

## OPERATING INSTRUCTIONS

# FLOWSIC100

Gas Velocity and Volume Flow  
Measuring Device





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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.

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 and maintenance.

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 MAIHAK representative will gladly provide you with additional information and support for special applications. We strongly advise that you contact a SICK MAIHAK specialist for consultation with regard to special applications.

- Notes:**
- Always read these operating instructions carefully before commencing work. The safety instructions and warnings must be followed at all times.
  - Some system components (such as the side-channel compressor of the purge-air units) are supplied with separate user information. This information must also be read carefully.

### 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:** A note provides information on the features of the device or system, along with additional tips.



### Important

The “Attention” sign indicates a risk of damage to the device or system components and potential functional impairments.



### Warning

The “Warning” sign 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 FLOWIC100 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 provided.

## 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.

## 1.3 Safety Information and Protective 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 FWE 200 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 FLOWSIC100 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.



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#### Warning

Plants and processes with toxic gases, high pressure, or high temperatures, must be shut down before the sender/receiver units are installed or removed.

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### 1.3.4 Behaviour at Purge-air Failure

Some system versions are equipped with a purge-air unit to protect the ultrasonic transducers from hot or corrosive gases. The transducers can be quickly destroyed if the purge-air supply fails. For this reason, the operator must ensure that:

- The power supply for the purge-air unit operates reliably and without interruption,
- A failure on the purge-air supply is detected immediately (for example, by using pressure monitors),
- The sender/receiver units are removed from the duct in the event of a purge-air failure and the duct openings are covered (for example, with a flange cover).

### 1.3.5 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,
- Unusually strong vibrations / unusual operating noise from a purge-air fan,
- Smoke or unusual odors.

### 1.3.6 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 and any resulting malfunctions,
- The defective equipment can be switched off immediately if necessary,
- Switching off equipment does not indirectly cause further malfunctions.

# **FLOWSIC100**

## **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 FLOW SIC100 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 FLOW SIC100 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 FLOW SIC100 series can be used to measure gas flows in pipelines, flue-gas and exhaust-gas ducts, and chimneys. If configured accordingly, the devices can measure the flow rate in both pure gases and in raw gases upstream of filter installations. As a result, the applications range from determining the volumetric flow in open and closed-loop control systems used in process control to flow monitoring for emission measurements.

The system is suitable for use in the following areas:

- Operating measurements and emissions monitoring 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
- 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
- Flow measurements in ventilation, heating, and air-conditioning systems in both industry and agriculture

### Certification

The measuring system is qualified to the Federal German Pollution Control Act (13th, 17th, and 27th Implementing Ordinances) and the Clean Air Regulations (TA-Luft).

## 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
- Flange with pipe  
for mounting the sender/receiver units on the gas duct
- MCU control unit  
for control, evaluation and output of the data of the sensors connected via RS485 interface, MCU with integrated purge-air supply for internally cooled s/r units
- Connection cables  
for analog/digital signal transmission between the sender/receiver units and the evaluation unit
- Connection box  
for connecting the connection cables
- Purge-air unit (option)  
for using certain sender/receiver units to keep the ultrasonic transducers clean
- Measuring pipe (option)  
Spool piece with flanges, preassembled for mounting in an existing pipe; with flanges with pipe for fitting the sender/receiver units

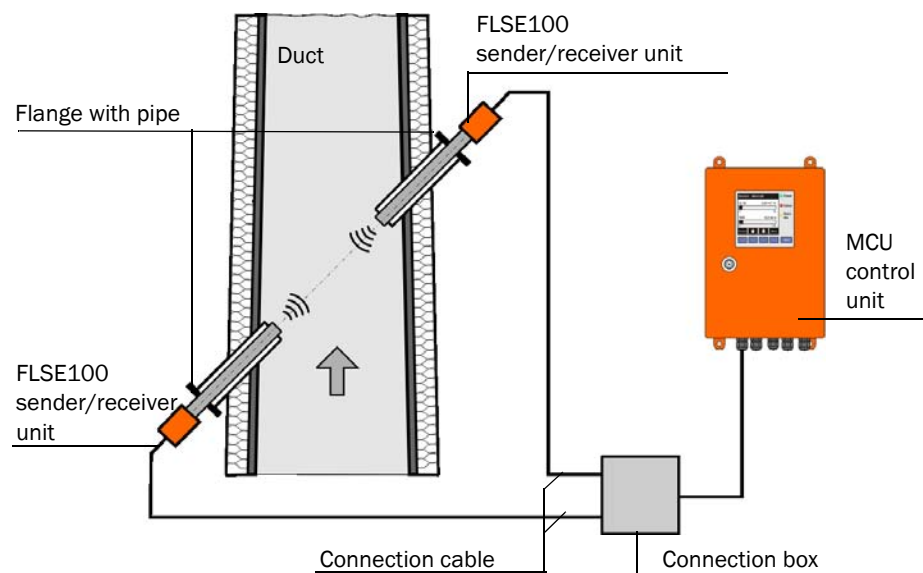


Fig. 2.1: FLOW SIC100 system components

## 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, the connection box in which the separation of the interfaces takes place, has to be installed at the master-FLSE.

Connection box is optional for type PR and PRAC (for long cable lengths).

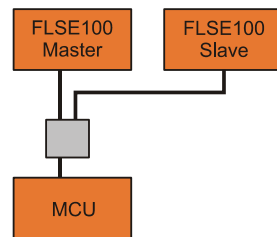


Fig. 2.2: Standard version (1 Sensor)

### Bus version with several connected measuring systems

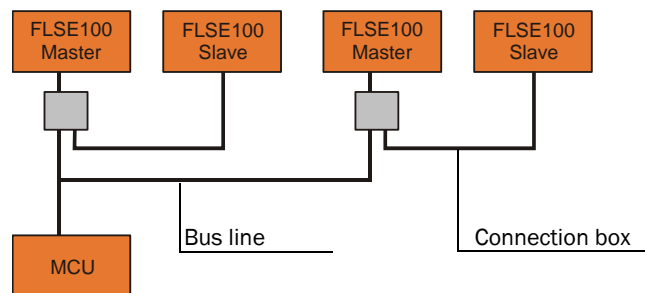


Fig. 2.3: Bus connection FLSE100 - MCU (2 Sensors)

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

- Notes:**
- For bus wiring the manufacturer set termination has to be deactivated in those system components, that are not on the cable end (see Service Manual Section 3.1).
  - Other sensor type (e.g. sensor for dust measurement) can be connected additionally to the MCU too.



### 2.2.3 Operating Principle

The FLOWSIC100 gas velocity monitors operate by measuring the transit time difference of ultrasonic pulses. Sender/receiver units are mounted on both sides of a duct/pipeline at a certain angle to the gas flow (**Fig. 2.4**).

These sender/receiver units contain piezoelectric ultrasonic transducers that function alternately as senders and receivers. The sound pulses are emitted at an angle  $\alpha$  to the flow direction of the gas. Depending on the angle  $\alpha$  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 increases, the higher the gas velocity and the smaller the angle to the flow direction is.

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.

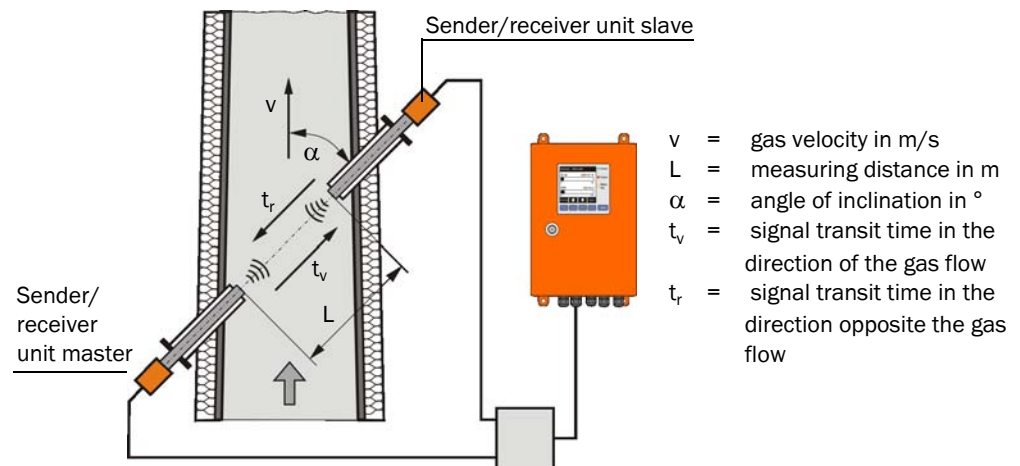


Fig. 2.4: Operating principle of the FLOWSIC100

### 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  $\alpha$  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:

$$t_v = \frac{L}{c + v \cdot \cos \alpha} \quad (2.1)$$

Against the gas flow (backward direction):

$$t_r = \frac{L}{c - v \cdot \cos \alpha} \quad (2.2)$$

After the resolution to v:

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

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. 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.

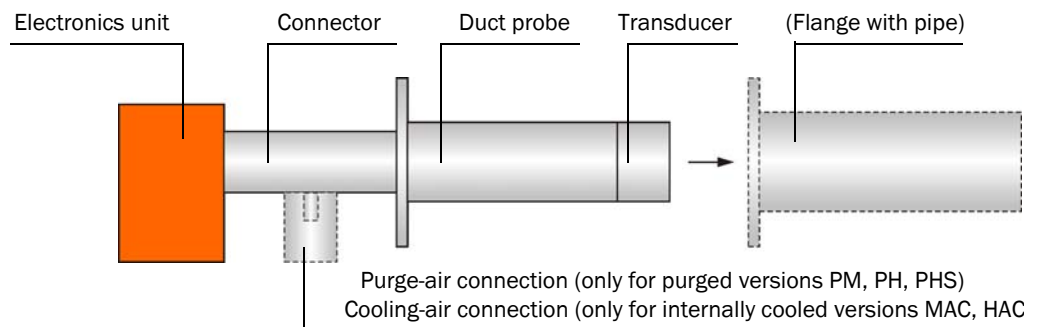


Fig. 2.5: Schematic diagram with modules of the sender/receiver unit and flange with pipe

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

- Gas temperature  
The choice of material (steel / titanium) for the duct probe and the choice of transducer type (standard / internally cooled) is determined by the decision, whether or not the sender/receiver unit can/must be operated with or without internal cooling air
- Gas composition (corrosive / slightly corrosive or not corrosive)  
The duct probe and transducers are selected on the basis of their resistance to corrosion (probe made from stainless steel / titanium, transducers made from titanium / hastelloy)
- Duct diameter, sound dampening, dust content  
The transducers are selected on the basis of the required transmitter power (medium power / high power)
- Dust properties  
Purged or unpurged sender/receiver units are selected. Purged sender/receiver units are only needed if it is necessary, to prevent contamination with sticky dust.
- Wall and insulation thickness of the gas duct  
The duct probe and the flange with tube is selected according to the nominal length (graded standard lengths). Other lengths can be supplied on request.
- 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  
Small or large flange dimensions  
(pitch diameter of the mounting holes 75 mm, 100 mm or 114mm)
- Internal duct pressure  
Pressure-resistant versions must be used with pressures greater than 100 mbar (see OI FLOWSIC100 PROCESS)
- Certification requirements  
Qualification tests for emission measurements, explosion protection requirements, pressure stages (also see OI FLOWSIC100 PROCESS),

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

Type key for sender/receiver unit:

**FLSE100-XXX (X) XX XX XX**

Purge-air supply yes/no

- P: Purged

Transducer power

- M: Medium power

- H: High power

- S: Low power with small dimensions (Small size)

- PR: Low power with small dimensions and probe version

Signal transmission

- D: Digital

- A: Analog (only FLSE100-SA)

Identification

- empty: No specific characteristics

- AC: Internal cooling of ultrasonic transducers

Nominal length of duct probe

- 12: 125 mm

- 20: 200 mm

- 35: 350 mm

- 55: 550 mm

- 75: 750 mm

Duct probe material

- SS: 1.4571 (Stainless Steel)

- TI: Titanium

- HS: Hastelloy

Transducer material

- TI: Titanium

- HS: Hastelloy

Example:

**FLSE100-M 35SSTI**

medium transducer power











duct probe nominal length 350mm

duct probe material 1.4571

transducer made from titanium

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
<b>M</b> 	<ul style="list-style-type: none"> <li>• medium power,</li> <li>• digital signal transfer to control unit</li> </ul>	2
<b>H</b> 	<ul style="list-style-type: none"> <li>• high power,</li> <li>• digital signal transfer to control unit</li> </ul>	2
<b>PR</b> 	<ul style="list-style-type: none"> <li>• with <b>two</b> transducers, small size and high frequency,</li> <li>• <b>single-probe</b> version for installation on one duct side,</li> <li>• digital signal transfer to control unit</li> </ul>	1
<b>SA/SD</b> 	<ul style="list-style-type: none"> <li>• with <b>two</b> transducers, small size and high frequency,</li> <li>• digital signal transfer to control unit (SD)</li> </ul>	1 each
<b>MAC</b> 	<ul style="list-style-type: none"> <li>• medium power,</li> <li>• digital signal transfer to control unit</li> <li>• air cooled (internally)</li> </ul>	2
<b>HAC</b> 	<ul style="list-style-type: none"> <li>• high power,</li> <li>• digital signal transfer to control unit</li> <li>• air cooled (internally)</li> </ul>	2
<b>PRAC</b> 	<ul style="list-style-type: none"> <li>• with <b>two</b> transducers, small size and high frequency,</li> <li>• <b>single-probe</b> version for installation on one duct side,</li> <li>• digital signal transfer to control unit</li> <li>• air cooled (internally)</li> </ul>	1
<b>PM</b> 	<ul style="list-style-type: none"> <li>• purged,</li> <li>• medium power,</li> <li>• digital signal transfer to control unit</li> </ul>	2
<b>PH</b> 	<ul style="list-style-type: none"> <li>• purged,</li> <li>• high power,</li> <li>• digital signal transfer to control unit</li> </ul>	2
<b>PHS</b> 	<ul style="list-style-type: none"> <li>• purged,</li> <li>• very high power,</li> <li>• digital signal transfer to control unit</li> </ul>	2

### Application range

Type FLSE100	Probe material	Transducer material	Max. gas temperature [°C]	Active meas. distance <sup>1)</sup> [m]	Duct/pipe diameter [m]
M	SS, TI	TI	260	0.2 - 4	0.15 - 3.4
	Hastelloy			0.2 - 2	0.15 - 1.7
H	SS, TI	TI		2 - 15	1.4 - 13
	Hastelloy			1.5 - 2.5 <sup>2)</sup>	1.1 - 2.5 <sup>3)</sup>
				2 - 5	1.4 - 4.3
PR	SS, TI	TI		0.27 - 0.28	> 0.40
SA/SD	SS		150	0.2 - 2	0.15 - 1.7
MAC	SS, TI		450	0.2 - 4	0.15 - 3.4
HAC				2 - 13	1.4 - 11.3
				1.5 - 2.5 <sup>2)</sup>	1.1 - 2.5 <sup>3)</sup>
PRAC			350	0.245 - 0.255	> 0.40
PM	SS		450	0.5 - 3	0.35 - 2.5
PH	SS, TI			1 - 10	0.7 - 8.7
				1 - 2 <sup>2)</sup>	0.7 - 2 <sup>3)</sup>
PHS	SS			2 - 13	1.4 - 11.3
		1.5 - 2.5 <sup>2)</sup>		1.1 - 2.5 <sup>3)</sup>	

- 1): The maximum possible measuring distance depends on the dust content, gas temperature, and gas composition  
 2): for extremely high dust concentrations up to max. 100 g/m<sup>3</sup>  
 3): for installation across secant (see Section 3.1.3)

### Configuration options

Type FLSE100	Duct probe							
	Nominal length in mm					Material		
	125	200	350	550	750	SS	TI	HS
M		x	x	x		x	x	x
H		x	x	x	x	x	x	x
PR			x	x	x	x	x	
SA/SD	x	x	x			x		
MAC			x	x		x	x	
HAC			x	x		x	x	
PRAC				x	x	x	x	
PM		x	x	x	x	x		
PH		x	x	x	x	x	x	
PHS			x	x	x	x		

### 2.3.1.1 Standard Sender/Receiver Units

A special transducer design makes it possible to use these sender/receiver units without cooling by extern purge-air even with higher gas temperatures. The advantages are:

- Lower expense for mounting and installation
- Easier maintenance
- Lower operating costs.

For these reasons, standard sender/receiver units should be used where possible.

The types FLSE100-M, H and PR are intended for use with gas temperatures up to max. 260°C. The types FLSE100-SA and SD are intended for use up to 150 °C.

**Note:** The measuring system FLOWSEC100 S contains one sender/receiver unit FLSE100-SA and one unit FLSE100-SD.

The type FLSE100-SA has no electronics unit. The communication to the FLSE100-SD as master (which communicates with the MCU control unit) is carried out via an analog cable (fixed length: 3m).

**Note:** In gases with dust concentrations  $> 1 \text{ g/m}^3$ , the sender/receiver units have to be installed in an angle to the flow direction of 60° (applies only for FLSE100-H). The downstream sender/receiver unit (slave in **Fig. 2.4**) has to be equipped with a rebound protector.

In addition to the various versions, the following differences apply:

Type FLSE100	Transducer and duct probe
M	Nominal diameter 35 mm
H	Nominal diameter 60 mm
PR	Measuring probe version (2 transducers)
SA, SD	Duct probe Ø 35 mm, transducer 15 mm

The type FLSE100-M is available with other flanges on request (see Section 2.7.1).

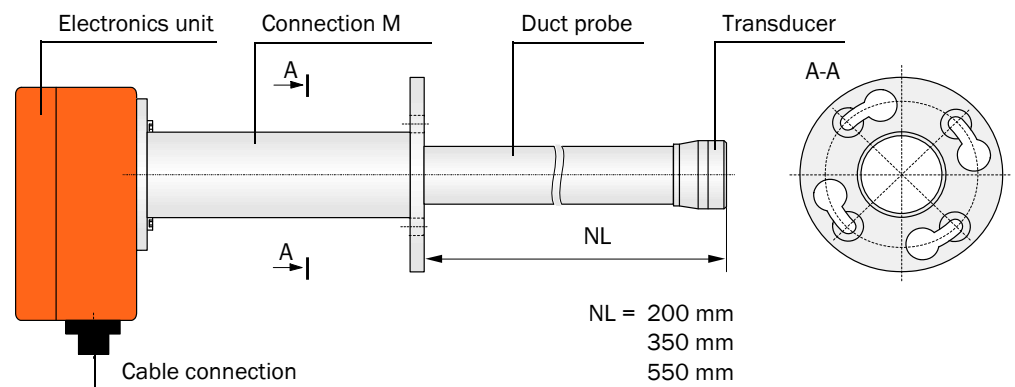


Fig. 2.6: FLSE100-M

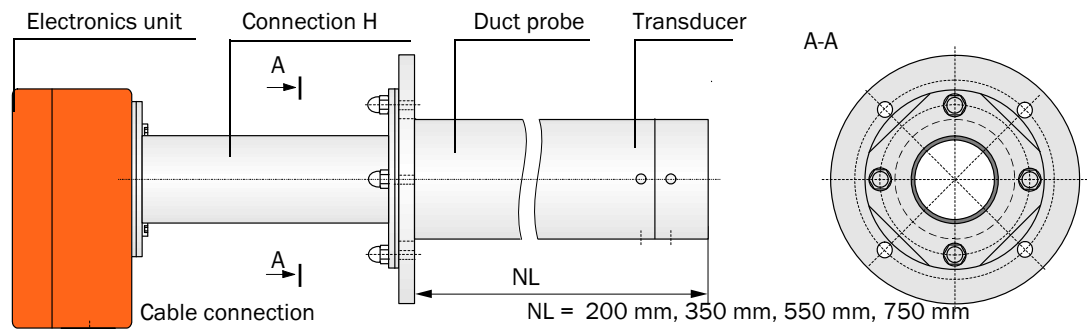


Fig. 2.7: FLSE100-H

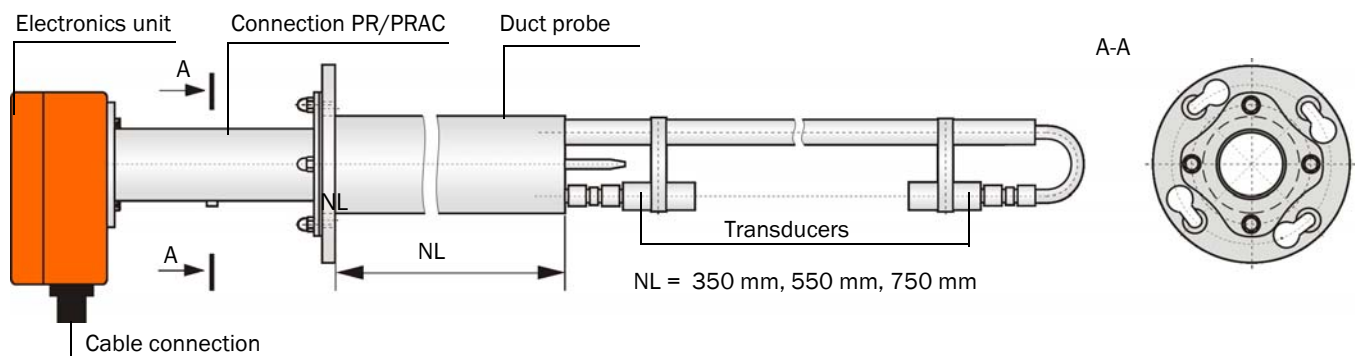


Fig. 2.8: FLSE100-PR

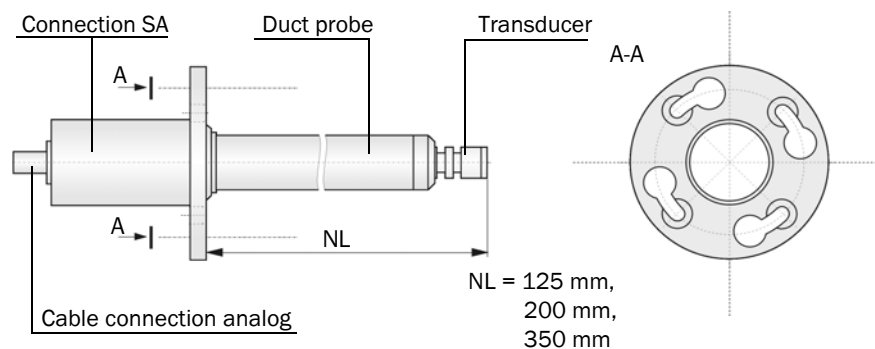


Fig. 2.9: FLSE100-SA

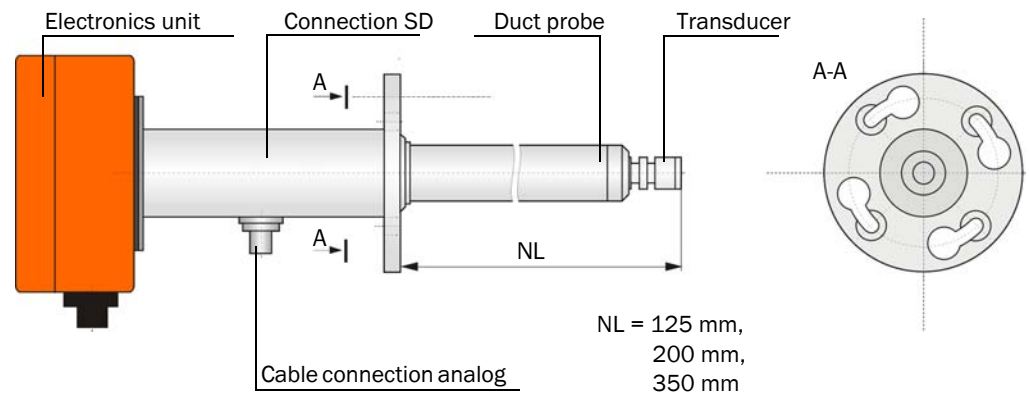


Fig. 2.10: FLSE100-SD



### 2.3.1.2 Internally Cooled Sender/Receiver Units

Through internal cooling of the ultrasonic transducers, the types FLSE100-MAC, HAC and PRAC can be used for gas temperatures of max. 450 °C (MAC, HAC) respectively max. 350 °C (PRAC). The cooling air (for type MAC and HAC) is supplied by a control unit with integrated filter and fan (see Section 2.3.3). For type PRAC the cooling air is supplied by an electronics unit with integrated membrane pump.

The advantages over the purged versions are:

- Lower costs of installation and operation,
- no flow of purge-air into the measured medium, therefore no direct influence on gas flow and flow rate,
- lower risk of passing below the dew point at probe head.

**Note:** Using the FLOWSEC100 in gases with dust concentrations > 1 g/m<sup>3</sup>, the sender/receiver units have to be installed in an angle to the flow direction of 60° (only applicable for FLSE100-HAC). The downstream sender/receiver unit (slave in **Fig. 2.4**) has to be equipped with a rebound protector.

The following differences exist in addition to the possible versions:

Type FLSE100	Transducer und Duct Probe
MAC	Nominal diameter 35 mm
HAC	Nominal diameter 60 mm
PRAC	Single-probe version (2 transducers)

Type FLSE100-MAC can be supplied with different flanges on request (see Section 2.7.1).

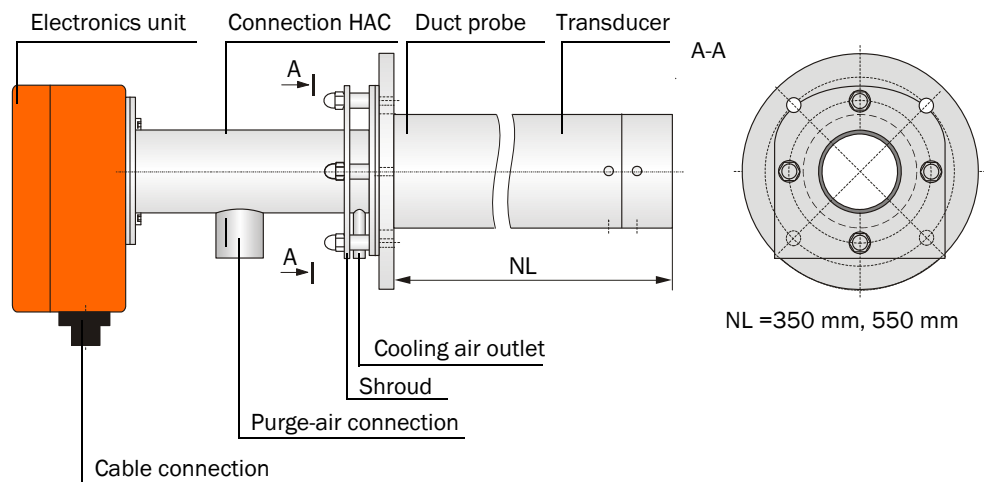


Fig. 2.11: FLSE100-HAC

Gas Velocity Monitor

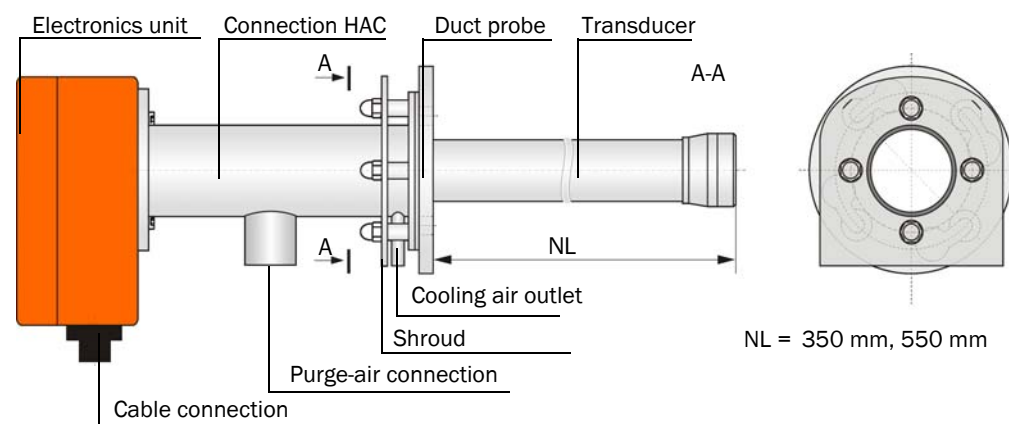


Fig. 2.12: FLSE100-MAC

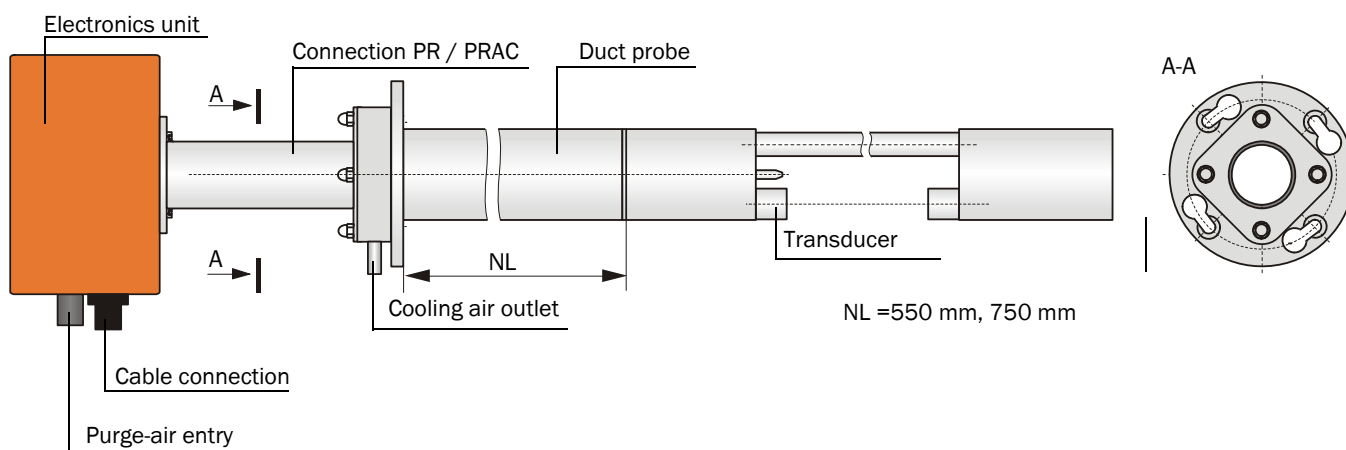


Fig. 2.13: FLSE100-PRAC

### 2.3.1.3 Purged Sender/Receiver Units

See table application range on page 22 for limitations of use.

These types are intended only for use with wet and sticky dust if the transducer surface is in high danger of contamination.

To prevent the contamination of the transducer surface, purge-air is supplied by a purge-air unit (see Section 2.3.6). The purge-air flow is optimized to maximize the directivity of the ultrasound beam.

The transducer temperature is monitored by a temperature sensor.

**Note:** Using the FLOWSEC100 in gases with dust concentrations  $> 1 \text{ g/m}^3$ , the sender/receiver units have to be installed in an angle to the flow direction of  $60^\circ$  (only applicable for FLSE100-PH and PHS). The downstream sender/receiver unit (B in Fig. 2.4) has to be equipped with a rebound protector.

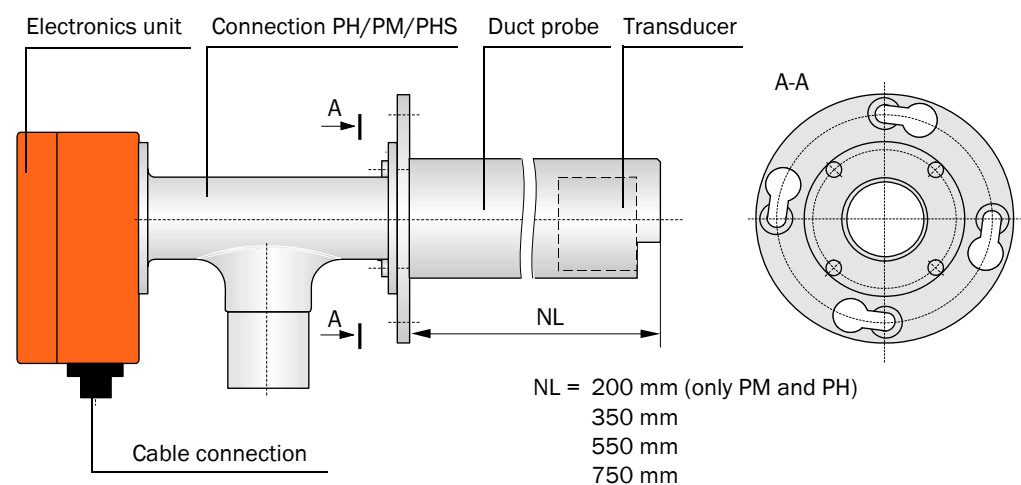


Fig. 2.14: FLSE100 PM, PH, PHS

**Note:** At low gas temperatures, the purge-air supply can cause the temperature to drop below the dewpoint. To minimize corrosion on the probe head as a result (for example, due to acid formation with corrosive gas compositions), duct probes with a nominal length greater than that actually required for the flanges with pipe must be selected for temperatures between  $150^\circ\text{C}$  and  $200^\circ\text{C}$  (for example, if the nominal length of the flange with pipe is 350 mm  $\rightarrow$  a duct probe with a nominal length of 550 mm should be used). The purge-air is then heated by the gas temperature in the probe tube, with the result that temperature drops below the dewpoint can be minimized.

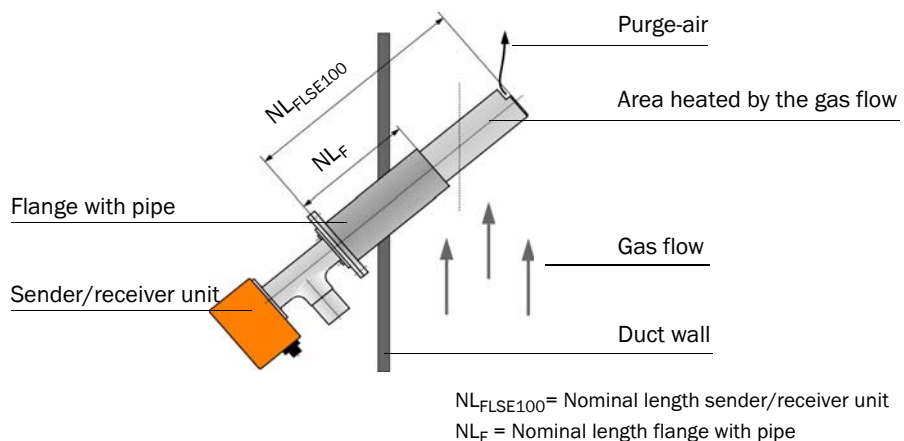


Fig. 2.15: Use of sender/receiver units with a nominal length greater than the flange with pipe

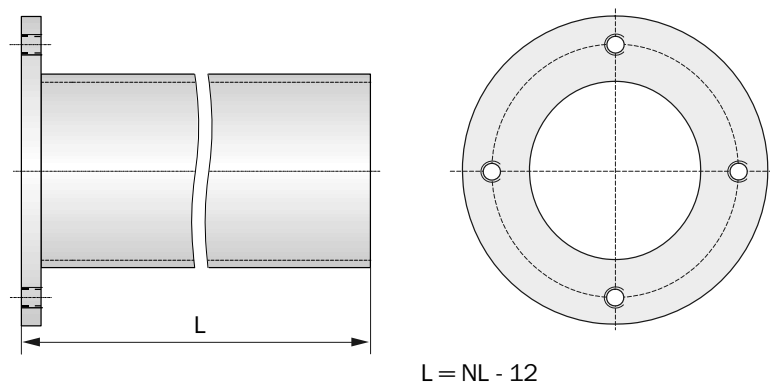
### 2.3.2 Flange with Pipe

If required, the flanges with pipe can also be delivered in advance.

The sender/receiver units are mounted in flanges with pipes, which are available in graded nominal lengths, different steel types and pitch hole diameters.

Your choice of flange with pipe depends on:

- The installation angle, and the wall and insulation thickness of the duct  
→ Determining the nominal length (see Section on Assembly)
- Type of sender/receiver unit  
→ Pitch hole diameter of flange, pipe diameter
- Duct material  
→ Steel types



Type FLSE100	Nominal length in mm	Material
S	125	St37, V4A  (others on request)
S, M, PM, PH	200	
S, M, MAC, H, HAC, PR, PM, PH, PHS	350	
M, MAC, H, HAC, PR, PRAC, PM, PH, PHS,	550	
H, PR, PRAC, PM, PH, PHS	750	

Fig. 2.16: Flange with pipe

### 2.3.3 Multi Control Unit (MCU)

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.

#### Versions

##### 1. Control unit without purge-air supply.

This control unit serves for the connection of the sender/receiver units FLSE100-M, H, PR, S, PM, PH and PHS.

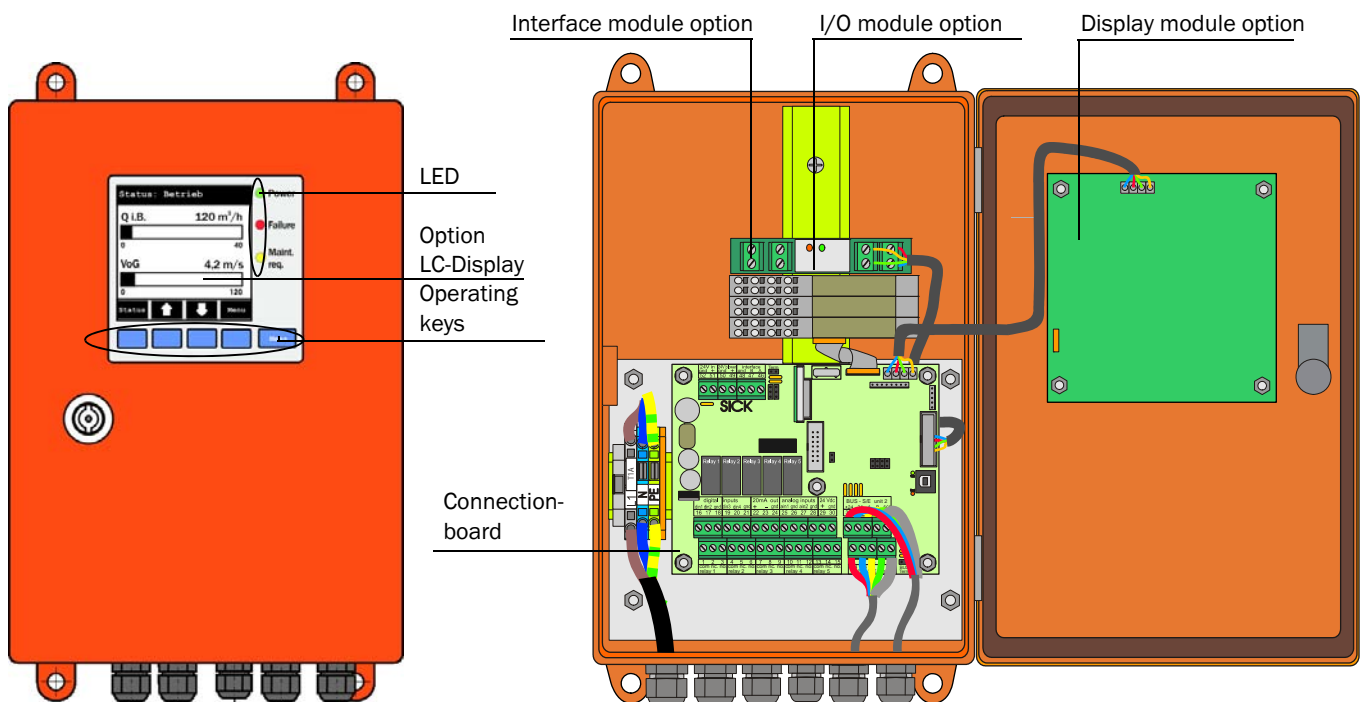


Fig. 2.17: Control unit MCU with options

### Control unit with integrated purge-air supply

This version is additionally equipped with a purge-air fan, air-filter and purge-air connection for the connection of purge-air hoses DN 25 (see Section 6.1.5, must be ordered separately) for the internally cooled sender/receiver units (types FLSE100-MAC and HAC).

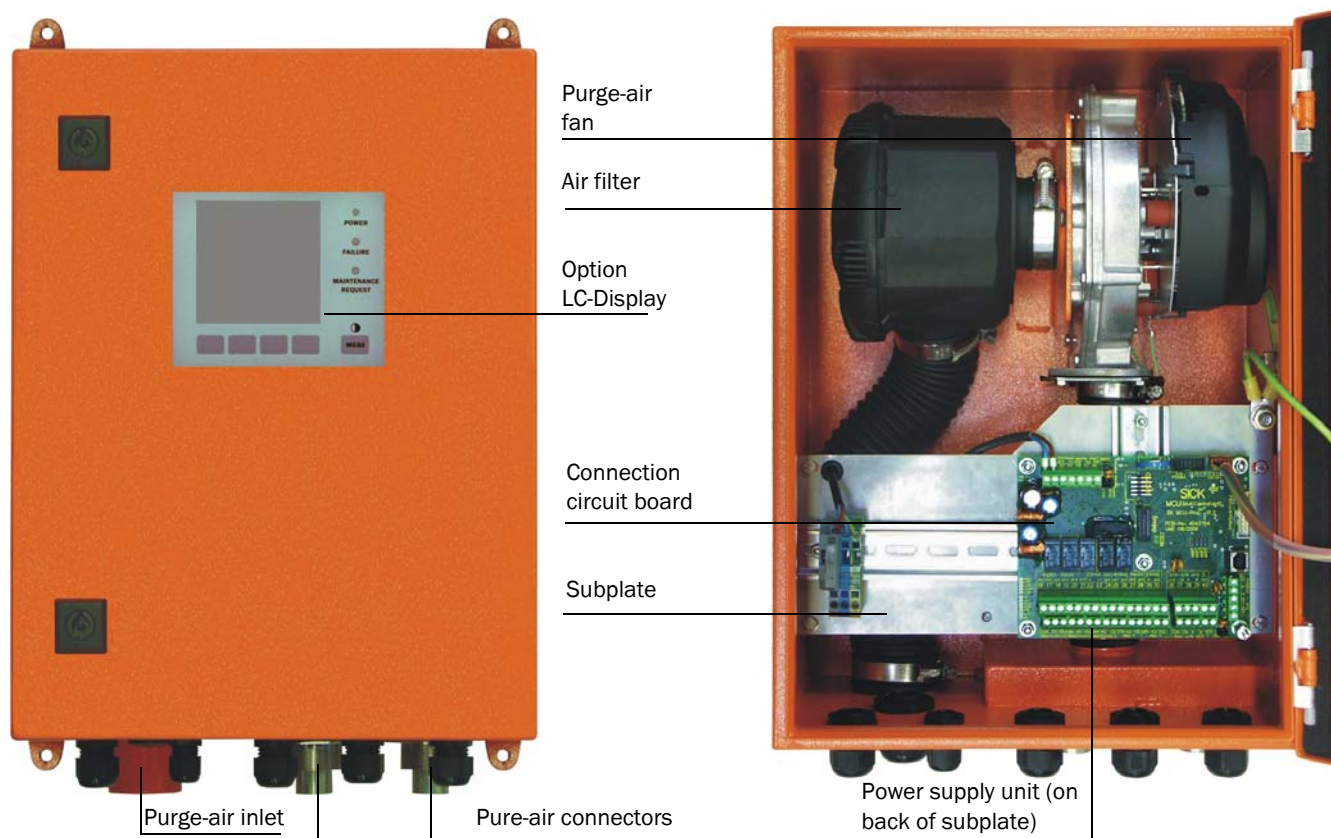


Fig. 2.18: Control unit with integrated purge-air supply

### 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"> <li>• Velocity</li> <li>• Volume flow a.c.</li> <li>• Volume flow s.c.</li> <li>• Temperature, resolution 12 bits</li> </ul>	2 inputs 0 ... 5/10 V (without electrical isolation) or 0 ... 20 mA for selectable input of calculation variables (temperature, pressure, moisture), resolution 12 bits	5 changeover contacts (120 V AC, 1 A) to output the status signals: <ul style="list-style-type: none"> <li>• Operation/ Malfunction</li> <li>• Maintenance</li> <li>• Control cycle</li> <li>• Warning</li> <li>• Limit value</li> </ul>	4 potential-free contacts for: <ul style="list-style-type: none"> <li>• connecting a maintenance switch</li> <li>• triggering a control cycle</li> <li>• separate zero point check</li> <li>• separate span check</li> </ul>	<ul style="list-style-type: none"> <li>• USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and firmware updates</li> <li>• RS485 to connect a sensor</li> </ul>

## Block Diagram

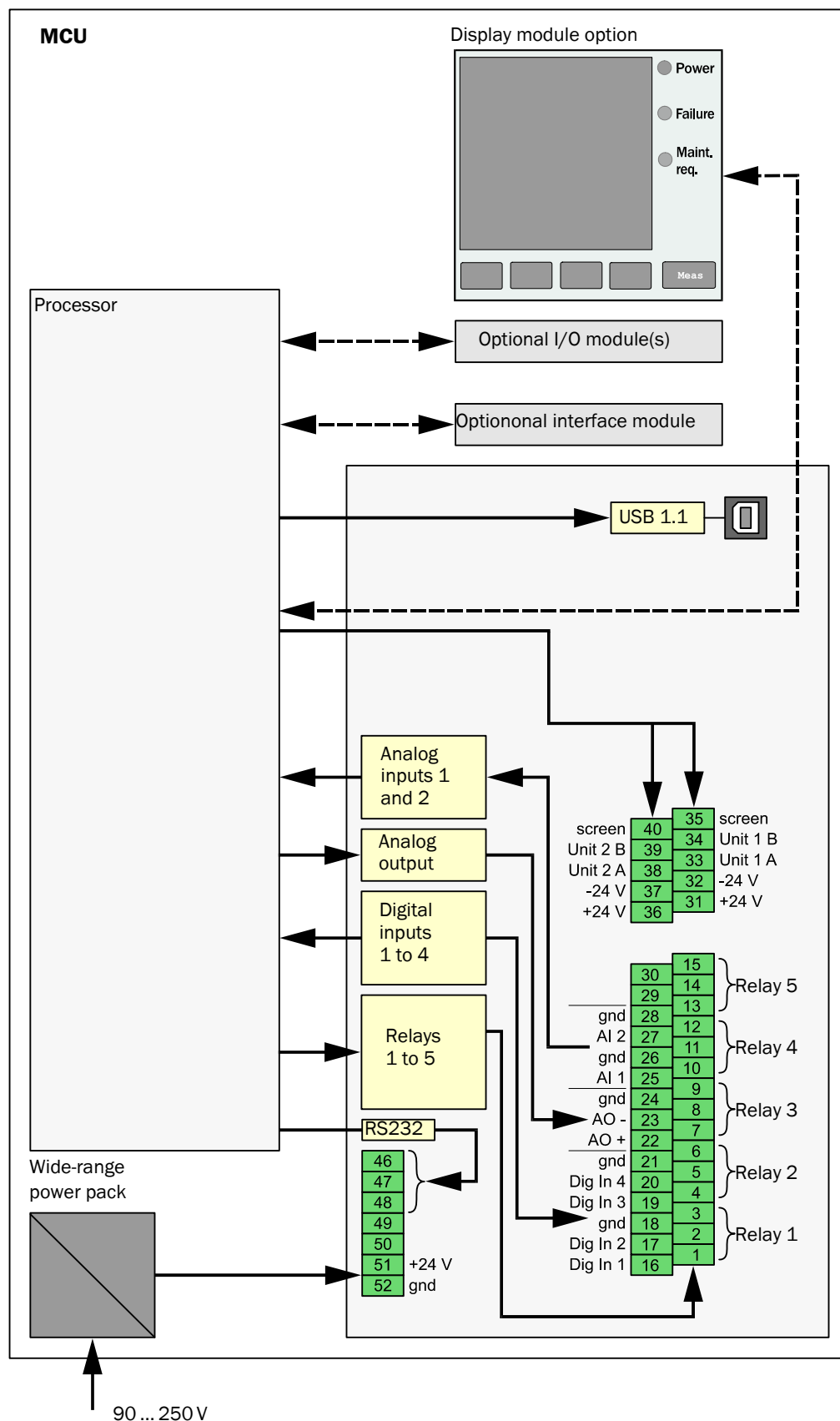


Fig. 2.19: MCU block circuit diagram

## 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"> <li>• Volume flow at actual conditions (Q a.c.)</li> <li>• Volume flow at standard conditions (Q s.c.)</li> <li>• Velocity of Gas (VoG)</li> <li>• Speed of Sound (SoS)</li> <li>• Acoustic temperature (T ac)</li> <li>• Transducer temperature A (T A)</li> <li>• Transducer temperature B (T B)</li> <li>• Signal to noise ratio A (SNR A)</li> <li>• Signal to noise ratio B (SNR B)</li> <li>• Mass flow</li> </ul>
	Text display	6 possible measured variables (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”).

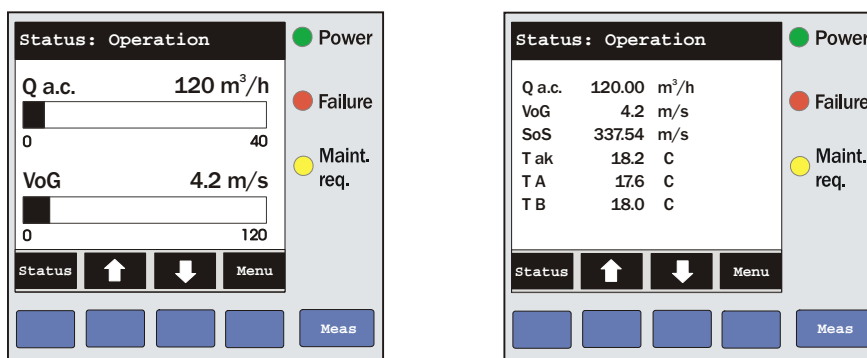


Fig. 2.20: LCD in graphical display (left) and in text display (right)

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

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 I<sup>2</sup>C 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

- 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. 2.21**).

# MCU processor board terminals

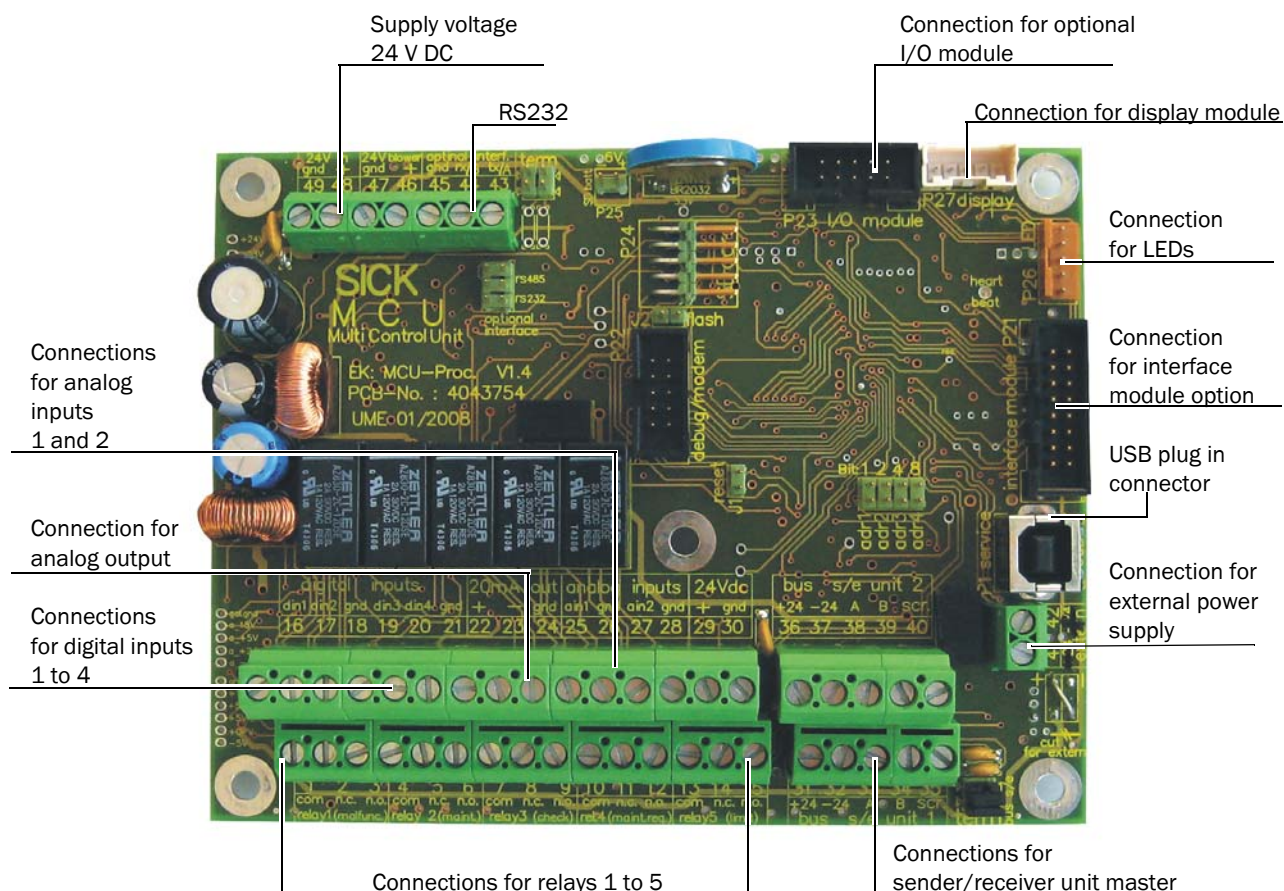


Fig. 2.21: Connections on the MCU processor board

## Type key MCU

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

Type key control unit:

MCU-X X X X X X X X X X X

Integrated purge-air supply

- N: without (no)
- P: with (purged)

## Power supply

- W: 90 ... 250 V AC
- 2: optional 24 V DC

## Housing variants

- O: wall housing SICK orange
- G: wall housing grey <sup>1)</sup>
- S: wall housing, stainless steel 1.4571 (coated grey) <sup>1)</sup>
- R: 19" housing

Display module

- N: without
- D: with

Option Analog input (plugging module; 0/4...20 mA; 2 inputs per module)

- 0: without
- n: with,  $n = 1, 2, \dots$

Option Analog output (plugging module; 0/4...20 mA; 2 outputs per module) |

- 0: without
- n: with,  $n = 1, 2, \dots$

Option Digital input (plugging module; 4 inputs per module)

- 0: without
- n: number on request

Option Digital output Power (plugging module; 48 V DC, 5 A;  
2 changeover contact per module) \_\_\_\_\_

- 0: without
- n: number on request

Option Digital output Low Power (plugging module; 48 V d.c., 0.5 A; 4 make contact elements per module) \_\_\_\_\_

- 0: without
- n: number on request

Option Interface module

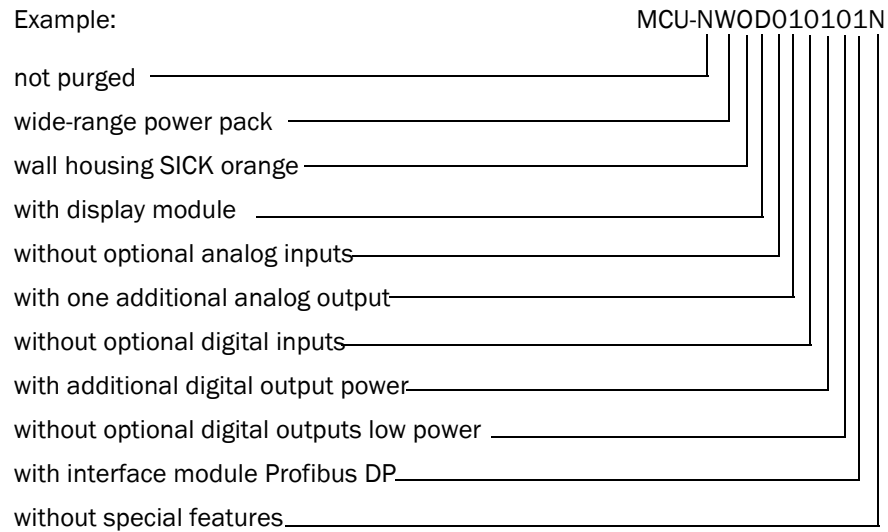
- O: without
- E: Ethernet
- P: Profibus

Misc. (e.g. Ex design)

- N: no special feature

1): Not valid for FLOWSIC100

<sup>2)</sup>: Up to 4 analog modules available on request



### 2.3.4 Connection Cables

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.



Standard cables  
Master (Length 5 m, 10 m)  
Slave (5 m, 10 m, 50 m)

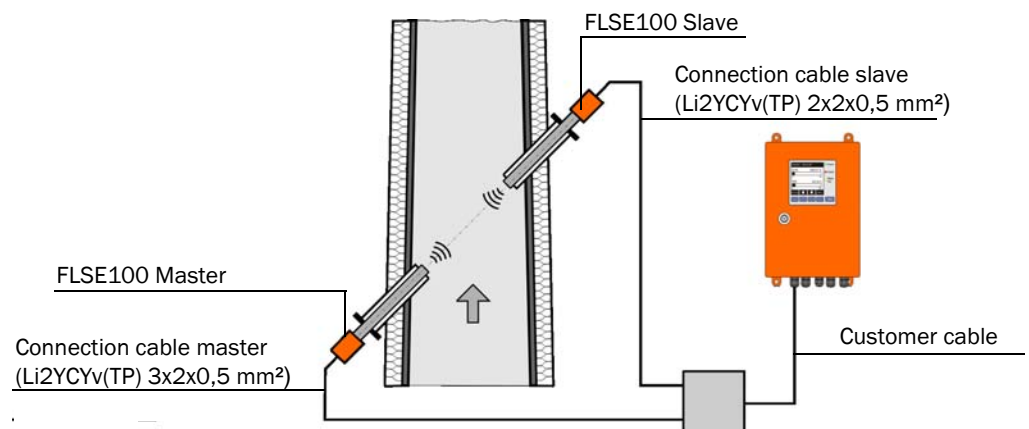


Fig. 2.22: Connection cables

**Note:** The cables provided on site must fulfill the following requirements (also see Section 3.3.4):

- Effective capacitance core/core less than 110 pF/m
- Min. core cross-section 0.5 mm<sup>2</sup> (AWG20).

We recommend the cable type UNITRONIC Li2YCYv(TP) 2x2x0.5 mm<sup>2</sup> with reinforced outer sheath (from Lappkabel).

The total length of the cable between connection box and MCU (customer cable) can be up to 1000 m.

If a bus configuration is used with two connected sensors, the maximum cable length total is reduced by half.

### 2.3.5 Connection Box

Connection cable master and slave have to be connected to the connection box. The connection box separates the communication between master FLSE100 and MCU and master FLSE100 and slave FLSE100.

### 2.3.6 Purge-air Unit Option

The purge-air unit is used to supply the sender/receiver units of the types FLSE100-PM, PH and PHS with clean purged air.

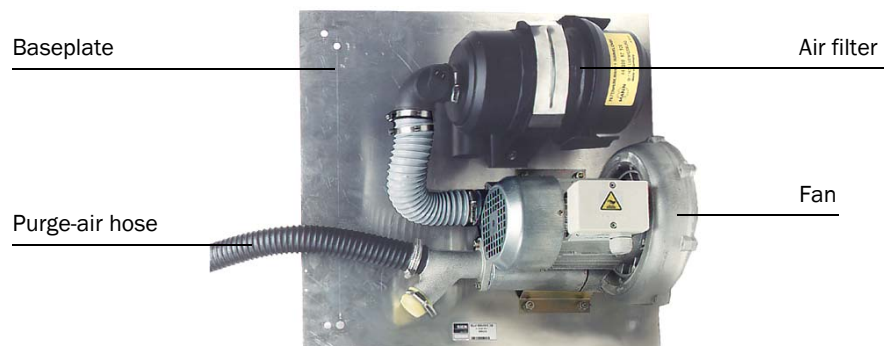


Fig. 2.23: Purge-air unit SLV 1

Depending on the internal duct pressure, you may need to use additional reducers (optional purge-air reducer set) or a purge-air unit with a more powerful fan.

Internal duct pressure (mbar)	Reducer	Fan type
-100 ... -20	40/7	2BH1300
-20 ... -10	40/10	
-10 ... +30	-	
+30 ... +100	-	2BH1400

### 2.3.7 Measuring Pipe Option

A pipe piece, as shown in **Fig. 2.24**, 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.

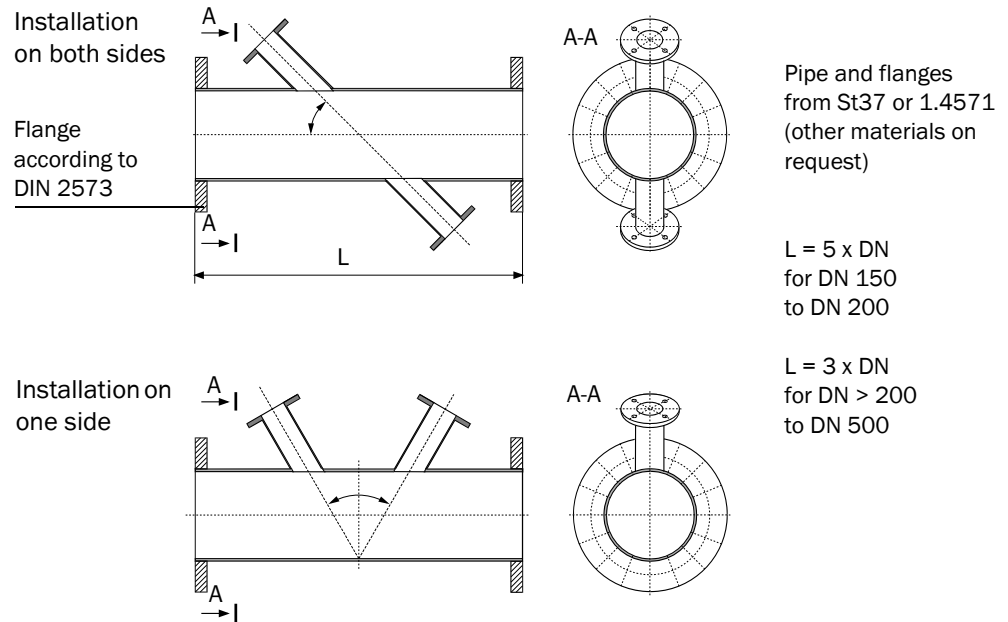


Fig. 2.24: Measuring pipe option

## 2.4 Calculations

### 2.4.1 Calculating and Calibrating the Volumetric Flow

#### Volumetric flow under actual conditions

Acoustic velocity monitors from the FLOWSIC100 series are usually used to determine the volumetric flow in closed pipes and ducts. The volumetric flow  $Q_{a.c.}$  through the representative cross-sectional area  $A$  and the mean gas velocity across the cross-section  $v_A$  (surface velocity) is defined as:

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

The FLOWSIC100, however, determines the representative mean value of the flow velocity on a sound path  $v$  (path velocity) between the two sender/receiver units. The sound path is generally arranged across the diameter (see Section 3.1.1).

Since the mean values of the path and surface velocity are not identical (particularly in small duct diameters), a functional, systematic correlation between the calculated path velocity and the mean surface velocity similar to the point-based flow measurement (for example, a pitot tube probe) was introduced.

$$v_A = K \cdot v$$

$K$  = Correction function

The correction factor  $k$  can be used for  $K$  with unimpeded, axial-symmetric flow profiles in round pipes.

$$k = \frac{v_A}{v} \quad 0.9 < k < 1$$

In many cases, however, an unimpeded, axial-symmetric flow profile is not guaranteed due to the installation conditions (short inlet sections, rectangular ducts, unsymmetrical flow profiles, and so on). For this reason, a second degree calibration function was implemented in FLOWSIC to map the correlation between the mean path and surface velocity.

$$v_A = Cv2 \cdot v^2 + Cv1 \cdot v + Cv0$$

**Note** If the flow in a round pipeline is unimpeded and axial symmetric,  $Cv\_1$  is equal to the correction factor  $k$ .

The coefficients in this calibration function can be determined by means of network measurements and regression analysis (see DIN EN 13284-1). The calculated regression coefficients must then be entered in the measuring device using the SOPAS ET operating software (see Section 4.3.2).

The default value from the factory is  $Cv2 = 0$ ,  $Cv1 = 1$ ,  $Cv0 = 0$ .

### Calculating the volumetric flow under standard conditions

The volumetric flow can be converted to the normalized state as follows:

$$Q_{sc} = Q_{ac} \cdot \left( \frac{100 - F}{100} \right) \cdot \left( \frac{p_{Duct} \cdot T_{normal}}{p_{normal} \cdot T_{Duct}} \right)$$

$Q_{ac}$ : Volumetric flow under actual conditions

$Q_{sc}$ : Volumetric flow under standard conditions

F: Humidity in percentage volume; usually configured as an installation-specific substitute value.

If an optional analog module is used as an analog input for connecting a separate humidity monitor, the volumetric flow can be normalized with the current installation values.

$p_{Duct}$ : Absolute pressure in the duct; usually configured as an installation-specific fixed/substitute value.

If an optional analog module is used as an analog input for connecting a separate pressure sensor, the volumetric flow can be normalized with the current installation values.

$p_{normal}$ : 1013 mbar

$T_{Duct}$ : Duct temperature (in K): in the FLOW SIC100, you can select whether a permanent substitute temperature calculated with the ultrasound measurement, or read via the optional analog input (for greater accuracy) is used.

$T_{normal}$ : Normalized temperature. In Europe 273 K, in USA 293 K

### 2.4.2 Calibrating the Temperature

The temperature measurement must be calibrated for calculating the flue-gas temperature accurately with the FLOW SIC100. There are only two cases where this calibration is not necessary:

- The exact sound velocity in the flue gas under normalized conditions is known (1013 mbar, 0 °C), as is the case with air, for example, (331 m/s)
- The exact active measuring distance is known.

The calibration is carried out by means of a comparison measurement using a separate temperature sensor (for example, Pt100) with at least 2 different temperatures (see Section 4.3.3 for calculating and entering the coefficients).



### 2.4.3 Response Time

The response time 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. 2.25**).

Typical: 60 ... 90 s

The response time can be set to a value in the range 1...300 s. Setting a higher response 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 response time is used to measure the gas velocity and gas temperature. The response time of the volumetric flow is identical to that of the gas velocity.

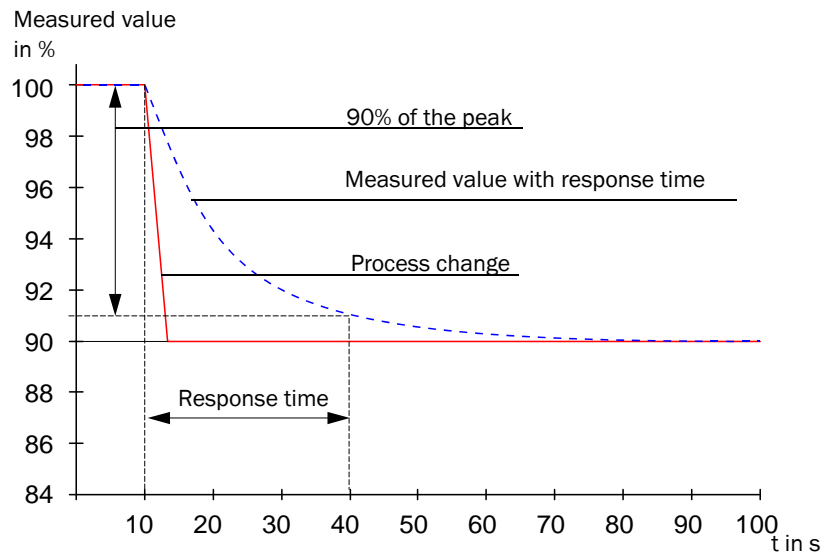


Fig. 2.25: Response time

**Note:** The response time should be regarded as a guide value. If the signal quality of the ultrasonic pulses is poor, the FLOWSIC100 requires more measured values to produce an output signal of the same accuracy. As a result, the response time is higher than the set time (within certain limits).

## 2.5 Check Cycle

You can trigger a check cycle on the FLOWSIC100 to test whether the device components are functioning correctly. The check cycle can also be triggered automatically (you can set the interval using the SOPAS ET operating software) and/or via a binary input (see Section 2.3.3).

Any deviations from the normal behavior are output as a warning or error.

If a malfunction is present or a warning is displayed, you can trigger a check cycle manually to locate the cause of the problem (see Service Manual).

The check cycle consists of a zero-point check and span test. The check values can be output via the analog output. The progress of the check cycle is output on the corresponding relay and, if the LCD is available, indicated by the text "Check cycle" on the display.

- Notes:**
- If the check cycle is not output on the analog output, the last measured value is output for the duration of the check cycle (approx. 20 s if the check runs correctly).
  - To trigger a zero-point check and span test, as well as a check cycle via a binary input, a contact must be closed at the corresponding terminals for at least 2 s.
  - Automatic check cycles are carried out periodically from the parameterized time interval, until the interval setting is changed (or the device is reset). After a device reset (or power failure), the check cycle begins at the defined time when the device resumes operation.
  - If the automatic check cycle and check cycle triggered via a binary input occur at the same time, only the cycle triggered first takes effect.

### 2.5.1 Zero-point Check

A special circuit arrangement in the sender/receiver units ensures that the transmission signals from the transducers can be read back instantaneously and with the original shape. These transmission signals are received as reception signals, amplified, demodulated, and evaluated.

If the device is operating correctly, the exact zero point must be calculated here. This check comprises a full check of all the system components, including the transducers. A warning is output for offsets greater than approx. 0.25 m/s (depending on the measuring distance and gas temperature). In this case, you should check the transducers and electronic components.

If the signal amplitude or shape does not match the expected values, the transducers or electronic components are defective. In this case, an error message is output.

### 2.5.2 Span Test

At the electronic zero point test, the time difference between both directions of signal transmission is generated. It is calculated with the installation parameters gas temperature, measuring distance and speed of sound and a velocity offset is calculated at the zero point. This offset is added to the chosen span value and is output. The span value can be set to between 50 and 70 % in steps of 1 % using the SOPAS ET operating software (factory setting 70 %).

If all of the system components are intact, the entire measuring system will respond in the prescribed manner.

### 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 is the default factory setting. It can be changed with the SOPAS ET operating software (see Section 4.2.2).
  - This output is only expedient for measured values that depend on velocity (gas velocity, volumetric flow under actual conditions, volumetric flow under standard conditions).

## 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									
Measuring range	Min. limit -40 to 0 m/s, max. limit from 0 to +40 m/s; continuously variable									
Accuracy of emission measurement <sup>1)</sup>	±0.1 m/s									
Reproducibility Process measurement, unpurged sender/receiver units	±1 % for v > 2 m/s; ±0.02 m/s for v < 2 m/s									
Response time t <sub>90</sub>	1 ... 300 s; freely selectable									
Displays										
LCD	Measured variables, warning and malfunction messages									
LED	Power, failure, maintenance request (see page 32)									
Installation										
FLSE100	M	H	PR	SA/SD	MAC	HAC	PRAC	PM	PH	PHS
Measuring distance transducer-transducer [m] <sup>2)</sup>	0.2 - 4 <sup>3)</sup>	2 - 15 <sup>4)</sup>	0.27 - 0.28	0.2 - 2	0.2 - 4	2 - 13	0.245 - 0.255	0.5 - 3	1 - 10	2 - 13
Internal duct diameter [m] <sup>5)</sup>	0.15 - 3.4	1.4 - 13	> 0.4	0.15 - 1.7	0.14 - 3.4	1.4 - 11.3	> 0.4	0.35 - 2.5	0.7 - 8.7	1.4 - 11.3
Gas temperature [°C]	-40 ... +260			-40 ... +150	-40 ... +450		-40 ... +350	-40 ... +450		
Installation angle (recommended) [°] <sup>6)</sup>	45 ... 60		45	45 ... 60			45	45 ... 60		
Internal duct pressure [bar]	± 0.1							±0.03 <sup>7)</sup> ; ±0.1 <sup>8)</sup>		
Max. dust concentration [g/m³ s.c.] <sup>9)</sup>	1	100 <sup>10)</sup>	1			100 <sup>10)</sup>	1		100	
Cable length between FLSE100 and MCU [m]	max. 1000									
Output signals										
Analog output	0/2/4 ... 22 mA, max. load 750 Ω., resolution 12 bit, add. 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 120 V, 1 A (30 V DC, 2 A); Add. relay outputs with I/O modules option									
Input signals										
Analog inputs	2 inputs 0 ... 5/10 V or 0 ... 20 mA (without galvanic separation); resolution 10 bit; add. 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									
Interfaces										
USB 1.1, RS232 (on terminals)	For measured value retrieval, configuration and firmware update via PC/laptop with SOPAS ET									
RS485	For connection of sender/receiver unit									
Optional interface module	For communication with host PC, optionally for RS485, Profibus, USB, Ethernet									
Power supply										
Operating voltage	90 ... 250 V AC; 50/60 Hz									
Power consumption	Approx. 20 W      types FLSE100-PM, PH, PHS, M, H, PR Approx. 25 W      type FLSE100-PRAC Approx. 75 W      types FLES100-MAC, HAC									

Ambient conditions	
Temperature range <sup>11)</sup>	-40 ... +60 °C      Sender/receiver units: -40 ... +60 °C      Control unit MCU-N: -40 ... +45 °C      Control unit MCU-P, purge-air supply in connection box <sup>13)</sup>
Storage temperature	-40 ... +70 °C
Degree of protection	IP 65
Dimensions, mass	
FLSE100	Nominal length (type specific) 200 / 260 / 350 / 550 / 750 mm; Max. mass (type specific) max. approx. 10.6 kg
MCU-N	Dimensions: 340 x 210 x 120 mm; steel plate housing, coated Mass: approx. 5 kg
MCU-P, purge-air supply in connection box	Dimensions: 440 x 300 x 220 mm; steel plate housing, coated Mass: approx. 14 kg
Flange with pipe	Nominal length 125 / 200 / 350 / 550 / 750 mm; Pitch diameter of the mounting holes 75 / 100 / 170 mm (depends on FLSE100 type); Material St37, V4A (others on request), max. mass approx. 6 kg
Option purge-air unit (with fan type 2BH1300)	
Components	Mounting plate, air filter, purge-air fan, Y distributor, low-pressure monitor
Operating voltage	200 ... 240 V / 345 ... 415 V at 50 Hz; 220 ... 275 V / 380 ... 480 V at 60 Hz
Rated current	Δ 2.6 A / Y 1.5 A
Motor rating	0.37 kW at 50 Hz; 0.45 kW at 60 Hz
Delivery rate	max. 63 m <sup>3</sup> /h; 48 m <sup>3</sup> /h at back-pressure of 30 mbar
Ambient temperature	-20 ... +40 °C
Degree of protection	IP 54
Hose connections	Ø 40 mm
Dimensions	550 x 550 x 270 mm; mass 14 kg

- 1): 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 %.
- 2): The maximum possible measuring distance depends on the dust content, gas temperature, and gas composition.
- 3): Maximum measuring distance FLSE100-M HSHS (duct probe and transducer in hastelloy) 2 m.
- 4): Maximum measuring distance FLSE100-H HSHS (duct probe and transducer in hastelloy) 5 m.
- 5): Minimum diameter for installation angle 45°, maximum diameter for installation angle 60°.
- 6): With high dust concentrations installation angle 60°.
- 7): With standard purge-air unit.
- 8): With purge-air fan 2BH1400 at overpressure of > 0.03 bar (contact SICK MAIHAK).
- 9): The maximum possible dust concentration depends on the measuring distance and the gas temperature.
- 10): Only for dry and non-sticky dust.
- 11): Lower ambient temperatures for FLSE and MCU on request.
- 13): For the MCU with integrated purge-air unit, the ambient temperatures may not sink below -40 °C during operation and -20 °C during start up operation of the fan.

## 2.7 Dimensions

All dimensions are indicated in mm.

### 2.7.1 Sender/Receiver Units

#### Standard Sender/Receiver Units

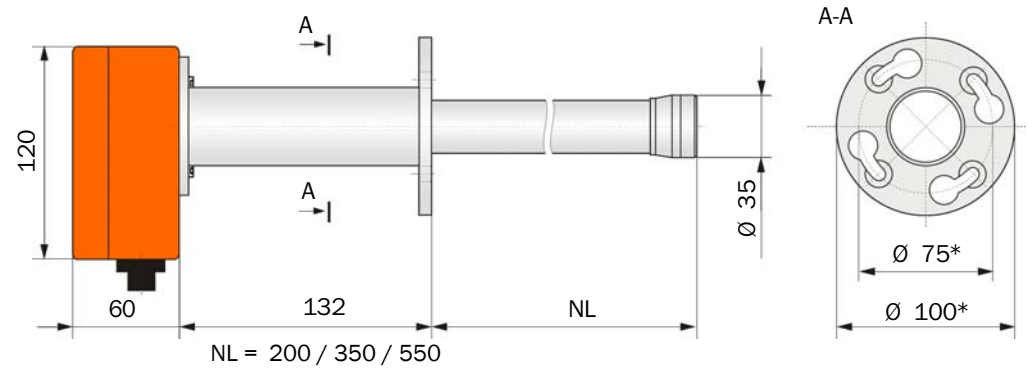


Fig. 2.26: FLSE100-M

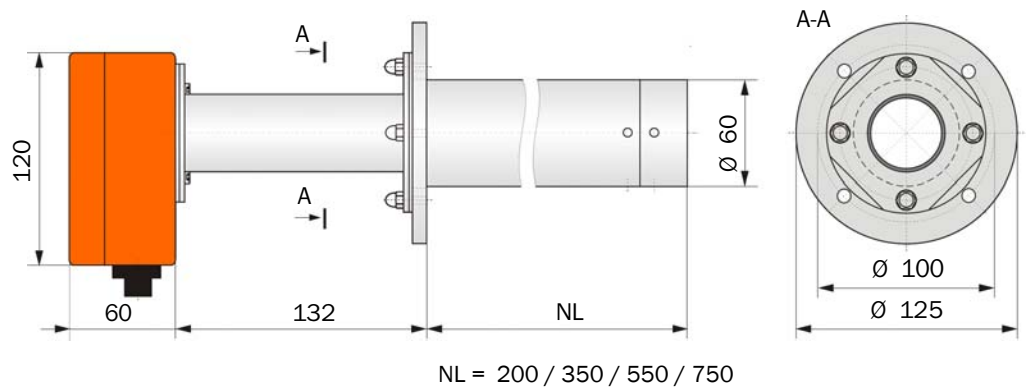


Fig. 2.27: FLSE100-H

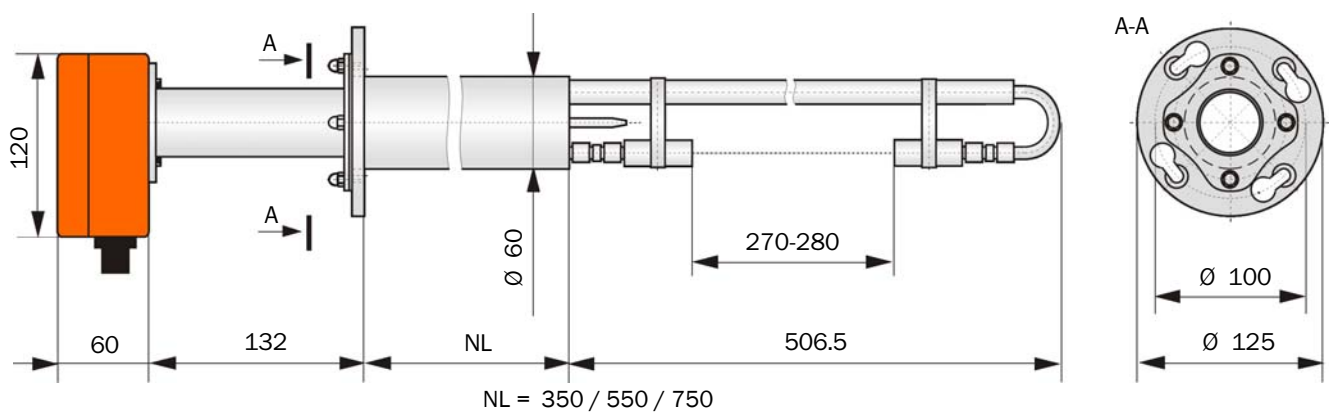


Fig. 2.28: FLSE100-PR

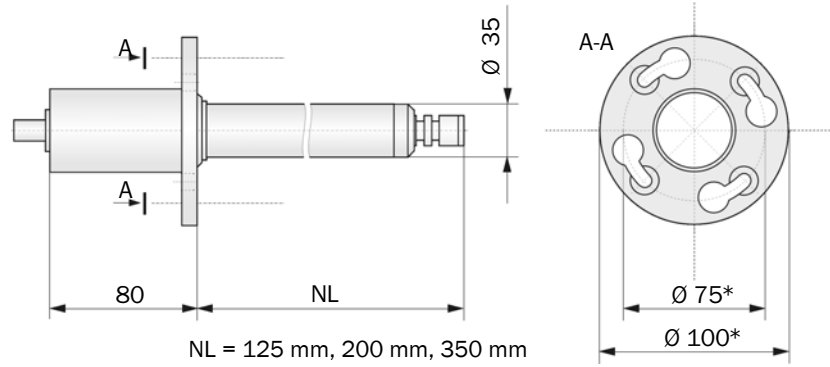


Fig. 2.29: FLSE100-SA

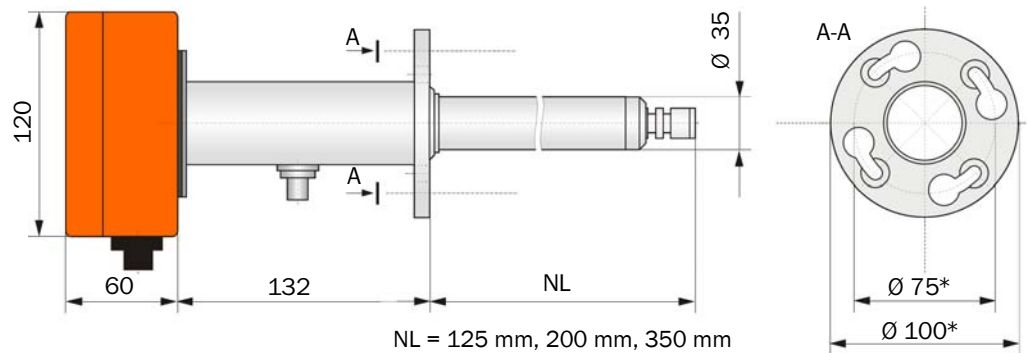
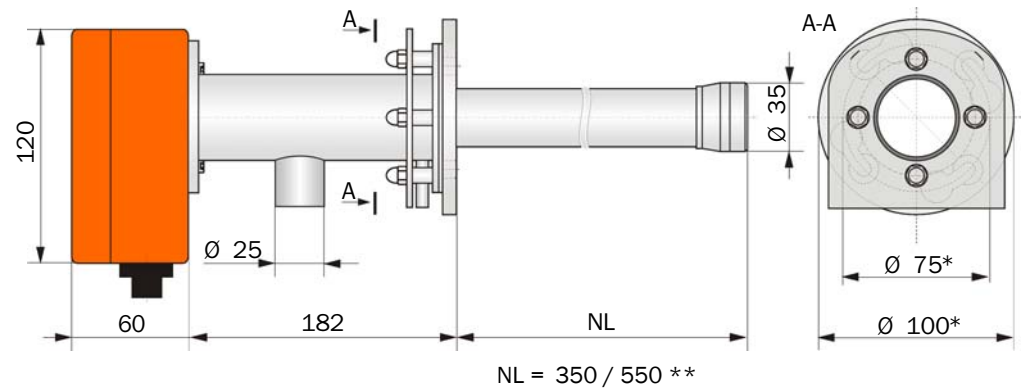


Fig. 2.30: FLSE100-SD

## Internally cooled sender/receiver units



\* On request delivered with pitch diameter 100mm and flange diameter 125mm

\*\* Other nominal lengths on request

Fig. 2.31: FLSE100-MAC

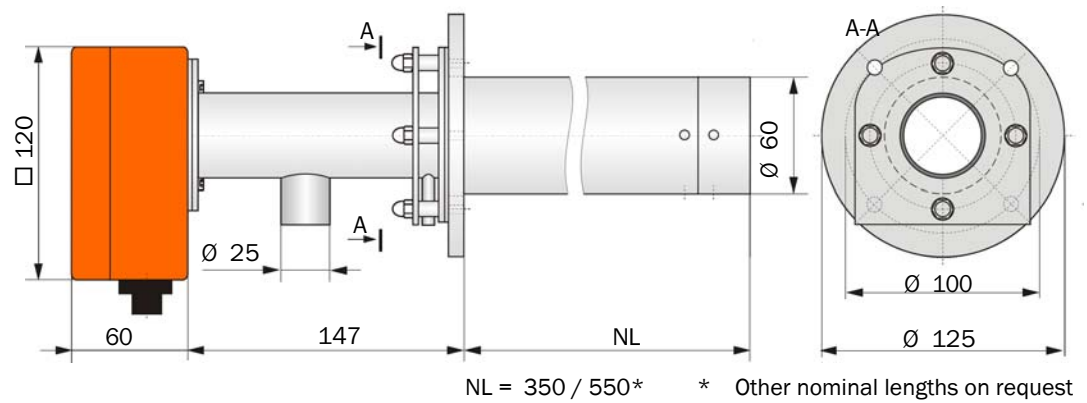


Fig. 2.32: FLSE100-HAC

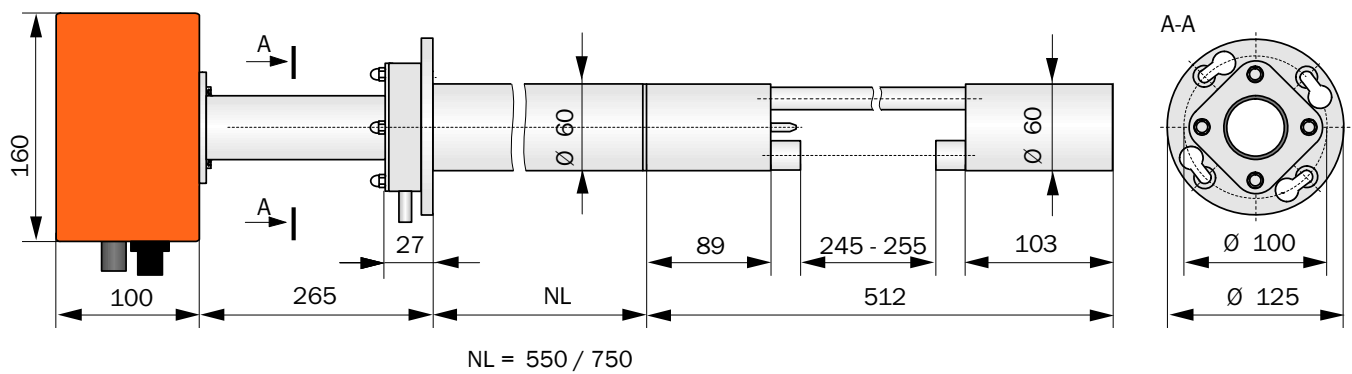


Fig. 2.33: FLSE100-PRAC

### Purged sender/receiver units

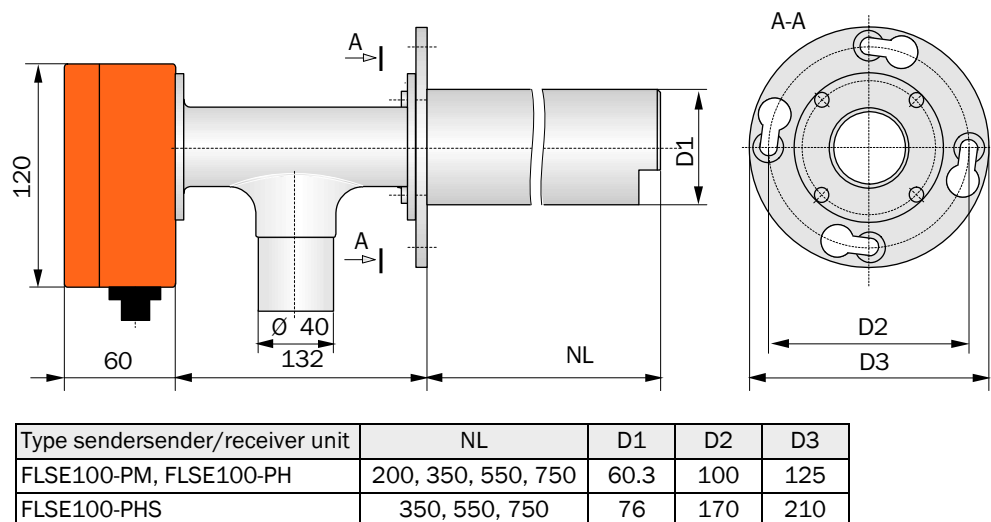
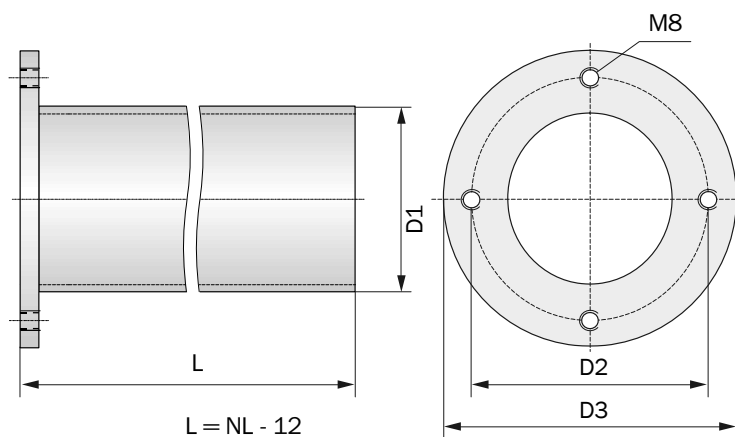


Fig. 2.34: FLSE100-PM, FLSE100-PH, FLSE100-PHS

\*: On request delivered with pitch diameter 100 mm and flange diameter 125 mm



## 2.7.2 Flange with Pipe



D1	D2	D3	NL	Type FLSE100
48,3	75	100	125	SA, SD
			200, 350	SA, SD, M
			350, 550	M, MAC
76,1	100	122	200	H, PM, PH
			350	H, HAC, PR, PM, PH
			550	H, HAC, PR, PRAC PM, PH
			750	H, PR, PRAC, PM, PH
114,3	170	210	350, 550, 750	PHS

Fig. 2.35: Flange with pipe

### 2.7.3 Control Unit MCU

#### Control unit MCU-N (without integrated purge-air supply)

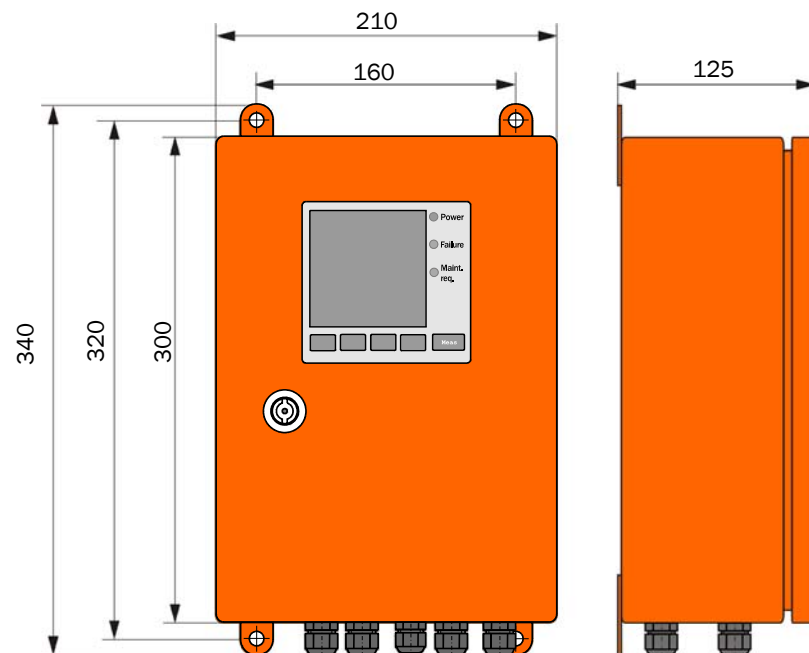


Fig. 2.36: Control unit MCU-N (with display module option)

#### Control unit MCU-P (with integrated purge-air supply )

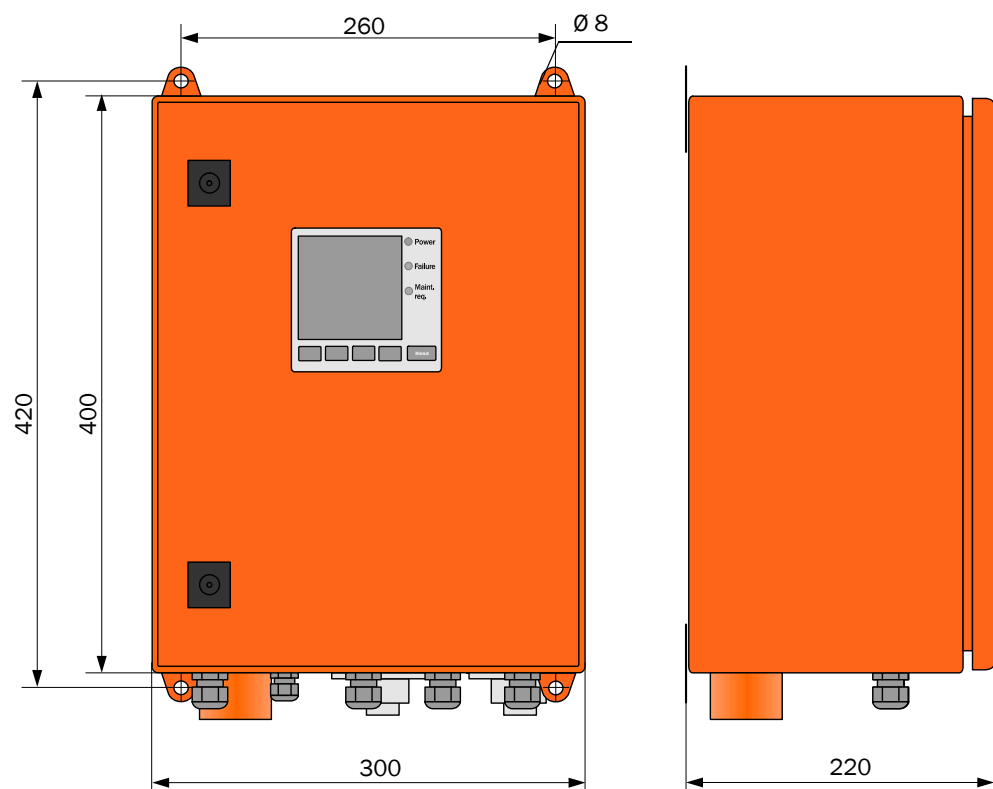
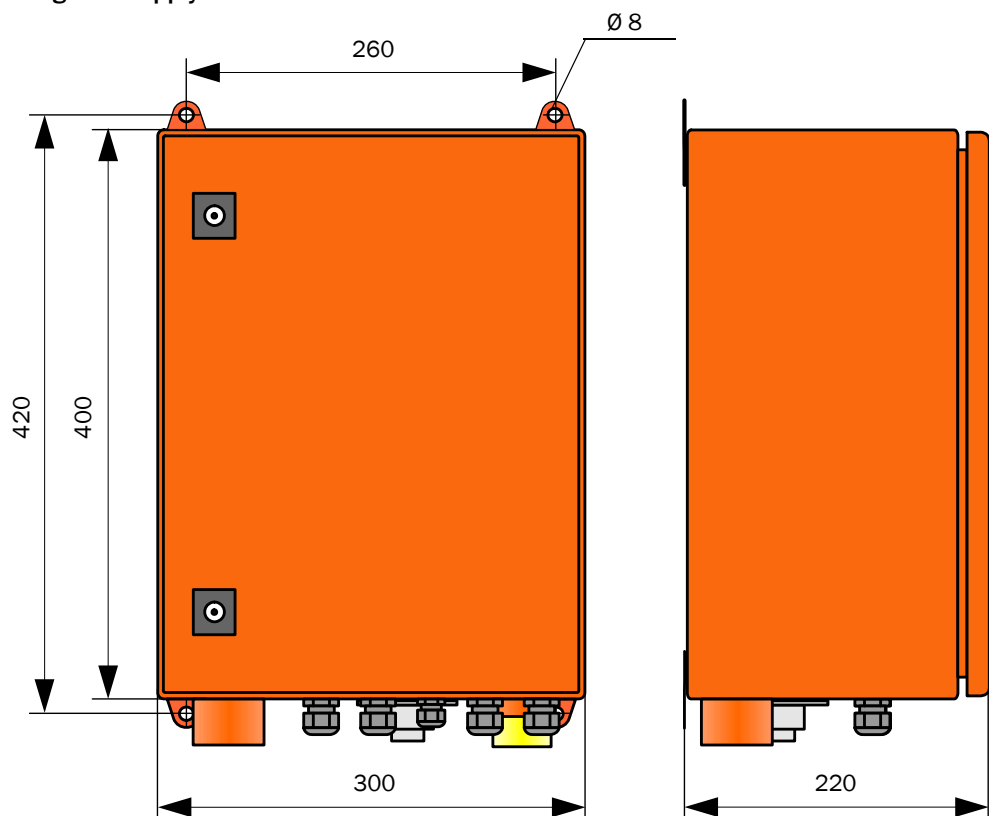


Fig. 2.37: MCU-P (with display module option)

### 2.7.4 Purge-air Supply in Wall-Cabinet



### 2.7.5 Connection Box for Connection Cable

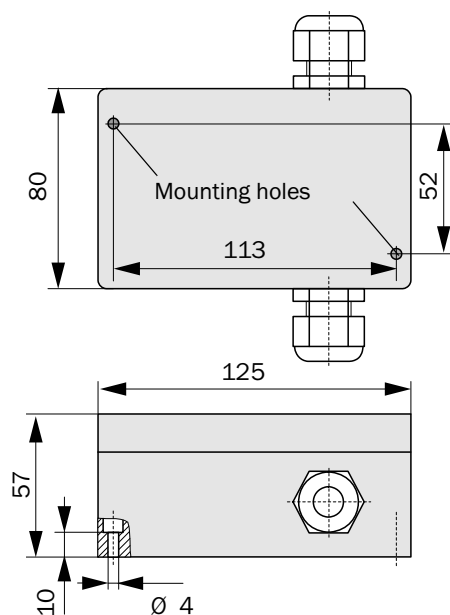


Fig. 2.38: Connection box for connection cable

### 2.7.6 Purge-air unit

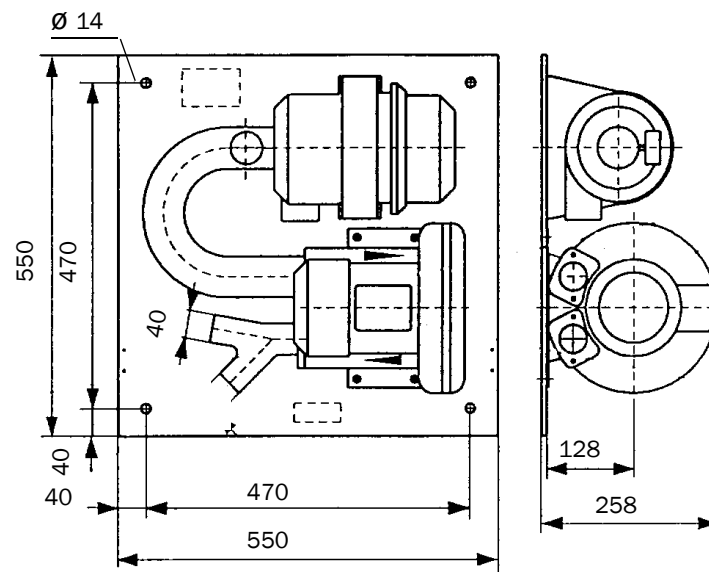


Fig. 2.39: Standard purge-air unit SLV1

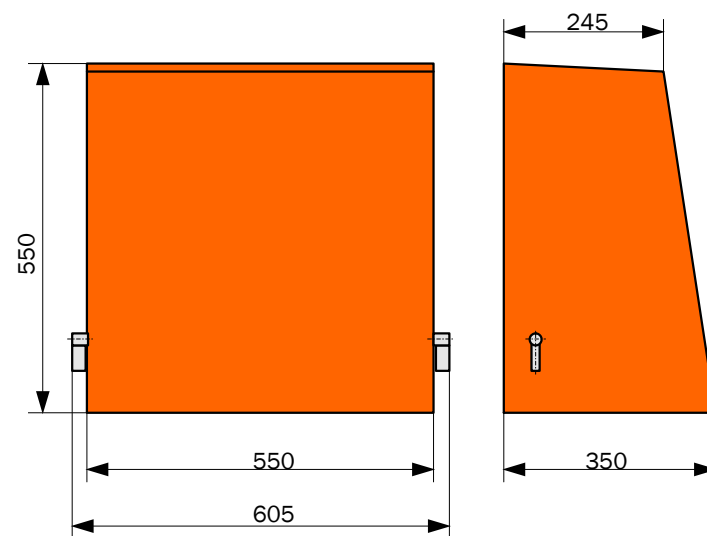


Fig. 2.40: Weather-proof hood for purge-air unit

**FLOWSIC100**

# Gas Velocity Monitor

## Assembly and Installation

**Project Planning**

**Assembly**

**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"> <li>Inlet and outlet sections must be of sufficient length</li> <li>Homogeneous flow distribution</li> </ul>	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 DIN EN 132841; 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"> <li>Fit weatherproof covers/sun protection</li> <li>Cover or insulate device components</li> </ul>	<input type="checkbox"/>
	Purge-air supply (for purged FLSE100 only)	Clean intake air (as little dust as possible, no oil, humidity, corrosive gases)	Choose the best possible intake location	<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 and purge-air unit (for purged FLSE100)		
	Gas temperature	<ul style="list-style-type: none"> <li>Type of sender/receiver unit (standard or internally cooled)</li> <li>Purge-air supply for purged FLSE100</li> </ul>		
	Dust concentration	Type of sender/receiver unit		
	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	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"/>

### 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 ( $D_i$ ). 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 DIN 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.

If the FLOWSIC100 is to be used for official measurements (for example, emission measurements pursuant to the Federal German Pollution Control Act), the measuring location should be determined by a legally authorized expert (for example, by means of an expert appraisal of a measuring location authorized in accordance with Articles 26 and 28 of the Federal German Pollution Control Act).

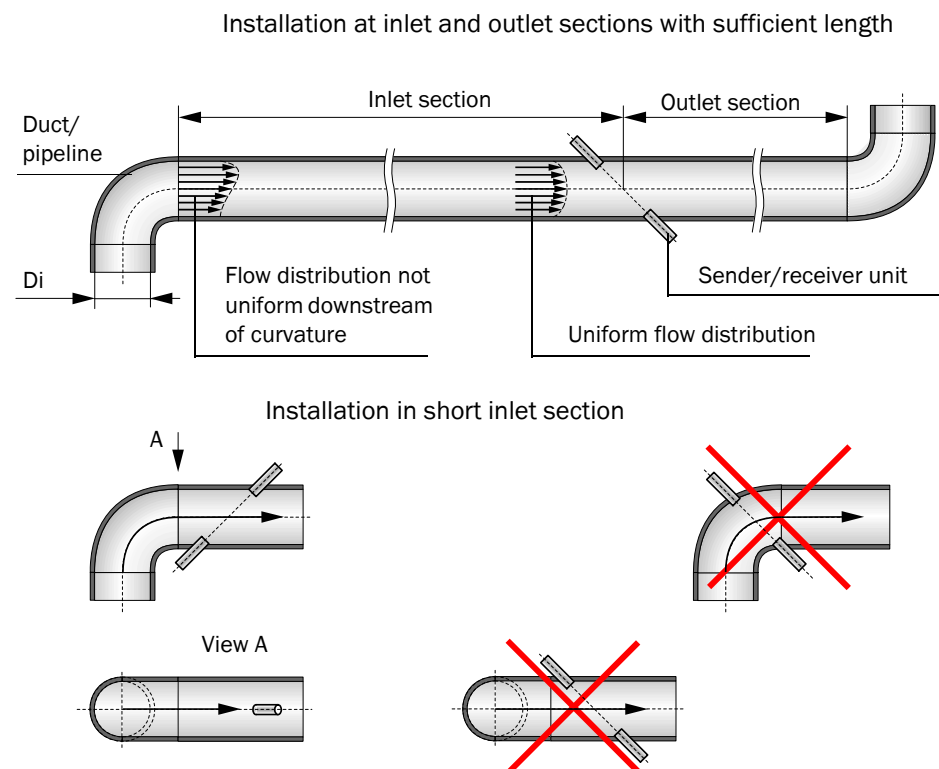


Fig. 3.1: Installing the sender/receiver units



### Installation location

The sender/receiver units can be installed on vertical, horizontal, or inclined ducts or pipelines. In vertical ducts, a minimum distance from the duct outlet (approx. 30 m) must be observed in order to prevent noise disturbance caused by rain drops on the probe head.

The mounting location for the device components must be free of vibration.

If a purge-air unit is required, it must be mounted at a location that allows the intake of clean air. The intake temperature must match the values specified in the technical data.

The mounting location should be equipped with power connections and permanent 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.

In vertical ducts, the installation angle should be selected as a function of the duct diameter so that only one platform is necessary. An additional basic platform and/or sealable opening in the platform with a basket guard can be helpful (see Fig. 3.2).

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

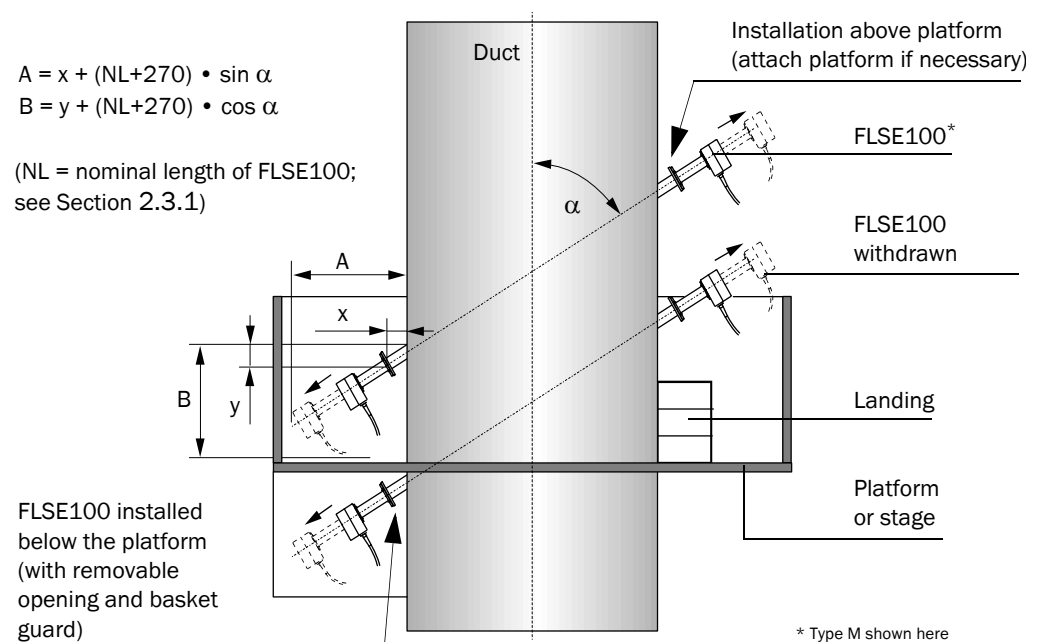


Fig. 3.2: Installing the sender/receiver units on a vertical duct

**Note:** With duct dimensions from approx. 4.5 m, an installation angle of 60° should be selected.

### 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**).

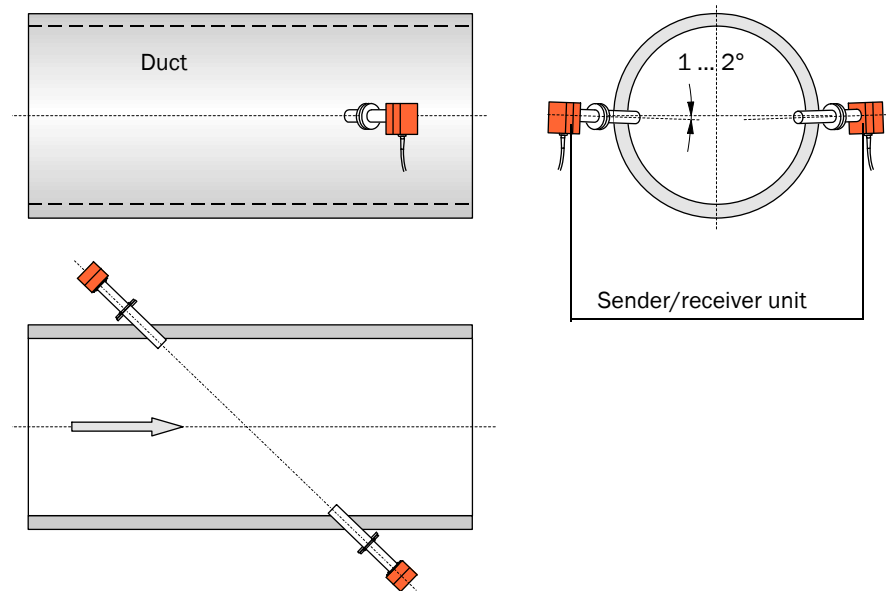


Fig. 3.3: Installing the sender/receiver units in horizontal pipelines

#### Installing the FLSE100-PR and PRAC sender/receiver unit

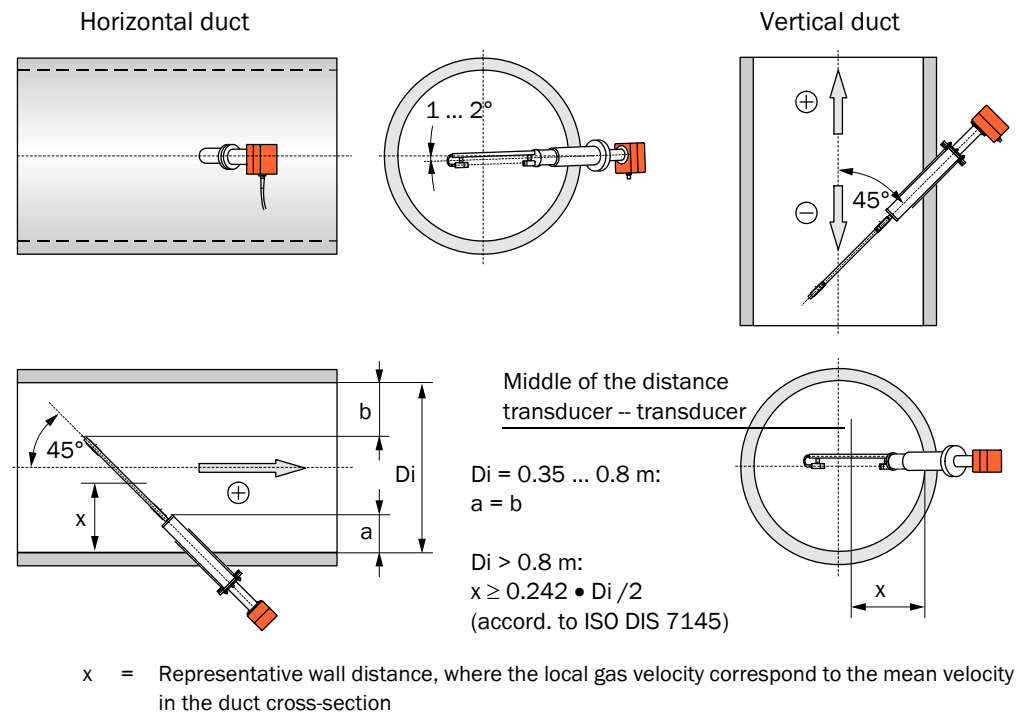


Fig. 3.4: Installing the sender/receiver unit type FLSE100-PR

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

**Note:** In vertical ducts, a negative sign is shown on the LCD of the evaluation unit if the direction of flow is from top to bottom. You can change the values to positive values by entering a negative linear regression coefficient (see Section 4.3.4).

### Preventing condensate accumulations

If standard sender/receiver units are installed in vertical ducts with wet gases, condensate can accumulate in the flange pipe of the sender/receiver unit A (see Fig. 2.4). The following solutions can help to prevent measurement problems (malfunctions caused by solid-borne noise, see Service Manual), or damages when removing the sender/receiver unit (condensate runs out):

- Complete insulation of the flange with pipe (reduces temperatures at the flange with pipe below the dew point)
- Continuous or periodical condensate drain through an opening (if necessary closeable) at the deepest point of the flange pipe (e.g. hole  $\varnothing$  4 mm with stopper, see Fig. 3.5) (only usable if the condensate is not damaging the installation and environment)
- Backflow of the condensate to the duct through a hose connection between flange pipe and duct (see Fig. 3.5).

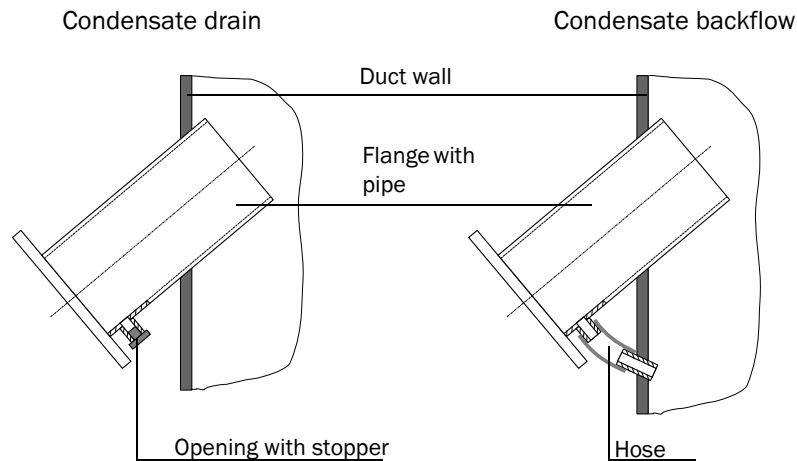


Fig. 3.5: Condensate drain / backflow

### Using the sender/receiver units at high dust contents ( $> 1 \text{ g/m}^3$ )

Further possibilities see Section "Reducing the measuring distance"

The measuring distance must be as short as possible. This requires to install the sender/receiver units in an angle to the flow direction of  $60^\circ$ .

In addition, rebound protectors (see Section 6.2.4) have to be installed at the downstream sender/receiver units (B in Fig. 2.4) of the types FLSE100-PH / PHS / H and HAC to prevent malfunctions of the measuring behavior by impacting of particles on the transducer surface.

### 3.1.3 Selecting the Flanges with Pipe

#### Inside coated ducts

The criteria listed in Section 2.3.2 should be used to select the flanges with pipe.

The following points must also be taken into account if the inside of the duct/pipeline is coated (rubber insulation):

- Since the inside of the flange pipes also has to be coated, you might need to select flange pipes with a greater inside diameter. The minimum distance between the probe pipe and flange pipe is 3 mm.
- If you cannot use a standard flange with pipe, you must provide your own flanges with pipe (contact SICK MAIHAK for availability).
- To ensure that the coating is complete, the flanges must be mounted before they are coated.

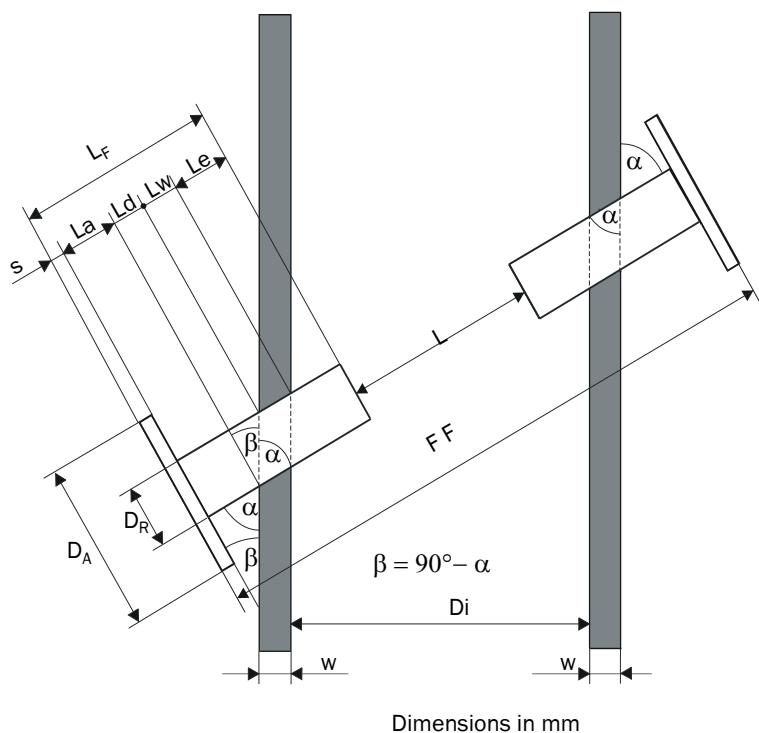
#### Plastic ducts

The standard flanges with pipe generally cannot be used for plastic ducts/pipelines. Possible solutions (to be provided by the customer):

- Glass-fiber-reinforced plastic ducts: laminate the steel core with pitch diameter of the mounting holes. The inside diameter of the laminated flange pipe must match the selected FLSE100.
- Use flanges with pipe made from duct/pipeline material; weld-mount or with plastic adhesive.
- Mount adapter flanges at apertures provided on site.

### Determining the nominal length

The required nominal length of the flanges with pipe can be determined using the following Sections.



$L_f$  = Length of flange with pipe (minimum)

$L_e$  = Draw-in length (min. 20)

$D_A$  = Outside diameter of flange

$D_R$  = Outside diameter of pipe

$\alpha$  = Installation angle

$s$  = Flange thickness = 10

$L$  = Active measuring path (input value)

$w$  = Thickness of duct wall + insulation

$D_i$  = Inside diameter of duct

$$L_w = \frac{w}{\sin \alpha}$$

$$L_d = D_R \cdot \tan \beta$$

$$L_{a_{\min}} = \frac{(D_A - D_R)}{2} \cdot \tan \beta$$

$$L_{F_{\min}} = s + \frac{(D_A + D_R)}{2} \cdot \tan(90^\circ - \alpha) + \frac{w}{\sin \alpha} + L_e$$

$$L = \frac{D_i}{\sin \alpha} - 2 \cdot L_e - L_d$$

Fig. 3.6: Determining the nominal length of the flanges with pipe

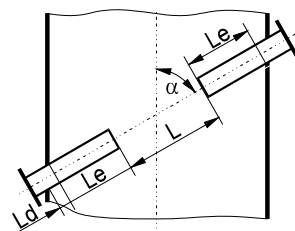
Maximum possible wall (and insulation) thickness as a function of the nominal length of the flanges with pipe, flange size (pipe diameter DR) and installation angle  $\alpha$  ( $L_e = 20$  mm):

Nominal length $L_F$ [mm]	Maximum wall (and insulation) thickness $w$ [mm]					
	$D_R = 114.3$		$D_R = 76.1$		$D_R = 48.3$	
	$\alpha = 45^\circ$	$\alpha = 60^\circ$	$\alpha = 45^\circ$	$\alpha = 60^\circ$	$\alpha = 45^\circ$	$\alpha = 60^\circ$
125					15	45
200			49	97	68	110
350	112	196	155	227	174	240
550	253	369	297	400	315	413
750	395	543	438	573		

### Reducing the measuring distance

To prevent problems in signal transmission in certain cases (e.g. using the types FLSE100 H, HAC, PH or PHS with high dust concentrations, see Section 2.3.1), 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. 3.7** and in the following table.



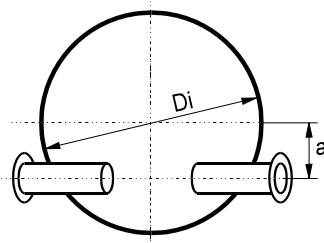
$L$  = Active measuring path

$L_e$  = 20 ... 500 mm

$a_{\max} = D_i / 4$

$\alpha = 60^\circ$

$L_d$  as in **Fig. 3.5**



with  $a = a_{\max}$  and circular ducts

then ( $\alpha = 60^\circ$ )

$D_{i_{\max}} = L + 2 L_e + L_d$

Fig. 3.7: Installation across secant

Correlation between the inside diameter  $D_i$  and measuring distance  $L$  as a function of the draw-in length  $L_e$  and installation type (dimensions in m).

$D_i$	Measuring distance $L$ at $\alpha = 60^\circ$ , $L_e = \dots$ and installation across											
	Diameter										Secant	
	$L_e=0.05$	$L_e=0.10$	$L_e=0.15$	$L_e=0.20$	$L_e=0.25$	$L_e=0.30$	$L_e=0.35$	$L_e=0.40$	$L_e=0.45$	$L_e=0.50$	$L_e=0.50$	$a_{\max}$
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			
1.75	1.88	1.78	1.68	1.58	1.48	1.38	1.28	1.18	1.08			
1.80	1.93	1.83	1.73	1.63	1.53	1.43	1.33	1.23	1.13	1.03		
1.85	1.99	1.89	1.79	1.69	1.59	1.49	1.39	1.29	1.19	1.09		
1.90		1.95	1.85	1.75	1.65	1.55	1.45	1.35	1.25	1.15		
1.95		2.01	1.91	1.81	1.71	1.61	1.51	1.41	1.31	1.21		
2.00			1.97	1.87	1.77	1.67	1.57	1.47	1.37	1.27		
2.05				1.92	1.82	1.72	1.62	1.52	1.42	1.32	1.01	0.51
2.10				1.98	1.88	1.78	1.68	1.58	1.48	1.38	1.06	0.53
2.15					1.94	1.84	1.74	1.64	1.54	1.44	1.11	0.54
2.20					2.00	1.90	1.80	1.70	1.60	1.50	1.16	0.55
2.25						1.95	1.85	1.75	1.65	1.55	1.21	0.56
2.30							1.91	1.81	1.71	1.61	1.26	0.58
2.35							1.97	1.87	1.77	1.67	1.31	0.59
2.40								1.93	1.83	1.73	1.36	0.60
2.45								1.99	1.89	1.79	1.41	0.61
2.50									1.94	1.84	1.46	0.63
2.55									2.00	1.90	1.51	0.64
2.60										1.96	1.56	0.65
2.65											1.61	0.66
2.70											1.66	0.68
2.75											1.71	0.69
2.80											1.76	0.70
2.85											1.81	0.71
2.90											1.86	0.73
2.95											1.91	0.74
3.00											1.96	0.75

## 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 evaluation unit
- ▶ Mounting the optional purge-air 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 with Pipe

#### 3.2.1.1 Duct/pipe diameter > 0.5 m

##### 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. 3.8**,
  - observe the minimum draw-in length  $Le$  (>20 mm or as shown in **Fig. 3.7** and table),
  - roughly align it and tack it into position with a few spot welds,
  - with brick and concrete ducts, tack it to a holding plate (see **Fig. 3.9**)

### Note:

For the installation of sender / receiver units FLSE100-PR and PRAC, the flange with pipe must be inserted into the duct with the longest possible draw in length  $Le$ .

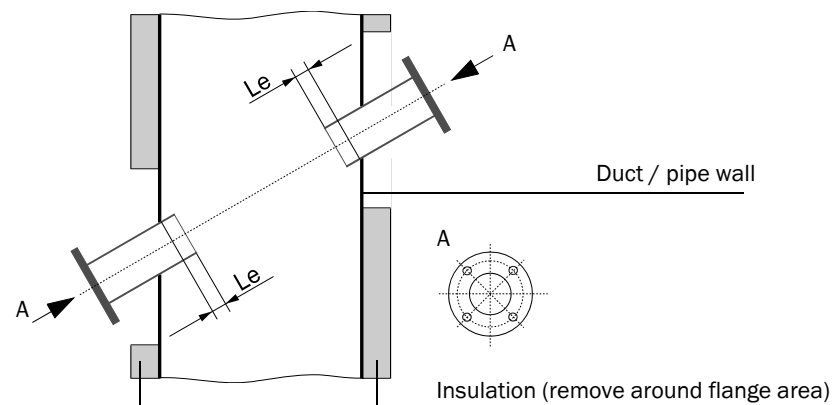
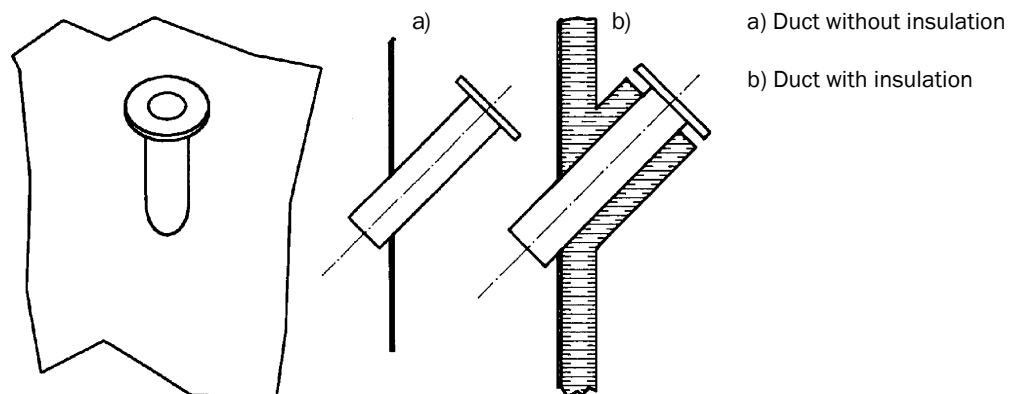
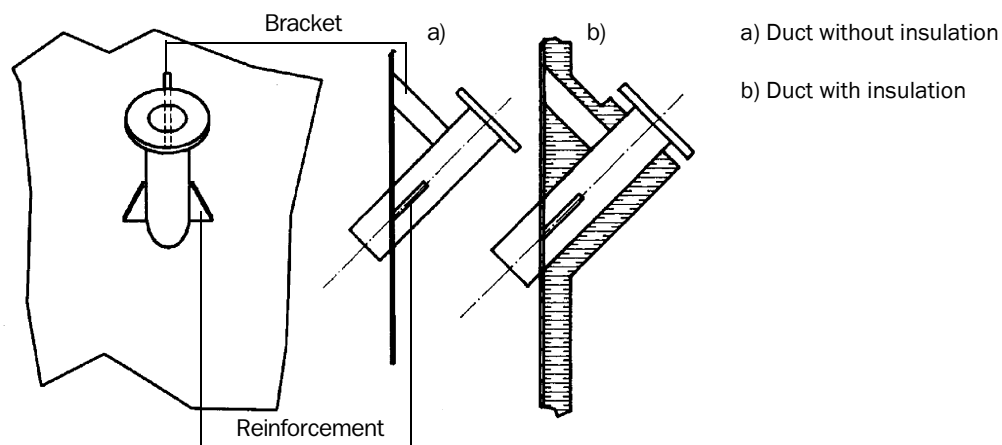


Fig. 3.8: Installation options for the flanges with pipe

Flange with pipe welded to a stable and sturdy steel wall



Flange with pipe welded to thin steel wall



Flange with pipe mounted on brick or concrete duct

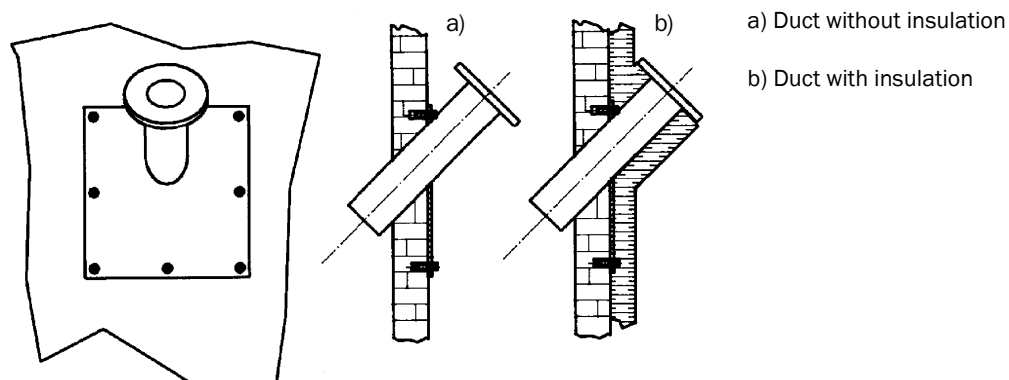


Fig. 3.9: Installation options for the flanges with pipe



- Once the two flanges with pipe have been mounted, precisely align the flange pipes after they have been tacked into position using a suitable pipe (for smaller ducts) or with the alignment device from SICK MAIHAK (can also be supplied on loan) (see **Fig. 3.10**). The alignment device is suitable for types H, H-AC, PM, PH only

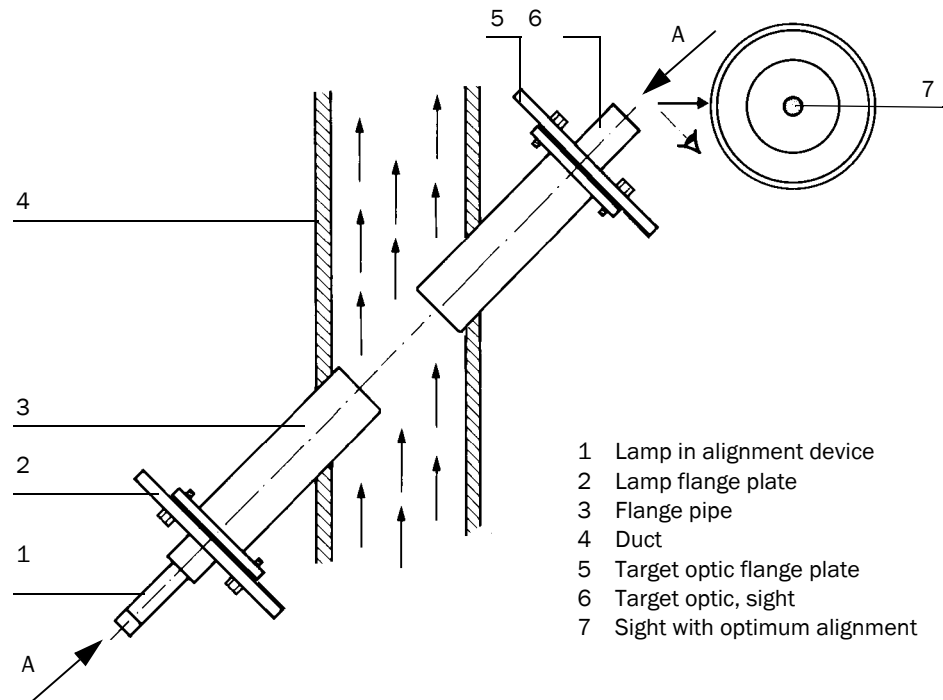


Fig. 3.10: Aligning the flanges with pipe using the optical alignment device

- Note:** Align the flange with the target optics in such a way that the light spot from the lamp is visible in the center of the target optics.
- Weld on the flange pipes, while constantly ensuring that the alignment is exact (correct it if necessary). If you are using the alignment device, you must first reposition the flange plate with lamp and flange plate with target optics before you weld on the second flange pipe.
  - Measure the installation angle and make a note of it for configuring the parameters later.
  - Measure the distance between the two flanges (dimension F-F in **Fig. 3.6**) and make a note of it for configuring the parameters later. You can use the DME 2000 distance sensor from SICK MAIHAK (option, see Section 6.2.4) for this purpose.
  - In thin-walled ducts/pipelines, provide suitable brackets/reinforcement to prevent distortion and vibration (see **Fig. 3.9**).
  - Seal the flange with a blind plug (optional).
  - Insulate the flange pipe (if necessary).
- Notes:**
- If you are mounting two flanges with pipe, the alignment of the two flange pipes has priority over the installation angle.
  - Distortions as a result of temperature changes or mechanical stresses can cause changes in the measuring distance.

### 3.2.1.2 Duct/pipe diameter < 0.5 m

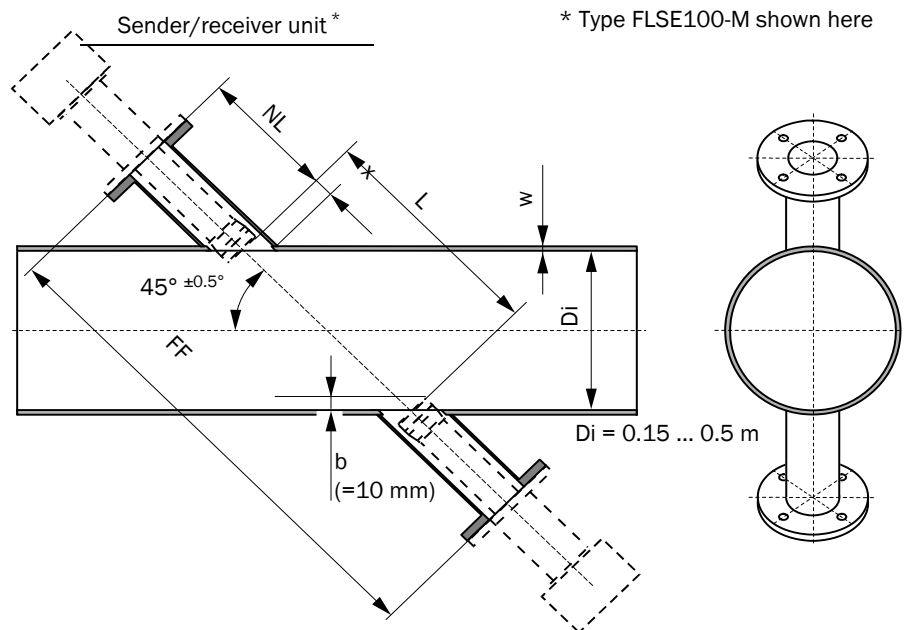
The activities are generally the same as those for larger diameters. The difference with small diameters is that installing the flanges and sender/receiver units can have a greater impact on the flow characteristics. To minimize this impact, therefore, the flange pipes should not be inserted in the pipeline,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

There are two installation options (see Fig. 3.11):

- 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.

Installation on both sides



Installation on one side

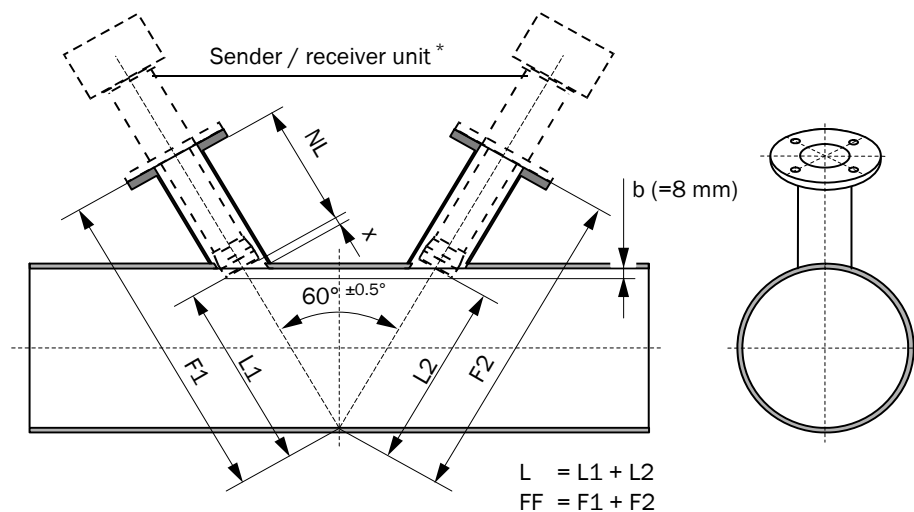


Fig. 3.11: Mounting the flanges with pipe

The following must be carried out before the flanges with pipe are mounted:

- ▶ Cut out suitable oval openings (apertures) in the duct wall (see Appendix for templates).
- ▶ Bevel the flange pipes at an angle of 45° or 60°.
- ▶ If necessary, adapt the flange pipes to the wall curvature as shown in **Fig. 3.12**.

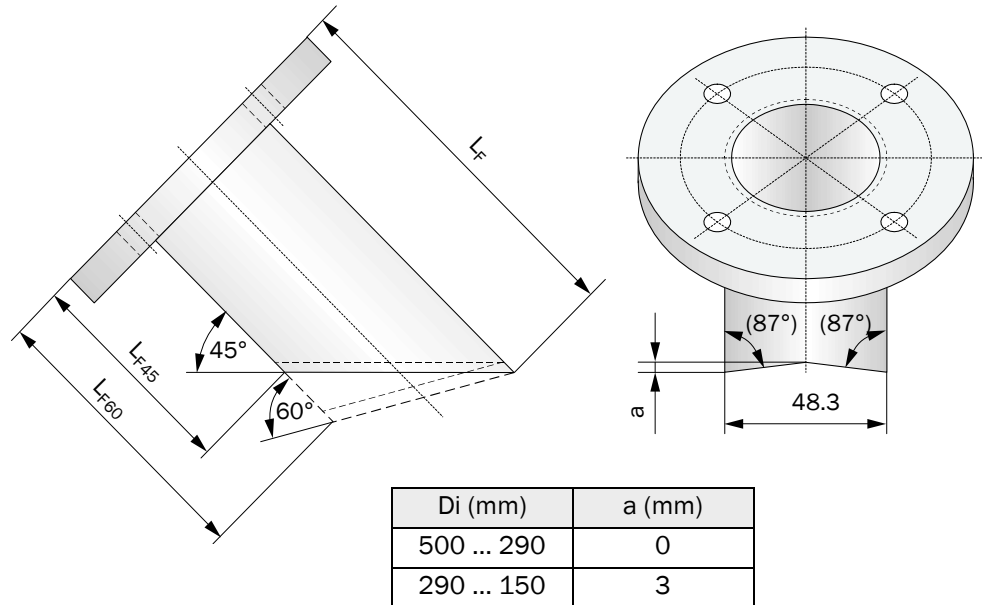


Fig. 3.12: Adapting the flanges with pipe

The length of the flange pipe  $L_F$  ( $L_{F45}$ ,  $L_{F60}$ ) depends on the mounting angle  $\alpha$ , wall thickness  $w$ , and nominal length  $NL$  (see **Fig. 3.11** and **Fig. 3.12**). This correlation is expressed by the following formulas:

$$L_F = NL + x \quad L_{F45} = L_F - 48.3 \quad L_{F60} = L_F - 27.9$$

$$x = \frac{48.3 + 35}{2 \cdot \tan \alpha} - \frac{(w + b)}{\sin \alpha}$$

$\alpha$	b
45°	10
60°	8

A selection of values is provided in the following table. As you can see from the table, flanges with pipe with the next longest nominal length than that of the sender/receiver units must be selected.

			Pipe length LF, LF45/LF60 at nominal length NL									
			NL=125		NL=200		NL=310		NL=350		NL=550	
$\alpha$	w	x	LF	LF45	LF	LF45	LF	LF45	LF	LF45	LF	LF45
45°	1	26.1	151.1	102.8	226.1	177.8	336.1	287.8	376.1	327.8	576.1	527.8
	2	24.7	149.7	101.4	224.7	176.4	334.7	286.4	374.7	326.4	574.7	526.4
	3	23.3	148.3	100.0	223.3	175.0	333.3	285.0	373.3	325.0	573.3	525.0
	4	21.9	146.9	98.6	221.9	173.6	331.9	283.6	371.9	323.6	571.9	523.6
	5	20.4	145.4	97.1	220.4	172.1	330.4	282.1	370.4	322.1	570.4	522.1
	6	19.0	144.0	95.7	219.0	170.7	329.0	280.7	369.0	320.7	569.0	520.7
	7	17.6	142.6	94.3	217.6	169.3	327.6	279.3	367.6	319.3	567.6	519.3
	8	16.2	141.2	92.9	216.2	167.9	326.2	277.9	366.2	317.9	566.2	517.9
	9	14.8	139.8	91.5	214.8	166.5	324.8	276.5	364.8	316.5	564.8	516.5
	10	13.4	138.4	90.1	213.4	165.1	323.4	275.1	363.4	315.1	563.4	515.1
$\alpha$	w	x	LF	LF60	LF	LF60	LF	LF60	LF	LF60	LF	LF60
60°	1	13.7	138.7	110.8	213.7	185.8	323.7	295.8	363.7	335.8	563.7	535.8
	2	12.5	137.5	109.6	212.5	184.6	322.5	294.6	362.5	334.6	562.5	534.6
	3	11.3	136.3	108.5	211.3	183.5	321.3	293.5	361.3	333.5	561.3	533.5
	4	10.2	135.2	107.3	210.2	182.3	320.2	292.3	360.2	332.3	560.2	532.3
	5	9.0	134.0	106.1	209.0	181.1	319.0	291.1	359.0	331.1	559.0	531.1
	6	7.9	132.9	105.0	207.9	180.0	317.9	290.0	357.9	330.0	557.9	530.0
	7	6.7	131.7	103.8	206.7	178.8	316.7	288.8	356.7	328.8	556.7	528.8
	8	5.6	130.6	102.7	205.6	177.7	315.6	287.7	355.6	327.7	555.6	527.7
	9	4.4	129.4	101.5	204.4	176.5	314.4	286.5	354.4	326.5	554.4	526.5
	10	3.3	128.3	100.4	203.3	175.4	313.3	285.4	353.3	325.4	553.3	525.4

Matching flanges with pipe can be provided by SICK MAIHAK on request (please specify with order). Alternatively, a pipe piece with premounted flanges can be ordered from SICK MAIHAK.

A pipe with a suitable diameter can be used to align the flanges for face-to-face mounting. Once the flanges have been welded into position, measure the dimensions F-F (see Fig. 3.11) and make a note of them for configuring the parameters subsequently.

### 3.2.2 Mounting the Control Unit

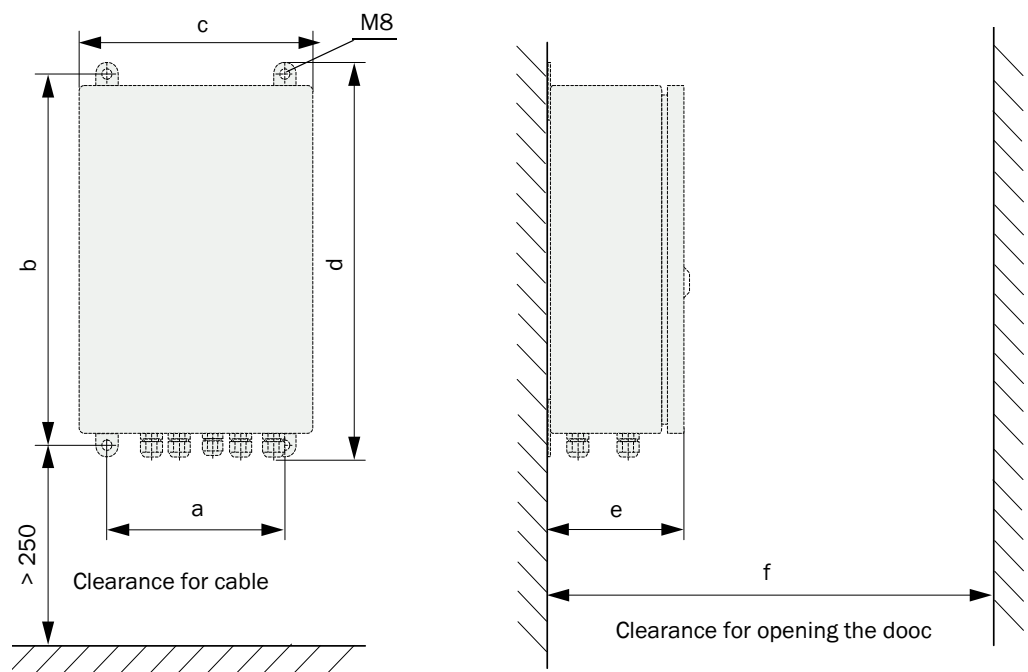
The control unit must be mounted on a level base at an accessible, protected location (see **Fig. 3.13** for dimensions). The following must be taken into account:

- 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 3.3.3), 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. 3.24**; the length is the total length of all the cables). For easier handling of the MCU, we recommend to install it in a control room. This facilitates communication with the FLOW SIC100 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	MCU-P
a	160	260
b	320	420
c	210	300
d	340	440
e	125	220
f	> 350	> 540

MCU-N: Control unit without purge-air supply

MCU-P: Control unit purge-air supply (see Section 2.7.3)

Fig. 3.13: Mounting dimensions of the MCU

### Prerequisite for Use of the Control Unit MCU-P (for FLSE100-MAC and HAC)

Additionally to the general requirements the following prerequisites apply:

- The purge-air unit must be mounted at a location with clean air. The intake temperature must match the values specified in the technical data (see Section 2.6). If necessary, lay an intake hose at a location where the conditions are more favorable.
- The purge-air hoses to both sender/receiver units should be as short as possible. They must be of equal length (max. hose length in each case 10 m).
- The purge-air hoses should be laid in such a way that water cannot collect. If necessary, provide a small opening at the lowest point on the hose (with a screwdriver, for example).
- If the control unit must be mounted at more than 10 m distance, the following equipment is additionally needed:
  - a separate fan unit (dimensions and mounting dimensions as MCU-P; Part No 7040289)
  - two purge-air hoses 40 (Part No 5304683, bulk stock)
  - two adapters 40-25 (Part No 7047019)

### 3.2.3 Installing the Connection Box

For assembly at stone / concrete ducts suitable mounting set are available.

This modules should be mounted on a level base plate (secure with 2 bolts M4x20).

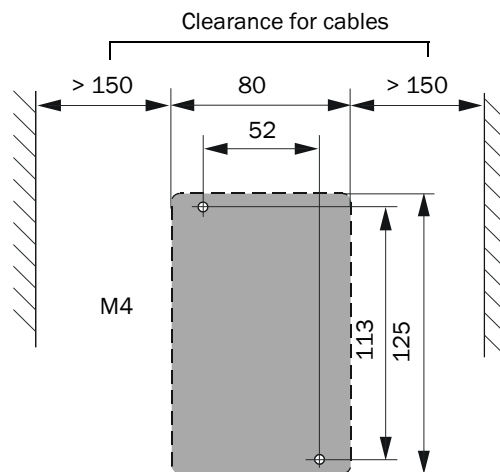


Fig. 3.14: Mounting dimensions for connection box

### 3.2.4 Mounting the Purge-air Unit Option

The steps below are only necessary if purged sender/receiver units are required.

The following points must be taken into account when selecting the mounting location:

- The purge-air unit must be mounted at a location with clean air. The intake temperature must match the values specified in the technical data (see Section 2.6). If necessary, lay an intake hose at a location where the conditions are more favorable.
- The mounting location must be easily accessible and fulfill all the applicable safety requirements.
- The purge-air unit must be mounted as far below the sender/receiver units as necessary, so that the purge-air hoses can be installed falling towards the purge-air unit (avoiding water collection).
- Sufficient clearance must be provided for replacing the filter insert.
- Sufficient clearance must also be provided for mounting and for raising the weatherproof cover, if the purge-air unit is mounted outdoors (see Fig. 3.15).

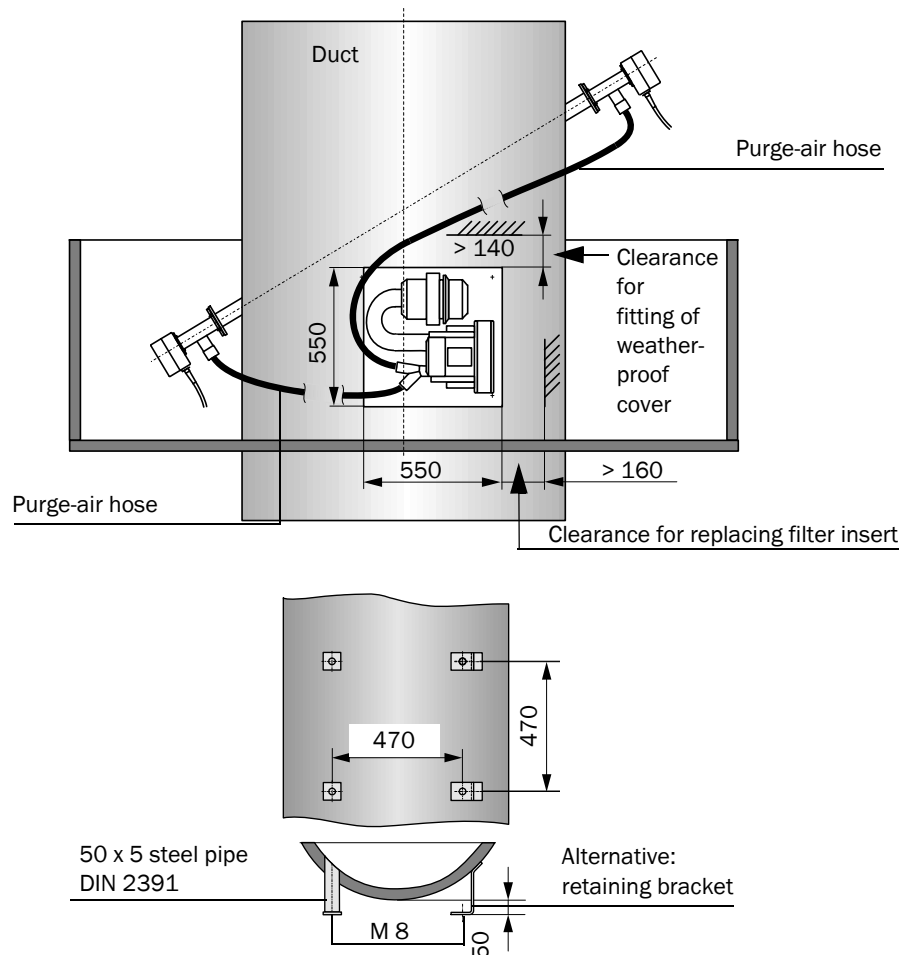


Fig. 3.15: Mounting the purge-air unit

#### Installation work

- Prepare the bracket as shown in Fig. 3.15.
- Secure the purge-air unit with 4 bolts (M8).
- Check whether the filter insert is installed in the filter housing; fit the insert if necessary.

### 3.2.5 Installing the Weatherproof Cover for the Purge-air Unit Option

The weatherproof cover consists of a cover and lock set.

- ▶ Mount the lock parts from the lock set on the baseplate.
- ▶ Mount the cover from above.
- ▶ Insert the side lock bolts in the counterparts, and rotate them until they latch into place.

### 3.2.6 Rebound Protector / Dust Protector Options

#### 3.2.6.1 Rebound Protection for FLSE100-H, HAC, PH and PHS

The rebound protector option is intended for the use of the FLWSIC100 in high dust applications with particle sizes  $>0.5$  mm. With the installation of this component, the surface of the ultrasonic transducer can be protected from particle impact effectively.

Usually it is sufficient to mount the rebound protector to the downstream sender/receiver (probe B). See Fig. 2.4.

#### Assembly

- ▶ Type FLSE100-PH and PHS are assembled with the securing bolts of the transducers.
- ▶ Type FLSE100-H and HAC are assembled with the provided securing bolts. The rebound protector is to be mounted to the provided securing holes at the transducer's head. .

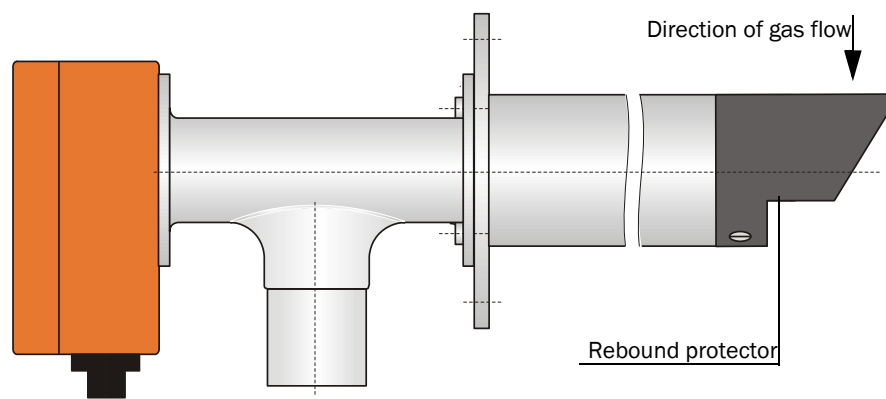


Fig. 3.16: Assembly of the rebound protector for the types FLSE100-PH and PHS

The rebound protector is located at the probe's head as shown in Fig. 3.16 and must be arranged facing the gas flow.



### 3.2.6.2 Dust Protector for FLSE100-PR

The optionally available dust protector PR can be used if dust contamination on the transducer surface of the single-probe version FLSE100-PR raises a problem. This option is designed to prevent possible contamination of dust on the ultrasonic transducers.

It contains the components “Dust Protector Right” and “Dust Protector Left”. The components are to be mounted to the upstream sides of the transducers according to Fig. 3.17.

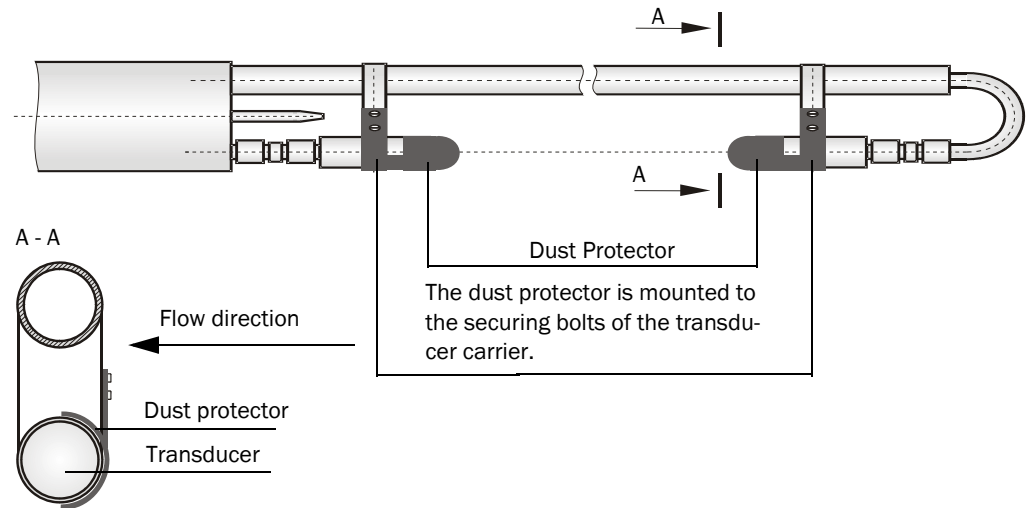


Fig. 3.17: Assembly of the dust protector option to type FLSE100-PR

### 3.2.7 Emergency Air Supply

To prevent damage to the transducers caused by purge-air failure with the devices FLOW SIC100 PM, PH and PH-S, an optional emergency air supply is available. Precondition for the use of this module is the provision of oil- and dustfree compressed air by the customer.

Detailed information is available on a special leaflet supplied on request.

### 3.2.8 Solid-Bourne-Noise Damping-Set K100 Option

If the sender/receiver unit is not acoustically decoupled from the flange, sound energy coming from the plant or through the ultrasonic transducers can affect the transducers and generate interference signals.

The optional solid-bourne noise damping set K100 can be used to improve the acoustic decoupling. It consists of additional gaskets, spring washers and washers as well as appropriate longer securing bolts, which are used for the assembly of the sender/receiver units to decouple them acoustically. They must be assembled according to the special leaflet supplied with the shipment.

### 3.3 Installation

#### 3.3.1 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 MAIHAK 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

If you are using a purge-air unit, the additional activities described in Section 3.3.2 must also be carried out.

- 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).



#### Warning

- All installation work must be carried out in line with the relevant safety regulations and instructions listed in Chapter 1.
- Suitable measures must be taken to protect against danger.

#### 3.3.2 Installing the Purge-air Supply

The following steps are only necessary if you have to use purged sender/receiver units.

- ▶ Lay the purge-air hoses on short routes and without kinks, shorten if necessary.
- ▶ Leave sufficient distance to hot duct walls.
- ▶ When installing to insulated ducts, keep the cooling air outlet (see Fig. 2.11 to Fig. 2.13) uncovered!

**Control Unit with Integrated Purge-air Supply (MCU-P)**

- ▶ Connect the power supply cable to the terminals L1, N and PE at the strip terminal.
- ▶ Connect the purge-air hose DN 25 to the purge-air outlet on the underside of the MCU-P (see **Fig. 3.18**) and secure it with a tightening strap. The purge-air outlet in the middle must be adjusted as displayed (correct if necessary).

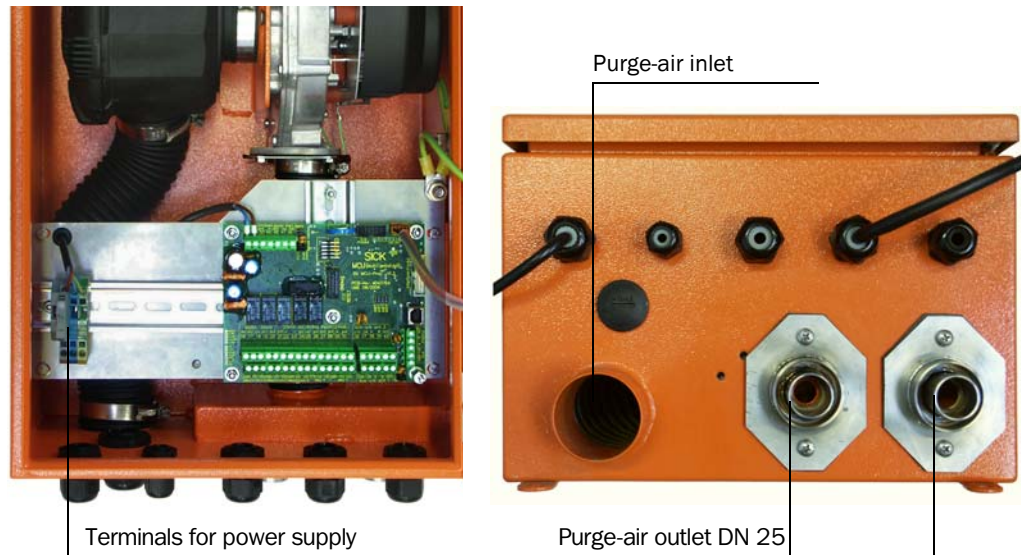


Fig. 3.18: Underside of control unit with integrated purge-air supply

**Purge-air supply in connection box**

- ▶ Connect the power supply cable to the terminals L1, N and PE at the strip terminal.
- ▶ Connect the purge-air hose DN 40 to the purge-air outlet on the underside of the connection box (see **Fig. 3.19**) and secure it with a tightening strap. The purge-air outlet in the middle must be adjusted as displayed (correct if necessary)

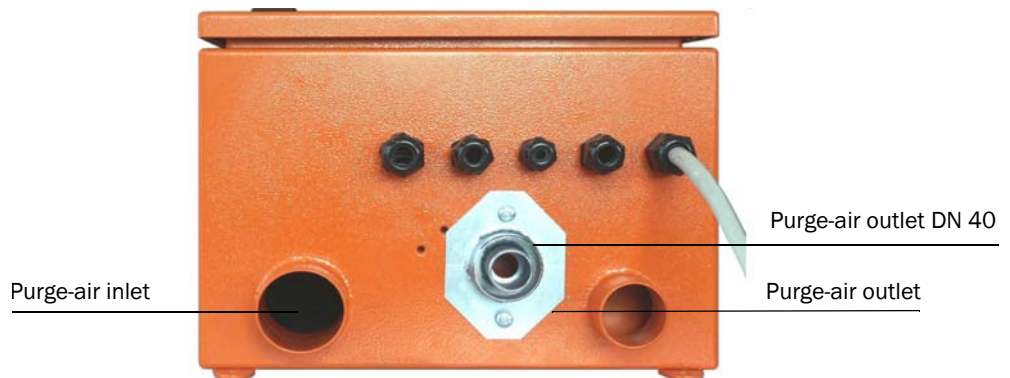


Fig. 3.19: Underside of purge-air supply in connection box

### Connecting/Commissioning the Optional Purge-air Unit

- Compare the supply voltage and frequency with those specified on the rating plate of the purge-air motor.



#### Important

Do not connect the purge-air unit if the values do not match.

- Connect the power supply cable to the terminals on the purge-air motor (see supplementary sheet on purge-air motor and cover of motor terminal box; see the connection arrangement shown in Fig. 3.20).
- Connect a protective conductor to the terminal.
- Set the motor circuit-breakers in accordance with the connection data of the fan (see technical data of purge-air unit) to a value 10% greater than the rated current.
- Check the functioning and running direction of the fan (flow direction of the purge-air unit must match the arrows at the inlet and outlet openings on the fan). If the direction of running on 3-phase motors is incorrect, swap power connections L1 and L2.
- Connect the (optional) pressure monitor for monitoring the purge-air supply.

#### Important



- Use a fail-safe power supply (emergency power supply, bar with redundant supply)
- The purge-air unit must be fused separately from the other system components. The fuse type must match the rated current (see technical details of purge-air unit). Fuse each phase separately. Provide circuit-breakers to protect against a phase failure on one side.

If you are in doubt, or if you are using a special motor version, the operating instructions supplied with the motor should take priority over any other information.

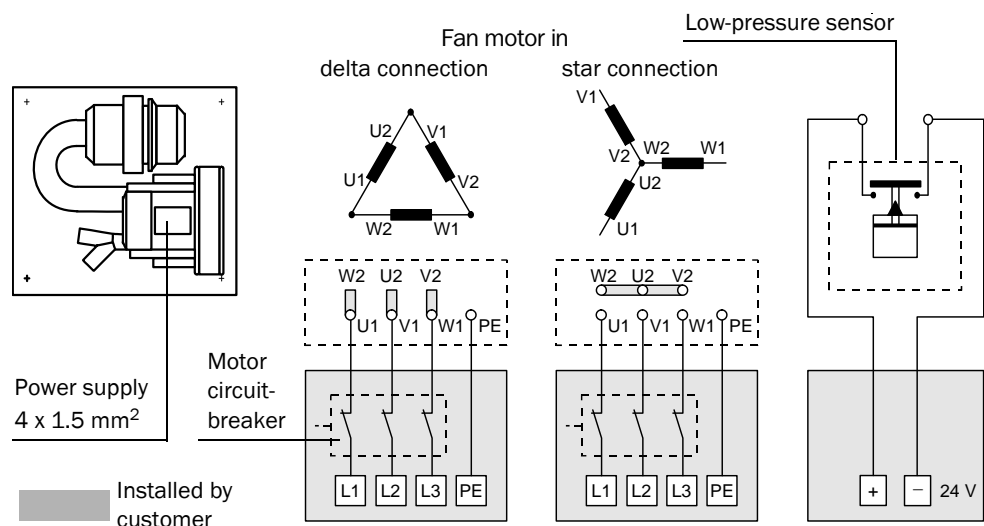


Fig. 3.20: Electrical connections for the purge-air unit

**Installing the Optional Purge-air Reducer Set**

If necessary, connect a purge-air reducer (see Section 2.3.6) as shown in **Fig. 3.21**.

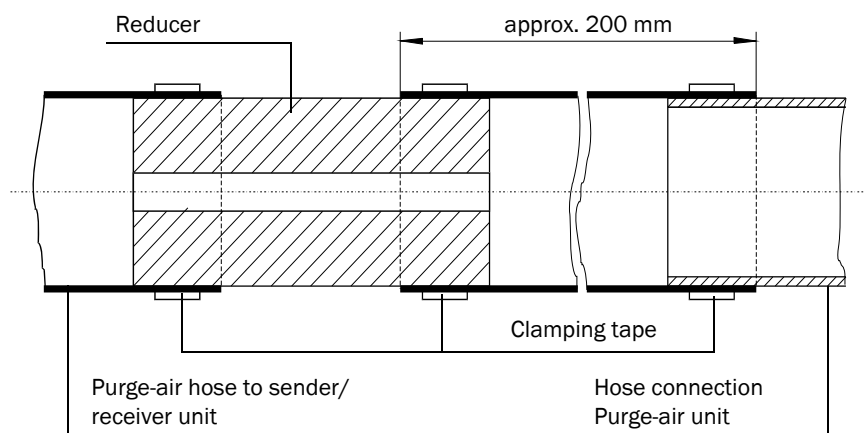


Fig. 3.21: Installing a purge-air reducer

### 3.3.3 Installing and Connecting the Sender/Receiver Units

Check the following before installation:

- ▶ The sender/receiver units must have at least the same nominal length as the flanges with pipe.
- ▶ The inside of the flange 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 with digital signal transmission must be at the bottom.

**Note:** If this does not comply with the installation requirements of the type FLSE100-PR as shown in **Fig. 3.4**, 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.

#### Purge-air Supply for Internally Cooled Sender/Receiver Units FLSE100-MAC/HAC

- ▶ The purge-air unit must be in operation.
- ▶ Connect the purge-air hose DN25 to the purge-air connection on the sender/receiver unit (mount the hose clamp on the free hose end, connect the purge-air hose and secure it with the hose clamp).
- ▶ Make sure, that the purge-air flows in and out from below (see **Fig. 3.22**).
- ▶ If this is not guaranteed, loosen the screwed connections between the purge-air connection and the duct probe, rotate the unit accordingly (90°, 180°, 270°), and screw the components together again.
- ▶ If the optional purge-air supply in the connection box is used, slide the loose end of the purge-air hose on adapter 40-25 and secure it with the hose clamp.

#### Purge-air Supply for Internally Cooled Sender/Receiver Unit FLSE100-PRAC

- ▶ The sender/receiver unit must be installed so that cable connection and air intake of the pump are oriented downwards.
- ▶ It has to be ensured that only contamination-free and dry air is taken in (use weather-proof covers if necessary).

**Purge-air Supply for Purged sender/receiver units**

- ▶ If used with corrosive gases, the sender/receiver units with the next longest nominal length than that of the flanges with pipe must be used to minimize corrosion (see Section 2.3.1.1).
- ▶ The purge-air unit must be in operation.
- ▶ Connect the purge-air hoses.  
Mount the hose clamp loosely on the free hose end, connect the purge-air hose to the purge-air connection on the sender/receiver units, and secure it with the hose clamp.
- ▶ The purge-air must be supplied from below; the purge air must flow out in the direction of the gas flow (see Fig. 3.22).

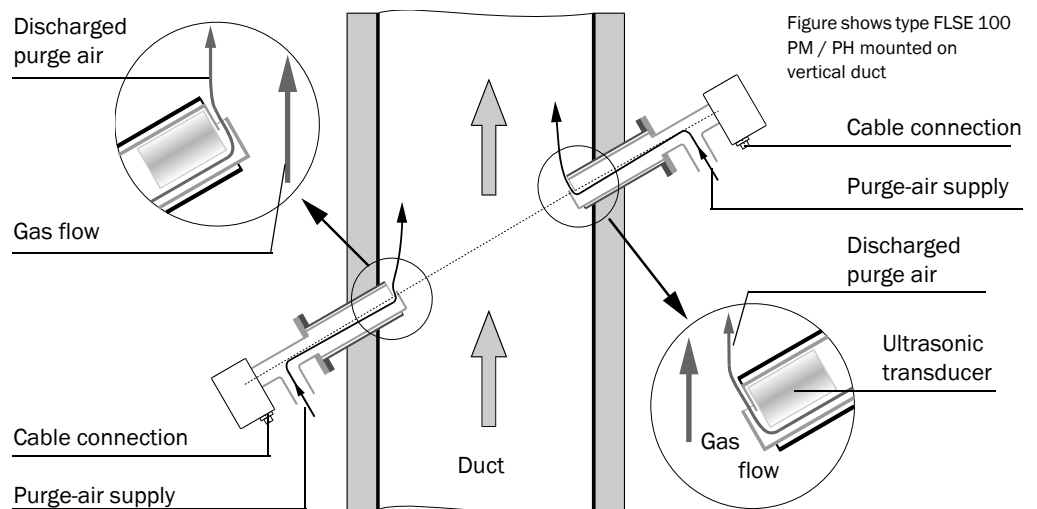


Fig. 3.22: Arrangement of cable connection and purge-air supply for internally cooled and purged sender/receiver units (figure shows type FLSE100-PM/PH)

**Installation and connection****Warning**

The sender/receiver units may only be mounted if it is safe to do so (for example, if the installation has been shut down, see Section 1.3.3).

- ▶ Remove the blind plug from the flange.
- ▶ Insert the sender/receiver units in the flanges with pipe as previously described, and screw the components together.
- ▶ Connect the cable to the evaluation unit at the connector on the sender/receiver unit.

### 3.3.4 Connecting the Control Unit MCU

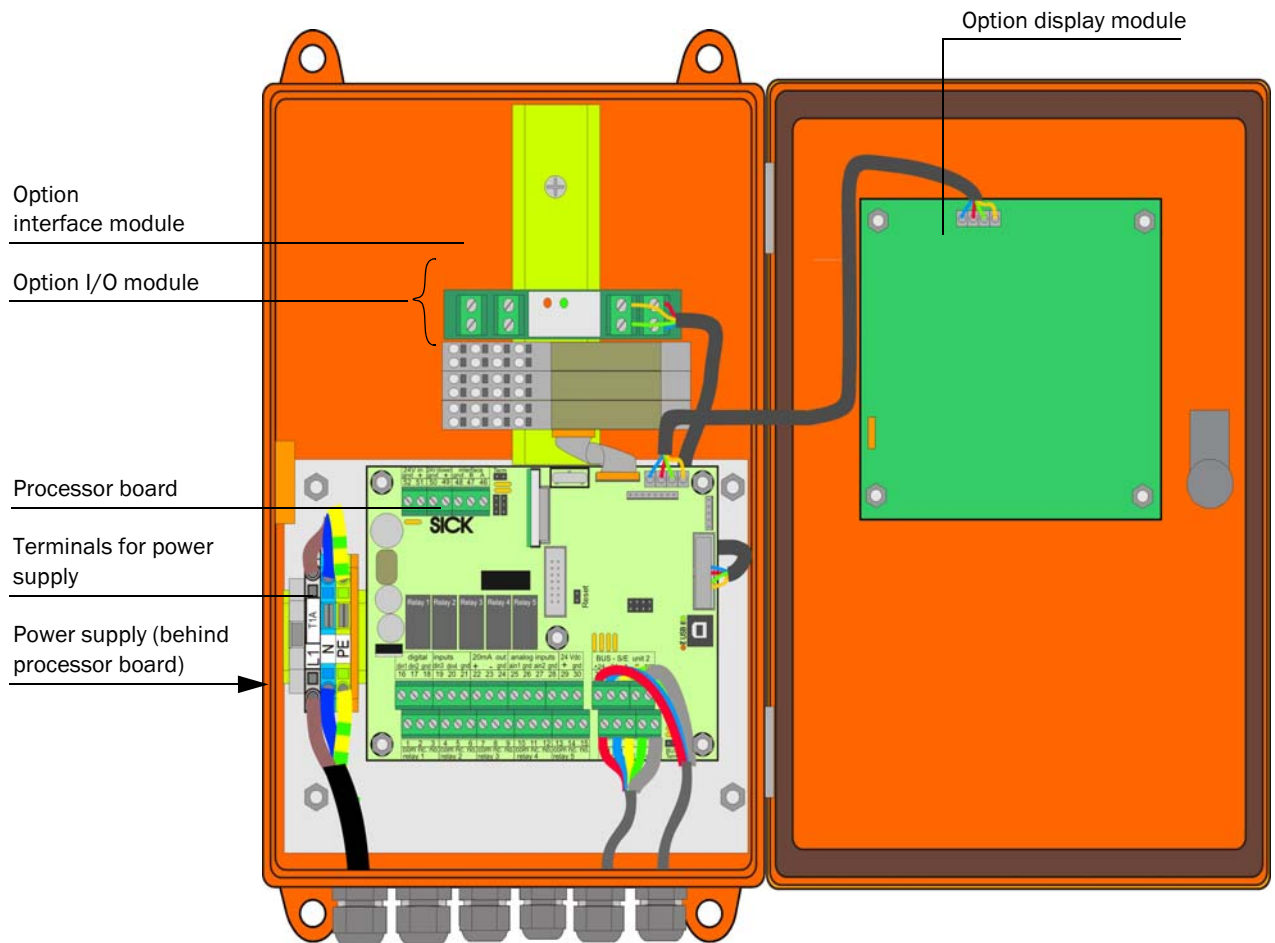


Fig. 3.23: Component alignment in the MCU (without purge-air supply, with options)

#### Necessary activities

- ▶ Connect the cables for the sender/receiver units as shown in **Fig. 3.24**.

**Note:** If the distance between the sender/receiver units and the evaluation unit is large, we recommend that you use a bus wiring configuration.

- ▶ Connect the cables for status signals (operation/malfunction, warning, maintenance, check cycle; analog output, and external maintenance switch according to the requirements.
- ▶ Connect the power supply cable to terminals L1, N, PE (see **Fig. 3.23**.)



### Connecting the Sender/Receiver Units FLSE100 to the MCU (Except for Type FLSE100-PR, PRAC and S)

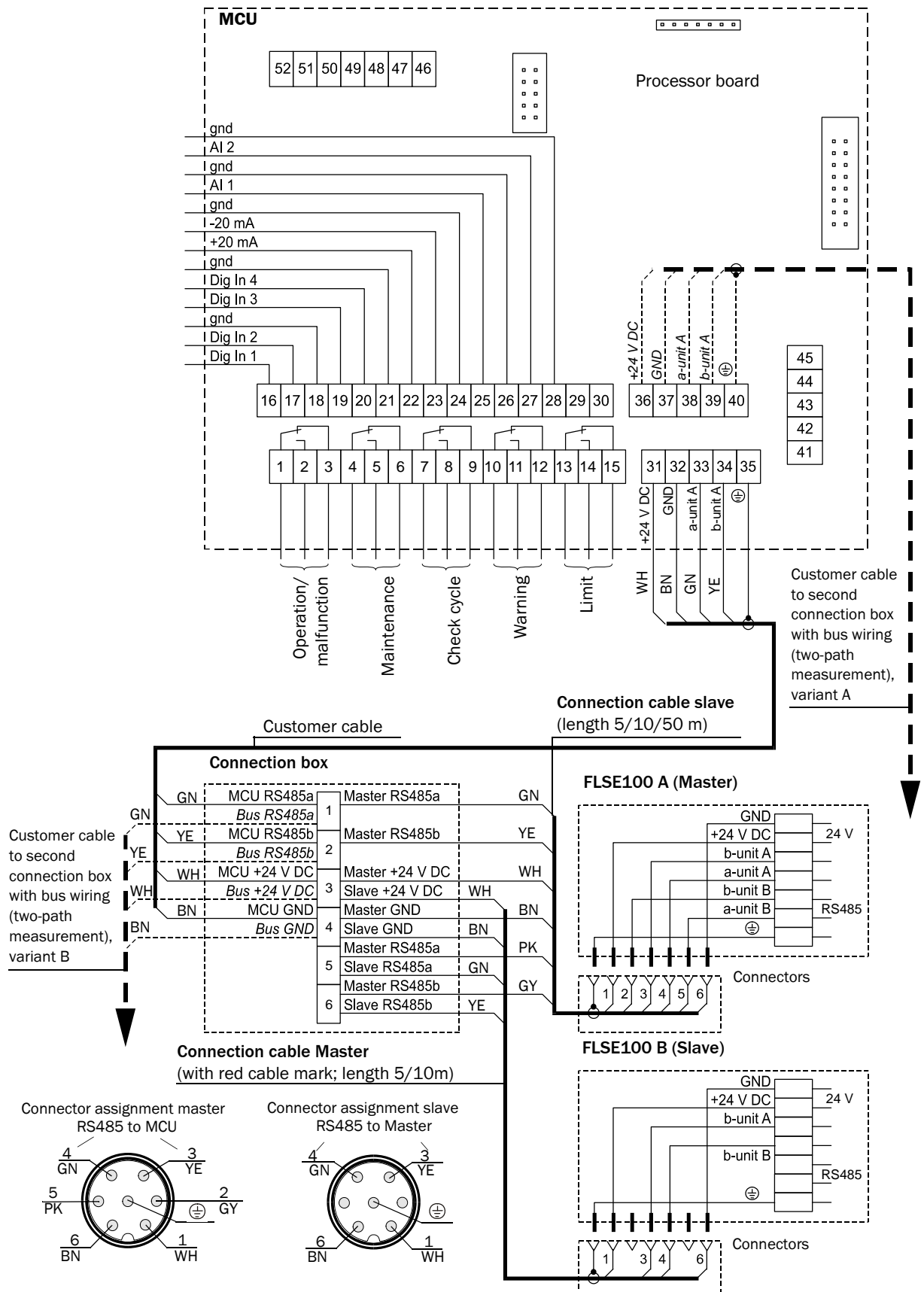


Fig. 3.24: Connecting the sender/receiver units to the MCU (except for type FLSE100-PR, PRAC, SA and SD)

# Connecting the FLOWSIC100 PR and PR-AC to the MCU

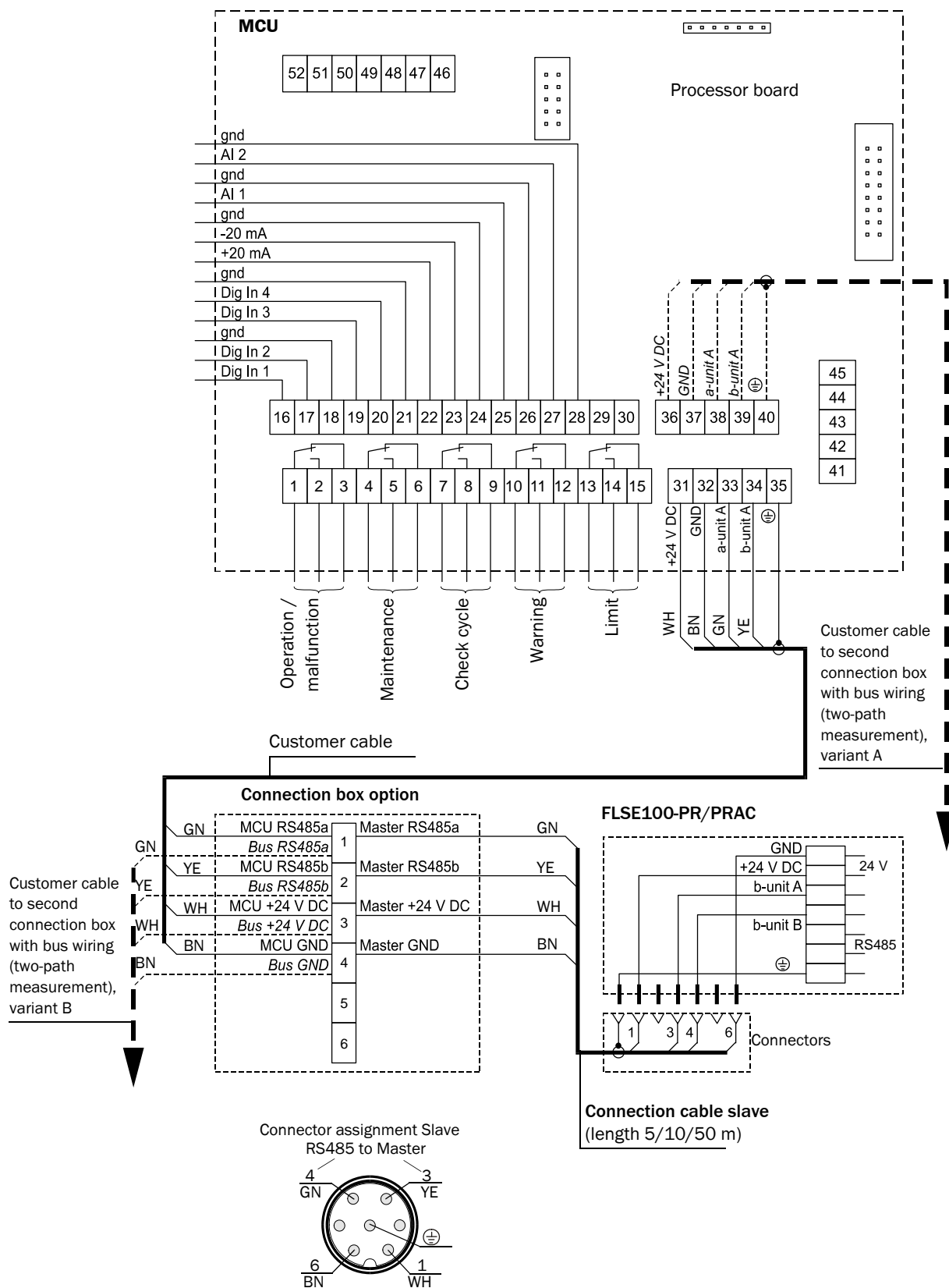


Fig. 3.25: Connecting the sender/receiver units FLSE100-PR and PRAC to the MCU

## Connection of the Sender/Receiver Units FLSE100-SA and SD to the MCU

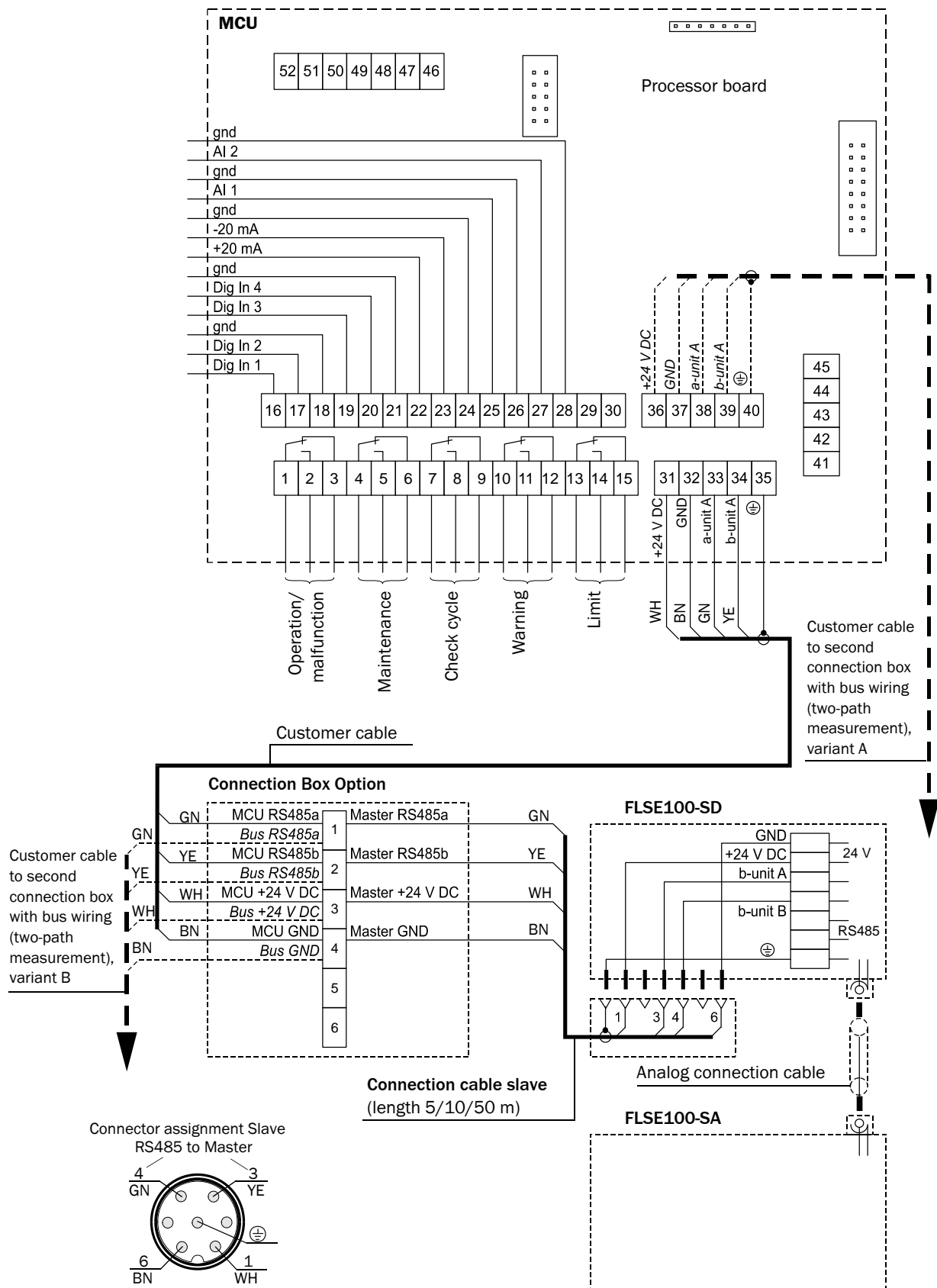


Fig. 3.26: Connecting the sender/receiver units FLSE100-SA and SD to the MCU

- Notes:**
- The connection cable between the control unit and connection box must be provided and laid by the customer. 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 mm<sup>2</sup> (AWG20).

We recommend the cable type UNITRONIC Li2YCYv(TP) 2x2x0.5 mm<sup>2</sup> with reinforced outer sheath (from Lappkabel).

- For wiring the bus version with two connected sensors (see **Fig. 2.3**) the maximum cable length is reduced by half.

To implement longer cable lengths:

- Use larger core diameter e.g. cable type with 4 core pairs and 2 core pairs for power supply
- Use MCU with high-capacity power supply

Both implementations are available from the manufacturer on request.

- For bus wiring the manufacturer set termination has to be deactivated in those system components, that are not on the cable end (see Service Manual Section 3.1).

### 3.3.5 Installing and Connecting the Interface and I/O Module Options

Plug these modules onto the top hat rail in the MCU (see **Fig. 3.22**) and connect them with the cable with plug to the corresponding connector on the processor board (see **Fig. 2.21**).

**FLOWSIC100**

# **Gas Velocity Monitor**

## **Commissioning and Configuration**



**Basics**

**Standard Commissioning Procedure**

**Extended Commissioning**

**Operation / Configuration with Option LCD Display**



## 4 Commissioning and Configuration

### 4.1 Basics

#### 4.1.1 General Notes

Commissioning essentially entails entering the plant data (for example, the measuring path, installation angle), configuring the parameters for the output variables and response times, and, if necessary, setting the check cycle (see Section 4.2). A zero-point adjustment is not required.

Additional calibration of the velocity measurement by means of a network point measurement using a reference system (for example, a pitot tube flowmeter) is only necessary if the velocity profile along the measurement axis is not representative for the entire cross-section (see Section 3.1.1). The calculated regression coefficients can then be easily entered in the device (see Section 4.3).

If the gas temperature measured with the FLOW SIC100 is to be used to normalize the volumetric flow, calibration using an external temperature is essential (see Section 4.3). This is because the speed of sound of the real gas under normalized conditions is seldom known.

The operating and configuration software “SOPAS Engineering Tool” (SOPAS ET) is supplied with the device for configuring the system parameters. The required settings can be easily configured using the software menus. Other functions (such as data backup and graphical display functions) are also available.

If the standard settings do not provide adequate stability under all plant conditions (for example, if the device is not deployed in line with the specifications set out in the technical data), you can enhance system performance by optimizing the internal parameter settings. These settings, however, must only be configured by adequately qualified personnel, since correct operation cannot be guaranteed if the settings are defined incorrectly. Changes of this kind should be carried out by SICK MAIHAK Service personnel only. The settings are listed in the Service Manual.

#### 4.1.2 Installing the SOPAS ET Operation and Configuration Software

##### Prerequisites for Configuration with Operating and Configuration Software

- Laptop/PC with:
  - Processor: Pentium III (or comparable type)
  - VGA graphic card
  - USB interface (alternative - RS232 via adapter)
  - Working memory (RAM): At least 256 MB
  - Operating system: MS Windows 98SE/ME/2000/XP or higher (not Windows 95/98/NT)
- USB interface cable to connect the laptop/PC to the FLOW SIC100 (MCU).
- The SOPAS ET software as well as the USB driver (scope of delivery) must be installed on the laptop/PC.
- The power supply must be switched on.

##### Installing the SOPAS ET Software

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

- ▶ Insert the enclosed CD into the disk drive at the PC, select the language, choose "Software" and follow the instructions.

##### Installing the USB driver

A special hardware driver is required for the communication between the SOPAS ET software and the FLOW SIC100 visibility measuring system via USB interface. This must be installed on the laptop/PC:

- ▶ Connect the USB connector to the PC .
- ▶ A message appears on the screen that a new hardware was found.
- ▶ Insert the enclosed CD into the disk drive at the PC and follow the installation instructions (see Fig. 4.1).

**Note:** To install the USB driver, you need administrator rights.



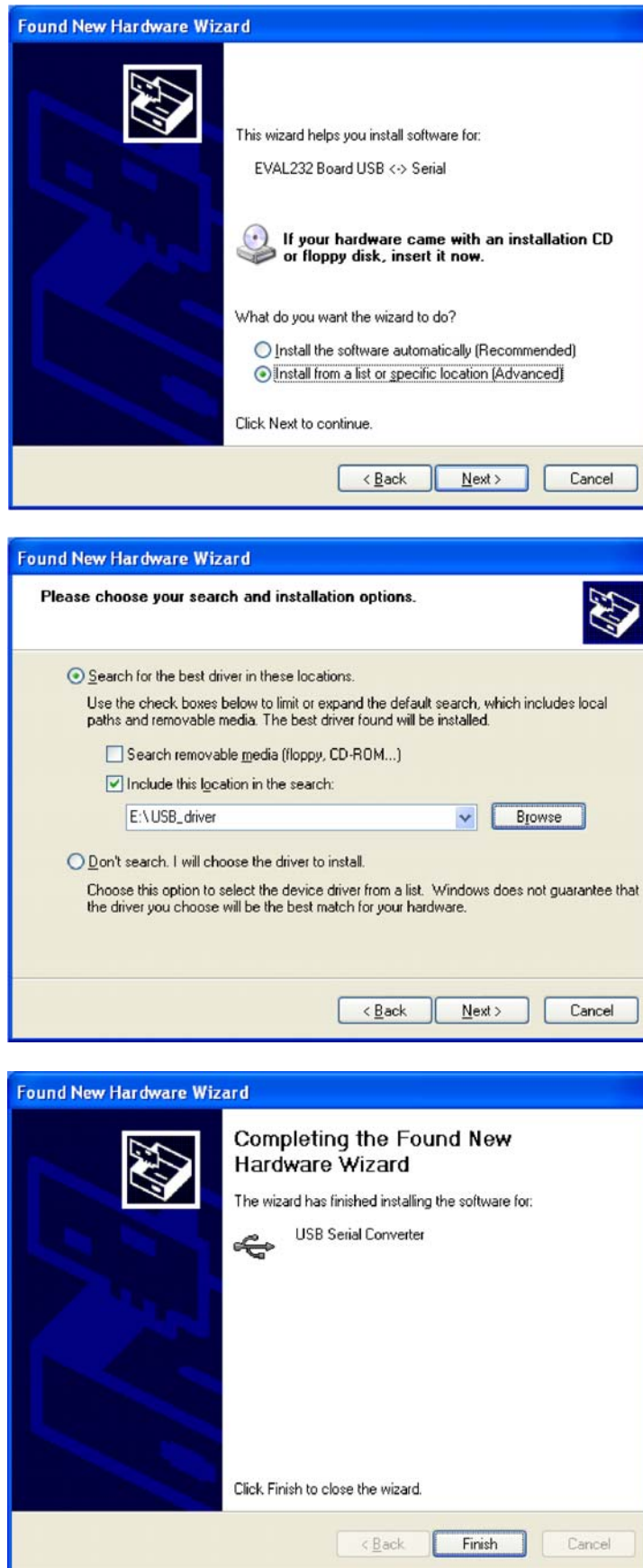


Fig. 4.1: Installing the USB driver

#### 4.1.3 Connecting the Device

- Connect the USB cable to the MCU control unit (see **Fig. 2.21**) 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).

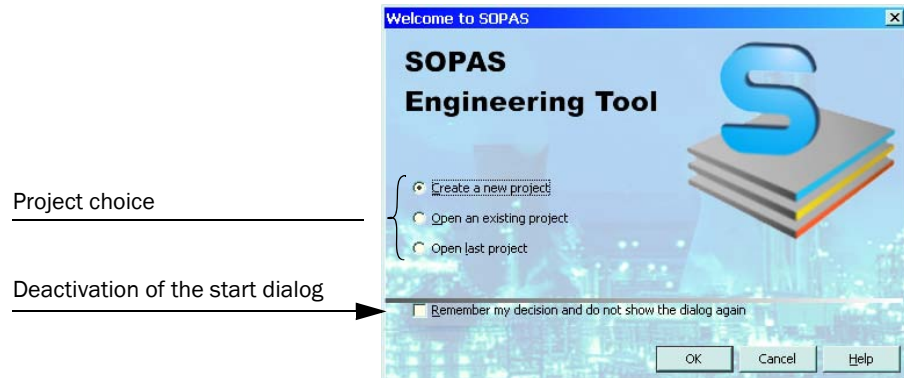


Fig. 4.2: Start dialog

After confirmation with "OK", the following start menu appears on the screen.

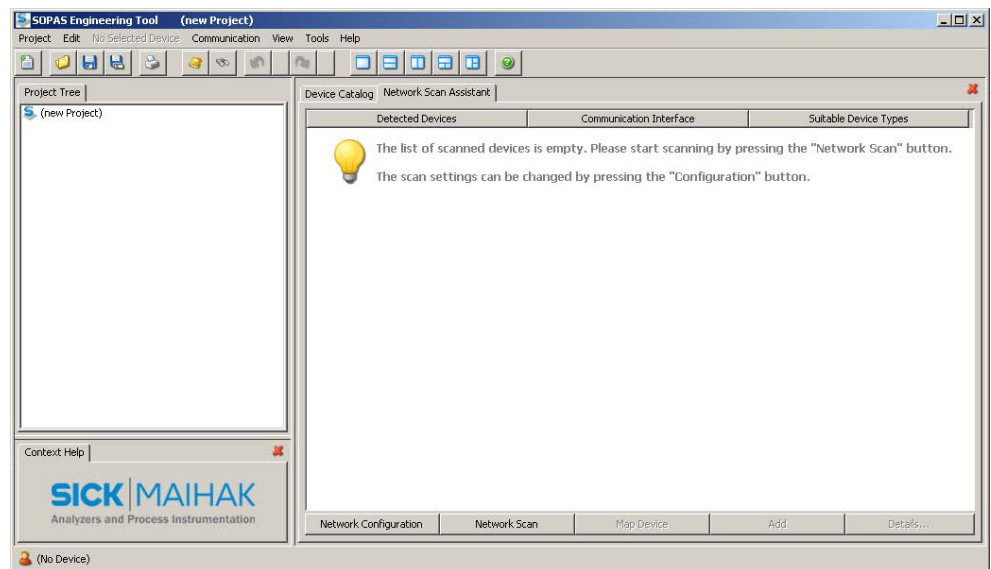


Fig. 4.3: Start menu

- Press the "Network Configuration" button, select the interface, press the "Advanced" button and configure according to **Fig. 4.4** (settings only required during the first connection to FLOWSIC100).

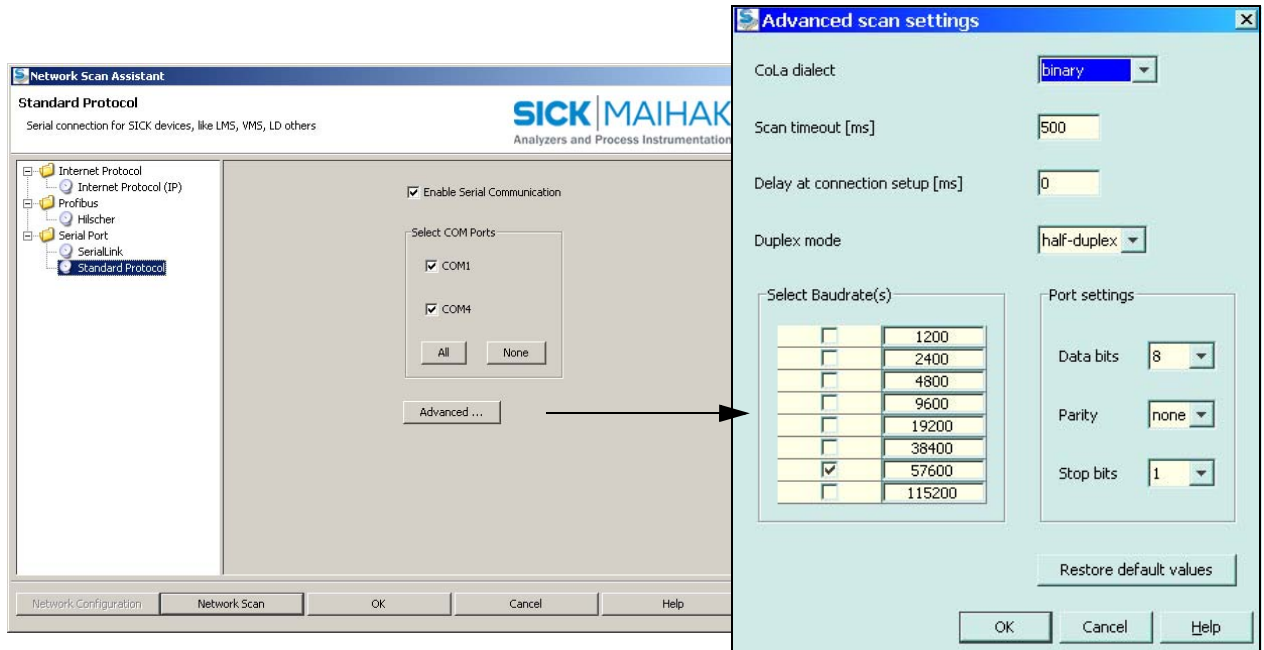
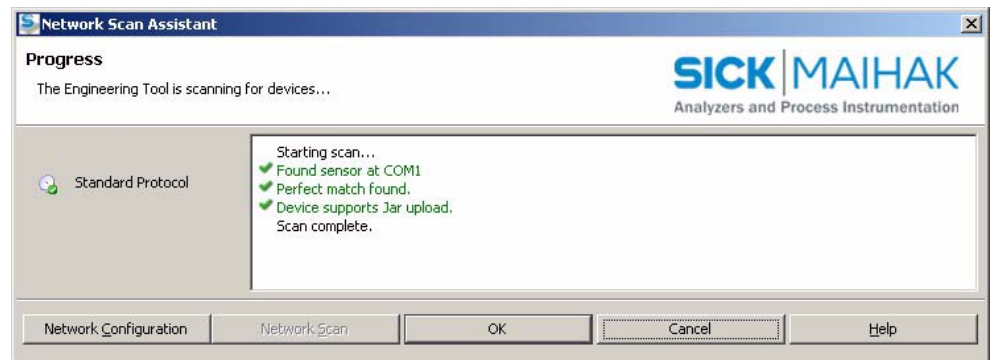


Fig. 4.4: Interface selection and configuration

- Press the "Network Scan" button in the "Network Scan Wizard" window, then the following menu appears.



The following message appears if no device is found. Contact the SICK MAIHAK service.

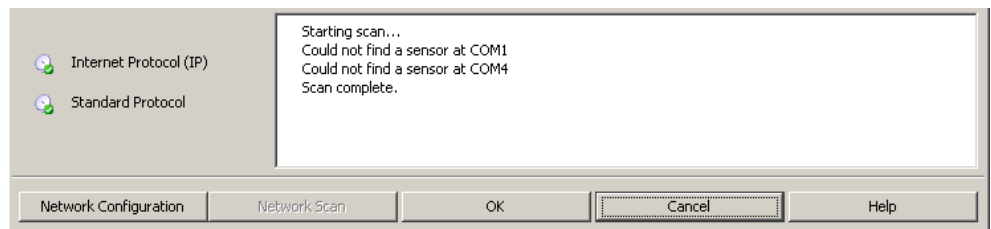


Fig. 4.5: Search for connected devices

#### 4.1.4 Using the SOPAS ET Configuration Software

##### Device Selection

Select the required devices on the "Network Scan Assistant" page and move them into the "Projekt Tree" (using the mouse with drag-and-drop or double-click, or using the "Add" button).

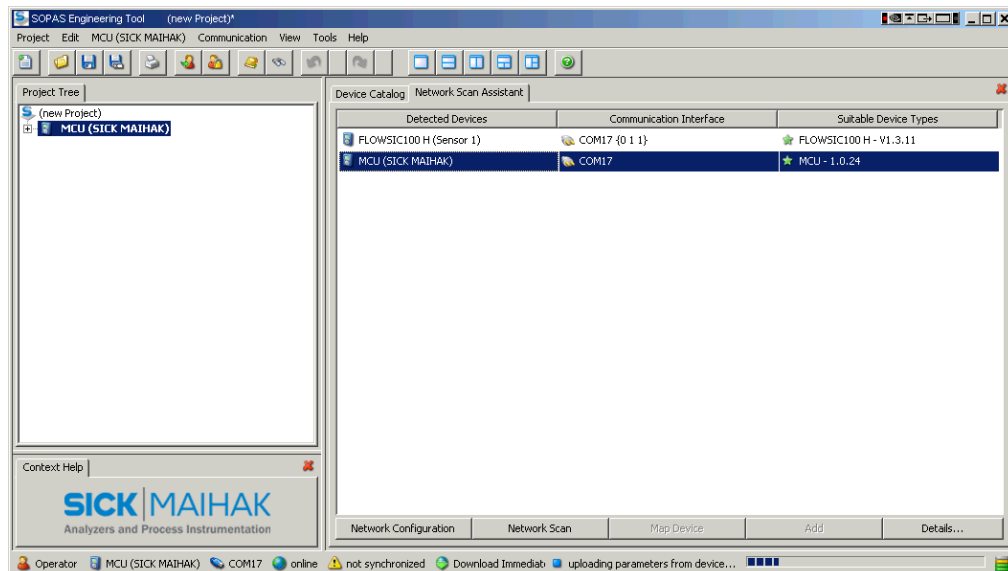


Fig. 4.6: Selection of required devices

##### Password

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

User level		Access to
0	none	Display of measured values and system status
1	"Authorized Operator"	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 Appendix.

##### Language Selection

If necessary, set the required language in the "Tools / Options / Localization" menu (see Fig. 4.7. The settings take effect after the software has been restarted.

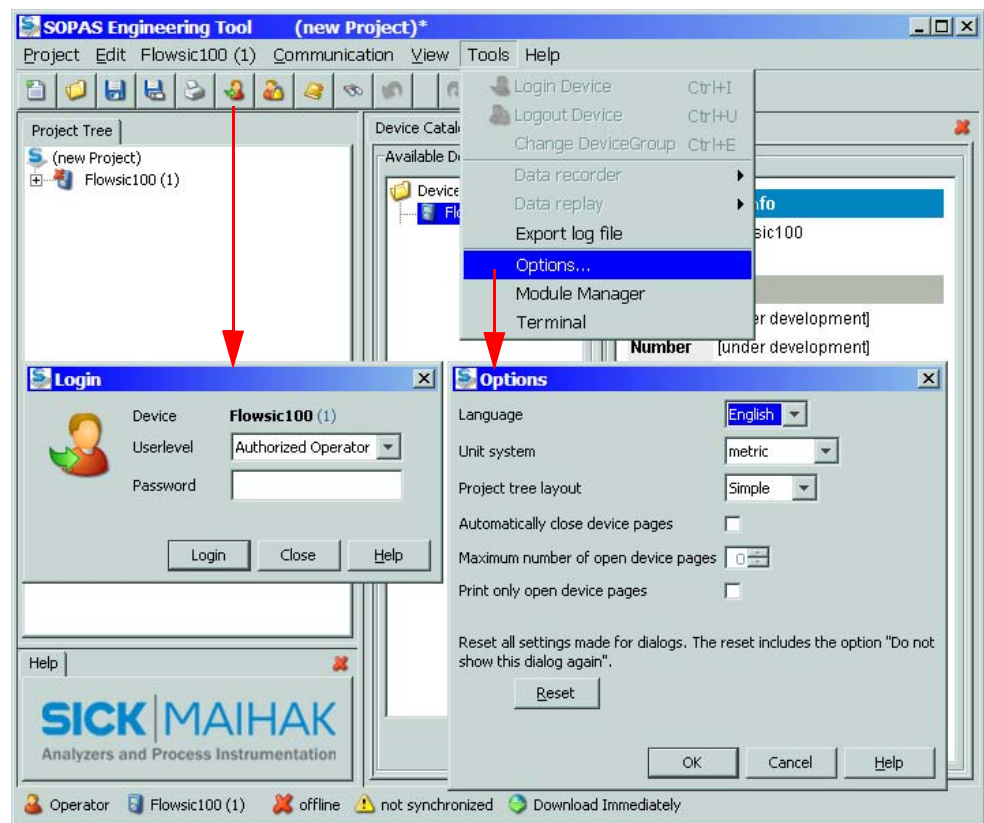


Fig. 4.7: Password entry and language selection

#### 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.

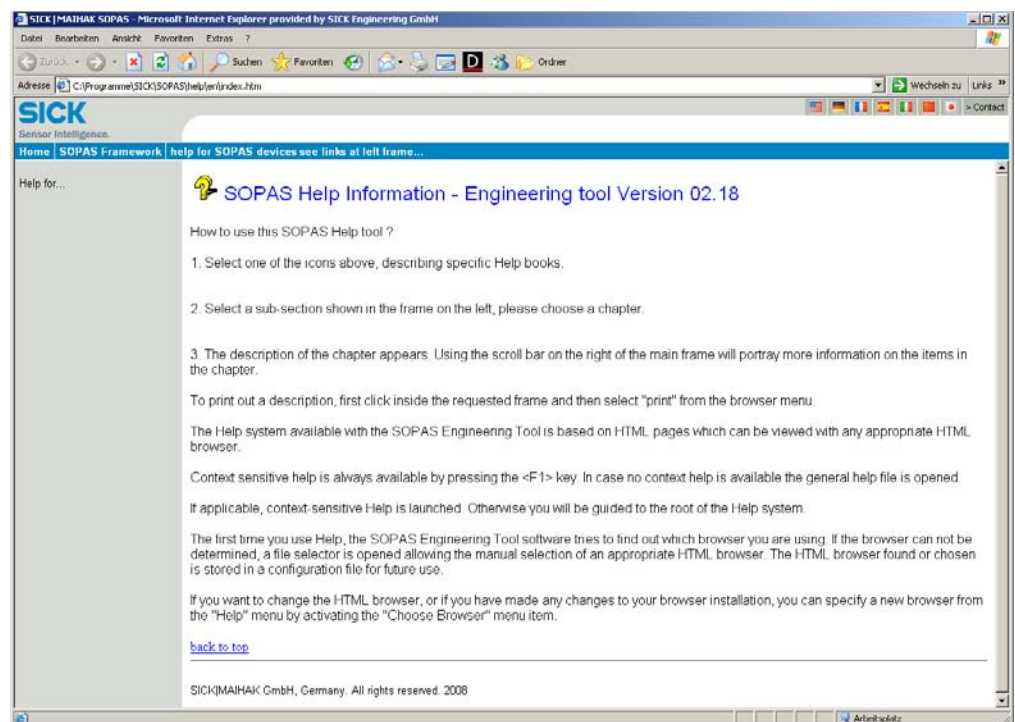


Fig. 4.8: Online Help

## 4.2 Standard Commissioning Procedure

Settings for calibration  
see Section 4.3

**Note:** Until the installation data has been fully entered, the error message “Error Parameter” is output.

To change the parameters, the following steps are required: Enter the password for user level 1 (see Fig. 4.7). Select the type FLOWSEC100 on the page "Network Scan Assistant" and move it into the "Project Tree" window by double-click or drag-and-drop. Switch the FLOWSEC100 to Maintenance Mode: Go to the subpage “Maintenance / Maintenance Status”, activate the check box "Sensor Maintenance" and click the “Set Status” button (see Fig. 4.9). The active Maintenance Mode is indicated by a glowing status indicator in this subpage and on the “Diagnosis / Sensor Values” subpage..

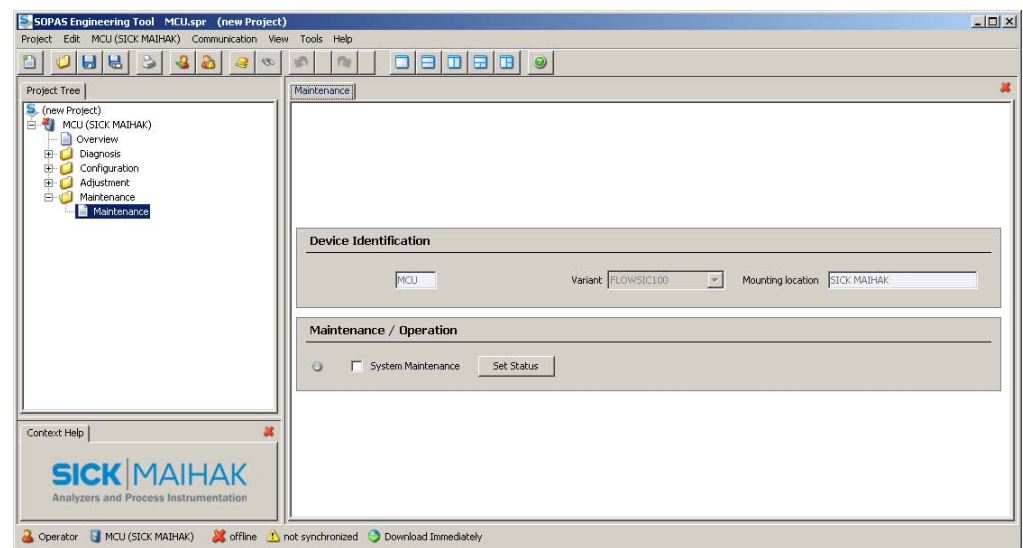


Fig. 4.9: Switching to Maintenance Mode

### 4.2.1 Entering the Application Data (Project Tree FLOWSEC100 Sensor)

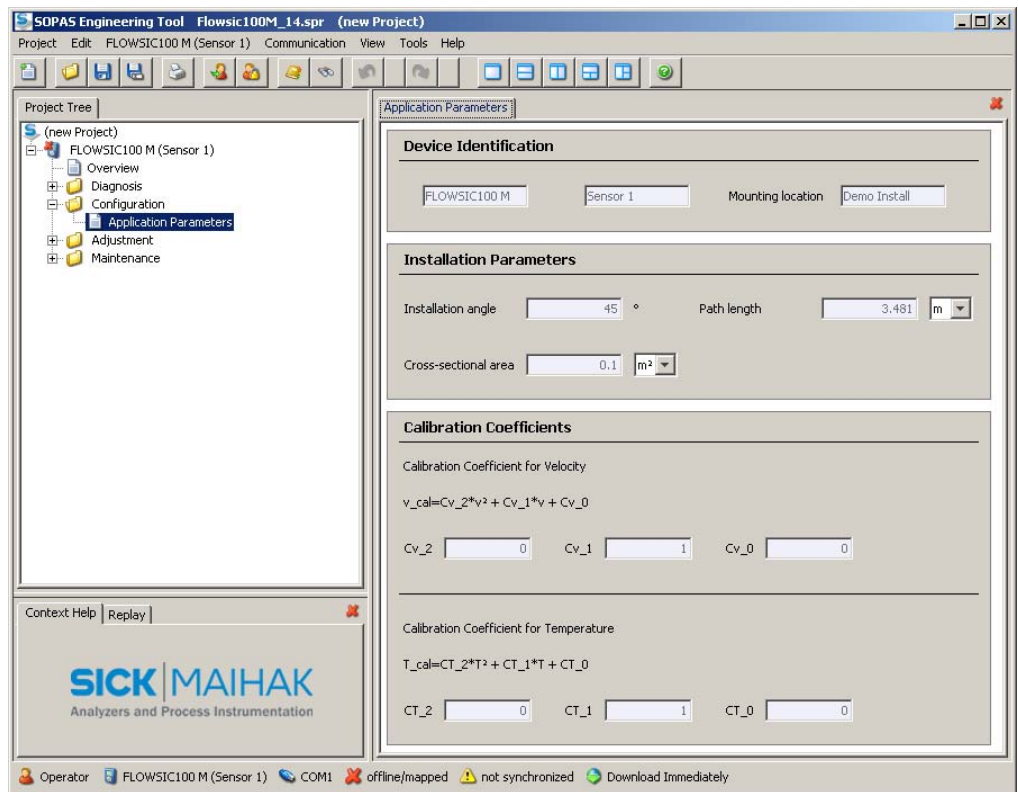
Before a measurement can be started, you have to select the unit system (metric or imperial units) and enter the application parameters (measuring distance, installation angle, cross-sectional area). Select the type FLOWSEC100 in the menu "Device Catalog / Available Devices" and go to the "Configuration / Application Parameters" subpage in the "Project Tree" window (see Fig. 4.10). The settings are uploaded to the FLOWSEC100 after switching from "Maintenance" to "Measurement".

**Note:** The application parameter settings are converted automatically if you change the unit system.

Application parameters:

Path length	Distance between the transducers (L in Fig. 4.11)
Installation angle	Angle between the measurement axis and main direction of the gas flow ( $\alpha$ in Fig. 4.11)
Area of duct (required to calculate the volumetric flow)	Area between the internal duct walls between the two sender/receiver units perpendicular to the flow direction; (A in Fig. 4.11) If the cross-sectional area changes in the vicinity of the measurement location, enter the mean value of the areas between the sender/receiver units A and B.





Input of calibration coefficients see Section 4.3

Fig. 4.10: "Application parameters" subpage (example for settings)

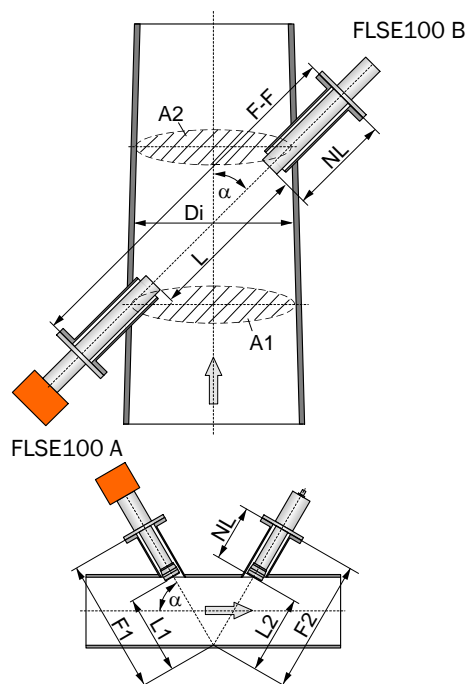


Fig. 4.11: Basic parameters

#### Cross-sectional area:

Circular ducts:      Rectangular ducts:

$$A = \frac{\pi}{4} \cdot D_i^2 \qquad A = a \cdot b$$

#### Cross-sectional changes

$$A = \frac{A_1 + A_2}{2}$$

#### Path length:

$$L = FF - 2 \cdot NL$$

$$FF = F_1 + F_2$$

$$L = L_1 + L_2 = (F_1 + F_2) - 2 \cdot NL$$

**Note:** For small duct dimensions <0.5 m (short measuring distances), take the thickness of the used gaskets into account when determining the measuring distance.

## 4.2.2 Configuring the Check Cycle

### Basic Settings

- Select the type MCU on the "Network Scan Assistant" page and move it into the "Project Tree" window (if not yet carried out).
- Select the type MCU in the "Project Tree" window and enter the password for user level 1.
- Switch the MCU to Maintenance Mode (see Section 4.2 ).

The output of the check cycle can be configured on the "Adjustment/Function Check - Automatic" subpage (see Fig. 4.12). The function check can also be started manually.

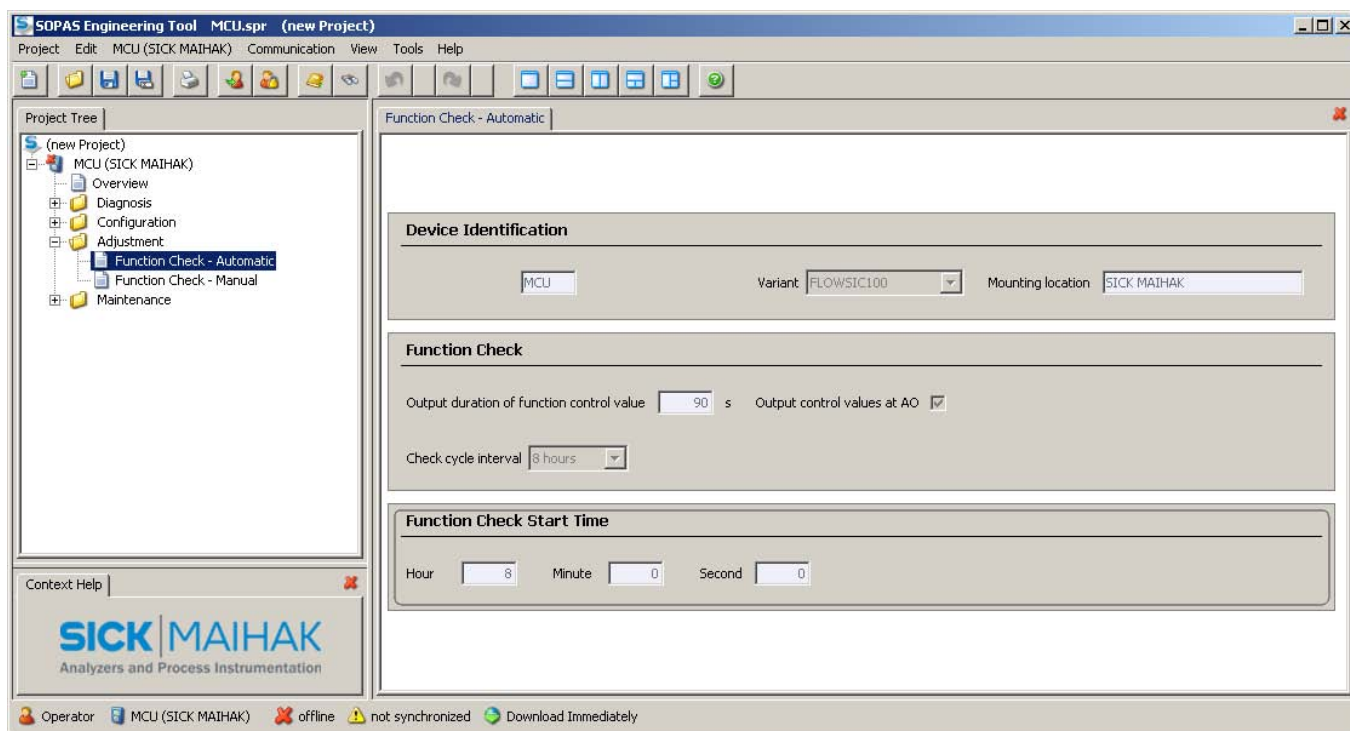


Fig. 4.12: "Adjustment/Function Check - Automatic" subpage (example for settings)

Field	Parameter	Remark
Function control of output duration	Value in seconds	Output duration of the check cycle
Output control values at AO	Inactive	The last measured value is output for the duration of the check cycle.
	Active	Check cycle is output at the analog output
Check cycle interval	Time between two check cycles	See Section 2.5
Function control start	Hour	Specification of a start time in hours, minutes and seconds
	Minute	
	Second	



### 4.2.3 Configuring the Analog Output

Switch to the MCU subpage "Configuration / I/O Configuration / Output Parameter FLOWSIC100" (see Fig. 4.13) and set the values for error and maintenance current.

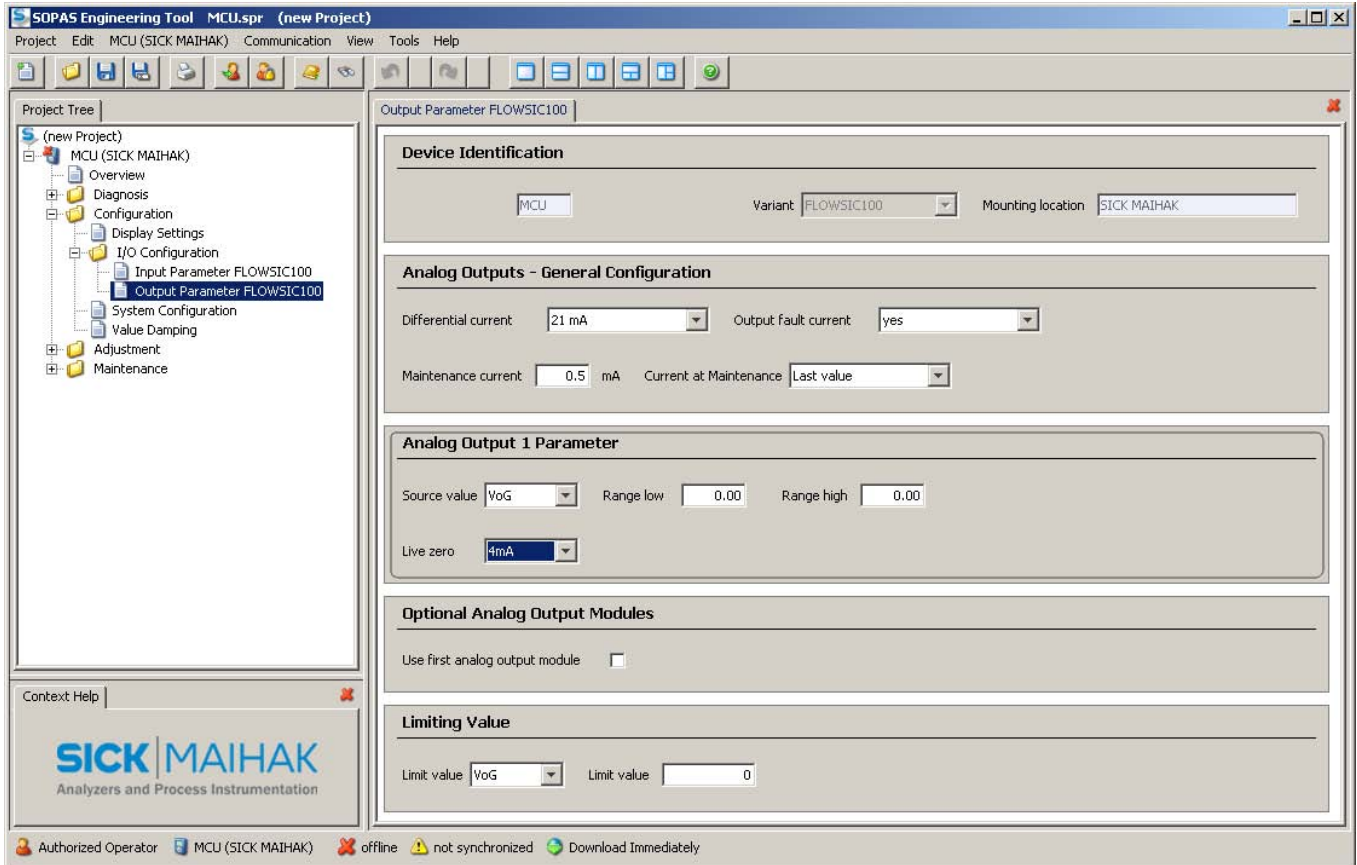


Fig. 4.13: "Configuration / I/O Configuration / Output Parameter FLOWSIC100" subpage (example for settings)

Field		Parameter	Notes
Analog output / general configuration	Differential current	Value > 20 mA	mA value to be output in case of mal-functions
	Output fault current	Yes	The error current is output
		No	The error current is not output
	Maintenance current	Value if possible ≠ Live Zero	mA value to be output during Maintenance Mode
	Current at maintenance	Last value	The last measured value is output during Maintenance Mode
		User defined value	A value to be defined is output during Maintenance Mode
		Measured value output	The current measured value is output during Maintenance Mode

Field		Parameter	Notes
Parameter analog output 1	Measured value	Velocity of gas	The selected measurand is output on the analog output
		Speed of sound	
		Q a.c.	
		Q s.c.	
		Molar mass	
		GasMassFlow	
	Lower end value	Lower measuring range limit	Physical value at live zero
	Upper end value	Upper measuring range limit	Physical value at 20mA
	Live zero	Zero point (0, 2 or 4 mA)	Select 2 or 4 mA for clear signalisation of the device state (operation or switched off / interrupted current loop).
Selection of optional module	Use first optional module	Inactive	No effect
		Active	Additional fields are opened for the configuration of optional modules (see Section 4.3.2)
Limit value configuration	Measured value	Velocity of gas	Selection of measurand for monitoring of a set limit value
		Speed of sound	
		Q a.c.	
		Q s.c.	
		Molar mass	
		Direction	
		GasMassFlow	
	Limit value		If a value $\neq 0$ is set, the limit value relais switches if the value for the selected measurand is exceeded

#### 4.2.4 Configuring the Analog Inputs

Switch to the MCU subpage "Configuration / I/O Configuration / Analog input / Input Parameter FLOWSIC100" (see Fig. 4.14) and set the basic parameters.

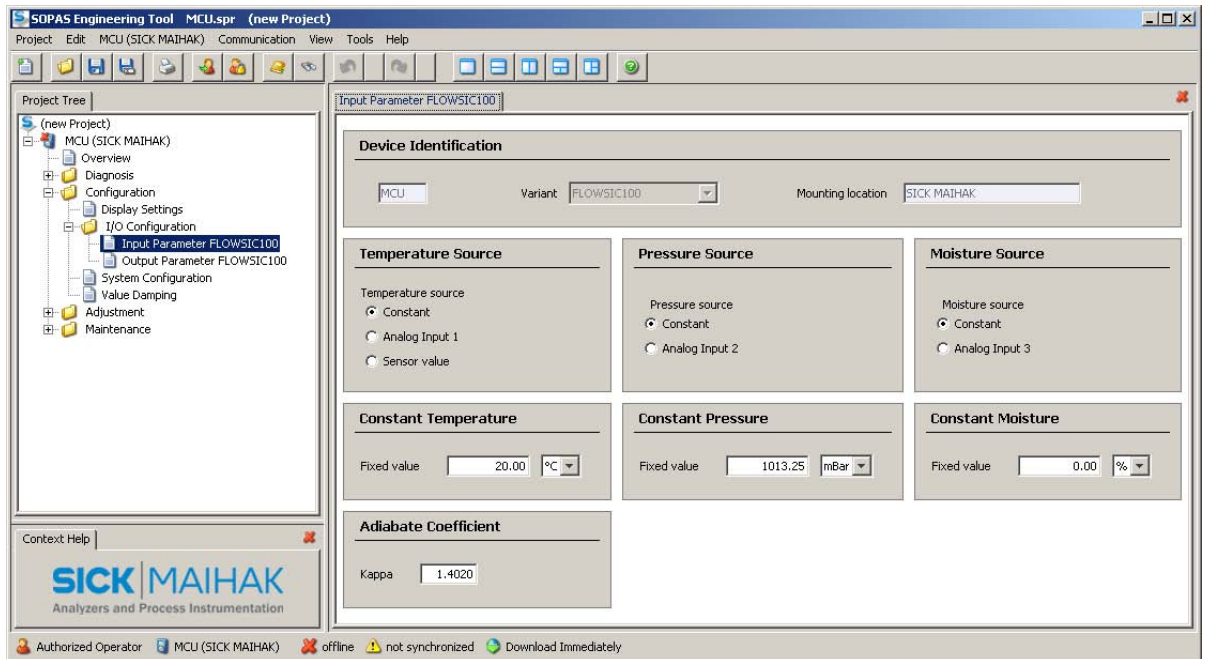


Fig. 4.14: "Input Parameter FLOWSIC100" subpage

Field	Parameter	Description
Temperature Source	Constant	A constant value is used for the standardization.
	Analog input 1	The value of an extern sensor connected to analog input 1 (standard shipment) is used for the standardization. If this field is activated, the input fields for the configuration of the input range appear under the "Temperature" field.
	Sensor measured value	The value of the integrated temperature sensor is used for the standardization
Pressure Source	Constant	A constant value is used for the standardization.
	Analog input 2	The value of an extern sensor connected to analog input 2 (standard shipment) is used for the standardization. If this field is activated, the input fields for the configuration of the input range appear under the "Pressure" field.
Moisture Source	Constant	A constant value is used for the standardization.
	Analogeingang 3	The value of an extern sensor connected to analog input 3 (standard shipment) is used for the standardization. If this field is activated, the input fields for the configuration of the input range appear under the "Pressure" field.
Constant Temperature	Value in °C	Setting of a value necessary for the standardization
	Value in K	
Constant Pressure	Value in mbar	
Constant Moisture	Value in %	

### 4.2.5 Value Damping

The value damping time can be configured in the MCU subpage “Configuration / Value Damping” (see Fig. 4.15 ).

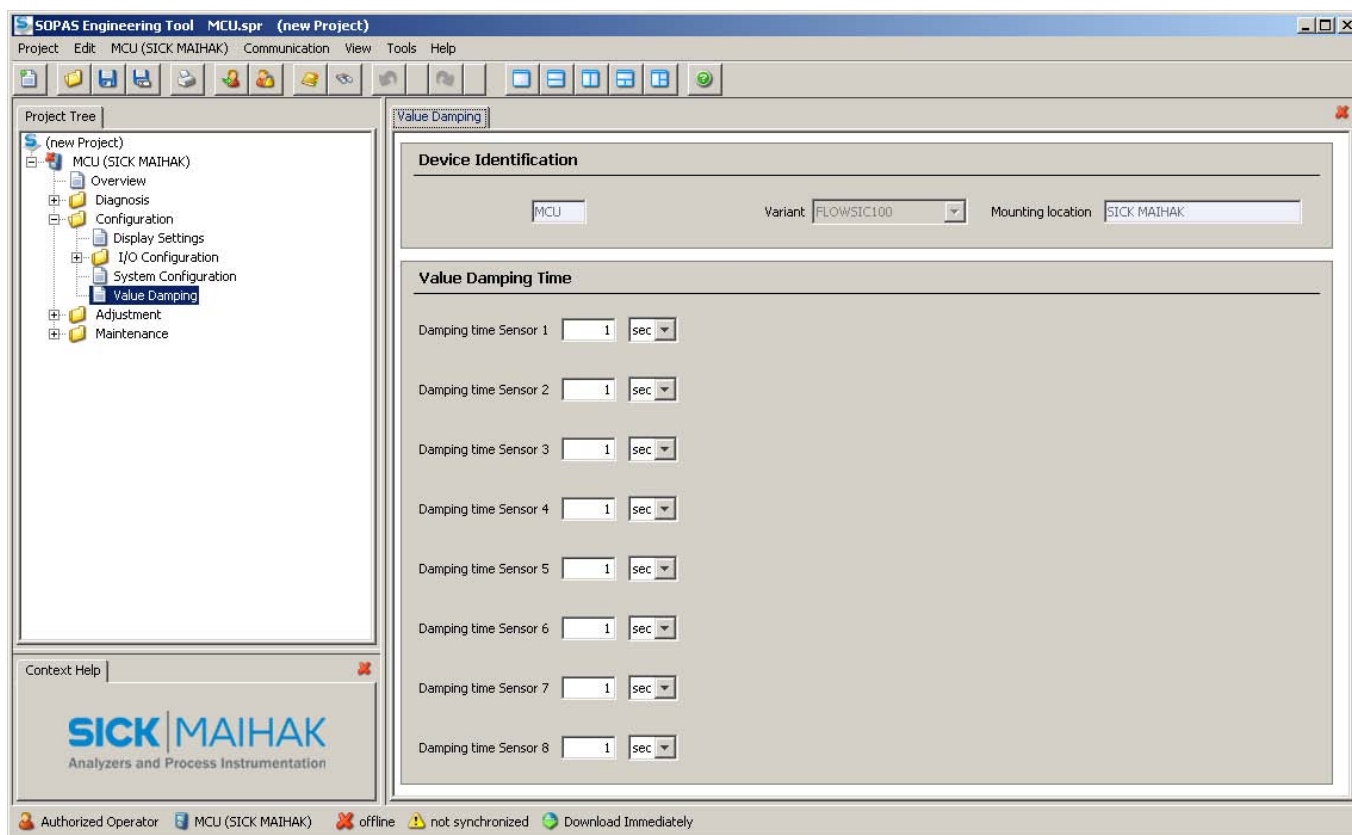


Fig. 4.15: “Value Damping” subpage

Field	Parameter	Notes
Damping Time Sensor 1	Value in s	Damping time of the selected measurand (see Section 2.4.3)
Damping Time Sensor 1 to 8	Value in s	Damping time of additional sensors connected to the control unit (bus wiring)

#### 4.2.6 Data Backup

All parameter relevant for the collection, processing and input/output of measured values and current measured values can be saved and printed. This allows the easy re-entering of set device parameters (e.g. after a firmware update) as well as the registration of device data or device states for diagnostic purposes.

Data can be saved in the following ways:

- Saving as project

Saving the data as project allows to save not only device parameters but also recordings.

- 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 Project

- Select the "Project / Save Project" menu for backup and specify the target directory and file name.

The name of the file to be saved can be specified arbitrarily. It is useful to specify a name with a reference to the respective measuring location (name of company and facility).

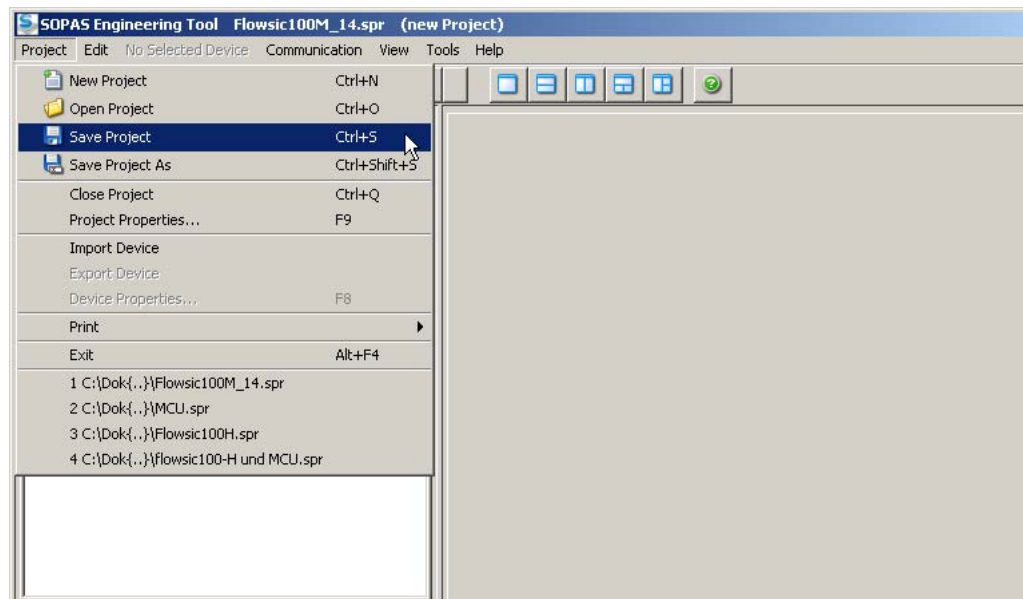


Fig. 4.16: "Project / Save Project" menu

### Saving as Protocol

- Select a device, go to the subpage “Diagnosis / Protocols” and click the button for the desired type of protocol.

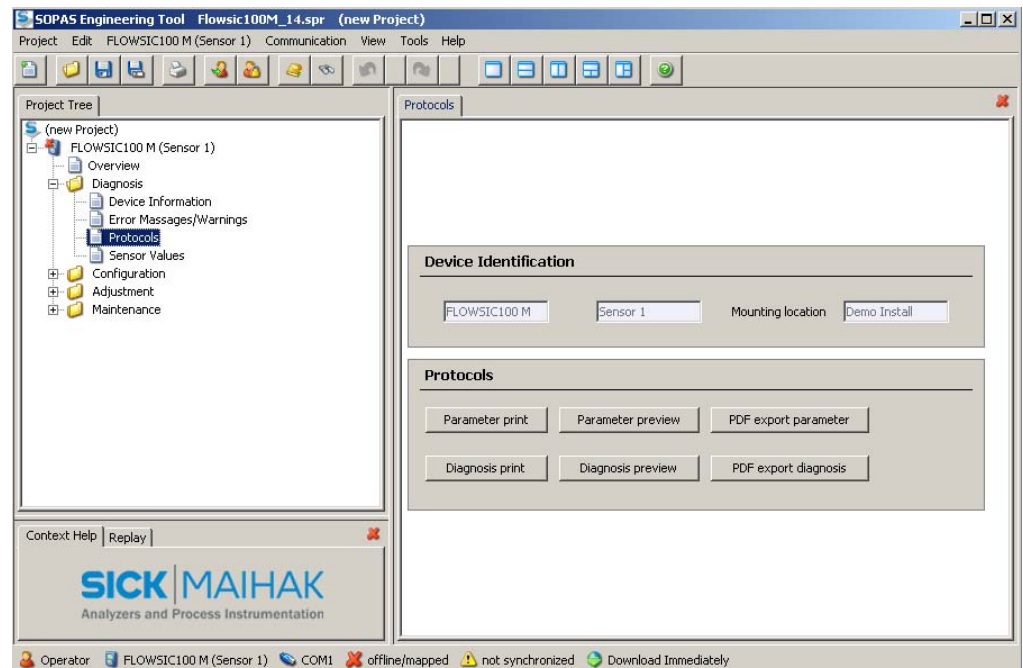


Fig. 4.17: “Diagnosis / Protocols” subpage

For the export to a PDF-file, file name and file location have to be specified.

## Example of a Parameter Protocol

**SOPAS Engineering Tool - Print Preview**

File View Help

Zoom 150

### FLWSIC100 - Parameter Protocol

**Device type: FLWSIC100 M**  
**Mounting location: Demo Install**  
**Sensor 1**

---

<p><b>Device Information</b></p> <p>Device type                      FLWSIC100 M          Firmware version              1.3.14          Serial number Master FLSE100    123456          Serial number Slave FLSE100    123456</p> <p><b>Application Parameter</b></p> <p>Path length                      3.4810 m          Installation angle              45.00 °          Cross-sectional area            0.1000 m²          Velocity CC(0)                  0.0000          Velocity CC(1)                  1.0000          Velocity CC(2)                  0.0000          Temperature CC(0)              0.0000          Temperature CC(1)              1.0000          Temperature CC(2)              0.0000          Fix temperature                20.00 °C          Speed of sound                331.500 m/s</p> <p><b>Device Parameter</b></p> <p><b>Transmitting parameter</b></p> <p>Transmit frequency A            42.000 kHz          Transmit frequency B           42.000 kHz          Total periods A                5.0          Total periods B                5.0          Activation periods A            5.0          Activation periods B            5.0          Retarding attenuation A        10.0          Retarding attenuation B        10.0          Amplitude A                    12          Amplitude B                    45          Sensortype                      42khz</p>	<p><b>Device Parameter</b></p> <p><b>Signal Processing</b></p> <p>Lower fraction                    35 %          Upper fraction                   50 %          Averaging number signal        10          Limit SNR                        10 dB          Min amplitude                   20 %</p> <p><b>Gain</b></p> <p>Gain level A                      30 dB          Gain level B                      30 dB          Target amplitude                60          Damping                         10          Gain control deactivated        no</p> <p><b>Reception Window</b></p> <p>Window size                      1000          Precounter                      0.000 ms          Control deactivated              no</p> <p><b>Limits</b></p> <p>Limit warning                    80 %          Limit malfunction               99 %          Limit range                      60.00 m/s          Max. transducer temperature   280.0 °C</p>
---	--

setting up fonts      Page 1 of 1

Fig. 4.18: Parameter protocol FLWSIC100 M (example)

#### 4.2.7 Starting Standard Measuring Mode

Normal measuring operation (Measuring Mode) starts by deactivating the Maintenance Mode. (Open the subpage "Mainenance / Maintenance Status" of the type FLWSIC100 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.

#### 4.2.8 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. 4.20** to **Fig. 4.30**, depending on the device type.



## Type FLSE100-M /MAC

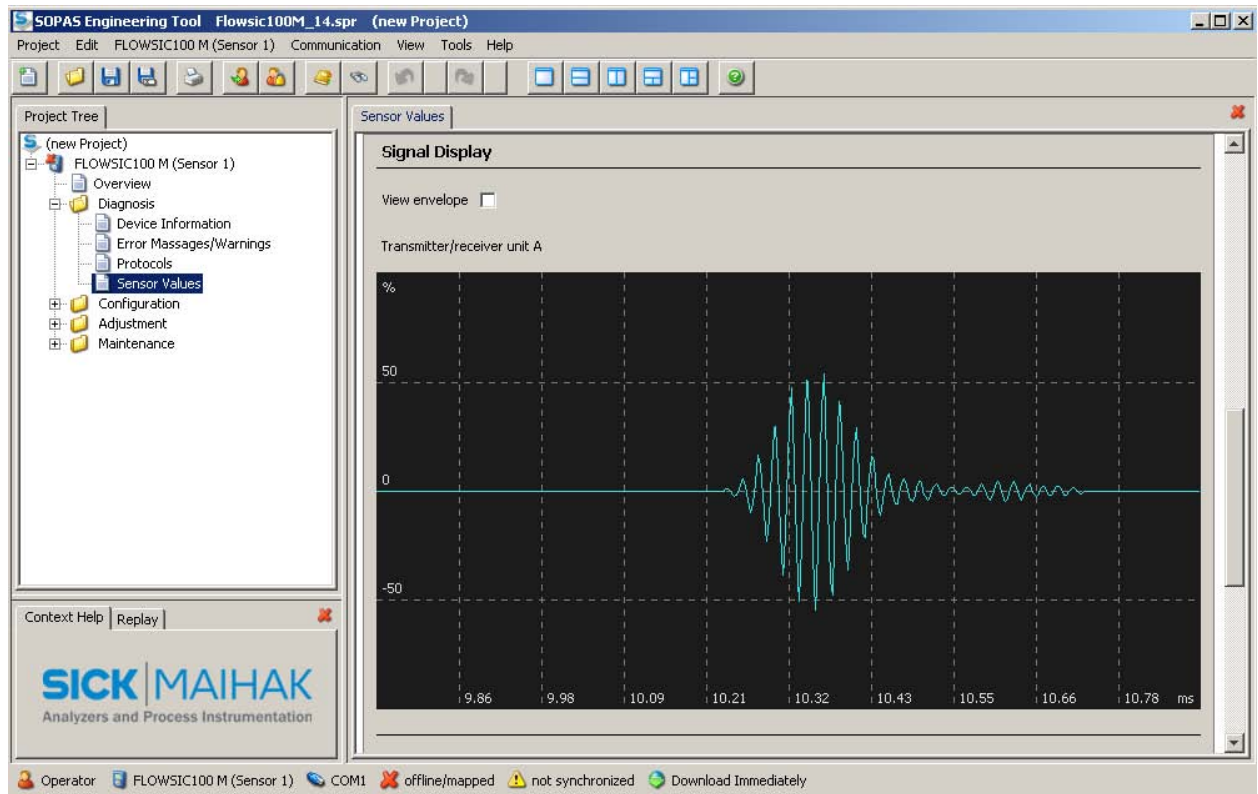


Fig. 4.19: Burst form HF-signal (unconditioned signal)

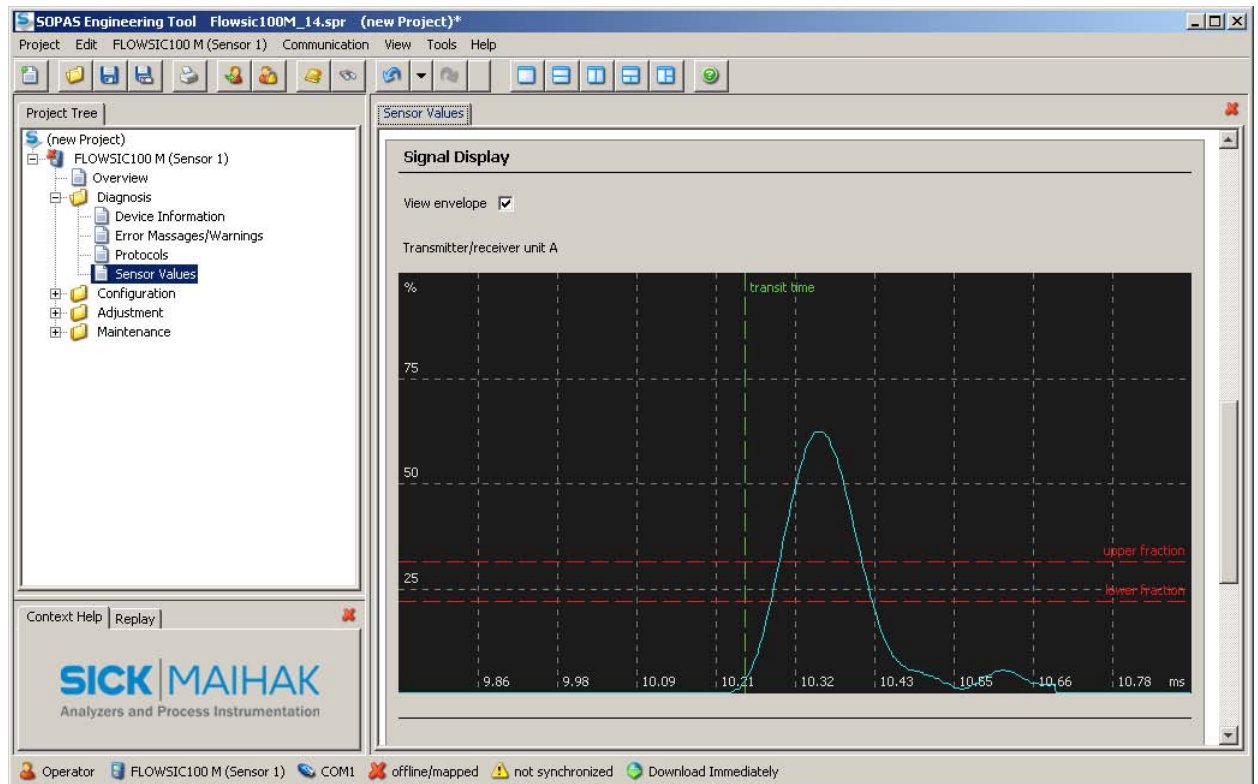


Fig. 4.20: Burst form demodulated signal (envelope)

Type FLSE100-H /HAC / PHS

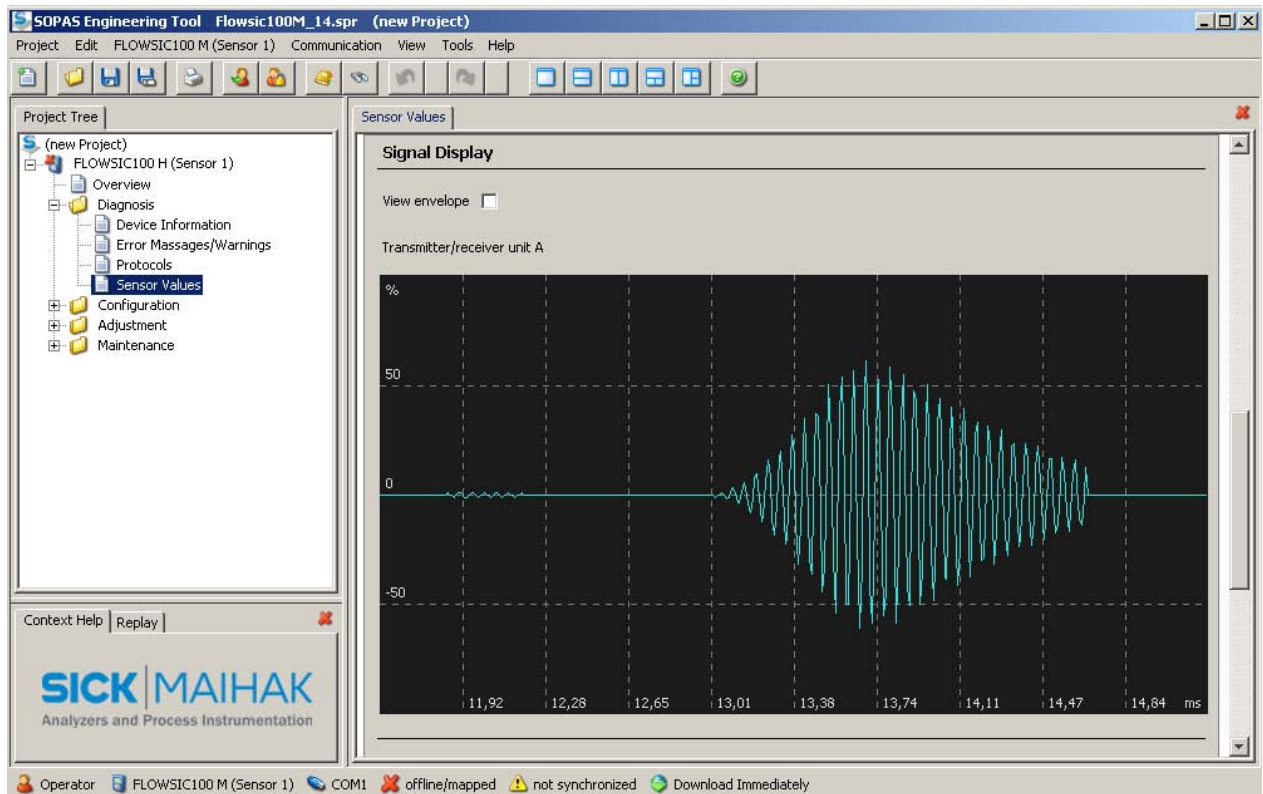


Fig. 4.21: Burst form HF-signal (unconditioned signal)

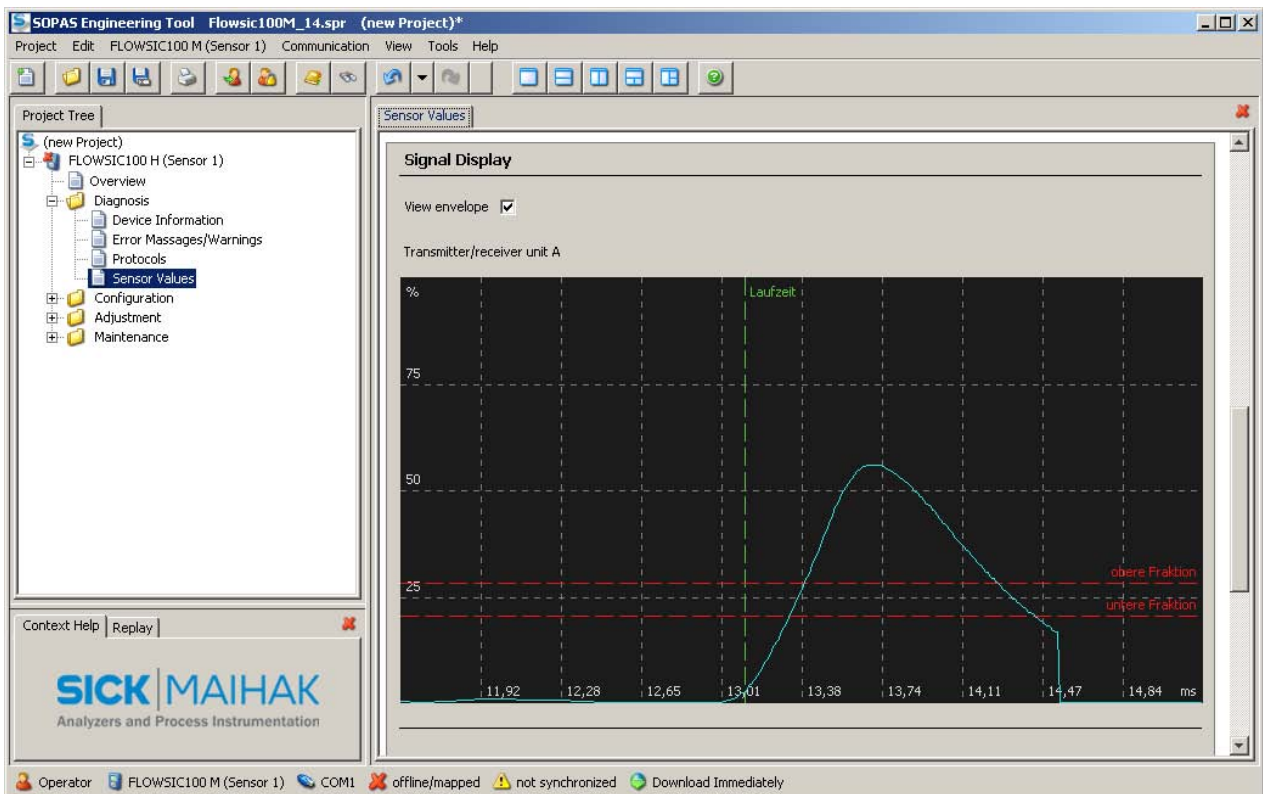


Fig. 4.22: Burst form demodulated signal (envelope)

## Type FLSE100-PH

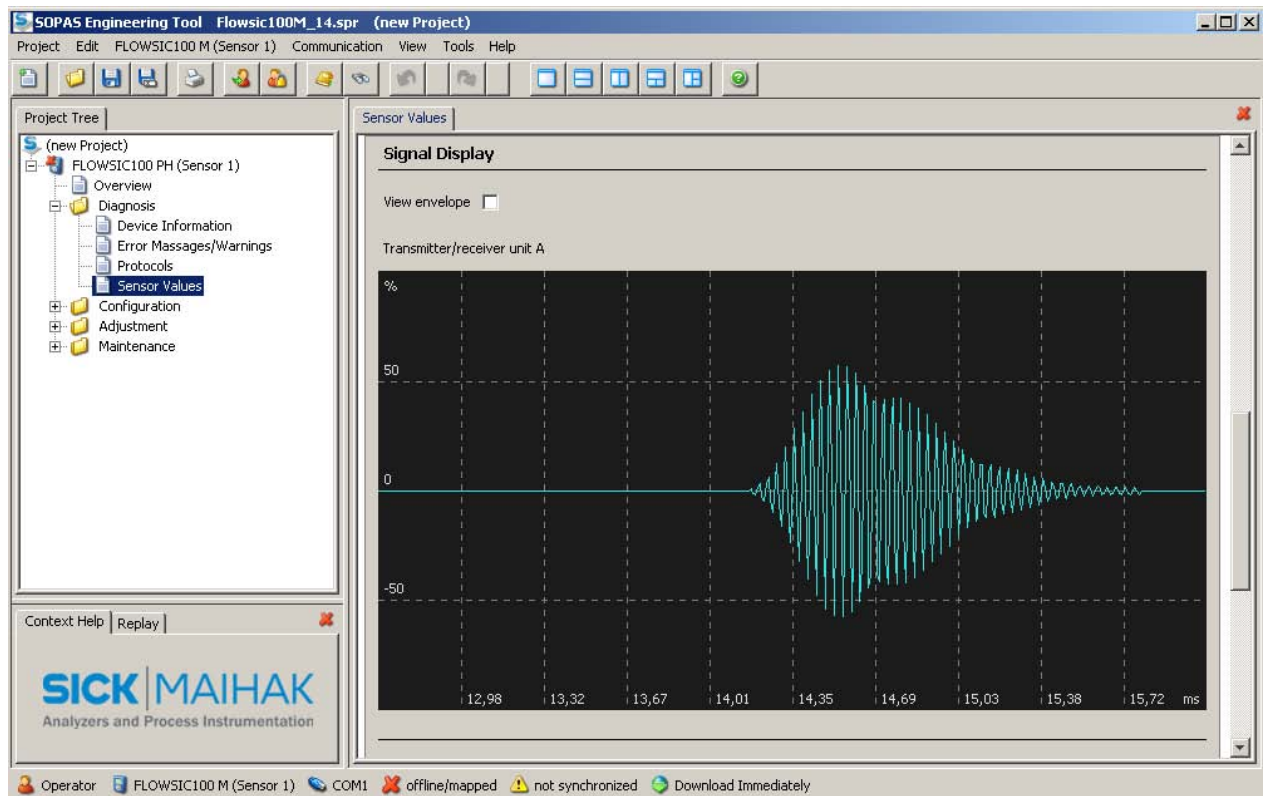


Fig. 4.23: Burst form HF-signal (unconditioned signal)

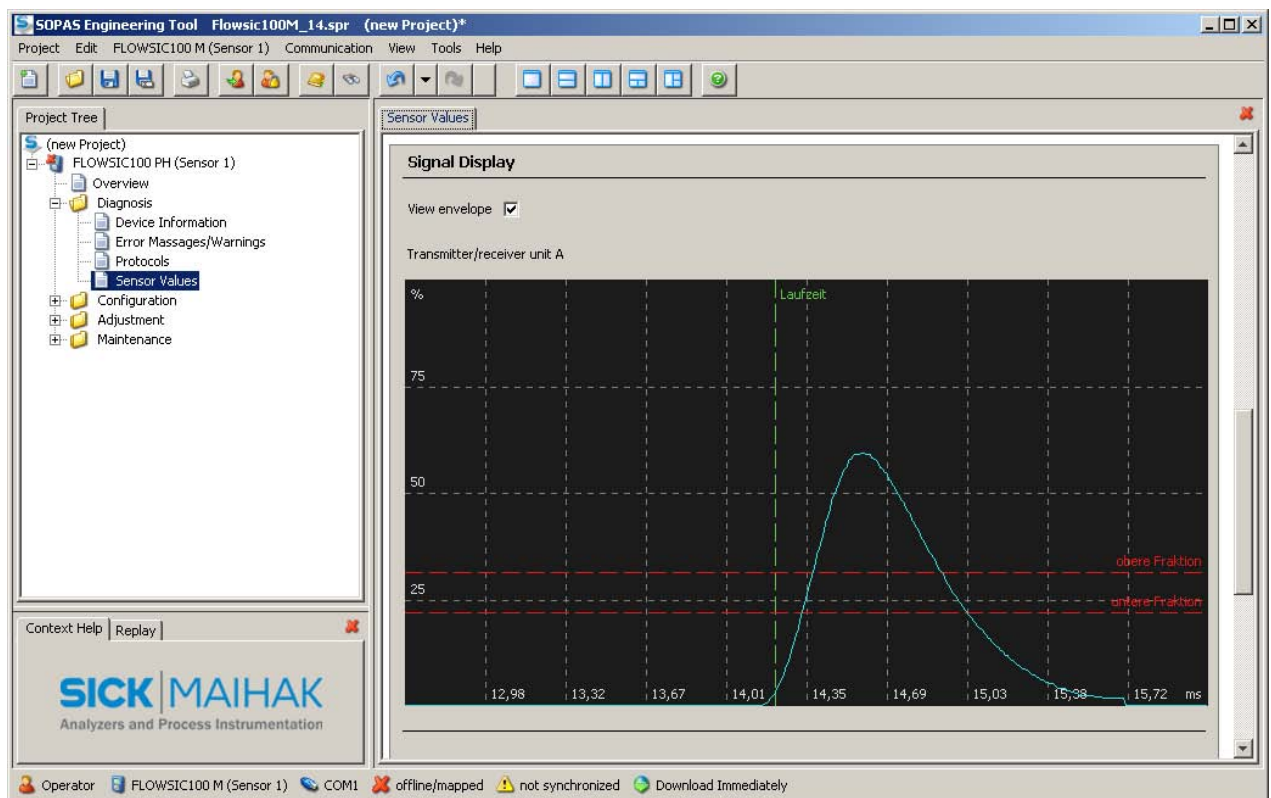


Fig. 4.24: Burst form demodulated signal (envelope)



Type FLSE100-S

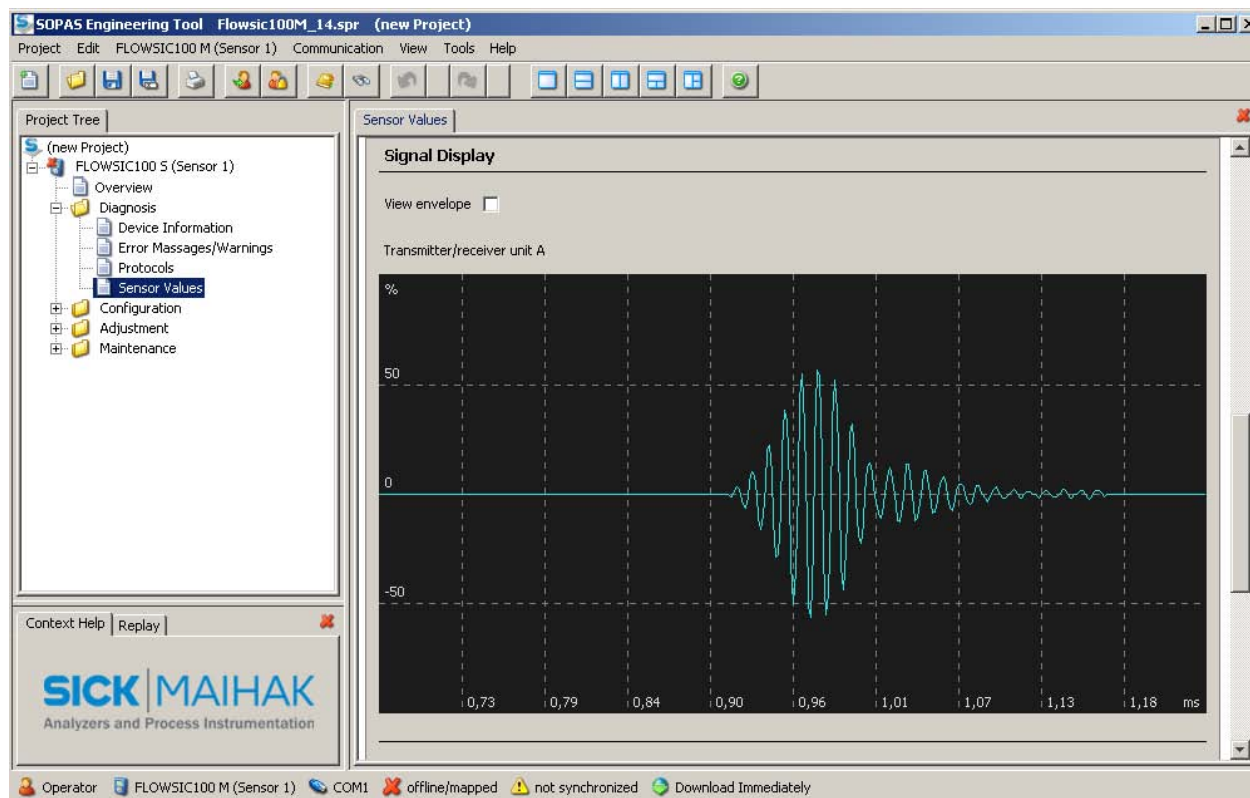


Fig. 4.25: Burst form HF-signal (unconditioned signal)

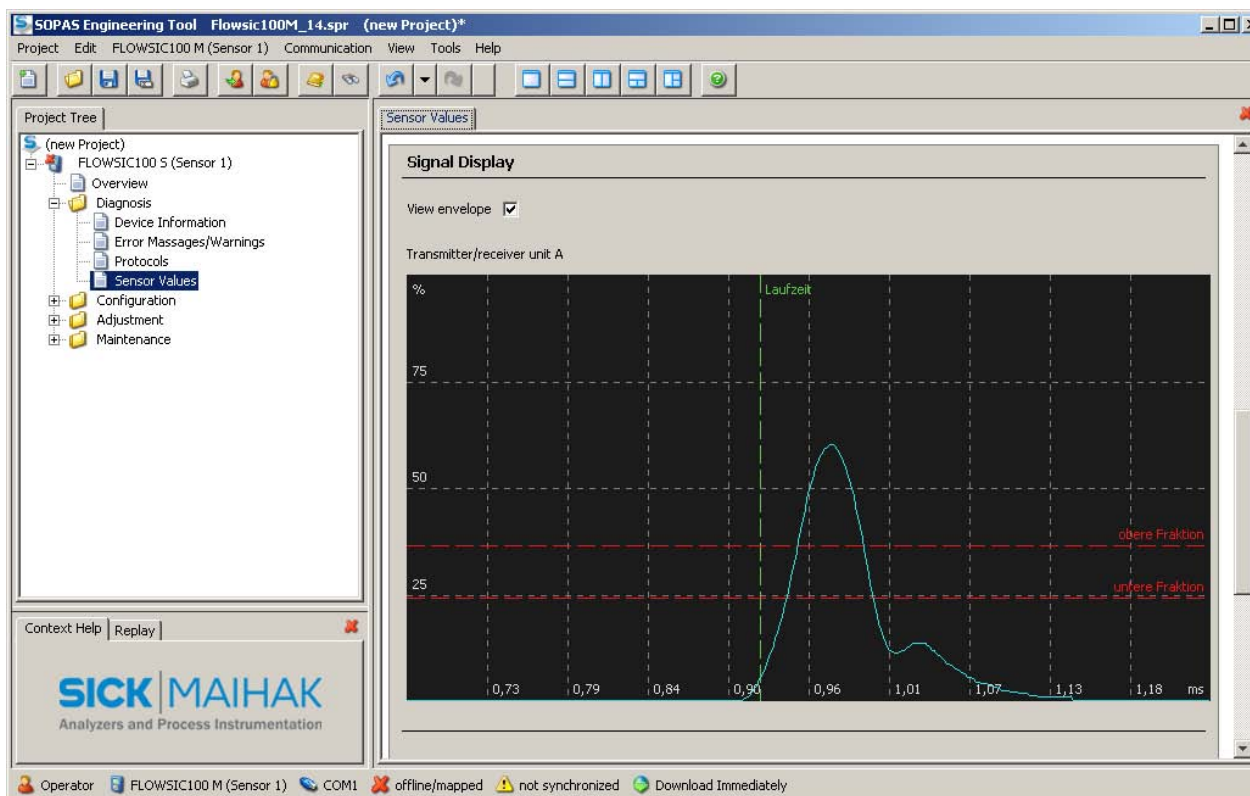


Fig. 4.26: Burst form demodulated signal (envelope)

## Type FLSE100-PR / PRAC

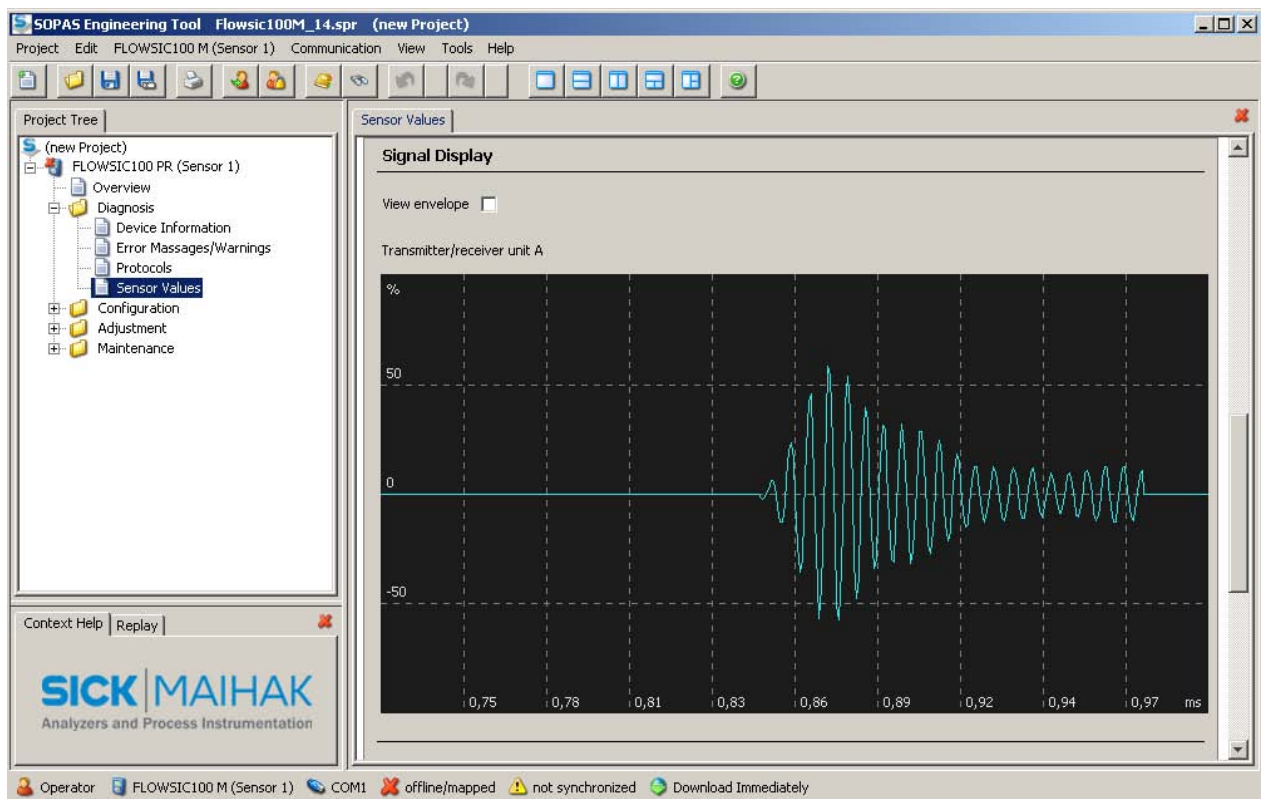


Fig. 4.27: Burst form HF-signal (unconditioned signal)

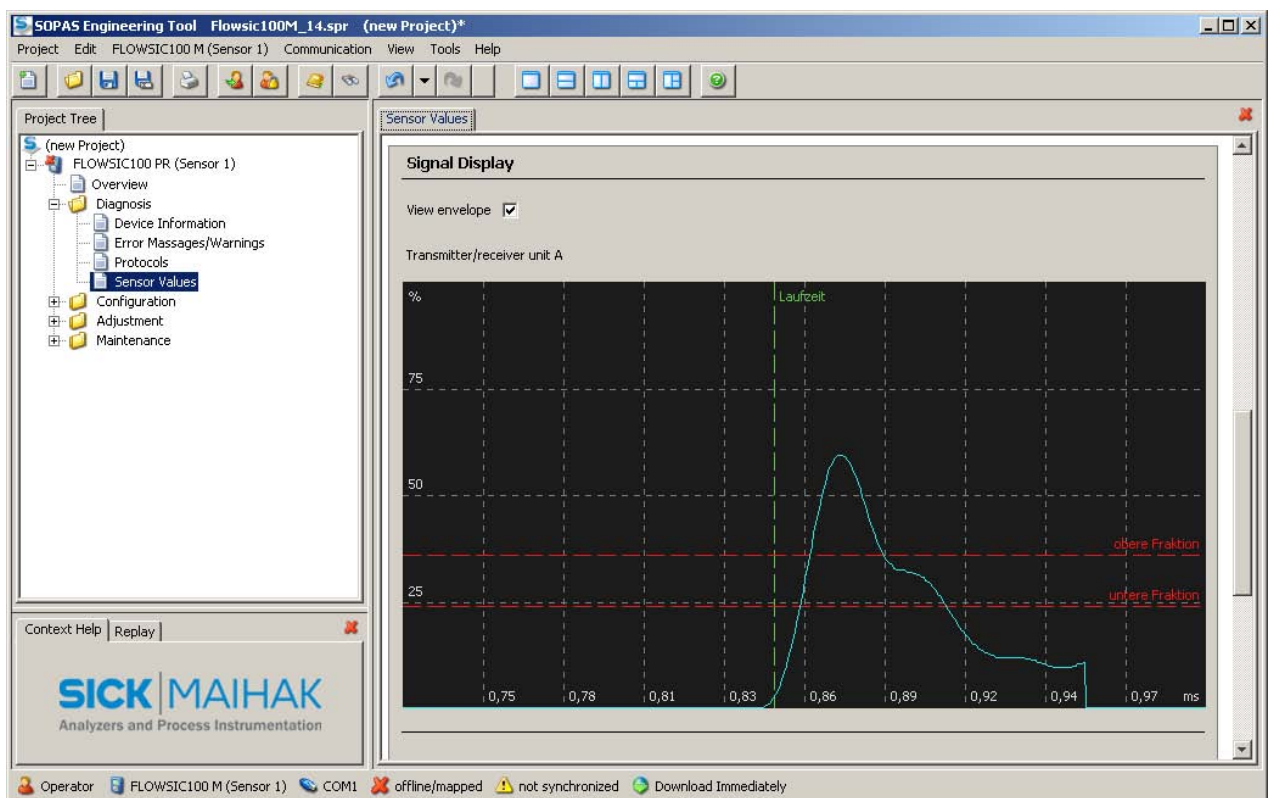


Fig. 4.28: Burst form demodulated signal (envelope)

## 4.3 Extended Commissioning

### 4.3.1 Application Selection

See Section 2.2.2.

The FLOW SIC100 offers means to measure on two measuring paths at the same time, calculate one common measured value from them and output the common measured value. This requires 2 sender / receiver units per measuring path or one measuring probe each (installation see Chapter 3). The necessary configurations are usually made in the factory. If this is not the case (e.g. if existing devices are upgraded), carry out the following procedure:

- ▶ In the window “Project Tree”, select the Typ MCU, change to User Access Level “Operator” and switch the system into the Maintenance Mode (see Section 4.2).
- ▶ Go to the submenu “Configuration / Application Selection”.

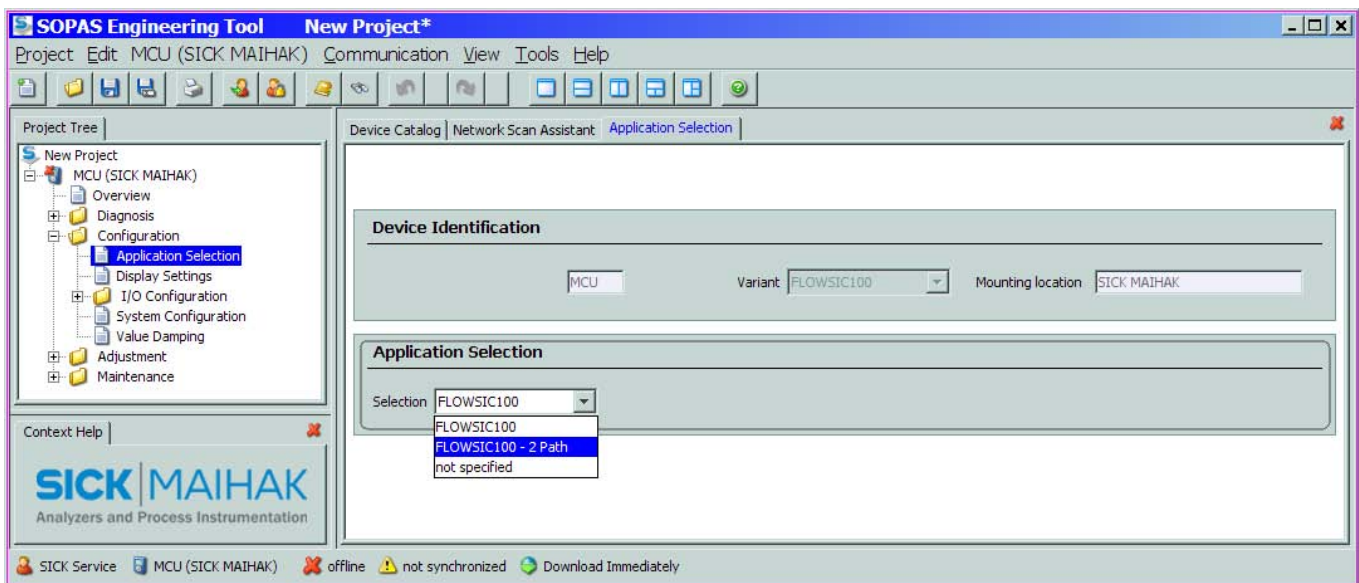


Fig. 4.29: Submenu “Configuration / Application Selection”

- ▶ In the window “Application Selection” select “FLOW SIC100 - 2 Path” in the field “Selection”.
- ▶ Close the SOPAS ET software and temporarily disconnect the MCU from the power supply (power reset).
- ▶ If additional configuration is necessary, reconnect the measuring system to the SOPAS ET software.

**Note:** Per default all measuring paths have the same weighting in the calculation of the output value (for changing the weighting see Service Manual).

### 4.3.2 Configuring Optional Analog Modules

#### Module analog output

in addition max. 8 AO  
available

The basic settings (subpage “Configuration / I/O Configuration / Output Parameter FLOWSIC100”) apply to all available analog outputs.

To configure the settings, carry out the following procedure:

- ▶ Select the type MCU in the “Project Tree” window, enter the password for user level 1 and switch the measuring system to Maintenance Mode (see Section 4.2).
- ▶ Go to the subpage “Configuration / I/O Configuration / Output Parameter FLOWSIC100” (see Fig. 4.31).
- ▶ Activate the check box “Use first analog output module”. New dialog boxes for “Analog Output 2 Parameter” and “Analog Output 3 Parameter” are opened.
- ▶ Configure the optional analog outputs according to the prerequisites in Section 4.2.3..

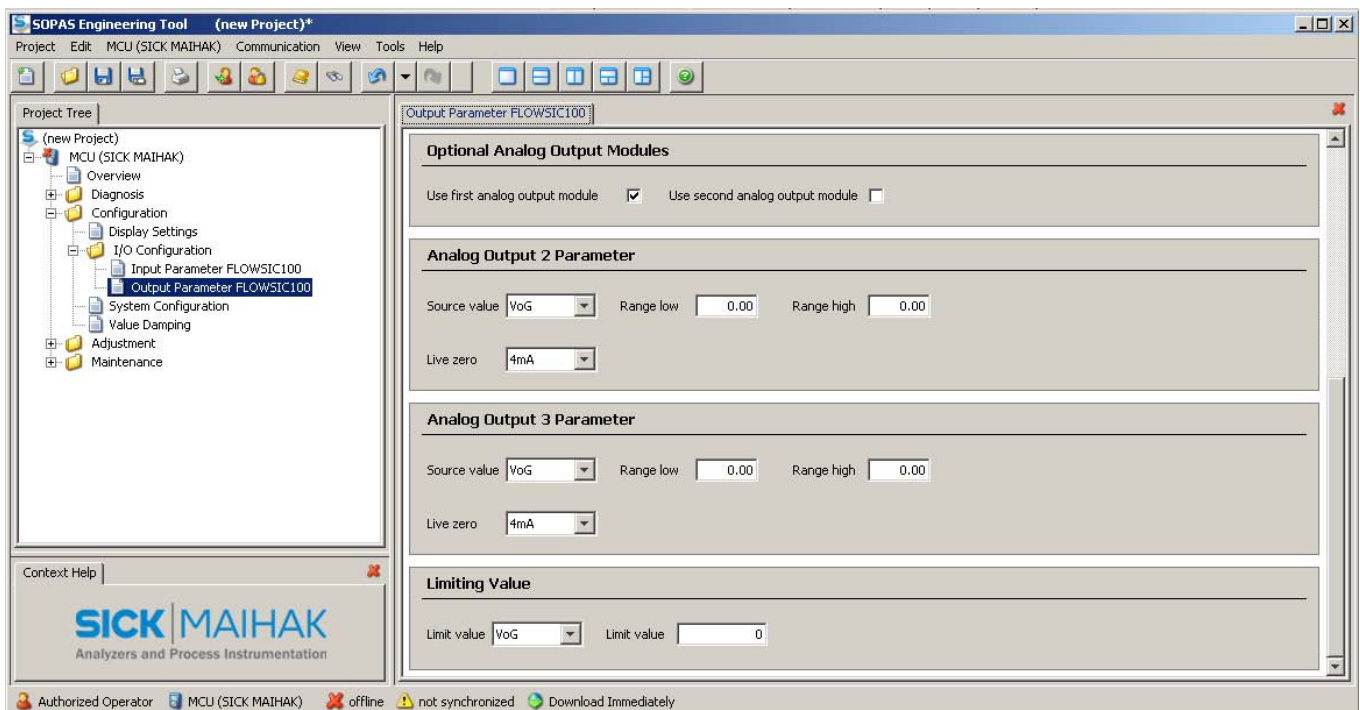


Fig. 4.30: “Configuration / I/O Configuration / Output Parameter FLOWSIC100” subpage

- ▶ If additional analog outputs have to be configured, activate the check box “Use second analog output module”. New dialog boxes for “Analog Output 4 Parameter” and “Analog Output 5 Parameter” are opened.
- ▶ To configure more analog outputs, continue as described above.

### 4.3.3 Configuring optional Interface Modules

The following steps are required for selection and configuration of the optionally available interface modules Profibus DP and Ethernet:

- ▶ Select the type MCU in the "Project Tree" window, enter the password for user level 1 and switch the measuring system to Maintenance Mode (see Section 4.2).
- ▶ Switch to the "Configuration / I/O Configuration / System Configuration" subpage (see **Fig. 4.31**). The installed interface module is displayed in the dialog box "Serial Extension Module".
- ▶ Configure the desired module according to the prerequisites.

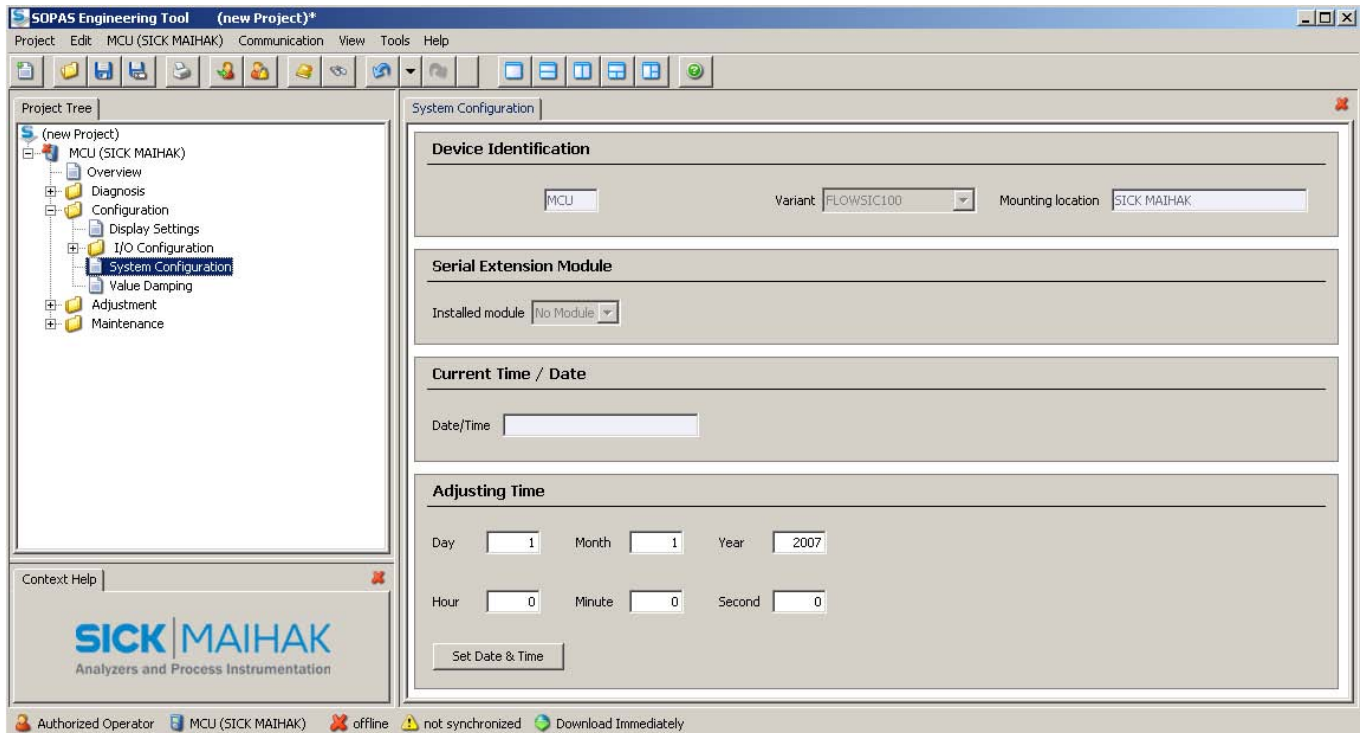


Fig. 4.31: "Configuration / I/O Configuration / System Configuration" subpage

**Note** Two of the eight measured values of every measuring unit can be selected for the cyclical data transfer if the Profibus DP module is installed.



### Assigning a New IP-Address to the Ethernet Module

If an IP-address was specified by the customer when the device was ordered, this address was set by the manufacturer.

If no IP-address was specified, the default address **192.168.0.10** is set.

Complete the following procedure to change the address:

- ▶ Go to the “Network Scan Assistant” and click the “Network Configuration” button.
- ▶ Go to the subpage “Internet Protocol / Internet Protocol (IP)”, activate the check box “Enable IP Communication” and click the “Add” button.
- ▶ Enter the desired IP-address and affirm with the OK button.

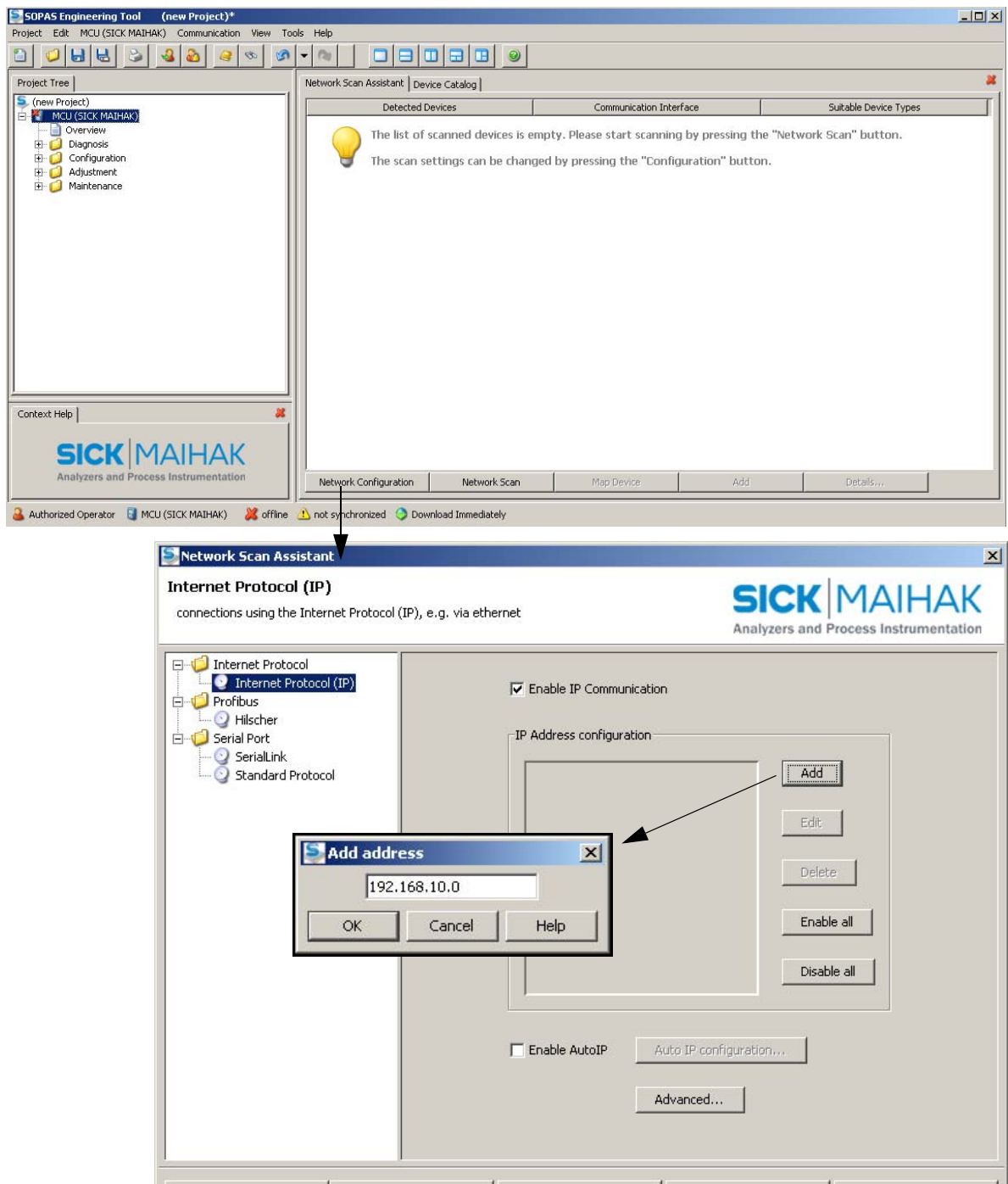


Fig. 4.32: IP address specification (example)

- ▶ In the subpage “Internet Protocol / Internet Protocol (IP)”, click the “Advanced” button (see Fig. 4.32).
- ▶ In the dialog “Advanced scan settings”, activate the “Custom” check box in the “Select TCP Port” area on the right hand (see Fig. 4.33).
- ▶ Enter the port address „2134” and confirm with the “OK” button (all other settings are factory settings as in Fig. 4.33).

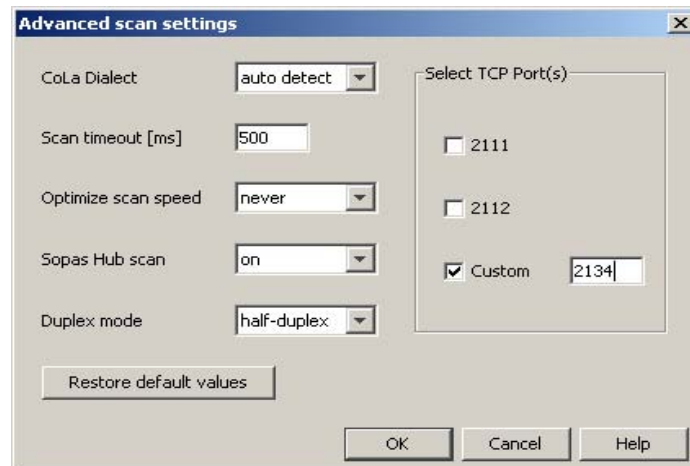


Fig. 4.33: TCP port specification

- ▶ Click the “Network Scan” button (see Fig. 4.32).
- ▶ If the right address has been entered, the components found on the network are displayed as shown in the following figure.

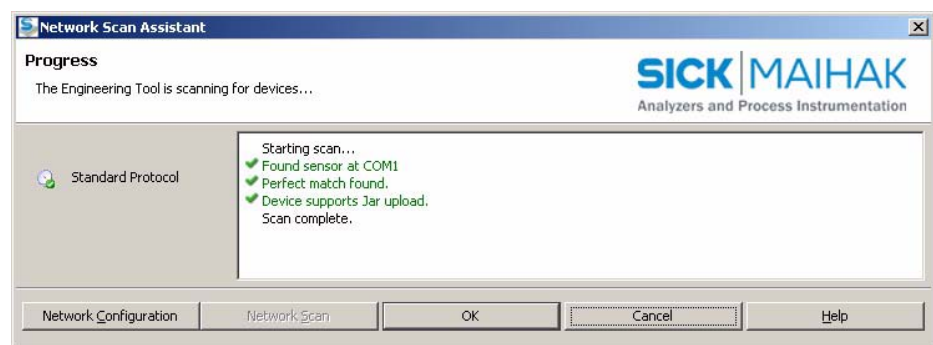


Fig. 4.34: Configuration of Ethernet module (example)

#### 4.3.4 Entering additional Variables for Measured Value Calculation and Calibration

See also Section 2.4

This Section describes parameter settings that are necessary for calibrating gas velocity and temperature measurements, and for outputting the volumetric flow under standard conditions. To do this, set the measuring system to "Maintenance" mode and enter the password level 1. Then choose the type FLOWIC100 in the menu "Device Catalog / Available Devices" and open the "Installation parameters" submenu (see Section 4.2.1).

##### Entering calibration coefficients for gas velocity measurements

Enter the calibration coefficients determined with a network point measurement using a reference system in the group "Calibration coefficients / Calibration coefficients for velocity".

The default settings are:

$Cv\_0$  (absolute) = 0,  $Cv\_1$  (linear) = 1,  $Cv\_2$  (square) = 0,

##### Calibrating temperature measurements

The precision of acoustic temperature measurements conducted with the FLOWIC100 is a square function of the measuring path and the speed of sound of the real gas under normalized conditions (see Section 2.2.2). Exact acoustic temperature measurements are only possible if the speed of sound of the real gas remains constant at a reference temperature. Since this is seldom the case, the internal temperature calculation in the device must be calibrated if it is to be used to normalize the volumetric flow.

**Note:** The speed of sound can be configured in the User Access Level "Service" (see Service Manual). Per default it is set to 331.5 m/s.

To calibrate the measurement, determine the value pairs from separately measured gas temperature (for example, with PT100 sensor) and display on the LCD at a minimum of two different gas temperatures. Convert the calculated values to absolute temperatures (add 273.15 K). You can then use a regression function to calculate the coefficients (for two pairs by linear, with more value pairs also by square regression). Enter  $CT\_2$ ,  $CT\_1$  and  $CT\_0$  in the "Calibration coefficients / Calibration coefficients for temperature" group.

The default settings are  $CT\_2 = 0$ ,  $CT\_1 = 1$ ,  $CT\_0 = 0$ .

**Example:**

Measurement	FLOWIC display		Measured value PT100	
	T in °C	T <sub>absolute</sub> in K	T in °C	T <sub>absolute</sub> in K
1	128	401	115	388
2	186	459	170	443

$$T_{Kal} = CT\_1 \cdot T_{FLOWIC} + CT\_0$$

$$CT\_1 = \frac{T_{PT100} - T_{PT100}}{T_{FLOWIC} - T_{FLOWIC}}$$

$$CT\_0 = \frac{1}{2} \cdot (T_{PT100} + T_{PT100} - CT\_1 \cdot (T_{FLOWIC} + T_{FLOWIC}))$$

$$CT\_1 = 0,9483$$

$$CT\_0 = 7,7310$$

## 4.4 Operation / Configuration with Option LCD Display

### 4.4.1 General Usage

The display and operation interface of the LCD display contain the functional elements displayed in **Fig. 4.35**.

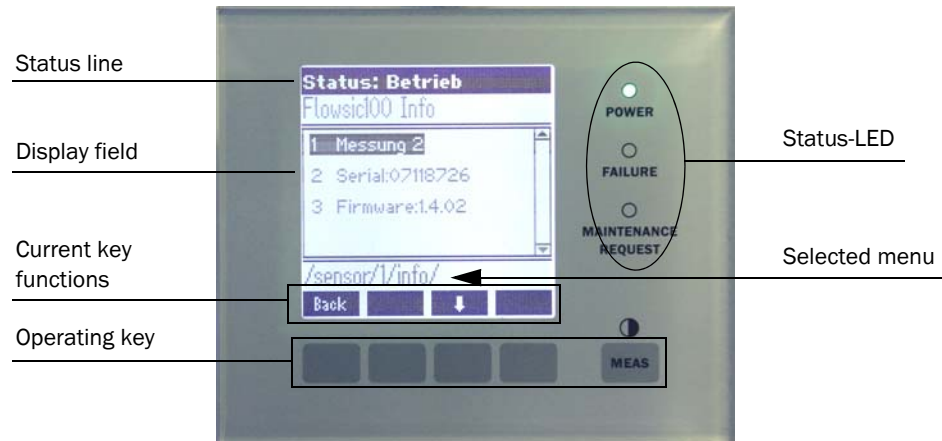


Fig. 4.35: Functional elements LCD display

### Key functions

The key's function depends on the current selected menu. Only the function currently displayed over the key is available.

Key	Function
Diag	Display diagnostic information (warnings and errors at start from the main menu, sensor information on start from the diagnostic menu; see <b>Fig. 4.36</b> )
Back	Go one menu up
Arrow ↑	Scroll up
Arrow ↓	Scroll down
Enter	Start an action that was chosen with the arrow keys (go to submenu, affirmation of selected parameter at configuration)
Start	Start an action
Save	Save a changed parameter
Meas	<ul style="list-style-type: none"> <li>Select a measured value to be displayed</li> <li>Switching between text and graphic display</li> <li>Jumb back to main menu from submenus</li> <li>Display of the contrast settings (after 2.5 s)</li> </ul>

## 4.4.2 Menu Structure

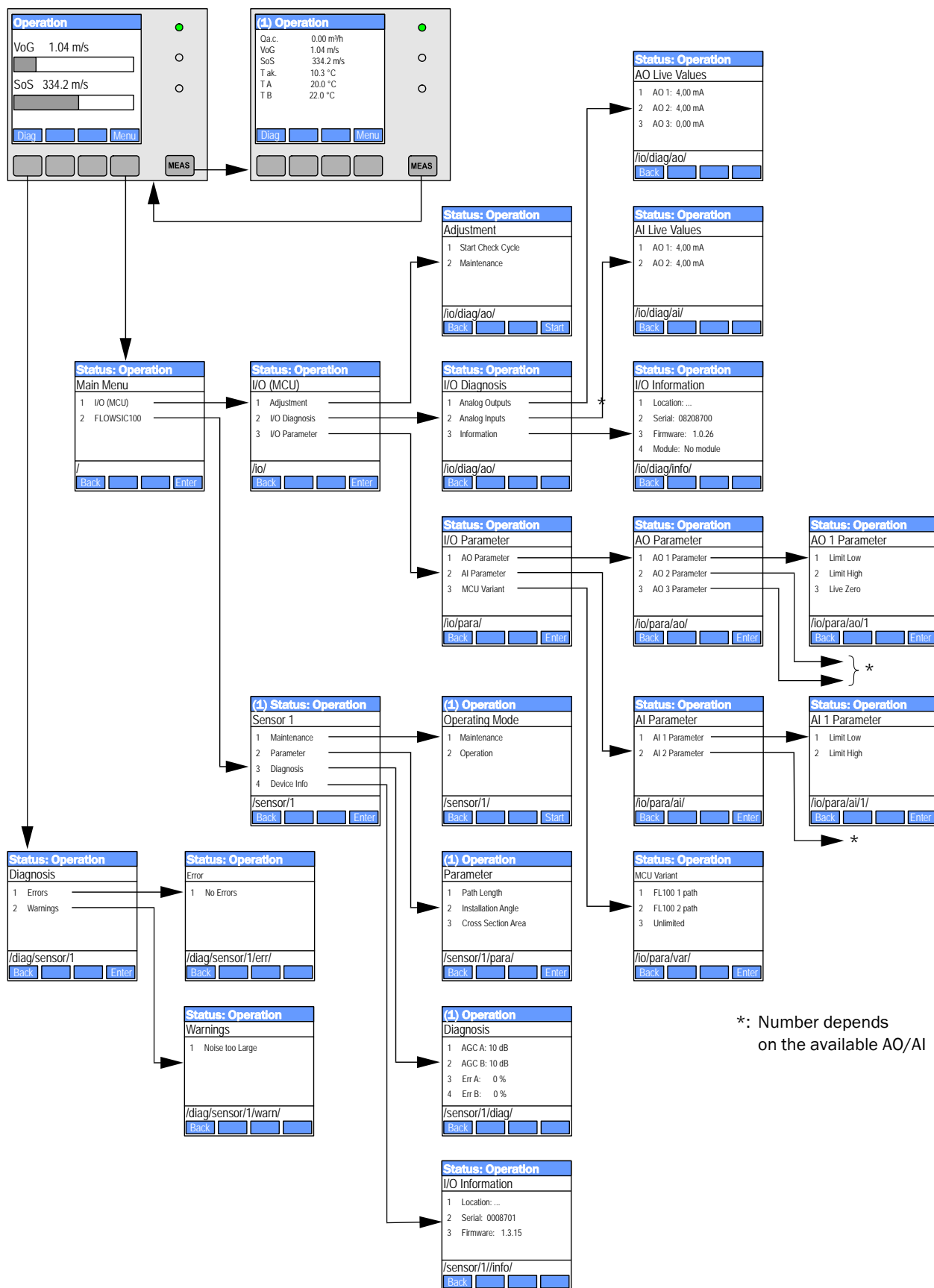


Fig. 4.36: Menu structure of LCD display

### 4.4.3 Configuration

Parameters for input / output (analog input / output) or installation (path length, installation angle, duct diameter) can be changed with the following procedure:

- Go to the appropriate submenu, select the line “Limit Low” or “Limit High” and press “Enter”  
The valid range is displayed in the fields “Min” and “Max”
- Enter the default password “1234” with the keys “^” (scrolls from 0 to 9) and/or “→” (moves the cursor right).
- Select the desired value for “Min” and “Max” with the keys “^” and/or “→” and affirm with “Save”.  
The selected value is saved to the device.

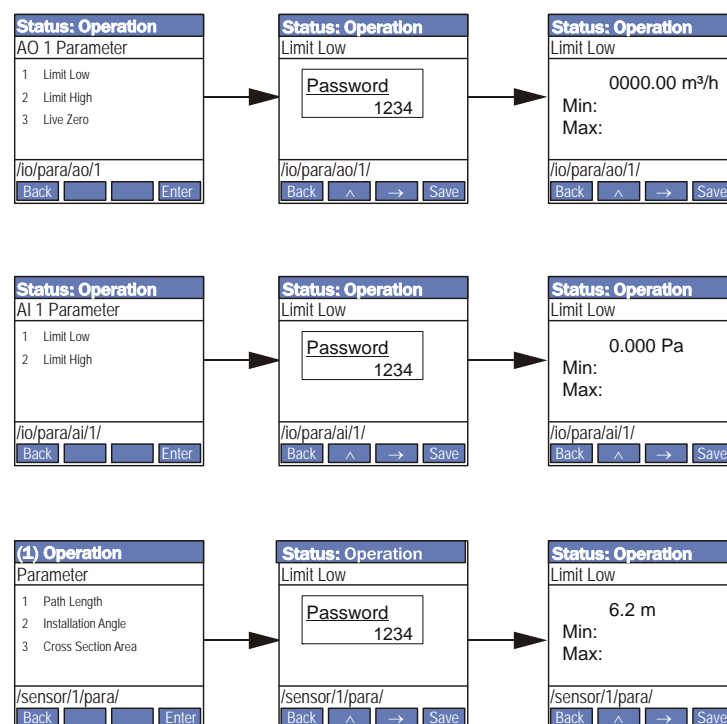


Fig. 4.37: Menu structure for configuration

### 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”.

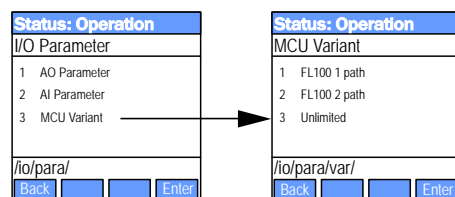


Fig. 4.38: Menu structure for selection of two-path measurement

#### 4.4.5 Configuring the Display Settings with SOPAS ET

To change the factory settings, select the type MCU in the “Project Tree” window, enter the password for user level 1 and go to the “Configuration / Display Settings” subpage.

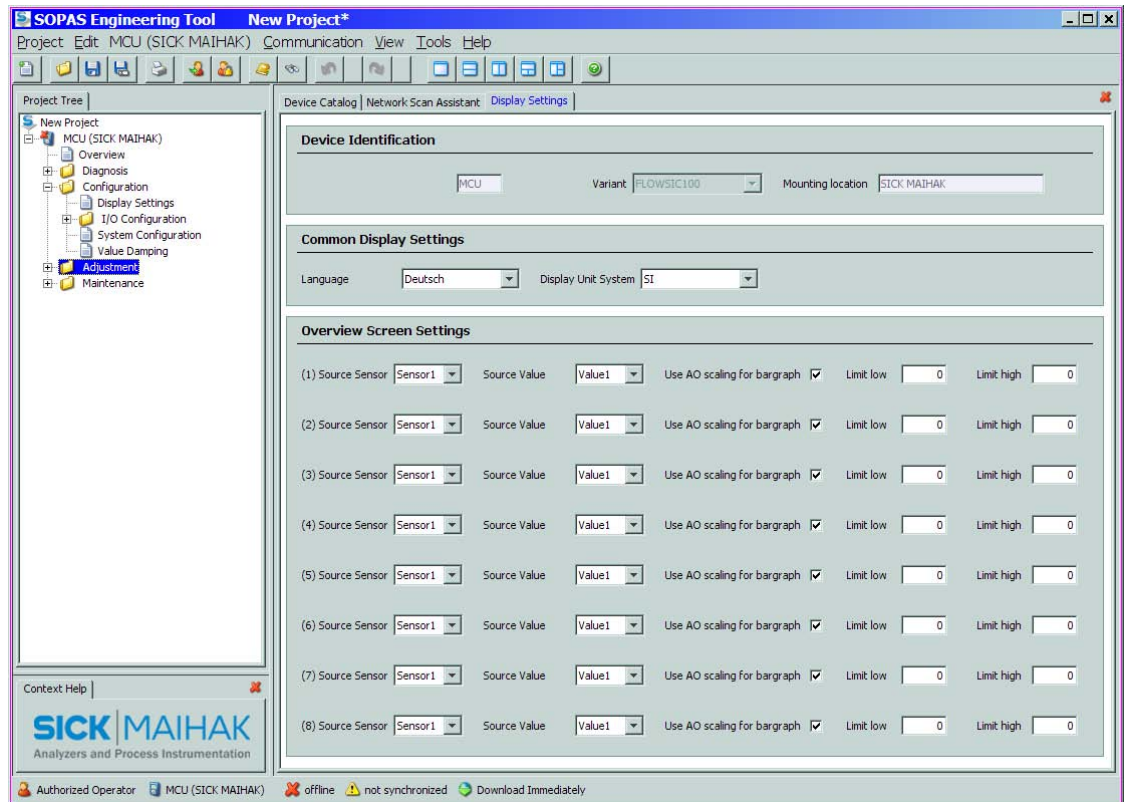


Fig. 4.39: “Configuration / Display Settings” subpage

Field		Description
Common Display Settings	Language	Language used on LCD display
	Display Unit System	Unit system used on LCD display
Overview Screen Settings	Source Sensor (1) to (8)	Sensor address for the first measuring bargraph of the graphic display
	Source Value	Measured value index for the first measured value bar
	Use AO scaling	If active, the measuring bargraph of the corresponding analog output is scaled. If the check box is not checked, the limit values must be defined separately.
	Limit Low	Values for the separate scaling of the measured value bar, independent of the analog output
	Limit High	





**FLAWSIC100**

# **Gas Velocity Monitor**

## **Maintenance**

### **General Notes**

#### **Maintaining the Sender/Receiver Units**

#### **Maintaining the Purge-air Unit of the Internally Cooled Types M-AC and H-AC**

#### **Maintaining the Cooling Air Supply for Device Type PR-AC**

#### **Maintaining the Extern Purge-air Unit Option**



## 5 Maintenance

### 5.1 General Notes

#### Maintenance Strategy

Like any electronic measuring system, the FLOWSiC100 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 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:

- Sender/receiver unit,
- Purge-air unit (for internally cooled and externally purged s/r units only).

Before you carry out these maintenance tasks, set the FLOWSiC100 to Maintenance Mode. You can do this by using an external maintenance switch (connection to the digital input 1), by using the operating and configuration software SOPAS ET or the display option (see Section 4.4.).

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

#### 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 MAIHAK Service department, or an authorized service partner. SICK MAIHAK offers a range of economical maintenance and repair agreements. As part of these agreements, SICK MAIHAK 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).

### Required tools and resources:

- Spanner for hexagon-socket screws, w/s 2 and 4,
- Screwdriver,
- Possibly a blind plug for flange with pipe,
- Brush, clean cloth, alcohol.

### 5.2.1 Removing the Sender/Receiver Units



### Warning

- ▶ Hot and/or aggressive gases can escape at the removal and installation → use suitable safety equipment!
- ▶ Shut the flange with pipe with blank flange after removal of the sender/receiver unit.
- ▶ Carry out repair work only when hot parts have cooled sufficiently!
- ▶ Disconnect the purged sender/receiver units from the purge-air supply only after the removal is complete.

### Activities

- ▶ Loosen the cable connection on the sender/receiver unit by rotating the knurled nut on the plug counterclockwise and carefully removing the plug.
- ▶ Protect the loose cable ends from dirt or moisture. Seal the socket on the sender/receiver unit using the associated cap.



### Important

Moist or corroded contacts will cause malfunctions.

- ▶ Loosen the screws on the sender/receiver unit flange.
- ▶ Carefully remove the sender/receiver unit and place it in a safe location.
- ▶ If necessary (for example, if the duct is pressurized), seal the flange with pipe using a blind plug (available as an option).

### 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.

### 5.3 Maintaining the Purge-air Unit of the Internally Cooled Types M-AC and H-AC

Maintenance activities are:

- inspecting the entire purge-air supply,
- cleaning the filter housing,
- replacing the filter insert, if necessary.

The dust load and wear on the filter insert depend on the degree of contamination of the intake ambient air. For this reason, specific intervals for carrying out these activities cannot be given. We recommend that you inspect the purge-air unit at short intervals (approx. 2 weeks) after commissioning, and then optimize the maintenance intervals over time.




---

#### Important

- Irregular or insufficient maintenance of the purge-air supply can cause it to fail and thus damage the transducers irreparably.
  - The purge-air supply must be guaranteed while the sender/receiver units are installed. Remove the sender/receiver units from the duct before you replace any damaged purge-air hoses.
- 

#### 5.3.1 Inspection

- ▶ Check the running noise of the fan at regular intervals; increases in the noise level can indicate a fan failure.
- ▶ Check that the hoses are secure and free of damage.
- ▶ Check the filter insert for contamination. If the insert is excessively contaminated, remove it, clean the filter housing, and fit a new insert.

The filter insert must be exchanged if:

- you can see high contamination (deposits on the filter surface),
- the purge-air flow is reduced considerably in face of the operation with a new filter element.

**Note:** You do not have to switch off the purge-air unit to clean the filter housing or replace the filter insert. In other words, the sender/receiver units do not have to be removed from the duct.

### 5.3.2 Connection Unit with Integrated Purge-air Supply

#### Cleaning or replacing the filter insert

- ▶ Open the door of the connection unit with the appropriate key.
- ▶ Open the clamping tape at the filter outlet (1) and unplug the filter from the gland (2).
- ▶ Remove the filter housing.
- ▶ Rotate the cover of the filter housing in the direction of the arrow "OPEN" and remove the cover.
- ▶ Remove filter insert and exchange with new insert.
- ▶ Clean inside of filter housing and cover with brush and cloth.



#### Important

Only use a cloth soaked in water to wet-clean the parts. Make sure that the parts are dried well afterwards.

Spare part:  
Filter insert C1140,  
Part No. 7047560

- ▶ Insert the new filter
- ▶ Mount the cover on the filter housing and rotate against the direction of the arrow until it audibly locks into position.
- ▶ Install the filter housing back in the control unit.

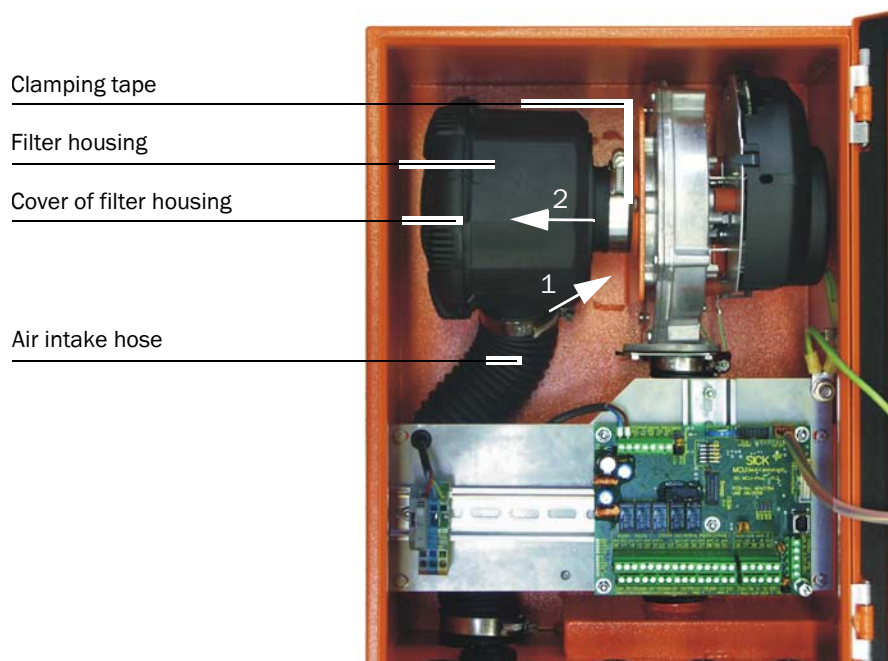


Fig. 5.1: Changing the filter insert for the control unit with purge-air supply

## 5.4 Maintaining the Cooling Air Supply for Device Type PR-AC

Pump exchange see Service Manual

The cooling air is taken in through a membran integrated in the electronics unit and is lead through a filter. The life cycle of this filter and of the pump is approximately 2 years. If the device is used in contaminated ambient air, the life cycle may be shorter.

### Checking the Operation of Filter and Pump

Within the scope of maintenance activities, the operation of the filter must be checked on a regular basis.

- For an easy check, hold a hand to the cooling-air intake-gland: if the filter is properly operating, a negative pressure (suction effect) is perceptible.

### Replacing Pump or Air Filter

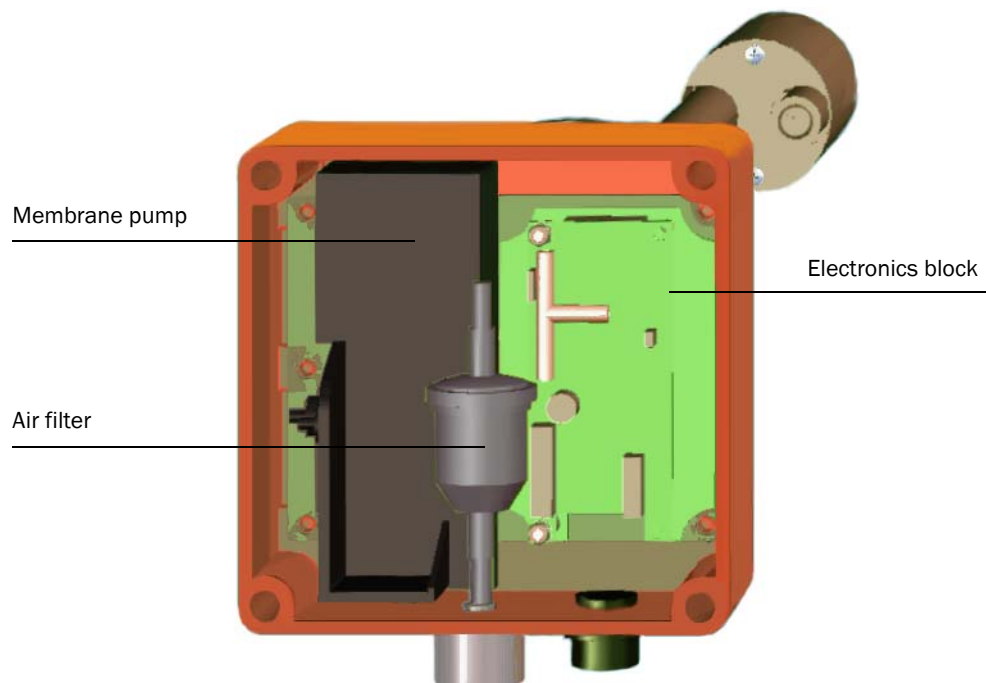


Fig. 5.2: Electronics housing FLSE100-PRAC without cover (hoses are not displayed)

Spare part:

Membran pump 24 V DC

Part No.: 6033117

Air filter complete

Part No, 5314720

- Open the cover of the electronics unit.
- Unplug the hoses from the connectors at the air filter and at the membran pump.
- Remove the air filter and replace it with a new one if necessary.
- To exchange the pump, carefully dismount the carrier plate with pump and electronics.
- Dismount the pump from the carrier plate.
- Mount the new pump on the carrier plate.
- Reassemble the sender/receiver unit in reversed order.



## 5.5 Maintaining the Extern Purge-air Unit Option

The following activities are only necessary, if purged sender/receiver units (types FLSE100-PM, PH, PHS) are used. Maintenance activities are:

- inspecting the purge-air supply,
- cleaning the filter housing,
- replacing the filter insert.

The dust load and wear on the filter insert depend on the degree of contamination of the intake ambient air. For this reason, specific intervals for carrying out these activities cannot be given. We recommend that you inspect the purge-air unit after commissioning at short intervals (1 to 2 weeks) after commissioning, and then optimize the maintenance intervals over time.

The filter insert must be exchanged if:

- high contamination (deposits on the filter surface) are visible,
- the purge-air flow is reduced considerably in face of the operation with a new filter element.



### Important

- Irregular or insufficient maintenance of the purge-air supply can cause it to fail and thus damage the transducers irreparably.
- The purge-air must be maintained at the latest when the low-pressure monitor on the filter outlet is triggered.
- The purge-air supply must be guaranteed while the sender/receiver units are installed. Remove the sender/receiver units from the duct before you replace any damaged purge-air hoses.

**Note:** You do not have to switch off the purge-air unit to clean the filter housing or replace the filter insert. In other words, the sender/receiver units do not have to be removed from the duct.

### 5.5.1 Inspection

- ▶ Check the running noise of the fan at regular intervals; increases in the noise level can indicate a fan failure.
- ▶ Check that the hoses are secure and free of damage.
- ▶ Check the filter insert for contamination. If the insert is excessively contaminated, remove it, clean the filter housing, and fit a new insert.

### 5.5.2 Replacing the filter insert

- ▶ Have a new filter insert (2) at the ready.
- ▶ Loosen the hose clamp (6) on the purge-air hose (7) and remove the hose. Secure the hose at a clean location.



#### Important

Place the end of the hose in a safe place so that impurities cannot be sucked in (this will cause irreparable damage to the fan). During this time, the purge-air entering the purge-air glands is unfiltered.

- ▶ Remove any dust from the outside of the filter housing (1).
- ▶ Press the two quick-release locks (4) on the filter housing cover (3) to remove it.
- ▶ Remove the filter insert (2) by twisting it counterclockwise.
- ▶ Clean the insert of filter housing and housing cover with a cloth and brush.



#### Important

Only use a cloth soaked in water to wet-clean the parts. Make sure that the parts are dried well afterwards.

Spare part:  
Filter insert Micro-Top  
element C11 100,  
Part No. 5306091

- ▶ Insert the new filter insert by twisting it clockwise.
- ▶ Mount the cover on the filter housing, ensuring that it is aligned correctly with the housing, and snap the quick-release locks into position.
- ▶ Connect the purge-air hose to the filter outlet again using the hose clamp.

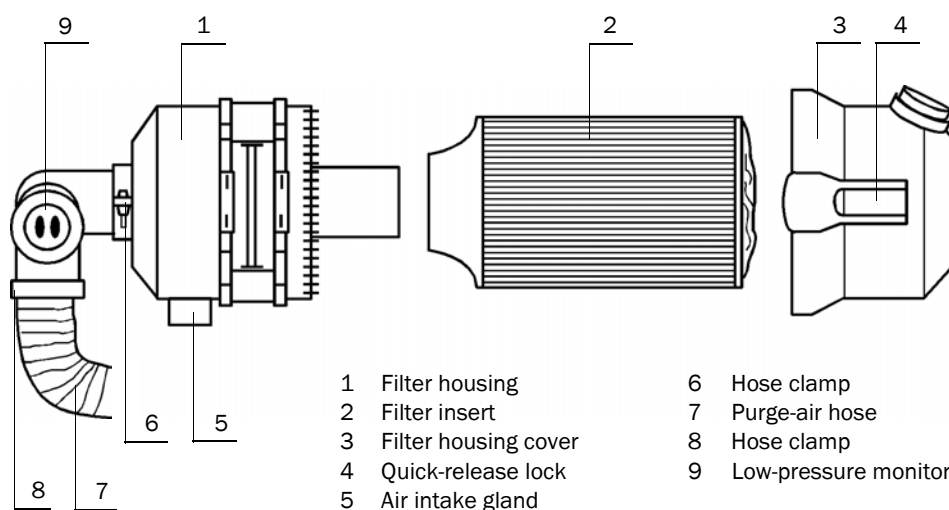


Fig. 5.3: Replacing the filter insert

# FLOWSIC100

## Gas Velocity Monitor

### Parts Overview



Standard Components

Miscellaneous Options

Consumable Parts for 2-Year Operation



## 6 Parts Overview

### 6.1 Standard Components

The standard components required for a complete measuring system depend on the type of signal transmission (analog/digital) and on the mechanical design of the sender/receiver unit. The following table shows the possible combinations and the quantities required:

Sender/receiver unit		Flange with pipe <sup>1)</sup>	Connection cable		Connection box	Control unit		Purge-air unit <sup>2)</sup>
Type	Number		Master	Slave		MCU-N	MCU-P	
FLSE100-M, H	2	2	1	1	1	1	—	—
FLSE100-PR	1	1	-	1	3)	1	—	—
FLSE100-SA/SD	1 each	2	-	1	3)	1	—	—
FLSE100-M-AC, HAC	2	2	1	1	1	—	1	—
FLSE100-PRAC	1	1	-	1	3)	1	—	—
FLSE100-PM, PH, PHS	2	2	1	1	1	1	—	1

1): The flanges with pipe must be suitable for the sender/receiver unit (see the table flanges with pipe; Section 2.3.2)

2): The internal duct pressure must be taken into consideration when selecting the type (see Section 2.3.6)

3): Connection box optional for longer cable lengths

#### 6.1.1 Sender/Receiver Units

The different nominal lengths, probe and transducer materials are defined by abbreviations in accordance with the type code (refer to Section 2.3.1).

#### Standard Versions (gas temperature up to +260 °C)

Name	Part number
FLSE100-M 20SSTI sender/receiver unit	1042678
FLSE100-M 35SSTI sender/receiver unit	1042679
FLSE100-M 55SSTI sender/receiver unit	1042680
FLSE100-M 20TITI sender/receiver unit	1042681
FLSE100-M 35TITI sender/receiver unit	1042682
FLSE100-M 55TITI sender/receiver unit	1042683
FLSE100-M 20HSHS sender/receiver unit	1042684
FLSE100-M 35HSHS sender/receiver unit	1042685
FLSE100-H 20SSTI sender/receiver unit	1042687
FLSE100-H 35SSTI sender/receiver unit	1042688
FLSE100-H 55SSTI sender/receiver unit	1042689
FLSE100-H 75SSTI sender/receiver unit	1042690
FLSE100-H 20TITI sender/receiver unit	1042691
FLSE100-H 35TITI sender/receiver unit	1042692
FLSE100-H 55TITI sender/receiver unit	1042693
FLSE100-H 75TITI sender/receiver unit	1042694
FLSE100-H 35HSHS sender/receiver unit	1042695
FLSE100-H 55HSHS sender/receiver unit	1042696

**Standard Versions as Single-probe version (gas temperature up to +260 °C)**

Name	Part number
FLSE100-PR 35SSTI sender/receiver unit	1042698
FLSE100-PR 55SSTI sender/receiver unit	1042699
FLSE100-PR 75SSTI sender/receiver unit	1042700
FLSE100-PR 35TITI sender/receiver unit	1042701
FLSE100-PR 55TITI sender/receiver unit	1042702
FLSE100-PR 75TITI sender/receiver unit	1042703

**Standard Version (gas temperature up to +150 °C)**

Name	Part number
FLSE100-SA 12SSTI sender/receiver unit	1043745
FLSE100-SD 12SSTI sender/receiver unit	1043742
FLSE100-SA 20SSTI sender/receiver unit	1043749
FLSE100-SD 20SSTI sender/receiver unit	1043747
FLSE100-SA 35SSTI sender/receiver unit	1043746
FLSE100-SD 35SSTI sender/receiver unit	1043743

**Internally Cooled Version (gas temperature up to +450 °C)**

Name	Part number
FLSE100-MAC 35SSTI sender/receiver unit	1042771
FLSE100-MAC 55SSTI sender/receiver unit	1042772
FLSE100-MAC 35TITI sender/receiver unit	1042773
FLSE100-MAC 55TITI sender/receiver unit	1042774
FLSE100-HAC 35SSTI sender/receiver unit	1042775
FLSE100-HAC 55SSTI sender/receiver unit	1042776
FLSE100-HAC 35TITI sender/receiver unit	1042777
FLSE100-HAC 55TITI sender/receiver unit	1042778

**Internally Cooled Version as Measuring Probes (gas temperature up to +350 °C)**

Name	Part number
FLSE100-PRAC 55SSTI sender/receiver unit	1042793
FLSE100-PRAC 75SSTI sender/receiver unit	1026405
FLSE100-PRAC 55TITI sender/receiver unit	1042794
FLSE100-PRAC 75TITI sender/receiver unit	1042795

**Purged Version (gas temperature up to +450 °C)**

Name	Part number
FLSE100-PM 20SSTI sender/receiver unit	1042674
FLSE100-PM 35SSTI sender/receiver unit	1042675
FLSE100-PM 55SSTI sender/receiver unit	1042676
FLSE100-PM 75SSTI sender/receiver unit	1042677
FLSE100-PH 20SSTI sender/receiver unit	1042659
FLSE100-PH 35SSTI sender/receiver unit	1042660
FLSE100-PH 55SSTI sender/receiver unit	1042661
FLSE100-PH 75SSTI sender/receiver unit	1042662
FLSE100-PH 20TITI sender/receiver unit	1042663
FLSE100-PH 35TITI sender/receiver unit	1042664
FLSE100-PH 55TITI sender/receiver unit	1042665
FLSE100-PH 75TITI sender/receiver unit	1042666
FLSE100-PHS 35SSTI sender/receiver unit	1042667
FLSE100-PHS 55SSTI sender/receiver unit	1042668
FLSE100-PHS 75SSTI sender/receiver unit	1042669

**6.1.2 Flanges with Tube**

Name	Part number	For FLSE100 type
Flange with tube D70ST200 Material St37, nominal length 200 mm	7042106	H, PM, PH
Flange with tube D70ST350 Material St37, nominal length 350 mm	7042109	H, PR, PM, PH
Flange with tube D70ST550 Material St37, nominal length 550 mm	7042110	
Flange with tube D70ST750 Material St37, nominal length 750 mm	7042247	
Flange with tube D70SS200 Material VA, nominal length 200 mm	7042111	H, PM, PH
Flange with tube D70SS350 Material VA, nominal length 350 mm	7042112	H, PR, PM, PH
Flange with tube D70SS550 Material VA, nominal length 550 mm	7042213	
Flange with tube D70SS750 Material VA, nominal length 750 mm	7042249	
Flange with tube D114ST350 Material St37, nominal length 350 mm	2033106	PHS
Flange with tube D114ST550 Material St37, nominal length 550 mm	7042356	
Flange with tube D114ST750 Material St37, nominal length 750 mm	7041949	
Flange with tube D50ST125 Material St37, nominal length 125 mm	7042279	SA, SD
Flange with tube D50ST200 Material St37, nominal length 200 mm	7042280	M, SA, SD
Flange with tube D50ST350 Material St37, nominal length 350 mm	7042281	
Flange with tube D50ST550 Material St37, nominal length 550 mm	7042282	M
Flange with tube D50SS125 Material St37, nominal length 125 mm	7042284	SA, SD

Name	Part number	For FLSE100 type
Flange with tube D50SS200 Material VA, nominal length 200 mm	7042285	M, SA, SD
Flange with tube D50SS350 Material VA, nominal length 350 mm	7042286	
Flange with tube D50S550 Material VA, nominal length 550 mm	7042287	M

### 6.1.3 Connection Cable

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

### 6.1.4 Control Unit MCU

Name	Part number
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
MCU-PWONN00000NN control unit in wall housing (orange), Supply voltage 90 ... 250 V AC, with purge-air unit, without display	1040668
MCU-PWODN00000NN control unit in wall housing (orange), Supply voltage 90 ... 259 V AC, with purge-air unit, with display	1040676
MCU-P2ONN00000NN control unit in wall housing (orange), Supply voltage 24 V DC, with purge-air unit, without display	1040670
MCU-P2ODN00000NN control unit in wall housing (orange), Supply voltage 24 V DC, with purge-air unit, with display	1040678

### 6.1.5 Miscellaneous

Name	Part number
Purge-air hose DN 25, length 3 m	7047535
Purge-air hose DN 25, length 10 m	7047536
Connection box for connection cable	2046418
Damping set K100	2042503



## 6.2 Options

### 6.2.1 Control Units

Name	Part number
MCU-NWON control unit in 19"-housing, Supply voltage 90 ... 250 V AC, without display	1040681
MCU-NWOD control unit in 19"-housing, Supply voltage 90 ... 250 V AC, with display	1040675
MCU-N2ON control unit in 19"-housing, Supply voltage 24 V DC, without display	1040682
MCU-N2OD control unit in 19"-housing, Supply voltage 24 V DC, with display	1040677
<b>Optional Modules</b>	
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
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
Connection cable for interface module	2040976

### 6.2.2 Purge-air Units

Name	Part number
Purge-air unit with 2BH13 fan and purge-air hose, length 5 m	1012424
Purge-air unit with 2BH13 fan and purge-air hose, length 10 m	1012409
Purge-air unit with 2BH14 fan and purge-air hose, length 5 m	2006979
Purge-air unit with 2BH14 fan and purge-air hose, length 10 m	1013461
Purge-air unit in connection box SLV-AK 230 V	7040289
Purge-air unit in connection box SLV-AK 24 V	1029127
Purge-air hose DN 40, bulk ware	5304683
Adapter 40-25	7047019

### 6.2.3 Weatherproof Cover

Name	Part number
Weatherproof cover for purge-air unit	5306108

### 6.2.4 Miscellaneous

Name	Part number
Mounting set 2D4-1.4571/PA (for terminal box for connection cable)	2031890
Rebound protector for transducer (for FLSE100-PM, PH, H)	2035283
Rebound protector for transducer (for FLSE100-PHS)	7041980
Purge-air reducer set	7042093
Hook wrench (for FLSE100-H)	7042115
Optical alignment device	1700462
DME 2000 distance sensor	1010578

### 6.3 Consumable Parts for 2-Year Operation

The ultrasonic transducers are exposed to the gas flow directly. Signs of wear can appear after more or less long time with that. Since the respective action time very strongly, however, depends on the concrete application conditions (gas composition, gas temperature) and the transducers can work for favorable conditions (no corrosive gases, low dust contents, no very high gas temperatures) without malfunctions over a long action time, these parts are listed as spare parts. They only have to be exchanged when malfunctions are signaled.

#### Purge-air Unit Extern

Name	Number	Part number
Filter insert	4	5306091

#### Control Unit MCU-P

Name	Number	Part number
Filter insert C1140	1	7047560

#### FLSE100-PRAC

Name	Number	Part number
Pump Mem 5,0 l/min, 24 DC pressure	1	6033117
Air filter WF3 complete	1	5314720

# FLOWSIC 100

## Gas Velocity Monitor

### Appendix

Password





## 9 Appendix

### 9.1 Password

User level		Password
0	"Operator"	none
1	"Authorized Operator"	"sickoptic"





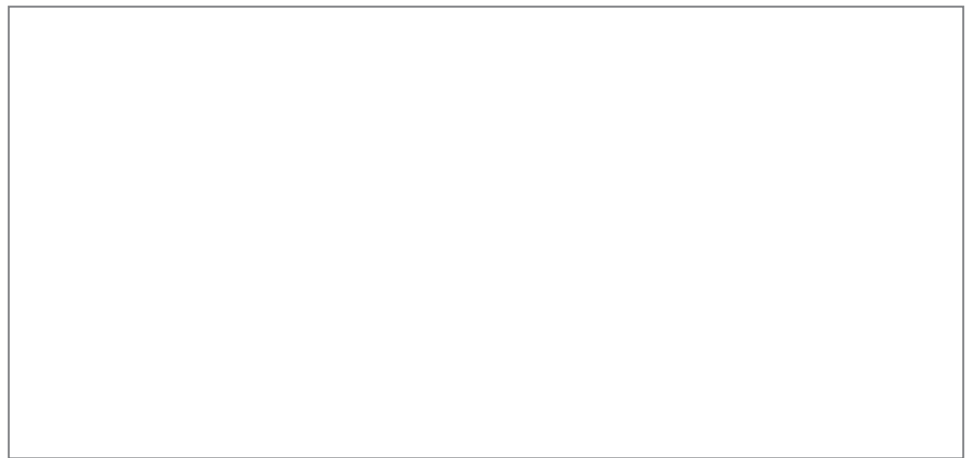
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