

FLAWSIC100 PROCESS

Gas Velocity and Volume Flow Monitor for Pressure and Ex Applications



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Installation
Operation



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About This Document

These operating instructions describe the FLOWSIC100 measuring system, which is designed to perform no-contact measurements of the gas velocity and temperature, or the volumetric flow rate with the variants:

- a. Pressure-resistant variant
 - FLOWSIC100 PN16 / CL150
- b. Explosion-proof and pressure-resistant variant
 - FLOWSIC100 EX-Z2 (variant for zone 2)
 - FLOWSIC100 EX-Z2-RE (retractable variant for zone 2)
- c. Explosion-proof variant, lance version
 - FLOWSIC100 PR-EX-Z2 (variant for zone 2)

as process devices of the measuring system FLOWSIC100.

These operating instructions contain general information on the method of measurement used, the design and function of the entire system and its components, as well as instructions for planning, assembly, installation, commissioning, maintenance, and troubleshooting.

A comparison of the characteristics of the available system variants is provided to help you decide on the configuration that is best suited to your needs in the planning phase.

These operating instructions only cover standard applications that match the technical data listed. Your SICK representative will gladly provide you with additional information. For support for special applications, we strongly advise that you contact a SICK representative for consultation with regard to special applications.

Note: Always read these operating instructions carefully before commencing work. The safety instructions and warnings must be followed at all times.

Symbols used in this document

For quick access and reasons of clarity, important safety information is specially highlighted in these operating instructions. These symbols are provided at the points in this documentation where the relevant information is required.

Note: provides information on the features of the device or system, along with additional tips.



Important

indicates a risk of damage to the device or system components and potential functional impairments.



Warning

identifies potential danger for personnel, particularly due to electrical equipment or as a result of incorrect handling of the device or system components. These warnings are intended to protect you from (fatal) injuries.

Always read warnings carefully and follow them at all times!

1 Safety Instructions

1.1 Intended Use

The FLOWSIC100 measuring system was designed for contactless measurement of gas velocity and temperature or volume flow. It must only be used in the manner intended by the manufacturer. In particular, it is important that:

- The system is operated in accordance with the technical data and specifications regarding assembly, connection, ambient, and operating conditions (see the documentation supplied, the order documents, device documents, and rating plates)
- All of the measures required to maintain the device, e.g. maintenance and inspection, transport and storage, are adhered to.
- The sender/receiver units of the variants FLOWSIC100 EX-Z2, FLOWSIC100 EX-Z2-RE and FLOWSIC100 PR-EX-Z2 have the II ATEX II 3G EEx nA e IIC T6 classification and type of protection. They are approved for use for gases in Zone 2.
- The selected material is basically suitable for the respective gas composition.
- Stainless steel probe may only be used in non-aggressive and dry gases
- The maximum gas temperature permitted for all sender/receiver units is 260 °C.



Warning

This value may not be exceeded even for a short period of time!



Warning

The measuring system must only be used within the pressure- and temperature ranges specified in these Operating Instructions. Additionally the choice of materials must guarantee resistance against process gases.

1.2 Authorized Personnel

Those responsible for personal safety must ensure that:

- All work on the measuring system is carried out by qualified personnel and checked by the experts responsible.
These persons must be qualified by virtue of their expertise (training, education, experience) or understanding of the relevant standards, specifications, accident prevention regulations, and properties of the system. It is crucial that these persons be able to identify and avoid potential hazards in good time.
Technical experts are those persons defined in DIN VDE 0105, or IEC 364, or directly equivalent standards.
- These persons must be familiar with the hazards posed during operation, such as those caused by hot, toxic, explosive, or pressurized gases, gas/liquid mixtures, or other media, and must have received special training on how to operate the measuring system.
- Cabling/installation in hazardous areas may only be carried out by trained personnel and in accordance with the installation conditions in EN 60079-14 or comparable national regulations.

1.3 General Safety Information and Protection Measures

1.3.1 General Notes

Handling or using the device incorrectly can result in personal injury or material damage. Read this chapter carefully and ensure that you observe the safety precautions for the FLOWSIC100 at all times. Always observe the warnings provided in these operating instructions.

The following applies at all times:

- The relevant legal stipulations and associated technical regulations must be observed when preparing and carrying out work on the installation.
- Extreme caution must be exercised in installations that are potentially hazardous (pressure pipes, installations with explosive atmospheres). The applicable special regulations must be followed at all times.
- All work must be carried out in accordance with the local, system-specific conditions and with due consideration paid to the operating dangers and specifications.
- The operating instructions for the measuring system and plant documentation must be available on site. The instructions for preventing danger and damage contained in these documents must be observed at all times.
- Suitable safety equipment and personal protection measures must be available in accordance with the potential hazard and must be used by the personnel.

1.3.2 Danger from Electrical Equipment

The FLOW SIC100 PROCESS measuring system is an item of electrical equipment designed for use in industrial power installations. When working on power connections or on live components, make sure that the power supply is switched off. If necessary, replace shock protection measures before reconnecting the power supply.

1.3.3 Danger due to Hot, Corrosive, or Pressurized Gases

The sender/receiver units are mounted directly on the gas-carrying duct. In installations with a low hazard potential (no risk of injury, ambient pressure, low temperatures, no risk of explosion), these units can be installed and removed while the installation is in operation, provided that the applicable specifications and safety regulations for the installation are adhered to and all necessary and suitable protective measures are taken.



Warning

Installations with toxic gases, high pressure, or high temperatures, must be shut down before the sender/receiver units are installed or removed. In hazardous areas the applicable statutory provisions and security regulations for the installation must be observed.

1.3.4 Detecting Malfunctions

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

- Significant drifts in the measurement results,
- Increased power consumption,
- A rise in system component temperature,
- Triggering of monitoring devices,
- Smoke or unusual odors.

1.3.5 Preventing Damages

To prevent personal injury or damage to the system, the operator must ensure that:

- The maintenance personnel responsible can reach the site immediately, and at any time,
- The maintenance personnel is sufficiently qualified to respond to malfunctions on the FLOW SIC100 PROCESS and any resulting malfunctions,
- The defective equipment can be switched off immediately if necessary,
- Switching off equipment does not indirectly cause further malfunctions.

1.4 Transport Protection of retractable Sender/Receiver Units

The sender/receiver units type FLSE100 EX-Z2-RE have to be secured before every transportation according to **Fig. 1.1** to prevent damages in transit.

- ▶ The transducer must be positioned inside the connection piece.
- ▶ The probe tube with transducer must be secured with cotter pins.

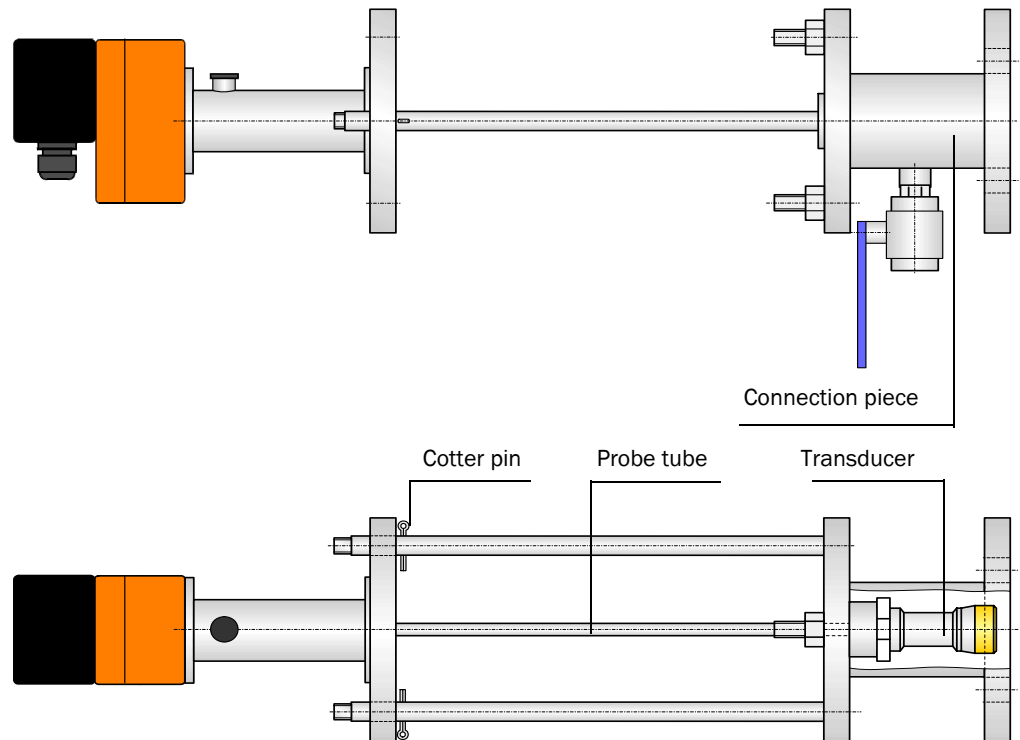


Abb. 1.1: Transport protection of retractable sender/receiver units

Gas Velocity Monitor

FLAWSIC100 PROCESS

Gas Velocity Monitor

Product Description

Features and Applications

System Overview and Operating Principle

System Components

Calculations

Check Cycle

Technical Data

Dimensions



2 Product Description

2.1 Features and Applications

The FLOWSIC100 PROCESS measuring system conducts simultaneous measurements of the gas velocity and temperature. The volumetric flow under actual conditions can be calculated from the gas velocity and output. By including the gas temperature and internal pressure inside the duct, the volumetric flow under standard conditions can be calculated.

Features and benefits

- Modular design
By selecting the right modules, you can combine the components to suit your application and fulfill a wide range of requirements. As a result, the measuring system can be used for very many applications.
- Integrated measurement of the gas velocity across the duct diameter, independent of the pressure, temperature, and gas composition
- Digital processing of the measurement values ensures high accuracy and low susceptibility to interference
- Self-test by means of automatic check cycle
- No pressure-reducing fittings in the gas flow, which ensures that the gas flow is not disrupted
- Easy to install
- Low wear and tear by selecting the most suitable modules for the application
- Minimum maintenance requirements

Applications

The measuring devices in the FLOWSIC100 PROCESS series can be used to measure gas flows in pipelines for controlling and regulation in process control engineering.

The system is for example suitable for use in the following areas:

- Process control engineering
 - Chemical industry
 - Drying and processing installations in the pharmaceutical, food, and foodstuffs industries
 - Heat treatment and extraction plants used in plastics processing
- Operating measurements in
 - Utilities industry: power station and industrial boilers for all utilities
 - Waste disposal: waste and residual waste incineration plants
 - Basic industries: installations in the cement and steel industry
- Flow measurements in ventilation, heating, and air-conditioning systems in both industry and agriculture

Certification

- The sender/receiver units of the variants FLOWSIC100 EX-Z2, FLOWSIC100 EX-Z2-RE and FLOWSIC100 PR-EX-Z2 have the ATEX II 3G EEx nA e IIC T4 classification and type of protection. They are approved for use for gases in Zone 2.
- The standard version of the control unit MCU is not ex-protected and has to be installed and operated outside of hazardous areas.
- A 24 V-version of the control unit MCU is optionally available for the operation in gases Ex Zone 2. It has the classification ATEX II 3G EEx nA nC IIC T4.

2.2 System Overview and Operating Principle

2.2.1 System Overview

The measuring system comprises the following components:

- FLSE100 sender/receiver unit
for transmitting and receiving ultrasonic pulses, signal processing and controlling the system functions
- Connection piece or mounting kit
for mounting the sender/receiver units on the gas duct
- MCU control unit
for control, evaluation and output of the data of max. 8 sensors connected via RS485 interface
- Connection cables (FLOWSIC100 PN16/CL150 only)
for analog/digital signal transmission between master sender/receiver unit and control unit
- Connection box (FLOWSIC100 PN16/CL150 only)
for connecting the connection cables
- Measuring pipe option
Pipe piece with flanges, preassembled for mounting in an existing pipe; with flanges with pipe for fitting the sender/receiver units

Component \ Device Type	PN16 / CL150	EX-Z2	EX-Z2-RE	PR-EX-Z2
FLSE100 sender/receiver unit	PN16 / CL150 probe A	EXZ2 probe A	EXZ2RE probe A	PREXZ2
	PN16 / CL150 probe B	EXZ2 probe B	EXZ2RE probe B	
Mounting part	Connection piece PN16 DN50LTGS260 or CL150 2ZLTCS260		Mounting kit PN16 DN50LTCS380 RE or CL150 2ZLTCS380 RE	SICK flange K100
Control unit	MCU, MCU (24 V d.c.)	MCU, MCU (24 V d.c.), MCU Zone 2, 24 V d.c.)		
Connection cable	Connect. cable Master, Connect. cable Slave	—		
Connection box	x	— ³⁾		

¹⁾: Installation outside of hazardous area (installation MCU EX-Z2 in Zone 2 possible)

²⁾: Connection cables for ex-protected device variants have to be provided by customer (not included in scope of supply); cable specification see Section 3.4.1).

³⁾: For bus cabling (2-path-measurement) one connection box approved for use in hazardous areas can be provided by SICK.

Gas Velocity Monitor

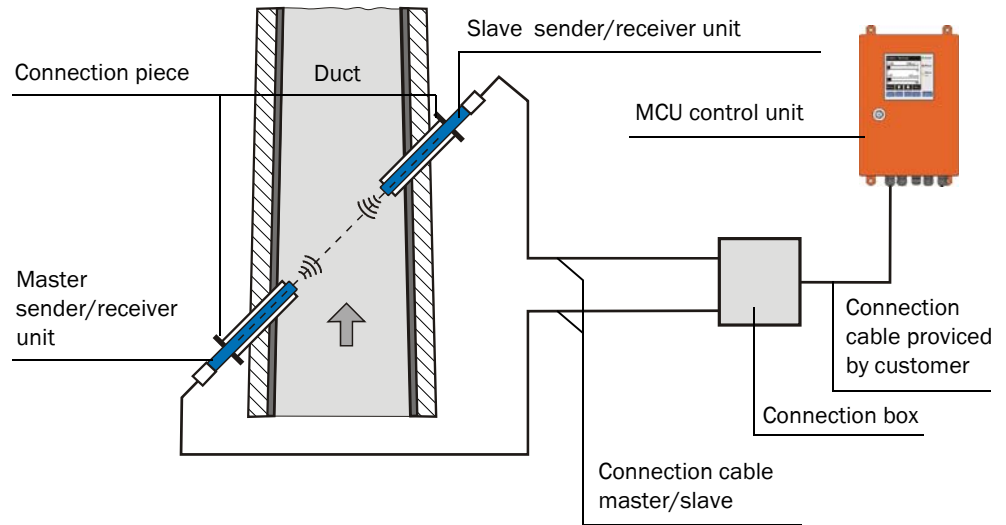


Fig. 2.1: System overview not ex-protected variants (FLAWSIC100 PN16/CL150)

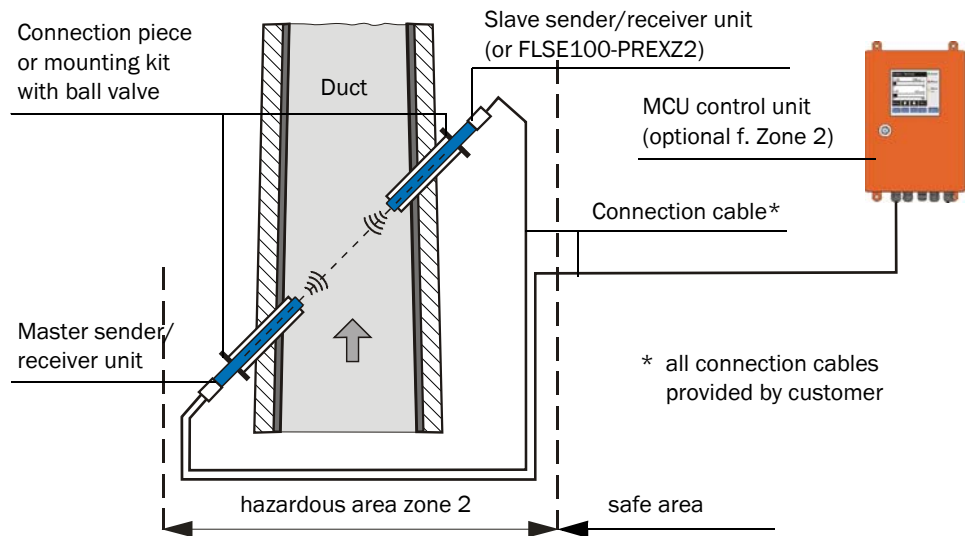


Fig. 2.2: System overview ex-protected variants

2.2.2 Communication between Sender/Receiver Units and Control Unit

Standard Version

The two sender/receiver units work as master and slave. The master-FLSE has a second interface to be able to separate the communication on the slave-FLSE and on the MCU well defined. The master triggers also the slave and controls the measurement regime. The MCU can demand the measured values from the master units independently of the trigger cycle (asynchronous).

For the cabling for type FLOW SIC100 PN16/CL150 (not ex-protected), the connection box in which the distribution of the interfaces takes place, has to be installed at the master-FLSE. For the ex-protected variants the distribution of the interfaces takes place in the terminal room of the master-FLSE100.

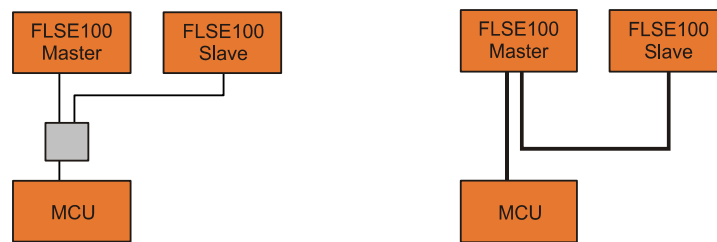


Fig. 2.3: Standard versions: Not ex-protected (fig. left) and ex-protected (fig. right)

Bus version with two connected FLOW SIC100 PROCESS (2-path-measurement)

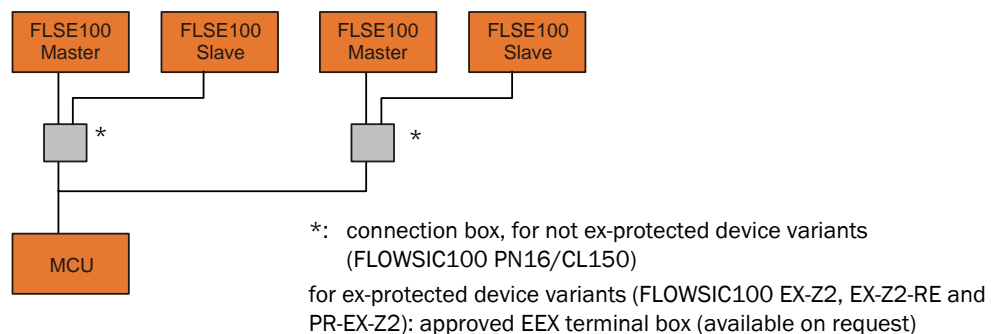


Fig. 2.4: Bus connection FLSE100 - MCU

With the bus version, two autarkic measuring paths (2 x 2 FLSE100) can be connected to a control unit for a 2-path-measurement. The MCU calculates the measurement values from both measuring paths.

Notes Other sensor types (e.g. sensors for dust measurement) can be connected to the MCU too.

2.2.3 Operating Principle

The FLAWSIC100 PROCESS gas velocity monitors operate by measuring the transit delay of an ultrasonic pulse. Sender/receiver units are mounted on both sides of a duct/pipeline at a certain angle to the gas flow (Fig. 2.5).

These sender/receiver units contain piezoelectric ultrasonic transducers that function alternately as senders and receivers. The sound pulses are emitted at an angle α to the flow direction of the gas. Depending on the angle α and the gas velocity v , the transit time of the respective sound direction varies as a result of certain "acceleration and braking effects" (formulas 2.1 and 2.2). The difference in the transit times of the sound pulses is greater the higher the gas velocity and the smaller the angle to the flow direction.

The gas velocity v is calculated from the difference between both transit times, independent of the sound velocity. Changes in the sound velocity caused by pressure or temperature fluctuations, therefore, do not affect the calculated gas velocity with this method of measurement.

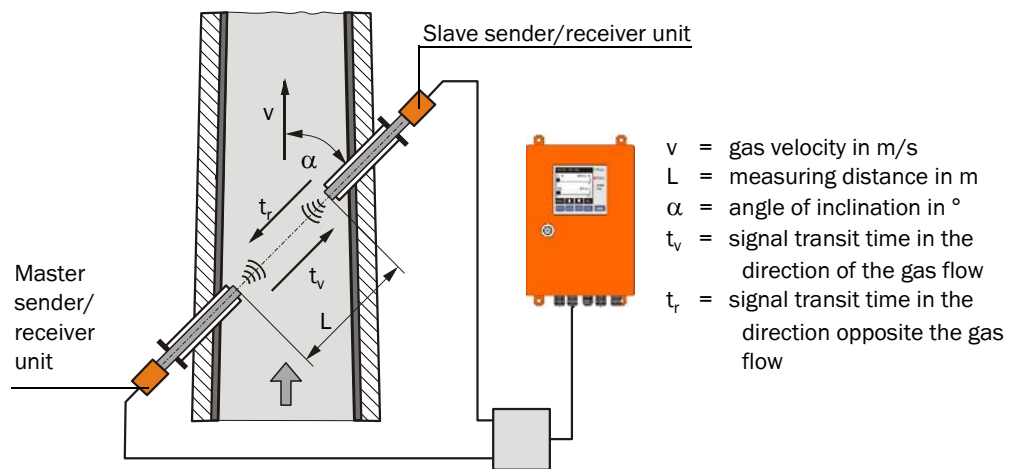


Fig. 2.5: Operating principle of the FLAWSIC100 PROCESS

Calculating the gas velocity

The measuring path L is equal to the active measuring distance, that is, the area through which the gas flows. Given the measuring path L , sound velocity c , and the angle of inclination α between the sound and flow direction, the sound transit time when the signal is transmitted in the direction of the gas flow (forward direction) can be expressed as:

$$t_v = \frac{L}{c + v \cdot \cos \alpha} \tag{2.1}$$

Against the gas flow (backward direction):

$$t_r = \frac{L}{c - v \cdot \cos \alpha} \tag{2.2}$$

After the resolution to v :

$$v = \frac{L}{2 \cdot \cos \alpha} \cdot \left(\frac{1}{t_v} - \frac{1}{t_r} \right) \tag{2.3}$$

Apart from the two measured transit times, this relationship only contains the active measuring distance and the angle of inclination as constants.

Speed of Sound

The speed of sound c can be calculated by rearranging formulas 2.1 and 2.2.

$$c = \frac{L}{2} \cdot \left(\frac{t_v + t_r}{t_v \cdot t_r} \right) \quad (2.4)$$

Based on the dependencies in formulas 2.5 and 2.7, the speed of sound can be used to determine the gas temperature, and for diagnosis purposes.

$$c = c_0 \cdot \sqrt{1 + \frac{\vartheta}{273^\circ\text{C}}} \quad (2.5)$$

Calculating the gas temperature

Since the speed of sound is dependent on the temperature, the gas temperature can also be calculated from the transit times (by rearranging formulas 2.4 and 2.5 to derive J).

$$\vartheta = 273^\circ\text{C} \cdot \left(\frac{L^2}{4 \cdot c_0^2} \cdot \left(\frac{t_v + t_r}{t_v \cdot t_r} \right)^2 - 1 \right) \quad (2.6)$$

Formula 2.6 shows that, in addition to the measured transit times, the square of the values of L and the standard velocity are included in the calculation.

Note This means that a **precise** temperature measurement is only possible if the measurement path L is measured extremely accurately, the gas composition is **constant**, and a calibration has been carried out (see Section 4.3.2).

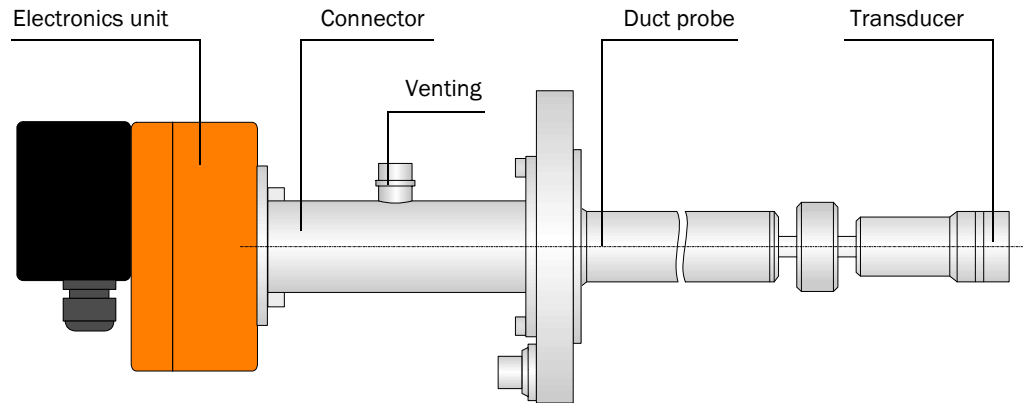
Determining the volumetric flow

The volumetric flow under actual conditions is calculated using the geometric constants of the duct. The process parameters "pressure", "temperature", and "humidity content" are required to calculate the volumetric flow under standard conditions. A more detailed description is provided in Section 2.4..

2.3 System Components

2.3.1 FLSE100 Sender/Receiver Unit

The sender/receiver unit consists of the electronics, connector, duct probe, and transducer modules. These modules are available in different versions that can be combined on the basis of the relevant application data to produce the optimum configuration for the application in question.



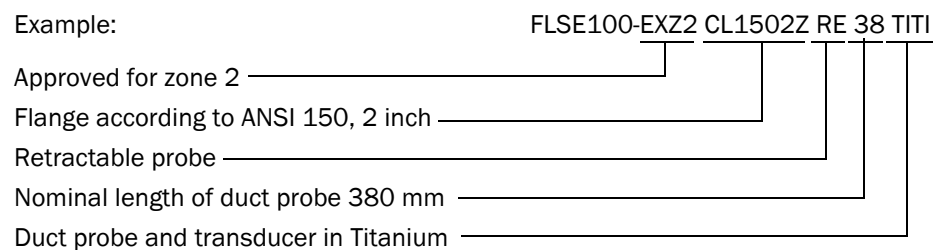
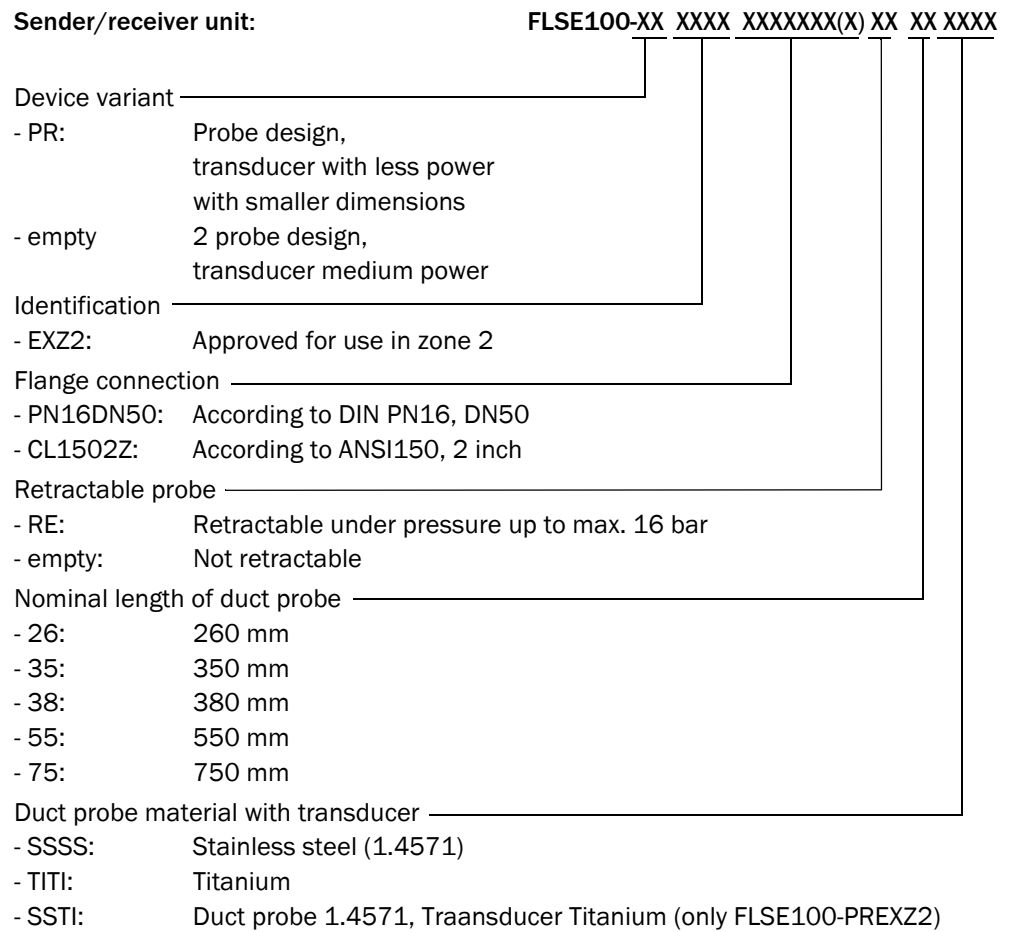
Flange design	D	k
C50 ND16 DIN 2527 1.4571	165	125
ANSI B16.5 CLASS 150 2"	152,4	120,7

Fig. 2.6: Schematic diagram with modules of the sender/receiver unit

The modules are selected on the basis of the following criteria:

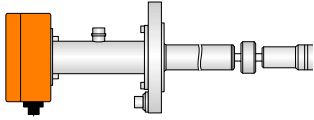
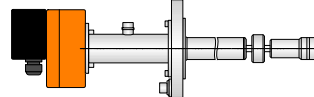
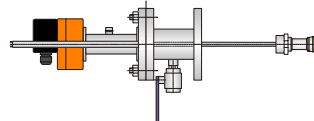
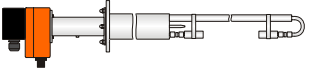
- Gas temperature / Ex approval
TDevice variants for Zone 2 up to max. 260 °C. Further selection according to Ex-protection requirements and pressure levels.
- Gas composition (corrosive / not corrosive)
The material for duct probe and transducers are selected on the basis of their resistance to corrosion (probe/transducer made from stainless steel / titanium)
- Wall and insulation thickness of the gas duct
The probe type PR-EX-Z2 with the nominal lengths 350,550,750 mm
Pressure and Ex-variants for max. 25.4 mm (1 inch) wall thickness
- Assembly type
On two sides, each with a sender/receiver unit at the opposite duct walls, or on one side with one sender/receiver unit (single-probe version)
- Flange size
Connection PN16 DN50 or CL150 2 inch (others on request) with probe version FLOWSIC100 PR-EX-Z2 with flange connection SICK K100
- Internal duct pressure
Probe type PR-EX-Z2 up to overpressure 100 mbar
All pressure resistant variants up to max. 16 bar.

The various configuration options are identified by a type key, which is structured as follows:



The possible versions, areas of application, configurations, and characteristics are listed in the following tables.

Basic versions

Type FLSE100	Description	Number of FLSE100 per system
PN16/CL150 	<ul style="list-style-type: none"> pressure-resistant variant, flange connection DIN PN16DN50 or ANSI CL150 2" 	2
EXZ2 PN16DN50 EXZ2 CL150Z2 	<ul style="list-style-type: none"> pressure-resistant variant, flange connection DIN PN16DN50 or ANSI CL150 2" Ex-protected for Zone 2 according to guideline 94/9/EG (ATEX) 	2
EXZ2 PN16DN50 RE EXZ2 CL150Z2 RE 	<ul style="list-style-type: none"> pressure-resistant variant, flange connection DIN PN16DN50 or ANSI CL150 2" Ex-protected for Zone 2 according to guideline 94/9/EG (ATEX) retractable 	2
PR EXZ2 	<ul style="list-style-type: none"> pressure up to 0.1 bar with 2 transducers small scale and high frequency probe version for one-side assembly Ex-protected for Zone 2 according to guideline 94/9/EG (ATEX) 	1

Application range

Type FLSE100	Probe with transducer material	Nominal length [mm]	Max. gas temperature [°C]	Active meas. distance * [m]	Channel / duct diameter [m]
PN16/CL150	complete SS	260	260 °C	0.2 - 2	0.15 - 1.7
EXZ2	complete SS				
EXZ2RE	or TI	380			
PREXZ2	Probe SS, transducer TI	350, 550, 750		0.27 - 0.28	>0.4

*: The maximum possible measuring distance depends on the gas temperature, and gas composition.

The maximum length of the cable between sender/receiver unit and MCU is 1000 m.

2.3.1.1 Sender/Receiver Unit FLSE100-PN16 / LCL150 (pressure-resistant variant)

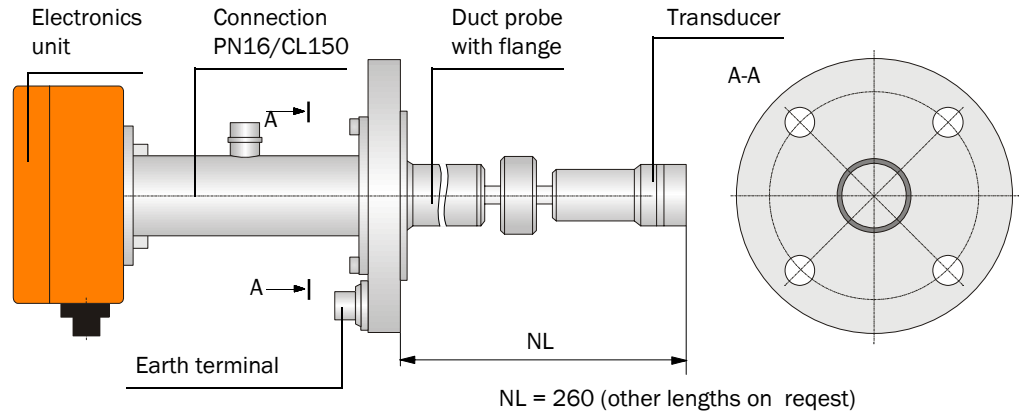


Fig. 2.7: Sender/receiver unit FLSE100-PN16/CL150

2.3.1.2 Sender/receiver units FLSE100-EXZ2 (pressure-resistant variant for Ex Zone 2)

The individual modules are connected to each other in the works to form a permanent connection that fulfils the hazardous location classification and is not to be dismantled.

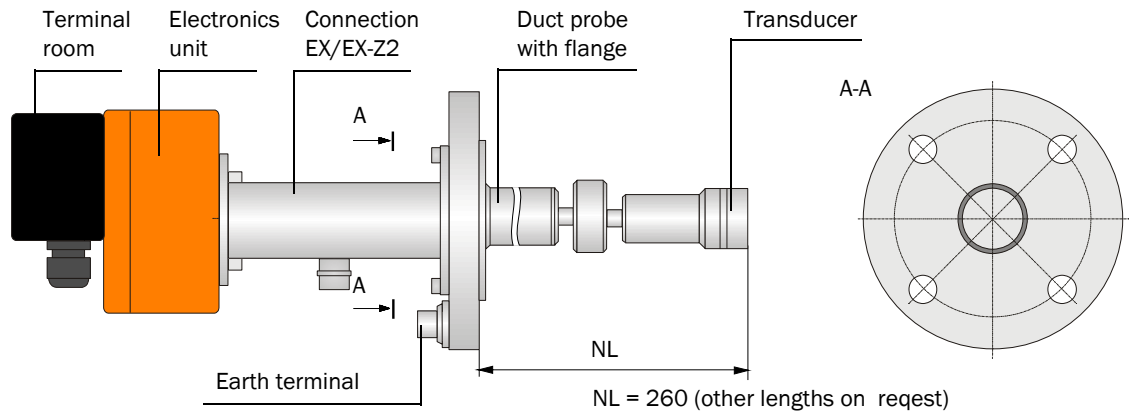


Fig. 2.8: Sender/receiver unit FLSE100-EXZ2

On request the duct probes are available in different variants (alternative flanges, nominal length, material). To fit the sender/receiver units on the duct, connection pieces are used as shown in Fig. 2.13.

The permitted gas pressure and temperature range is shown in the following diagram.

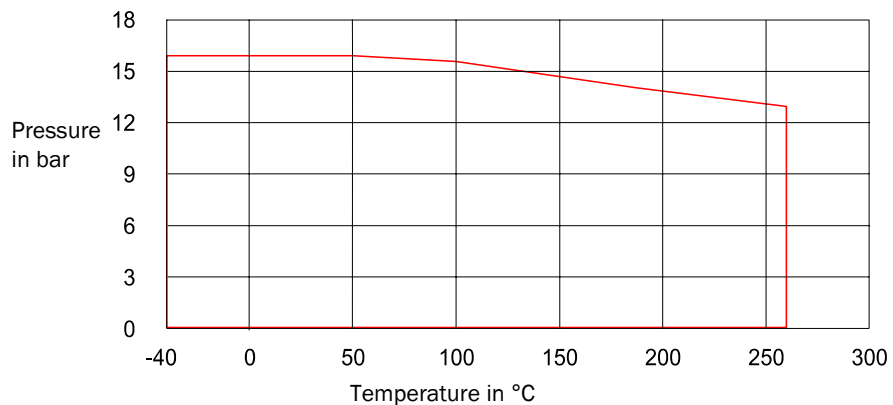


Fig. 2.9: Maximum permitted operational parameters

2.3.1.3 Sender/Receiver Units FLSE100-EXZ2RE (Pressure-resistant and Retractable Variant for Ex Zone 2)

Unlike FLOWSIC100-EXZ2 this sender/receiver unit can be assembled or disassembled while the plant is under regular operation. It is installed at the duct via mounting kit with ball valve and gland (see Fig. 2.14).

The maximum possible wall thickness for the installation of the sender/receiver unit is 25.4 mm (1 inch).

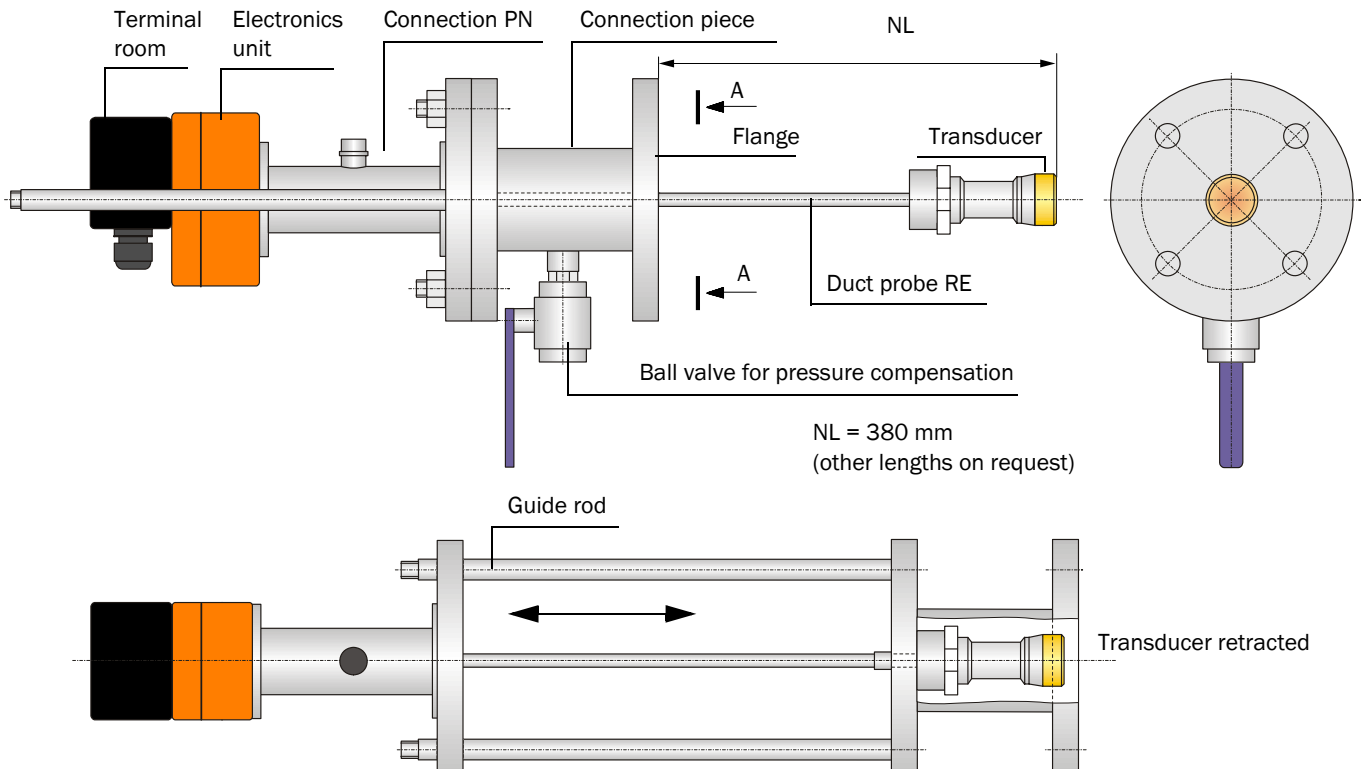


Fig. 2.10: Sender/receiver unit FLSE100-EXZ2RE

The permitted gas pressure and temperature range is shown in the following diagram.

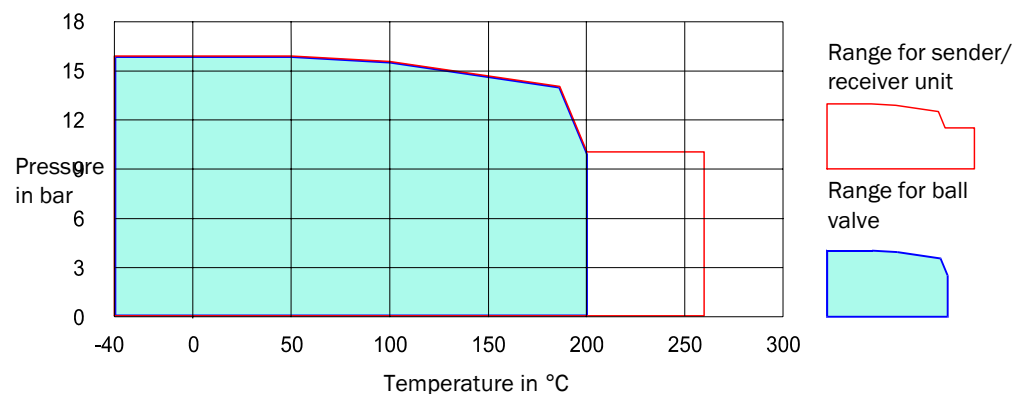


Fig. 2.11: Maximum permitted operational parameters for retractable sender/receiver units

Note The mounting set (connection piece, ball valve, mounting material) are adequate for a maximum working temperature of 200 °C. But because the mounting kit is outside of the duct and is not subject to direct flow from the medium, it can be assumed that for medium temperature up to 260 °C it is - due to heat loss - not to be expected, that the tolerable temperatures of 200 °C are exceeded.

2.3.1.4 Sender/receiver unit FLSE100-PREXZ2 (Probe Version for Ex Zone 2)

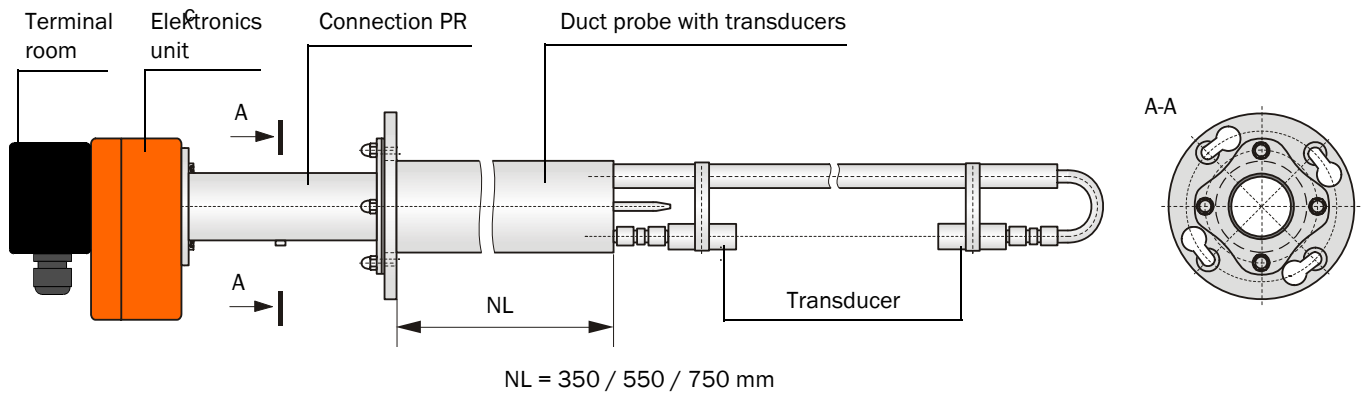


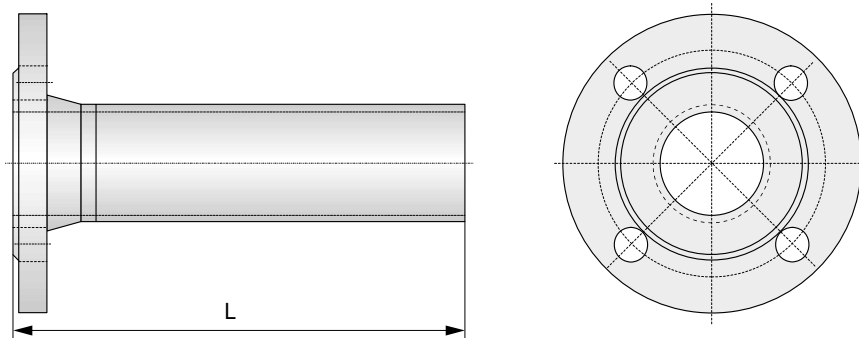
Fig. 2.12: Sender/receiver unit FLSE100-PREXZ2

A flange with pipe according to Fig. 2.15 is used to fit the probe at the duct.

2.3.2 Mounting Equipment for Fitting the FLSE100

Note NL = Nominal length of the corresponding sinder/receiver unit.

2.3.2.1 Connection piece (for FLSE100-EXZ2 with DIN or ANSI flange)

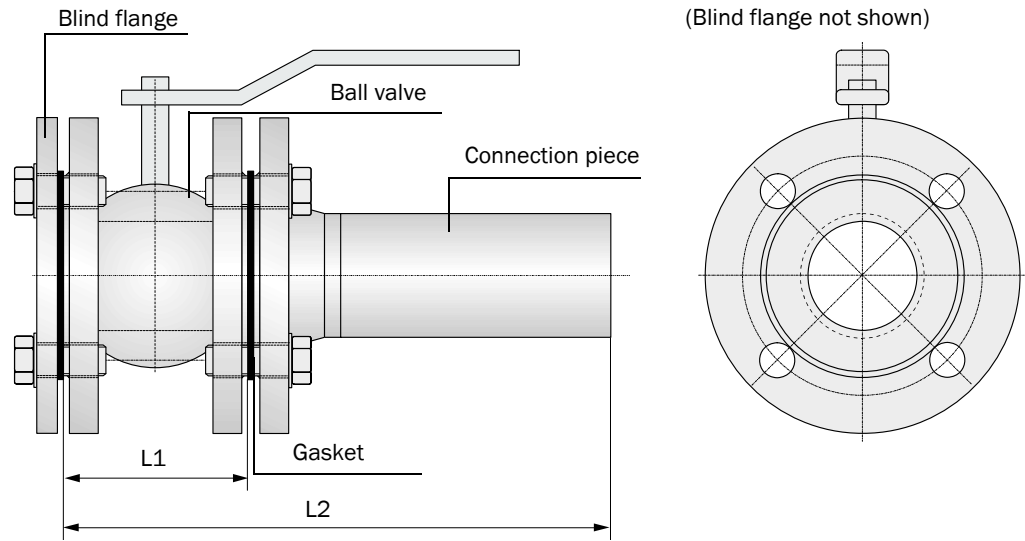


Type	L
Connection piece CL150 2ZLTCS260	NL - 10
Connection piece CL150 2ZLTCS260 60°*	NL + 30
Connection piece PN16 DN50LTCS260	NL - 10
Connection piece PN16 DN50LTCS260 60°*	NL + 30

* For inner channel diameter < 0.5 m

Fig. 2.13: Connection piece PN16 DN50LTCS260 / CL150 2ZLTCS260

2.3.2.2 Mounting Kit (for Retractable FLSE100-EXZ2RE)



Type	L1	L2
Mounting kit CL150 2ZLTCS380 RE	150	NL-10
Mounting kit CL150 2ZLTCS380 60° RE*		NL+30
Mounting kit PN16 DN50LTCS380 RE	150	NL-10
Mounting kit PN16 DN50LTCS380 60° RE*		NL+30

* For inner channel diameter < 0.5 m

Fig. 2.14: Mounting kit for retractable sender/receiver units FLSE100-EXZ2RE

2.3.2.3 Flange with pipe (for Probe Version FLSE100-PREXZ2)

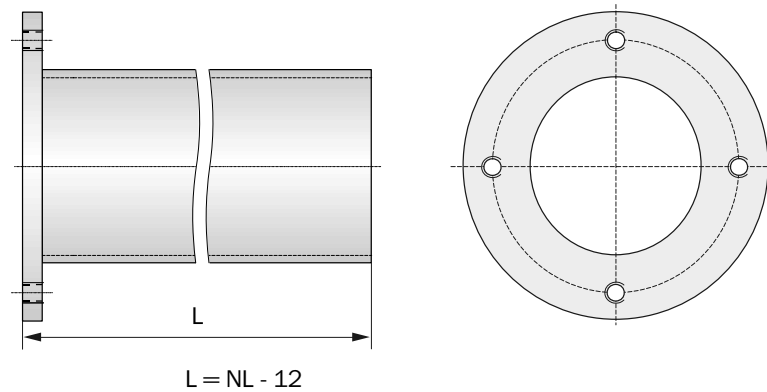


Fig. 2.15: Flange with pipe

2.3.3 MCU Control Unit

The control unit has the following functions:

- Control of data transfer and processing the data from the measuring unit(s) connected via RS485 interface
- Signal output via analog outputs (measured value) and relay outputs (device status)
- Signal input via analog and digital inputs
- Power supply for the connected measuring units via 24 V switching power pack with wide-range input
- Communication with host control systems via optional modules

Plant and device parameters can be set easily and conveniently via a USB interface using a laptop and the user-friendly SOPAS ET operating software. The parameters are stored reliably even in the case of a power failure.

The control unit is usually installed in a steel plate housing. It is also available as a 19" slide-in unit (not for use in Ex zone).

Versions

- Control unit for use in non-hazardous area (non Ex)
- Control unit for use in hazardous area Ex Zone 2 (ATEX), only 24 V version

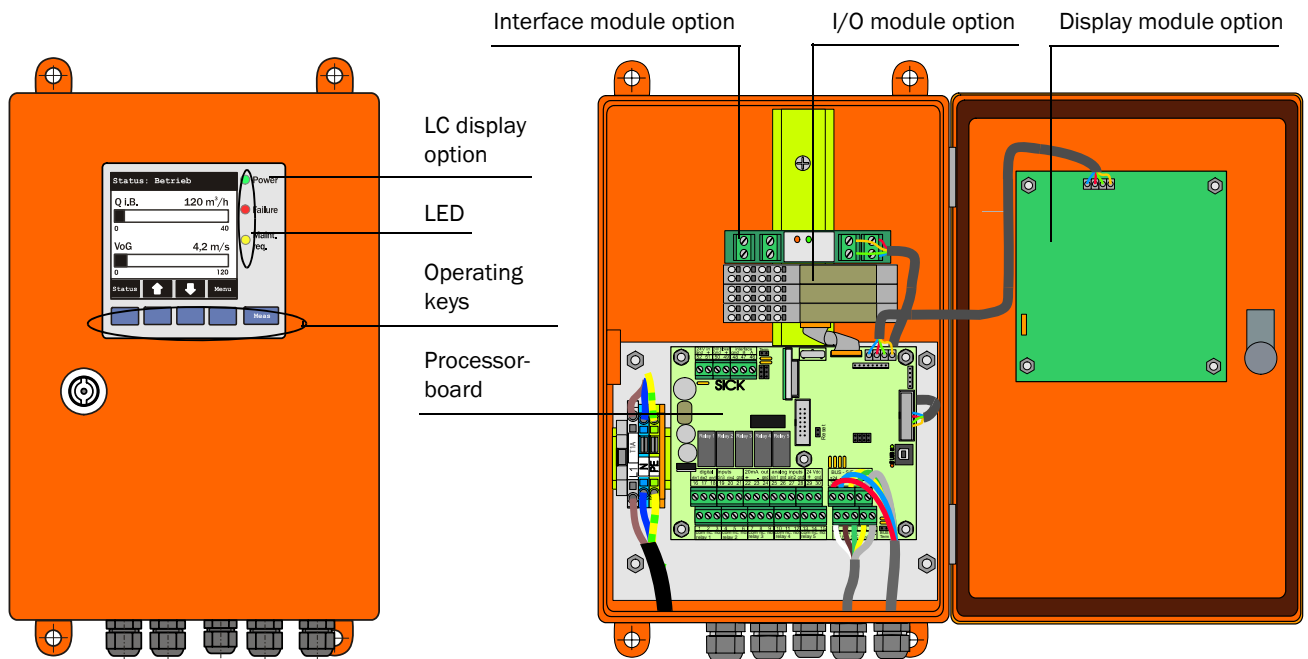


Fig. 2.16: Control unit MCU with options

Standard interfaces

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
1 output 0/2/4 ... 22 mA (active) for selectable output of: <ul style="list-style-type: none"> • Velocity • Volume flow a.c. • Volume flow s.c. • Temperature, Resolution 10 bits 	2 inputs 0 ... 20 mA (without electrical isolation) for selectable input of calculation variables (temperature, pressure, moisture), Resolution 10 bits	5 changeover contacts (48 V, 1 A) to output the status signals: <ul style="list-style-type: none"> • Operation/Malfunction • Maintenance • Control cycle • Maintenance request • Limit value 	4 potential-free contacts for: <ul style="list-style-type: none"> • connecting a maintenance switch • triggering a control cycle • separate zero point check • separate span check 	<ul style="list-style-type: none"> • USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and software updates • RS485 to connect a sensor

Options

Using the following options, the functionality of the MCU can be extended considerably:

1. Display module

Module to display measured values and status information of the connected sensors using operating keys (capacitive sensors). The integration of this module into already delivered control units can only be done by the supplier.

Displays

Type		Display
LED	Power (green)	Power supply OK
	Failure (red)	Functional failure
	Maint. request (yellow)	Maintenance required
LCD	Graphical display (main display)	Two of a variety of possible measured values: <ul style="list-style-type: none"> • Volume flow at actual conditions (Q a.c.) • Volume flow at standard conditions (Q s.c.) • Velocity of Gas (VoG) • Speed of Sound (SoS) • Acoustic temperature (T ac) • Transducer temperature A (T A) • Transducer temperature B (T B) • Signal to noise ratio A (SNR A) • Signal to noise ratio B (SNR B) • Mass flow • Molecular weight
	Text display	Max. 8 measured values (see graphical display)

The measurement screen displays bar graphs of two selectable main measured values of a connected sensor or of the MCU. Alternatively up to 8 individual measured values of a sensor can be displayed (switching with key “Meas”).

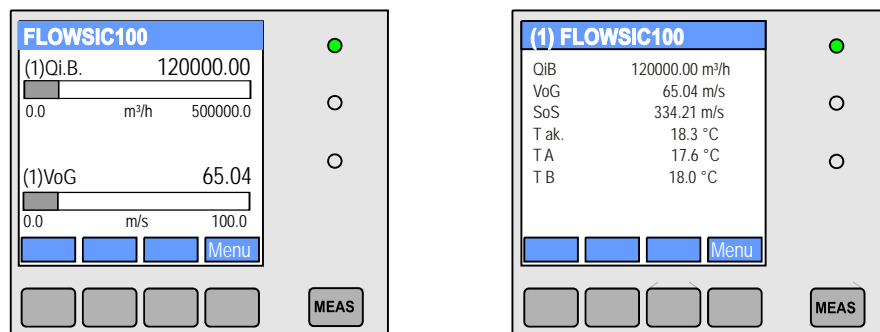


Fig. 2.17: LCD in graphical display (left) and in text display (right)

If a threshold value is exceeded, the display alternates between the measured values and an alarm message.

Operating keys

Key	Function
Meas	<ul style="list-style-type: none"> • Selection of the measured value to be displayed • Switching between text display and graphical display • Display of the contrast settings (after 2.5 s)
Arrows	Selection of next/previous measuring value page
Status	Display of alarm or error messages
Menu	Display of main menu

The following functions are additionally available in the display module:

- Commissioning by setting of installation parameters
- Initiating of a check cycle
- Switching to the Maintenance Mode.

2. I/O module

For plugging on module carriers, communication via I²C bus, optionally as:

- 2x analog output 0/4 ... 22 mA to output further measured variables (load 500 Ω)
- 2x analog input 0/4 ... 22 mA to read in values from external sensors
- 4 x digital input to connect potential-free contacts
- 2x digital output (changeover contacts, load of 48 V a.c./d.c., 5 A)
- 4x digital output (make-contacts, load of 48 V a.c./d.c., 5 A)

Notes

- One module carrier is necessary for each module (to insert on top hat rail). One module carrier has to be connected to the processor board with a special cable, other module carriers can be docked to it.
- Max. 8 I/O modules can be plugged, max. 4 modules of these may be of the same type.

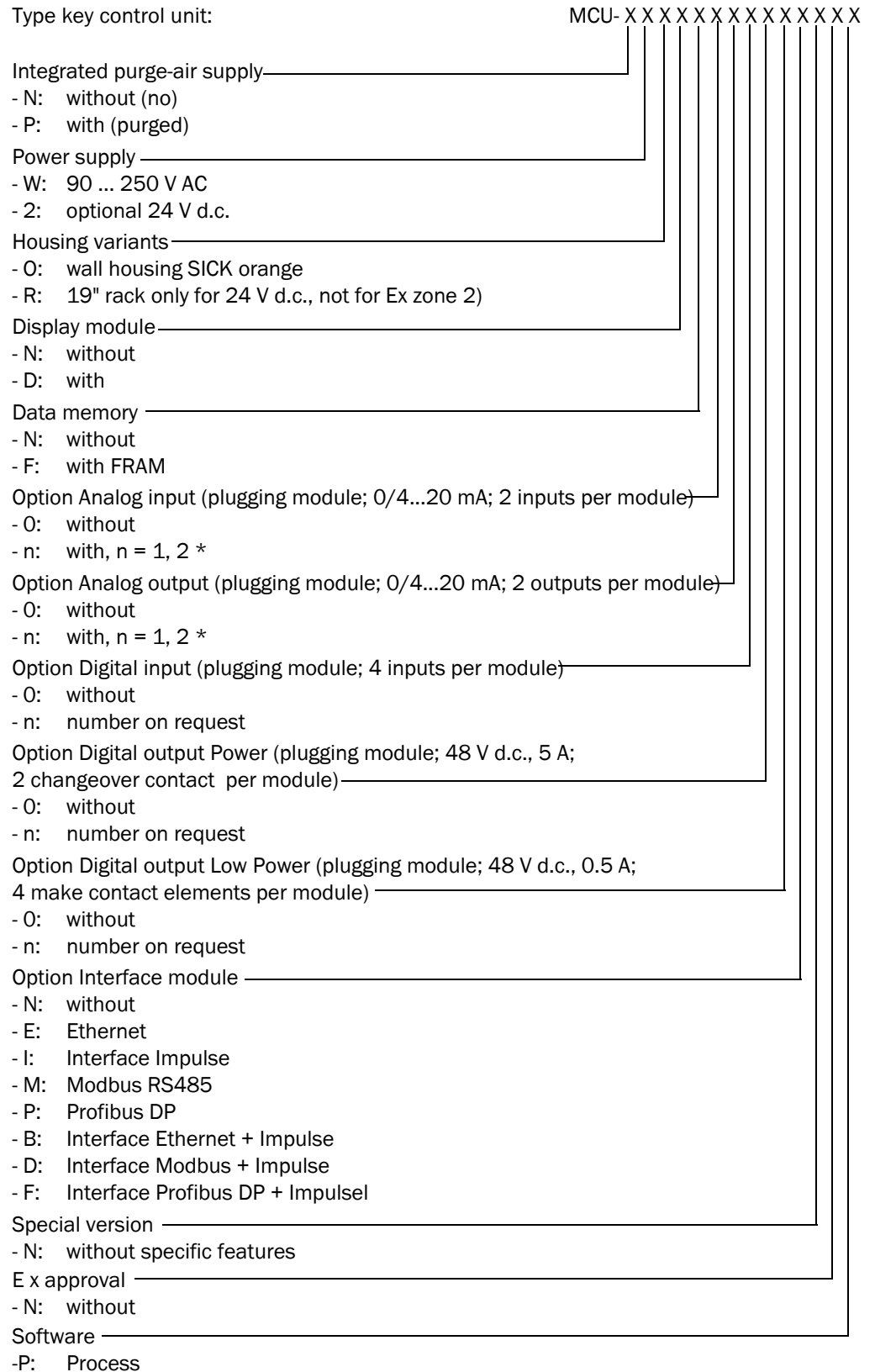
3. Interface Module

Profibus DP-V0 to transfer via RS485 according to DIN 19245 Part 3 as well as IEC 61158.

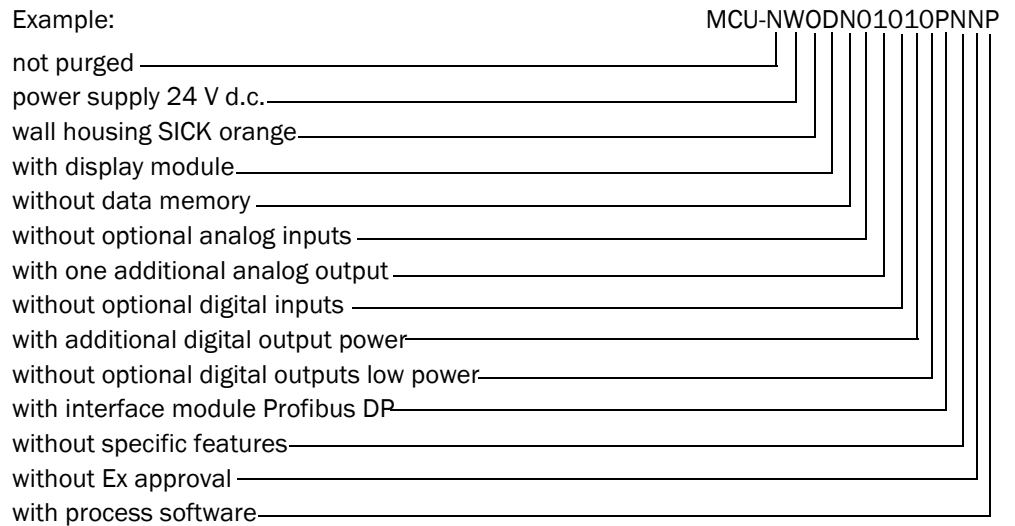
Module to pass measured values, system status and service information to higher level control systems, optional for Profibus and Ethernet, To insert in slots (see **Fig. 2.16**).

Type key MCU

The various configuration variants are defined by the following type key:



*: Up to 4 analog modules available on request



2.3.4 Connection Cables

2.3.4.1 Connection Cables for not Ex-Protected Variants (FLOWSIC100 PN16/CL150)

The connection cables master (Master FLSE100) and slave (Slave FLSE100) are used to connect the sender/receiver units with the control unit MCU. Both cables are available in different lengths. The connection cable master is marked with a red marker behind the cable box.

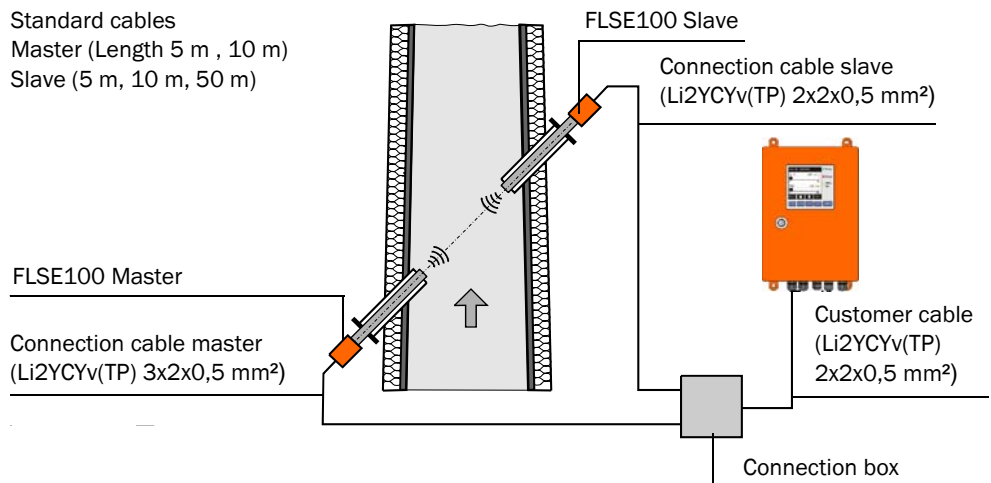


Fig. 2.18: Connection cables for not Ex-protected variant

Notes • The cables provided on site must fulfill the following requirements :

- Effective capacitance core/core less than 110 pF/m
- Min. core cross-section 0.5 mm² (AWG20).

We recommend the cable type UNITRONIC Li2YCYv(TP) 2x2x0.5 mm² with reinforced outer sheath (from Lappkabel).

The total length of all cables (standard cables + cables provided on site) can be up to 1000 m.

- If a bus configuration is used with two connected sensors (see Fig. 2.4), the maximum cable length total is reduced depending on the number of connected measuring points:
 - Cable length with one measuring point = 1000 m,
 - Cable length with two measuring points = 500 m.

2.3.4.2 Connection Cables for Ex-protected Variants

Cable requirements and notes on cabling see Section 3.4.1

Connection cables for Ex-protected variants are not scope of delivery from SICK and must be provided by the customer on site. For the maximum cable lengths the same restrictions apply as for non Ex-protected variants. Before choosing the cables, the regulations and guidelines for cabling in the Ex-Zone applicable to the installation must be observed.

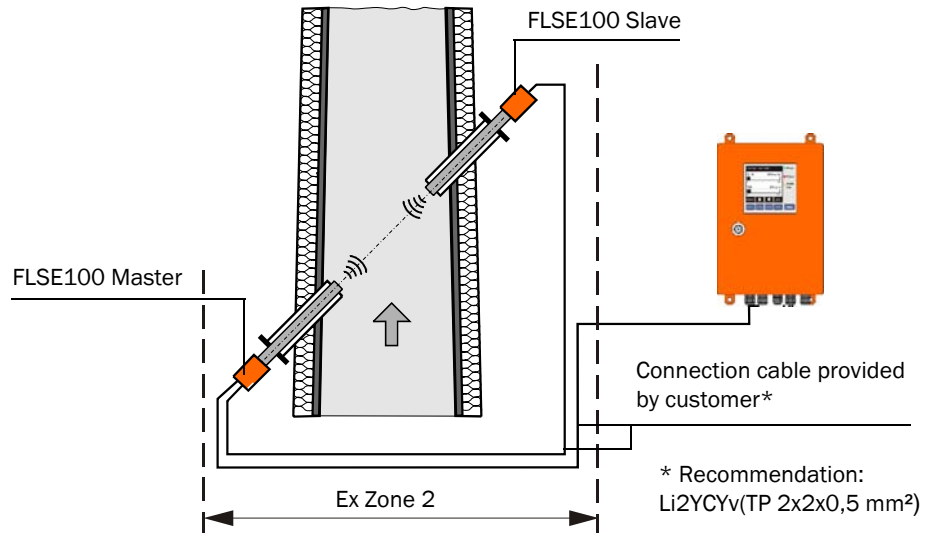


Fig. 2.19: Connection cable for Ex-protected variant

2.3.5 Measuring Pipe Option

A pipe piece, as shown in Fig. 2.20, can be supplied for pipes with diameters up to max. DN500 for easy mounting (welding the flanges with pipe). Basis for the exact design are customer-specific data.

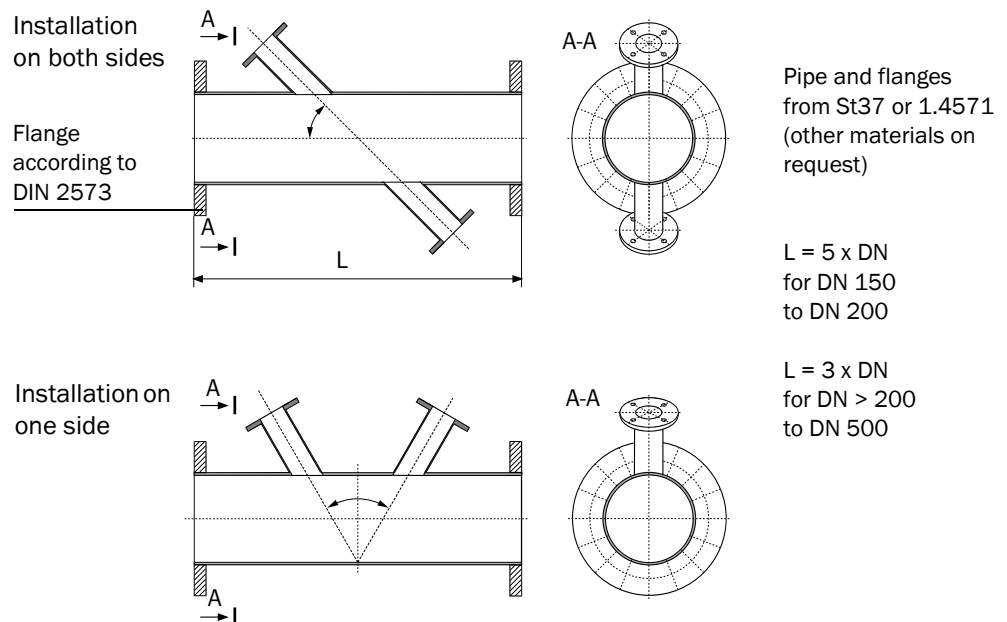


Fig. 2.20: Measuring pipe option

2.4 Calculations

2.4.1 Calculating and Calibrating the Volumetric Flow

Volumetric flow in operating state

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

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

FLOWSIC100 PROCESS, on the contrary, determines the representative average value of the flow velocity on a sound path v (path velocity) between the two sender/receiver units. The sound path is to be placed centrally above the cross-section of the pipeline.

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.

$$k(\text{Re}) = \frac{v_A}{v} \qquad 0.9 < k < 1 \qquad (\text{Re} = \text{Reynolds' number})$$

This functional relation is implemented by a calibrating function in the FLOWSIC100 PROCESS. The coefficients of this function are determined at the factory through comparison measurement on a test bench and regression analysis, and stored in the FLOWSIC100 PROCESS. The coefficients for various nominal tube diameters are activated during start-up.

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

Calculation of volume flow in the standard state

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

$$Q_{std} = Q_{act} \cdot \left(\frac{100 - F}{100}\right) \cdot \left(\frac{p_{pipe} \cdot T_{normal}}{p_{normal} \cdot T_{pipe}}\right)$$

- Q_{act}: Volumetric flow in operating state
- Q_{std}: Volumetric flow in standard state
- F: Moisture in volume percent; usually entered as a default value typical for the equipment.
- 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 FLOW SIC100 PROCESS, 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 USA 293 K

2.4.2 Determining the mass flow

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) Standard algorithm:
Uses a constant value for substance-dependent coefficient k.
- b) Algorithm MR-113:
Determines k under consideration of the actual gas composition for alkane-hydrocarbon mixture.
- c) Alkane algorithm:
Determines k according to the function relation to the standard sound velocity.

2.4.3 Calibrating the Temperature

Temperature measurement must be calibrated for exact determination of the gas temperature with FLWSIC100 PROCESS. Calibration is not required if the following requirements are fulfilled:

- Exact knowledge of sound velocity in the sample gas under standard conditions (1013 mbar, 0 °C), as e.g. for air (331 m/s)
- Extremely accurate knowledge of the active measuring path.

The calibration is performed by comparison measurement with a separate temperature sensor (e.g. Pt100) with at least 2 different temperatures (calculation and input of coefficients see Section 4.3.4.)

2.4.4 Response Time

The response time t_{90} is the time taken by the measuring device to reach 90 % of the end value after a sudden change in the measured value (see Fig. 2.21).

Typical: 60 ... 90 s

The t_{90} time can be set to a value in the range 1...300 s. Setting a higher t_{90} time (typically: 60...90 sec.) provides better attenuation of transient fluctuations in the measured value and interference to produce a "smoother" output signal.

A special t_{90} time is used to measure the gas velocity and gas temperature. The t_{90} time of the volumetric flow is identical to that of the gas velocity.

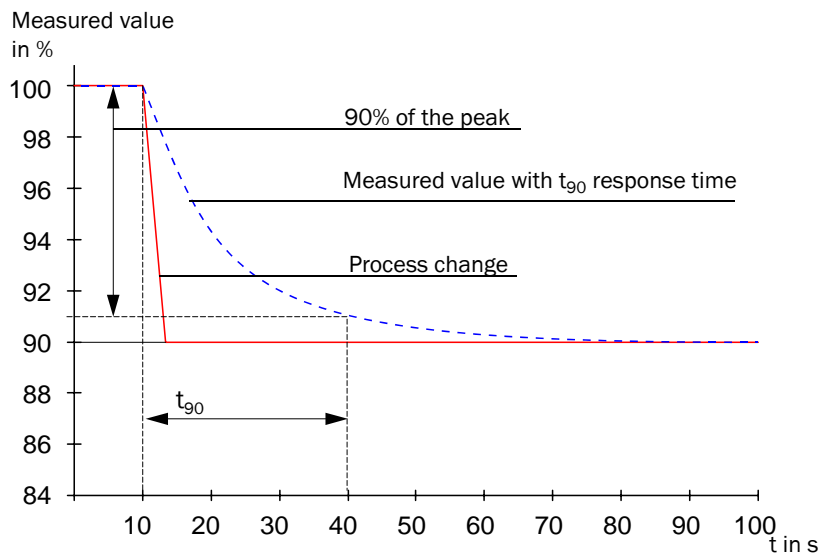


Fig. 2.21: Response time

Note The t_{90} time should be regarded as a guide value. If the signal quality of the ultrasonic pulses is poor, the FLWSIC100 PROCESS requires more measured values to produce an output signal of the same accuracy. As a result, the t_{90} time is higher than the set time (within certain limits).

2.5 Check Cycle

For the automatic functional check of all device components, a check cycle can be initiated in FLOWSIC100 PROCESS. Initiation can be performed time-controlled (setting of interval time by means of an operating program) and/or additionally via the digital input (see Section 2.3.3).

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, at the same time on the display by the clear text message "Check cycle".

- Notes**
- 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 after 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.

2.5.1 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.

2.5.2 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.

2.5.3 Check Cycle on the Analog Output

A check cycle is output as follows:

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

- Note**
- 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 only for velocity-dependent measured values (gas velocity, volume flow act., volume flow std.).

2.6 Technical Data

Measured Value Acquisition				
Measured variables	Gas velocity, volumetric flow under actual conditions (a.c.), volumetric flow under standard conditions (s.c.), gas temperature, speed of sound, mass flow			
Measuring range	Min. limit -40 to 0 m/s, max. limit from 0 to +40 m/s ¹⁾ ; continuously variable			
Reproductibility ²⁾	±1 % for v > 2 m/s; ±0,02 m/s for v < 2 m/s			
Response time	1 ... 300 s; freely selectable			
Displays				
2-line LCD	Measured variables, warning and malfunction messages			
LED	Power, failure, maintenance request			
Installation				
FLSE100	PN16/CL150	EXZ2	EXZ2RE	PREXZ2
Ex-classification	- ATEX II 3 G EEx nA II T4 according to guideline 94/9/EG			
Measuring distance transducer-transducer ³⁾	0.17 m ... 2 m; up to 4 m in air and gases with low temperature and low CO ₂ content and dust content			0.27-0.28 m
Internal duct diameter	0.15 m ... 1.7 m			> 0,4 m
Gas temperature [°C]	-40 ... +260		-40 ... +260 ⁴⁾	
Installation angle (recommended)	60 °			45 °
max. internal duct pressure	-0,5 bar ... +16 bar			±0.1 bar
max. dust concentration	1 g/m ³ i.N.			
max. cable length between FLSE100 and MCU	1000 m			
Output signals				
Analog output	0/2/4 ... 22 mA, max. load 750 Ω; resolution 10 bit; additional analog outputs with I/O modules option			
Relay outputs	5 potential-free outputs (change over contact) for status signals: operation/malfunction, limit, warning, maintenance, check cycle; load capability 48 V, 1 A; Add. relay outputs with I/O modules option			
Input signals				
Analog inputs	2 inputs 0 ... 20 mA (without galvanic separation); resolution 10 bit; additional analog inputs with I/O modules option			
Digital inputs	4 potential-free contacts for connection of maintenance switch, activation control cycle, separate zero-phase check, separate span test; Add. digital inputs with I/O modules option			
Communication interfaces				
USB 1.1, RS232 (on terminals)	For measured value retrieval, configuration and firmware update via PC/laptop with SOPAS ET program			
RS485	For connection of sender/receiver unit			
Optional interface module	For communication with host PC, optionally for RS485, Profibus, USB, Ethernet (HART on request)			
Power supply				
Operating voltage	90 ... 250 V a.c.; 50/60 Hz, optional 24 V d.c.			
Power consumption	approx. 20 W Types PN16/CL150, EXZ2, EXZ2RE, PREXZ2			
Ambient conditions				
Temperature range	-40 ... +60 °C	Sender/receiver units:		
	-40 ... +60 °C	Control unit MCU-N:		
Storage temperature	-40 ... +70 °C			
Degree of protection	IP 65			

Dimensions (L x W x H), mass				
	PN16/CL150	EX-Z2	EX-Z2-RE	PR-EX-Z2
FLSE100	With DIN flange approx.: 452 mm x 165 mm x 165 mm, with ANSI flange approx.: 452 mm x 153 mm x 153 mm, Mass approx. 3 kg (depending on type)	With DIN flange approx.: 527 mm x 165 mm x 165 mm, with ANSI flange approx.: 527 mm x 153 mm x 153 mm, with SICK-flange approx.: 467 mm x 122 mm x 122 mm; Mass approx. 3 kg (depending on type)	With DIN flange approx.: 722 mm x 165 mm x 350 mm, with ANSI flange approx.: 722 mm x 153 mm x 342 mm; Mass approx. 6 kg (depending on type)	NL 350 approx.: 1124 mm x 125 mm x 125 mm, NL 550 approx.: 1324 mm x 125 mm x 125 mm, NL 750 approx.: 1524 mm x 125 mm x 125 mm, Mass max. 5 kg (depending on type)
MCU-N	Dimensions: 340 mm x 210 mm x 120 mm; steel plate housing, coated Mass: approx. 5 kg			

- 1): For measurement in flare gas up to +70 m/s
- 2): The accuracy of flow measurements depends on calibration, installation situation, the flow profile, and the variation range of the pressure and temperature parameters. Typical values for the single-path measurement are 1 ... 5 %.
- 3): The maximum possible measuring distance depends on the dust content, gas temperature, and gas composition.
- 4): Maximum operating temperature of the mounting kit is +200 °C, see Section 2.3.1.3

2.7 Dimensions

All dimensions are indicated in mm.

2.7.1 Sender/Receiver Units

Sender/receiver units FLSE100-PN16/CL150 (pressure-resistant variant)

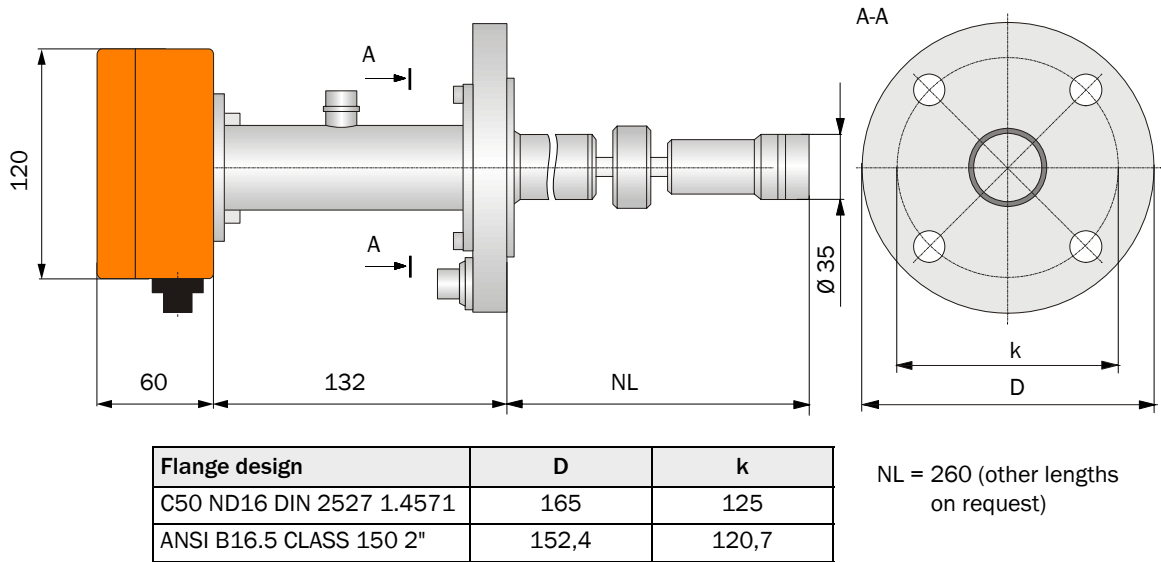


Fig. 2.22: Sender/receiver unit FLSE100-PN16/CL150

Sender/receiver units FLSE100-EXZ2 (pressure-resistant variant for Ex-Zone 2)

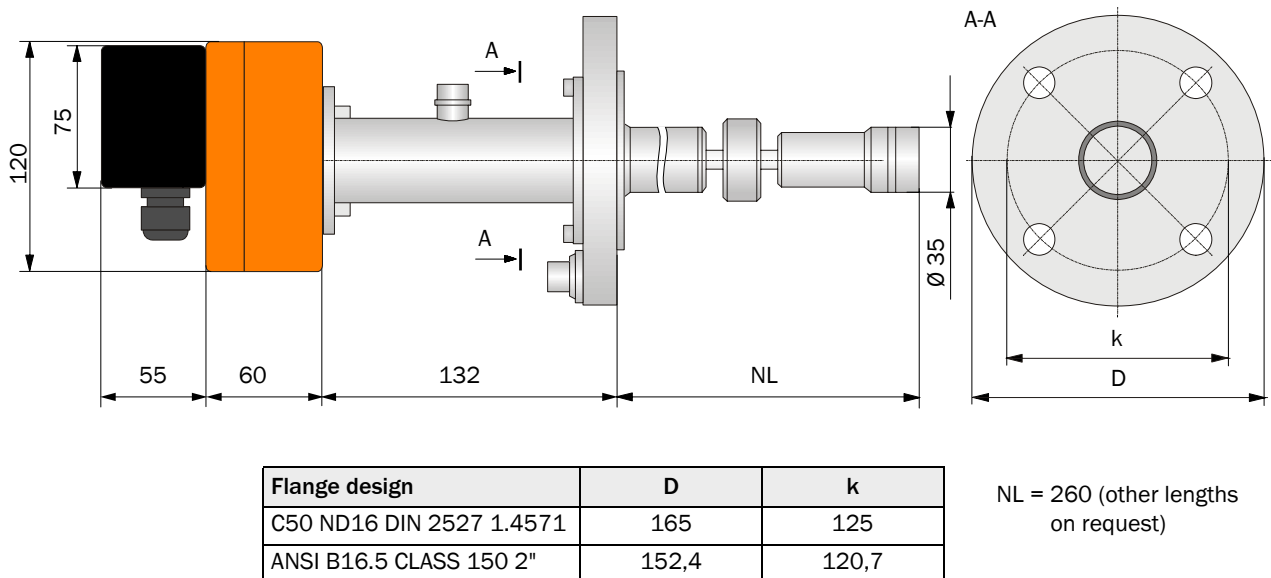
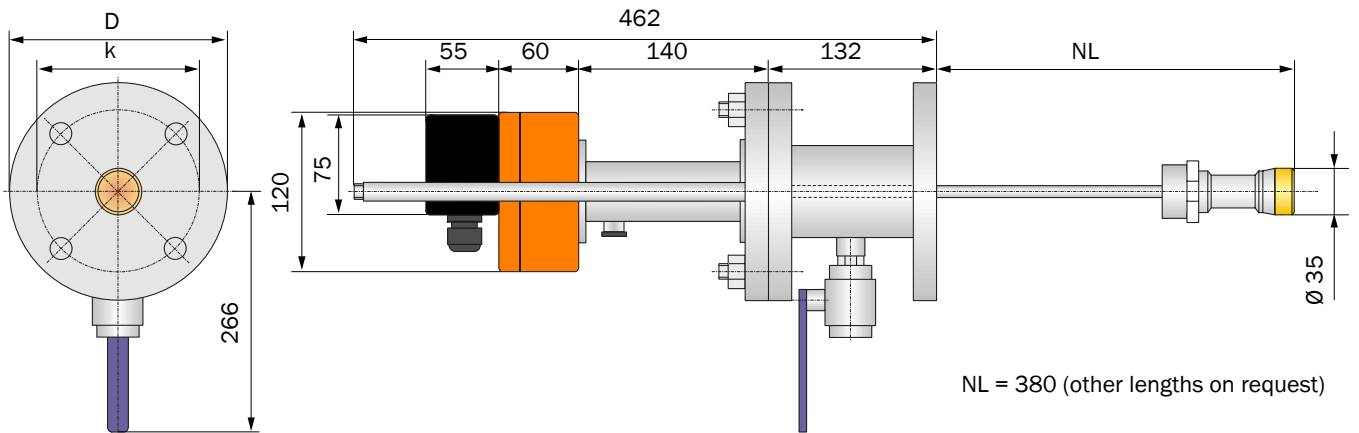


Fig. 2.23: Sender/receiver unit FLSE100 EX-Z2

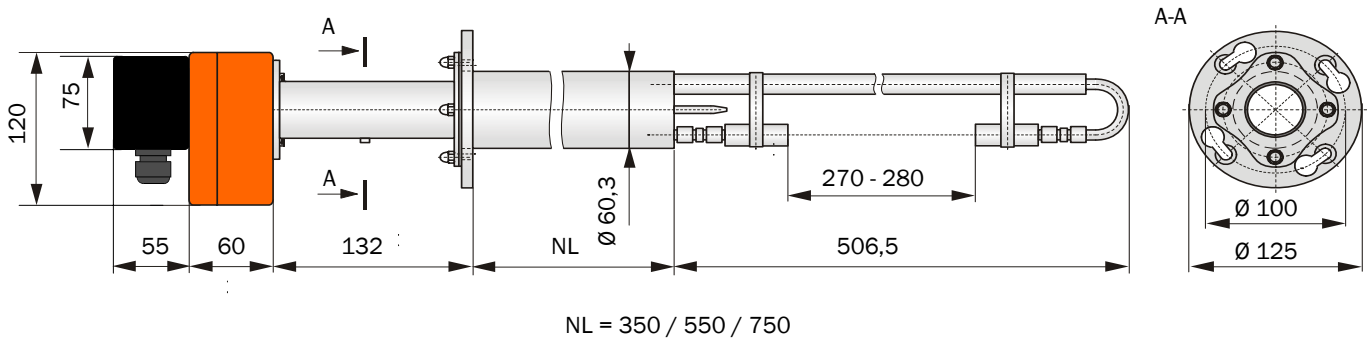
Sender/receiver units FLSE100-EXZ2RE (pressure-resistant and retractable variant for Ex Zone 2)



Flange design	D	k
B50 ND40 DIN 2527 1.4571	165	125
ANSI B16.5 CLASS 150 2"	152,4	120,7

Fig. 2.24: Sender/receiver unit FLSE100-EXZ2RE

Sender/receiver unit FLSE100-PREXZ2 (probe version for Ex Zone 2)

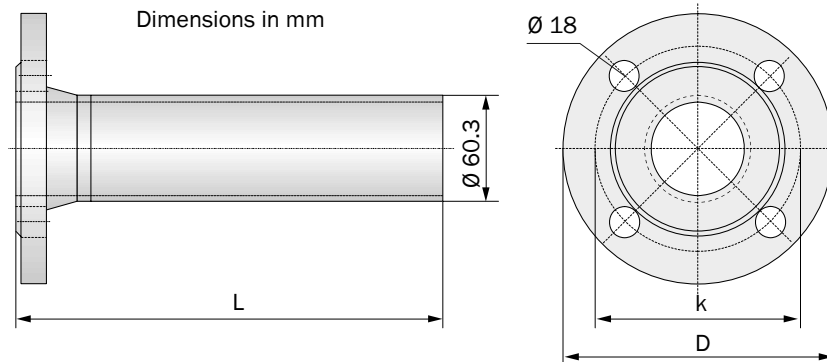


NL = 350 / 550 / 750

Fig. 2.25: Sender/receiver unit FLSE100-PREXZ2

2.7.2 Mounting Equipment

Glands (for pressure-resistant FLSE100-EXZ2 with DIN or ANSI flange)

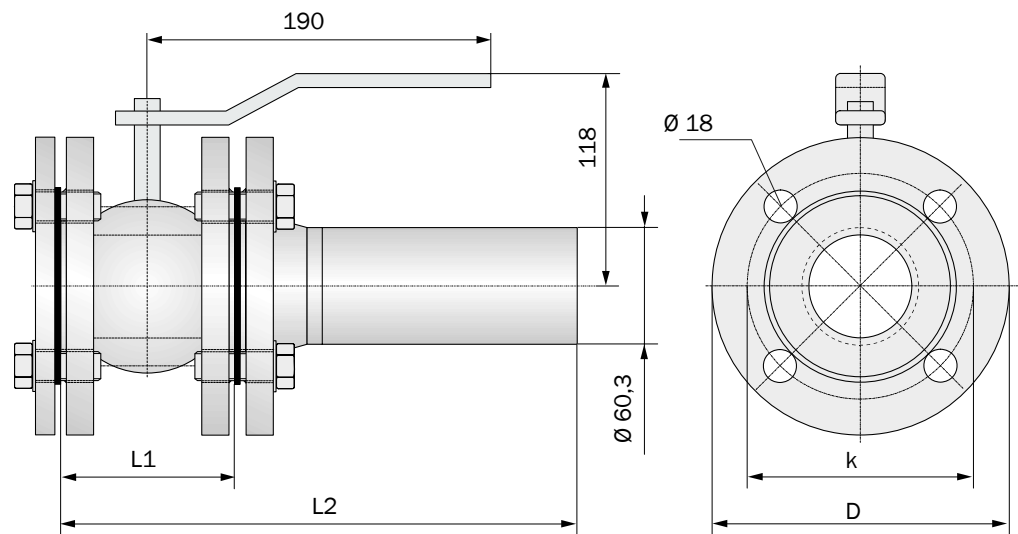


Type	L	D	k
Gland CL150 2ZLTCS260	NL - 10	152,4	120,7
Gland CL150 2ZLTCS260 60° *	NL + 30		
Gland PN16 DN50LTCS260	NL - 10	165	125
Gland PN16 DN50LTCS260 60° *	NL + 30		

* For inner duct diameter < 0.5 m

Fig. 2.26: Gland PN16 DN50LTCS260 / CL150 2ZLTCS260

Mounting kit (for retractable FLSE100-EXZ2RE)



Type	L1	D	k	L2
Mounting kit CL150 2ZLTCS380 RE	150	152,4	120,7	NL-10
Mounting kit CL150 2ZLTCS380 60° RE*				NL+30
Mounting kit PN16 DN50LTCS380 RE	150	165	125	NL-10
Mounting kit PN16 DN50LTCS380 60° RE*				NL+30

* For inner duct diameter < 0.5 m

Fig. 2.27: Mounting kit for retractable sender/receiver unit FLSE100-EXZ2RE

Flange with Pipe (for probe version FLSE100-PREXZ2)

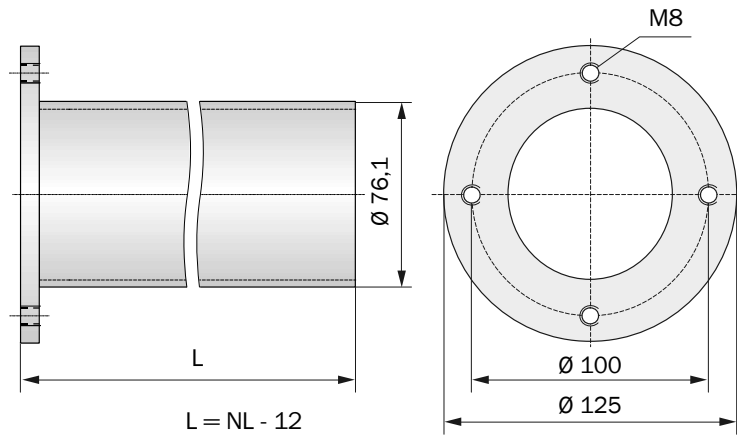


Fig. 2.28: Flange with pipe

2.7.3 MCU Control Unit

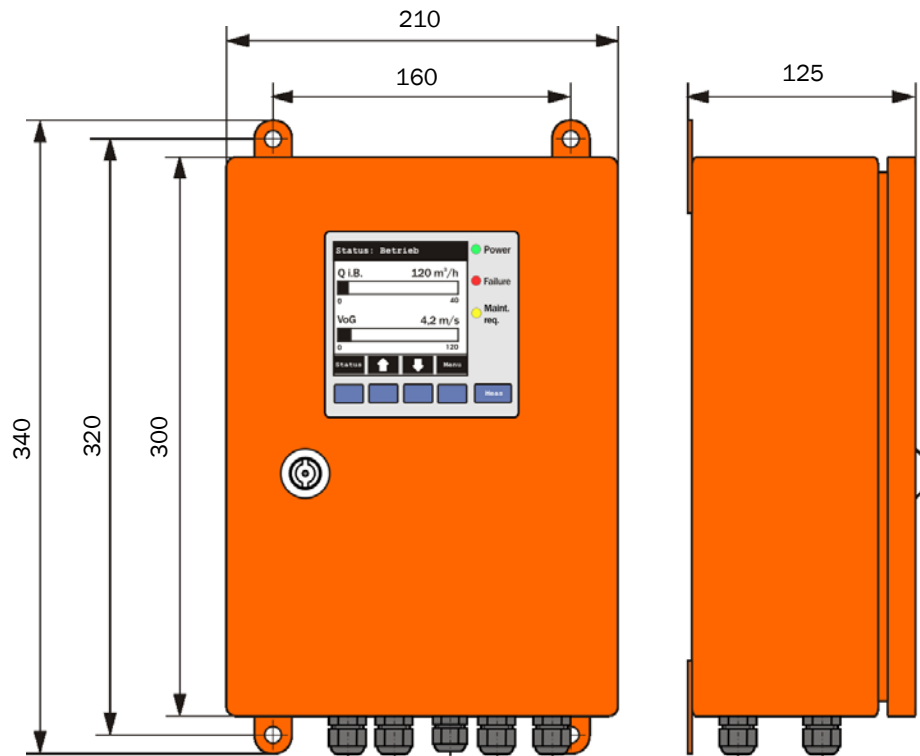


Fig. 2.29: Control unit MCU-N (with display module option)

2.7.4 Connection Box for Connection Cables (only for FLOWsic100 PN16/CL150, not ex protected)

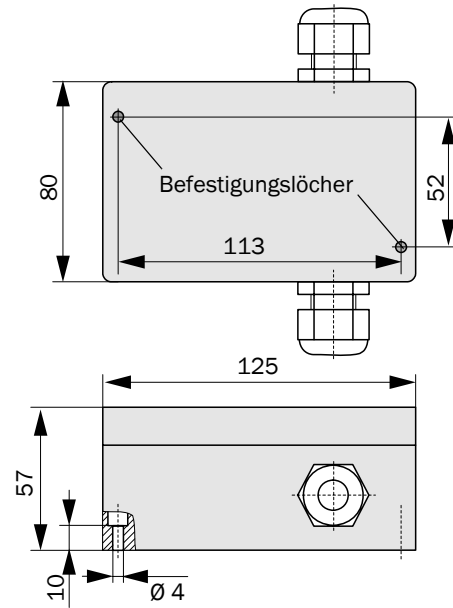
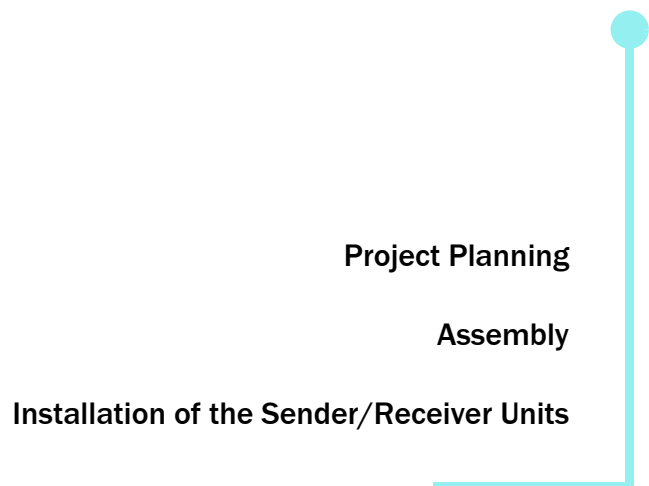


Fig. 2.30: Connection box for connection cables

FLAWSIC100 PROCESS

Gas Velocity Monitor

Assembly and Installation



3 Assembly and Installation

3.1 Project Planning

The following table provides an overview of the project planning work you have to carry out to ensure that the device is correctly installed and fully functional. You can use this table as a checklist by ticking off all the steps you have carried out.

Task	Requirements	Step	<input checked="" type="checkbox"/>	
Determine the measuring and installation locations for the device components (see Section 3.1.1)	<ul style="list-style-type: none"> Inlet and outlet sections must be of sufficient length Homogeneous flow distribution 	If possible, no bends, cross-section variations, feed pipes, discharge pipes, flaps, or fittings in the inlet and outlet sections.	Comply with specifications for new installations; choose the best possible location for existing installations; if necessary, determine flow profile according to VDI 2066; if the inlet/outlet sections too short: inlet section > outlet section	<input type="checkbox"/>
	Accessibility, accident prevention	The device components must be easily and safely accessible	Provide platforms if necessary	<input type="checkbox"/>
	Vibration-free installation	Accelerations < 1 g	Take appropriate measures to eliminate/reduce vibrations	<input type="checkbox"/>
	Ambient conditions	For limit values, see "Technical data".	If necessary: <ul style="list-style-type: none"> Fit weatherproof covers/sun protection Cover or insulate device components 	<input type="checkbox"/>
Choose the device components	Internal duct diameter	Type of sender/receiver unit	Choose the components according to the configuration table and notes in Section 2.3; If necessary, plan additional measures to install the flange with pipe (see Section 3.2.1).	<input type="checkbox"/>
	Duct wall strength with insulation	Nominal length of sender/receiver unit, flange with pipe		
	Internal duct pressure	Type of sender/receiver unit		
	Gas temperature	<ul style="list-style-type: none"> Type of sender/receiver unit, Ex-classification 		
	Gas condition	Material of duct probe and transducer		
	Installation locations	Cable and purge-air hose lengths		
Plan the calibration openings	Accessibility	Easy and safe	Provide platforms/pedestals if necessary	<input type="checkbox"/>
	Distances to the measurement level	No mutual interference between calibration probe and FLOWSIC100 PROCESS	Ensure sufficient distance between the measurement and calibration level (approx. 500 mm)	<input type="checkbox"/>
Plan the power supply	Operating voltage, maximum demand	According to the technical data in Section 2.6	Ensure sufficient cable cross-sections and fuse	<input type="checkbox"/>

Note Decide on cable length.

Temperature limits

- Due to direct thermal contact between the transducer and the medium, the gas temperature must not exceed 260 °C even for a short space of time.
- When heat insulation measures are taken only the mounting flange may be insulated.
- A separate insulation of the electronics unit for use at low ambient temperatures is possible.
- The temperature class is dependent on the medium temperature.

Basically, it should be assumed that hot parts of the plant could be an ignition hazard. This includes the glands or flanges with pipes and mounting kit for fitting the sender/receiver units. (see Fig. 2.13 to Fig. 2.15).

The achievable temperature class for gas temperatures above 60 °C can be fixed according to the following table:

Gas temperature	Achievable temperature class	FLWSIC100 PROCESS type
60 °C ... 120 °C	T4 (135 °C)	EX-Z2, EX-Z2-RE, PR-EX-Z2
>120 °C ... 180 °C	T3 (200 °C)	
>180 °C ... 200 °C	T2 (300 °C)	

Connection piece

See Section 2.3.2

Suitable connection pieces PN16DN50/CL1502Z or flanges with tube (SICK flanges) or mounting flanges in other designs should be selected according to the design of the probe.

3.1.1 Determining the Measurement and Mounting Location

Flow profile

The accuracy of measurement is subject to the flow conditions and the position of the measurement axis. Significant changes in the cross-section, duct curvatures, fittings in the duct, air dampers, or inlets can cause profile deformations or turbulence that will impair the result of the measurement. To ensure that the measurement is as accurate and trouble-free as possible, the gas flow at the location of the measurement should be homogeneous (see Fig. 3.1).

Regular, unimpeded profiles are most likely with long inlet and outlet sections. The longer the inlet section, in particular, the greater the reproducibility of the measurement results. If possible, the inlet section should be more than 20 times greater, and the outlet section 10 times greater than internal diameter of the duct (Di). With rectangular cross-sections, the diameter is calculated as 4 times the cross-section divided by the duct circumference.

On existing installations, choose the optimum location.

If you are uncertain of the flow conditions, you should measure the profile at the measuring location, for example, using pitot tube flow meters (see EN 13284-1). Calibration apertures must be provided for this purpose. The measurement axis must then be defined in such a way that any changes in the profile will only have a minimum impact on the result of the measurement.

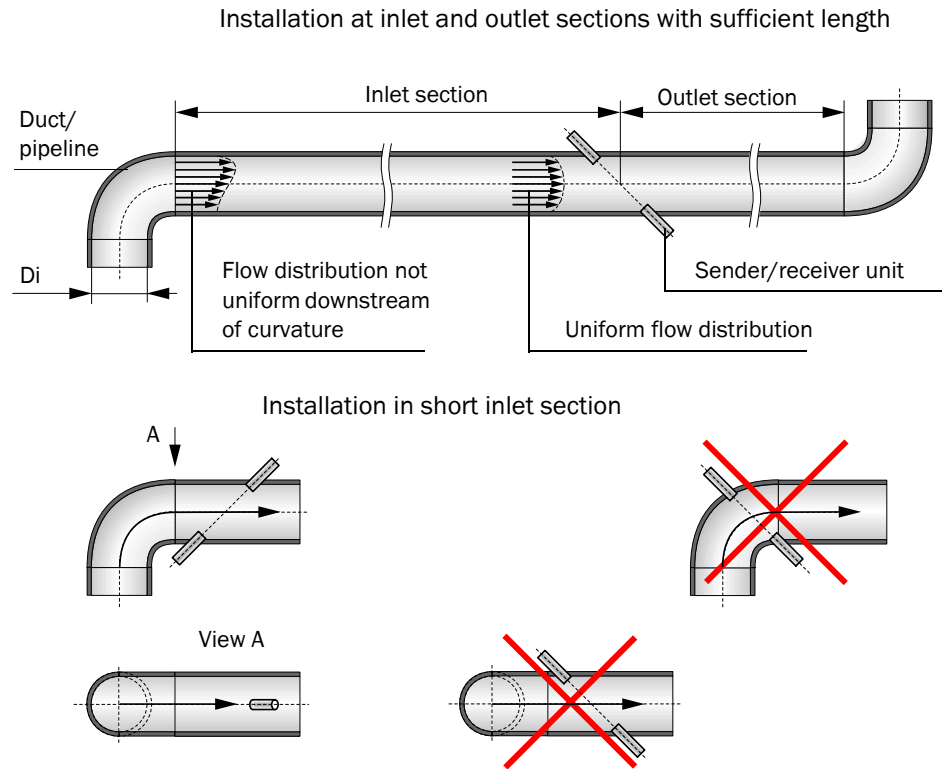


Fig. 3.1: Installing the sender/receiver units

Installation location

The sender/receiver units can be installed on vertical, horizontal, or inclined ducts or pipelines. The mounting location for the device components must be free of vibration and must be equipped with power faucets and installed lighting.

Platform

The sender/receiver units must be easily accessible for installation and maintenance. If necessary, provide a suitably wide platform secured by a handrail.



Warning

The plant operator is responsible for ensuring that the applicable accident prevention and occupational health and safety regulations are observed.

Ensure that sufficient clearance is provided for installing and removing the sender/receiver units.

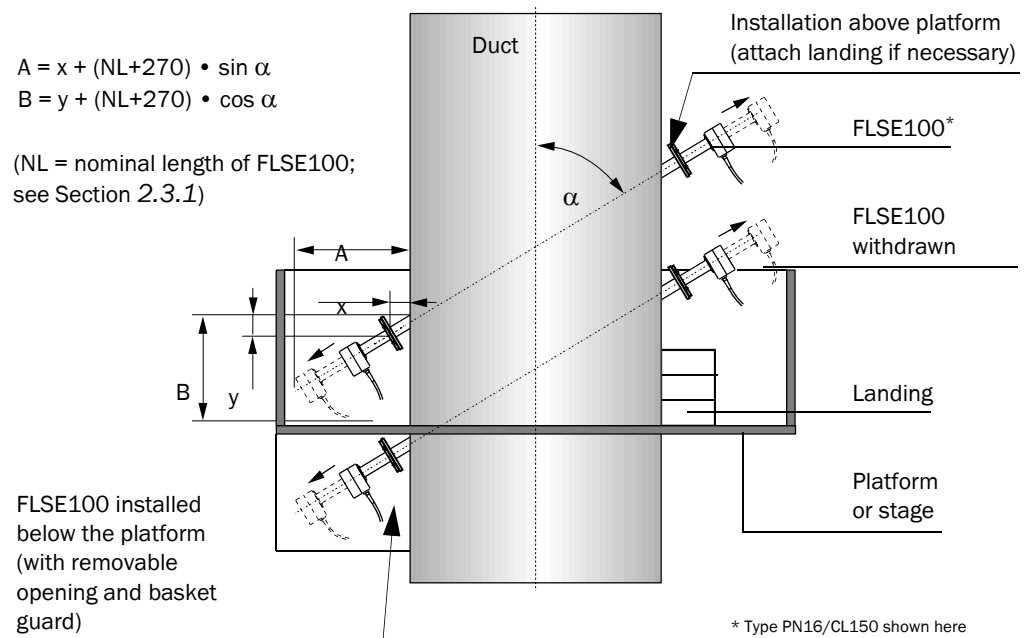


Fig. 3.2: Installing the sender/receiver units on a vertical duct

3.1.2 Further Planning Instructions

Installing the FLSE100 in horizontal ducts

In horizontal ducts and pipelines, the sender/receiver units should be installed horizontally and slightly inclined to prevent condensate from entering the duct (see **Fig. 3.3**).

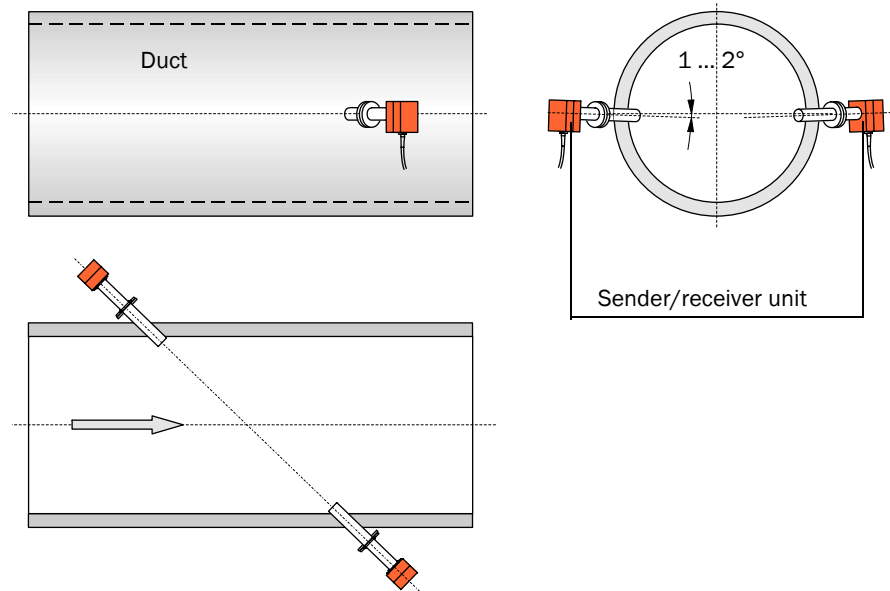


Fig. 3.3: Installing the sender/receiver units in horizontal pipelines

Installing the FLSE100-PREXZ2 sender/receiver unit (probe version)

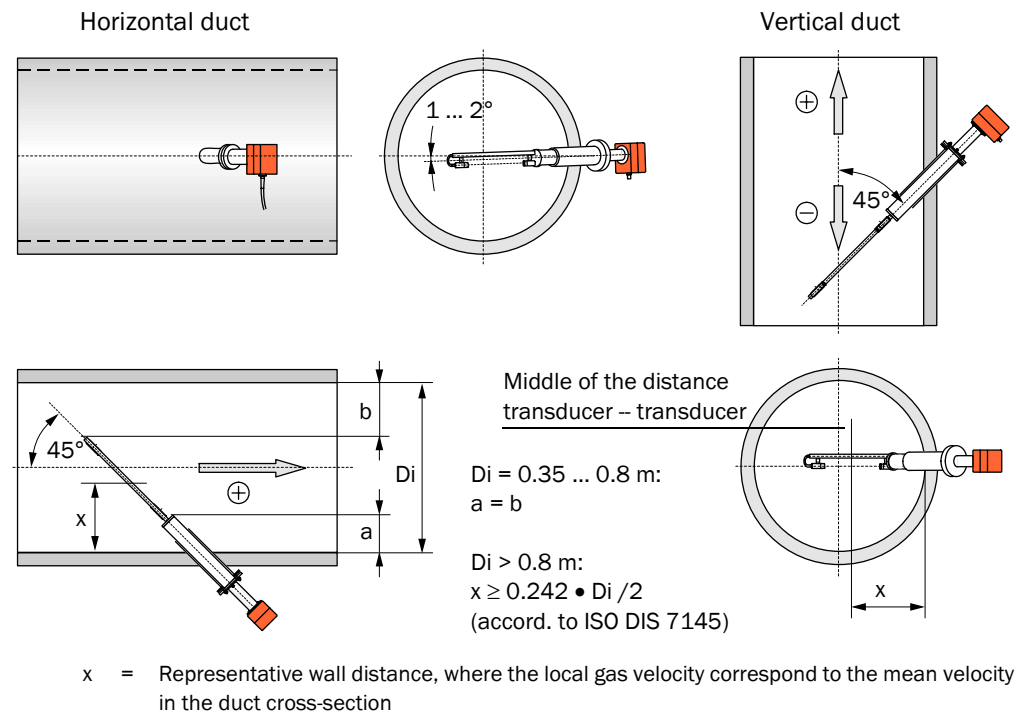


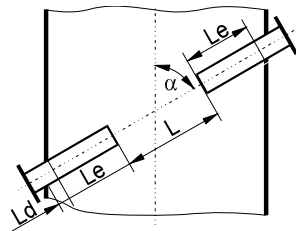
Fig. 3.4: Installing the sender/receiver unit type FLSE100-PREXZ2

Sender/receiver units with special length can be delivered if the condition for x cannot be observed.

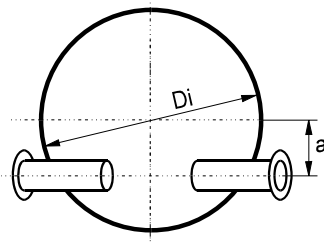
Reducing the measuring distance

To prevent problems in signal transmission in certain cases, it can be necessary to reduce the measuring distance. You can realize this by installation of extended flange pipes and/ or flanges with pipe across a secant.

The installation conditions are provided in **Fig. 3.5** and in the following table.



- L = Active measuring path
- Le = 20 ... 500 mm
- $a_{max} = Di / 4$
- $\alpha = 60^\circ$
- Ld as in **Fig. 3.6**



with $a = a_{max}$ and circular ducts
then ($\alpha = 60^\circ$)

$$Di_{max} = L + 2 Le + Ld$$

Fig. 3.5: Installation across secant

Correlation between the inner diameter Di and measuring distance L as a function of the draw-in length Le and installation type (dimensions in m):

Di	Measuring distance L at $\alpha = 60^\circ$, $Le = \dots$ and installation across								
	Diameter								
	Le=0.05	Le=0.10	Le=0.15	Le=0.20	Le=0.25	Le=0.30	Le=0.35	Le=0.40	Le=0.45
1.00	1.01								
1.05	1.07								
1.10	1.13	1.03							
1.15	1.18	1.08							
1.20	1.24	1.14	1.04						
1.25	1.30	1.20	1.10	1.00					
1.30	1.36	1.26	1.16	1.06					
1.35	1.41	1.31	1.21	1.11	1.01				
1.40	1.47	1.37	1.27	1.17	1.07				
1.45	1.53	1.43	1.33	1.23	1.13	1.03			
1.50	1.59	1.49	1.39	1.29	1.19	1.09			
1.55	1.65	1.55	1.45	1.35	1.25	1.15	1.05		
1.60	1.70	1.60	1.50	1.40	1.30	1.20	1.10	1.00	
1.65	1.76	1.66	1.56	1.46	1.36	1.26	1.16	1.06	
1.70	1.82	1.72	1.62	1.52	1.42	1.32	1.22	1.12	1.02

3.2 Assembly

All of the assembly and installation work has to be carried out by the customer. This includes:

- ▶ Installing the flanges with pipe or glands for high-pressure versions
- ▶ Mounting the control unit
- ▶ Installing weatherproof covers



Warning

- When carrying out assembly and installation work, observe the relevant safety regulations and the safety information in Chapter 1!
- Assembly and installation work on potentially dangerous installations (hot or corrosive gases, high internal duct pressure) must only be carried out when the plant is shut down!
- Suitable measures must be taken to protect against local or installation-specific hazards!

3.2.1 Installing the Flanges respectively Glands with Pipe

3.2.1.1 FLOWSIC100 PREXZ2

Activities

- ▶ Measure out the mounting locations in such a way that the planned installation angle is reached (if mounting two flanges with pipe, observe the diameter) and mark the mounting location.
- ▶ Remove the insulation (if present).
- ▶ Cut out suitable oval openings (apertures) in the duct wall; with brick and concrete ducts, drill suitably sized holes (see Appendix for templates).



Important

Make sure that parts do not fall into the duct!

- ▶ Insert the flange with pipe in the aperture as shown in **Fig. 3.6**,
 - observe the minimum draw-in length L_e of minimum 20 mm,
 - roughly align it and tack it into position with a few spot welds,
 - with brick and concrete ducts, tack it to a holding plate

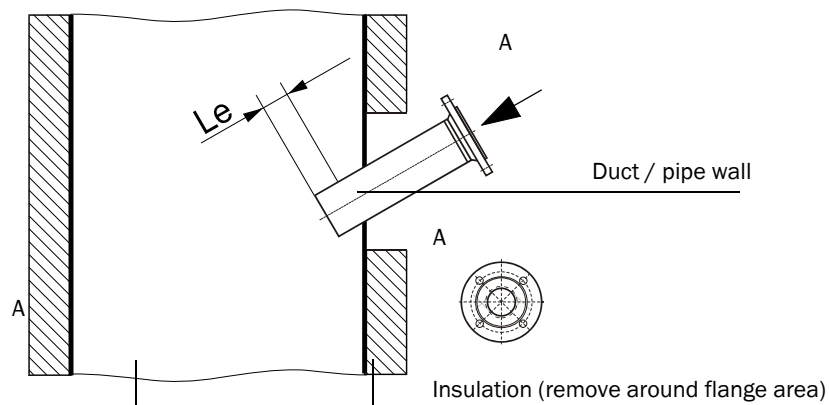


Fig. 3.6: Installation options for the flanges with pipe

3.2.1.2 FLOWSIC100 PN16/CL150, EX22 and EX22RE

For the installation of the glands PN16DN50 or CL150Z2 apply the procedures given in the Appendix of the Operating Instructions for FLOWSIC100 PROCESS. The notes on dimensions and alignment of the flanges with pipe in Section 3.2.1 are to be followed and applied.

- Notes**
- If two glands are mounted, the alignment of both gland pipes has priority over the compliance of the installation angle.
 - Distortion because of temperature shift or mechanical stress kann cause changes of the measuring distance.

Duct/pipe diameter > 0.5m

The maximum wall thickness for the installation of the mounting kit with the retractable sender/receiver units is 25.4mm (1 inch).

The insertion length (dimension L_e in Section 3.2.1.1) should be approx. 10 mm.

Duct/pipe diameter < 0.5 m

The activities are generally the same as those for larger diameters. The difference with small diameters is that installing the flanges and sender/receiver units can have a greater impact on the flow characteristics. To minimize this impact, therefore, the flange pipes should not be inserted in the pipeline, but rather mounted and welded on the outside.

There are two installation options (see Fig. 3.7 and Fig. 3.8):

- On two sides
- On one side, using the sound reflection at the opposite inside wall.

This solution can be used with very small ducts to increase the measuring distance, or if access is only possible from one side.

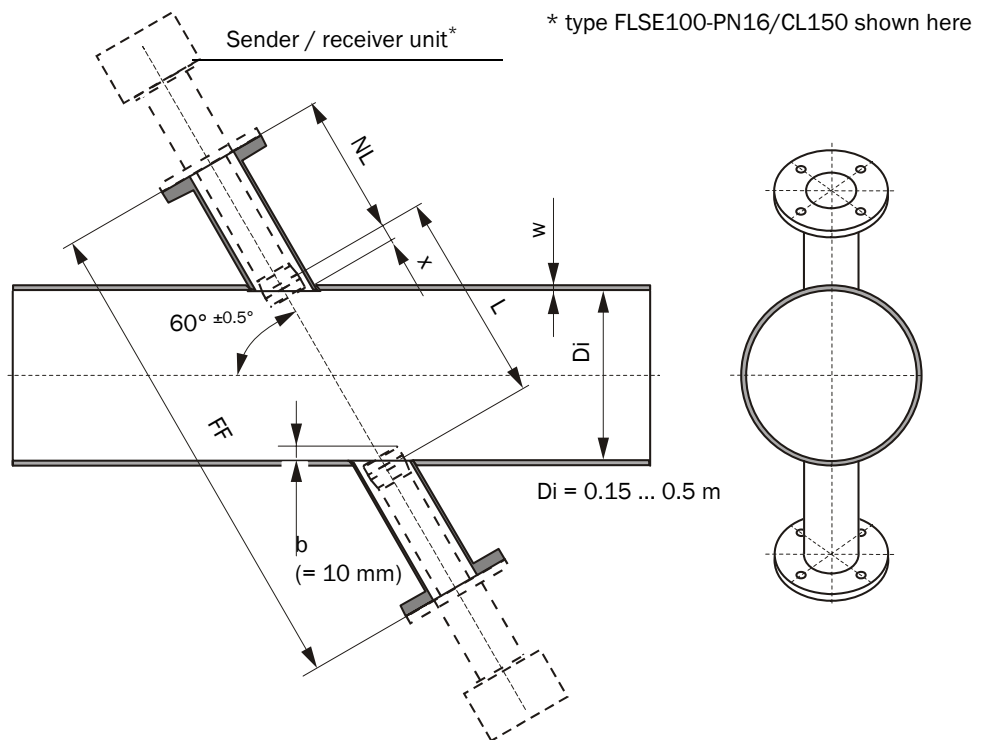


Fig. 3.7: Two-side assembly of the glands with pipe

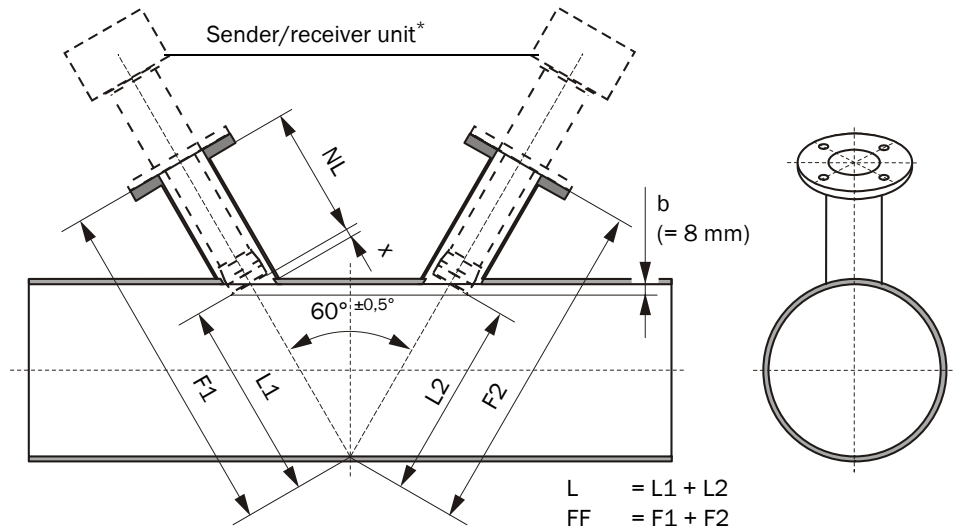
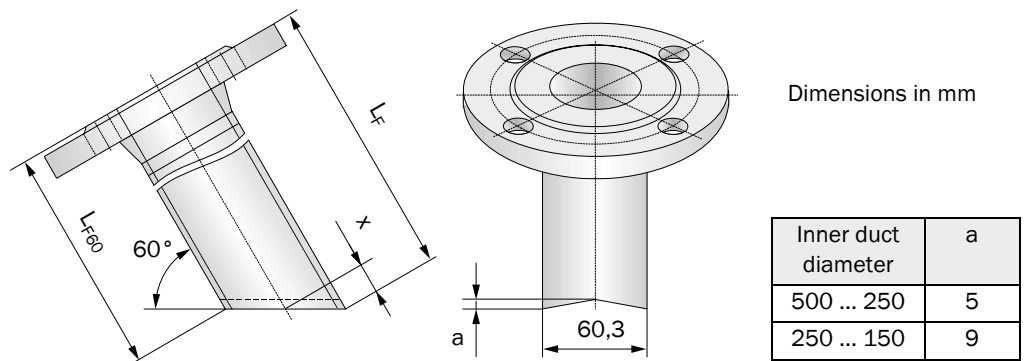


Fig. 3.8: One-side assembly of the glands with pipe

For pressure-resistant variants FLSE100-PN16DN50, CL1502Z, EXZ2 and EXZ2RE with DIN or ANSI flange.

Select the glands according to Section 6.1.2, and adapt them to the wall curvature as shown in the following figure.



$$L_F = NL - NL_{KH} + x$$

$$L_{F60} = L_F - 34,8$$

$$x = \frac{60,3 + 35}{2 \cdot \tan \alpha} - \frac{(w + b)}{\sin \alpha} \quad \begin{matrix} w = \text{Wall thickness} \\ b = 8 (\alpha = 60^\circ) \end{matrix}$$

NL = Nominal length sender/receiver unit

- not retractable sender/receiver units:

NL = 260

- retractable sender/receiver units:

NL = 380

NL_{KH} = Installation length ball valve

- not retractable sender/receiver units:

NL_{KH} = 0

- retractable sender/receiver units:

NL_{KH} = 150

Fig. 3.9: Adapting the glands

3.2.2 Mounting the Multi Control Unit (MCU)

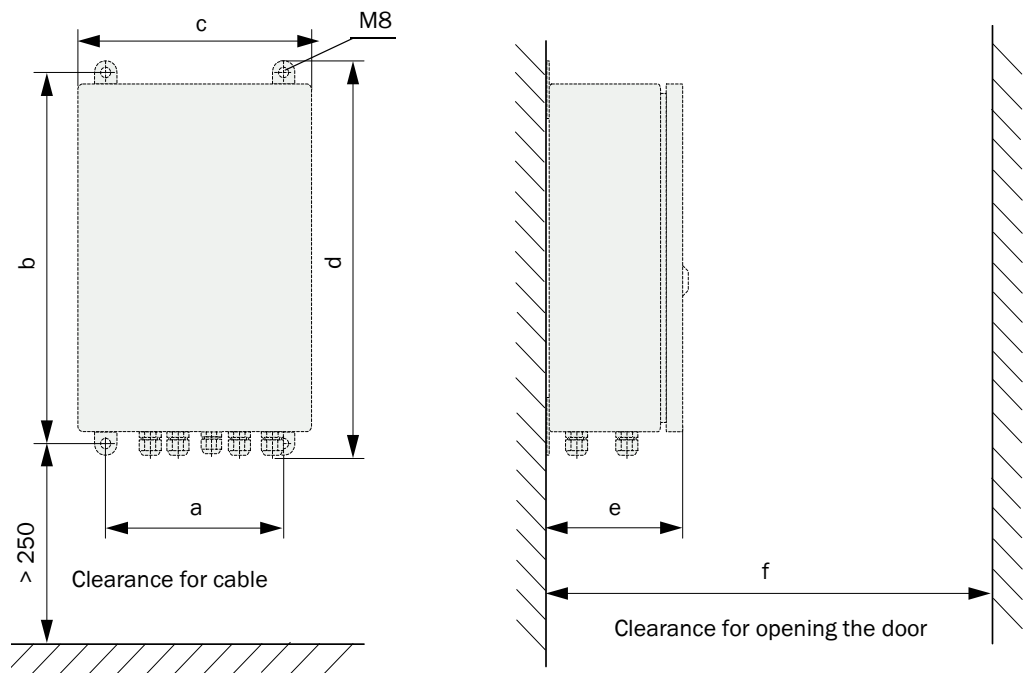
The control unit must be mounted on a level base at an accessible, protected location (see Fig. 3.10 for dimensions). The following must be taken into account:

- The ambient temperature range specified in the technical data must be observed; note any radiant heat (and provide a shield if necessary).
- Protect the unit from direct sunlight.
- The mounting location should be free of vibration; provide stabilization measures if necessary.
- Provide sufficient clearance for the cables and for opening the front panel.

Provided that suitable cables are used (see Section 3.4.3), the MCU-N control unit can be mounted at a distance of up to 1000 m from the sender/receiver units (use bus wiring as shown in Fig. 3.16; the length is the total length of all the cables). For easier access to the MCU, we recommend to install it in a control room. This facilitates communication with the FLOW SIC100 PROCESS for configuration or troubleshooting.

If the device is to be mounted outdoors, the optional weatherproof cover for the control unit or equivalent cover (corrugated roof) must be provided.

Mounting Dimensions



Size	Type connection unit
	MCU-N and MCU-N for Ex Zone 2
a	160
b	320
c	210
d	340
e	125
f	> 350

Fig. 3.10: Mounting dimensions of the MCU

3.3 Installation of the Sender/Receiver Units

3.3.1 Prerequisites

Check the following before installation:

- ▶ The sender/receiver units must have at least the same nominal length as the gland pipes.
- ▶ The inside of the gland pipes must be free of welding beads.
- ▶ The inside of the probe pipes on the sender/receiver units must not come into contact with the flange pipes.
- ▶ The cable connection on the electronics unit for sender/receiver units must be at the bottom.

Note Under consideration of the mounting instructions according to **Fig. 3.4**, for the type FLSE100-PREXZ2 loosen the screwed connections between the electronics unit and PR / PRAC connection, rotate the unit accordingly (90°, 180°, 270°), and screw the components together again.

3.3.2 Installation of Retractable Sender/Receiver Units

The sender/receiver unit FLSE100-EXZ2RE may be installed/uninstalled on the mounting kit while the facility is operating if the following instructions are adhered to.



Warning

- ▶ Observe and adhere absolutely to the relevant safety regulations and the safety information in Chapter 1!
- ▶ Take special precautions for use in plants with increased hazard potential (toxic/aggressive/explosive gasses, higher pressure, higher temperature) (risk of serious injuries)!
- ▶ Suitable measures must be taken to protect against local or installation-specific hazards.
- ▶ Make sure that the ball valve DN50 is closed.
- ▶ The permitted operational parameters according to the diagrams in Section 2.3.1 apply to all work.

Installation

See Fig. 3.11

- ▶ Loosen the fastening screws on the blind flange of the mounting kit (1) and remove the blind flange (2).
- ▶ Set the sender/receiver unit with seal on the ball valve DN 50 (3, 4) and secure it with the fastenings screws (5). The ball valve DN 12 must be closed.
- ▶ Remove the cotter pins from the guide rods (6) and loosen both fastening nuts (7).
- ▶ Open the ball valve DN 50 (8).
- ▶ Slide the sender/receiver unit carefully into ball valve and connection piece up to the stop and secure it with the nuts (9).
- ▶ Attaching the cotter pins at the guide rods (10).

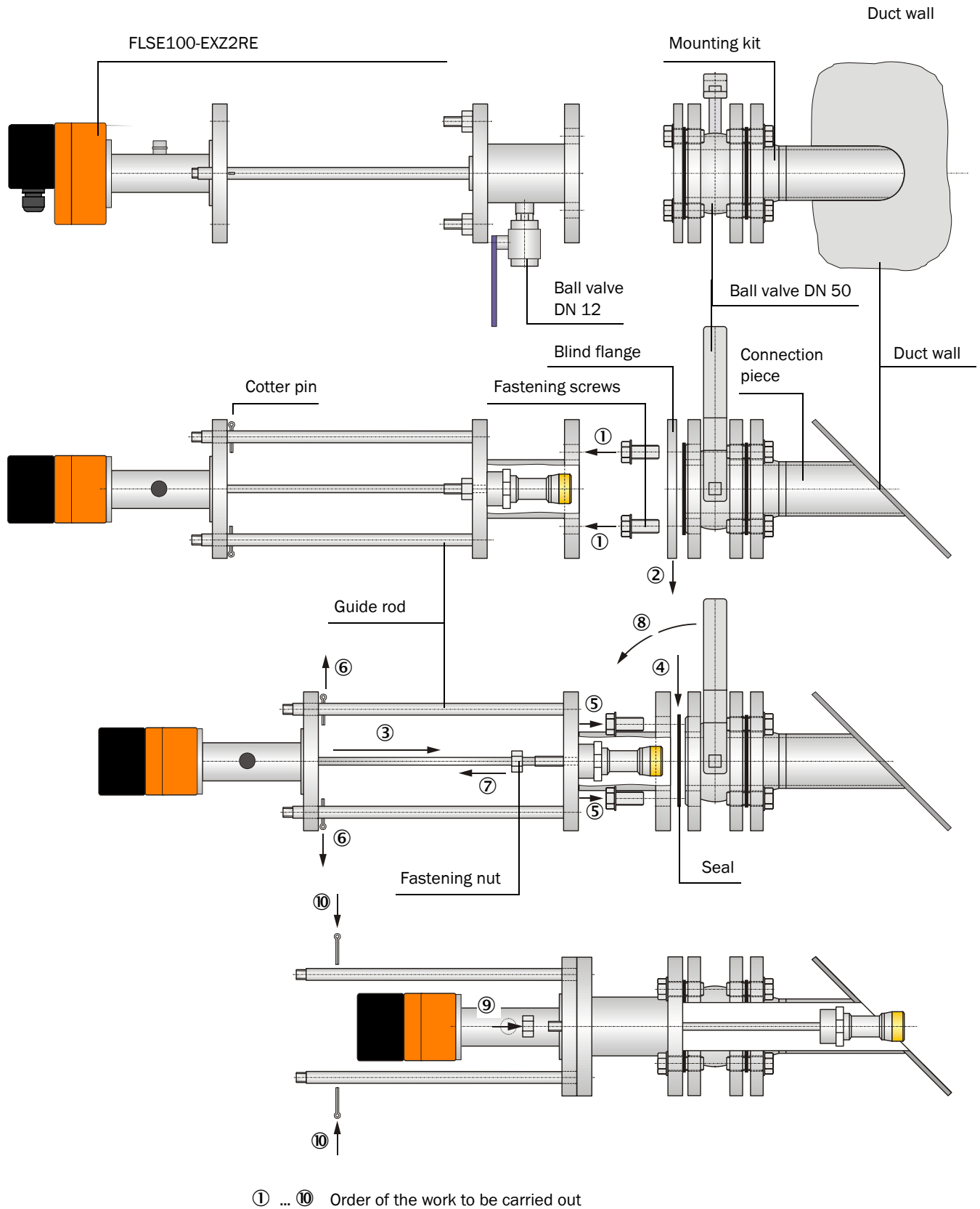


Fig. 3.11: Installation of the retractable sender/receiver units (shown for duct <0.5 m)

3.4 Installation

3.4.1 General Instructions, Prerequisites

Before you start the installation work, you must have carried out the steps described in Section 3.2.

Unless otherwise agreed with SICK or an authorized representative, all of the installation work must be carried out by the customer. This includes:

- Laying all the power supply and signal cables
- Connecting the power supply and signal cables to the system components
- Installing the switches and power fuses.



Warning

- ▶ Carry out all installation work in line with the relevant safety regulations and instructions listed in Chapter 1.
- ▶ Take suitable measures to protect against danger.

Notes

- ▶ Plan adequate cable cross-sections (see Section 2.6 "Technical Data")
- ▶ The cable ends with connector for connecting the sender/receiver units must be long enough.
- ▶ Cable connectors that are not connected must be protected from dirt and moisture (fit cover).

Energy consumption of sender/ receiver units FLSE100-PREXZ2/EXZ2/EXZ2RE in measuring mode

Supply voltage[V]	24	22	20	18	16
FLSE100-PREXZ2					
Current consumption [mA]	27	28,5	30	31,5	34
Power consumption [mW]	648	627	600	567	544
FLSE100-EXZ2/EXZ2RE					
Current consumption [mA]	30,5	32	34	36,5	40
Power consumption [mW]	732	704	680	657	640

3.4.2 Connecting the Sender/Receiver Units FLSE100-PN16DN50/CL150 and Control Unit MCU (not Ex-protected Variant)



Warning

- ▶ Put measuring system in de-energised state before connecting or disconnecting any cables.

Faulty cabling can lead to the failure of the sender/receiver units! Should this be the case, the warranty will be invalid. The manufacturer takes no responsibility for further damage.

Necessary activities

- ▶ Connect the cables for the sender/receiver units as shown in **Fig. 3.16**.
- ▶ Connect the cable provided by the customer according to xxFig 3.13 to the connection box and to the MCU.

Note When choosing the cable type, make sure that the core/core effective capacitance is less than 110 pF/m and the minimum core cross-section is 0.5 mm² (AWG20).

We recommend the cable type UNITRONIC Li2YCYv(TP) 2x2x0.5 mm² with reinforced outer sheath (from Lappkabel).

- ▶ Connect the cables for status signals (operation/malfunction, warning, maintenance, check cycle), analog output, analog- and digital inputs to the MCU according to the requirements.
- ▶ Connect the power supply cable to terminals L1, N, PE (see **Fig. 3.12**)
- ▶ Check the cabling during the installation for possible damage.

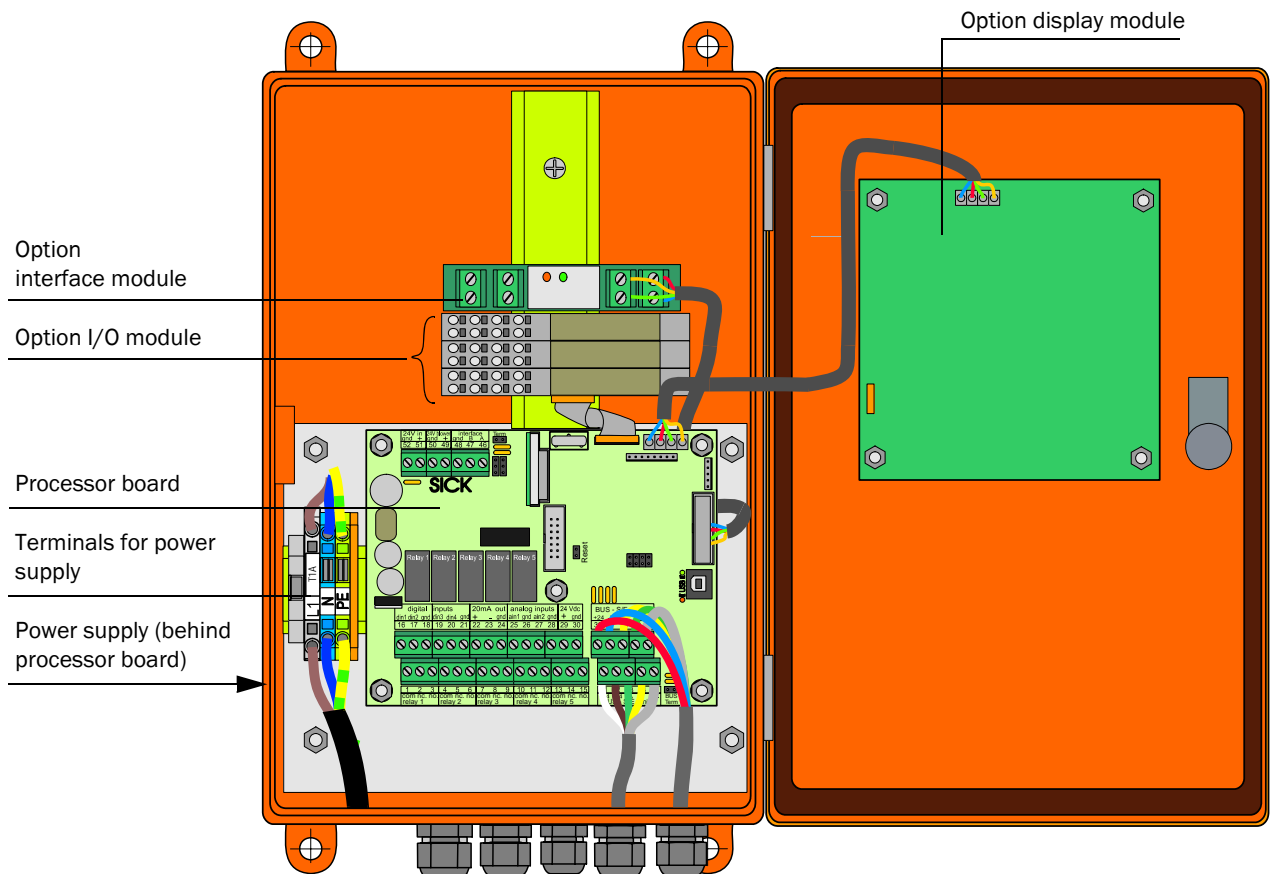


Fig. 3.12: Component alignment in the MCU

MCU processor board terminals

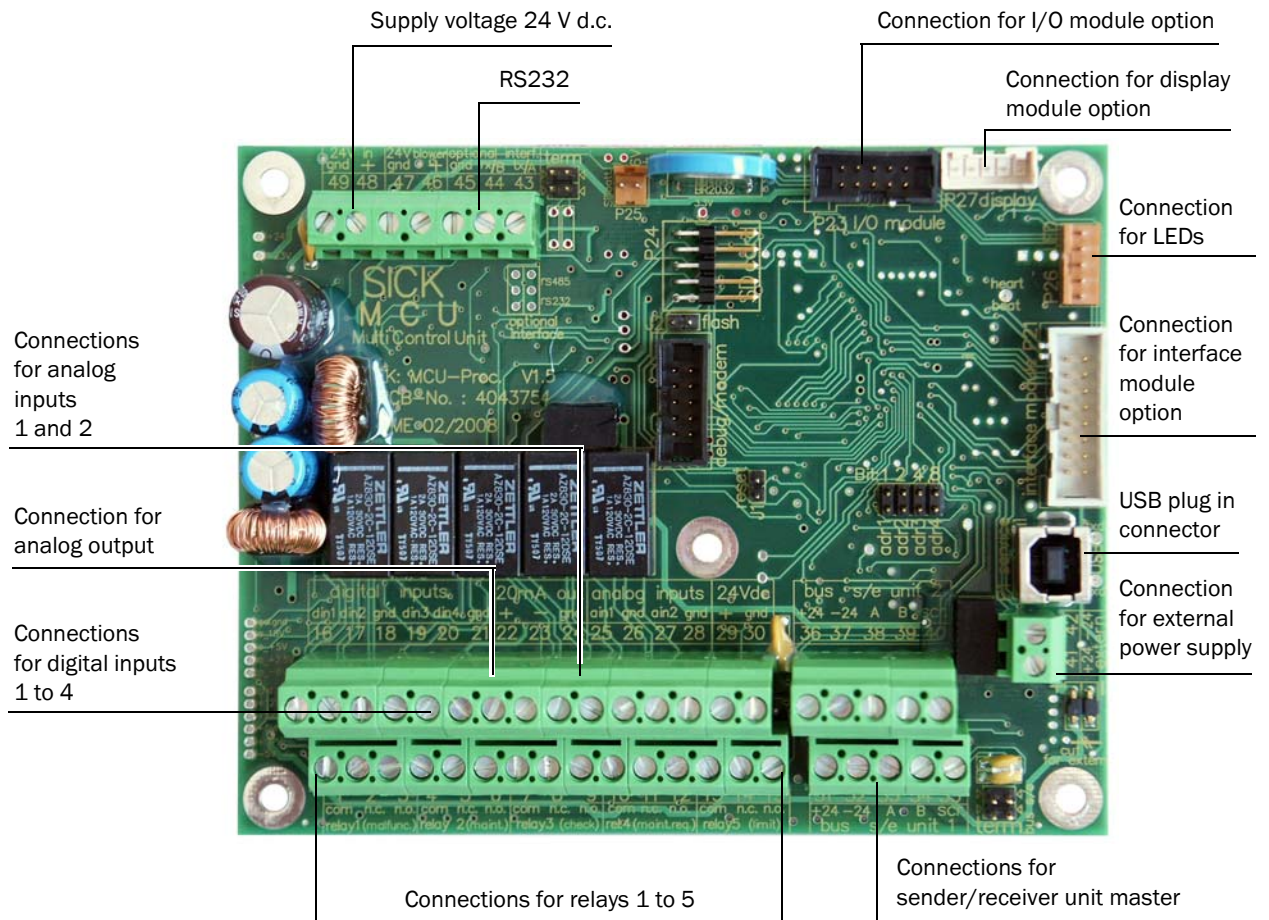


Fig. 3.13: Connections on the MCU processor board

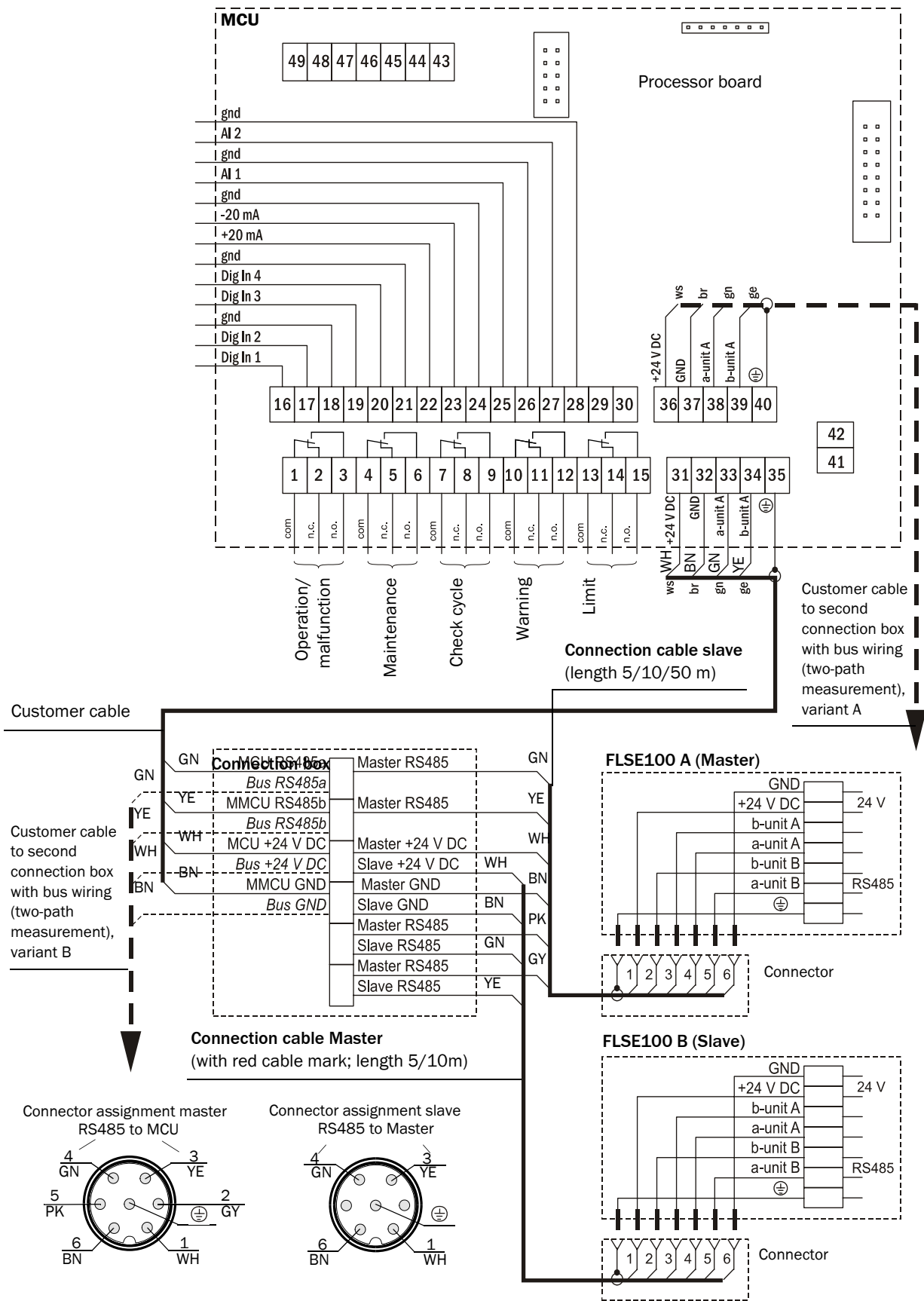


Fig. 3.14: Connecting the sender/receiver units, connection box and MCU in not-Ex-protected variant

3.4.3 Connecting the Sender/Receiver Units FLSE100-EXZ2/EXZ2RE/PREXZ2 and Control Unit MCU/MCUEX (Ex-protected Variant)

Requirements of the wiring in the hazardous location

- Cables must fulfil the prerequisites of EN 60079-14.
- Cables which are particularly endangered due to thermal, mechanical or chemical stress should be protected, e.g. by laying them in conduits open on both sides.
- Cables not protected against the spread of fire must be flame retardant according to German standard DIN VDE 0472 Part 804 Test type B.
- The cross section of each individual core must not be less than 0.5 mm².
- When selecting the cables, care must be taken that the clamping range for the screwed cable gland is 6 - 12 mm.
- The use of cables with core identity code according to DIN 47100 is recommended to facilitate installation and avoid connection faults.
- Recommended cable type: Li2YCYv 2x2x0.5mm² by LAPP-Kabel
- Protect the core ends from splicing by using wire end ferrules.
- The existing air gaps and creep distances according to EN 50019 must not be reduced after the cables have been connected in the terminal chamber of the FLSE100-EXZ2/EXZ2RE/PREXZ2.
- Unused screwed cable glands should be replaced with the enclosed EExe-vent plugs.
- The equipotential bonding must be designed in accordance with EN 60079-14 (see also the following section).
- Excess-current release 10 A.
- Overload release with trigger characteristics B.



Warning

- ▶ Connect the Sender/Receiver Units Type FLSE100-EXZ2/EXZ2RE only to the control unit MCU/MCUEX. A connection to non-system devices, especially external power supply facilities, power packs etc. is not allowed.
- ▶ Put measuring system in de-energised state before connecting or disconnecting any cables.
- ▶ The EExe-terminal chambers of the Ex-protected sender/receiver units must only be opened in de-energised state.

Faulty cabling can lead to the failure of the sender/receiver units! Should this be the case, the warranty will be invalid. The manufacturer takes no responsibility for further damage.

Terminal Assignment in Terminal Chamber of Sender/Receiver Unit FLSE-EXZ2/EXZ2RE/PREXZ2

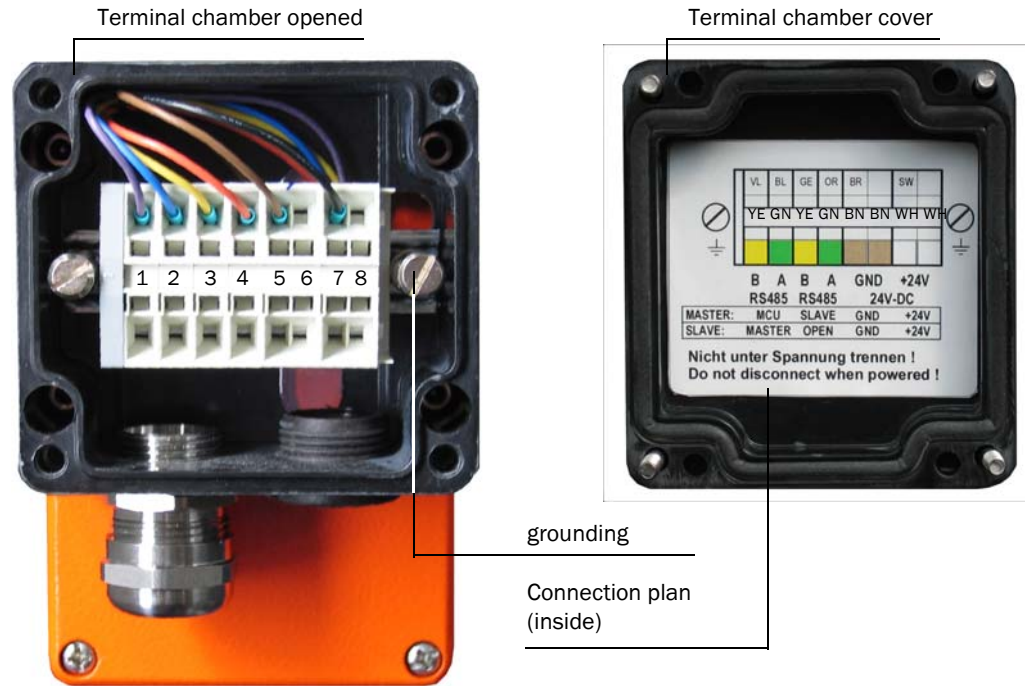


Fig. 3.15: Terminal chamber sender/receiver unit FLSE100-EXZ2/EXZ2RE/PREXZ2

Connection FLSE100-EXZ2/EXZ2RE Master

Customer connection internal	blue	violet	orange	yellow	brown		black	
	1	2	3	4	5	6	7	8
Connection external	green	yellow	green	yellow	brown		white	
Configuration	IF1	IF1	IF2	IF2	gnd		+24 V DC	

IF1: Communication between FLSE-Master and MCU (Interface 1)

IF2: Communication between FLSE-Master and FLSE Slave (Interface 2)

Connection FLSE100-EXZ2/EXZ2RE Slave

Customer connection internal	blue	violet	orange	yellow	brown		black	
	1	2	3	4	5	6	7	8
Connection external	green	yellow	green	yellow	brown		white	
Configuration	IF2	IF2			gnd		+24 V DC	

Connection FLSE100-PREXZ2

Customer connection internal	blue	violet	orange	yellow	brown		black	
	1	2	3	4	5	6	7	8
Connection external	green	yellow	green	yellow	brown		white	
Configuration	IF1	IF1			gnd		+24 V DC	

Necessary activities

- ▶ Connect the cable provided by the customer according to xxFig 3.13 and Fig 3.16 xx and the above table to FLSE-Master, FLSE-Slave and MCU/MCUEX.

Note The connection cables for installation in the Ex-Zone must comply with the aforementioned specifications.

- ▶ Connect the cables for status signals (operation/malfunction, warning, maintenance, check cycle), analog output, analog- and digital inputs to the MCU according to the requirements.
- ▶ Connect the power supply cable to terminals L1, N, PE (see Fig. 3.12)
- ▶ Check the cabling during the installation for possible damage.

Cabling FLOWVIC100 EX22 / EX22RE

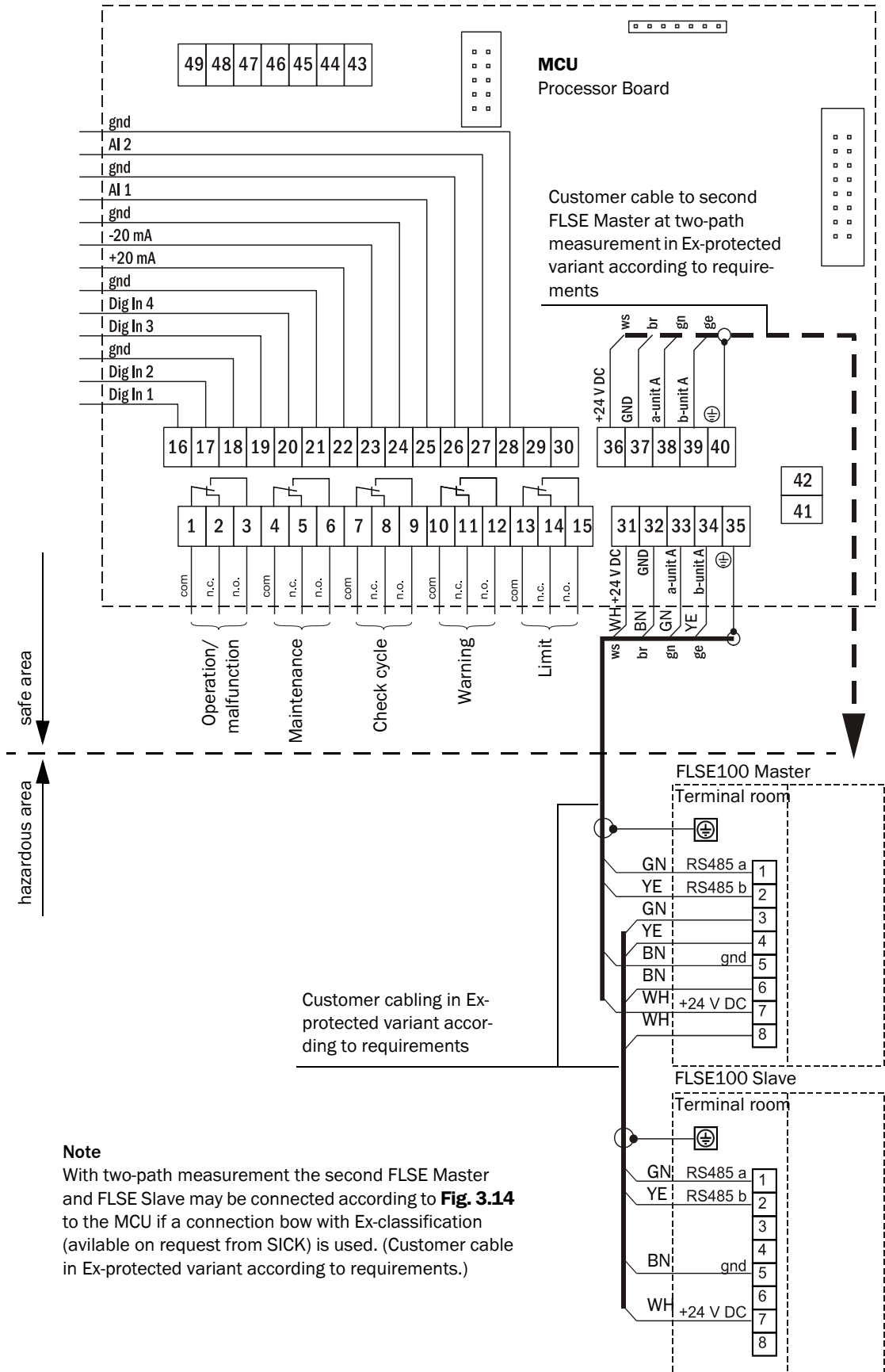


Fig. 3.16: FLOWVIC100 EX-22 / EX-22-RE

Cabling FLOWsic100 PREXZ2

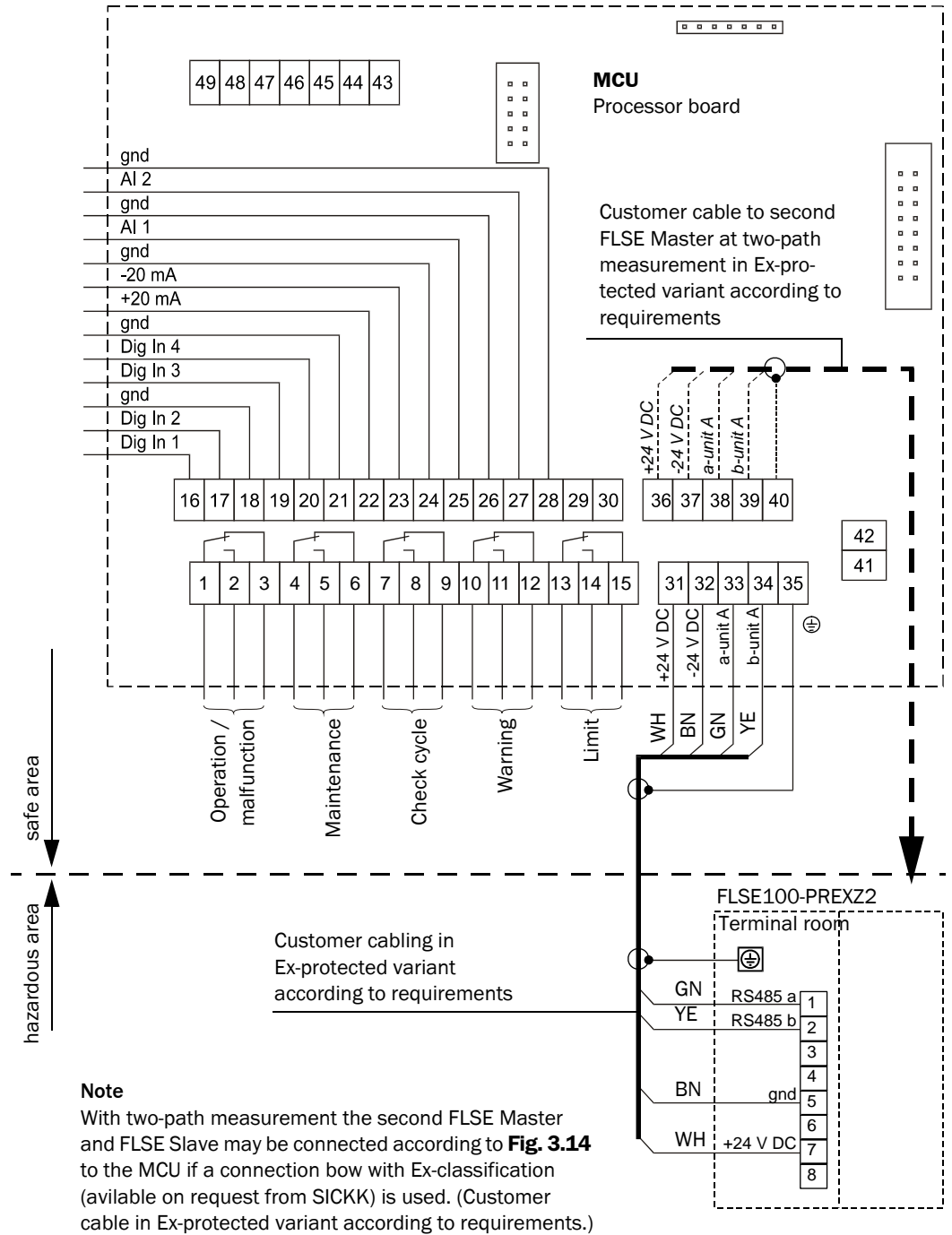


Fig. 3.17: Cabling FLOWsic100 PR-EX-Z2

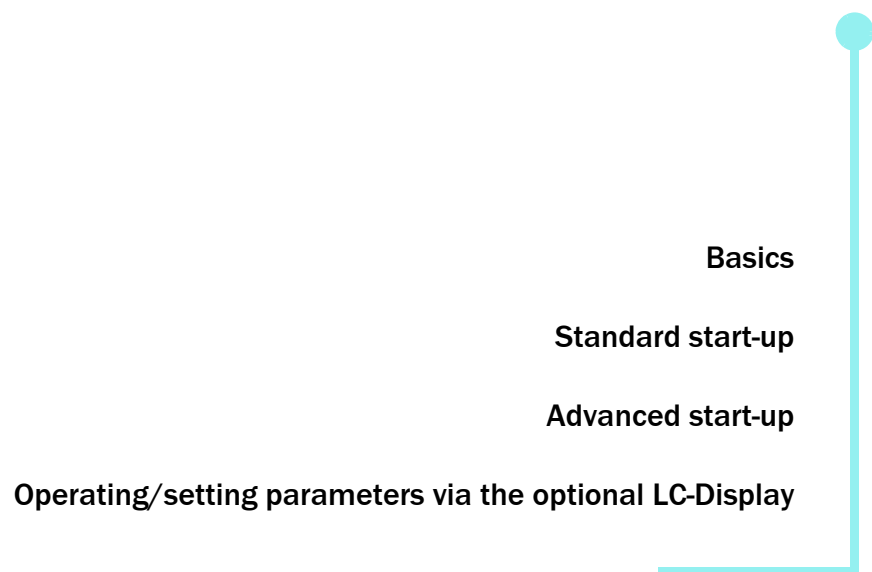
3.4.4 Installing and Connecting the Interface and I/O Module Options

Plug these modules onto the top hat rail in the MCU (see **Fig. 3.12**) and connect them with the cable with plug to the corresponding connector on the processor board (see **Fig. 3.13**).

FLAWSIC100 PROCESS

Gas Velocity Monitor

Commissioning and Configuration



4 Commissioning and Configuration

4.1 Basics

4.1.1 General Notes

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 (see Section 4.2.2). A zero adjust is not necessary.

An additional velocity measurement calibration using network point measurement with a reference measuring system (e.g. dynamic pressure probe) is then only necessary when the velocity profile on the measuring axis is not representative for the overall cross-section. The regression coefficients determined can then be entered into the device without problems (see Section 4.3.6).

If the gas temperature determined with the FLOWSIC100 PROCESS is to be used to scale the volume flow, a calibration with external temperature sensor is necessary in such cases (see Section 4.3). This is because the sound velocity of the real gas under standard conditions is seldom known.

The SOPAS Engineering Tool (SOPAS ET) program is also delivered 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 device internal parameters. The required settings may only be made by sufficiently qualified persons because erroneous settings mean the device functionality is no longer ensured. This work should only be carried out by SICK Service. Possible settings are described in the Service Manual.

4.1.2 Installing the operating and parameter program SOPAS ET

Note 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 256 MB
 - Operating system: MS Windows 98SE/ME/2000/XP/Vista (not Windows 95/98/NT)
- USB interface cable to connect the Laptop/PC to the measuring system (MCU).
- The operating and parameter program as well as the USB driver (scope of delivery) must be installed on the Laptop/PC.
- The voltage supply must be switched on

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 MCU 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 (see Fig. 4.1).

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

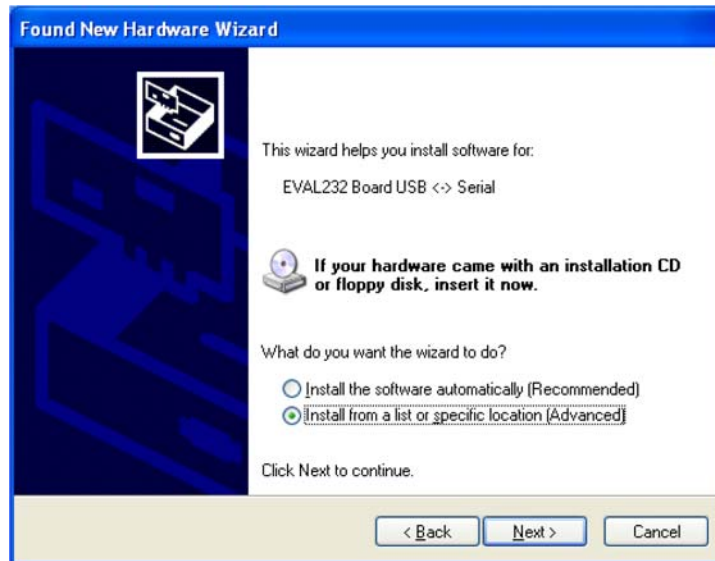


Fig. 4.1: Installing the USB driver

4.1.3 Connecting the Device

- ▶ Connect the USB cable to the MCU control unit (see Fig. 3.13) and laptop/PC.
- ▶ Start the software from the "SICK\SOPAS" start menu.
- ▶ The start dialog appears on the screen (can be deactivated for the further software use).

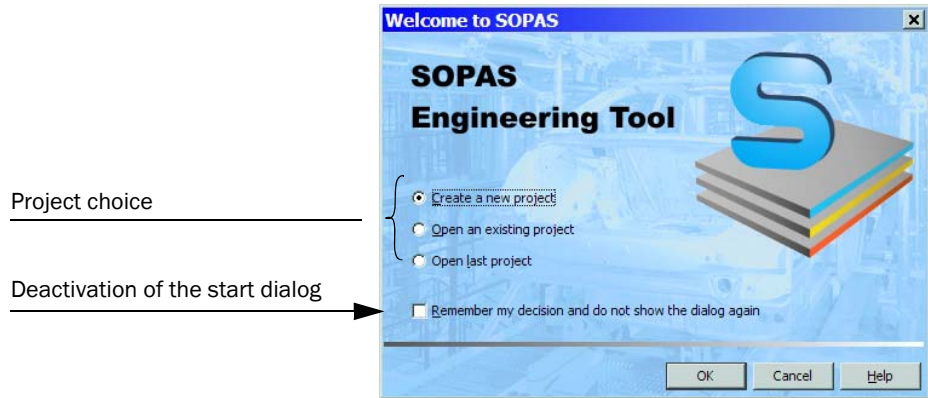


Fig. 4.2: Start dialog

The following Start menu appears after confirmation with "OK"

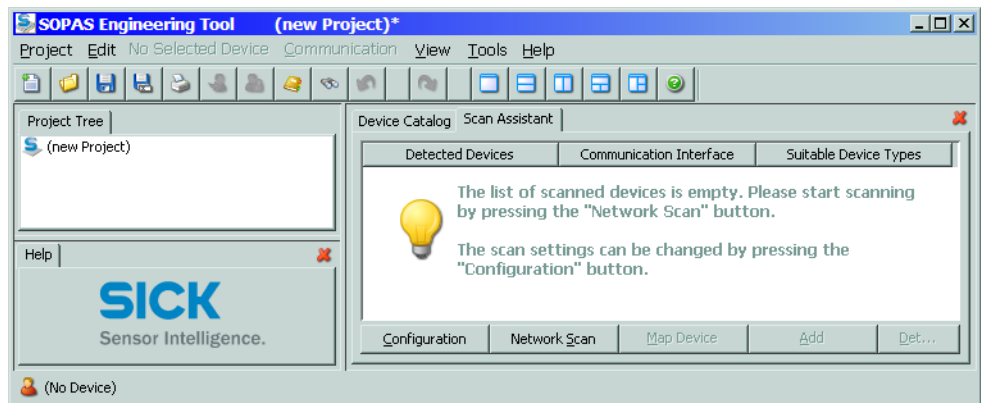


Fig. 4.3: Start menu

- ▶ If required, set the desired language in menu "Tools / Options / Language", confirm with "OK" and restart the program.

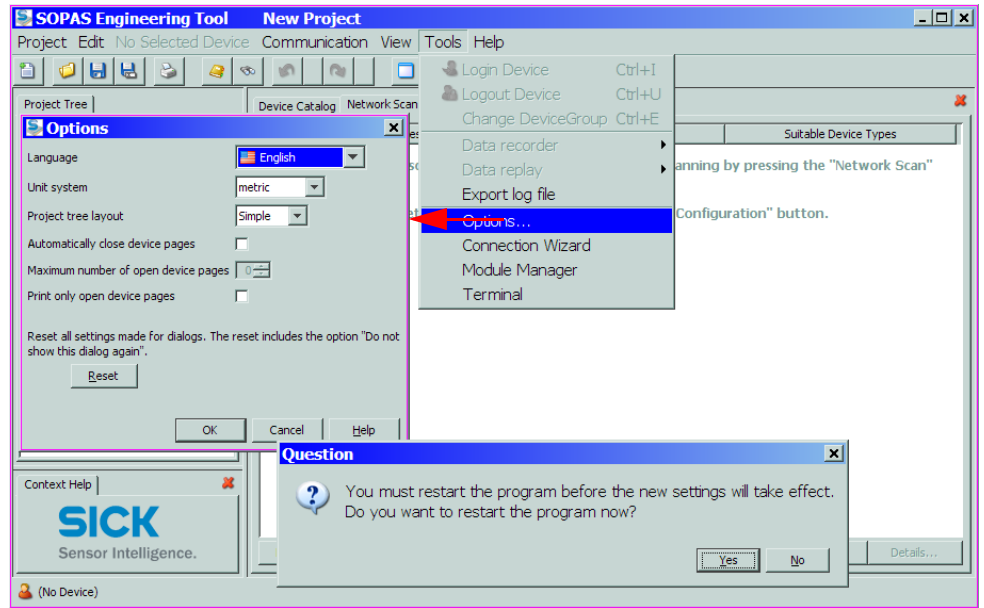


Fig. 4.4: Changing the language setting

- ▶ Click "Configuration" in the Start menu (see Fig. 4.3) and select the "Standard Protocol" menu.
- ▶ Select an available interface in the "Select COM Ports" group, click "Advanced..." and configure according to Fig. 4.5 (settings only need to be made during first connection to the measuring system).

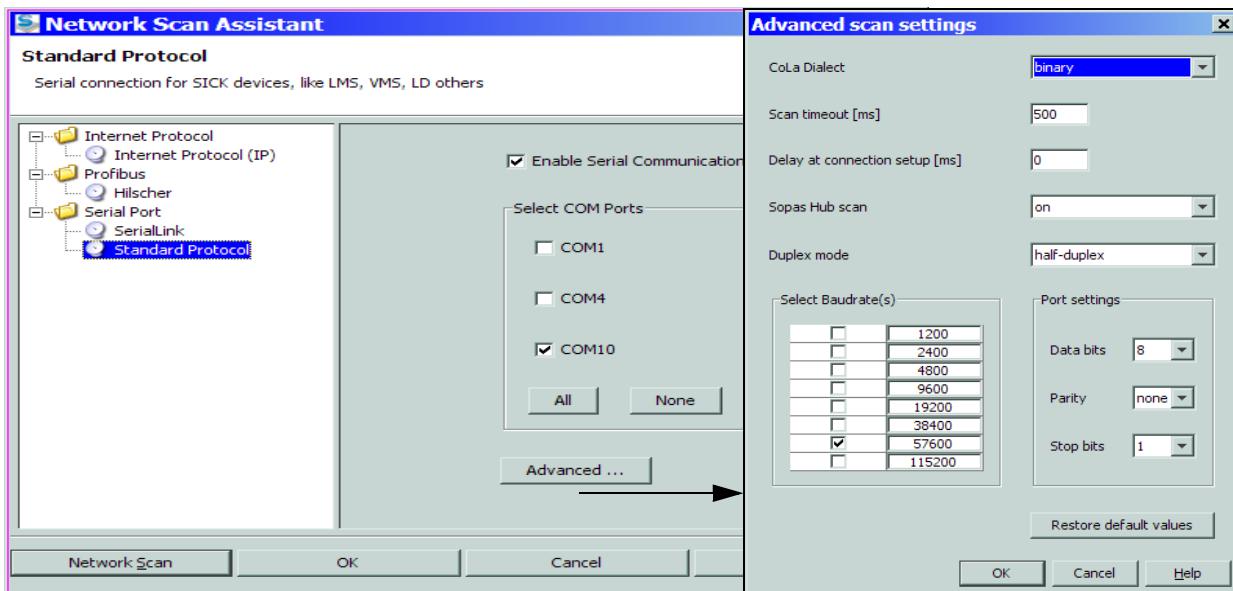
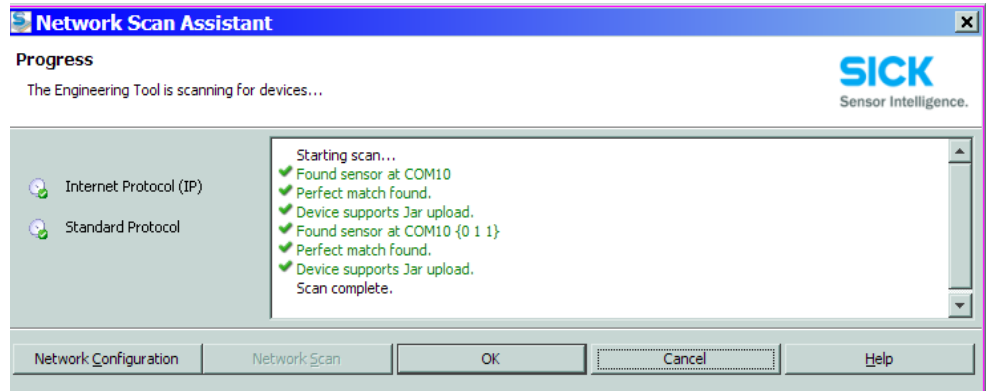


Fig. 4.5: Interface selection and configuration

- ▶ Click the "Network Scan" button in the "Network Scan Assistant" directory and the following window appears.



The following message appears when no device is found (Troubleshooting, see Service Manual):

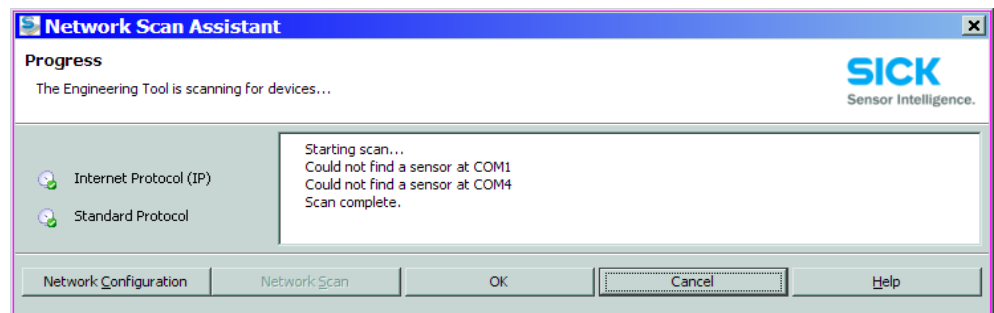


Fig. 4.6: Searching for connected devices

- ▶ Confirm search for connected devices with "OK".

4.1.4 Information on using the program

Device Selection

Select the required devices from those displayed in the "Network Scan Assistant / Detected devices" register and move these to the "Project Tree" window (drag-and-drop per mouse or click the "Add" button).

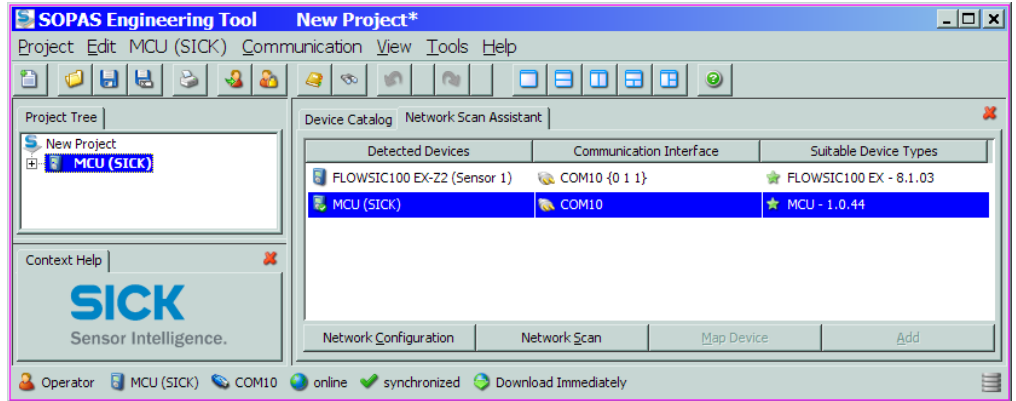


Fig. 4.7: Selection of required devices

Password

Certain device functions are only accessible after a password has been entered (see Fig. 4.8). Access rights are assigned in 3 user levels:

User level		Access to
0	none	Display of measured values and system status
1	"Authorized Client"	Displays inquiries as well as commissioning resp. adjustment to customer-specific demands and diagnosis of necessary parameters
2	"Service"	Displays inquiries as well as all parameters required for service tasks (e.g. diagnosis and clearance of possible malfunctions)

The password for user level 1 is contained in the Annex.

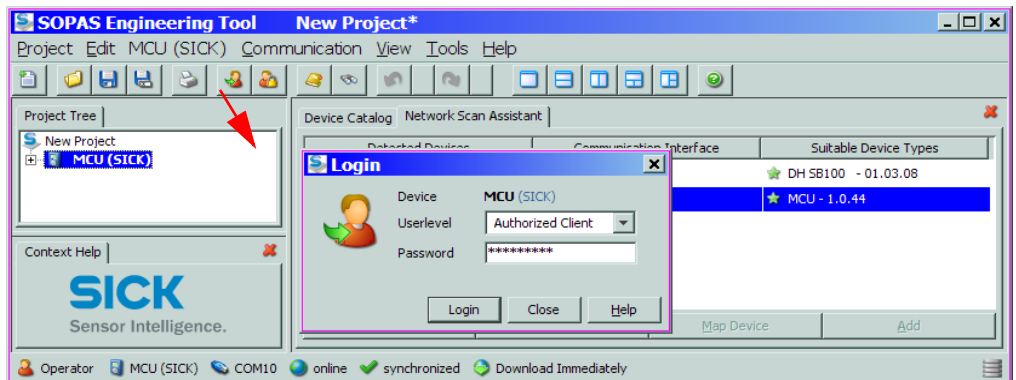


Fig. 4.8: Entering the password

4.1.5 Online-Help

The individual menus and setting options are described in detail in the online help and are therefore not described further here.

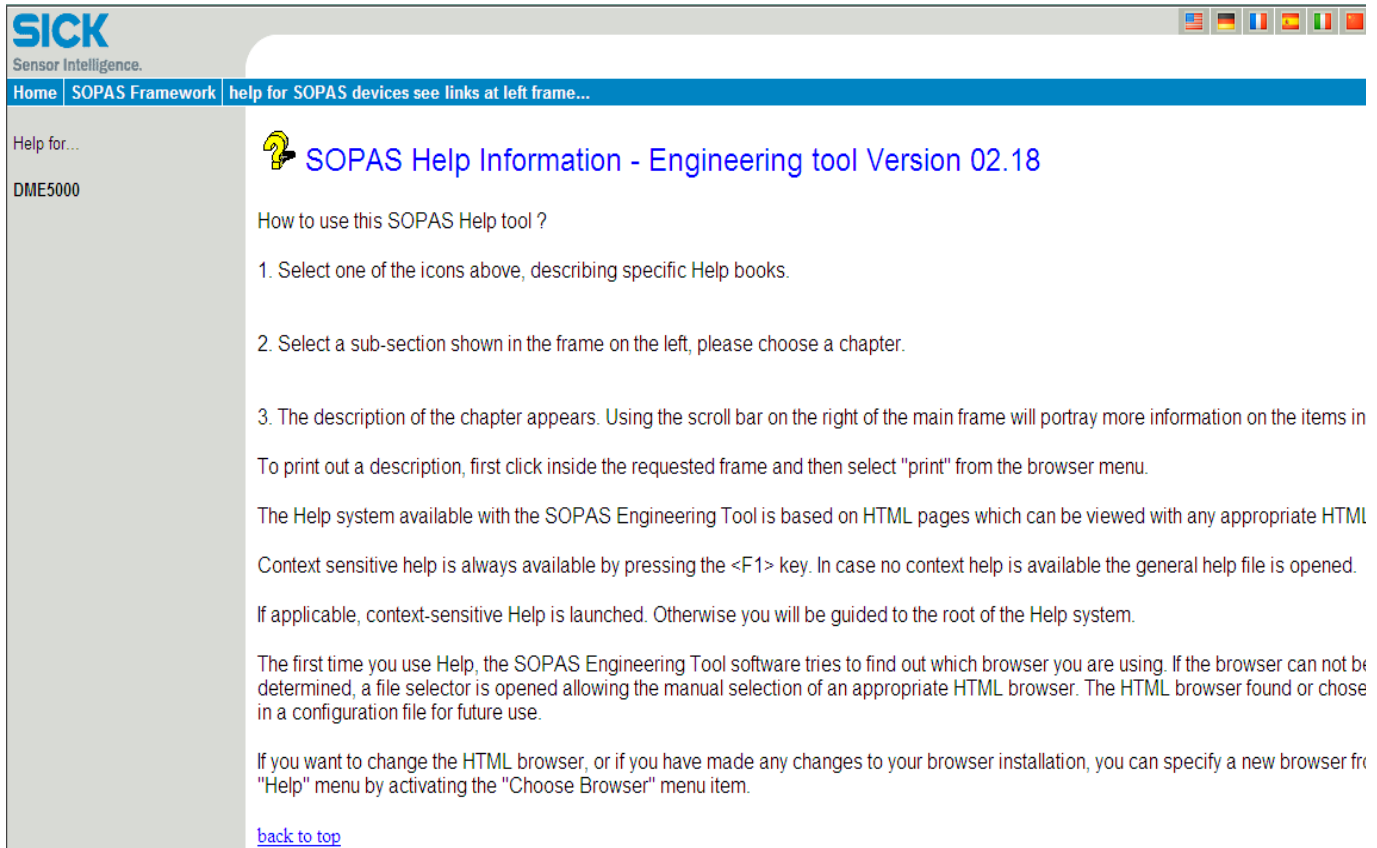


Fig. 4.9: Online Help

4.2 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 see Section 4.3).

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

4.2.1 Entering equipment data

- ▶ Start the SOPAS ET program and connect to the measuring system (see Section 4.1.3).
- ▶ Select the required device file (FL100-xx) from those displayed in the "Network Scan Assistant" window and move it to the "Project Tree" window (see Section 4.1.4).

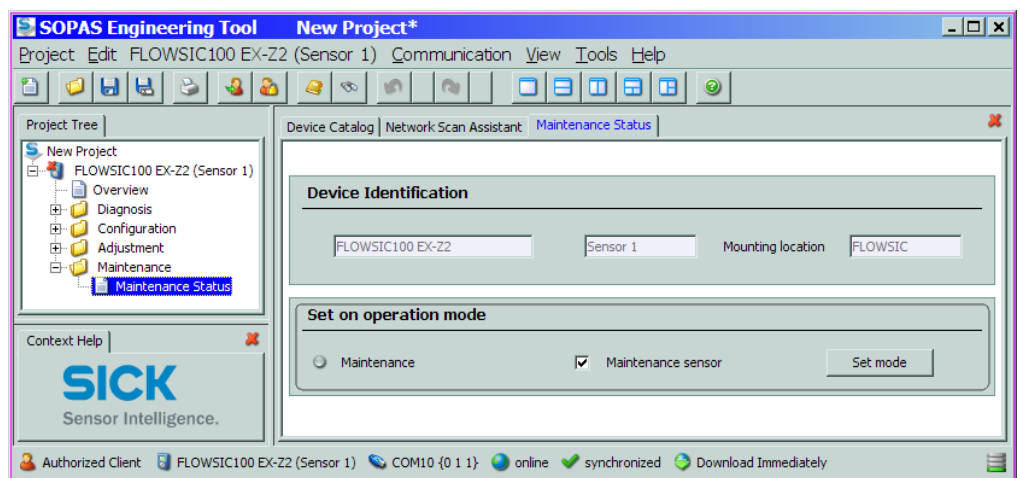


Fig. 4.10: Setting "Maintenance" mode

- ▶ Select the unit of measurement to be used in the "Tools / Options" menu (see Fig. 4.4) (SI or US standard).
- ▶ Select the "Configuration / Application Parameter" directory (see Fig. 4.11) and enter the values determined for path length and angle determined in Section 3.2.1 as well as the cross-sectional area according to Fig. 4.12.

Installation angle	Angle between measuring axis and main gas flow direction (path angle α in Fig. 4.12)
Active measuring path	Distance transducer - transducer (path length L in Fig. 4.12)
Cross-sectional area (required to calculate the volume flow)	Area between inner pipe walls in the measurement setup area vertical to flow direction A (A in Fig. 4.12) Enter the average value of the areas for sender/receiver units A and B after cross-section changes.

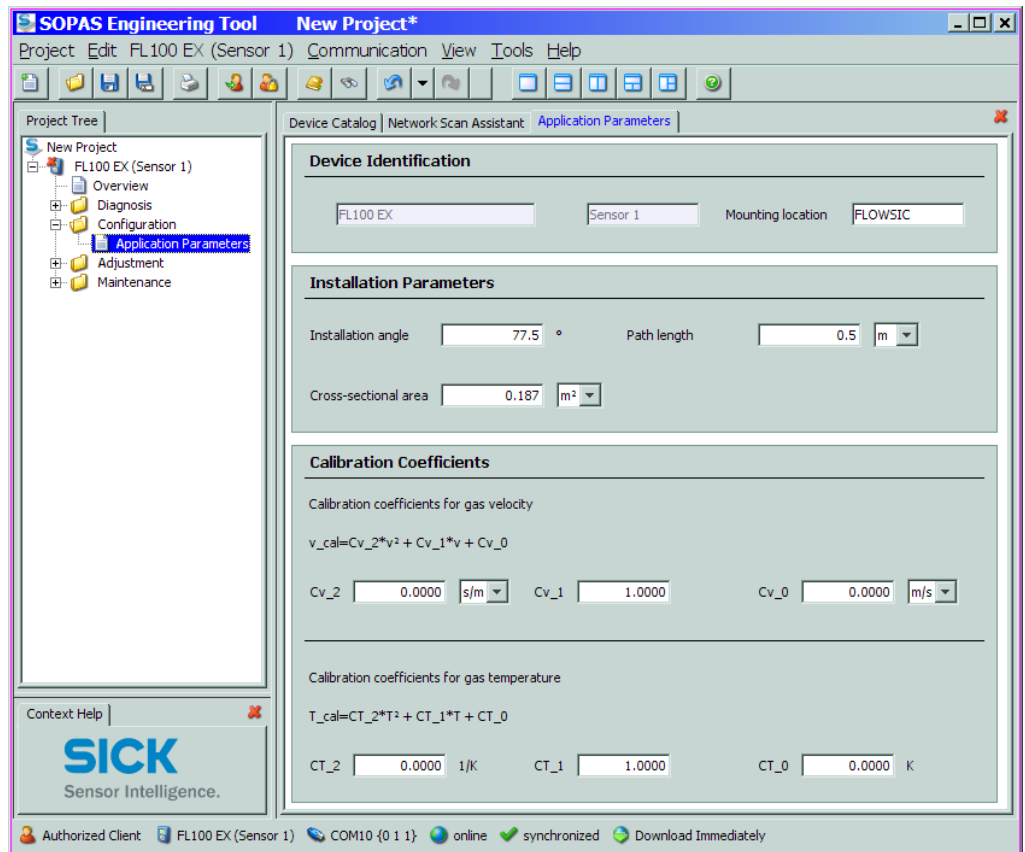


Fig. 4.11: "Application parameters" subpage (example for settings)

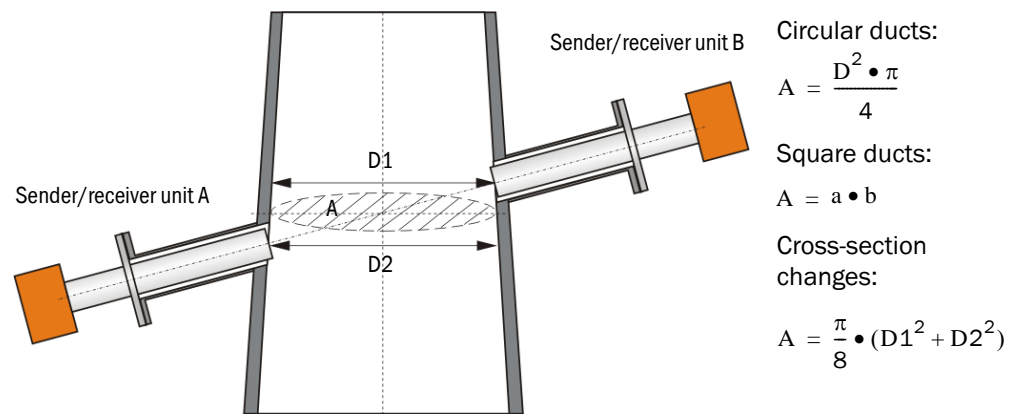


Fig. 4.12: Basic parameters

- Note**
- The entered parameters are saved in the FLOWVIC100 Flare after the switch from "Maintenance" to "Measurement".
 - Set installation parameters are converted automatically when the unit of measurement is changed.

4.2.2 Entering application parameters concerning measuring points

- ▶ Select device file "MCU-P" in the "Network Scan Assistant" and move it to the "Project Tree" window (see Section 4.1.4).
- ▶ Set the MCU to "Maintenance" mode and enter the Level 1 password (see Section 4.1.4).
- ▶ Select the "Parameter / Measure Point 1(2/3) / Measure Point Parameters" directory.
- ▶ In the "Measuring Point 1 - Application Parameters (I)" window, enter data for TAG No., measuring point description, pipe diameter, adjustment factor and zero point threshold. A negative flow velocity can be optionally suppressed.

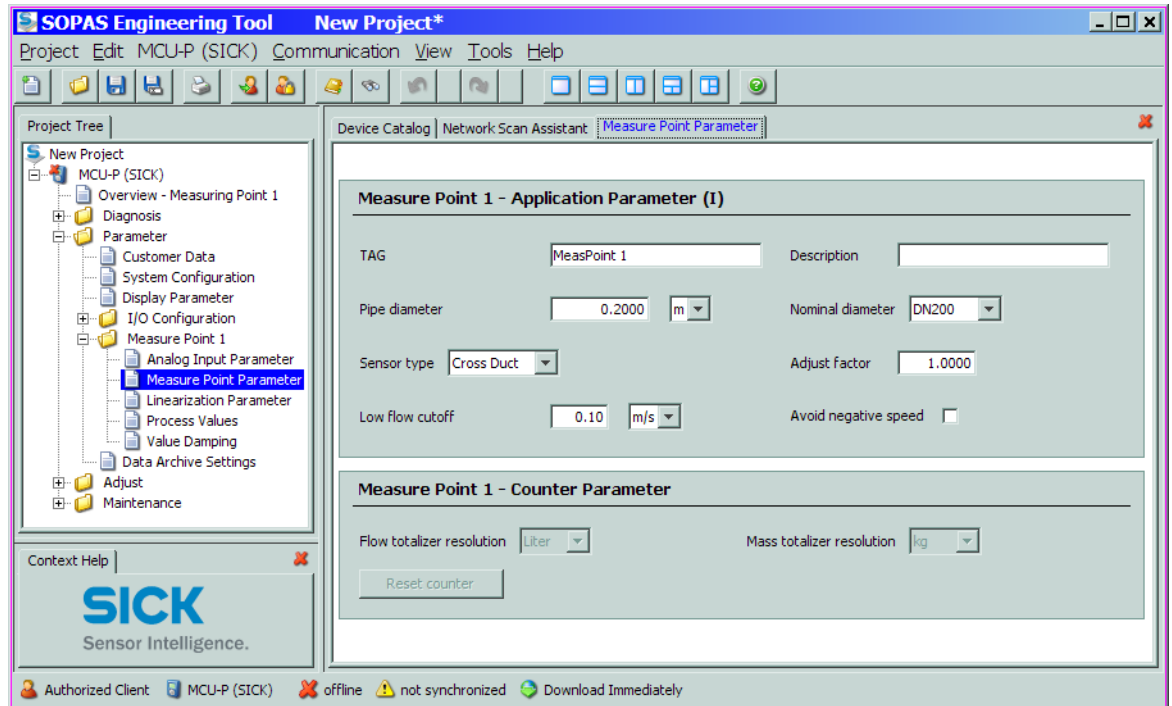


Fig. 4.13: "Parameter / Measure Point 1 / Measure Point Parameters" directory

4.2.3 Determining the check cycle

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

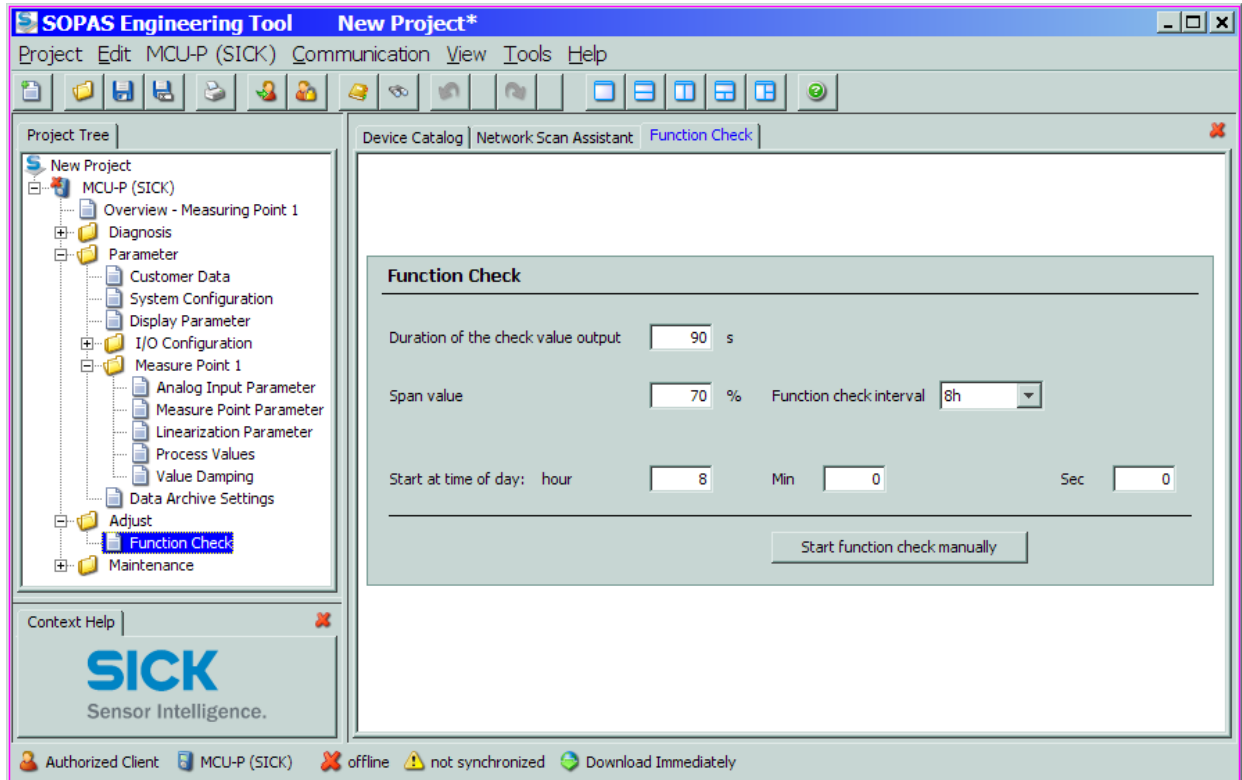


Fig. 4.14: "Adjustment/Function Check" directory (example for settings)

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 (see Section 2.5)
Function check interval	Time between two check cycles	see Section 2.5
Start at time of day	Hours	Defining a start timepoint in hours, minutes and seconds
	Minutes	
	Seconds	

Note The value measured last is output during check value determination.

4.2.4 Setting the analog outputs parameters

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

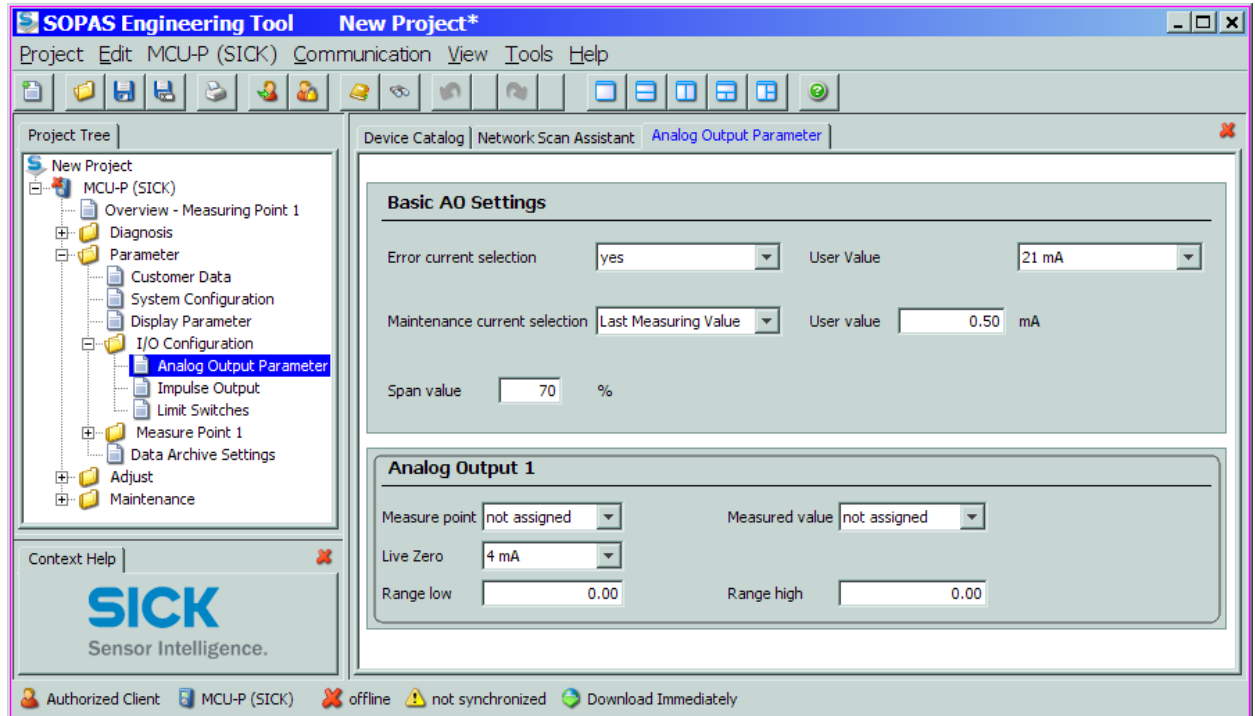


Fig. 4.15: "Parameter / I/O Configuration / Analog Output Parameters" directory

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

Gas Velocity Monitor

Field		Parameter	Remark	
Basic AO settings	Error current selection	Yes	Fault current is output.	
		No	Fault current is not output.	
	User 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 value measured last 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	Measure point	Measuring point 1, 2 or 3		
	Measured value	Volume flow act.	Volume flow in operating state	The selected measured variables are output on the analog output.
		Volume flow std.	Volume flow in standard state	
		Mass flow		
		Molecular mass		
		Gas velocity		
		Sound velocity		
	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.	
Range low	Lower measuring range limit	Physical value at live zero		
Range high	Upper measuring range limit	Physical value at 20 mA		

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

4.2.5 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.

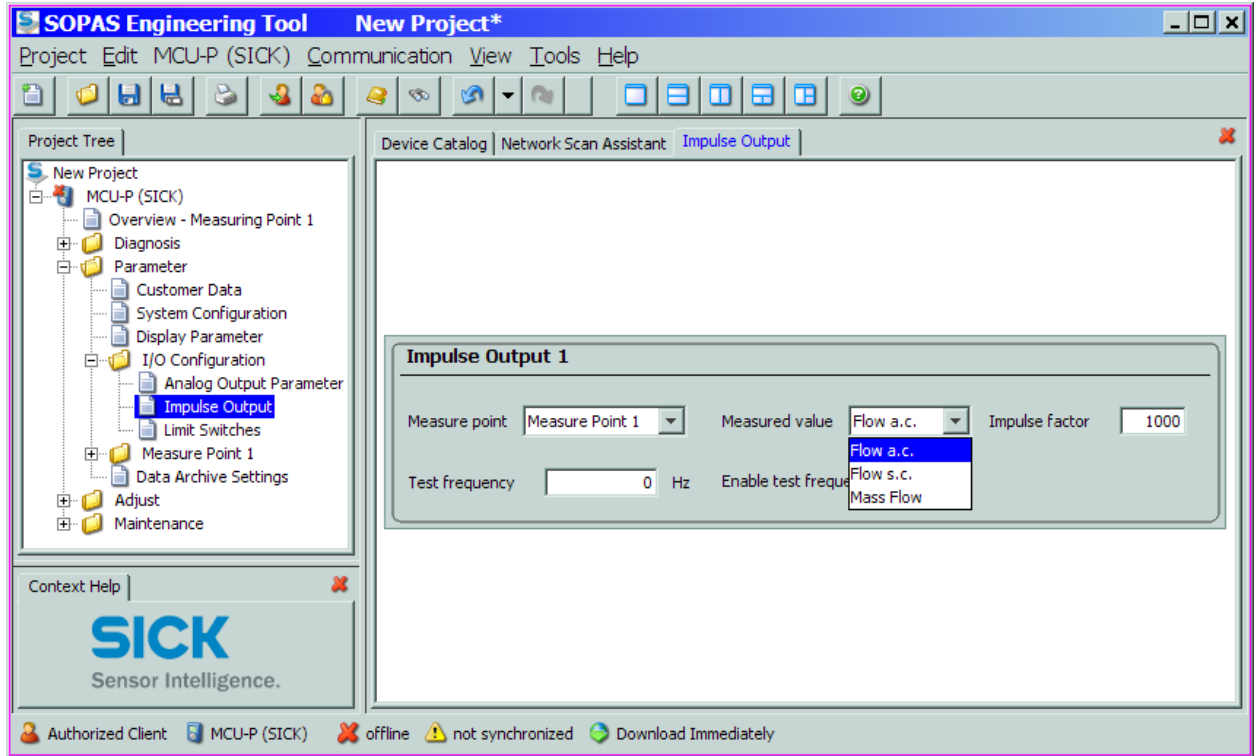


Fig. 4.16: "Parameter / I/O Configuration / Impulse Output" directorye

Field	Parameter	Remark
Measure point	Measuring point 1, 2 or 3	
Measured value	Flow a.c.	Volume flow in operating state
	Flow s.c.	Volume flow in normalized state
	Mass flow	
Impulse factor	Value	Pulses per m ³
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

4.2.6 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.

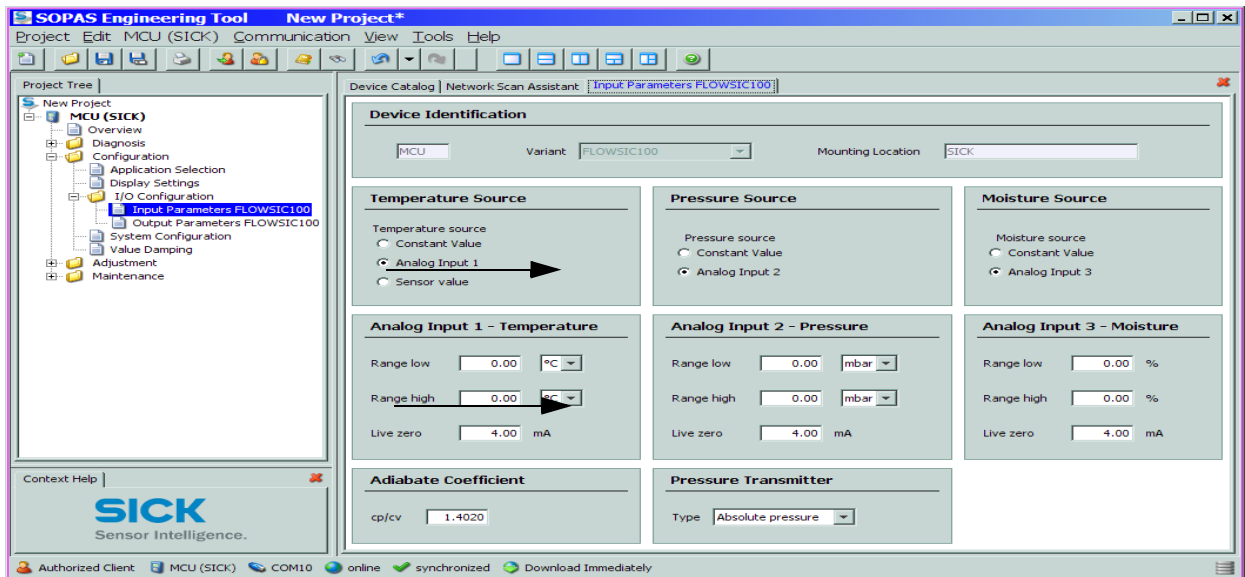


Fig. 4.17: "Parameter / Measure Point 1 / Analog Input Parameter" directory

Field	Parameter	Remark
Temperature Source Selection	Analog input	The value of one of the external sensors connected to the analog input is used to calculate the scaled value. 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.
	Constant Value	A constant value to be entered in the adjacent field is used to calculate the scaled value.
	Sensor value	The temperature value determined internally is used to calculate the scaled value
Pressure Source Selection	Analog input	The value of one of the external sensors connected to the analog input is used to calculate the scaled value. 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.
	Constant Value	A constant value to be entered in the adjacent field is used to calculate the scaled value.

4.2.7 Setting the response time

Select the "Parameter / Measure Point 1(2/3) / Value Damping" directory ("MCU-P" device file) to set the response time.

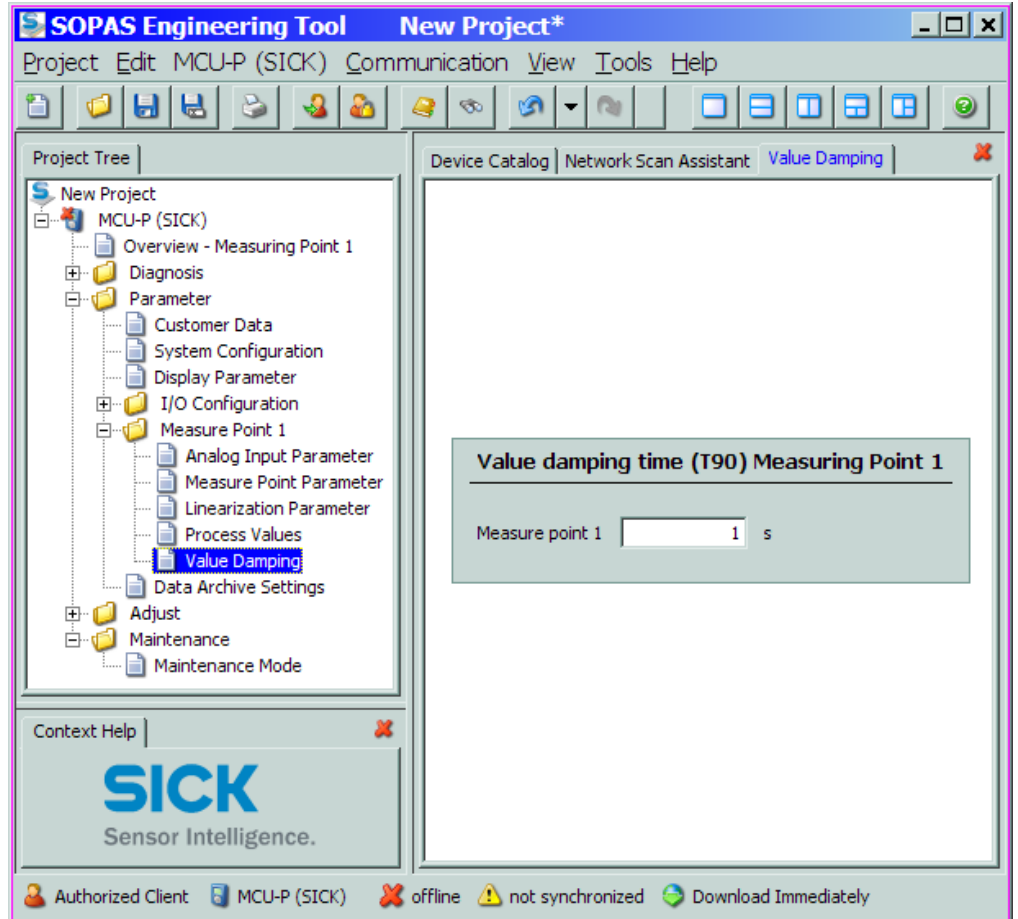


Fig. 4.18: "Parameter / Measure Point 1/ Value Damping" directory

Field	Parameter	Remark
Response time (T90) Measuring point 1	Value in s	Response time of measured value at measuring point 1

4.2.8 Defining the limit value

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

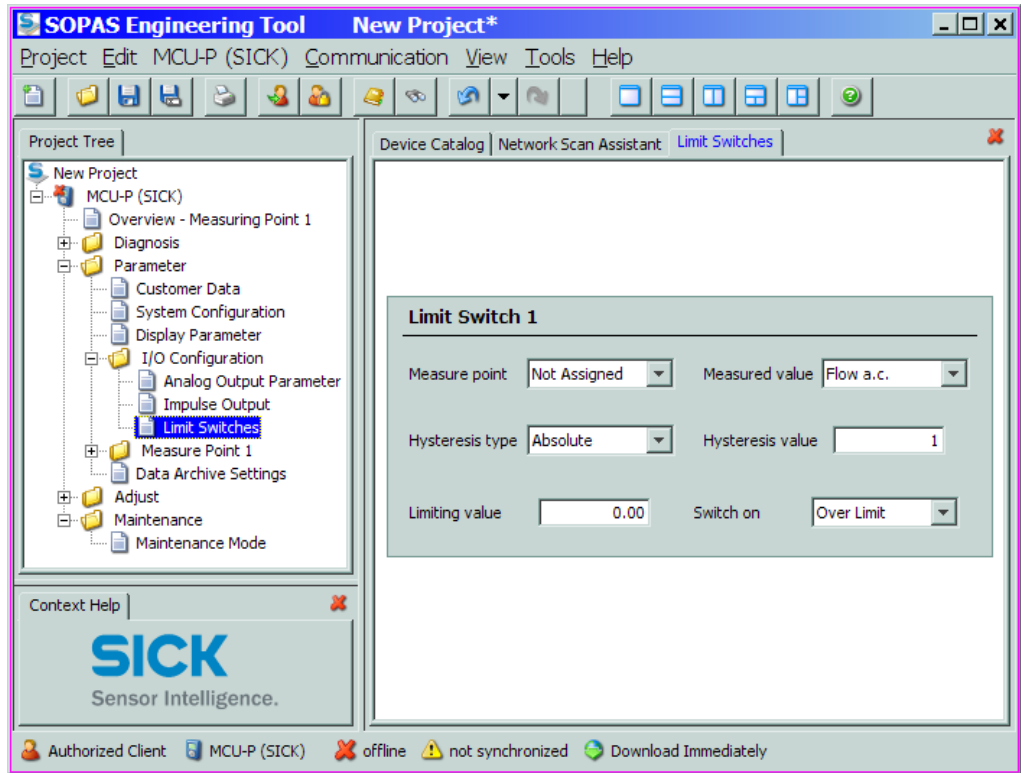


Fig. 4.19: "Parameter / I/O Configuration / Limit Switches" directory

Field	Parameter	Remark
Measure point	Measuring point 1, 2 or 3	
Measured value	Flow a.c.	Volume flow in operating state
	Flow s.c.	Volume flow in normalized state
	Mass Flow	
	Molar mass	
	VoG	Gas velocity
	VoS	Speed of sound
Hysteresis type	Percentaged	Assignment of the value entered in the "Hysteresis Value" field as relative or absolute value of defined limit value
	Absolute	
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.
Switch on	Over limit	Defines the switching direction
	Under limit	

4.2.9 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 MCU
- Malfunction MCU
- Logbook full
- Data archive full
- Measured value limit <No.> exceeded
- Operating mode switched
- Parameter write operation

Maximum 200 entries are registered in the logbook. A warning is output 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".

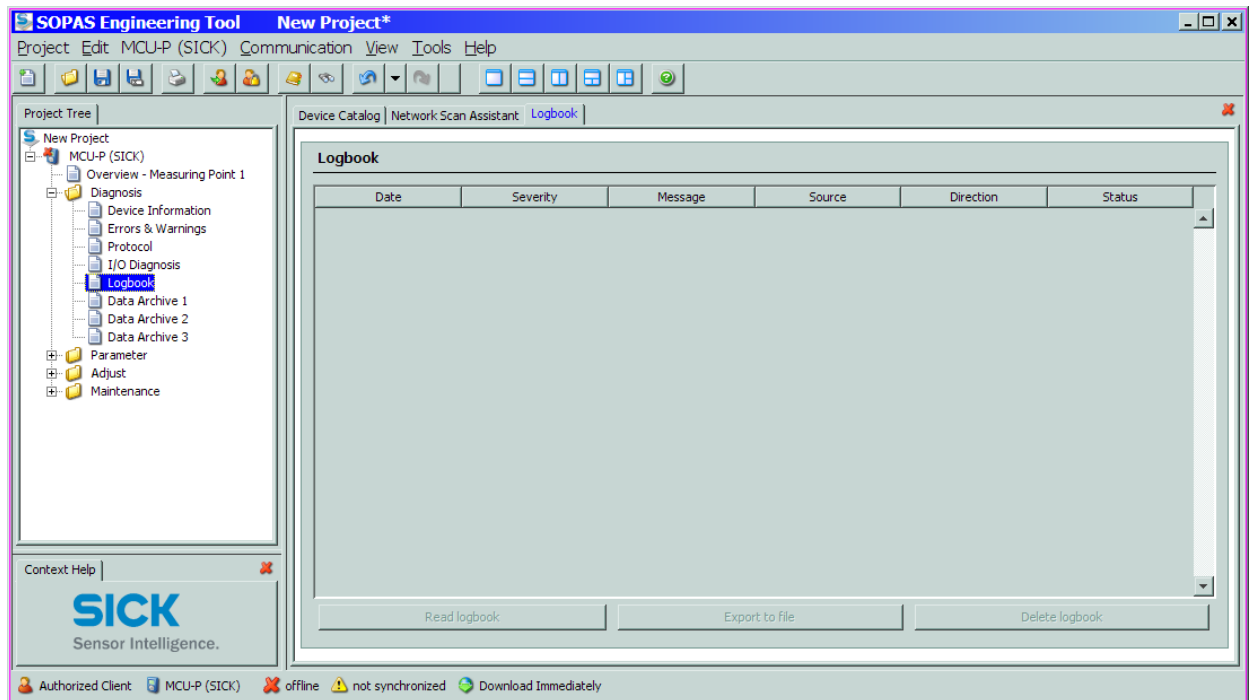


Fig. 4.20: Logbook

4.2.10 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 reentering set device parameters when necessary without problems or to register device data or states for diagnostic purposes..

Data can be saved in the following ways:

- Saving as project
Data recordings can also be stored apart 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.
- Saving as protocol
In the parameter protocol device data and parameter are recorded.
To analyse the device function and to identify possible malfunctions, a diagnosis protocol can be generated.

See Service Manual for description

Saving as a project

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

To save, select the respective device, call up the "Project / Save Project" 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).

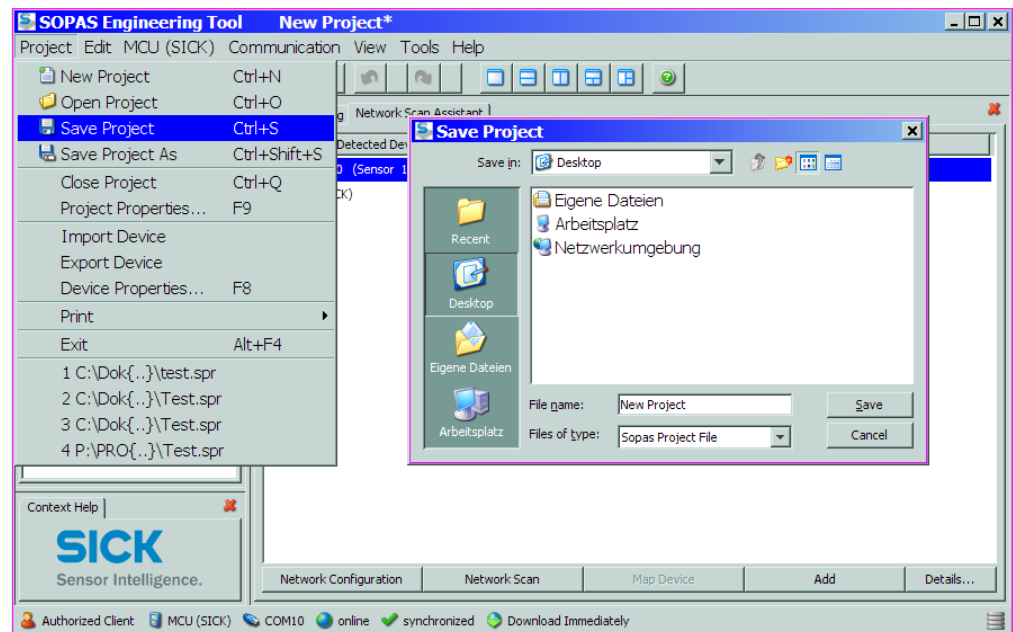


Fig. 4.21: "Project / Save Project" menu

Saving as a protocol

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

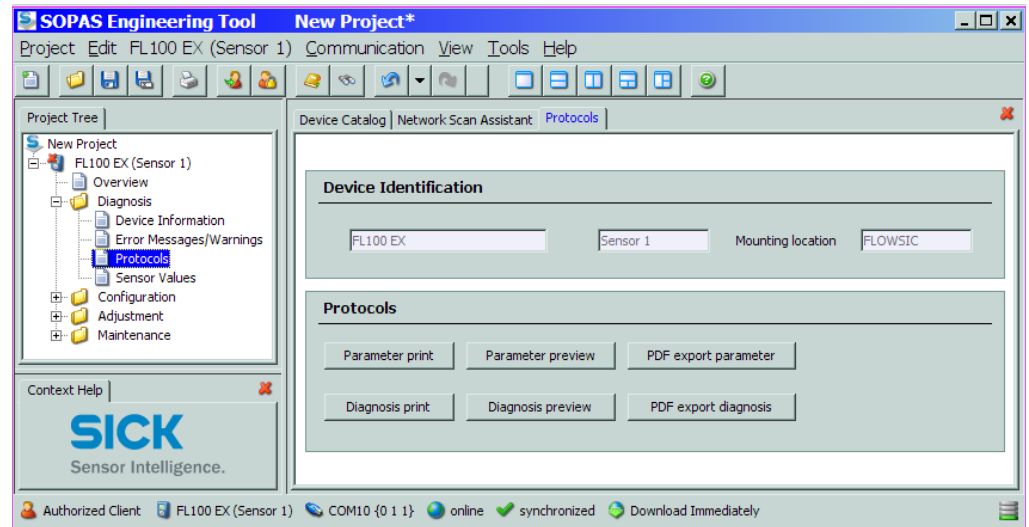


Fig. 4.22: "Diagnosis / Protocols" subpage

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

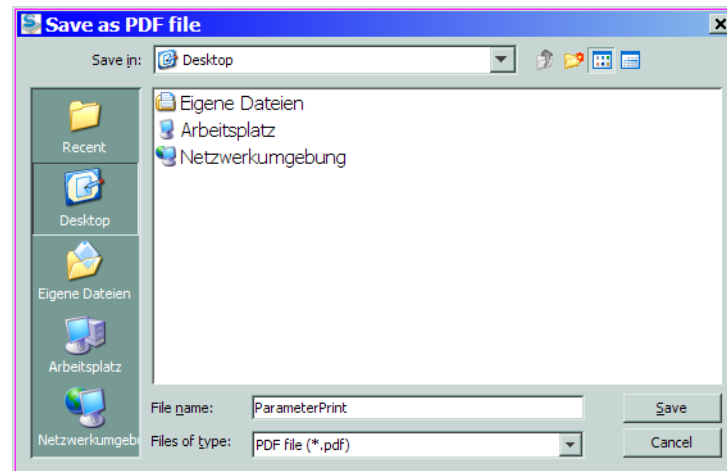


Fig. 4.23: Specification of file name and storage location

Example of a Parameter Protocol

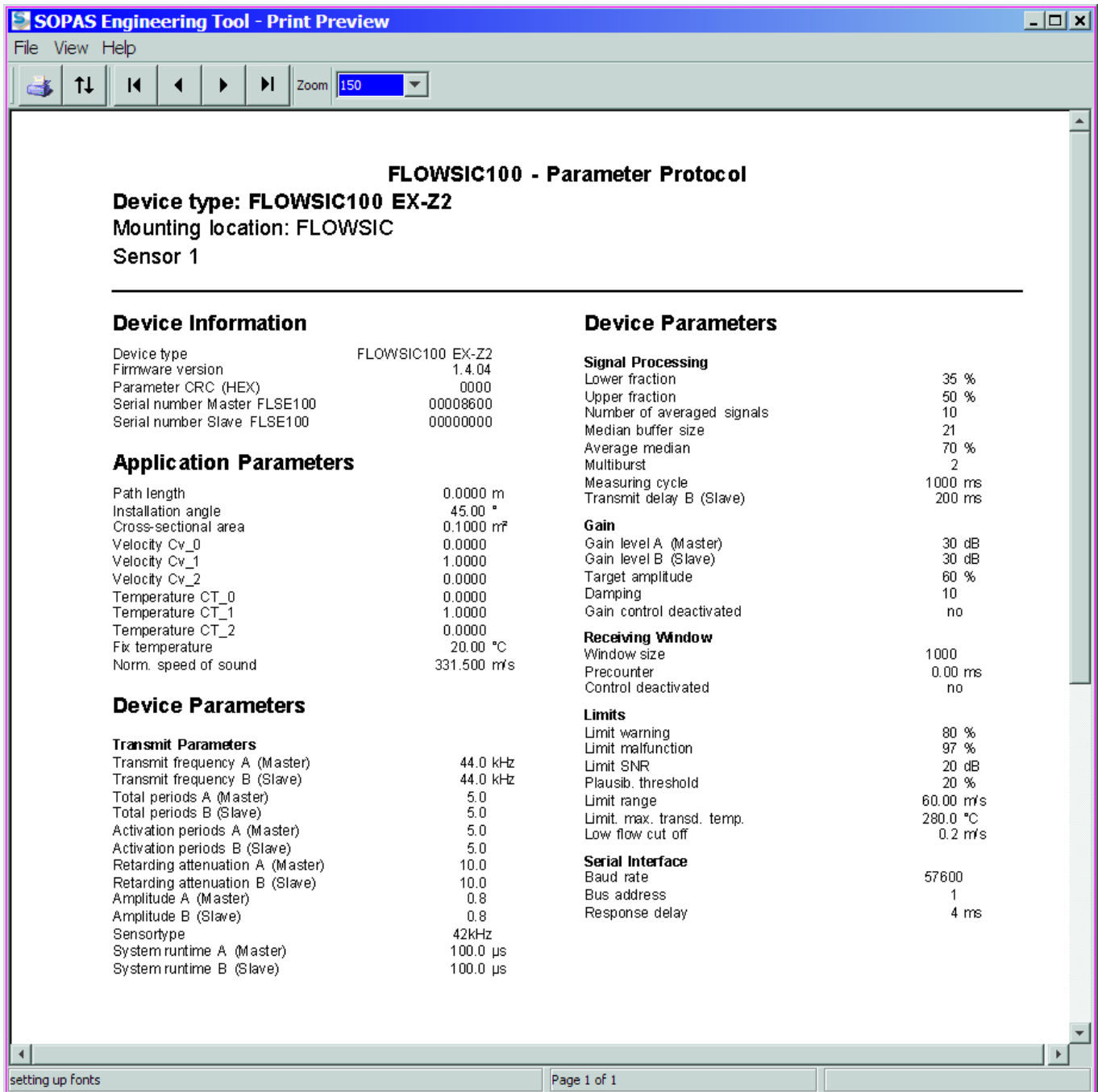


Fig. 4.24: Parameter protocol FLOWSIC100 EX (example)

4.2.11 Starting normal measuring operation

Normal measuring operation (Measuring Mode) starts by deactivating the Maintenance Mode. (Open the subpage "Mainenance / Maintenance Status" of the type FLOWSIC100 PROCESS in the "Project tree" window, deactivate the check box in the "Set Status" box and press the button "Set Status".) Standard commissioning is now completed.



Attention

For internally cooled and purged (sender/receiver units, the purge-supply has to be guaranteed during facility downtime. Else the sender/receiver units must be removed from the duct.

4.2.12 Signal Form

Checking the signal form makes it possible to assert a conclusion about the quality of the received ultrasonic signals. To view the signal form, the menu "Diagnosis / Sensor Values" must be selected (in Measurement Mode). The "Signal Display" screen displays alternating the ultrasonic signals of both transducers as unconditioned signal and as envelope.

If the option "View Envelope" is checked, the envelopes of both transducers are displayed. The signal shape should match the shapes in the **Fig. 4.26** to **Fig. 4.28**, depending on the device type.

Gas Velocity Monitor

Type FLSE100-PN16/CL150, EXZ2, EXZ2RE

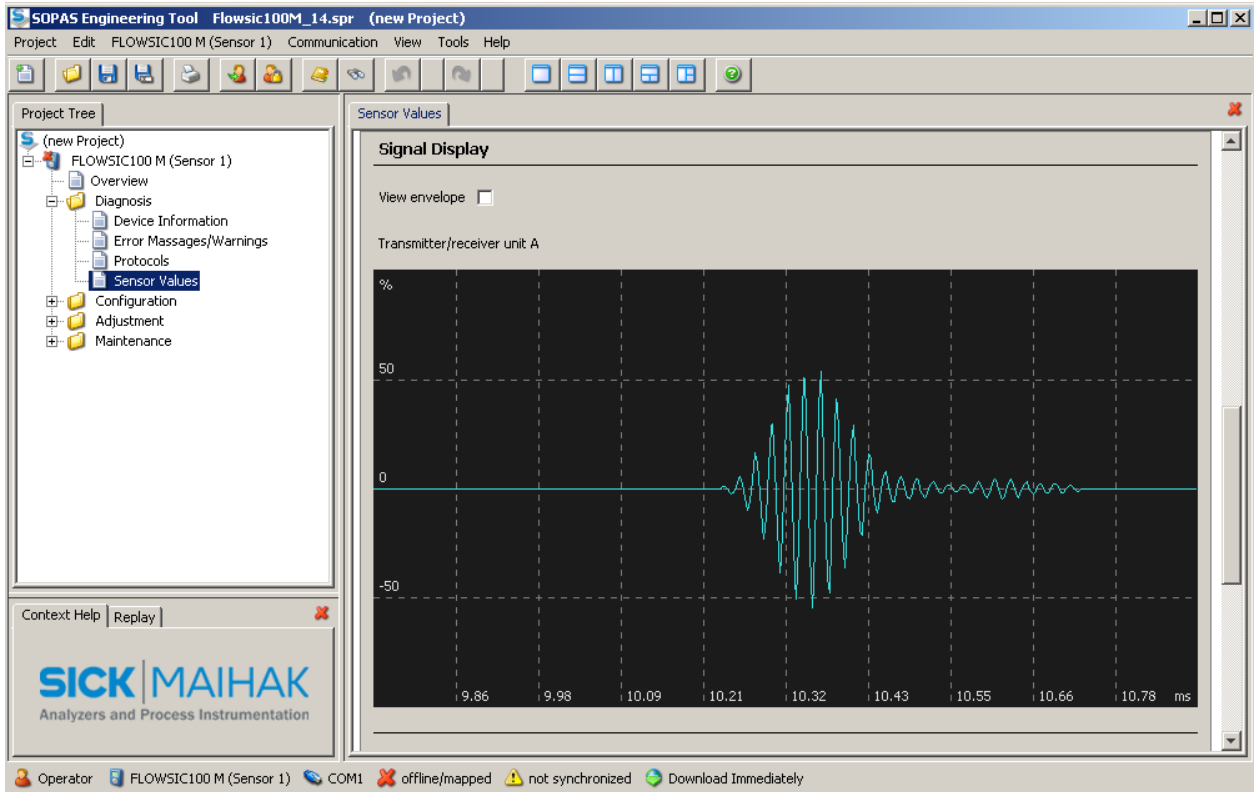


Fig. 4.25: Burst form HF-signal (unconditioned signal)

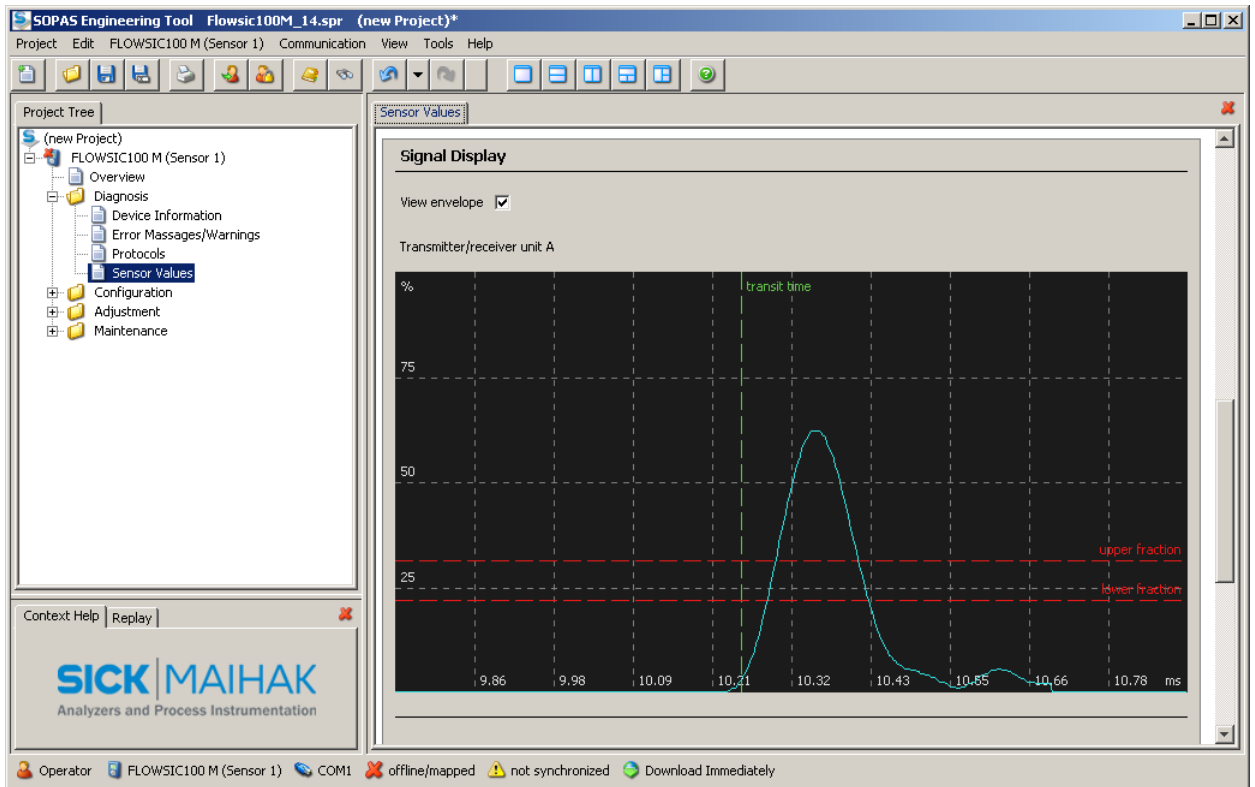


Fig. 4.26: Burst form demodulated signal (envelope)

Type FLSE100-PREXZ2

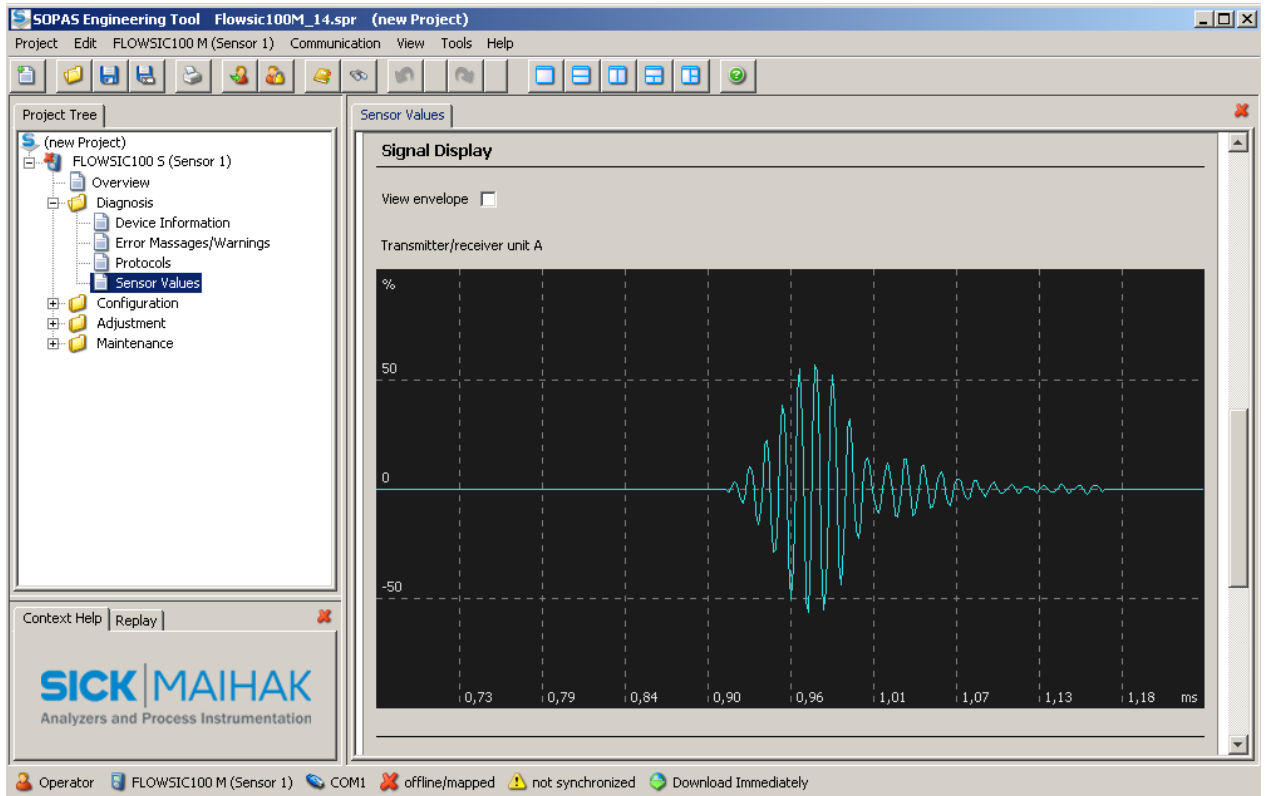


Fig. 4.27: Burst form HF-signal (unconditioned signal)

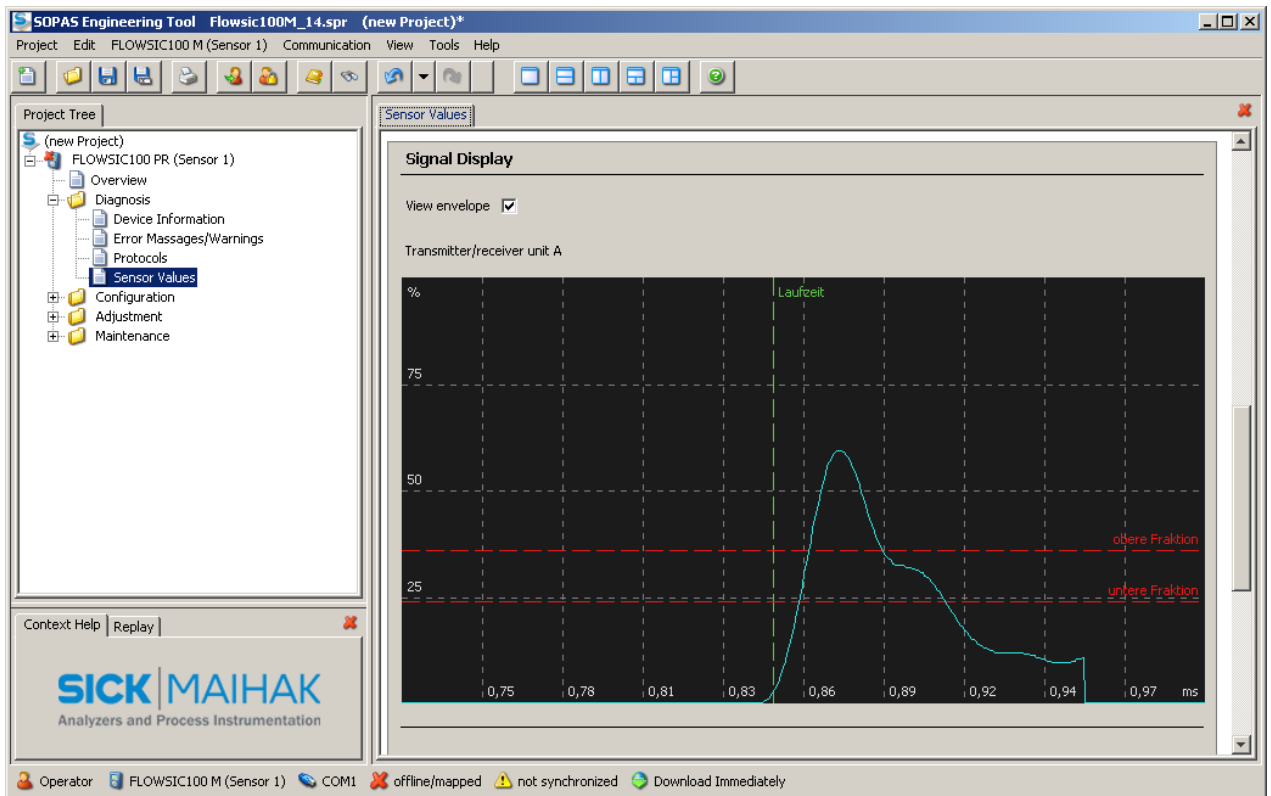


Fig. 4.28: Burst form demodulated signal (envelope)

4.3 Advanced start-up

4.3.1 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.

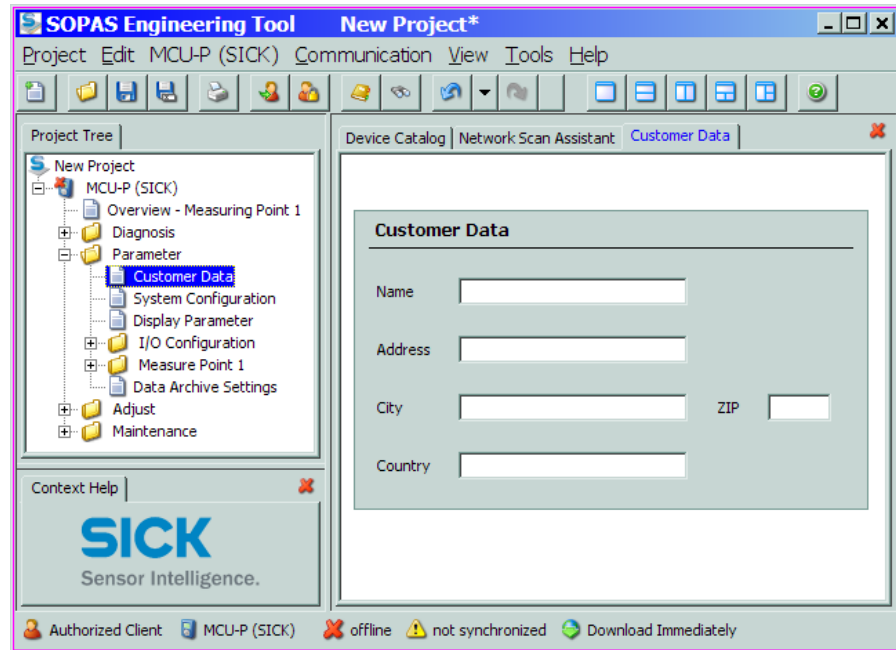


Fig. 4.29: "Parameter / Customer Data" directory

4.3.2 Entering counter function parameters

- ▶ Select device file "MCU-P", enter the Level 2 password ("service") and set the measuring system to "Maintenance" mode.
- ▶ Select the "Parameter / Measure Point 1(2/3) / Measure Point Parameter" directory.
- ▶ Enter values for volume counter factor and mass counter factor in the "Measure point 1 - Counter Parameter" window. The units m^3 or kg are best.

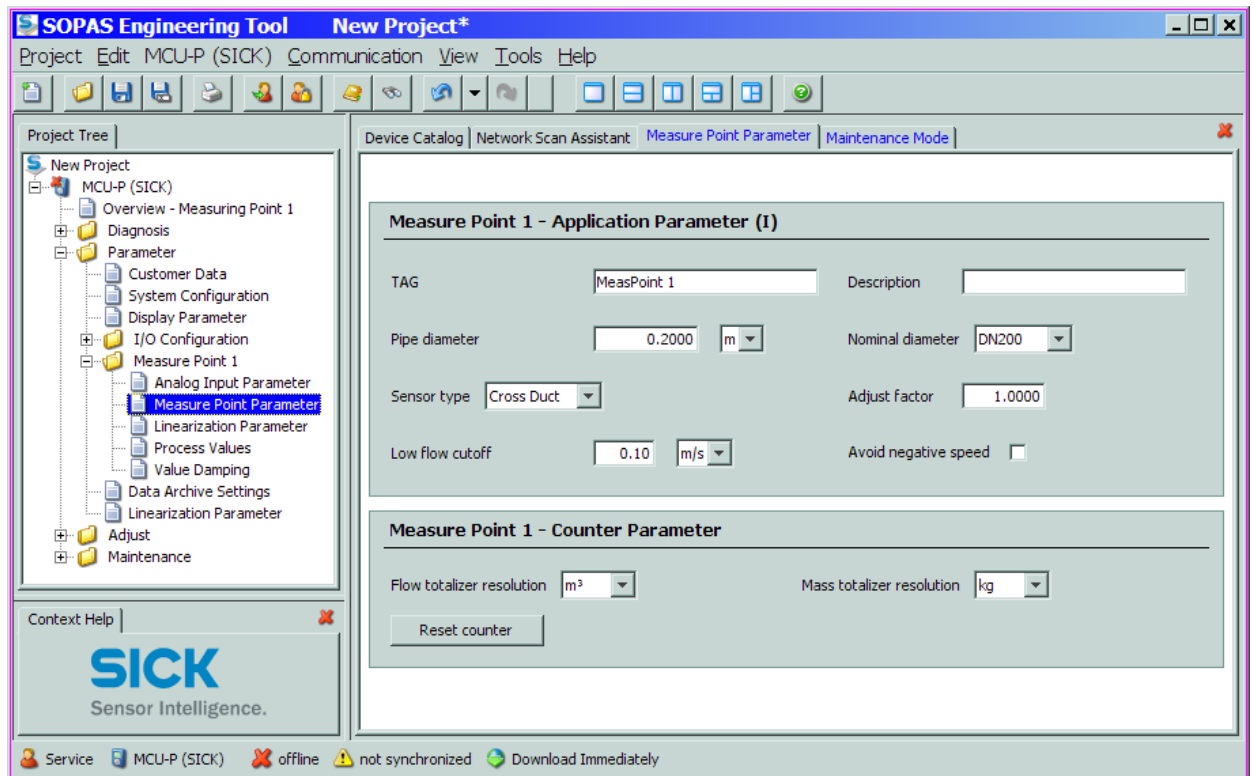


Fig. 4.30: "Parameter / Measuring Point 1 / Measure Point Parameter" directory

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

4.3.3 Data archive

Three non-volatile data archives are implemented in the MCU control unit to create monthly reports. The following values are stored:

- Date, time
- Standard flow (l)
- Mass (kg)
- Gas pressure (mbar) (optional with ext. sensor connection)
- Gas temperature (°C) average value (acoustically or optional from ext. sensor)
- Molar mass (g/mol)
- Volume flow, scaled (m³/h)
- AGC path 1 (transducer amplification)
- AGC path 2 (transducer amplification)
- Availability (%)
- Status information

The data archives can be preset individually. An overall maximum of 2000 values can be stored.

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

- ▶ Select device file "MCU", enter the Level 2 password ("Service") and set the measuring system to "Maintenance" mode.
- ▶ Switch to the "Parameter / Data Archive Settings" directory.
- ▶ Enter the parameters for recording interval, entry depth, write mode and reference to measuring point for all 3 archives.

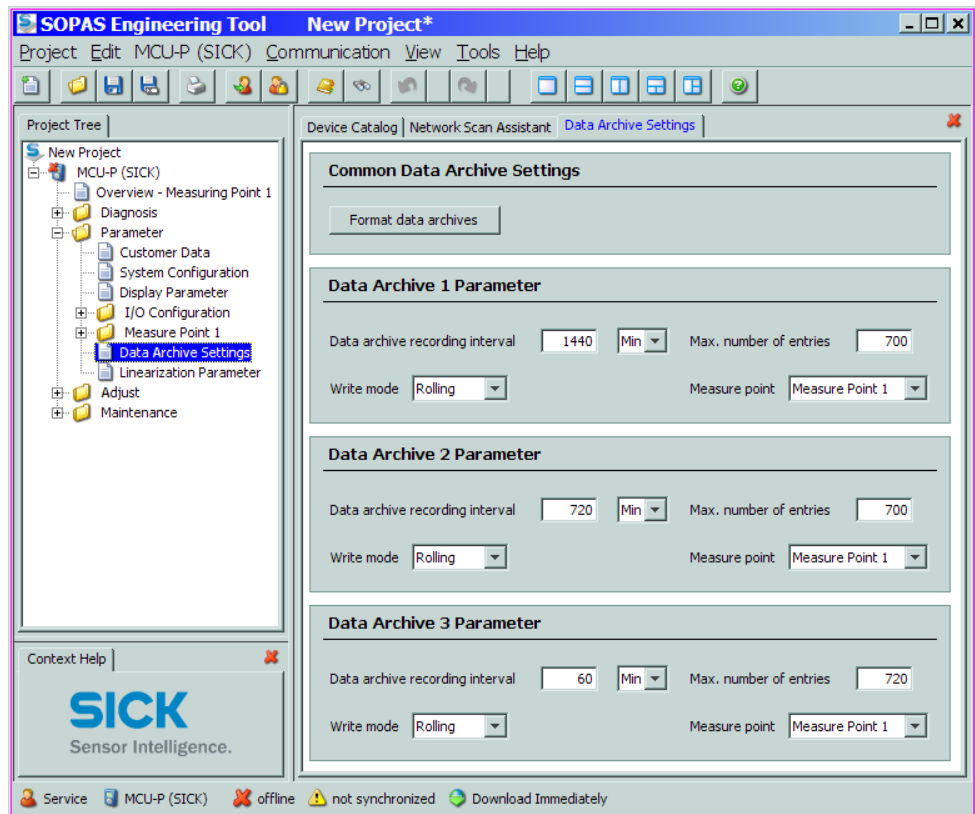


Fig. 4.31: "Parameter / Data Archive Settings" directory

Clicking "Read data" in the "Diagnose / Data Archive x" displays the corresponding data archive. The display is not refreshed automatically but must be called again manually. Clicking "Delete 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.

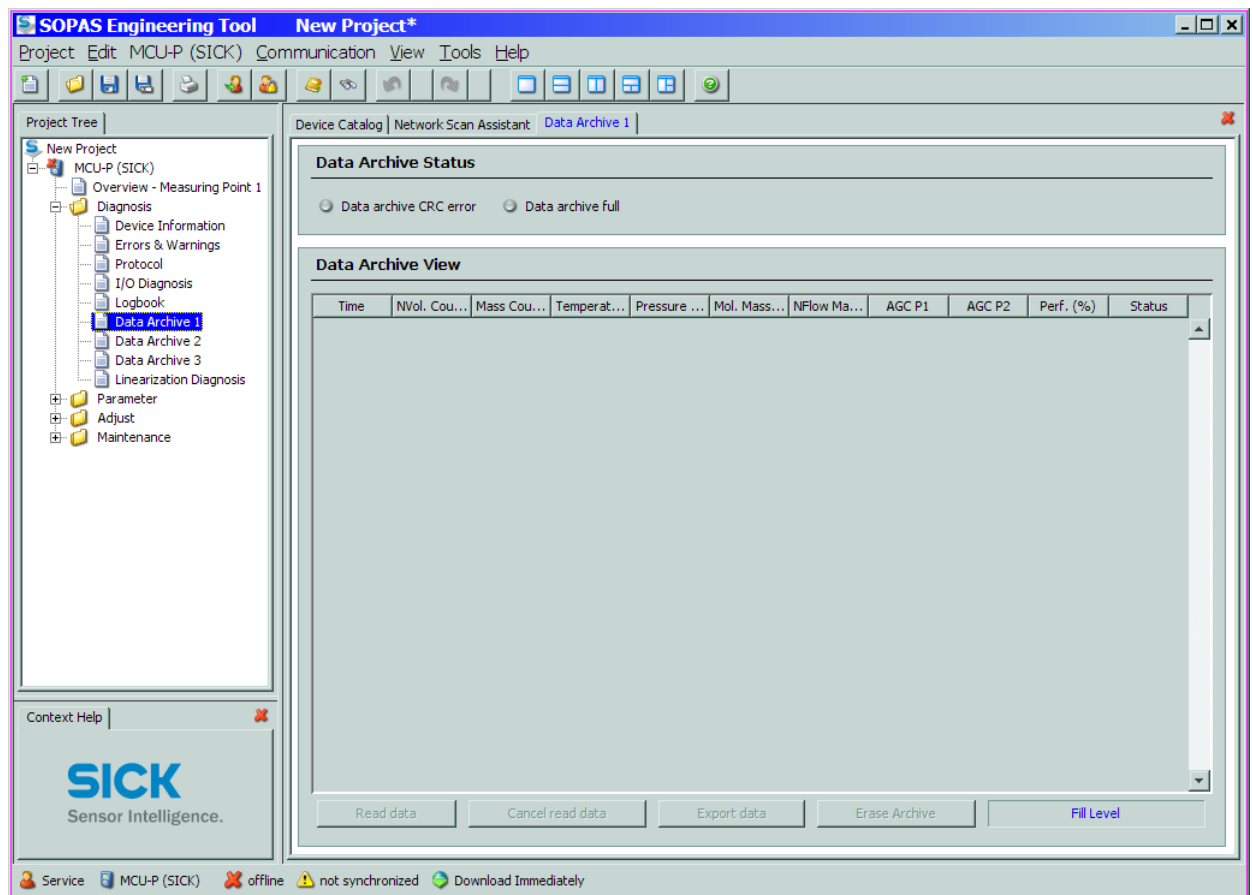


Fig. 4.32: "Diagnosis / Data archive 1" directory

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.

4.3.4 Entering process parameters

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

- ▶ Select device file "MCU-P", enter the Level 2 password ("Service") and set the measuring system to "Maintenance" mode.
- ▶ Select the "Parameter / Measuring Point 1(2/3) / Process Values" directory.
- ▶ Select the algorithm for measured value computation (see Section 2.4.2).
- ▶ If necessary, correct the constant values entered at the factory for the process parameters:
 - When using the standard algorithm:
 - Viscosity, compressibility, adiabatic coefficient
 - When using the MR-113-03 algorithm:
 - Gas composition values
 - When using the alkane algorithm:
 - Viscosity, compressibility

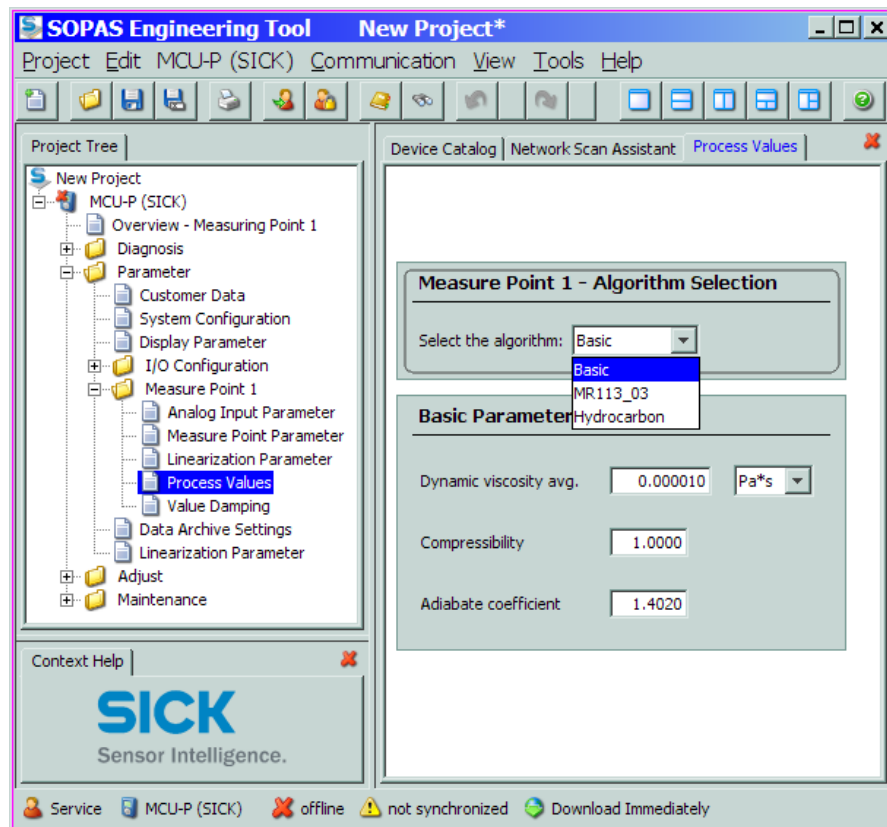


Fig. 4.33: "Parameter / Measure Point 1 / Process Values" directory

4.3.5 Setting Interface module parameters

4.3.5.1 General information

The following steps are necessary to select and set the optionally available Interface modules Profibus DP and Ethernet:

- ▶ Select device file "MCU-P", set the measuring system to "Maintenance" mode and enter the Level 1 password (see Section 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.

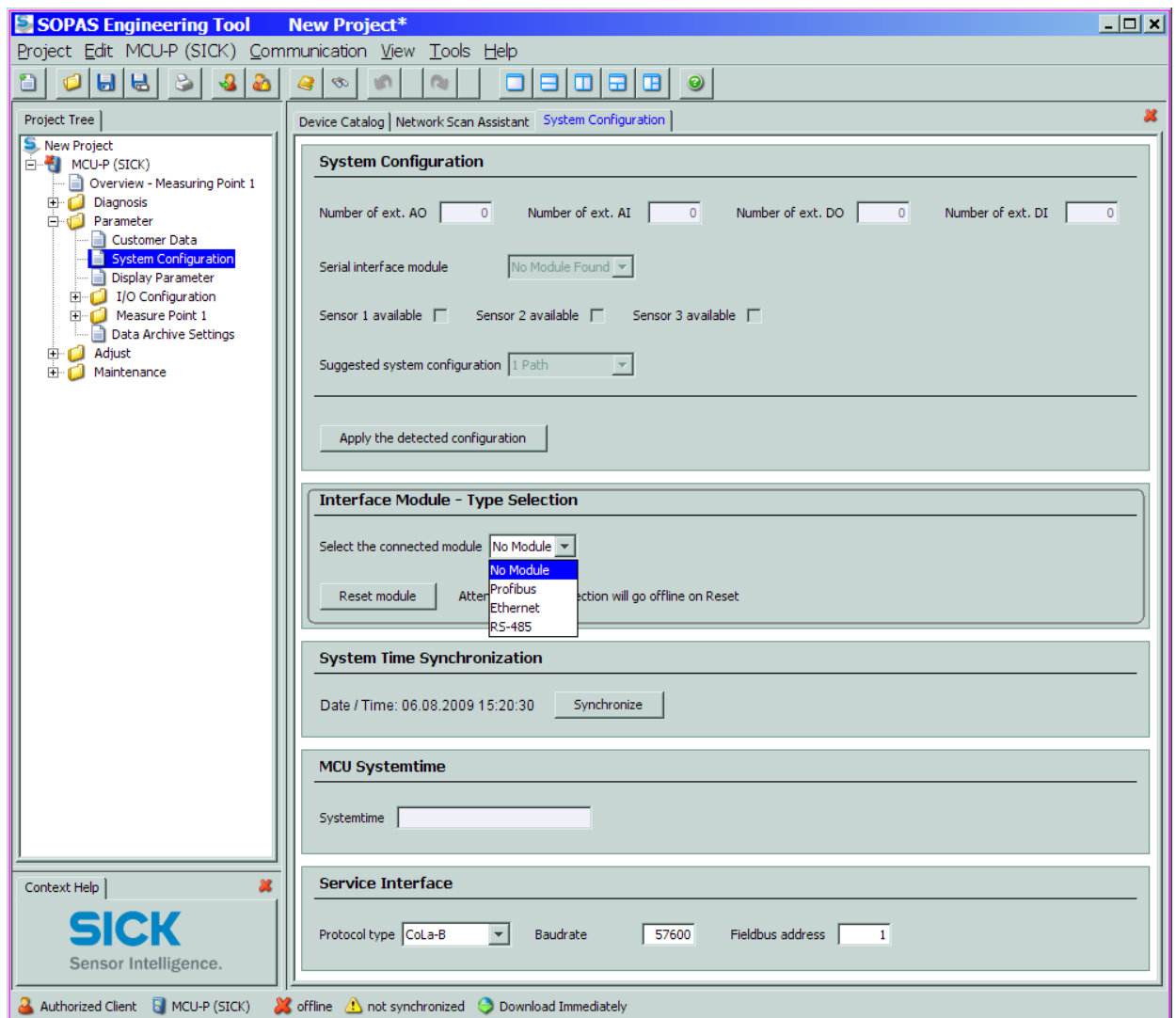


Fig. 4.34: "Parameter / System Configuration" directory

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

4.3.5.2 Setting Ethernet module parameters

Assigning the Ethernet module a new IP address

An IP address specified by the customer is entered at the factory when 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".

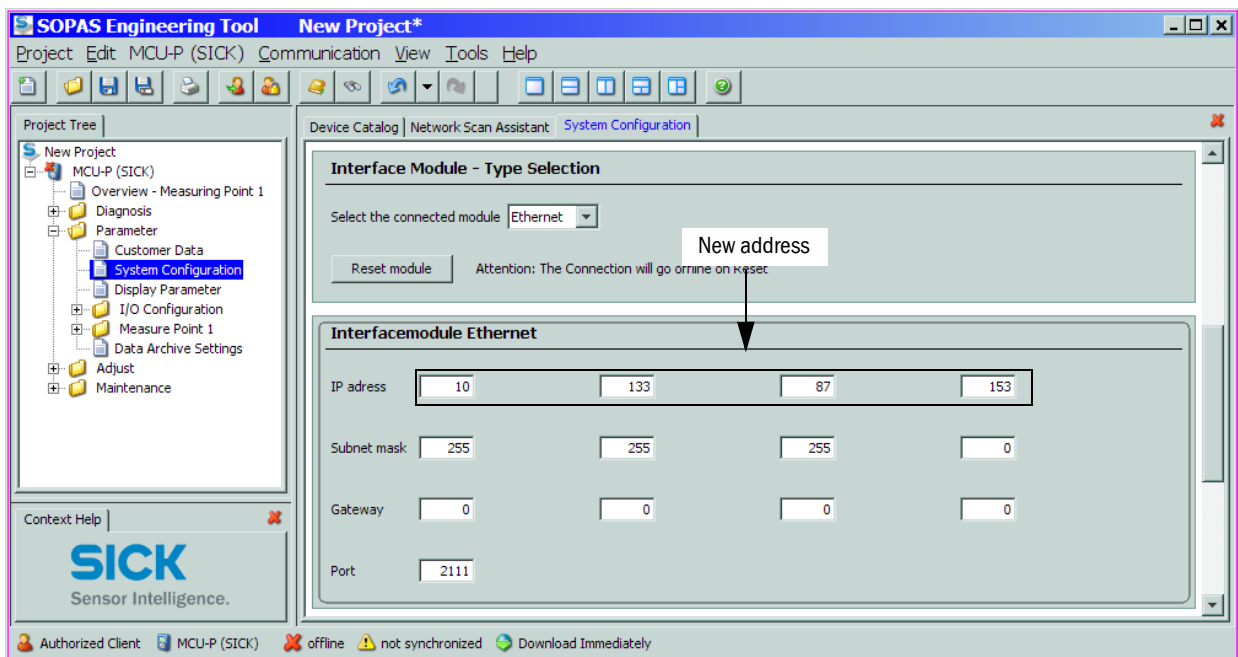


Fig. 4.35: "Parameter / System Configuration" directory

Assigning a new IP address using the SOPAS ET program

- ▶ Select the "Network Scan Assistant" register and click "Network Configuration".
- ▶ Select the "IP Communication" directory, set the "Enable IP Communication" entry field to active and click "Add".
- ▶ Enter the new IP address set in the "Parameter / System Configuration" directory and confirm with "OK".

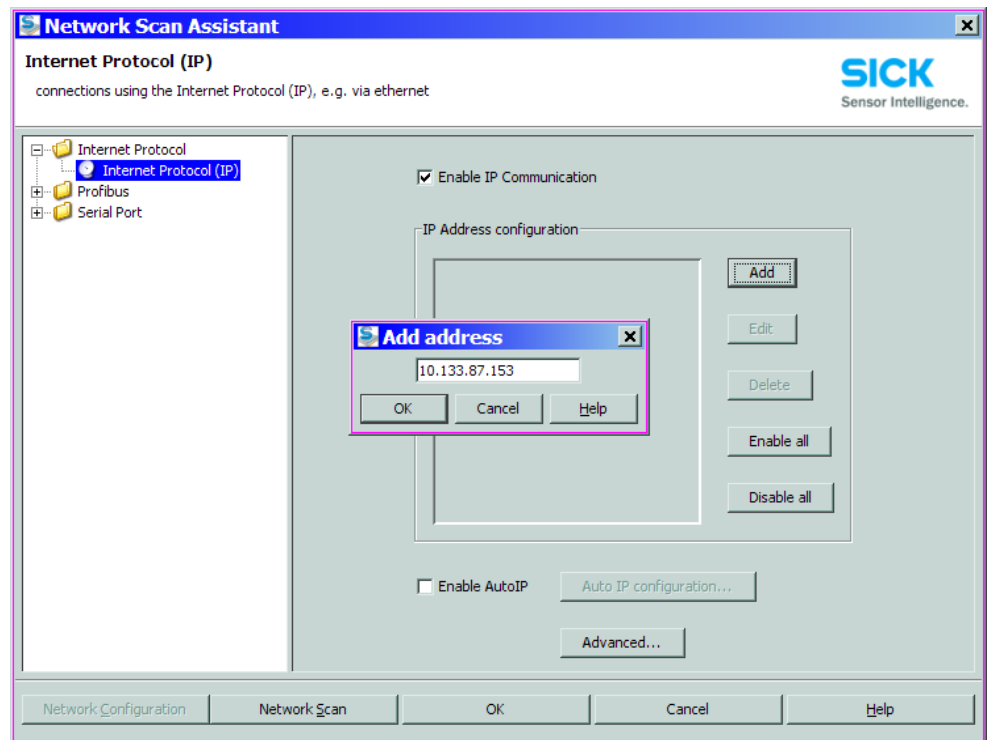


Fig. 4.36: Entering the IP address (example)

- ▶ Click "Advanced..." in the "IP Communication" directory.
- ▶ Activate the "Custom" checkbox under "Select TCP Port(s)" in the "Advanced scan settings" dialog.
- ▶ Enter port address "2111" and confirm with "OK" (all other settings and values according to Fig. 4.37).

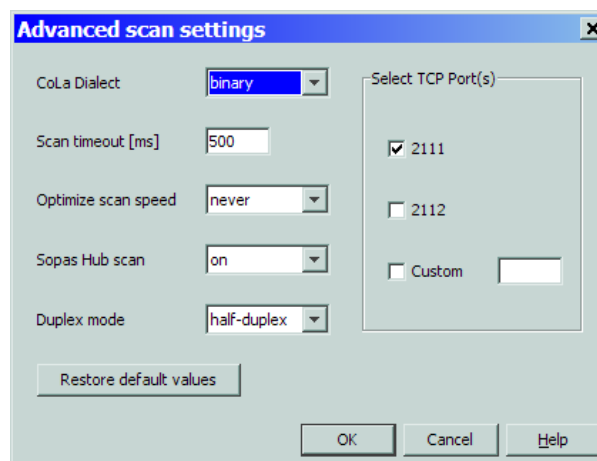


Fig. 4.37: Specifying the TCP port

Note Only activate the required TCP port.

- ▶ Select the "Network Scan Assistant" register, click "Network Scan" and check whether the address set is displayed.

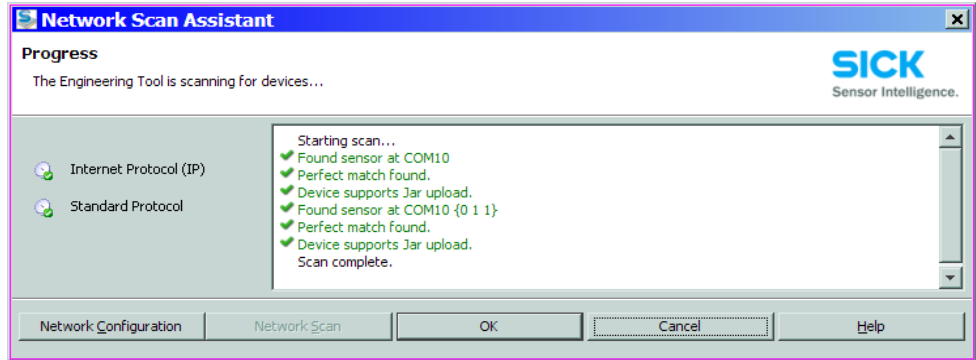


Fig. 4.38: Network scanning



Important

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 from 500 ms to 3000 ms can minimize communication problems.

4.3.6 Setting Modbus module parameters

- ▶ Select type "RS-485" in the "Select the connected module" window in the "Parameter / System Configuration" directory, field "Interface Module - Type Selection".
- ▶ Set the protocol type and Modbus address in the "Interface module RS-485" field.

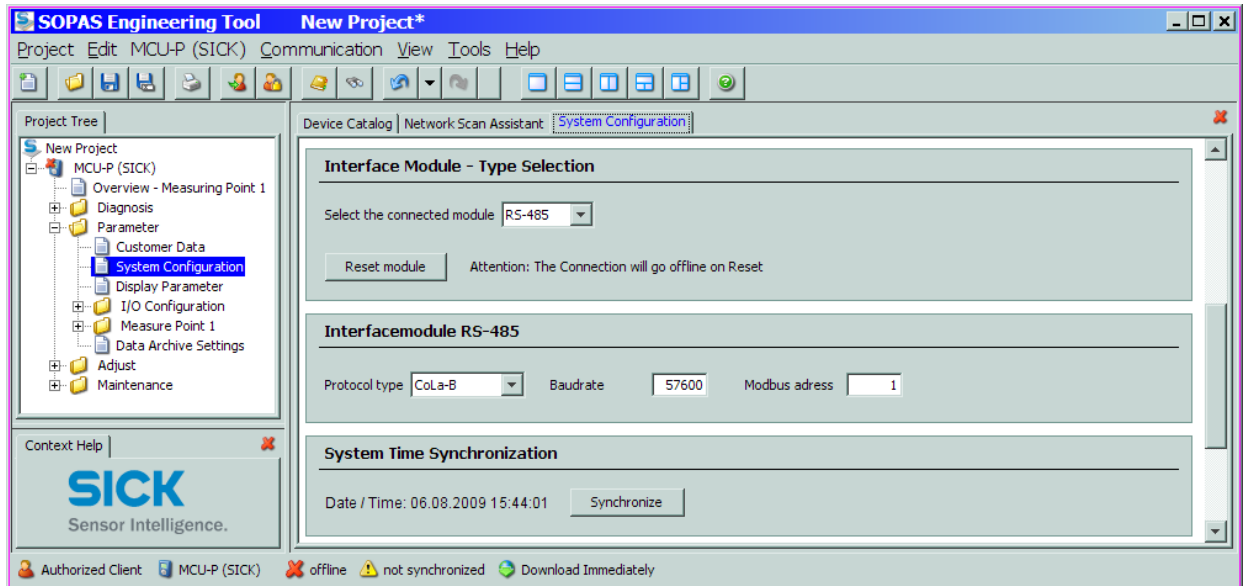


Fig. 4.39: "Parameter / System Configuration" directory

Note 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.

4.3.7 Calibrating the velocity and temperature measurement

to enter calibration coefficients set the measuring system to "Maintenance" mode and enter the Level 1.

Calibrating gas velocity measurement

The measuring precision of the velocity measurement can be improved by a comparison measurement (net point measuring with reference measuring system) still further. The measured values have to be entered as an offset in the "Adjust factor" window in the "Parameter / Measure Point 1 / Measure Point Parameter" directory, field "Measure Point 1 - Application Parameter (I)" (see Fig. 4.30).

Calibrating temperature measurement

The accuracy of the acoustic temperature measurement with the FLOWIC100 Flare depends quadratically on the square of the active measuring path and sound velocity of the real gas under standard conditions (see Section 2.2.3). Exact acoustic temperature measurement is only possible when the sound velocity of the real gas remains constant at a reference temperature. We recommend calibrating the internal device temperature determination when using the volume flow for scaling.

Note The sound velocity parameter can be set at "Service" user level (see Service Manual). The parameter is set to 331.5 m/s at the factory.

For calibration, determine the value pairs from gas temperature (e.g. with PT100 sensor) and display on the LC-Display separately for at least two different gas temperatures. Convert the values determined to absolute temperatures (add 273.15K). The coefficients can now be determined using a regression calculation (linear for two different values, also using quadratic regression for several value pairs). Enter CT_2 , CT_1 and CT_0 under "Calibration Coefficients / Calibration Coefficients for Temperature".

The standard setting ex factory is CT_2 = 0, CT_1 = 1, CT_0 = 0.

Example:

Measurement	FLOWIC display		PT100 measured value	
	T in °C	T _{absolute} in K	T in °C	T _{absolute} in K
1	128	401	115	388
2	186	459	170	443

$$T_{KAL} = CT_1 \cdot T_{FLOWIC} + CT_0$$

$$CT_1 = \frac{T_{PT100} - T_{1PT100}}{T_{FLOWIC} - T_{1FLOWIC}}$$

$$CT_0 = \frac{1}{2} \cdot (T_{PT100} + T_{1PT100} - CT_1 \cdot (T_{FLOWIC} + T_{1FLOWIC}))$$

$$CT_1 = 0.9483$$

$$CT_0 = 7.7310$$

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. 4.40.

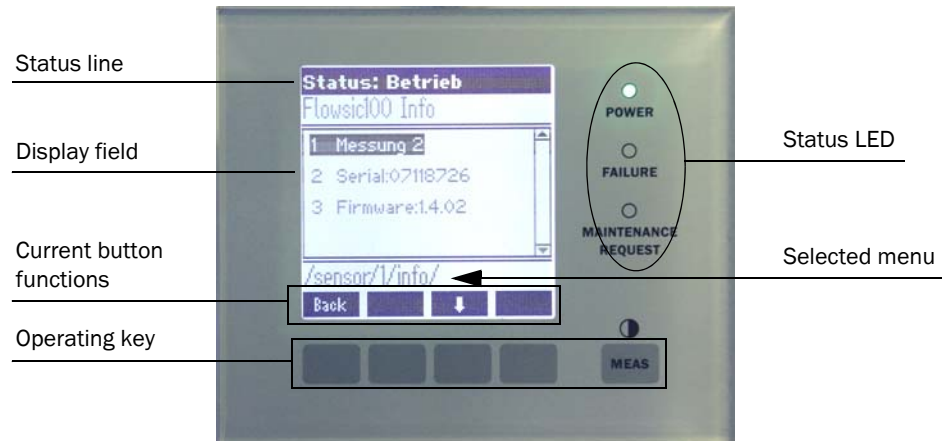


Fig. 4.40: Functional elements LCD display

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; see Fig. 4.41) 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

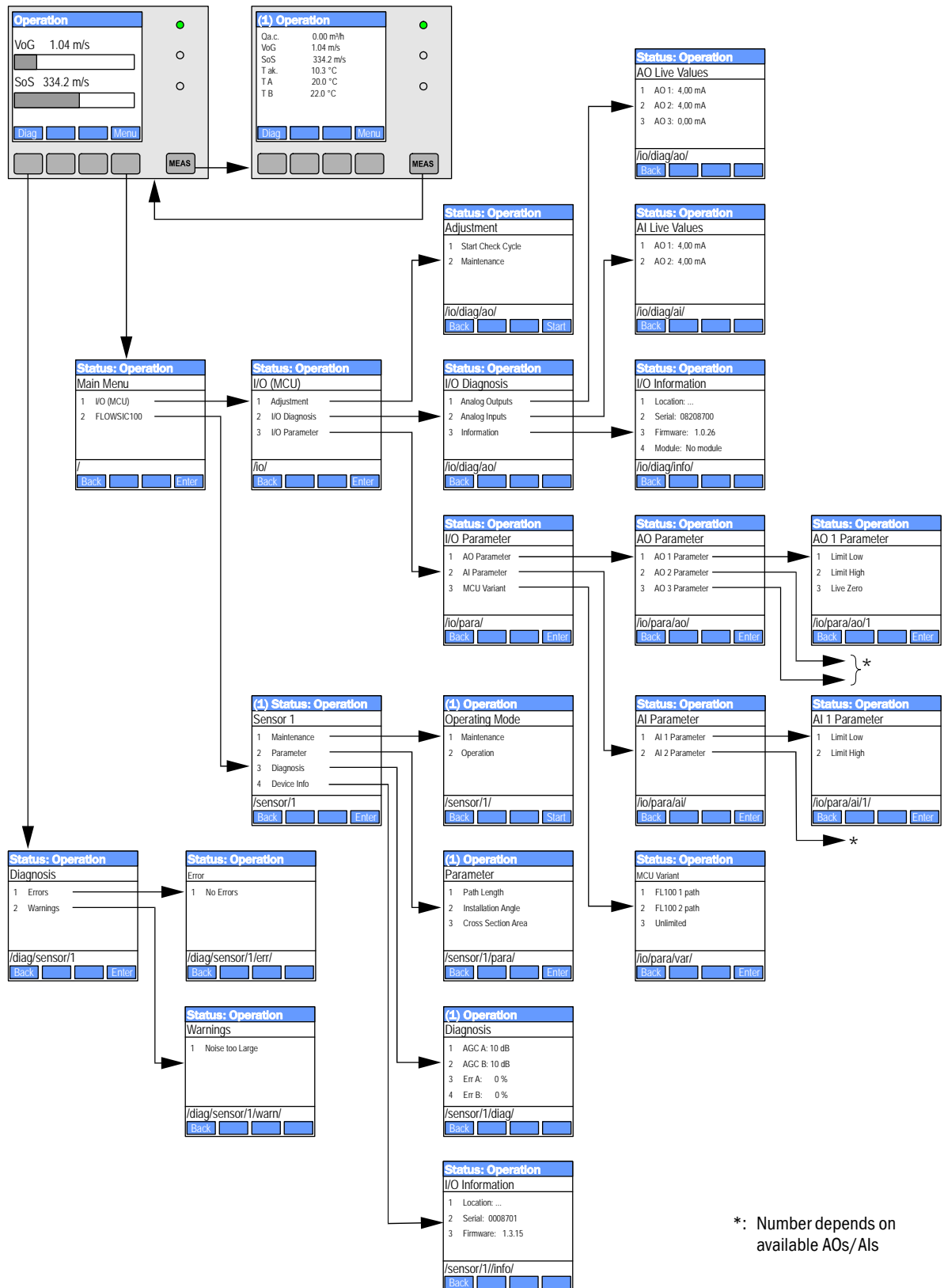


Fig. 4.41: LC-Display menu structure

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.

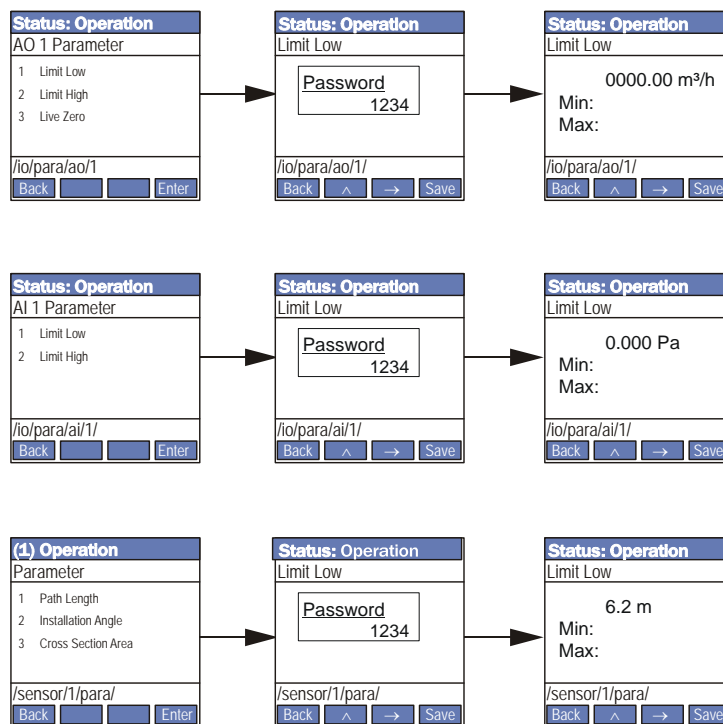


Fig. 4.42: Menu structure for configuration

4.4.4 Change Application Parameter

- ▶ In the menu "I/O (MCU)" go into the submenu "I/O Parameter", select the line "MCU Variant" and affirm with "Enter".
- ▶ In the submenu "MCU Variant", select the line "FL100 2 path" and affirm with "Enter".

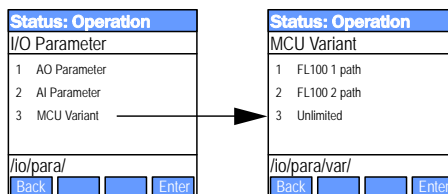


Fig. 4.43: Menu structure for selection of two-path measurement

4.4.5 Using SOPAS ET to modify display settings

To modify factory settings, select type "MCU-P" in the "Project Tree" window, enter the Level 1 password and select the "Parameter / Display Settings" menu.

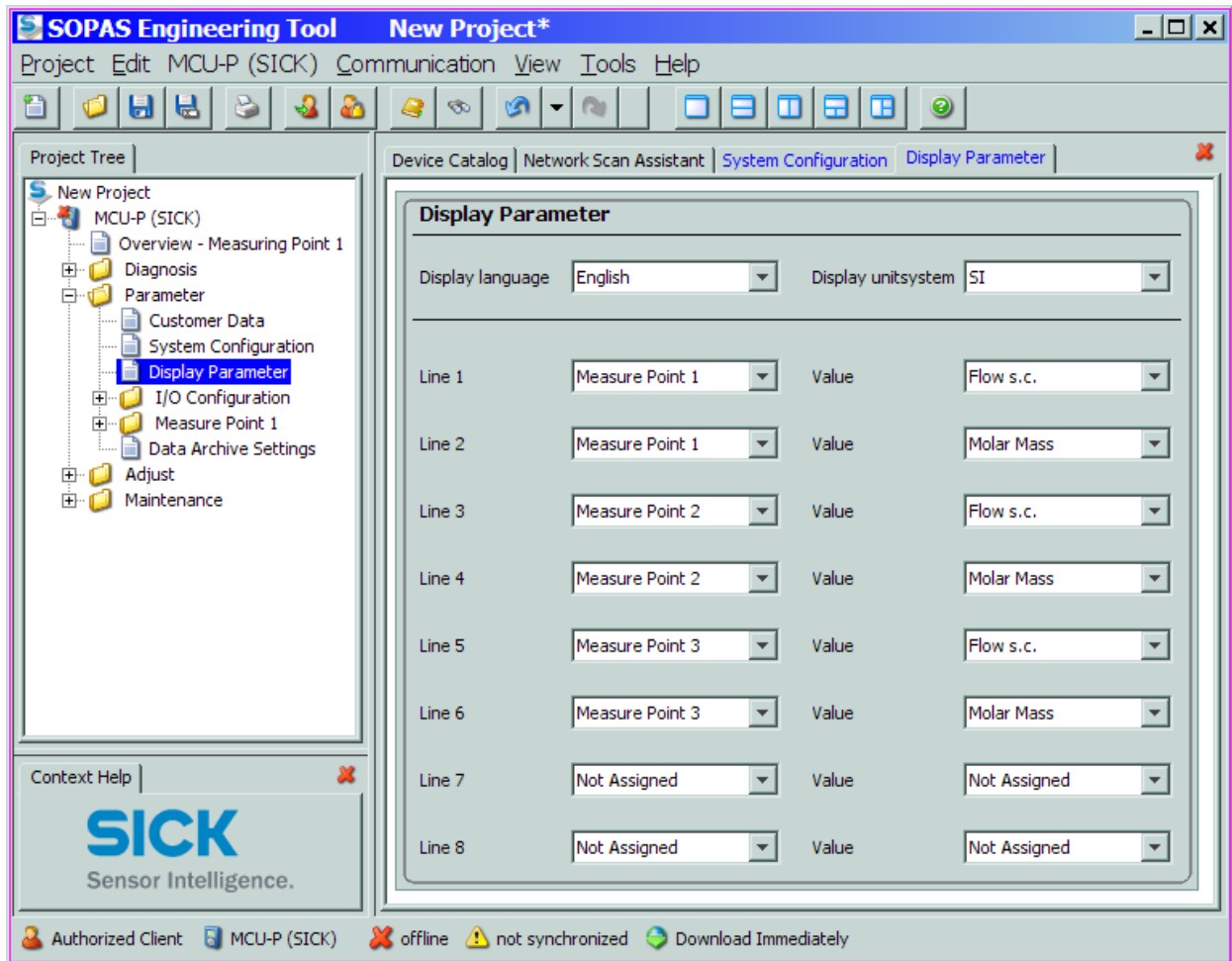


Fig. 4.44: "Parameter / Display Settings" menu

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 valuebar in the graphic display
Value	Assignment of measuring variable to the respective measured value bar

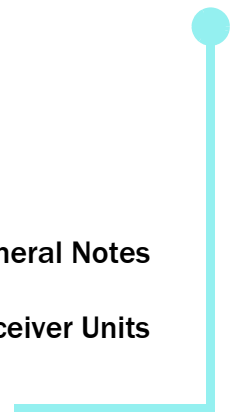
FLAWSIC100 PROCESS

Gas Velocity Monitor

Maintenance

General Notes

Maintaining the Sender/Receiver Units



5 Maintenance

5.1 General Notes

Maintenance Strategy

Like any electronic measuring system, the FLOWSIC100 PROCESS requires regular maintenance. By inspecting the system regularly and replacing wear-and-tear parts in good time, you can extend the service life of the device significantly and ensure that your measurements are always reliable.

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

Maintenance Tasks

The maintenance tasks are limited to the sender/receiver units.

Before you carry out these maintenance tasks, set the FLOWSIC100 PROCESS to Maintenance Mode. You can do this by using an external maintenance switch (connection to the digital input 1), or by using the operating and configuration software SOPAS ET.

Once you have completed the maintenance activities, return the system to Measuring Mode.

Note If the Maintenance Mode has been set with the SOPAS ET software, the device can be set back to Measuring Mode with the software only.

Maintenance Intervals

The maintenance intervals are assessed according to the qualification test. These intervals will depend on the specific conditions at the plant, such as operation, gas composition, temperature and humidity, as well as the ambient conditions. For this reason, shorter maintenance intervals may be necessary if conditions are unfavorable.

The activities required and their completion must be documented by the operator in a Maintenance Log.

Maintenance Agreement

Regular maintenance activities can be carried out by the plant operator. These activities must be carried out by qualified persons (as described in Chapter 1) only. If requested, all maintenance activities can also be performed by the SICK Service department, or an authorized service partner. SICK offers a range of economical maintenance and repair agreements. As part of these agreements, SICK assumes responsibility for all maintenance activities; repairs are carried out by specialists on site (as far as possible).

5.2 Maintaining the Sender/Receiver Units

The sender/receiver units must be cleaned at regular intervals and inspected for signs of corrosion and damage. To do so, remove the sender/receiver units from the flanges with pipe.



Warning

- ▶ When carrying out work on the system, always observe the relevant safety precautions and instructions provided in Section 1.3 (in particular, in Section 1.3.3).
- ▶ Observe and adhere to the respective explosion-protection requirements.
- ▶ Take suitable protection measures against possible hazards.
- ▶ Carry out repair work only when hot parts have cooled sufficiently.

Required tools and resources:

- Spanner for hexagon-socket screws, S5,
- Spanner SW 24,
- Screwdriver,
- Possibly a blind plug for flange with pipe,
- Brush, clean cloth, alcohol.

5.2.1 Removing the Sender/Receiver Units

Non-exchangeable sender/receiver units



Warning

- ▶ At plants with increased hazard potential (toxic, aggressive, explosive gasses, health endangering, higher pressure and temperatures), remove the sender/receiver unit only when the plant is out of operation.

A small amount of gas escapes uncontrolled into the environment during disassembly of the sender/receiver unit from connection piece.

- ▶ Take special precautions at toxic, aggressive, explosive, health endangering and/or hot gasses (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 connection piece with a blind plug (optionally available).

Exchangeable sender/receiver units



Warning

- ▶ Observe and adhere to the permitted operation parameters according to the diagrams in Section 2.3.1.
- ▶ Close the ball valve after removing the sender/receiver unit with a blind flange.

The necessary steps have to be carried out in principle in reverse order to those shown in **Fig. 3.11**.

- ▶ Remove the cotter pins from the guide rods (10) and loosen both fastening nuts (9).
- ▶ Move the transmitter/receiver unit slowly back to the stop and hold it tight well.
- ▶ Close the ball valve DN 50 (8).
- ▶ Open ball valve DN 12 for pressure compensation.
- ▶ Screw on the fastening nuts (7) and attach the cotter pins to the guide rods (6).
- ▶ Loosen the fastening screws (5) and remove the transmitter/receiver unit together with the seal from the ball valve DN 50 (4, 3).
- ▶ Mount the blind flange (2) and the seal with the fastening screws (1) at the ball valve DN 50.

5.2.2 Cleaning the Sender/Receiver Unit

Clean the outside of the sender/receiver unit after it has been removed. Inspect the probe tube and transducers for signs of corrosion, and replace them if necessary. Dust deposits and caked dust can generally be removed without disassembling the transducer.



Important

The transducer must be cleaned with extreme care. Do not damage the transducer diaphragm.

Note Depending on the conditions at the installation, the probe tube 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 max. 6 months.

The activities required to replace the components (probe tube, transducers) are listed in the Service Manual.

- ▶ Once you have completed the work, reinstall the sender/receiver unit.

Reassembling the Retractable FLSE100 EXZ2RE Sender/Receiver Units

The installation has to be carried out according to Section 3.3.

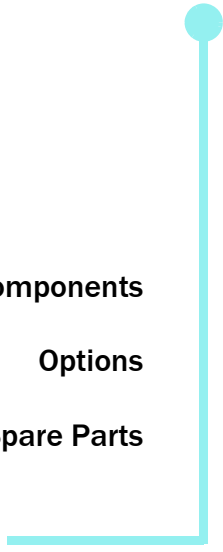
Gas Velocity Monitor

FLAWSIC100 PROCESS

Gas Velocity Monitor

Parts Overview

- Standard Components
- Options
- Spare Parts



6 Parts Overview

6.1 Standard Components

6.1.1 Sender/Receiver Units

Name	Part number
Pressure-resistant	
FLSE100-PN16DN50 26SSSS sender/receiver unit	1042705
FLSE100-CL150Z2 26SSSS sender/receiver unit	1042706
Pressure-resistant, ex-protected	
FLSE100-EXZ2PN16DN50 26SSSS sender/receiver unit	1042710
FLSE100-EXZ2CL150Z2 26SSSS sender/receiver unit	1042711
FLSE100-EXZ2PN16DN50 26TITI sender/receiver unit	1043762
FLSE100-EXZ2CL150Z2 26TITI sender/receiver unit	1043761
Pressure-resistant, ex-protected, retractable, for zone 2	
FLSE100-EXZ2PN16DN50RE 38SSSS sender/receiver unit	1042716
FLSE100-EXZ2CL150Z2RE 38SSSS sender/receiver unit	1042717
FLSE100-EXZ2PN16DN50RE 38TITI sender/receiver unit	1043764
FLSE100-EXZ2CL150Z2RE 38TITI sender/receiver unit	1043763
Probe type, ex-protected, for zone 2	
FLSE100-PREXZ2 35SSTI sender/receiver unit	1042726
FLSE100-PREXZ2 55SSTI sender/receiver unit	1042727
FLSE100-PREXZ2 75SSTI sender/receiver unit	1042728

6.1.2 Mounting Flanges

Name	Part number	For FLSE100 EX type
Connection piece (pipe from St37, up to 0.1 bar)		
Connection piece PN16 DN50ST260	2039140	PN16, EXZ2-PN16DN50
Connection piece PN16 DN50ST310 45° (for internal pipe diameter < 0.5 m)	2039142	
Connection piece CL150 2"ST260	2039144	CL150, EXZ2CL150Z2
Connection piece CL50 2"ST310 45° (for internal pipe diameter < 0.5 m)	2039146	
Flange with pipe (pipe from St37, up to 0.1 bar)		
D70ST350 flange with pipe (Material St37, nominal length 350 mm)	7042109	PREXZ2
D70ST550 flange with pipe (Material St37, nominal length 550 mm)	7042110	
D70ST750 flange with pipe (Material St37, nominal length 750 mm)	7042247	
Flange with pipe (pipe from 1.4571, up to 0.1 bar)		
D70SS350 flange with pipe (Material VA, nominal length 350 mm)	7042112	PREXZ2
D70SS550 flange with pipe (Material VA, nominal length 550 mm)	7042113	
D70SS750 flange with pipe (Material VA, nominal length 750 mm)	7042249	

Name	Part number	For FLSE100 EX type
Mounting kit (for retractable variants, up to 16 bar), (gland: flange 316 Ti, pipe A333 Gr.6)		
Mounting kit PN16DN50 LTCS 380RE (with connection piece LTCS, ball valve SS, blind flange 1.4571, installation material, seals)	2045278	EXZ2PN16DN50 RE (wechselfähig)
Mounting kit PN16DN50 LTCS 380RE 60° for pipe diameter < 0.5 m and/or Hot Tapping Installation (with connection piece LTCS, ball valve SS, blind flange 1.4571, installation material, seals)	2045277	
Mounting kit CL1502Z LTCS 380RE (with connection piece LTCS, ball valve SS, blind flange 1.4571, installation material, seals)	2038872	EXZ2CL1502Z RE (wechselfähig)
Mounting kit CL1502Z LTCS380 60° for pipe diameter < 0.5 m and/or Hot Tapping Installation (with connection piece LTCS, ball valve SS, blind flange 1.4571, installation material, seals)	2045279	

6.1.3 MCU Control Unit

Name	Part number
MCU control unit not ex-protected	
MCU-NWONN00000NN control unit in wall housing (orange), Supply voltage 90 ... 250 V AC, without display	1040667
MCU-NWODN00000NN control unit in wall housing (orange), Supply voltage 90 ... 250 V AC, with display	1040675
MCU-N2ONN00000NN control unit in wall housing (orange), Supply voltage 24 V DC, without display	1040669
MCU-N2ODN00000NN control unit in wall housing (orange), Supply voltage 24 V DC, with display	1040677
MCUEX control unit for Ex Zone 2	
MCUEX-N2ODN00000N1 control unit in wall housing (orange), Supply voltage 24 V DC, with display, for Ex-Zone 2	1044445

6.1.4 Connection Cable for FLOWSIC100 PN16/CL150 (not usable for Ex-Zone)

Name	Part number
Connection cable Master 7 core, length 5 m	2043678
Connection cable Master 7 core, Länge 10 m	2043679
Connection cable Slave 5 core, Länge 5 m	7042017
Connection cable Slave 5 core, Länge 10 m	7042018
Connection cable Slave 5 core, Länge 50 m	7042019

6.2 Options

6.2.1 Control Unit

Name	Part number
Analog-input module, 2 channels, 100 W, 0/4...22 mA, galv. isolated	2034656
Analog-output module, 2 channels, 500 W 0/4 ... 22 mA, module wise galv. isolated	2034657
Modul Digital-Eingang, 4 Kanäle, für potentialfreie Kontakte, max. 4,5 mA	2034658
Modul Digital-Ausgang, 2 Wechsler, Kontaktbelastung 48 V AC/DC, 5 A	2034659
Modul Digital-Ausgang, 4 Schließer, Kontaktbelastung 48 V AC/DC 0,5A	2034661
Module carrier (for one AI, AO, DI or DO module)	6028668
Connection cable for optional I/O modules	2040977
Interface Profibus module DP V0	2040961
Interface Ethernet module	2040965
Interface Impulse	2048961
Interface Profibus DP + Impulse	2048920
Interface Ethernet + Impulse	2048960
Interface Modbus + Impulse	2048958

6.2.2 Miscellaneous

Name	Part number
Connection box for connection cable	2046418
Mounting set 2D4-1.4571/PA	2031890
USB cable (for connecting the control unit with a Laptop/PC)	6033633
Adjusting tool	1700462
DME 2000 distance sensor	1010578

6.3 Spare Parts

6.3.1 Sender/Receiver Units

Name	Part number
Seal DN50 PN16 1.4571	7040843
Grooved seal B9A 2" 150 1,4571	5315113

Other parts can only be replaced by the manufacturer.

6.3.2 Mounting Kit

Name	Part number
Mounting kit DN50 PN16	
Ball valve flange DN50 PN16 3.1B	2046584
Seal DN50 PN16 1.4571	7040843
Mounting kit ANSI150	
Ball valve flange ANSI150	2045496
Grooved seal B9A 2" 150 1,4571	5315113

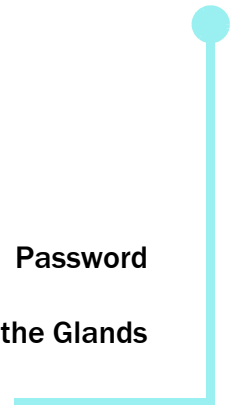
FLAWSIC100 PROCESS

Gas Velocity Monitor

Appendix

Password

Notes on Welding the Glands



7 Appendix

7.1 Password

User level		Password
0	“Operator”	none
1	“Authorized Client”	“sickoptic”

7.2 Notes on Welding the Glands

The following two procedures (A) and (B) contain instructions for welding on the glands DIN 28115-C 50 PN16 - St (order no. 7042289) for mounting the transmitter/receiver units FLSE 100 UMA PN16 and UMD PN16. The plant operator is solely responsible for ensuring that the work is carried out correctly and in line with the applicable safety instructions.

7.2.1 Procedure (A) "Welding on the Glands for Ultrasonic Measurements" Austentic Steels



Important

All work on pipes made of austentic steels must be carried out using special tools that are suitable for these materials in order to prevent subsequent corrosion.

Note

1. Mark and punch the mounting point, and drill a hole approx. 1 – 2 mm deep using a twist drill Ø 4 - 6 mm.
2. Use a hand drill (or preferably a drill bracket with a prismatic fixture for the main pipe and a permanently set drill support at a predefined angle) to drill a 5 - 8 mm hole in the main pipe at an angle of approx. 30 - 45° .
3. Gradually drill out, grind, or mill the hole in the main pipe to $D_i = 40$ mm, maintaining an angle of 30 - 45°.
4. Round off the sides of the hole in the vicinity of the inside of the pipe to prevent subsequent bearing cracks near the hole.
5. Mechanical adjustments to the prefabricated weld-on gland
 - Beveling in accordance with the angle setting for drilling
 - Adjust the air gap of 2 - 3 mm between the glands and main pipe in accordance with the diameter of the main pipe.
 - Rub down the seam edge.
 - The seam edge angle changes as a result of welding on the gland at an angle of 30 to 45°.
 - Note that accessibility for root welding near the acute angle is restricted.
6. Align and tack the weld-on glands to the main pipe. - Ensure that the internal diameters of the weld-on gland / hole in main pipe match.
7. Cover the 2" thread with metal cap or foil at 2 positions at least.
8. Weld the root pass – root areas not included must be ground out or improved.
9. Weld the surface layer(s) using the stringer bead technique. Note the maximum component temperature of 150°C when performing welding work (see WPS).

10. Carefully remove the residual slag by brushing around the SN root and surface layer.
 - Remove any initial paint in the vicinity of the seam root (using a stud grinder or milling tool)
 - Remove any initial paint near the surface layer mechanically or using paint remover and then a neutralizer.

11. Perform a visual inspection of the seam – compile documentation if requested.

Minimum welder qualifications:

EN 287-1 111 T BW WII R t04 D48 PA ss/nb

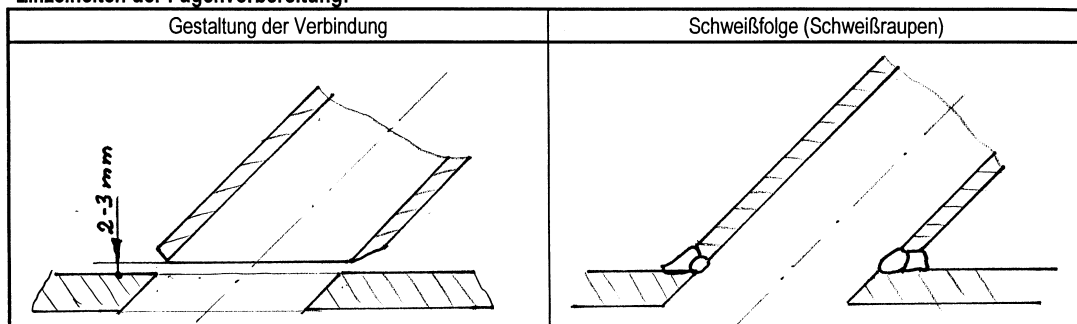
PF ss/nb

Example of an inspection certificate

Schweißanweisung des Herstellers (WPS)

Ort:	-	Prüfer od.Prüfstelle:	TÜV Bayern Hessen Sachsen Südwest e.V.
Schweißverfahren des Herstellers:	Lichtbogenhandschweißen	Art der Vorbereitung und Reinigung:	mechanisch, Schweißnahtbereich metallisch blank und fettfrei
Beleg Nr.:	-	Spezifikation des Grundwerkstoffs:	austenitische Stähle
WPAR-Nr.:	-	Werkstoffgruppe:	1. 4301, 1.4541, 1.4571(artähnliche)
Hersteller:		Werkst.dicke (mm):	W09 (EN 288-3)
Schweißer (Name):		Außen-Ø (mm):	3,0 ≥ t ≥ 16,0
Schweißprozeß:	111 (E) Lichtbogenhandschweißen	Schweißposition:	≥ DN 200
Nahtart:	BW (Stumpfnah) am Rohr-Rohrstutzen		PF (steigend) , PA (horizontal)

Einzelheiten der Fugenvorbereitung:



Einzelheiten für das Schweißen:

Schweißraupe	Prozeß	Ø des Zusatzwerkstoffes	Stromstärke (A)	Spannung (V)	Stromart / Polung	Drahtvorschub	Ausziehlänge / Vorschubgeschwindigkeit	Wärmeeinbringung
W	111	2,0	40-60		=+/ ≈	----	---	---
ZL	111	2,5	50-90		=+/ ≈	----	---	---
D	111	3,2	80-120		=+/ ≈	----	---	---

Zusatzwerkstoff: - Einteilung: E 19 12 3 Nb R DIN 85 56
 E 19.12.3 Nb R ISO 35 81

Sondervorschriften für Trocknung: 200°C 2h

Hilfsstoffe bzw. Wurzelschutz: Formiergas F1 EN 439 bei 3,0 ≥ t ≥ 5,0

Gasdurchflußmenge Wurzelschutz: 8,0-12 l / min

Wolframelektrodenart / Durchmesser: -

Ausfugen / Schweißbadsicherung: ss nb

Vorwärmtemperatur: -

Zwischenlagentemperatur: < 150°C

Wärmenachbehandlung / Aushärten: ohne

Arbeiten nach der Schweißung: Schweißnähte sind nach dem Schweißen zu beizen und zu neutralisieren

Weitere Informationen: (z.B. Pendeln)
 Pendeln; max. Raupen- Strichraupentechnik
 breite: max 2x Kerndraht-
 durchmesser

Besonderheiten: Bei Verwendung der
 Werkstoffe 1.4301
 und
 1.4541 auch Zusatz
 E 19 9 Nb R möglich

Hersteller

Prüfer oder Prüfstelle

Name, Datum und Unterschrift

Name, Datum und Unterschrift



B. Jantke 2009-07-10

7.2.2 Procedure (B) "Welding on the Glands for Ultrasonic Measurements" C Steels and Higher-strength Steels

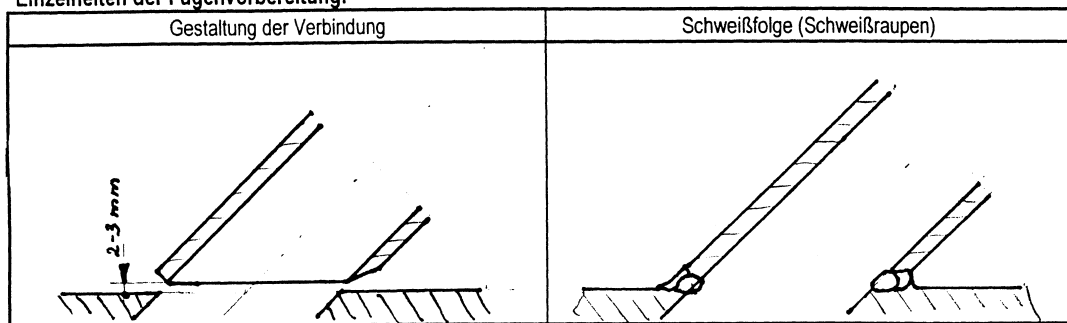
1. Mark and punch the mounting point, and drill a hole approx. 1 – 2 mm deep using a twist drill \varnothing 4 - 6 mm.
2. Use a hand drill (or preferably a drill bracket with a prismatic fixture for the main pipe and a permanently set drill support at a predefined angle) to drill a 5 - 8 mm hole in the main pipe at an angle of approx. 30 - 45°.
3. Gradually drill out, grind, or mill the hole in the main pipe to $D_i = 40$ mm, maintaining an angle of 30 - 45°.
4. Round off the sides of the hole in the vicinity of the inside of the pipe to prevent subsequent bearing cracks near the hole.
5. Mechanical adjustments to the prefabricated weld-on gland
 - Beveling in accordance with the angle setting for drilling
 - Adjust the air gap of 2 - 3 mm between the glands and main pipe in accordance with the diameter of the main pipe.
 - Rub down the seam edge.
 - The seam edge angle changes as a result of welding on the gland at an angle of 30 to 45°.
 - Note that accessibility for root welding near the acute angle is restricted.
6. Align and tack the weld-on glands to the main pipe. - Ensure that the internal diameters of the weld-on gland / hole in main pipe match.
7. Cover the 2" thread with metal cap or foil at 2 positions at least.
8. Weld the root pass – root areas not included must be ground out or improved.
9. Weld the surface layer(s). Note that preheating may be necessary.
(see WPS)
10. Carefully remove any residual slag near the root and surface layers – mechanically remove any root slag.
11. Perform a visual inspection of the seam – compile documentation if requested.
12. Minimum welder qualifications:
13. EN 287-1 111 T BW W01 R t04 D48PA ss/nb
14. PF ss/nb

Example of an inspection certificate

Schweißanweisung des Herstellers (WPS)

Ort:	-	Prüfer od.Prüfstelle:	TÜV Bayern Hessen Sachsen Südwest e.V.
Schweißverfahren des Herstellers:	Lichtbogenhandschweißen	Art der Vorbereitung und Reinigung:	mechanisch, Schweißnahtbereich metallisch blank, fettfrei
Beleg Nr.:	-	Spezifikation des Grundwerkstoffs:	alle gut schweißbaren C- Stähle und Feinkornbaustähle
WPAR-Nr.:	-	Werkstoffgruppe:	StE 255, StE 285, StE 355, StE 460, 16Mo3
Hersteller:	-	Werkst.dicke (mm):	W01, W03
Schweißer (Name):	-	Außen-Ø (mm):	6,3 ≥ t ≥ 22,2
Schweißprozeß:	111 (E) Lichtbogenhandschweißen	Schweißposition:	≥ DN 200
Nahtart:	BW (Stumpfnah) am Rohr		PF (steigend) , PA (horizontal)

Einzelheiten der Fugenvorbereitung:



Einzelheiten für das Schweißen:

Schweißraupe	Prozeß	Ø des Zusatzwerkstoffes	Stromstärke (A)	Spannung (V)	Stromart / Polung	Drahtvorschub	Ausziehlänge / Vorschubgeschwindigkeit	Wärmeeinbringung
W	111	2,5	60- 100		= / - / ≈	----	---	---
D	111	3,2	90- 140		= / - / ≈	----	---	---

Zusatzwerkstoff: - Einteilung: E4343 RR(B) DIN 1913
 E434 RR ISO 2560
 Sondervorschriften für Trocknung: (200°C 2h)
 Schutzgas bzw. Schweißpulver: -
 Hilfsstoffe bzw. Wurzelschutz: -
 Gasdurchflußmenge Schutzgas: -
 Gasdurchflußmenge Wurzelschutz: -
 Wolframelektrodenart / Durchmesser: -
 Ausfugen / Schweißbadsicherung: ss nb
 Vorwärmtemperatur: 150-200°C bei 16Mo3 t <20,0mm
 Zwischenlagentemperatur: -
 Wärmenachbehandlung / Aushärten: ohne
 Zeit, Temperatur, Verfahren: -
 Erwärmungs- und Abkühlungsrate: -

Weitere Informationen: (z.B. Pendeln)
 Pendeln; max. Raupenbreite: -
 Pendeln; Amplitude: -
 Pendeln; Frequenz: -
 Pendeln; Verweilzeit: -

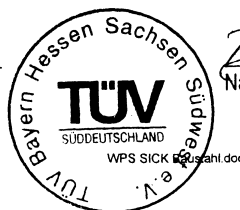
Hinweis: auch rein basische Zusatzwerkstoffe wie z. B. E43 55 B DIN 1913 möglich

Hersteller

Prüfer oder Prüfstelle

Name, Datum und Unterschrift

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