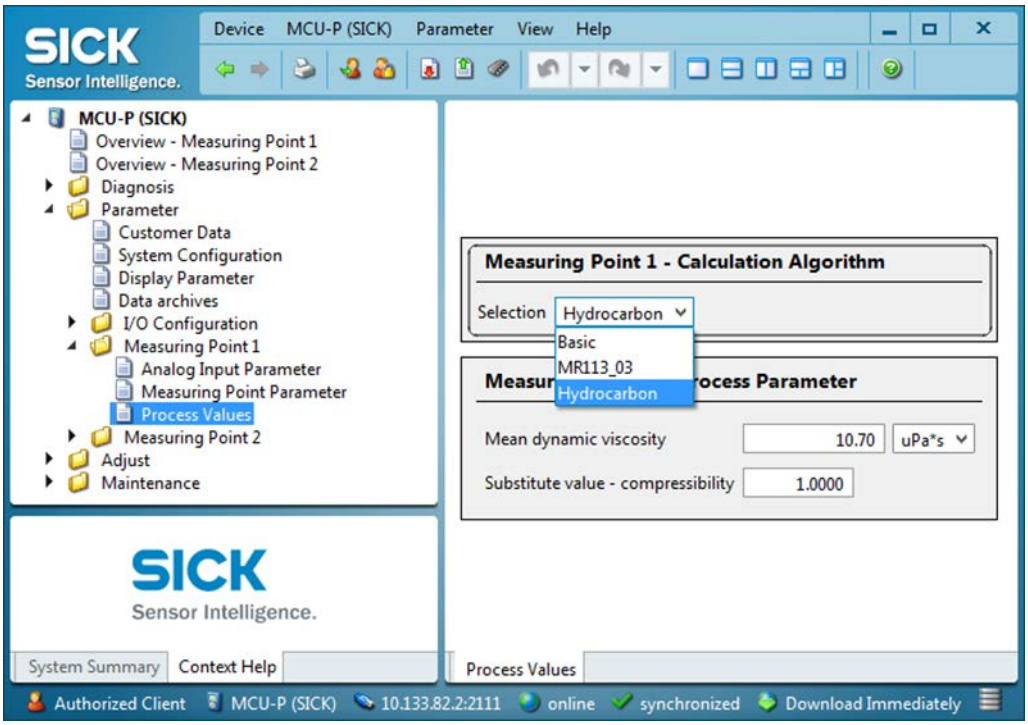
v = velocity of the sensor
D = inner pipe diameter
ρ = density of the medium
η = viscosity of the medium

NOTICE:
The correct evaluation of the Reynolds number is decisive to determine the correct calibration function, → pg. 70, § 2.3.1. To achieve the device accuracy provided by SICK, the Reynolds number has to be determined with a precision of 20 %.

Entering process parameters

- ► Select device file "MCU-P", enter the Level 1 password and set the measuring system to "Maintenance" mode (→ pg. 163, § 4.1.4).
- ► Select the "Parameter / Measuring Point 1(2/3) / Process Values" directory.
- ► Select the algorithm for measured value computation (→ pg. 71, § 2.3.2).
- ► If necessary, correct the constant values entered at the factory for the process parameters:
  - When using the basic algorithm:
    Viscosity, compressibility, adiabatic coefficient
  - When using the MR-113-03 algorithm:
    Gas composition values
  - When using the Hydrocarbon algorithm:
    Viscosity, compressibility

Fig. 143 "Parameter / Measuring Point 1 / Process Values" directory



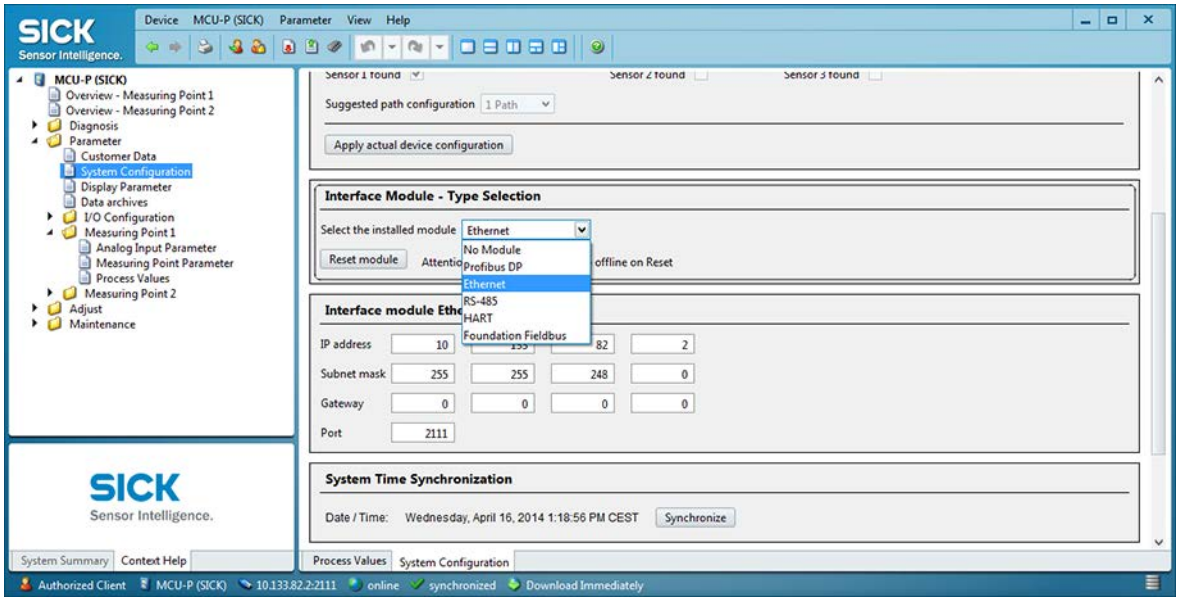
4.3.15 Setting Interface module parameters

4.3.15.1 General information

The following steps are necessary to select and set the optionally available Interface modules (→ pg. 60, § 2.2.4, Optional modules):

- ► Select device file "MCU-P", set the measuring system to "Maintenance" mode and enter the Level 1 password (→ pg. 163, § 4.1.4).
- ► Select the "Parameter / System Configuration“ directory.
  The Interface module installed is shown under "Interface Module - Type Selection".
- ► Configure the Interface module according to requirements.

Fig. 144 "Parameter / System Configuration" directory



> ***NOTICE:***
> Factory setting for counted flow direction is "positive flow".

GSD file and measured value assignment are available for the Profibus DP module on request.

4.3.15.2 Setting Ethernet module parameters

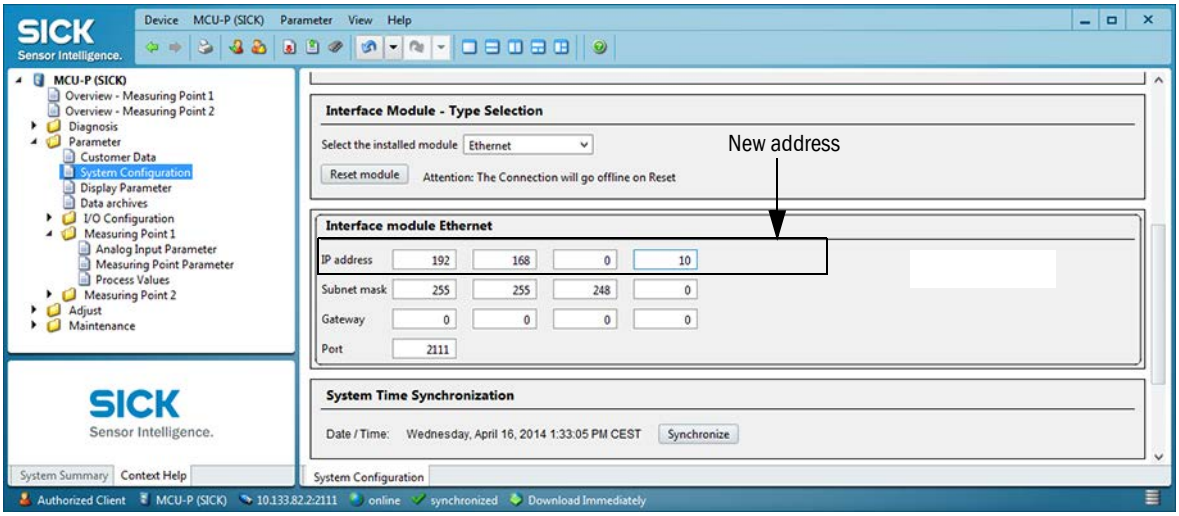
Assigning the Ethernet module a new IP address

An IP address specified by the customer is entered at the factory if the address is available when the device is ordered. If not, standard address 192.168.0.10 is entered.

The following steps are necessary to change the address:

- ► Set the desired network configuration in the "Parameter / System Configuration" directory, Field "Interface module Ethernet" field.
- ► Click "Reset module" in the "Interface Module - Type Selection".

Fig. 145 "Parameter / System Configuration" directory



- ► Assign the new IP address to SOPAS ET (→ pg. 157, § 4.1.3).

NOTICE:

Malfunctions in data transfers not caused by the measuring system can occur during communication via Ethernet.

- ► The FLOWSIC100 Flare manufacturer assumes no responsibility for malfunctions that may occur during equipment operation when measured value transfers and their usage to control processes run solely via Ethernet.

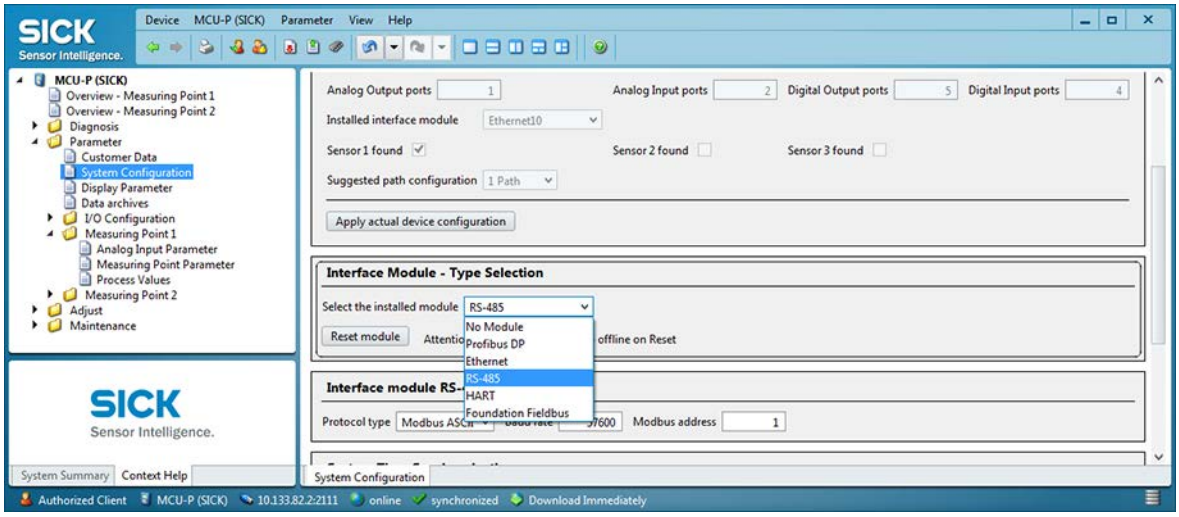
Increasing the value in the "Scantimeout" field to 3000 ms can minimize communication problems.

4.3.16 Setting Modbus and HART® bus module parameters

4.3.16.1 Modbus module

- ► Open the "Parameter / System Configuration" directory and select type "RS-485" in the "Select the installed module" menu (group "Interface Module - Type Selection").
- ► Set the protocol type and Modbus address in the "Interface module RS-485" field.

Fig. 146 "Parameter / System Configuration" directory

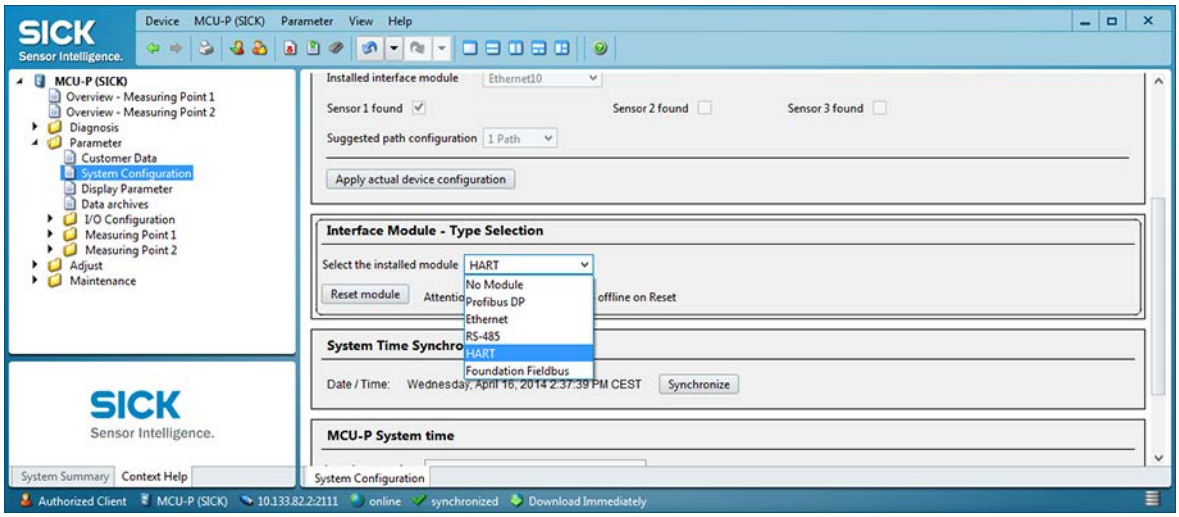


A detailed Modbus specification for parameter setting, read-out of measured values and data storage is contained on the product CD belonging to the scope of supply.

4.3.16.2 HART® bus module

- ► Open "Parameter / System Configuration" directory and select type "HART" in the "Select the installed module" menu (group "Interface Module - Type Selection").

Fig. 147 "Parameter / System Configuration" directory



For operation in HART® bus networks, the polling-address needs a higher value than 0. The modification of the addressing can only be realized via the HART® bus interface itself. Changes of the configuration by using the user software SOPAS ET are not supported.

The provided services, commands, telegrams and data types by this module are described in a separate specification.

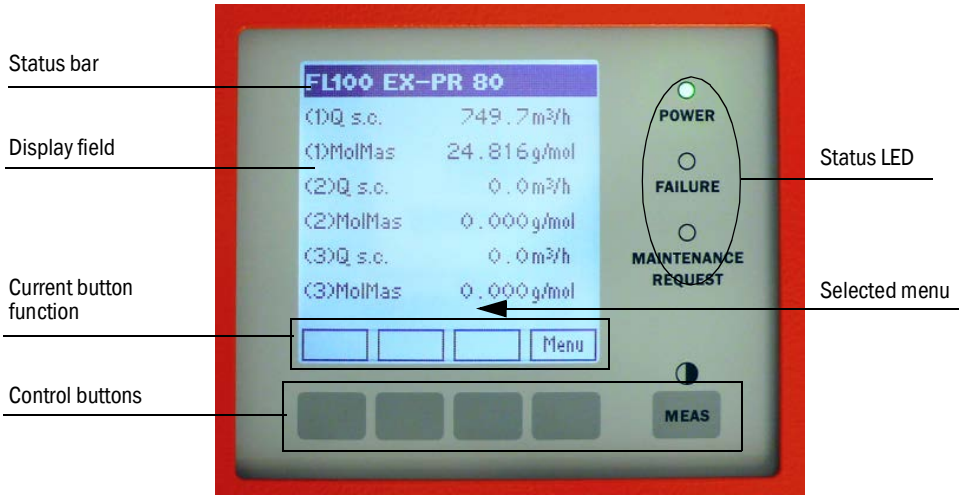
For detailed information, see „Interface Documentation FLOWSIC100 Flare“.

4.4 Operating/setting parameters via the optional LC-Display

4.4.1 General information on use

The display and operating interface of the LC-Display contains the functional elements shown in → Fig. 148.

Fig. 148 LC-Display functional elements



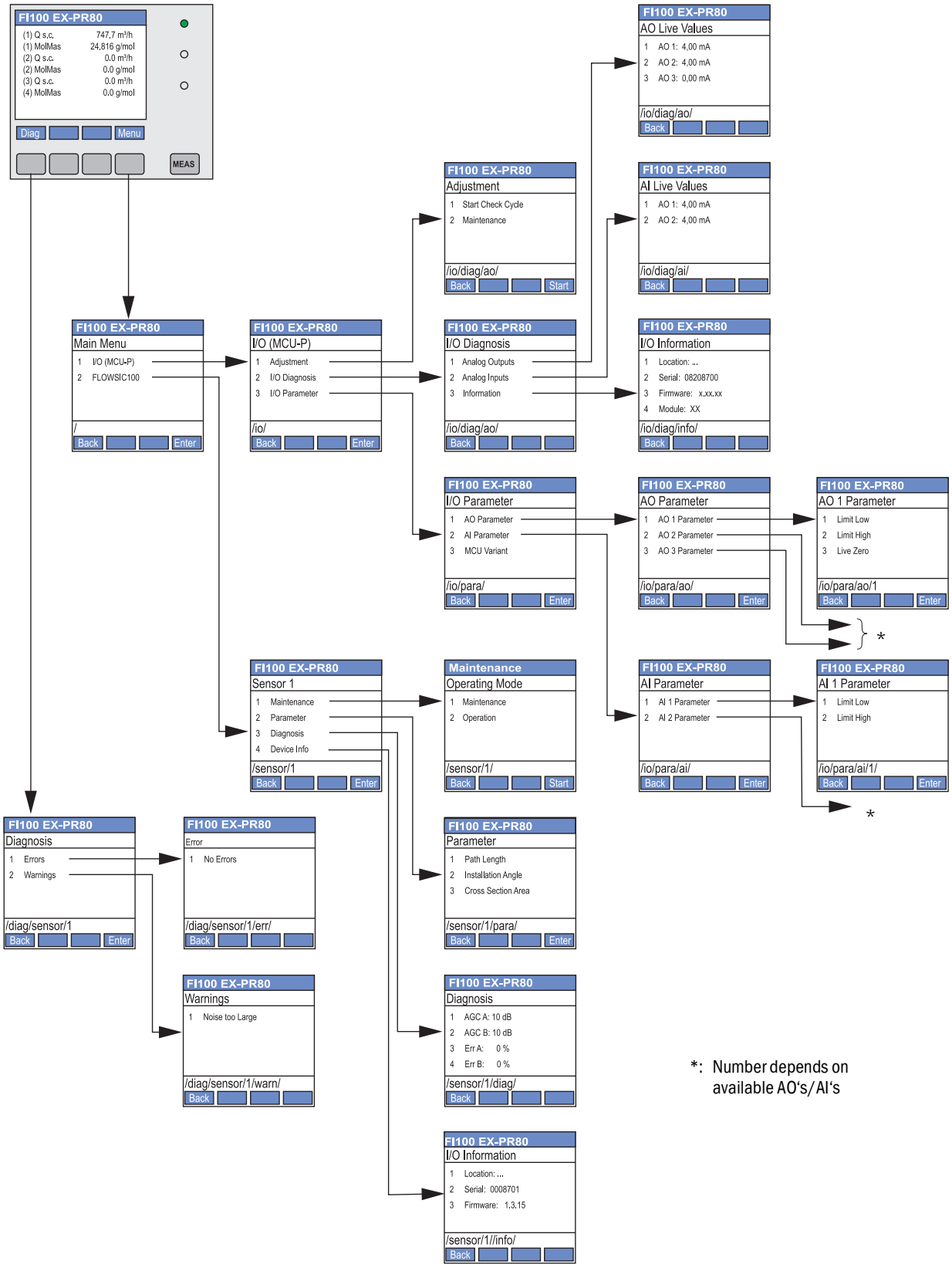
Button functions

The function shown depends on the menu currently selected. Only the function shown in the button is available.

Button	Function
Diag	Diagnostic information display (warnings and errors during a start using the Main menu, sensor information during a start using the Diagnostics menu → Fig. 149) This function is only active when warnings or malfunctions are present.
Back	Switch to higher level menu
Arrow ⇑	Scroll up
Arrow ⇓	Scroll down
Enter	Execution of the action selected with an arrow button (switch to a submenu, confirm parameter selected during parameter setting)
Start	Start an action
Save	Store a changed parameter
Meas	Toggle between test and graphic display Return from submenu to main menu Display the contrast setting (after 2.5 s)

4.4.2 Menu structure

Fig. 149 LC-Display menu structure

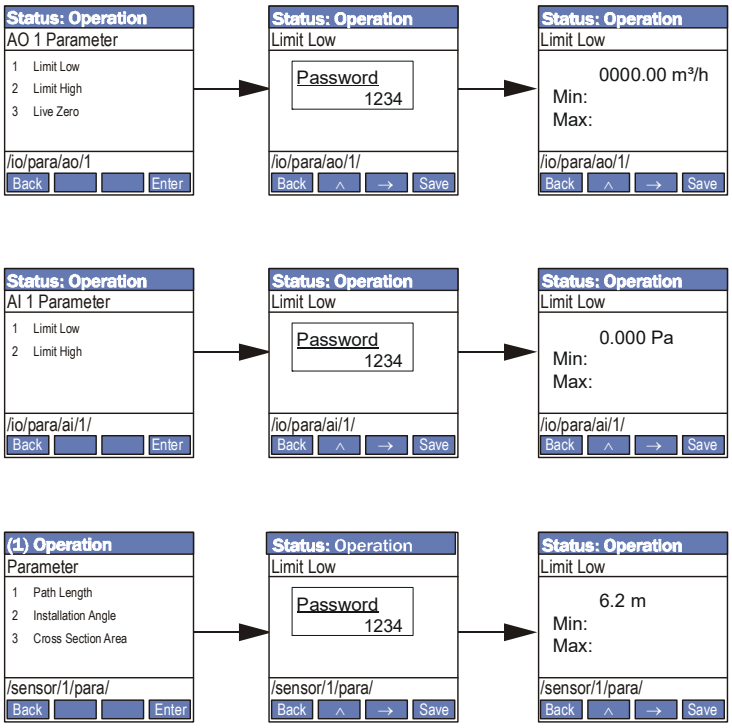


4.4.3 Parameter setting

Parameters for inputs/outputs (analog input, output) or device installation (measuring path, installation angle) can be modified as follows:

- ► Call the respective submenu, select the line "Limit Low" or "Limit High" and confirm with "Enter".
- ► The valid value range is shown in "Min" and "Max".
- ► Enter the default password "1234" using the "^" (scrolls from 0 to 9) and/or "→" (move the cursor right) buttons.
- ► Select the desired value for "Min" or "Max" using the "^" and/or "→" and confirm with "Save"
- ► The selected value is written to the device.

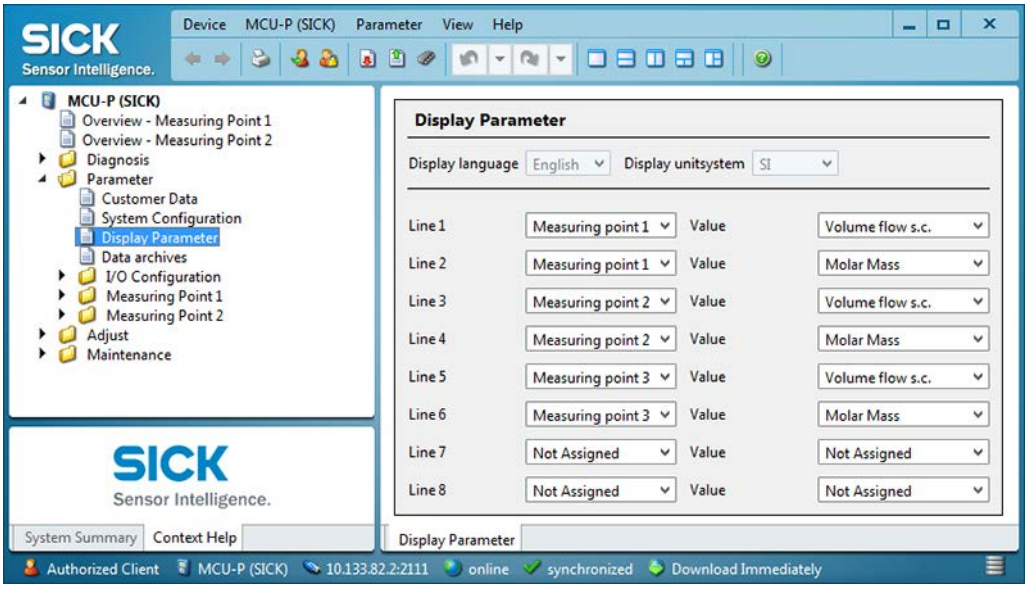
Fig. 150 Menu structure to set parameters



4.4.4 Using SOPAS ET to modify display settings

To modify factory settings, open the "MCU-P" device file, enter the Level 1 password and select the "Parameter / Display Parameter" menu.

Fig. 151 "Parameter / Display Parameter" menu



Entry field	Significance
Display language	Language version shown on the LC-Display
Display unit system	Unit of measurement system used in displays
Line 1 to 8	Assignment of measuring point to first and second measured value bar in the graphic display
Value	Assignment of measuring variable to the respective measured value bar

FLOWSIC100 Flare

5 Maintenance

General
Recognizing malfunctions
Maintaining the sender/receiver units
Maintaining the MCUP for use zone 2

5.1 General

Maintenance strategy

The FLOWSIC100 Flare requires scheduled maintenance just like every electronic measuring system. Regular checks and preventive consumable parts replacement can lengthen the service life considerably and have a decisive influence on measurement reliability.

Due to the measuring principle and system design, the FLOWSIC100 Flare only requires a low maintenance effort despite the customary rugged field usage.

Maintenance work

The work to be carried out is limited to cleaning the sender/receiver units.

Switch the FLOWSIC100 Flare to "Maintenance" mode before starting any maintenance work. This can be done using an external maintenance switch (connected to digital input 1), using the SOPAS ET operating and parameter program or via the LC-Display option (→ pg. 201, §4.4).

Switch back to "Operation" after completing maintenance work.

Maintenance intervals

The maintenance interval depends on specific application parameters such as mode of operation, gas composition, gas temperature and moisture as well as the ambient conditions. Typical values are approx. 6 months up to 1 year. Shorter maintenance intervals may be necessary under unfavorable conditions.

The plant operator must specify the specific work to be carried out and its performance in a Maintenance Manual.

Maintenance contract

Scheduled maintenance work can be carried out by the plant operator. Only qualified personnel according to Section 1 should be allowed to do the work. If desired, SICK Service or authorized Service support centers can carry out all maintenance work. Any repairs will be made by specialists on-site whenever possible.

5.2 Recognizing malfunctions

Every deviation from normal operation is to be regarded as a serious indication of a functional impairment. These are, amongst others:

- Warning displays (e.g. heavy contamination)
- Large drifts in measured results
- Increased power input
- Higher temperatures of system parts
- Monitoring device triggering
- Smells or smoke emission
- Failure of a measuring path

NOTICE:

Proceed as follows when a measuring path fails:

- ► Pull back the sender/receiver units and disconnect them from the process by closing the ball valve.
- ► Inform SICK Customer Service.

5.3 Maintaining the sender/receiver units

The sender/receiver units must be cleaned in regular intervals and checked for corrosion and damage. To do this, the sender/receiver units must be dismounted from the nozzles.

WARNING:

- ► Observe the relevant safety regulations as well as the safety notices in Section 1 during all installation work (→ pg. 10, § 1.1 et seq.).
- ► Take suitable protection measures against possible hazards.
- ► Carry out maintenance work only when hot parts have cooled sufficiently.

Required tools and auxiliary means:

- Key for Allen screws SW 5
- Jaw wrench SW 24
- Screw driver
- Possibly blind plug for nozzle for non-retractable version
- Brush, cleaning cloth and cleaning alcohol

5.3.1 Removing sender/receiver units

Non-retractable sender/receiver units

WARNING:

- ► At plants with increased hazard potential (toxic, aggressive, explosive gases, health endangering, higher pressure and temperatures), remove the sender/receiver unit only when the plant is out of operation.

An amount of gas escapes uncontrolled into the environment during disassembly of the sender/receiver unit from nozzle.

- ► Take special precautions in the presence of toxic, aggressive, explosive, hot, or other gases posing a health risk (risk of serious injuries)!

- ► Loosen the screws on the flange of the sender/receiver unit.
- ► Carefully pull out the sender/receiver unit and place it in a suitable location.
- ► Close the nozzle with a blind plug (optionally available).

Retractable sender/receiver units

WARNING:

- ► Observe the maximum permitted pressure for operating the retraction mechanism on retractable sender/receiver units:
  - Device types FLSE100-EXS and EXRE: 16 bar at 50 °C (→ pg. 43, Fig. 11)
  - Device type FLSE100-EXPR: 0.5 bar at whole temperature range
- ► Close the ball valve after removing the sender/receiver unit with a blind flange.
- ► Take special precautions in the presence of toxic, aggressive, explosive, hot, or other gases posing a health risk (risk of serious injuries)!

In principle, the single steps described in § 3.6.2 are carried out in the reverse sequence (→ pg. 116, Fig. 61).

- ► Loosen fastening nuts (7) and take cotter pins (7) out of guide rods (8).
- ► Hold the sender/receiver unit tight and pull it back slowly to stop.
- ► Close the 2" (FLSE100-EXS and EXRE) or 3" (FLSE100-EXPR) ball valve (5).

  A small amount of gas remains in the retractable nozzle and can escape uncontrolled into the environment during disassembly of the sender/receiver unit from the ball valve.

Controlled venting is possible when using retractable sender/receiver units with the vent device option (ball valve). To do so, connect the ball valve with a suitable hose that ends away from the measuring point.

WARNING:

- ► Take special precautions at toxic, aggressive, explosive, health endangering and/or hot gases (risk or serious injuries) when using retractable sender/receiver units without the vent device option.

- ► Screw fastening nuts (9) on and insert the cotter pins in the guide rods.
- ► Loosen fastening screws (3) and take the sender/receiver unit with seal (6) off the ball valve 2" (or 3").
- ► Fit blind flange (2) and seal on the ball valve 2" (or 3") with fastening screws (1).

The delivered seal may only be used once. Replace it with a new one after every disassembly/assembly.

5.3.2 Cleaning the sender/receiver unit

Clean the outside of the sender/receiver unit after it has been removed. Inspect the duct probe and transducers for signs of corrosion and replace them if necessary. Dust deposits and caked dust can generally be removed without disassembling the transducer.

WARNING:

The transducer must be cleaned with extreme care. Do not damage the transducer diaphragm!

Depending on the conditions at the installation site, the duct probe and transducers may initially require maintenance more frequently (approx. every 2 weeks or less if necessary). If contamination is limited, the cleaning intervals can be gradually extended to a maximum of 6 months.

Reinstall the sender/receiver unit after completion of the work.

The work required to replace parts (duct probe, transducers) is listed in the FLOWSIC100 Flare Service Manual.

5.4 Maintaining the MCUP for use zone 2

CAUTION: Danger through power voltage

► Disconnect the device from the power supply before opening!

Carry out visual and functional checks of the device at regular intervals. We recommend to start with short intervals and to prolong these depending on the degree of stress and the examination results.

The individual device components must be checked, in particular the processor board with relays, display, interface modules, input and output modules as well as the seals. Signs of increased stress can be, for example:

- Discoloration
- Deformation
- Perforation
- Malfunction
- Other noticeable changes

If characteristics have deteriorated, these parts must be replaced. To prevent repeated deterioration, the user must determine the cause and take appropriate precautions before restarting the device.

FLOWSIC100 Flare

6 Specifications

Technical Data
Applications of FLOWSIC100 Flare in regulated environment
Application ranges
Dimensions and Part Numbers
Options for MCUP control unit
Password
Sealing installation instruction
Connection diagrams for MCUP Ex zone 1 - configuration examples with optional modules
Wiring diagrams for USA and Canada

6.1 Technical Data

NOTICE:

The exact device specifications and performance data of the product may deviate from the information provided here, and depend on the application in which the product is being used and the relevant customer specifications.

The measuring parameters described in the application evaluation sheet exclusively apply. If the delivery documentation of your FLOWSIC100 Flare does not include an Application Evaluation Datasheet, contact your SICK partner!

Example of an Application Evaluation Datasheet: → p. 216, Fig. 152

Version	EX-S	EX/EX-RE	EX-PR
Measuring parameters			
Measured values	Mass flow, volumetric flow s. c. (standard condition), volumetric flow a. c. (actual condition), molecular weight, gas volume and mass, gas velocity, gas temperature, sound velocity		
Measuring principle	Ultrasonic transit time difference measurement, ASC-technology (active sound correlation)		
Measuring medium	Typical flare gas		
Measuring ranges [1]	0.03 m/s ... 120 m/s		
Measuring span [1]	Up to 4000:1		
Repeatability	(acc. to ISO 5725-1; JCGM 200:2012): < 0.5% of the measured value in the range ≥ 1 m/s		
Resolution	(acc. to JCGM 200:2012): + 0.001 m/s		
Uncertainty of measurement [1, 2, 3]	Volumetric flow a. c.: 1% ... 5% Related to the measured value (in the range ≥ 0.3 m/s to measuring range end value) 0.5% ... 1.5% with spool piece and flow calibration Related to the measured value (in the range ≥ 1 m/s to calibration range end value) [4]		
	Mass flow rate a. c.: 2% ... 5.5% Related to the measured value (in the range ≥ 0.3 m/s to measuring range end value) 1.5% ... 2% with spool piece and flow calibration Related to the measured value (in the range ≥ 1 m/s to calibration range end value) [4]		
Uncertainty of measurement ASC technology [1, 5]	Volumetric flow a. c.: 1% ... 8%		
Internal pipe diameter [6]	4" to 24"	8” to 72” [7]	12” to 72”
Measuring conditions			
Gas temperature [8]	● Standard range -70 ... +180°C (-95 ... 356 °F) ● High-temperature range Zone 1: -70 ... +280°C (-95 ... 535 °F) Zone 2: -70 ... +260°C (-95 ... 500 °F) ● Low-temperature range [9] -196 ... +100°C (-325 ... 210 °F)		
Pressure range	- 0.5 ... 16 barg 0.5 barg for use of retraction mechanism with retractable version of FLOWSIC100 EX-PR		
Ambient conditions			
Temperature range	● Sender/receiver units [10] - 40 ... +70°C (- 40 ... 158 °F); option: - 50 ... +70°C (- 58 ... 158 °F) ● Control unit MCUP [11] -40 ... +60°C (- 40 ... 140 °F) ;- 20 ... +50 °C (- 4 °F ... 122 °F) for 19” rack		
Storage temperature	● Sender/receiver units -40 ... +70°C (-40 ... 158 °F); option: -50 ... +70°C (-58 ... 158 °F) ● MCUP [11]: -40 ... +70°C (-40 ... 158 °F)		
Relative humidity	<95% (take suitable corrosion protection measures for black steel nozzles)		

Ex approvals						
Sender/receiver unit, Zone 1	● ATEX II 1/2 G Ex d [ia Ga] IIC T4 Ga/Gb ● ATEX II 1/2 G Ex d e [ia Ga] IIC T4 Ga/Gb ● IECEx Ga/Gb Ex d [ia] IIC T4 ● CSA Cl I, Div1 Group B, C, D ● CSA Cl I, Div2 Group A, B, C, D ● CSA Cl I, Zone 1/Zone 2 IIC T4 Option: ● Temperature code T6 ● Zone 0 for ultrasonic transducer		● ATEX II 2 G Ex d IIC T4 Gb ● ATEX II 2 G Ex d e IIC T4 Gb ● IECEx Ex d IIC T4 ● CSA Cl I, Div1 Group B, C, D ● CSA Cl I, Div2 Group A, B, C, D ● CSA Cl I, Zone 1/Zone 2 IIC T4 Option: ● Temperature code T6		● ATEX II 1/2 G Ex d [ia Ga] IIC T4 Ga/Gb ● ATEX II 1/2 G Ex d e [ia Ga] IIC T4 Ga/Gb ● IECEx Ga/Gb Ex d [ia] IIC T4 ● CSA Cl I, Div1 Group B, C, D ● CSA Cl I, Div2 Group A, B, C, D ● CSA Cl I, Zone 1/Zone 2 IIC T4 Option: ● Temperature code T6 ● Zone 0 for ultrasonic transducer	
Sender/receiver unit, Zone 2	● ATEX II 3 G Ex nA IIC T4 Gc					
MCUP control unit , CSA	CSA Cl I, Div 1, groups A, B, C, D; T6; 4X/IP66, enclosure type 4 [11] CSA Cl I, Div 2, groups A, B, C, D; T4; 4X/IP66, enclosure type 4 [11]					
MCUP control unit, Zone 1	ATEX II 2 G Ex d e IIC T6					
MCUP control unit, Zone 2	ATEX II 3 G Ex nA IIC T4 Gc					
Housing version, degree of protection						
Sender/receiver units	● for use in Zone 1: Flameproof enclosure made of aluminum or stainless steel (option), IP 65/67 [12] ● for use in Zone 2: Housing made of aluminum, IP 65					
	● CSA: Enclosure type 4, IP65		● CSA: Enclosure type 6, IP 65/67 'single seal'		● CSA: Enclosure type 4, IP 65	
MCUP	● for use in Zone 1: Flameproof enclosure of aluminum, IP 66 ● for use in Zone 2, Div2: Wall housing made of steel, IP 66, enclosure type 4 (optional 4X) ● for use in Div 1: Flameproof enclosure of aluminum, IP 66, enclosure type 4 (optional 4X), ● for use in safe area: Wall housing made of steel, IP 66 and 19” rack of aluminum, IP 20					●
Inputs, outputs, controls via MCUP control unit						
Analog output	1 output active: 0/2/4 ... 22 mA, max. load 500 Ω, acc. to NAMUR NE43					
Analog inputs	2 inputs: 0 ... 5/10 V or 0 ... 20 mA					
Digital outputs	Pulse/frequency output (optional modules); 5 outputs: 48 V DC/1A, 30 V DC/1A (MCUP Zone 2); floating status signals: Operation/malfunction, maintenance, check cycle, limit value, maintenance request					
Digital inputs	2 inputs for connection of floating contacts [13]					
Communication interfaces						
USB 1.1, RS232 (on terminals)	For measured value inquiries, configuration and software update via PC/laptop with operating program					
RS485	For connection of sender/receiver units					
Interface modules	Pulse, Ethernet + pulse, Ethernet Triplex + pulse, MODBUS TCP + pulse, MODBUS RS485 + pulse, HARTBUS AO + pulse, PROFIBUS RS485 + pulse, Foundation Fieldbus + pulse					
Power supply						
	MCUP non-EX version		MCUP ATEX Zone 2; CSA Cl I, Div 2		ATEX Zone 1; CSA Cl I, Div 1	
	AC Version	DC Version	AC Version	DC Version	AC Version	DC Version
Operating voltage	90...250 VAC	22 ... 28.5 VDC	115/230 VAC	22 ... 28.5 VDC	100 ... 240 VAC	22 ... 28.5 VDC
Frequency	50/60 Hz		50/60 Hz		50/60 Hz	
Current			1 A	2 A	1 A	2 A
Power input	30 W	25 W	30 W	25 W	30 W	25 W
Fuse protection[14]	Fuse T2A, slow-blow, sand-filled	Fuse T4A, slow-blow, sand-filled	See note in the device or on the device label			

Weights		
Sender/receiver units	Depending on the version, max. approx. 35 kg	
MCUP	● Zone 1 housing size 4: ● Zone 1 housing size 6: ● Zone 1 housing stainless steel: ● Zone 2 and version without explosion protection: ● 19" rack: ● CSA Cl I, Div 1 housing size 4: ● CSA Cl I, Div 1 housing size 6:	Approx. 14 kg Approx. 18 kg Approx. 70 kg Approx. 5 kg Approx. 6 kg Approx. 12 kg Approx. 16 kg
Nozzle	ANSI Cl150 2" CS: Approx. 3.5 kg	ANSI CL150 3" CS: Approx. 8 kg
Ball valve	ANSI CL150 2": Approx. 6.1 kg	ANSI CL150 3": Approx. 12 kg

1 Depending on application conditions, such as gas composition, process temperature, device type, pipe diameter, etc. To be evaluated by SICK.

2 For ultrasonic transit time difference measurement with fully developed turbulent flow profile

3 The exemplary uncertainty statement acc. to GUM (Guide to the Expression of Uncertainty in Measurement): ISO/IEC Guide 98-3:2008-09 assumes a gas temperature of 20 °C, ambient pressure, a typical molecular weight greater than 27 g/mol and a pipe diameter greater than 8".

Below a specific threshold Reynolds number, the Application Evaluation Datasheet only considers run time effects and uncertainties of geometry

Threshold Reynolds number is determined using $Re_{Thres} = VOG_{Thres} * D * 60000$

D here denotes the inside diameter of the spool piece in meters. VOG_{Thres} is a parameterizable value. The default value is 0.25 m/s. The constant 60000 comes from the density and the dynamic viscosity, which were used in the calculation of the linearization coefficients.

4 Depending on the capabilities of the selected flow lab.

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

6 Maximum pipe diameter dependent on the gas composition

7 Preferred operating range for nominal pipe diameter ≥ 24", smaller diameters at difficult gas compositions with sound-absorbing components

8 Operating temperature range of ball valve:

Standard range -50 ... +200°C

High-temperature range -50 ... +350°C

Low-temperature range -196 ... +100°C

9 On request; for use in Zone 1 only FLOWSIC100 EX-S and FLOWSIC100 EX-PR

10 Sender/receiver units with Ex group IIC T6: - 40 ... +55 °C (- 40 ... 131 °F); option: - 50 ... +55 °C (- 58 ... 131 °F);

IIC T6 not for gas temperature > 80°C

11 For some device configurations the temperature range is reduced. The permitted temperature range is indicated on the device label.

MCUP Zone 1, aluminum housing:

-40 ... +55 °C (-40 ... +131 °F) - ATEX / IECEx

-55 ... +55°C (-67 ... +131°F) for 24V DC - ATEX / IECEx on request

MCUP Zone 1, stainless steel housing:

-20 ... +40 °C (-4 ... +104 °F) - ATEX

-20 ... +40 °C (-4 ... +104 °F) - IECEx

-20 ... +55 °C (-4 ... +131 °F) - ATEX on request

MCUP Zone 2/Div 2 (24 V version)

-40 ... +60°C (-40 ... +140 °F) - group A, B, C, D T4

MCUP Zone 2/DIV 2 (115 V/230 V version)

-25°C...60°C (-13...+140°F) - group A,B,C, D T4"

MCUP Div 1,

-25 ... +50°C (-13 ... +122 °F) - group A, B, C, D

-50 ... +50°C (-58 ... +122 °F) - group C, D

12 IP67 for sender/receiver units without junction box only

13 Additional inputs/outputs when using optional modules

14 Replacement fuses T 2 A are included in delivery. Explosion-protected control units contain a separate note concerning the fuse type on the device label.

Fig. 152 Application Evaluation Datasheet (example)

FLARE Gas Application Evaluation Datasheet

FLOWSIC100 Flare / FLOWSIC100 Flare-XT

SICK Sensor Intelligence.

General Information

Project Name	Testprojekt
Reference (CRM/ZTA)	12345
TAG No.	654
Device Type	EX-S 135 kHz
Path Configuration	1-path
Nominal pipe size in "	12
Type of installation	Hot Tapped

Process data

	☑ min	☐ norm	☐ max
pressure in bar(a)	1		
Temperature in K	300		
Speed of sound in m/s	400		

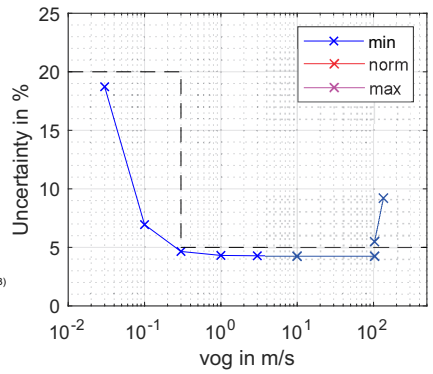
Ex-zone: Zone 2

Specified uncertainty by customer ☑: 20 % up to 0.3 m/s; 5 % above

Results

Molecular weigth in g/mol	21.82		
Max. velocity in m/s	100.96		
Max. flow rate in m³/h	26520		
Max. velocity ASC in m/s	131.25		
Max. flow rate ASC in m³/h	34476		

vog in m/s	Flow rate in m³/h	Measurement Uncertainty of Flow [1] in %		
0.03	7.9	18.72		
0.10	26.3	6.94		
0.30	78.8	4.65		
1.00	262.7	4.31		
3.00	788.0	4.28		
10.00	2626.8	4.28		
v_max	Q_max	4.26		
		5.49		
v_max,AS	Q_max,AS	9.14 [2), 3)]	[2), 3)]	[2), 3)]



[1] for fully developed flow profiles; based on
[2] extended measurement range based on Active Sound Correlation technology
[3] in the range of 100-130% of last ultrasonic

6.2 Applications of FLOWSIC100 Flare in regulated environment

The gas flow measuring instrument can be applied in emission measurements which may be subject to one or more regulations in some jurisdictions. Compliance to all emissions regulations applicable at the installation site remains owner / operator responsibility.

If designed and applied correctly SICK‘s ultrasonic flow technology will meet or exceed most performance requirements set forth by any regulatory authority. Please contact your SICK representative to inquire about the correct flare measurement solution which will meet the currently applicable requirements set forth by the authorities.

6.3 Application ranges

Fig. 153 V_{max} of 1-path and 2-path solutions dependent on Speed of Sound (SOS)

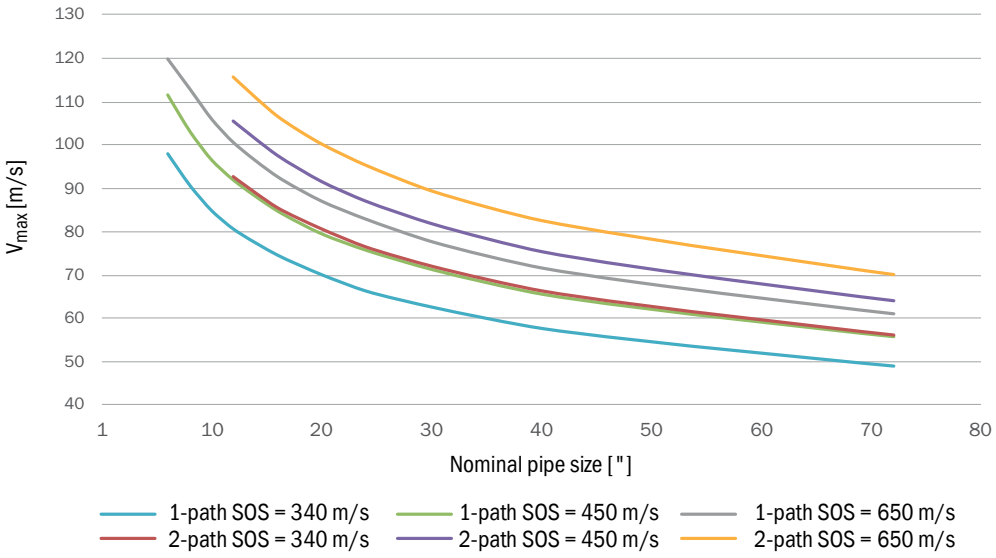
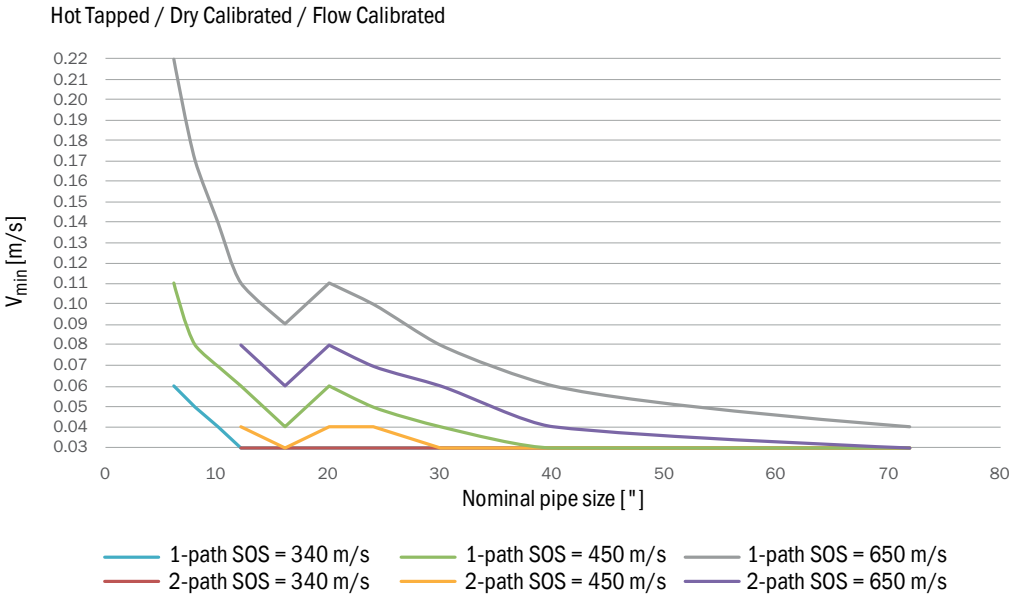
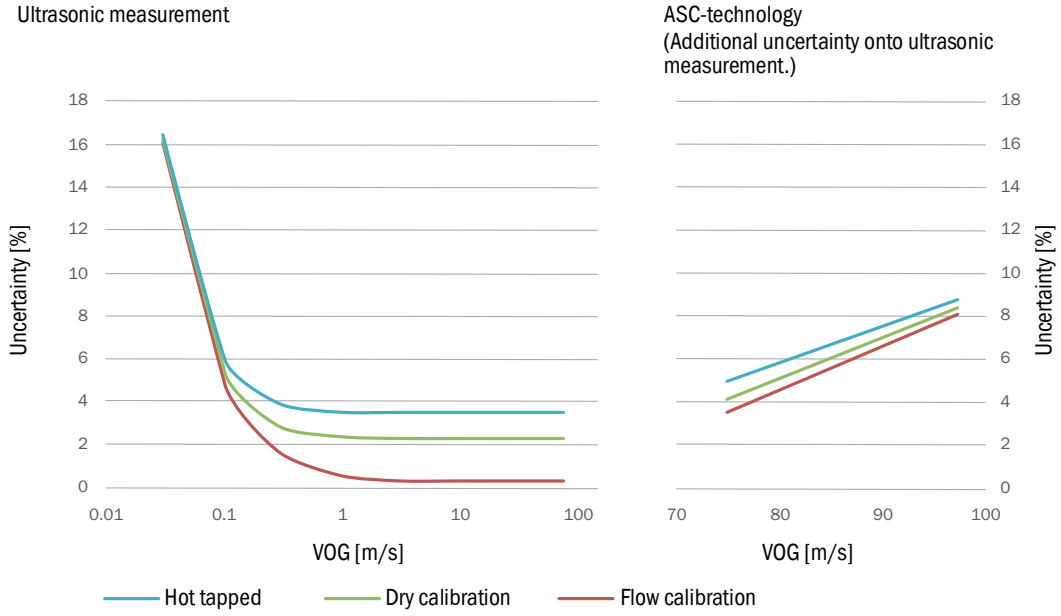


Fig. 154 V_{min} at 20% uncertainty of 1-path and 2-path solutions dependent on Speed of Sound



V_{min} exemplary – 4" ... 16": E X-S with transducers for standard temperature range, 20" ... 72": EX- RE

Fig. 155 Uncertainty of volume flow as a function of velocity of gas (VOG)



This exemplary uncertainty statement according to GUM (Guide to the Expression of Uncertainty in Measurement): ISO/IEC Guide 98-3:2008-09 shows a EX-S 80 in 1-path, 16" nominal pipe size configuration and assumes a gas temperature of 20 °C, ambient pressure, a typical molecular weight of greater than 27 g/mol.

6.4 Dimensions and Part Numbers

The devices of the FLOWSIC100 Flare measuring system adhere at least the limits of the EMC guideline class A . The requirements on the disturbing radiation in residential areas weren't taken into account in the approval.

All measurements specified are in millimeters.

6.4.1 FLOWSIC100 EX-S sender/receiver units[1]

Sender/receiver units FLSE100-EXS according to ATEX for Ex Zone 2 only, non-retractable[2]

Fig. 156 Sender/receiver unit FLSE100-EXS Master

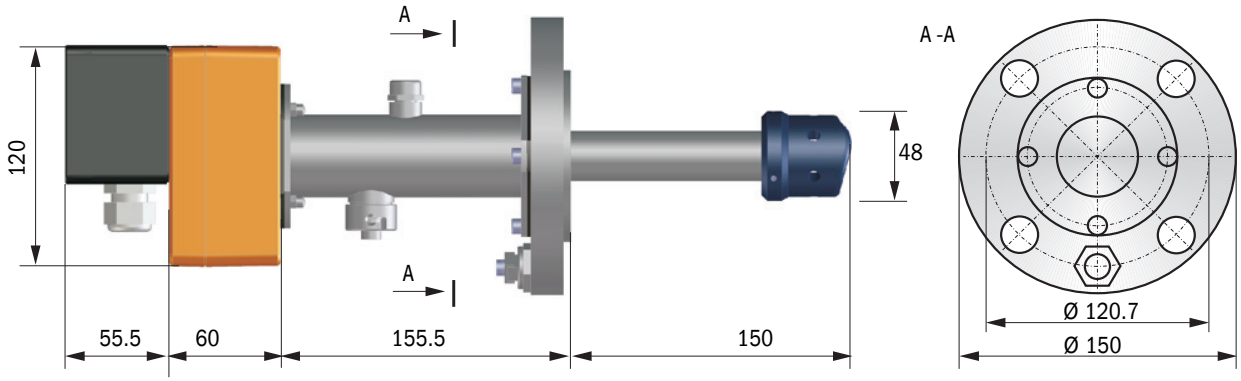
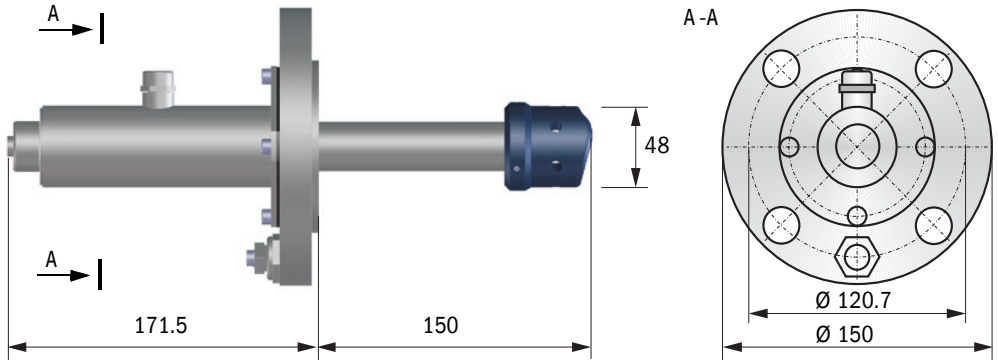


Fig. 157 Sender/receiver unit FLSE100-EXS Slave



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

Sender/receiver units FLSE100-EXS according to ATEX for Ex zone 1/zone 2, non-retractable[1, 2]

Fig. 158 Sender/receiver unit FLSE100-EXS Master

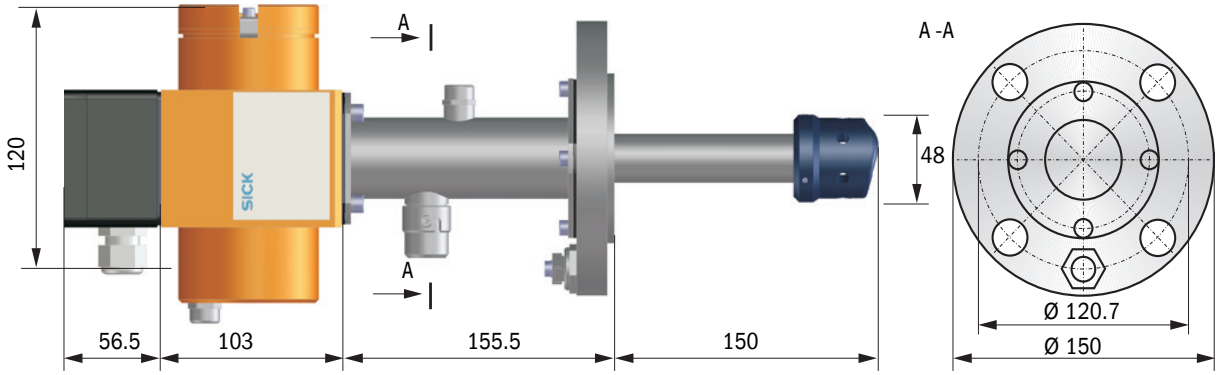
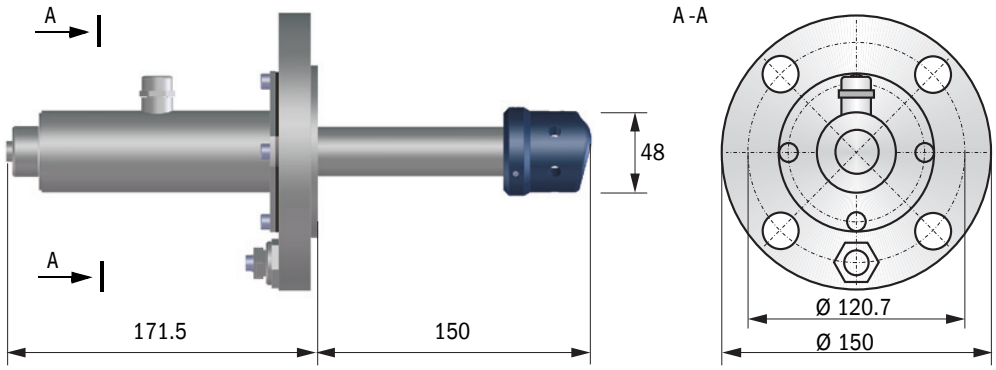


Fig. 159 Sender/receiver unit FLSE100-EXS Slave



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

Sender/receiver units FLSE100-EXS according to ATEX for Ex Zone 1/zone 2, IECEx zone 1 **and according to CSA for Cl** I**, Div.1/Div.2, non-retractable**[1, 2]

Fig. 160 Sender/receiver unit FLSE100-EXS Master

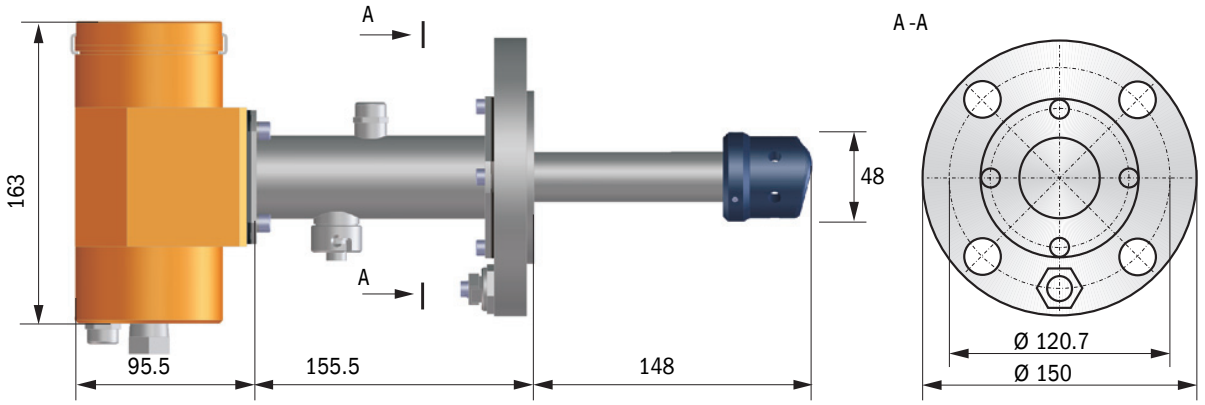
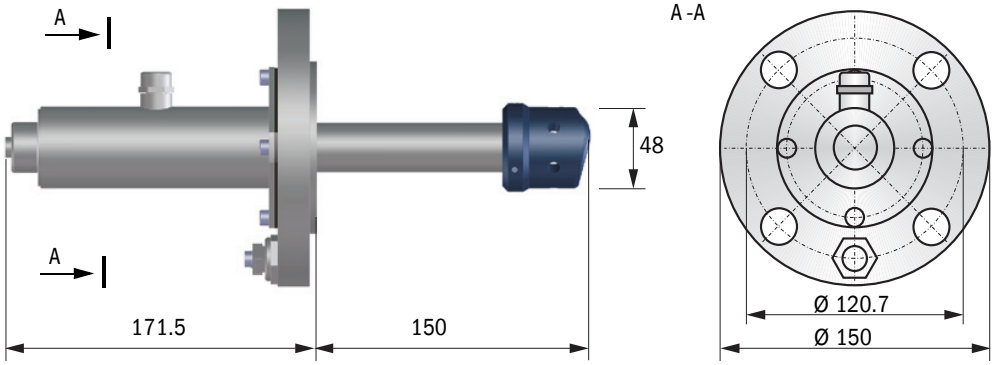


Fig. 161 Sender/receiver unit FLSE100-EXS Slave



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

Sender/receiver units FLSE100-EXS according to ATEX for Ex zone 2 only , retractable[1, 2]

Fig. 162 Sender/receiver unit FLSE100-EXS Master

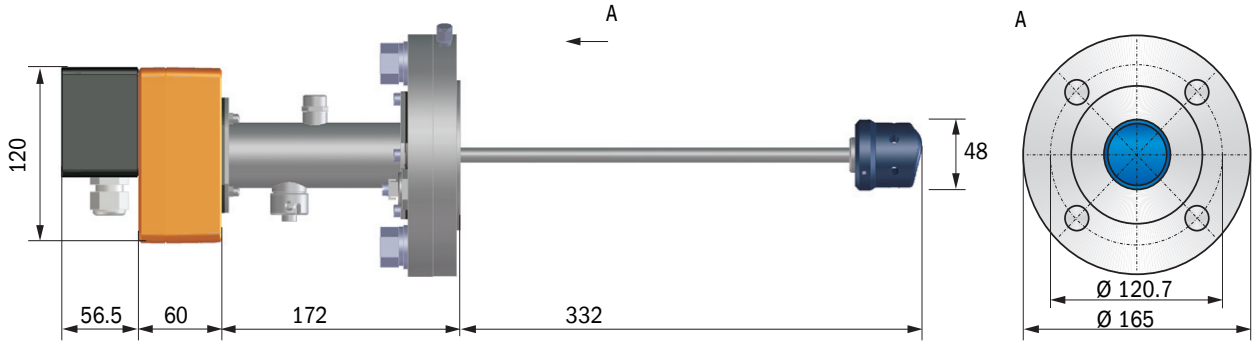
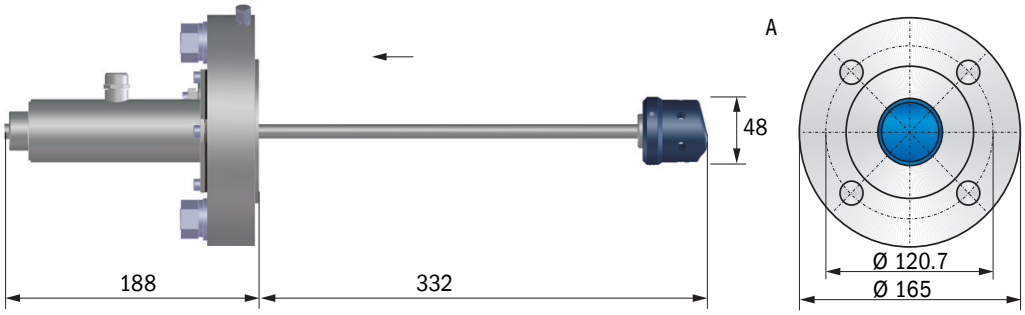


Fig. 163 Sender/receiver unit FLSE100-EXS Slave



> ***NOTICE:***
> High temperature version has different design of retraction flange with longer total lengths of +111mm.

1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

Sender/receiver units FLSE100-EXS according to ATEX for Ex zone 1/ zone 2, retractable[1, 2]

Fig. 164 Sender/receiver unit FLSE100-EXS Master

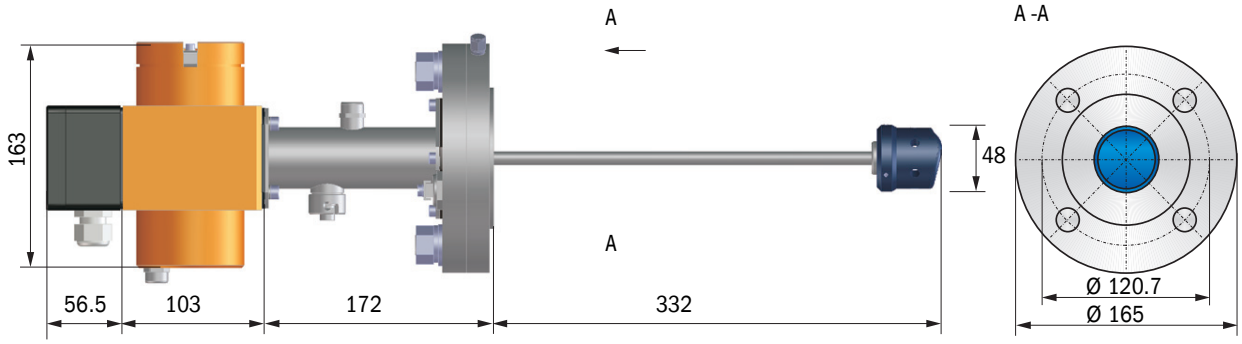
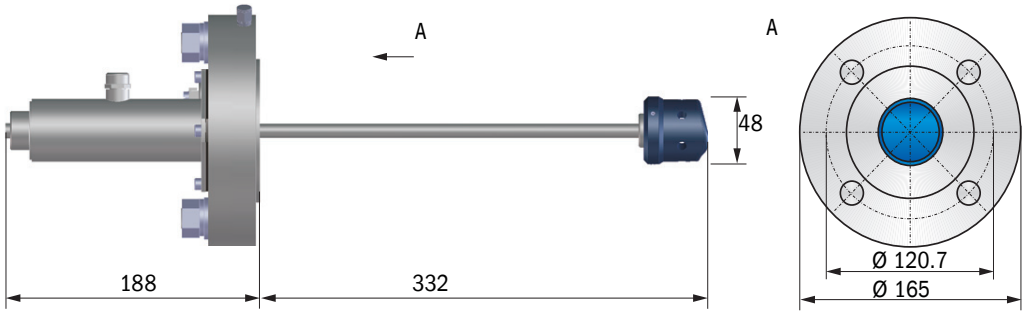


Fig. 165 Sender/receiver unit FLSE100-EXS Slave



NOTICE:
High temperature version has different design of retraction flange with longer total lengths of +111mm.

1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

Sender/receiver units FLSE100-EXS according to ATEX for Ex Zone 1/zone 2, IECEx zone 1 **and according to CSA for Cl** I**, Div.1/Div.2, retractable**[1, 2]

Fig. 166 Sender/receiver unit FLSE100-EXS Master

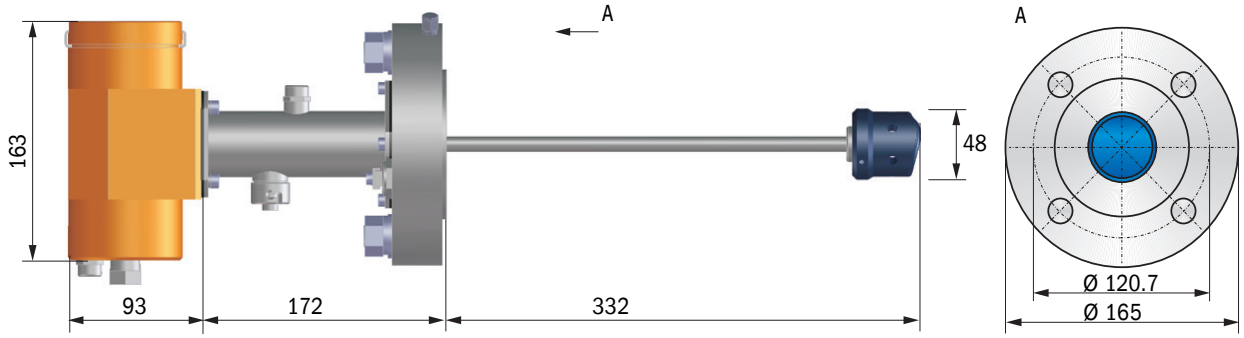
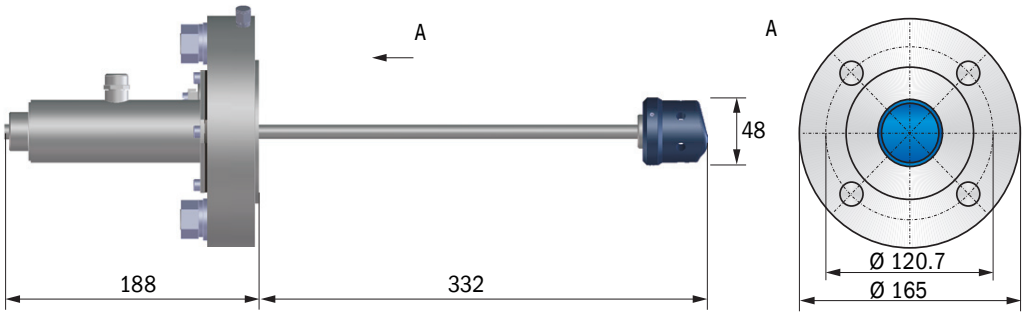


Fig. 167 Sender/receiver unit FLSE100-EXS Slave



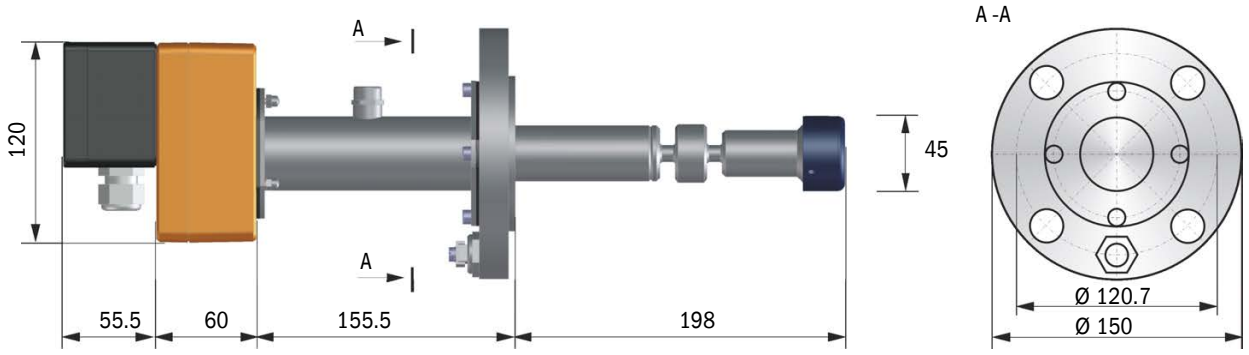
NOTICE:
High temperature version has different design of retraction flange with longer total lengths of +111mm.

1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

6.4.2 FLOWSIC100 EX/EX-RE sender/receiver units

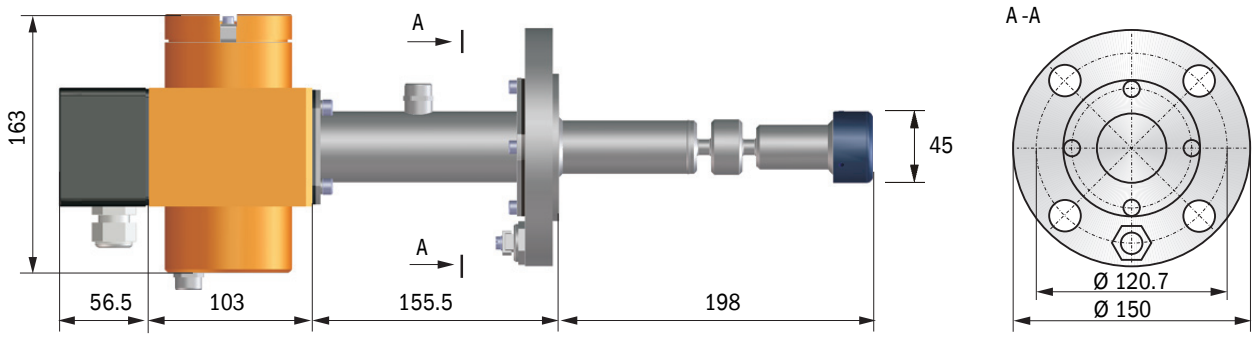
Sender/receiver units FLSE100-EX according to ATEX for Ex Zone 2 only, non-retractable[1, 2]

Fig. 168 Sender/receiver unit FLSE100-EX



Sender/receiver units FLSE100-EX according to ATEX for Ex Zone 1/ zone 2, non-retractable[1, 2]

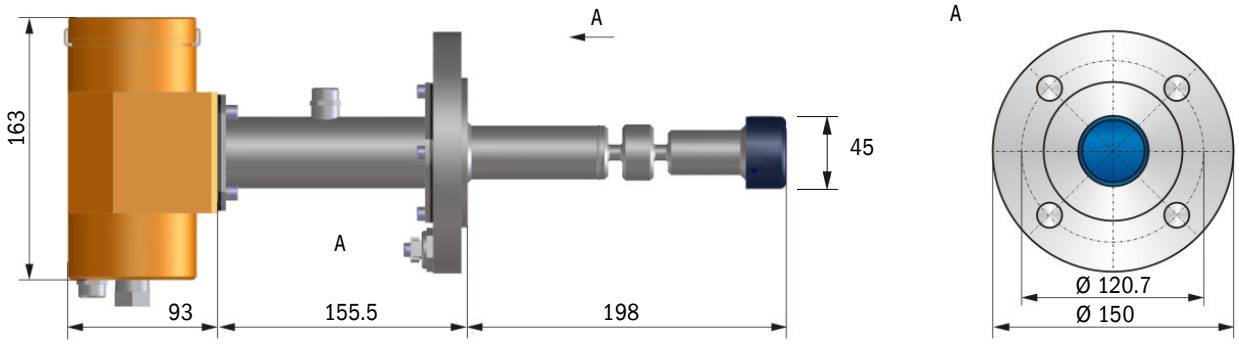
Fig. 169 Sender/receiver unit FLSE100-EX



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

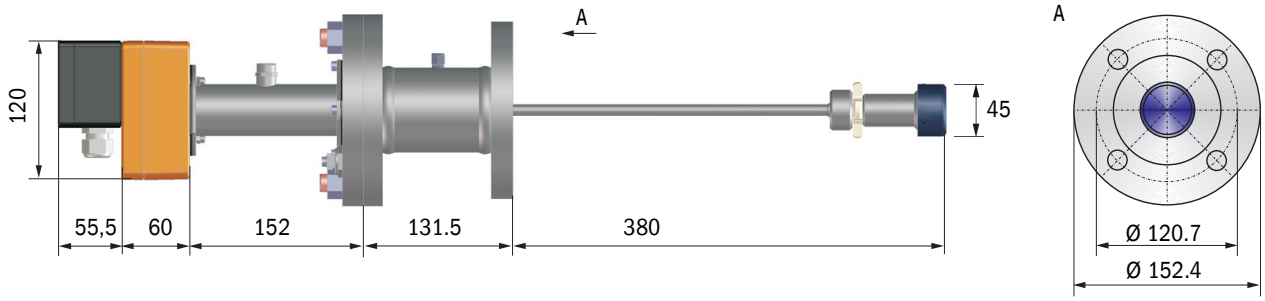
Sender/receiver unit FLSE100-EX according to ATEX for Ex Zone 1/zone 2, IECEx zone 1 and according to CSA for Cl I, Div.1/Div.2, non-retractable[1, 2]

Fig. 170 Sender/receiver unit FLSE100-EX



Sender/receiver units FLSE100-EXRE according to ATEX for Ex Zone 2 only, retractable[1, 2]

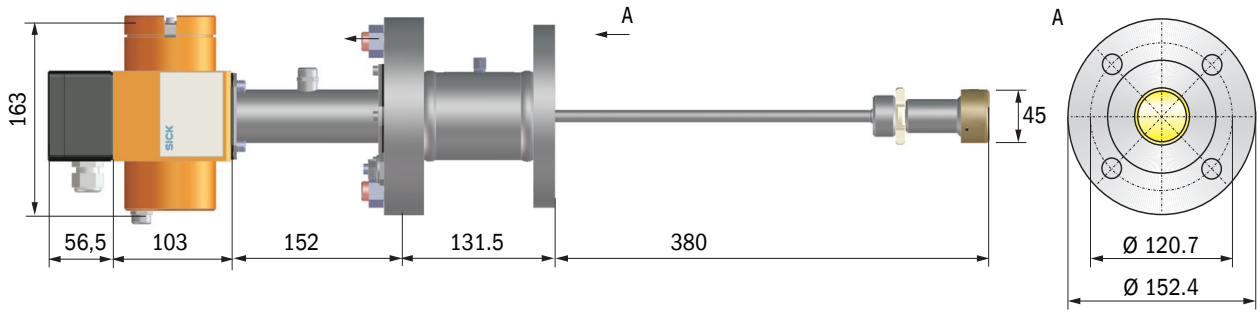
Fig. 171 Sender/receiver unit FLSE100-EXRE



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

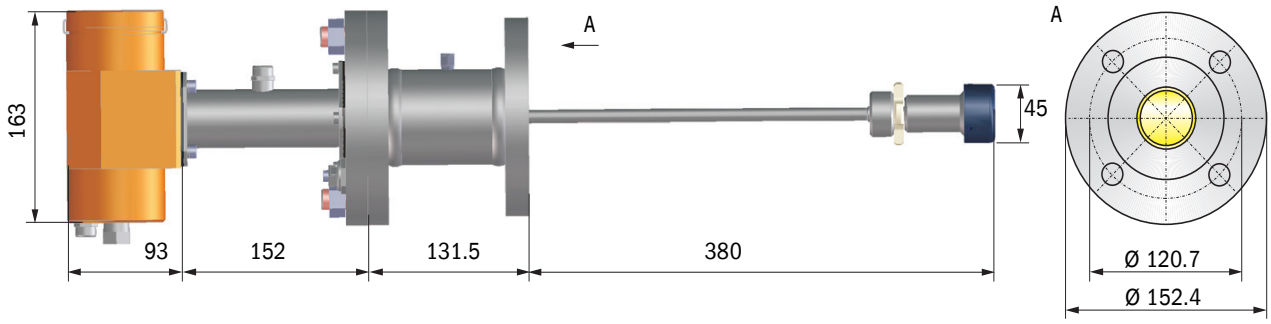
Sender/receiver units FLSE100-EXRE according to ATEX for Ex zone 1/zone 2, retractable[1, 2]

Fig. 172 Sender/receiver unit FLSE100-EXRE



Sender/receiver units FLSE100-EXRE according to ATEX for Ex Zone 1/zone 2, IECEx zone **1 and according to CSA for Cl** I, **Div.1/Div.2, retractable[1, 2]**

Fig. 173 Sender/receiver unit FLSE100-EXRE

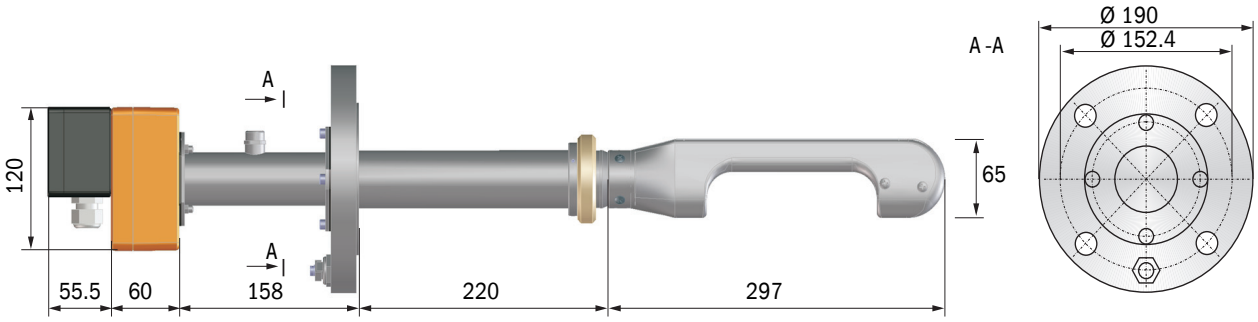


1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 2" CL150 RF acc. to ASME B16.5. DN50 PN16 form B1 acc. to EN 1092-1 available as option

6.4.3 FLOWSIC100 EX-PR sender/receiver units

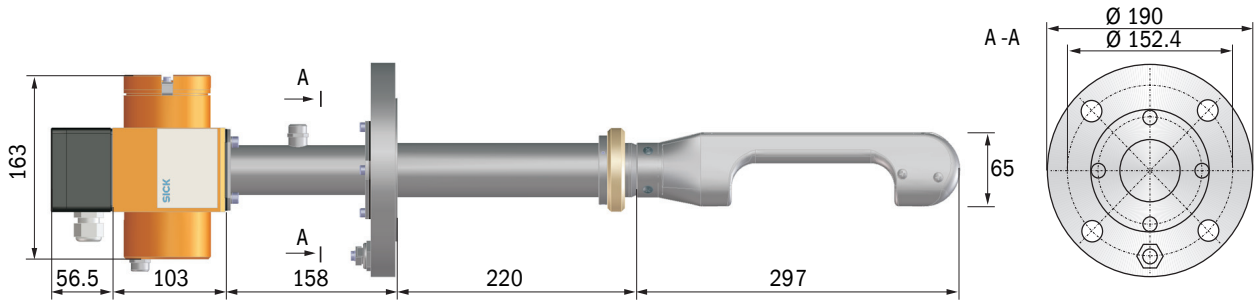
Sender/receiver units FLSE100-EXPR according to ATEX for Ex zone 2 only, non-retractable[1, 2]

Fig. 174 Sender/receiver unit FLSE100-EXPR



Sender/receiver units FLSE100-EXPR according to ATEX for Ex zone 1/zone 2, non-retractable[1, 2]

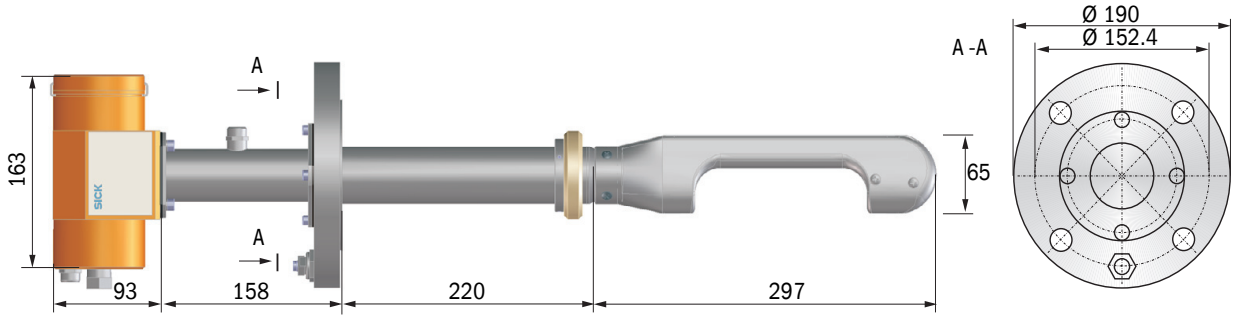
Fig. 175 Sender/receiver unit FLSE100-EXPR



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 3" CL150 RF acc. to ASME B16.5. DN80 PN16 form B1 acc. to EN 1092-1 available as option

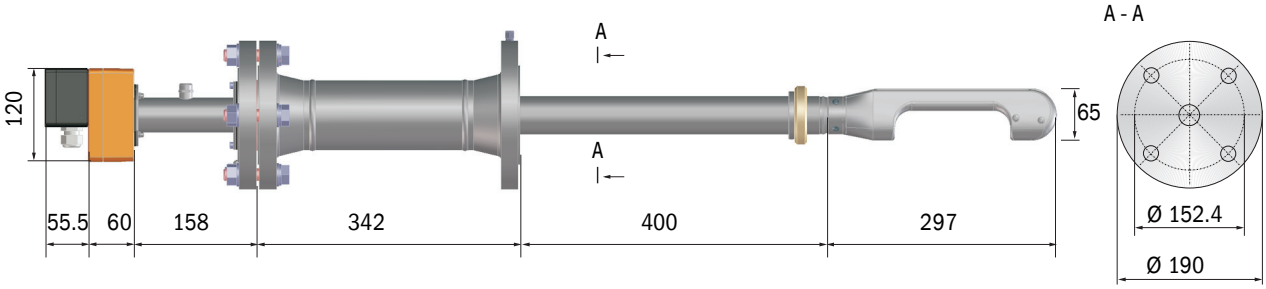
Sender/receiver units FLSE100-EXPR according to ATEX for Ex Zone 1/zone 2, IECEx zone 1 **and according to CSA for Cl** I**, Div.1/Div.2, non-retractable**[1, 2]

Fig. 176 Sender/receiver unit FLSE100-EXPR



Sender/receiver units FLSE100-EXPR according to ATEX for Ex zone 2 only, retractable[1, 2]

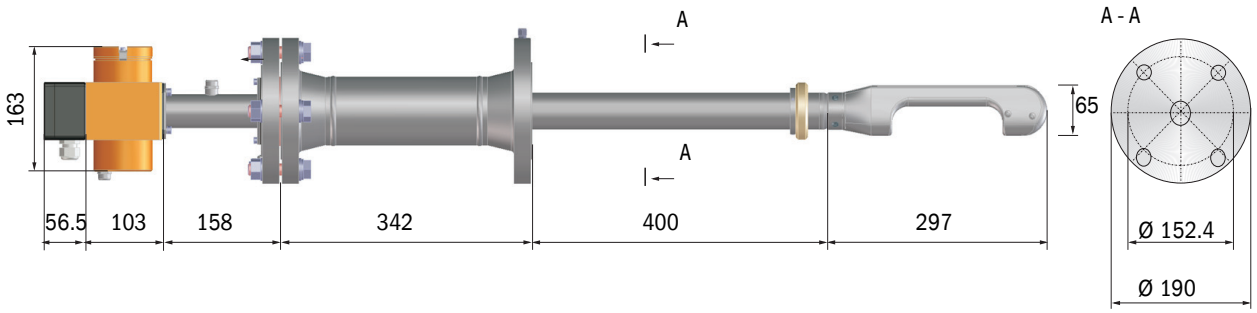
Fig. 177 Sender/receiver unit FLSE100-EXPR



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 3" CL150 RF acc. to ASME B16.5. DN80 PN16 form B1 acc. to EN 1092-1 available as option

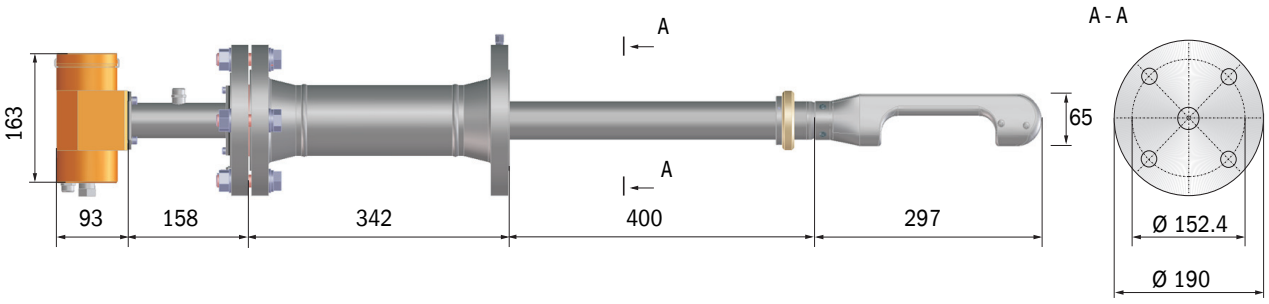
Sender/receiver units FLSE100-EXPR according to ATEX for Ex zone 1/zone 2, retractable[1, 2]

Fig. 178 Sender/receiver unit FLSE100-EXPR



Sender/receiver units FLSE100-EXPR according to ATEX for Ex Zone 1/zone 2, IECEx zone 1 **and according to CSA for Cl** I**, Div.1/Div.2, retractable[1, 2]**

Fig. 179 Sender/receiver unit FLSE100-EXPR



1 For part nos. see → p. 231, 6.4.4
2 Process connections to fit flange 3" CL150 RF acc. to ASME B16.5. DN80 PN16 form B1 acc. to EN 1092-1 available as option

6.4.4 Sender/receiver units - parts list

Table 12 FLOWSIC100 EX-S non-retractable

Sender/receiver Unit	Part No.
Sensor system ATEX Zone 1/IECEx, stainless steel	
FLSE100-EXS 148SA218VS NN 81CDAMN NN	1057382
FLSE100-EXS 148SA218VS NN N1CNNNN NN	1047661
Sensor system ATEX Zone 2 with junction box, stainless steel	
FLSE100-EXS 148SA218VS NN 82CSAMY NN	1046287
FLSE100-EXS 148SA218VS NN 82CSAMY NN	1046356
Sensor system CSA CI I, Div1/Div2, stainless steel	
FLSE100-EXS 148SA218VS NN 83CDATN NN	1047667
FLSE100-EXS 148SA218VS NN N3CNNNN NN	1047668
Sensor system ATEX Zone 1/IECEx, titanium	
FLSE100-EXS 148TA218VS NN 81CDAMN NN	1057408
FLSE100-EXS 148TA218VS NN N1CNNNN NN	1047664
Sensor system ATEX Zone 2 with junction box, titanium	
FLSE100-EXS 148TA218VS NN 82CSAMY NN	1047656
FLSE100-EXS 148TA218VS NN N1CNNNN NN	1047657
Sensor system CSA CI I, Div1, titanium	
FLSE100-EXS 148TA218VS NN 83CDATN NN	1047671
FLSE100-EXS 148TA218VS NN N3CNNNN NN	1047672

Table 13 FLOWSIC100 EX-S retractable

Sender/receiver Unit	Part No.
Sensor system ATEX Zone 1/IECEx, stainless steel	
FLSE100-EXS 330SA218VS RS 81CDAMN NN	1057409
FLSE100-EXS 330SA218VS RS N1CNNNN NN	1047662
Sensor system ATEX Zone 2 with junction box, stainless steel	
FLSE100-EXS 330SA218VS RS 82CSAMY NN	1047655
FLSE100-EXS 330SA218VS RS N2CNNNN NN	1046268
Sensor system CSA CI I, Div1, stainless steel	
FLSE100-EXS 330SA218VS RS 83CDATNNN	1047669
FLSE100-EXS 330SA218VS RS N3CNNNN NN	1047670
Sensor system ATEX Zone 1/IECEx, titanium	
FLSE100-EXS 330TA218VS RS 81CDAMN NN	1057411
FLSE100-EXS 330TA218VS RS N1CNNNN NN	1047666
Sensor system ATEX Zone 2 with junction box, titanium	
FLSE100-EXS 330TA218VS RS 82CSAMY NN	1047659
FLSE100-EXS 330TA218VS RS N2CNNNN NN	1047660
Sensor system CSA CI I, Div1/Div2, titanium	
FLSE100-EXS 330TA218VS RS 83CDATN NN	1047673
FLSE100-EXS 330TA218VS RS N3CNNNN NN	1047674

Table 14 FLOWSIC100 EX non-retractable

Sender/receiver Unit	Part No.
Sensor system ATEX Zone 1 with junction box, stainless steel	
FLSE100-EX 198SA214VS NN 41CDAMN NN	1057412
Sensor system ATEX Zone 2 with junction box, stainless steel	
FLSE100-EX 198SA214VS NN 42CSAMY NN	1047693
Sensor system CSA CI I, Div1/Div2, stainless steel	
FLSE100-EX 198SA214VS NN 43CDATN NN	1047697
Sensor system ATEX Zone 1/IECEx, titanium	
FLSE100-EX 198TA214VS NN 41CDAMN	1057413
Sensor system ATEX Zone 2 with junction box, titanium	
FLSE100-EX 198TA214VS NN 42CSAMY NN	1047695
Sensor system CSA CI I, Div1/Div2, titanium	
FLSE100-EX 198TA214VS NN 43CDATN NN	1047699

Table 15 FLOWSIC100 EX-RE (retractable)

Sender/receiver Unit	Part No.
Sensor system ATEX Zone 1/IECEx, stainless steel	
FLSE100-EXRE 380SA214VS RS 41CDAMN NN	1057414
Sensor system ATEX Zone 2 with junction box, stainless steel	
FLSE100-EXRE 380SA214VS RS 42CSAMY NN	1047694
Sensor system CSA CI I, Div1/Div2, stainless steel	
FLSE100-EXRE 380SA214VS RS 43CDATN NN	1047698
Sensor system ATEX Zone 1/IECEx, titanium	
FLSE100-EXRE 380TA214VS RS 41CDAMN NN	1057415
Sensor system ATEX Zone 2 with junction box, titanium	
FLSE100-EXRE 380TA214VS RS 42CSAMY NN	1047696
Sensor system CSA CI I, Div1/Div2, titanium	
FLSE100-EXRE 380TA214VS RS 43CDATN NN	1047700

Table 16 FLOWSIC100 EX-PR non-retractable

Sender/receiver Unit	Part No.
Sensor system ATEX Zone 1/IECEx, titanium	
FLSE100-EXPR 220TA311VS NN 11CDAMN NN	1057416
Sensor system ATEX Zone 2 with junction box, titanium	
FLSE100-EXPR 220TA311VS NN 12CSAMY NN	1047683
Sensor system CSA CI I, Div1/Div2, titanium	
FLSE100-EXPR 220TA311VS NN 13CDATN NN	1047687

Table 17 FLOWSIC100 EX-PR retractable

Sender/receiver Unit	Part No.
Sensor system ATEX Zone 1/IECEx, titanium	
FLSE100-EXPR 400TA311VS RS 11CDAMN NN	1057417
Sensor system ATEX Zone 2 with junction box, titanium	
FLSE100-EXPR 400TA311VS RS 12CSAMY NN	1047684
Sensor system CSA CI I, Div1/Div2, titanium	
FLSE100-EXPR 400TA311VS RS 13CDATN NN	1047688

6.4.5 Connection cables

6.4.5.1 Non-armored connection cables (SICK standard for ATEX installations)

Connection between s/r units or s/r unit master and junction box

Designation	Part No.
FLOWSIC100-EXS	
Connection cable, analog, Exi, TNC - TNC 3 m	2050614[1]
FLOWSIC100 EX/EXRE	
Connection cable, 5 meter, for FLSE100 with Exe junction box, tinned leads	2052424
Connection cable, meter good, for FLSE100 with Exe junction box, single wires	7041941[2]

1 Intrinsically safe connection, also suitable for CSA installations

2 When the cable is used at a temperature of -40°C, it must be laid fixed; free-hanging installation is not permitted.

Connection between s/r unit master and MCUP

Designation	Part No.
Connection cable, 5 meter, for FLSE100 with Exe junction box, tinned leads	2055381
Connection cable, 10 meter, for FLSE100 with Exe junction box, tinned leads	2055386
Connection cable, meter good, for FLSE100 with Exe junction box, single wires	7041941[1]

1 When the cable is used at a temperature of -40°C, it must be laid fixed; free-hanging installation is not permitted.

6.4.5.2 Armored connection cables (SICK standard for ATEX installations)

Connection between s/r units or s/r unit master and junction box

Designation	Part No.
FLOWSIC100-EXS	
Connection cable FLSE / FLSE analog,armoured, Exi, TNC/TNC, 3 meter,with safety catch,for FLSE100 EX-S	2075210
FLOWSIC100 EX/EXRE	
Connection cable, armored, XLPE (high temp., halogen free), meter good	6042293

Connection between s/r unit master and MCUP

Designation	Part No.
Connection cable, armored, XLPE (high temp., halogen free), meter good	6042293

6.4.5.3 Cable glands for non-armored cable types (SICK standard for ATEX installations)

Sender/receiver units

Designation	Part No.
Ex-d cable gland metric, M20 brass	5324884
Ex-d cable gland metric M20, stainless steel	5324992
Ex-d cable gland NPT 1/2", brass	5324915
Ex-d cable gland NPT 1/2", stainless steel	5325257

Control unit MCUP

Designation	Part No.
Exe cable gland metric M20, brass	5321687
Exe cable gland metric M20, stainless steel	5325259
Exe cable gland metric M25, brass	5325260
Exe cable gland metric M25, stainless steel	5325261
Exe cable gland NPT 1/2", brass	5325262
Exe cable gland NPT 1/2", stainless steel	5325263
Exe cable gland NPT 3/4", brass	5325264
Exe cable gland NPT 3/4", stainless steel	5325265

6.4.5.4 Cable glands for armored cable types (SICK standard for ATEX installations)

Sender/receiver units

Designation	Part No.
Ex-d cable gland metric M20, brass	5324271
Ex-d cable gland metric M20, stainless steel	5325258
Ex-d cable gland NPT 1/2", brass	5324801
Ex-d cable gland NPT 1/2", stainless steel	5324296

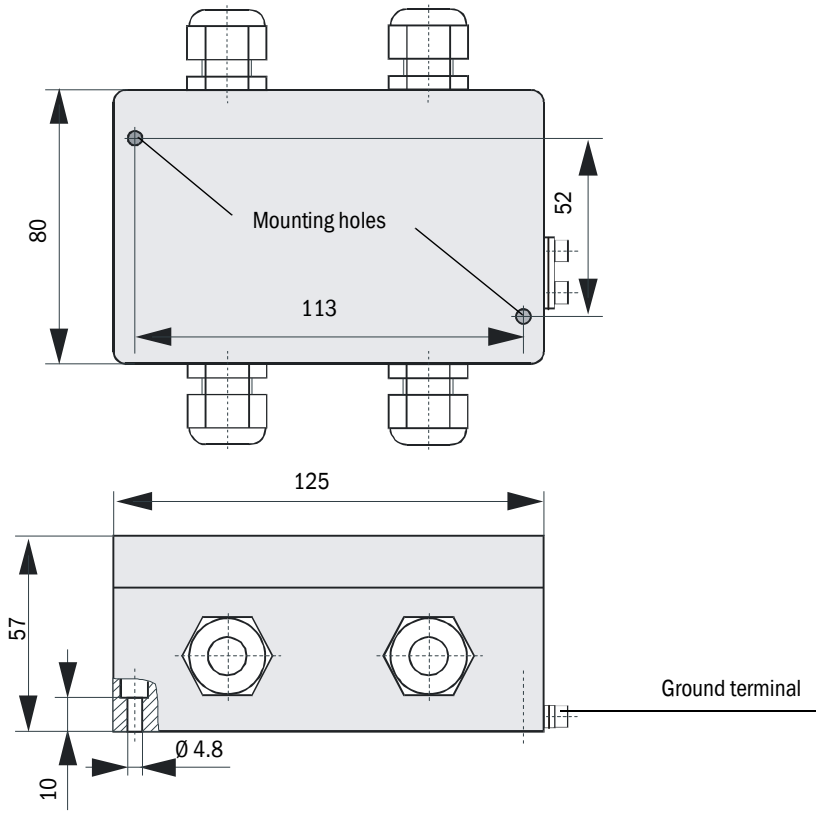
Control unit MCUP

Designation	Part No.
Exe cable gland metric M20, brass	5325266
Exe cable gland metric M20, stainless steel	5325267
Exe cable gland metric M25, brass	5325268
Exe cable gland metric M25, stainless steel	5325270
Exe cable gland NPT 1/2", brass	5325271
Exe cable gland NPT 1/2", stainless steel	5325272
Exe cable gland NPT 3/4", brass	5325273
Exe cable gland NPT 3/4", stainless steel	5325274

6.4.6 Junction box for Ex zone 2 (for ATEX versions only)

In Aluminium housing

Fig. 180 Junction box



Designation	Part No.
Junction box for connection cable for zone 2	2046562
Fastening set 2D4-1.4571/PA (for junction box for connection cable)	2031890

6.4.7 Nozzles

Nozzle 2" for FLSE100-EXS, carbon steel, nozzle type Long Welding Neck

Designation	Part No.
Nozzle CL1502Z, prepared for pipe size 4"	2055388
Nozzle CL1502Z, prepared for pipe size 6"	2055391
Nozzle CL1502Z, prepared for pipe size 8"	2054627
Nozzle CL1502Z, prepared for pipe size 10"	2055392
Nozzle CL1502Z, prepared for pipe size 12"	2051965
Nozzle CL1502Z, prepared for pipe size 14"	2052154
Nozzle CL1502Z, prepared for pipe size 16"	2052155
Nozzle CL1502Z, prepared for pipe size 18"	2052156
Nozzle CL1502Z, prepared for pipe size 20"	2052157
Nozzle CL1502Z, prepared for pipe size 22"	2052158
Nozzle CL1502Z, prepared for pipe size 24"	2052159

Nozzle 2" for FLSE100-EX and EX-RE, carbon steel, nozzle type Long Welding Neck

Designation	Part No.
Nozzle CL1502Z, prepared for pipe size 8"	2055395
Nozzle CL1502Z, prepared for pipe size 10"	2055396
Nozzle CL1502Z, prepared for pipe size 12"	2051671
Nozzle CL1502Z, prepared for pipe size 14"	2051668
Nozzle CL1502Z, prepared for pipe size 16"	2051669
Nozzle CL1502Z, prepared for pipe size 18"	2051670
Nozzle CL1502Z, prepared for pipe size 20"	2051986
Nozzle CL1502Z, prepared for pipe size 22"	2051987
Nozzle CL1502Z, prepared for pipe size 24"	2051988
Nozzle CL1502Z, prepared for pipe size 26"	2051993
Nozzle CL1502Z, prepared for pipe size 28"	2051994
Nozzle CL1502Z, prepared for pipe size 30"	2051995
Nozzle CL1502Z, prepared for pipe size 32"	2051996
Nozzle CL1502Z, prepared for pipe size 34"	2051997
Nozzle CL1502Z, prepared for pipe size 36"	2051998
Nozzle CL1502Z, prepared for pipe size 38"	2051999
Nozzle CL1502Z, prepared for pipe size 40"	2052000
Nozzle CL1502Z, prepared for pipe size 42"	2052001
Nozzle CL1502Z, prepared for pipe size 44"	2052002
Nozzle CL1502Z, prepared for pipe size 46"	2052003
Nozzle CL1502Z, prepared for pipe size 48"	2052004
Nozzle CL1502Z, prepared for pipe size 52"	2052005
Nozzle CL1502Z, prepared for pipe size 56"	2052006
Nozzle CL1502Z, prepared for pipe size 60"	2052007
Nozzle CL1502Z, prepared for pipe size 64"	2052008
Nozzle CL1502Z, prepared for pipe size 68"	2052009
Nozzle CL1502Z, prepared for pipe size 72"	2052010

Nozzle 3" for FLSE100-EXPR, carbon steel

Designation	Part No.
Nozzle CL1503Z, prepared for pipe size 12"	2057109
Nozzle CL1503Z, prepared for pipe size 14"	2057110
Nozzle CL1503Z, prepared for pipe size 16"	2059283
Nozzle CL1503Z, prepared for pipe size 18"	2059284
Nozzle CL1503Z, prepared for pipe size 20"	2057113
Nozzle CL1503Z, prepared for pipe size 22"	2057114
Nozzle CL1503Z, prepared for pipe size 24"	2059285
Nozzle CL1503Z, prepared for pipe size 26"	2057116
Nozzle CL1503Z, prepared for pipe size 28"	2057117
Nozzle CL1503Z, prepared for pipe size 30"	2057118
Nozzle CL1503Z, prepared for pipe size 32"	2057119
Nozzle CL1503Z, prepared for pipe size 34"	2057120
Nozzle CL1503Z, prepared for pipe size 36"	2057121
Nozzle CL1503Z, prepared for pipe size 38"	2057122
Nozzle CL1503Z, prepared for pipe size 40"	2057123
Nozzle CL1503Z, prepared for pipe size 42"	2057124
Nozzle CL1503Z, prepared for pipe size 44"	2057125
Nozzle CL1503Z, prepared for pipe size 46"	2057126
Nozzle CL1503Z, prepared for pipe size 48"	2057127
Nozzle CL1503Z, prepared for pipe size 52"	2057128
Nozzle CL1503Z, prepared for pipe size 56"	2057129
Nozzle CL1503Z, prepared for pipe size 60"	2057130
Nozzle CL1503Z, prepared for pipe size 64"	2057131
Nozzle CL1503Z, prepared for pipe size 68"	2057132
Nozzle CL1503Z, prepared for pipe size 72"	2057133

Nozzle installation tool

Designation	Part No.
Nozzle installation tool EX-S	2050598
Nozzle installation tool EX	2050599
Nozzle installation tool EX-PR	2050601

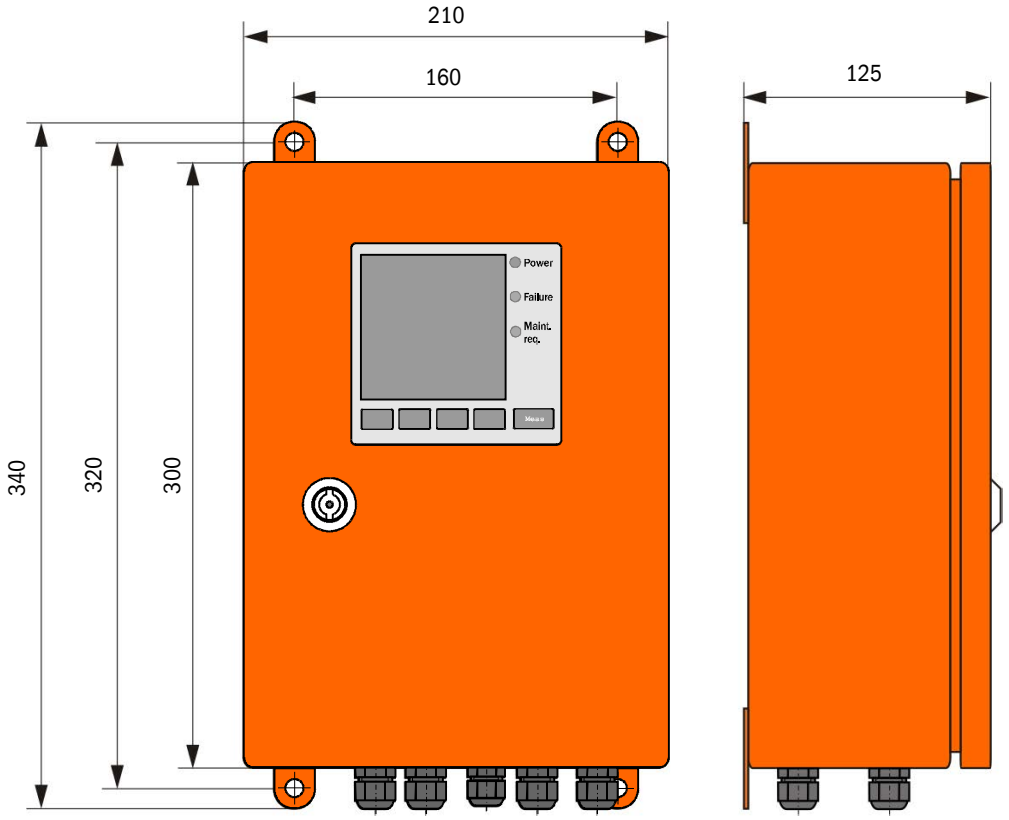
6.4.8 Additional accessories for retractable sender/receiver units

Designation	Part No.
Blind flange 2" for FLSE100-EXS and FLSE100-EXRE	
Blind flange ANSI CL1502Z CS, material carbon steel	2051991
Blind flange 3" for FLSE100-EXPR	
Blind flange ANSI CL1503Z CS, material carbon steel	2051990
Ball valve 2" for FLSE100-EXS and FLSE100-EXRE	
Ball valve ANSI CL1502Z SS, material stainless steel 1.4408 (CF08M)	2051963
Ball valve 3" for FLSE100-EXPR	
Ball valve ANSI CL1503Z SS, material stainless steel 1.4408 (CF08M)	2051966

6.4.9 MCUP control unit

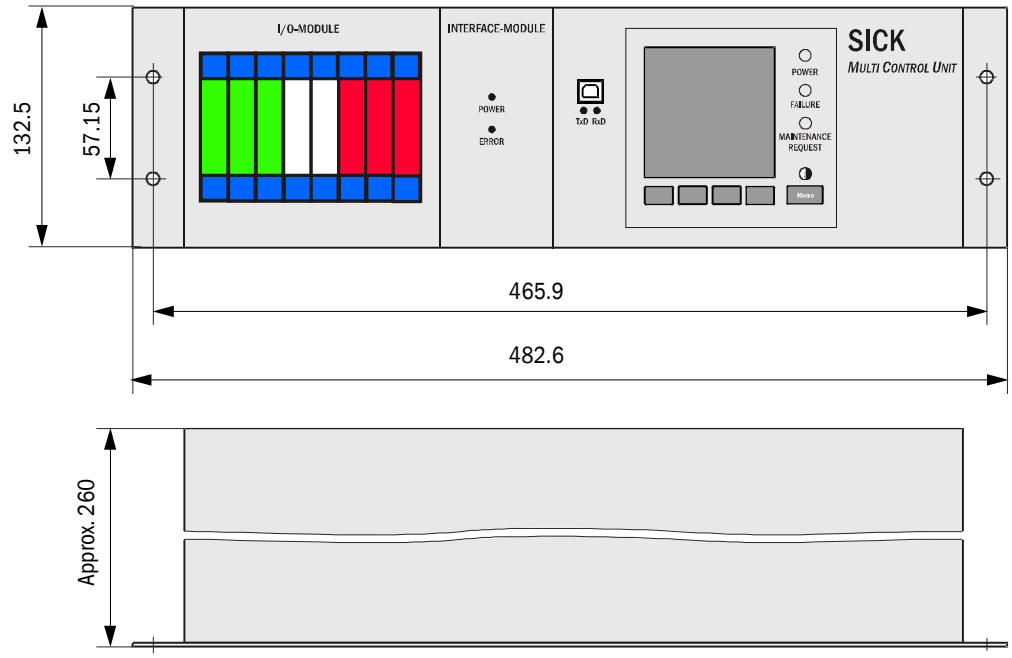
MCUP without explosion protection

Fig. 181 MCUP control unit without explosion protection in compact size housing



Designation	Part No.
Control unit MCUP-WNA1MN00000NRN	1050334
Control unit MCUP-2NA1MN00000NRN	1047618

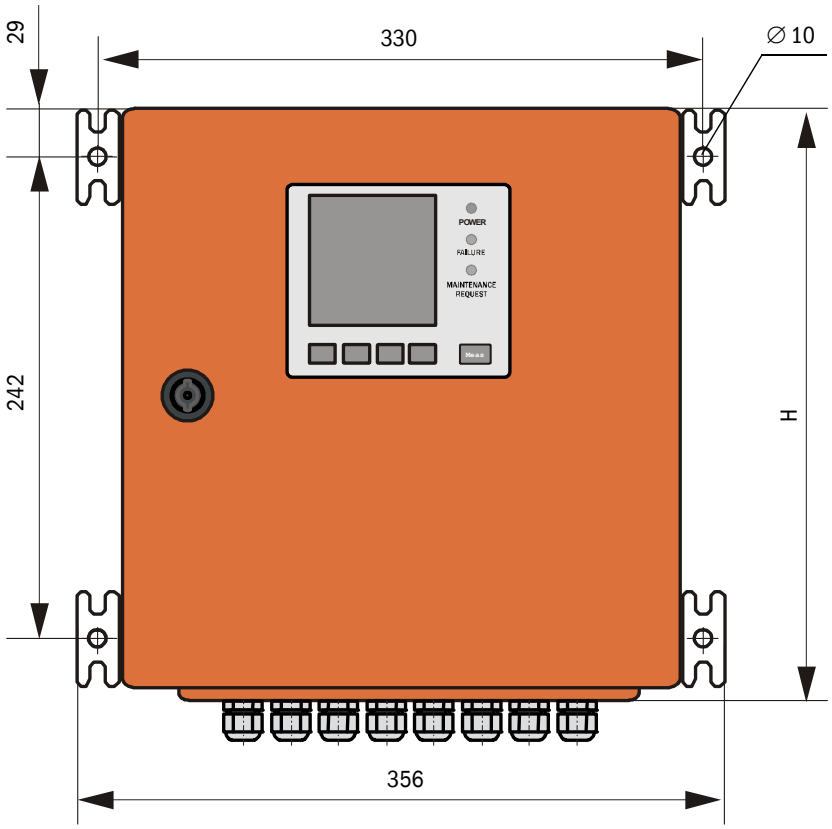
Fig. 182 MCUP control unit in 19" rack (shown with Display module option)



Designation	Part No.
Control unit MCUP-WNF1MN00000NRN	1047704
Control unit MCUP-2NF1MN00000NRN	1047705

MCUP without explosion protection and for use in zone 2 and CL I, Div 2

Fig. 183 MCUP control unit in medium size housing

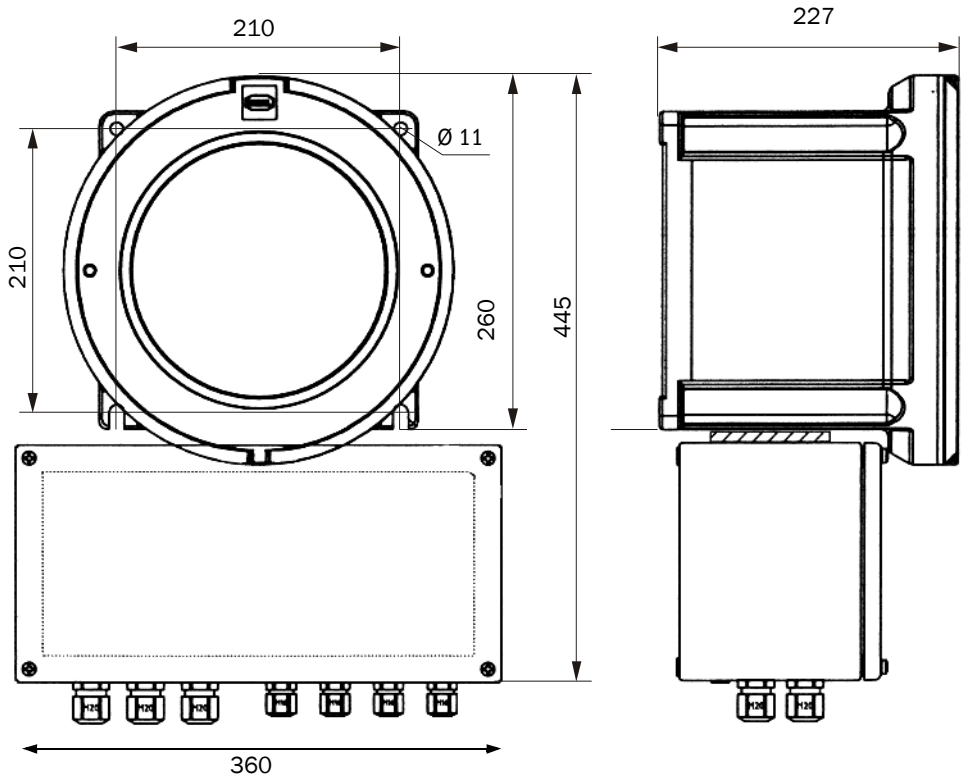


H = 300 (for ATEX zone 2 version
320 (for CSA CII Div 2 version

Designation	Part No.
Control unit MCUP-WNB3MN00000NRN	1050336
Control unit MCUP-2NB3MN00000NRN	1050335
Control unit MCUP-SNB3MB00000NSN	1050337
Control unit MCUP-2NB3MB00000NSN	1047706
Control unit MCUP-SNB3CE00000NSN	1050340
Control unit MCUP-2NB3CE00000NSN	1050339

MCUP for ATEX Zone 1

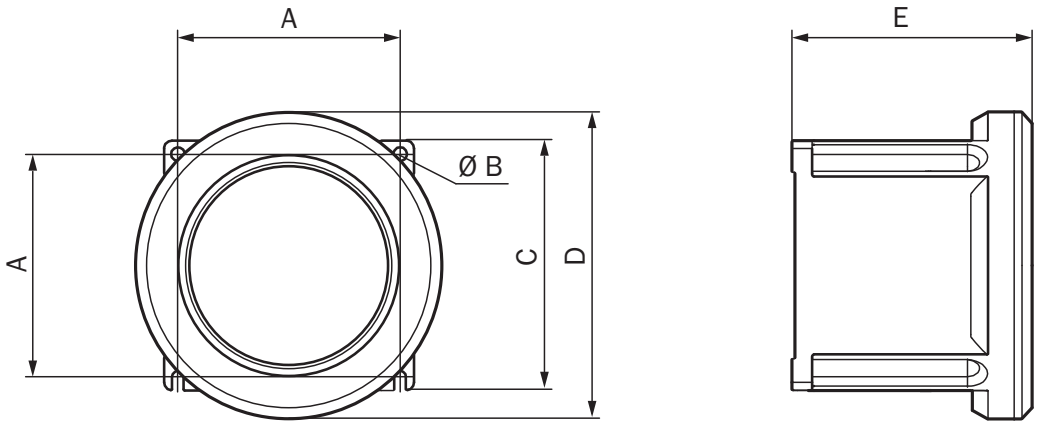
Fig. 184 MCUP in Ex housing for zone 1 STAHL



Designation	Part No.
Control unit MCUP-WND1MA00000NSN	1048164
Control unit MCUP-2ND1MA00000NSN	1047707

MCUP for CSA Cl I, Div 1

Fig. 185 MCUP in Ex housing for CSA Cl I, Div 1



Designation	Part No.
Control Unit MCUP-2NK1CD00000NSN	1069773
Control Unit MCUP-WNK1CD00000NSN	1069771
Control Unit MCUP-WNL1CD00000NSN	on request
Control Unit MCUP-2NL1CD00000NSN	on request

6.5 Options for MCUP control unit

6.5.1 Inputs/outputs

Designation	Part No.
Analog input module, 2 channels, 100 Ω, 0/4...22 mA, electrically isolated	2034656
Analog output module, 2 channels, 500 Ω, 0/4 ... 22 mA, electrically isolated per module	2034657
Digital output module, 2 changeover contacts	2034659
Module carrier (for one each AI, AO, DI or DO module)	6033578
Connection cable for optional I/O modules	2040977
I/O module carrier 19" (to install up to 4 AI/AO or 4 DI/DO modules)	2048378

6.5.2 Interface module

Designation	Part No.
Interface Modbus TCP + Impulse	2059546
Interface Ethernet triplex + Impulse	2072693
Interface Foundation Fieldbus	on request
Interface Impulse	2048961
Interface Profibus DP + Impulse	2048920
Interface Ethernet + Impulse	2055719
Interface Modbus + Impulse	2048958
Interface HART® BUS + Impulse	2050607

6.5.3 Interface modules for MCUP 19" version

Designation	Part No.
Interface Modbus TCP + Impulse	on request
Interface Ethernet triplex + Impulse	2073110
Interface Impulse	2049348
Interface Profibus DP + Impulse	2049334
Interface Ethernet + Impulse	2048377
Interface Modbus + Impulse (on request)	2050674
Interface HART® BUS + Impulse (on request)	2050608

6.6 Password

User level		Password
0	"Operator"	Without
1	"Authorized client"	sickoptic

6.7 Sealing installation instruction

Fig. 186 Sealing installation (designed by ”pikotek”)

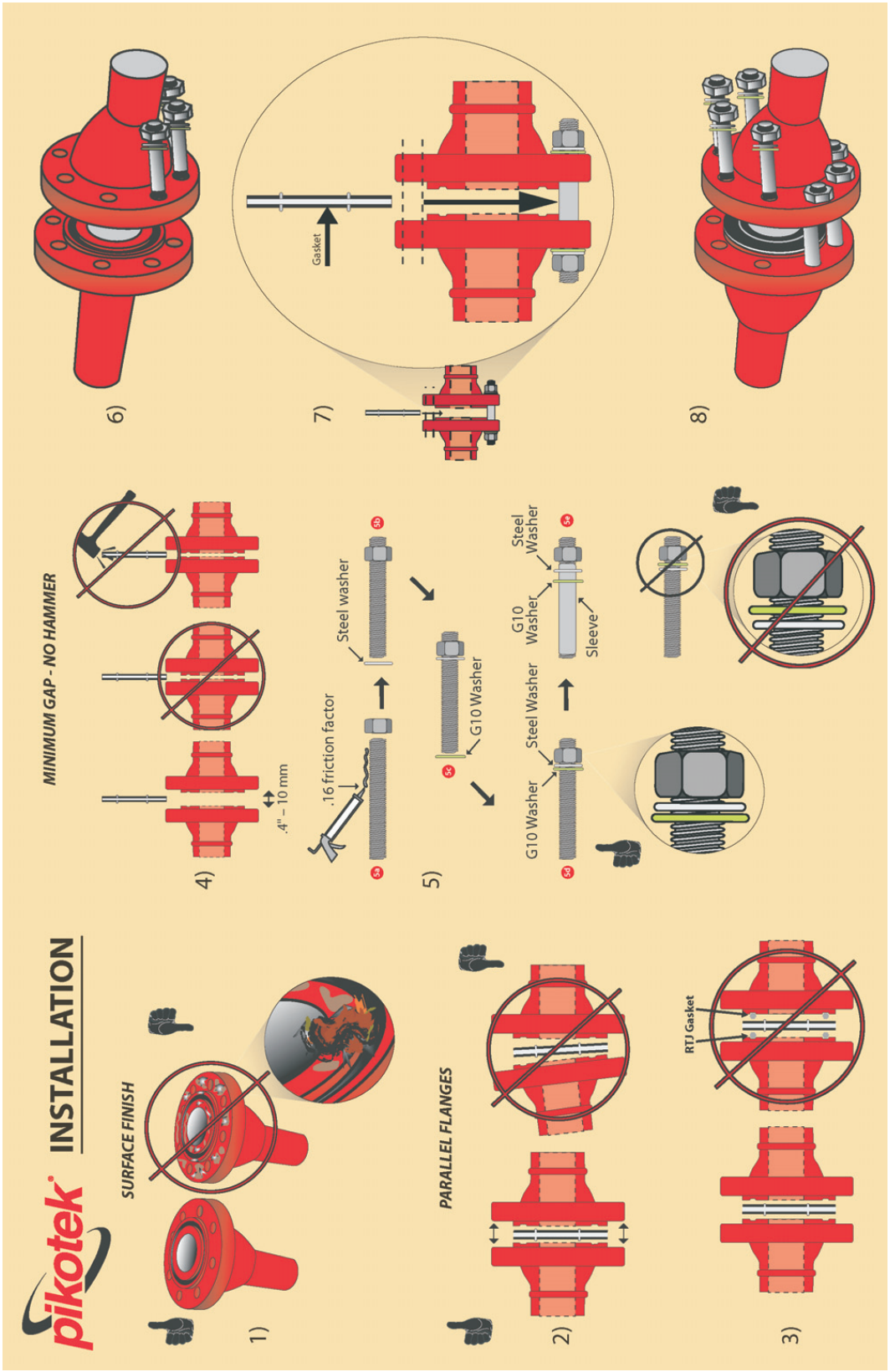
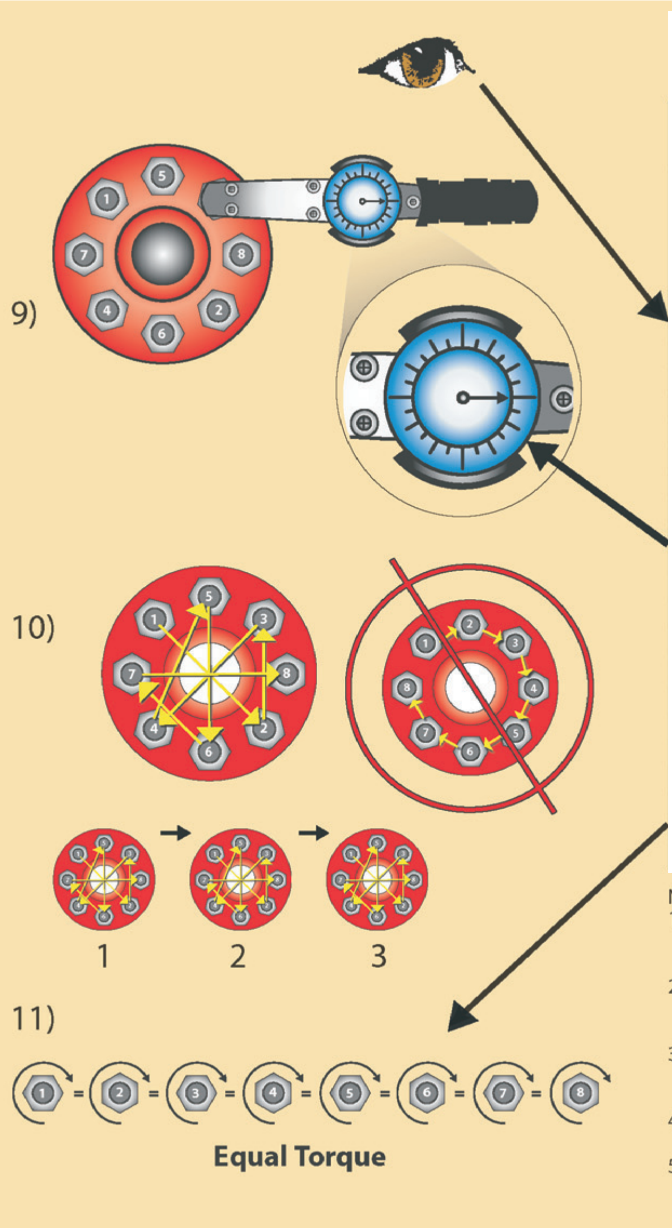


Fig. 187 Sealing installation (designed by "pikotek"), bolt torque values for grooved metal gasket B9A and polymer gasket GYLON



Tightening torques

- Default: Grooved metal gasket B9A
- Option: Polymer gasket GYLON

	Grooved metal 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
Thickness of gasket	4,25 mm		4,6 mm	
No. of bolts	4	4	4/8	4

Notes:
1) Recommended bolt torque is based on deriving a minimum 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-neck (integral) flanges.
4) Blind or other flange types may require different seating loads.
5) 30 ksi bolt stress may exceed the design allowable stress levels for certain stud bolt materials.

Subject to change without notice

6.8 SICK Commissioning check list

Fig. 188 SICK Commissioning check list, page 1

SICK

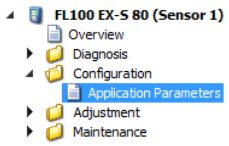
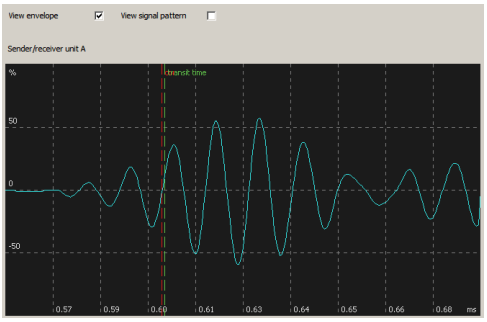
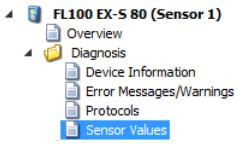
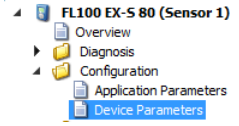
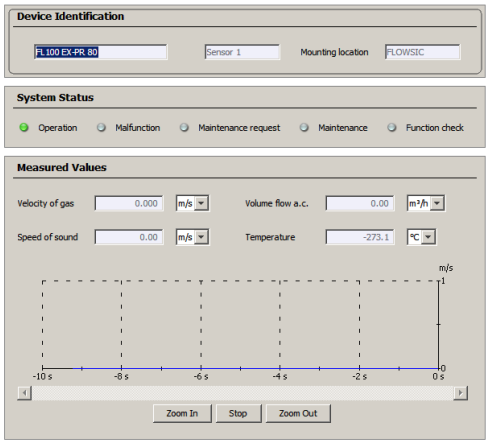
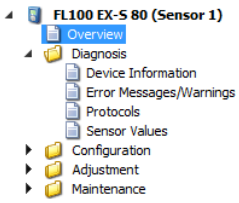
Commissioning check list
FLOWSIC100 Flare

Client information	
Company name:	
Plant location:	
Address:	
Responsible Plant Manager:	
Phone:	
FAX:	
email:	
Meter information	
TAG number:	
Serial number S/R unit A:	
Serial number S/R unit B:	
Serial number MCU:	
Device configuration (1 path, 2 path):	
Device version (CrossDuct/Probe):	
Type key of S/R unit:	
Type key of MCU:	
Measurement Location:	
Add. description:	
Service information	
Date of this service:	
Time of this service:	
Technician name:	
Technician phone:	
Technician email:	
Date of last service:	

Fig. 189 SICK Commissioning check list, page 2

SICK

1 Configuration sensor

1	☐	Enter application parameters: ☐ Installation angle ☐ Path length ☐ Cross-sectional area	
2	☐	Check the zerophase cursors (see fig.) 	
3	☐	Zerophase Adjustment by using Parameter "Zero phase", see also service manual for nearer instructions	
4	☐	Check the page "Overview" for Malfunctions and Maintenance requests. If there any event going into more detailed information on page "Error messages/Warnings" 	

E_49990 2/9

Fig. 190 SICK Commissioning check list, page 3

2 Configuration MCU

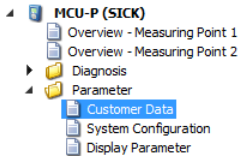
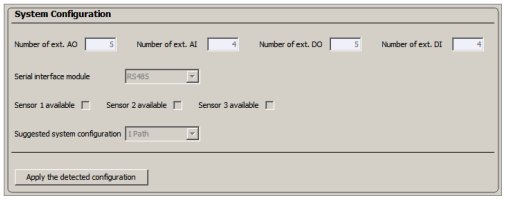
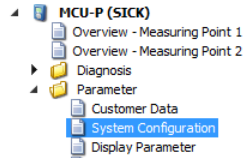
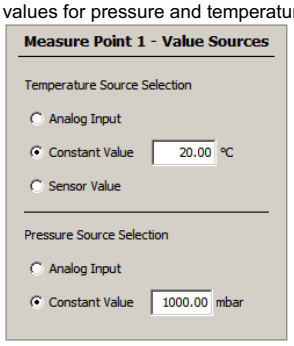
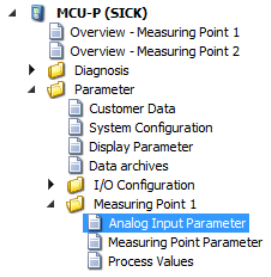
1	☐	Enter customers data: Name, Street, City, Country	
2	☐ ☐ ☐ ☐ ☐ ☐	Enter the system configuration: Measuring point configuration Check the view for all detected hardware modules and press "Apply the detected configuration"  Select the connected module and additional settings for the interface. Synchronize the runtime to customer's local time. Configure service interface settings Protocol type, Baud rate, address. Configure reference data temperature and pressure. Configure the measuring points.	
3	☐	Configure reference data temperature and pressure Open page "Analog Input Parameter" and configure the values for pressure and temperature 	

Fig. 191 SICK Commissioning check list, page 4

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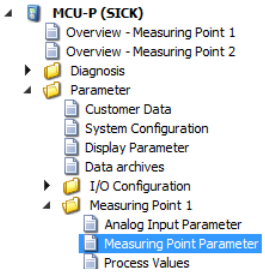
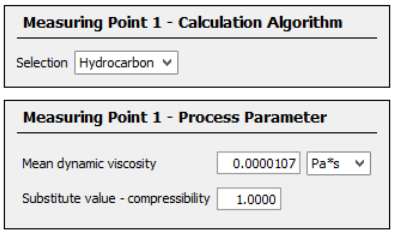
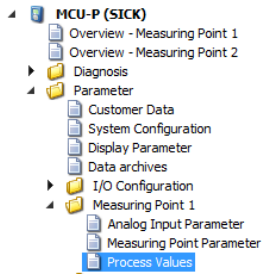
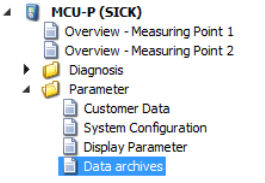
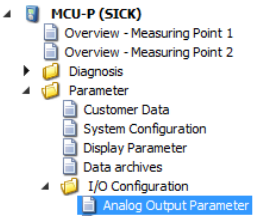
4	☐ TAG ☐ Description ☐ Pipe diameter ☐ Nominal diameter ☐ Sensor type ☐ Low flow cut off ☐ Suppress negative speed	Change to page “Measuring Point Parameter” and configure:	
5	☐ Calculation algorithm (Basic, Hydrocarbons, MR113) ☐ Dependent on the selected algorithm, configure additional parameters.	Enter the Process values: 	
6	☐ Recording interval ☐ Records ☐ Write mode ☐ Measuring point	Configure the data archive settings for all measuring points:	
7	☐ Error current selection ☐ Value ☐ Maintenance current selection	Select page "Analog Output Parameter" and enter the following settings:	
8	☐ Measuring point ☐ Measured value ☐ Live zero ☐ Range low ☐ Range high	Configure for all analog outputs:	

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Fig. 192 SICK Commissioning check list, page 5

SICK

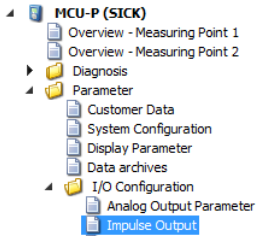
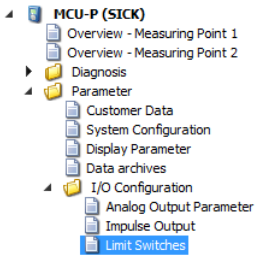
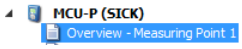
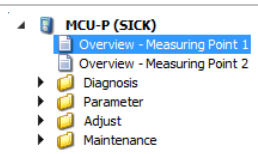
9	☐ ☐ ☐	Change to page "Impulse Output" and enter: Assigned measuring point Measuring value Impulse factor	
10	☐ ☐ ☐ ☐ ☐ ☐	Change to page "Limit Switches" and configure for all measuring points: Assigned measuring point Measured value Hysteresis type Hysteresis value Switching direction Limiting value	
11	☐ ☐	Check the page "Overview" for Malfunctions and Maintenance requests. If there are any events, see more detailed information on page "Error messages/Warnings"	

Fig. 193 SICK Commissioning check list, page 6

SICK

Check Diagnostic

1	☐	Check the following diagnostic values for plausibility:	
	☐ VOG _____		
	☐ SOS _____		
	☐ SNR _____		
	☐ AGC _____		
	☐ Pressure _____		
	☐ Temperature _____		
	☐ Mol. weight _____		
	☐ Density _____		

Check Output / Input

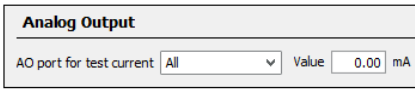
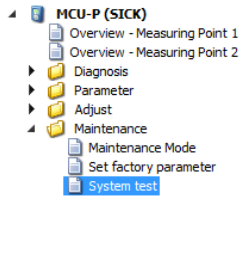
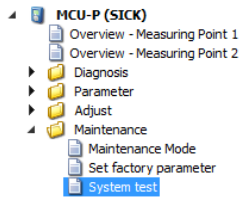
1	☐	Check analog outputs: For loop check change to page "System test" and use the simulation mode for AO Outputs and compare with customers DCS Screen values. 	
	☐ AO 1 ok ☐ AO 2 ok ☐ AO 3 ok ☐ AO 4 ok ☐ AO 5 ok ☐ AO 6 ok		
2	☐	Check analog inputs: For loop check change to page "System test" and use the SOPAS ET screen values and compare with customers DCS screen values. 	
	☐ AO 1 ok ☐ AO 2 ok ☐ AO 3 ok ☐ AO 4 ok ☐ AO 5 ok ☐ AO 6 ok		

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Fig. 194 SICK Commissioning check list, page 7

SICK

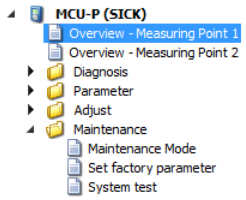
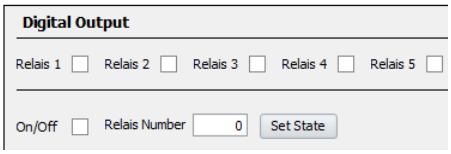
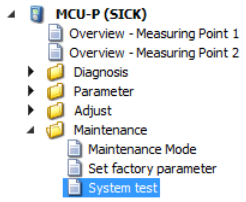
	☐ ☐ ☐ ☐ ☐ ☐	Check pressure and temperature transmitter values from SOPAS ET with real line conditions: Pressure Measuring Point 1 Temperature Measuring Point 1 Pressure Measuring Point 2 Temperature Measuring Point 2 Pressure Measuring Point 3 Temperature Measuring Point 3	
3	☐ ☐ ☐ ☐ ☐ ☐	Check switch output: Change to systemtest and use the simulation function of digital outputs.  Relay Malfunction (check with system test active on/off) Relay Maintenance request / Warning (disconnect 1 path) Relay Maintenance (Maintenance on/off) Relay limit (check by limits adjustments) Relay check (start check cycle manually)	

Fig. 195 SICK Commissioning check list, page 8

SICK

Miscellaneous MCU

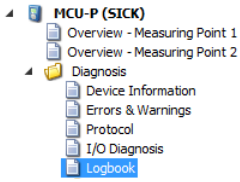
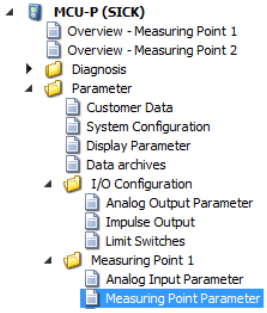
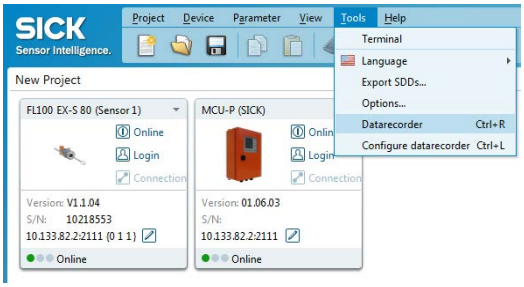
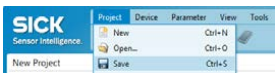
1	☐	Change to page "Logbook" and delete.	
2	☐	Change to page "Measuring Point Parameter" and reset counters.	
3	☐	Select option "Tools/Datarecorder" on the toolbar and configure a datarecorder.  Press the button and select the logging group "Diagnosis log": ☑ FL100 EX-S 80 Diagnosis log	
4	☐ ☐	Save project file and device file Save project	

Fig. 196 SICK Commissioning check list, page 9

SICK

	☐ ☐	Export device MCU Export device Sensor	

☐ Installation and Commissioning would be successfully finished. Following additional notes should be fixed.

Technician name Signature Date/Time

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6.9 Connection diagrams for MCUP Ex zone 1 - configuration examples with optional modules

Fig. 197 2-path configuration, 1 measuring point, supply voltage 230 V a.c (Drawing 9178258)

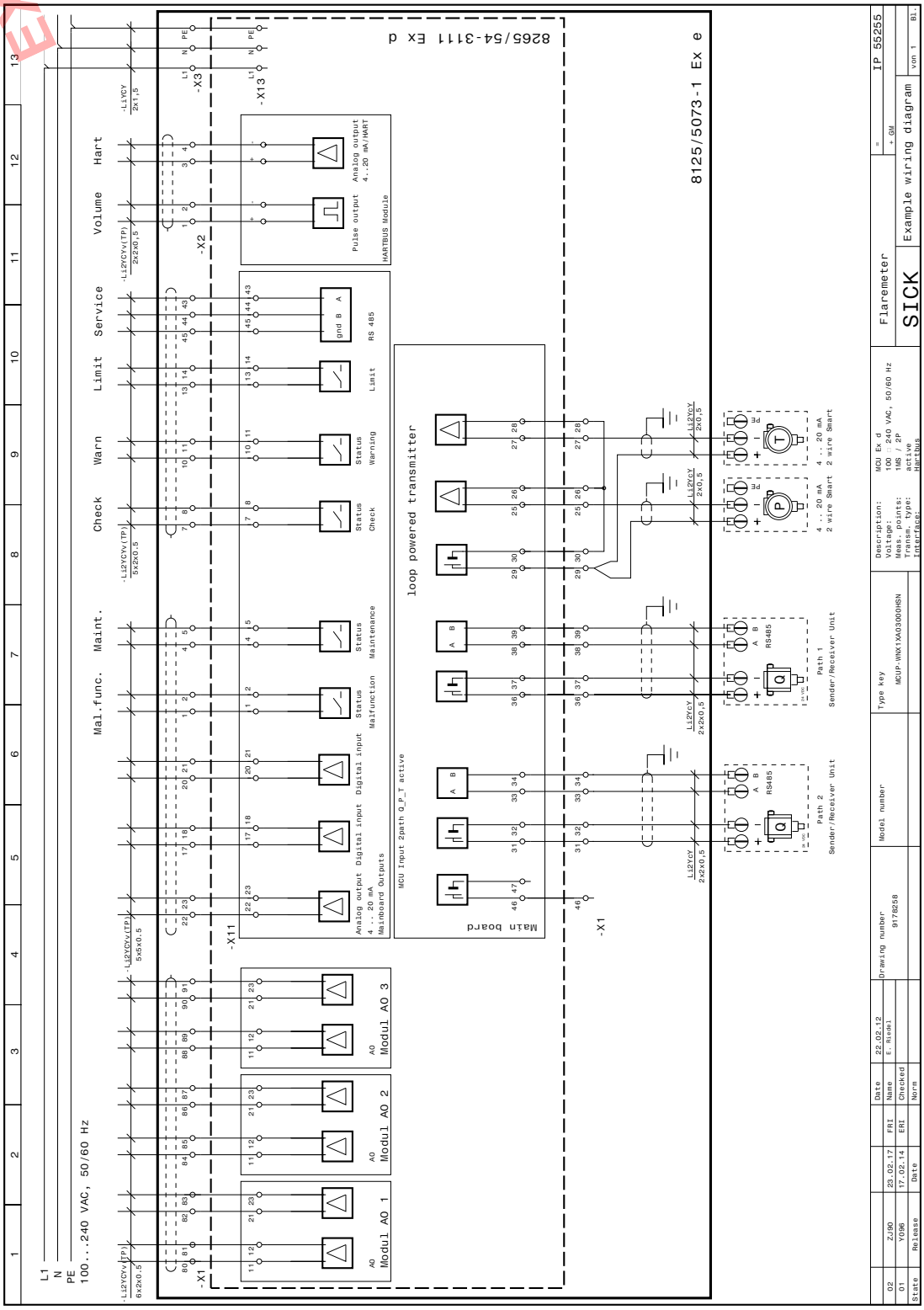


Fig. 198 1-path configuration, 1 measuring point, supply voltage 115 / 230 V a.c (Drawing 9176519)

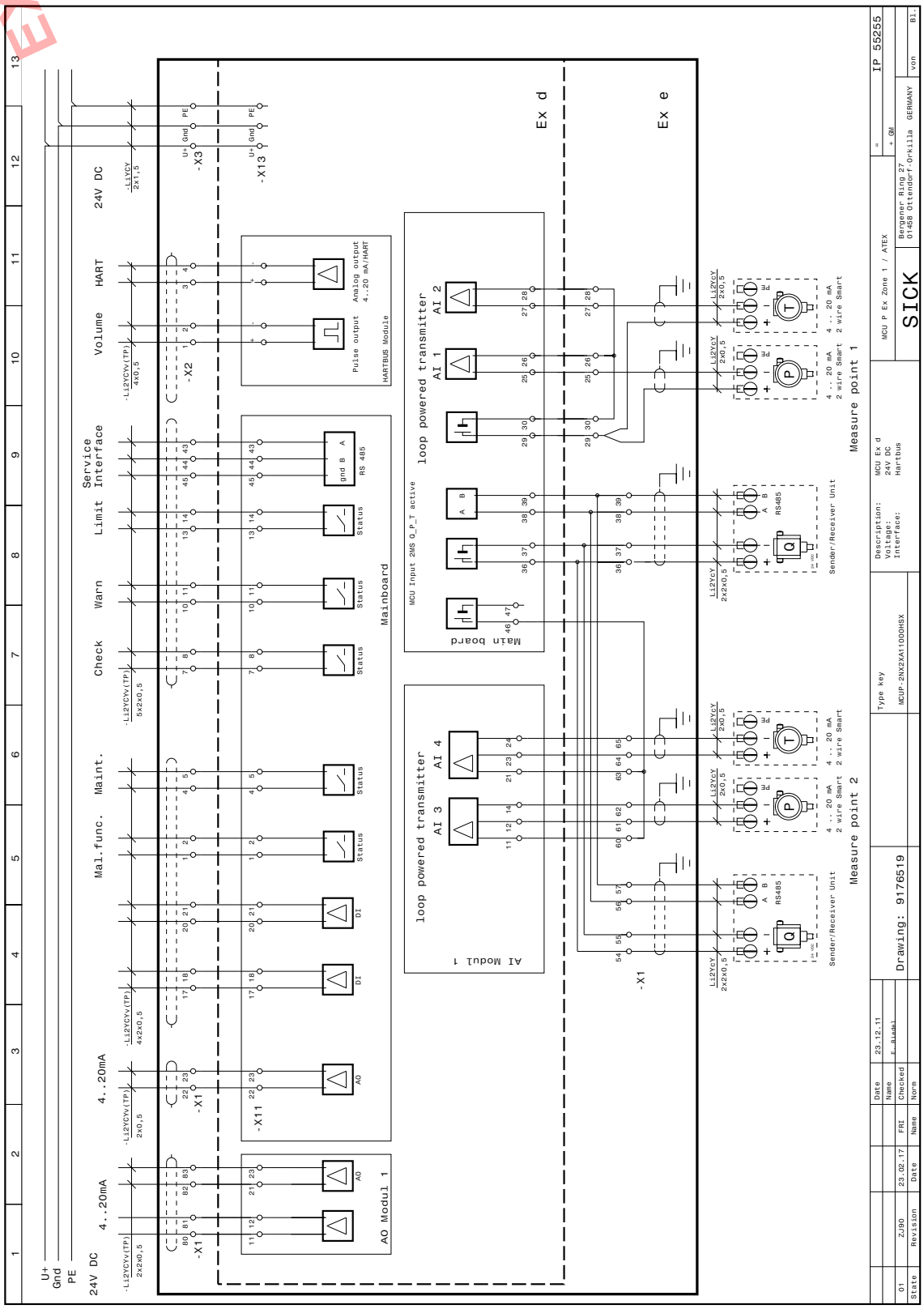
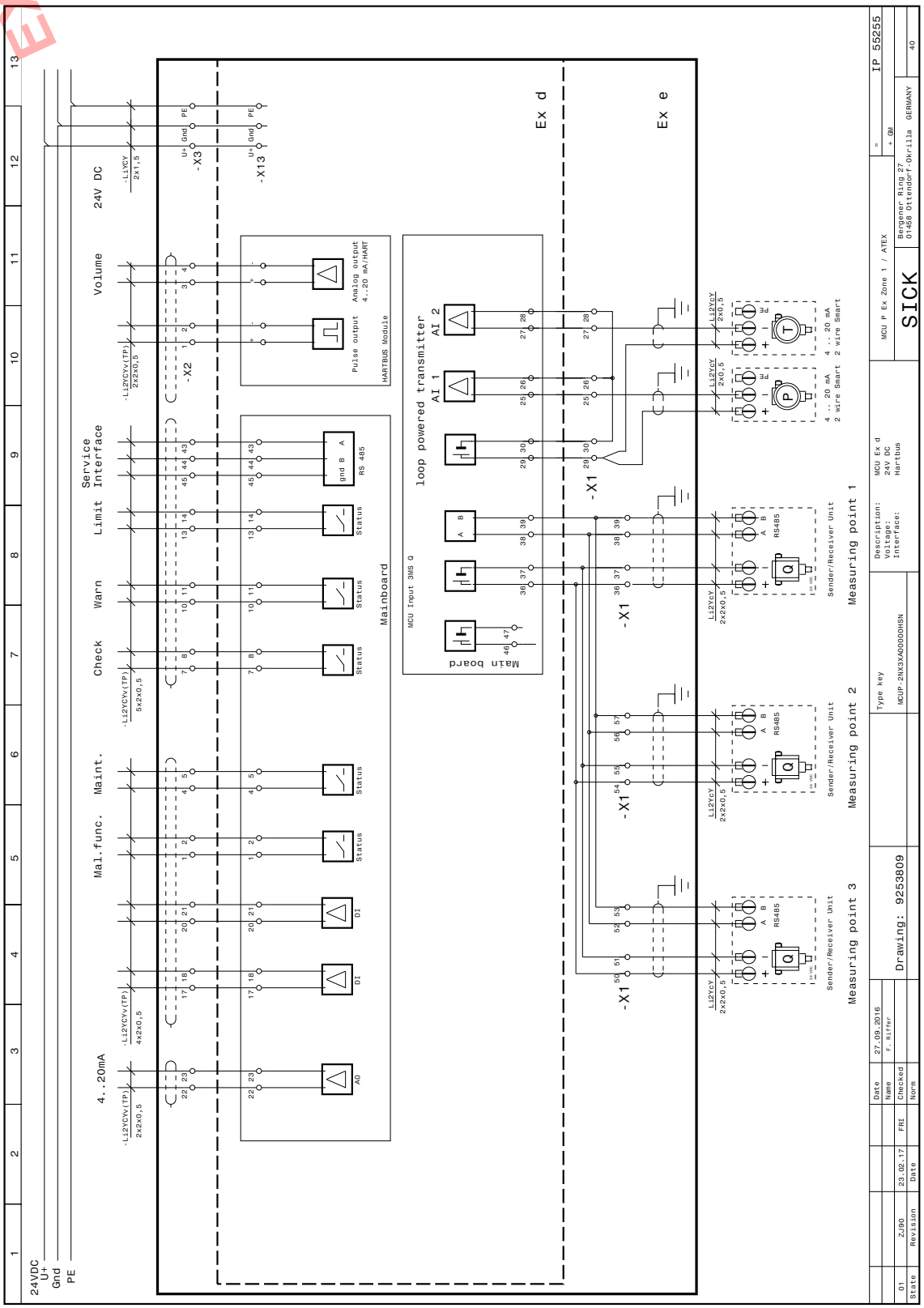


Fig. 199 1-path configuration, 3 measuring points, supply voltage 230 V a.c (Drawing 9253809)



6.10 Wiring diagrams for USA and Canada

6.10.1 FLSE100-EXS/FLSE100-EXPR

Fig. 200 Type key FLSE100-EXS/FLSE100-EXPR

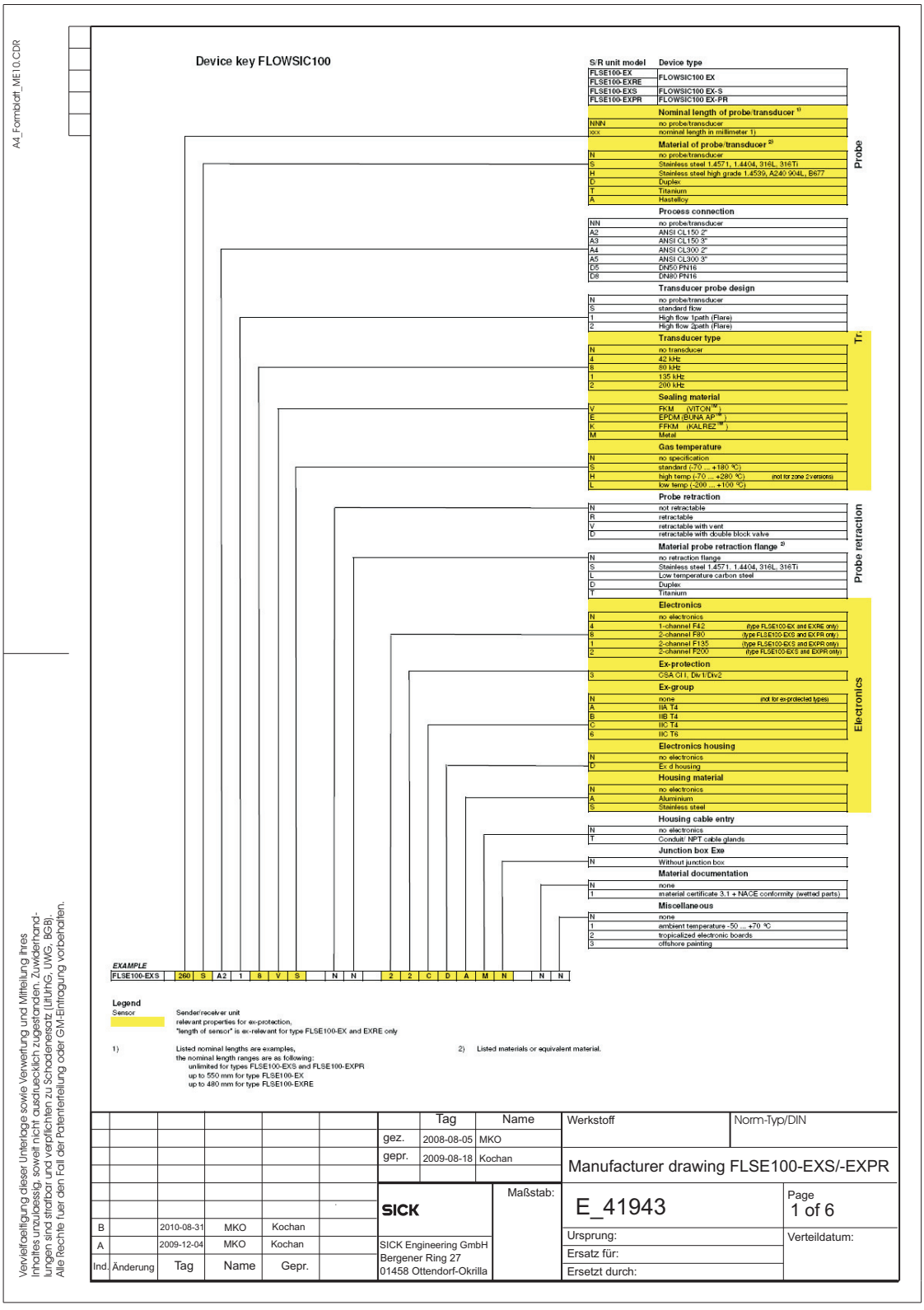


Fig. 201 Wiring diagram for FLSE100-EXS/FLSE100-EXPR

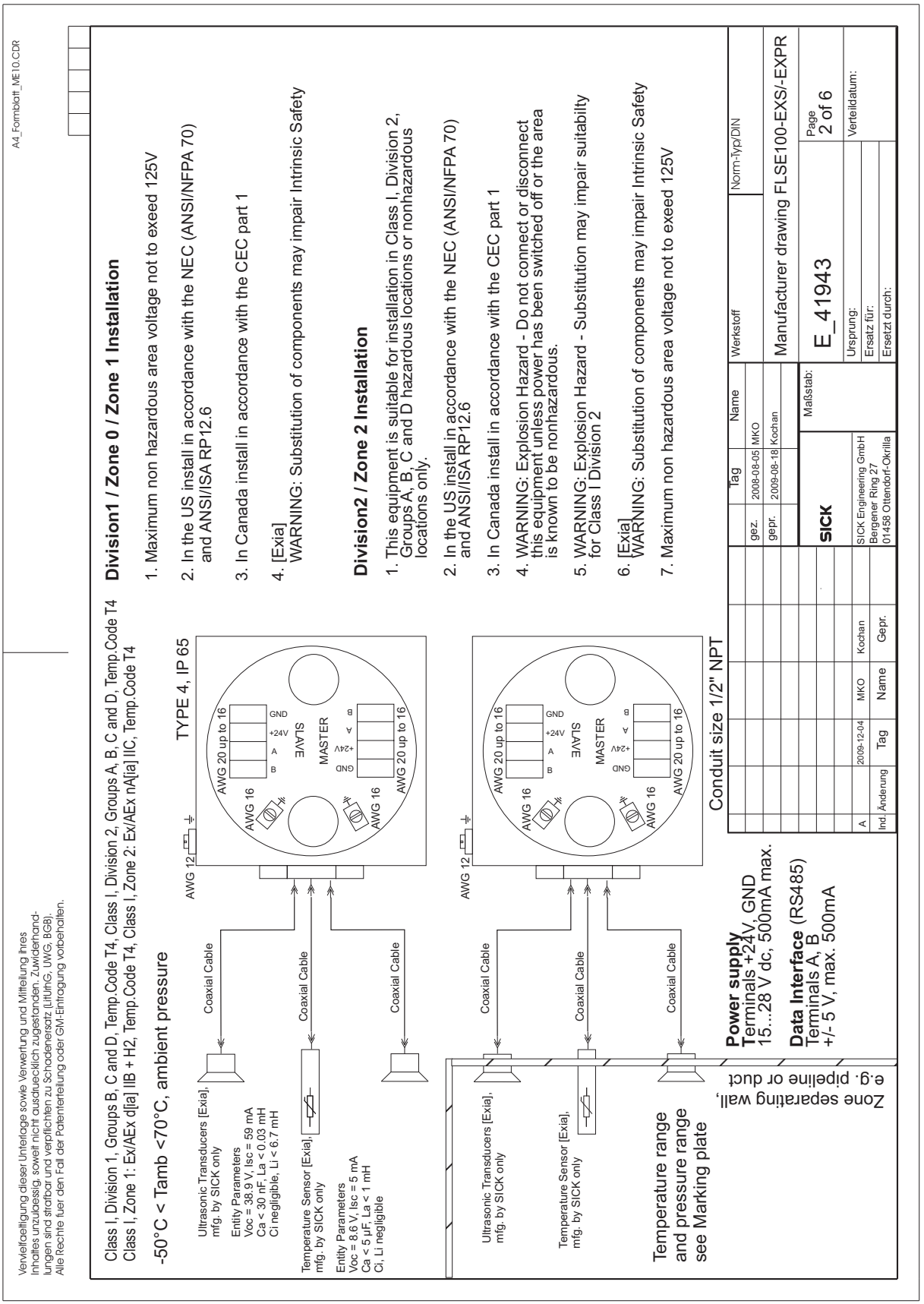


Fig. 202 Wiring diagram for FLSE100-EXS/FLSE100-EXPR

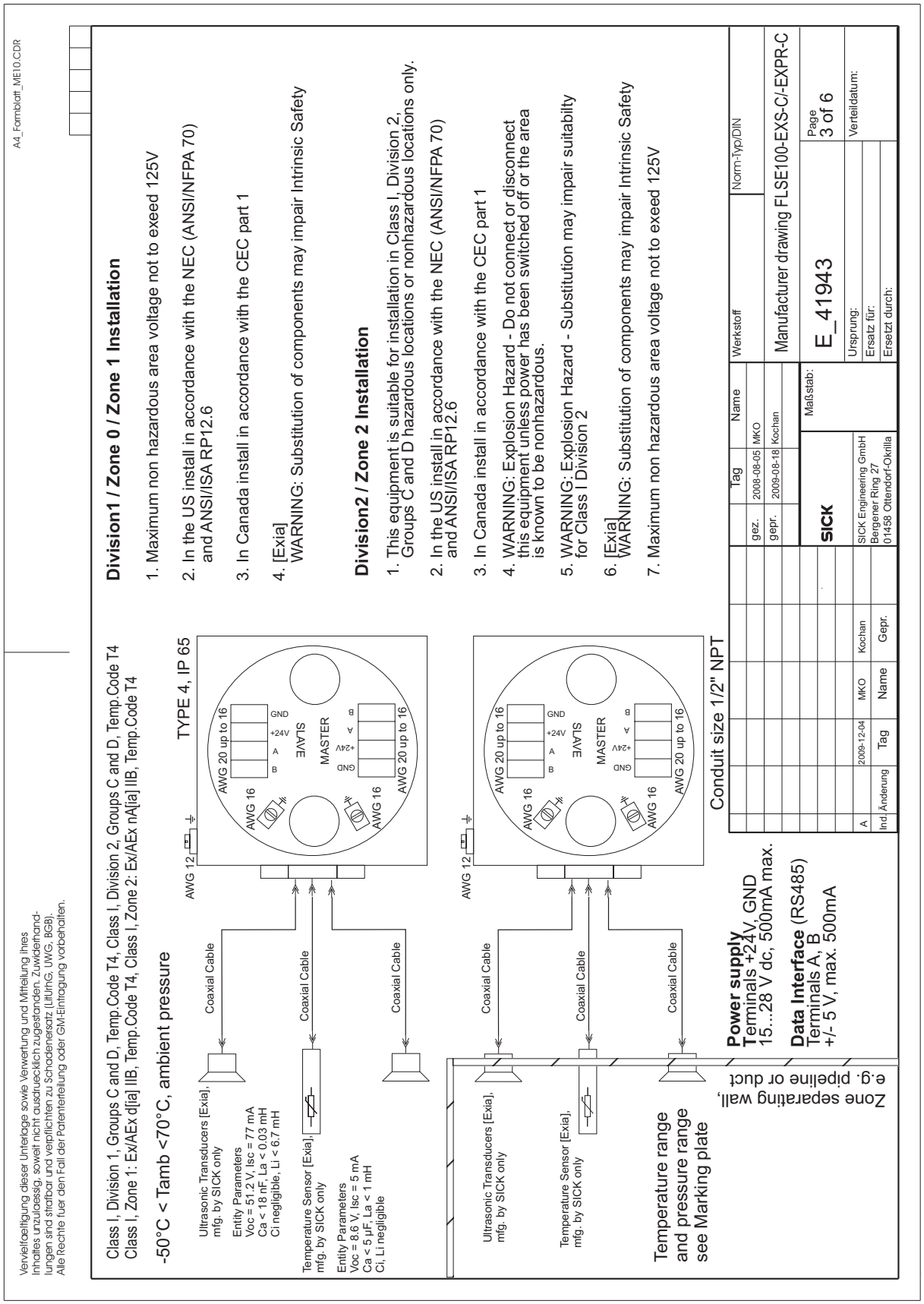


Fig. 203 Wiring diagram for FLSE100-EXS/FLSE100-EXPR

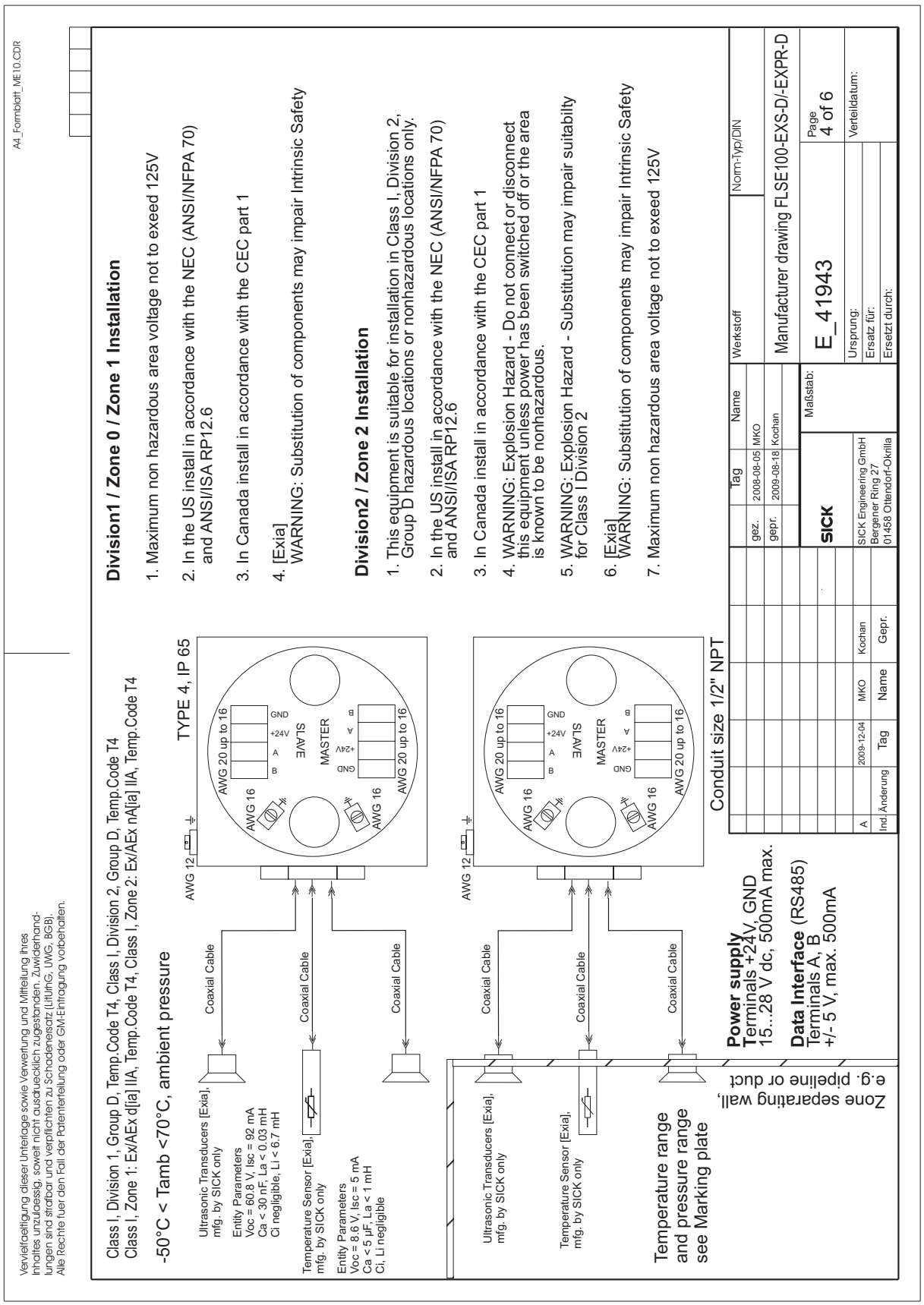
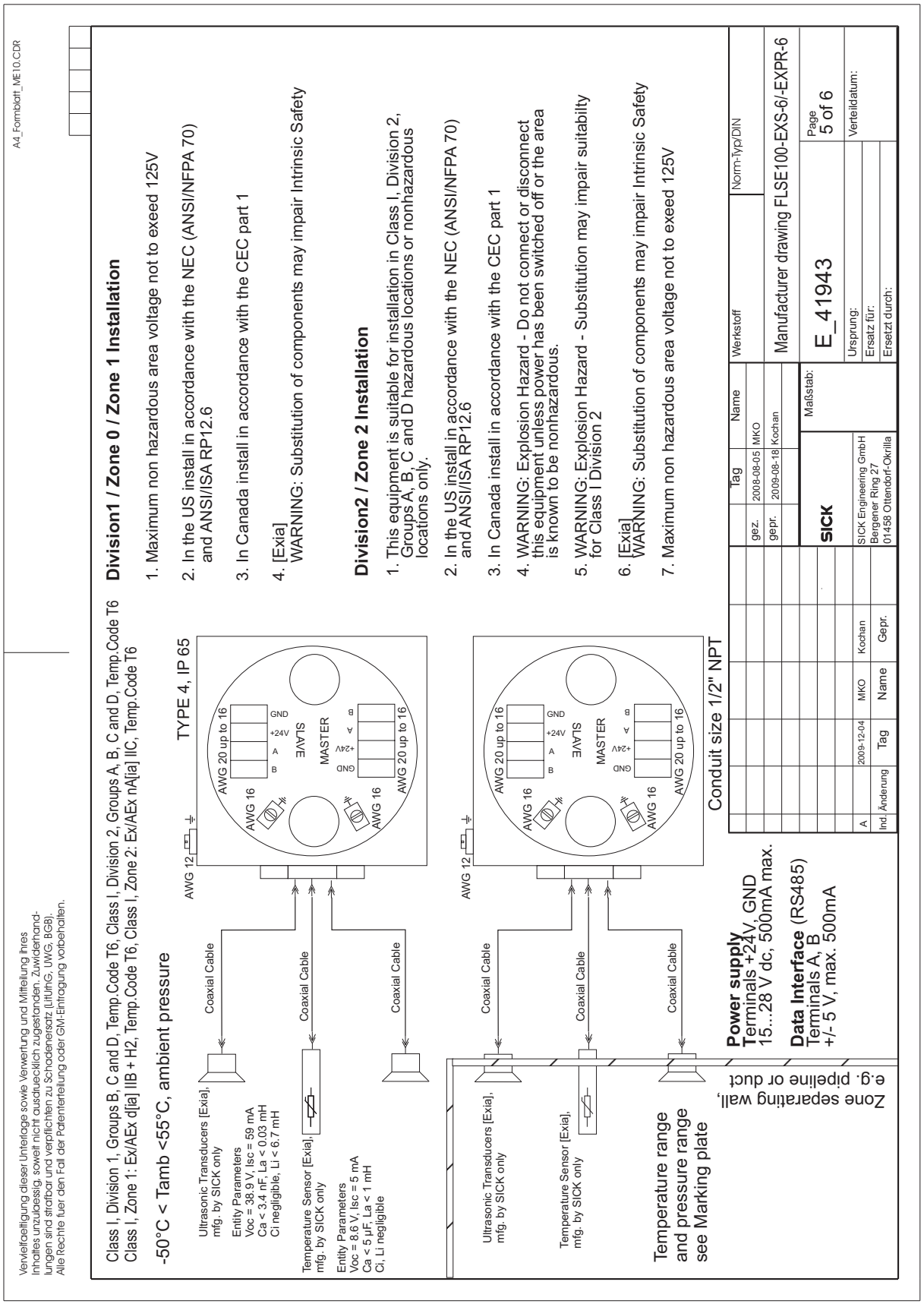


Fig. 204 Wiring diagram for FLSE100-EXS/FLSE100-EXPR



A4_Formblatt_ME10.CDR

Suitability of Materials *)

Medium**)	Ultrasonic transducer material			Sealing material in the retraction flange ***)		
	SS	Ti	HS	FKM Viton TM -40°C up to +180°C	EPDM Vistalon TM -50°C up to +100°	FFKM Kalrez TM -15°C up to +280°C
air / like air	+++	+++	+++	+++	+++	+++
HF	-	-	+++	++	-	+++
O_2	+++	+	+++	++	+	+++
water steam up to 100°C	+++	+++	+++	-	+++	+++
water steam up to 280°C	+++	+++	+++	-	-	+++
CH4 / natural gas	+++	+++	+++	+++	-	+++
sour gas	+	+++	+++	+	+++	+++
CO_2	+++	+++	+++	+++	+	+++
flare gas	+++	+++	+++	+++	+++	+++
Cl_2	+	-	+++	++	-	+++
H_2	+++	+	+++	+++	+++	+++
NH_4	+++	+++	+++	-	+++	+++

+++ very good ++ good + conditional good - not suitable

SS - stainless steel group 4 ; Ti - titanum grade2 / grade5 HS – hastelloy

*) For information only. Suitability have to be checked by the user
**) Rated gas temperature and MWP see marking plate
***) For retractable ultrasonic transducer only.
Indicated in the type code, see marking plate.
Leacking O-rings have to be changed by the SICK service only.

Ind.	Änderung	Tag	Name	Gepr.
B		2010-05-26	MKO	Kochan
A		2009-12-04	MKO	Kochan

	Tag	Name
gez.	2008-08-05	MKO
gepr.	2009-08-18	Kochan

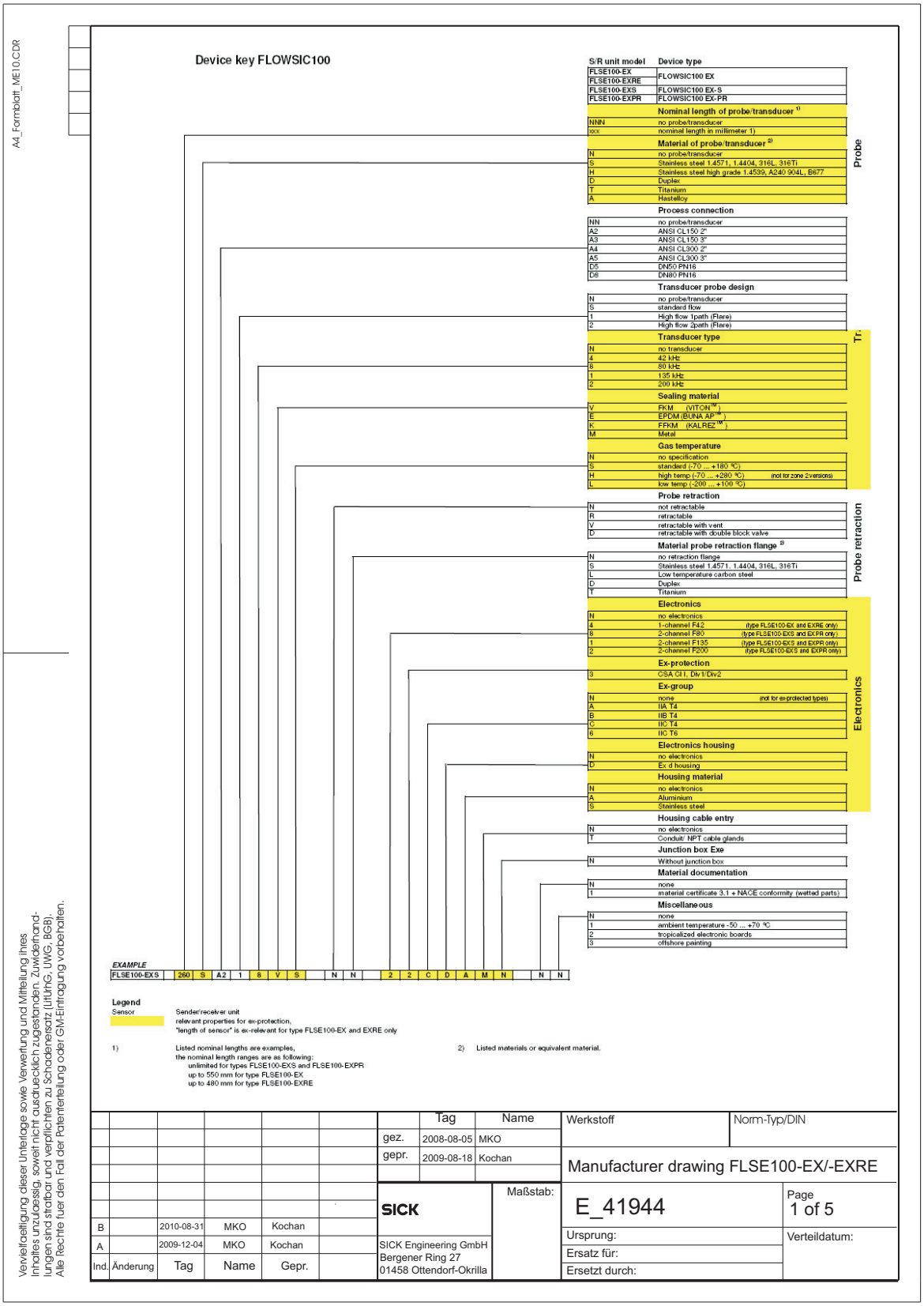
SICK
SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Maßstab:

Werkstoff	Norm-Typ/DIN
Manufacturer drawing FLSE100-EXS/-EXPR	
E_41943	Page 6 of 6
Ursprung:	Verteildatum:
Ersatz für:	
Ersetzt durch:	

6.10.2 FLSE100-EX/FLSE100-EXRE

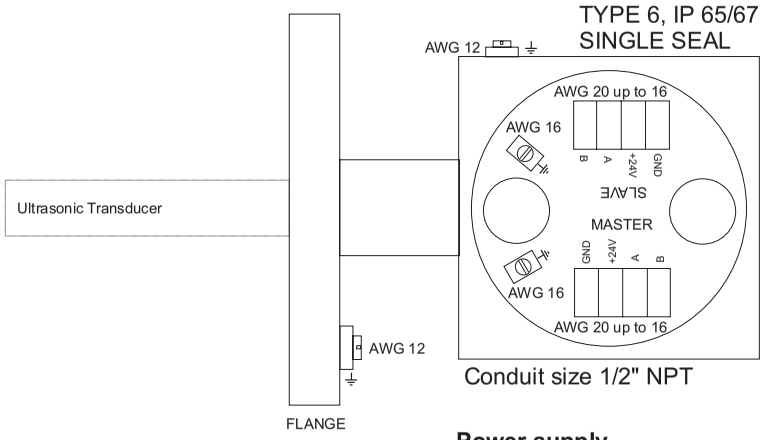
Fig. 206 Type key FLSE100-EX/FLSE100-EXRE



A4_Formblatt_ME10.CDR

Class I, Division 1, Groups B, C and D, Temp.Code T4, Class I, Division 2, Groups A, B, C and D, Temp.Code T4
Class I, Zone 1: Ex/AEx d IIB + H2, Temp.Code T4, Class I, Zone 2: Ex/AEx nA IIC, Temp.Code T4

-50°C < Tamb <70°C, ambient pressure



Power supply
Terminals +24V, GND
15...28 V dc, 500mA max.

Data Interface (RS485)
Terminals A, B
+/- 5 V, 500mA max.

Division1 / Zone 1 Installation

1. In the US install in accordance with the NEC (ANSI/NFPA 70)
2. In Canada install in accordance with the CEC part 1

Division2 / Zone 2 Installation

1. This equipment is suitable for installation in Class I, Division 2, Grouos A, B, C and D hazardous locations or nonhazardous locations only.
2. In the US install in accordance with the NEC (ANSI/NFPA 70)
3. In Canada install in accordance with the CEC part 1
4. WARNING: Explosion Hazard - Do not connect or disconnect this equipmentn unless power has been switched off or the area is known to be nonhazardous
5. WARNING: Explosion Hazard - Substitution may impair suitabilty for Class I Division 2

Ind.	Änderung	Tag	Name	Gepr.
B		2010-08-31	MKO	Kochan
A		2009-12-04	MKO	Kochan

	Tag	Name
gez.	2008-08-05	MKO
gepr.	2009-08-18	Kochan

SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Maßstab:

Werkstoff | Norm-Typ/DIN

Manufacturer Drawing FLSE100-EX/-RE

E_41944 | Page 2 of 5

Ursprung: | Verteildatum:

Ersatz für:

Ersetzt durch:

Fig. 208 Wiring diagram for FLSE100-EX/FLSE100-EXRE

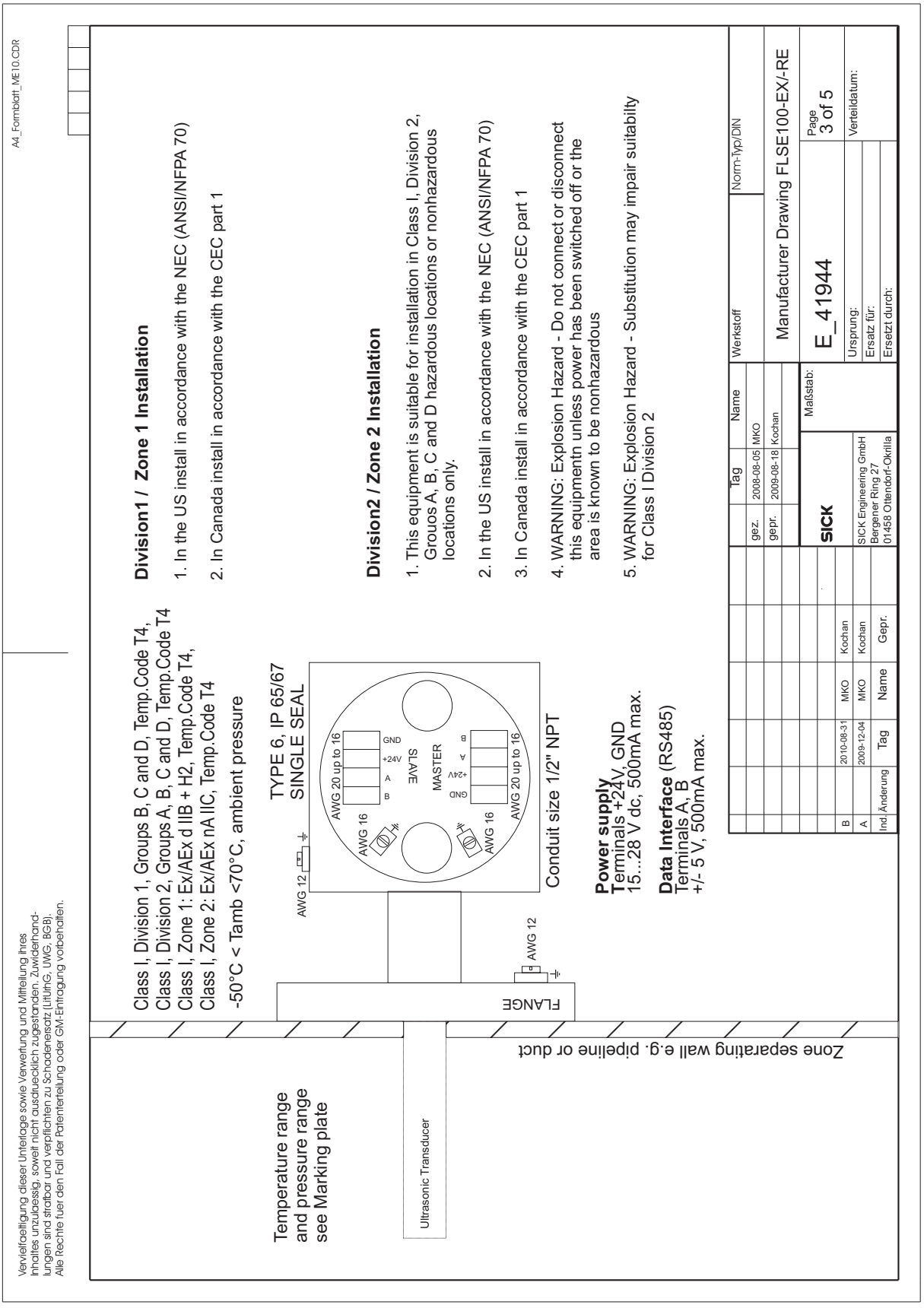
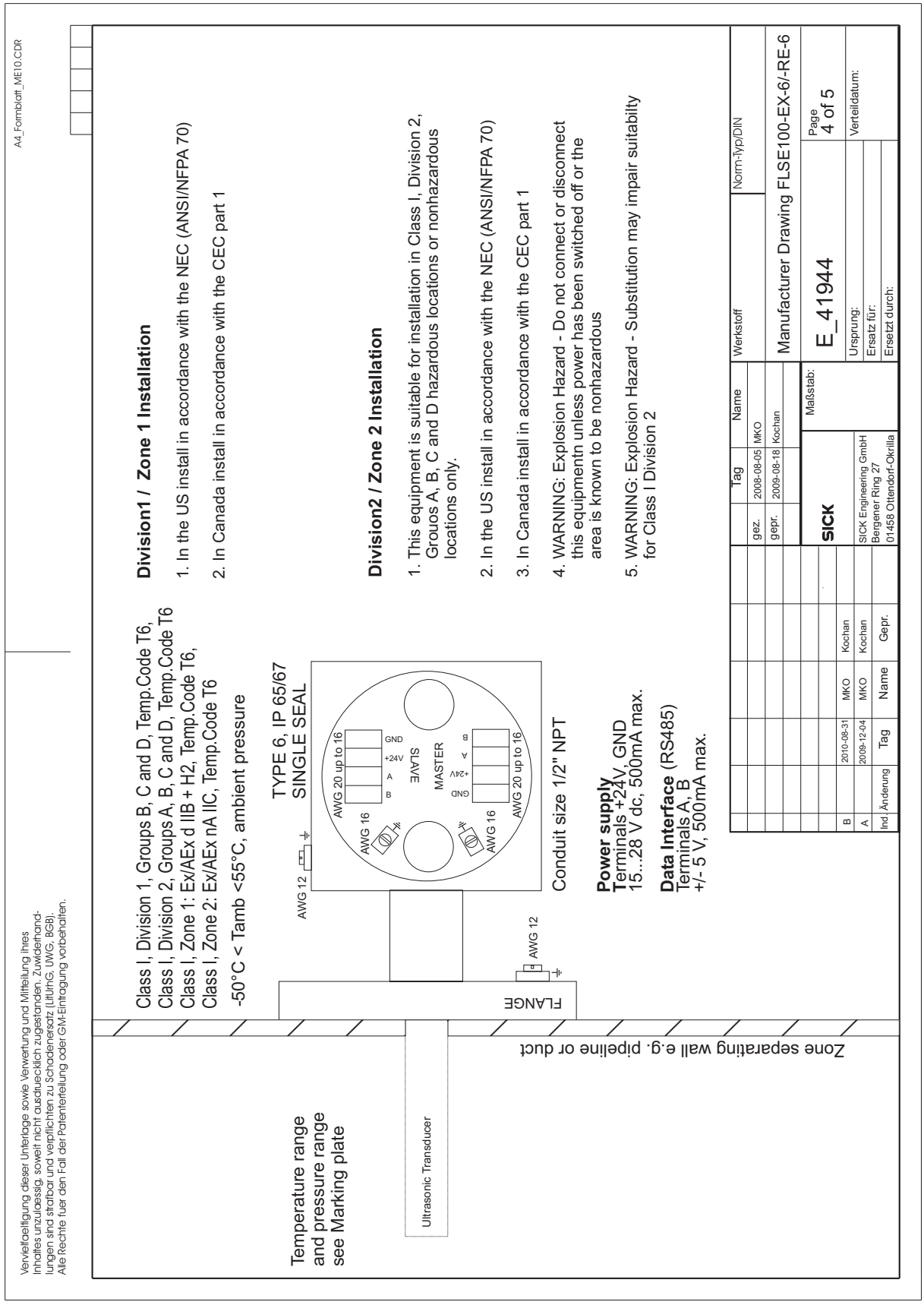


Fig. 209 Wiring diagram for FLSE100-EX/FLSE100-EXRE



A4_Formblatt_ME10.CDR

Suitability of Materials *)

Medium**)	Ultrasonic transducer material			Sealing material in the retraction flange ***)		
	SS	Ti	HS	FKM Viton TM -40°C up to +180°C	EPDM Vistalon TM -50°C up to +100°	FFKM Kalrez TM -15°C up to +280°C
air / like air	+++	+++	+++	+++	+++	+++
HF	-	-	+++	++	-	+++
O_2	+++	+	+++	++	+	+++
water steam up to 100°C	+++	+++	+++	-	+++	+++
water steam up to 280°C	+++	+++	+++	-	-	+++
CH4 / natural gas	+++	+++	+++	+++	-	+++
sour gas	+	+++	+++	+	+++	+++
CO_2	+++	+++	+++	+++	+	+++
flare gas	+++	+++	+++	+++	+++	+++
Cl_2	+	-	+++	++	-	+++
H_2	+++	+	+++	+++	+++	+++
NH_4	+++	+++	+++	-	+++	+++

+++ very good ++ good + conditional good - not suitable

SS - stainless steel group 4 ; Ti - titanum grade2 / grade5 HS – hastelloy

*) For information only. Suitability have to be checked by the user
**) Rated gas temperature and MWP see marking plate
***) For retractable ultrasonic transducer only.
Indicated in the type code, see marking plate.
Leacking O-rings have to be changed by the SICK service only.

Ind.	Änderung	Tag	Name	Gepr.
B		2010-05-26	MKO	Kochan
A		2009-12-04	MKO	Kochan

	Tag	Name
gez.	2008-08-05	MKO
gepr.	2009-08-18	Kochan

SICK
SICK Engineering GmbH
Bergener Ring 27
01458 Ottendorf-Okrilla

Maßstab:

Werkstoff | Norm-Typ/DIN

Manufacturer drawing FLSE100-EX/-EXRE

E_41944 | Page 5 of 5

Ursprung: | Verteildatum:

Ersatz für:

Ersetzt durch:

6.10.3 Connection of external pressure and temperature transmitters

Fig. 211 FLOWSIC100 Flare - loop powered pressure and temperature transmitters

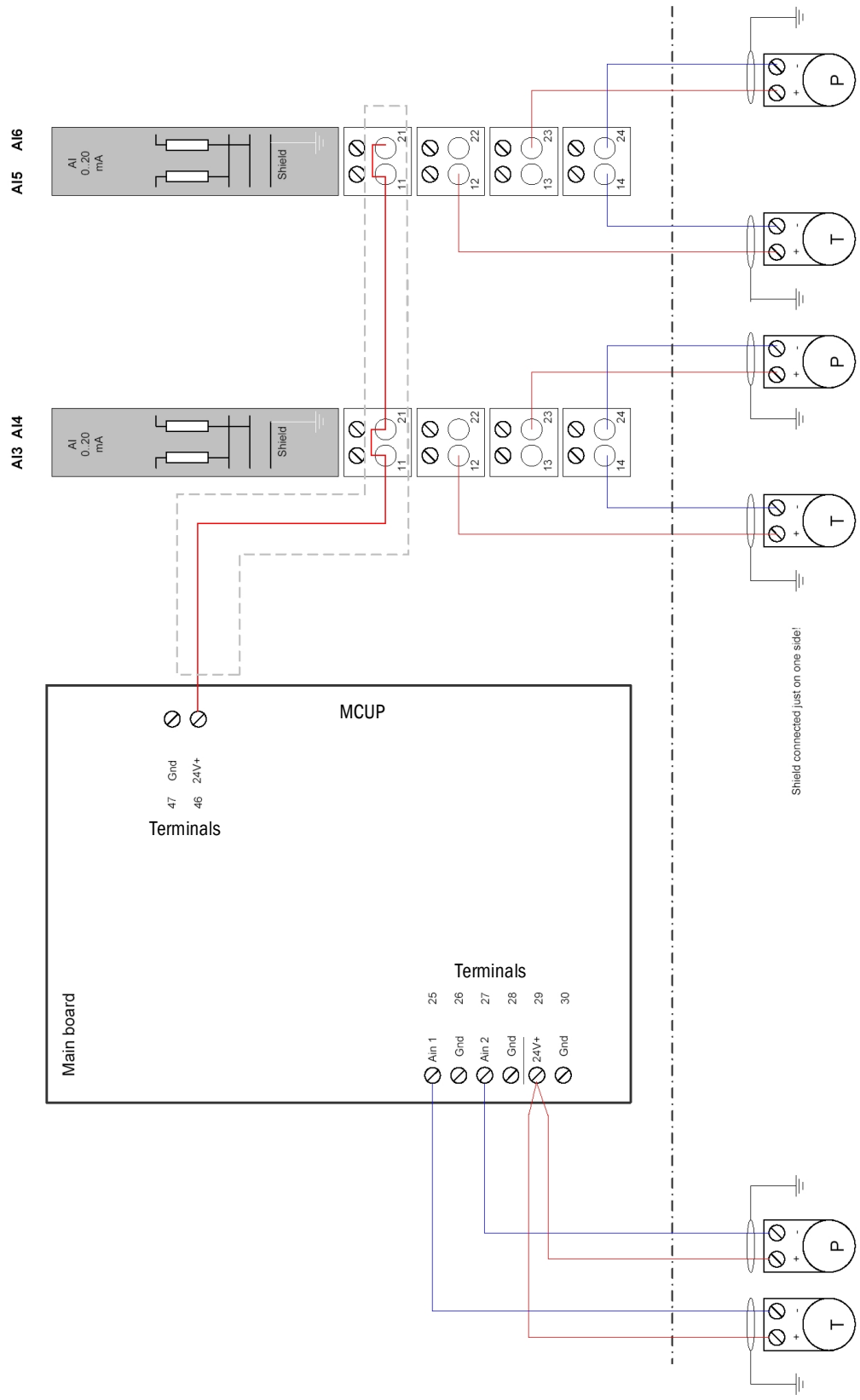
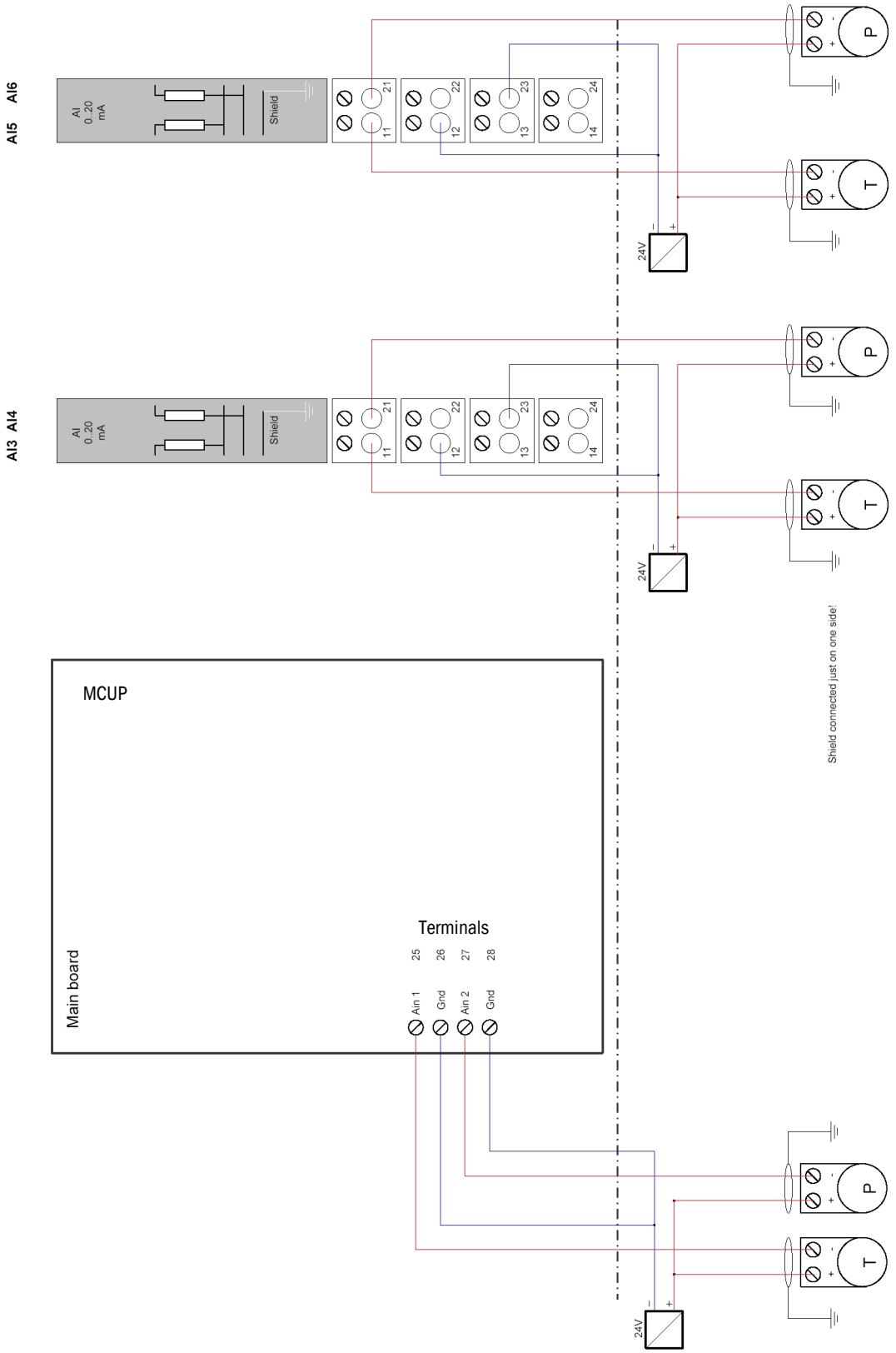


Fig. 212 FLOWSIC100 Flare - external powered pressure and temperature transmitters



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