

Operating Instructions

FLAWSIC200

Flow Velocity Monitor



Described product

Product name: FLOW SIC200

Manufacturer

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

Legal information

This work is protected by copyright. Any rights derived from the copyright shall be reserved for Endress+Hauser SICK GmbH+Co. KG. Reproduction of this document or parts of this document is only permissible within the limits of the legal determination of Copyright Law.

Any modification, abridgment or translation of this document is prohibited without the express written permission of Endress+Hauser SICK GmbH+Co. KG.

The trademarks stated in this document are the property of their respective owner.

© Endress+Hauser SICK GmbH+Co. KG. All rights reserved.

Original document

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



Warning symbols



Hazard (general)



Hazard through voltage

Warning levels / signal words

DANGER

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

WARNING

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

CAUTION

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

NOTICE

Hazard which *could* result in property damage.

Information symbols



Important technical information for this product



Supplementary information

1	Important information	7
1.1	Function of this document	8
1.2	Scope of application	8
1.3	Target groups	8
1.4	Data integrity	9
1.5	Intended use	9
1.6	Safety information and protective measures	10
1.6.1	General information	10
1.6.2	Basic safety information	11
1.6.3	Recognizing malfunctions	11
1.6.4	Preventing damage	12
2	Product description	13
2.1	System overview, functional principle	14
2.1.1	System overview	14
2.1.2	Communication between sender/receiver units and control unit	15
2.1.3	Functional principle	16
2.2	System components	18
2.2.1	FLSE200 sender/receiver unit	18
2.2.2	Bracket for sender/receiver unit	19
2.2.3	MCU control unit	20
2.2.4	Connection cable	25
2.2.5	Mounting kit	26
2.3	Computations	27
2.3.1	Flow velocity calibration	27
2.3.2	Temperature calibration	27
2.3.3	Response time	27
2.4	Check cycle	28
2.4.1	Zero point check	28
2.4.2	Span test	28
2.4.3	Check cycle output on the analog output	29
3	Assembly and installation	31
3.1	Project planning	32
3.1.1	Planning steps	32
3.1.2	Requirements for the installation location for the sender/receiver units	32
3.2	Assembly	34
3.2.1	Fitting the brackets for the sender/receiver units	34
3.2.2	Setting the bus systems	35
3.2.2.1	Check the termination	35
3.2.2.2	Bus addressing via hardware setting	36
3.2.3	Fitting the sender/receiver units	37
3.2.4	Aligning the sender/receiver units	39
3.2.5	Installing the junction box	40
3.2.6	Installing the MCU control unit	41

3.3	Installation	42
3.3.1	General information, prerequisites	42
3.3.2	Information on wiring	43
3.3.2.1	Cable specification (connection of a measuring point)	44
3.3.2.2	Cable lengths	45
3.3.3	Connecting sender/receiver units and junction boxes	45
3.3.4	Connecting the control unit with wall housing	46
3.3.5	Connecting the control unit in the 19" housing	51
4	Commissioning and parameterization	55
4.1	Basics	56
4.1.1	General information	56
4.1.2	Installing the SOPAS ET program	56
4.1.3	Connecting to the device	58
4.1.3.1	Changing the language	58
4.1.3.2	Connecting to the device via the "Device family" mode (recommended search settings)	59
4.1.3.3	Connect to the device with advanced mode	61
4.1.4	Information on using the program	64
4.2	Standard commissioning procedure	67
4.2.1	Assigning sensors	68
4.2.2	Activating connected sender/receiver units	69
4.2.3	Assigning the measuring system to the measuring location	70
4.2.4	Entering system data	71
4.2.5	Setting the check cycle	72
4.2.6	Configuring the analog output	73
4.2.7	Configuring the analog inputs	75
4.2.8	Configuring the limit value relay	76
4.2.9	Setting the response time (damping time)	77
4.2.10	Output flow direction	78
4.2.11	Data backup	79
4.2.12	Starting normal measuring operation	82
4.3	Advanced commissioning	85
4.3.1	Parameterizing optional analog and digital output modules	85
4.3.1.1	Analog outputs	85
4.3.1.2	Digital outputs	86
4.3.1.3	Assigning and configuring limit value switches to optional digital outputs	88
4.3.2	Configuring optional Interface modules	89
4.3.2.1	General information	89
4.3.2.2	Changing the field bus address for the Profibus module	90
4.3.2.3	Configuring the Ethernet module	91
4.3.3	Calibrating velocity and temperature measurement	92
4.3.4	Bus addressing using SOPAS ET	93
4.3.5	Configuring automatic system restart	94

4.4	Operating / parameterization with the LC display option	95
4.4.1	General information on use	95
4.4.2	Menu structure	96
4.4.3	Configuring	96
4.4.3.1	MCU	96
4.4.3.2	Sender/receiver units	98
4.4.4	Changing the display settings with SOPAS ET	99
5	Maintenance	101
5.1	General	102
5.2	Measures to be taken when cleaning the tunnel	103
6	Malfunctions	105
6.1	General information	106
6.1.1	Implausible measured values	107
6.1.2	General system malfunctions	107
6.2	Sender/receiver unit	108
6.3	Control unit	109
7	Specification	111
7.1	Technical data	112
7.2	Dimensions, Part Nos.	113
7.2.1	Sender/receiver units	113
7.2.2	Bracket for sender/receiver unit	115
7.2.3	MCU control unit	116
7.2.4	Junction box	117
7.3	Accessories	118
7.3.1	Accessories for mounting	118
7.3.2	Connection cable, sender/receiver unit - junction box	118
7.4	Options	118
7.4.1	MCU control unit	118
7.4.2	Miscellaneous	119
7.5	Consumable parts for 2-years operation	119
7.6	Password	120

FLAWSIC200

1 Important information

Function of this document

Intended use

Safety information and protective measures

1.1 **Function of this document**

These Operating Instructions describe for the FLOWSIC200 measuring system:

- Device components
- Installation
- Operation
- For the maintenance work required for safe operation, detailed information on function testing/device setting, data backup, software update, fault and error handling and possible repairs, see the Service Manual.

Retention of documents

- ▶ Keep these Operating Instructions and all associated documents available for reference.
- ▶ Pass the documents on to a new owner.

1.2 **Scope of application**

These Operating Instructions apply exclusively to the FLOWSIC200 measuring system with the described system components.

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

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

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

1.3 **Target groups**

This Manual is intended for persons who install, operate and maintain the device.

Requirements for personnel qualification

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

The persons named must have precise knowledge of operational hazards, e.g. due to low voltage, hot, toxic, explosive or pressurized gases, gas-liquid mixtures or other media, as well as sufficient knowledge of the measuring system through training.

1.4

Data integrity

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

Endress+Hauser always assumes that the customer ensures the integrity and confidentiality of data and rights affected in connection with the use of the products.

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

1.5

Intended use

Purpose of the device

The FLOWSIC200 measuring system is used for non-contact measurement of flow velocity and air temperature in traffic tunnels (road, railroad tunnels) or can be used in other tunnel facilities.

Correct use

- ▶ Only use the device as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- ▶ Observe all measures necessary for conservation of value, e.g., for maintenance and inspection and/or transport and storage.
- ▶ Do not remove, add or modify any components to or on the device unless described and specified in the official manufacturer information. Otherwise, the device could become a hazard, any warranty of the manufacturer is void.

1.6

Safety information and protective measures

1.6.1

General information**WARNING: General information**

Improper use or handling can cause health or material damage. Read this Section carefully and ensure you observe the safety precautions during all work on the FLOWSIC200, as well as the warning and caution information in the individual Sections of these Operating Instructions.

Adhere to the following:

- ▶ The relevant legal stipulations and associated technical regulations must be observed when preparing and carrying out work on the installation.
- ▶ All work must be carried out in accordance with the local, system-specific conditions and with due consideration to operating hazards and specifications.
- ▶ The Operating Instructions belonging to the measuring system as well as system documentation must be available on site. Always observe the information on the prevention of injuries and damage given therein.

**WARNING: Danger through power voltage**

The FLOWSIC200 measuring system is an item of electrical equipment designed for use in industrial high-voltage systems.

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

**WARNING: Hazards through ultrasonic signals**

Do not expose unprotected hearing to the sonic beam of the transducer.

- ▶ Wearing suitable hearing protection is recommended when inspecting the duct, connecting the device outside the duct or similar activities.

**NOTICE:**

The user must ensure:

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



NOTICE:

The operator must ensure the following to avoid malfunctions that can indirectly or directly lead to injuries to persons or material damage:

- ▶ The responsible maintenance personnel are at hand at all times and as quickly as possible,
- ▶ The maintenance personnel are adequately qualified to react correctly to malfunctions of the measuring system and any resulting operational interruptions (e.g., when used for measurement and control purposes),
- ▶ The malfunctioning equipment is switched off immediately in case of doubt and that switching off does not cause collateral malfunctions.

1.6.2

Basic safety information

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

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

- ▶ Only put the FLOWSIC200 into operation after reading the Operating Instructions.
- ▶ Observe all safety information.
- ▶ If anything is not clear: Please contact Endress+Hauser Customer Service.
- ▶ Only use the FLOWSIC200 measuring system as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- ▶ Do not carry out any work or repairs on the FLOWSIC200 not described in this Manual.
- ▶ Do not remove, add or modify any components to or on the FLOWSIC200 unless described and specified in the official manufacturer information.
- ▶ Only use accessories approved by the manufacturer.
- ▶ Do not use damaged components or parts.
- ▶ If you do not follow these guidelines, the following applies:
 - ▶ Any warranty by the manufacturer becomes void
 - ▶ The FLOWSIC200 can become dangerous
 - ▶ The approval for use in potentially explosive atmospheres is no longer valid.

1.6.3

Recognizing malfunctions

Any deviations from normal operation must be regarded as a serious indication of a functional impairment. This includes, amongst others:

- Significant drifts in measured results
- Increased power consumption
- Increased temperatures of system components
- Triggering of monitoring devices
- Unusually strong vibrations or unusual operating noise from a purge air/cooling air blower
- Smells or smoke emission

1.6.4

Preventing damage

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

- The responsible maintenance personnel are at hand at all times and as quickly as possible
- The maintenance personnel is sufficiently qualified to respond to malfunctions on the FLOWSIC200 and any resulting operational malfunctions
- Malfunctioning equipment is switched off immediately in case of doubt and that switching off does not cause collateral failures

FLOWSIC200

2 Product description

System overview, functional principle

System components

Computations

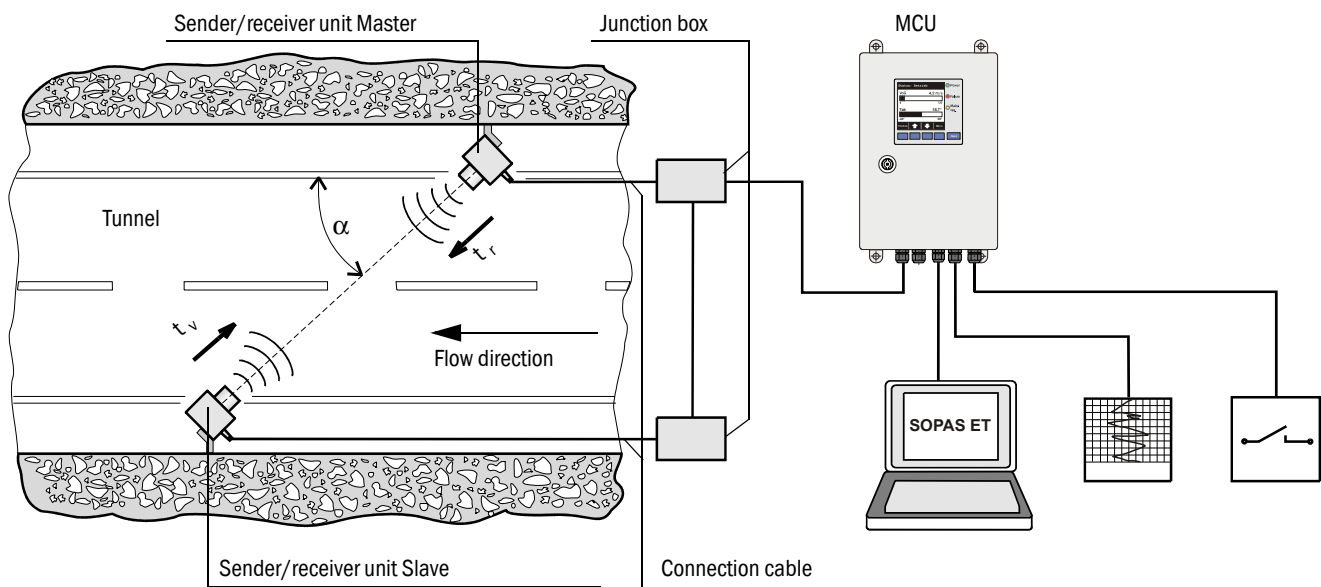
Check cycle

2.1 System overview, functional principle

2.1.1 System overview

- ▶ FLSE200 sender/receiver unit for transmitting and receiving ultrasonic pulses
- ▶ Bracket for FLSE200 for mounting the sender/receiver units on the tunnel wall
- ▶ MCU control unit For control, evaluation and output of data of sensors connected via RS485 interface
- ▶ Connection cable Junction box for connection cable
- ▶ Connection cable to connect the FLSE200 to the junction box

Fig. 1 FLOWVIC200 system components



2.1.2 **Communication between sender/receiver units and control unit**

Standard version

The two sender/receiver units (FLSE) work as Master and Slave. The master FLSE has a second interface to be able to completely separate communication to the slave FLSE and to the MCU. The master triggers the slave and controls measurement. The MCU can request measured values from the master unit independent of the measuring cycle (asynchronous). For wiring, the junction box is installed on both FLSEs. Interface division runs in the master FLSE junction box.

Fig. 2 Bus connection FLSE200 - MCU with one measuring point

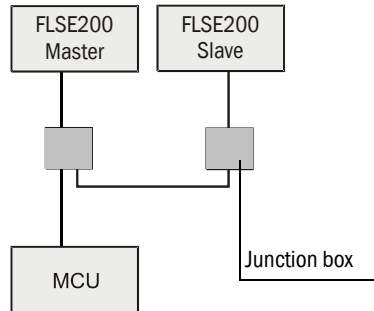
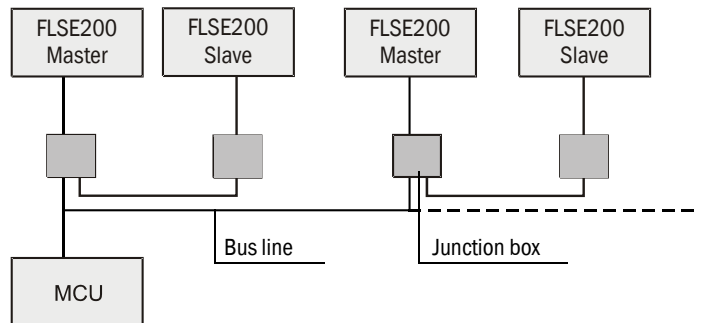


Fig. 3 Bus connection FLSE200 - MCU with several measuring points



With the bus version, up to eight sensors can be connected to one MCU.



NOTICE:

- ▶ For bus wiring, the factory-set termination must be disabled in the system components not at the end of the line.
- ▶ To ensure the power supply for all connected measuring points, follow the instructions on → p. 45, §3.3.2.2.
- ▶ The S/R units of the FLOWSIC200 must be set to address 1 ... 7 on the hardware side (→ p. 36, §3.2.2.2).
- ▶ The physical order of the sensors on the bus does not necessarily have to match the logical address assignment, it is just not allowed to assign addresses twice.

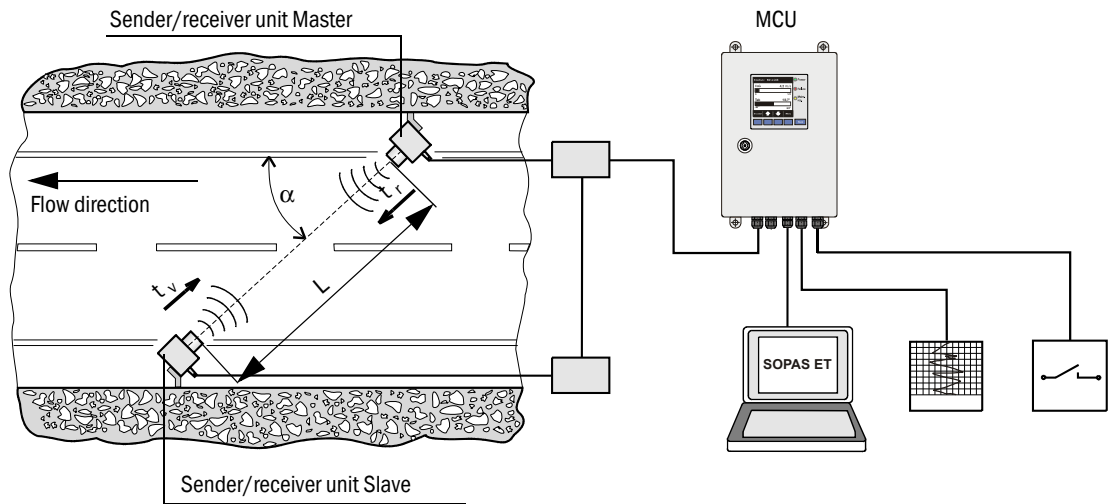
2.1.3 **Functional principle**

The FLOWSIC200 works according to the principle of ultrasonic transit time difference measurement. Sender/receiver units are mounted on both sides of a tunnel at a certain angle of inclination to the gas flow (→ Fig. 4).

The sender/receiver units contain piezoelectric ultrasonic transducers which operate alternately as senders and receivers. The sound pulses are emitted at an angle α to the flow direction. Depending on angle α and the flow velocity, 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 higher the flow velocity and the smaller the angle to the flow direction are, the higher the difference in the transit times of the sound pulses.

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

Fig. 4 Functional principle of the FLOWSIC200



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

- v = Flow velocity in m/s
- L = Measuring distance in m
- α = Angle of inclination in °
- t_v = Sound transit time in flow direction
- t_r = Sound transit time against the flow

Determining the flow velocity

Measuring path L is equal to the active measuring distance, that is, the free flowing distance. Given measuring path L, sound velocity c, and angle of inclination α between the sound and flow direction, the following applies for the transit time of the sound when sound is emitted in flow direction (forward direction):

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

Valid against the flow is:

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

The resolution to v gives:

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

A relation in which, apart from the two measured transit times, only the active measuring distance and the angle of inclination are constants.

Determining the air temperature

The temperature dependency of the sound velocity allows using the calculated transit times to determine the air temperature.

Simultaneous detection of flow velocity and temperature can be used to warn of icy conditions when the road surface is wet and temperatures are below or around freezing point.

The sound velocity is obtained by resolving to c:

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

For the temperature dependence of the sound velocity, the following applies with standard sound velocity c_0 at 0 °C (= 331.4 m/s) and air temperature ϑ in °C:

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

This results in the following for the air temperature:

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

Formula 2.6 shows that the determined temperature depends not only on the measured transit times but also quadratically on the measuring distance and the standard sound velocity.



This means precise temperature measurement is only possible when measuring distance L has been determined very accurately and a calibration has been carried out (→ p. 92, §4.3.32) and the air composition is constant.

2.2 **System components**

2.2.1 **FLSE200 sender/receiver unit**

The sender/receiver unit consists of the electronics unit and the ultrasonic transducer. The electronics unit contains all the necessary assemblies for signal processing, digitalization and communication. The ultrasonic transducer is firmly connected to the enclosure.

The sender/receiver unit is supplied with 24 V. Communication to the MCU is via a bus-capable serial connection.

The sender/receiver units are available in three versions:

Sender/receiver unit type		
FLSE200-M	FLSE200-HM	FLSE200-H
Use without special requirements	Use in highly saline ambient air	Use in highly saline ambient air, for large measuring distances or interference with ultrasonic transmission
Aluminum transducer, medium power, in protective tube made of aluminum	Titanium transducer, medium power	Titanium transducer, high power
Electronics unit housing made of aluminium, anodized, powder-coated and painted grey	Electronics unit housing made of stainless steel V4A	Electronics unit housing made of stainless steel V4A
Measuring distance 5 ... 25 m		Measuring distance 5 ... 40 m

The protective tube of the FLSE200-M serves to protect the ultrasonic transducer from excessive contamination and mechanical damage (e.g. during tunnel cleaning).

Fig. 5 FLSE200-M sender/receiver unit

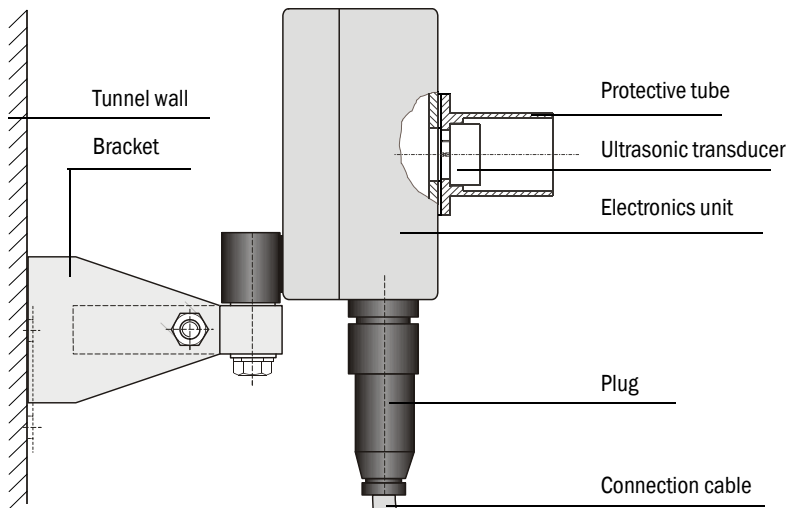
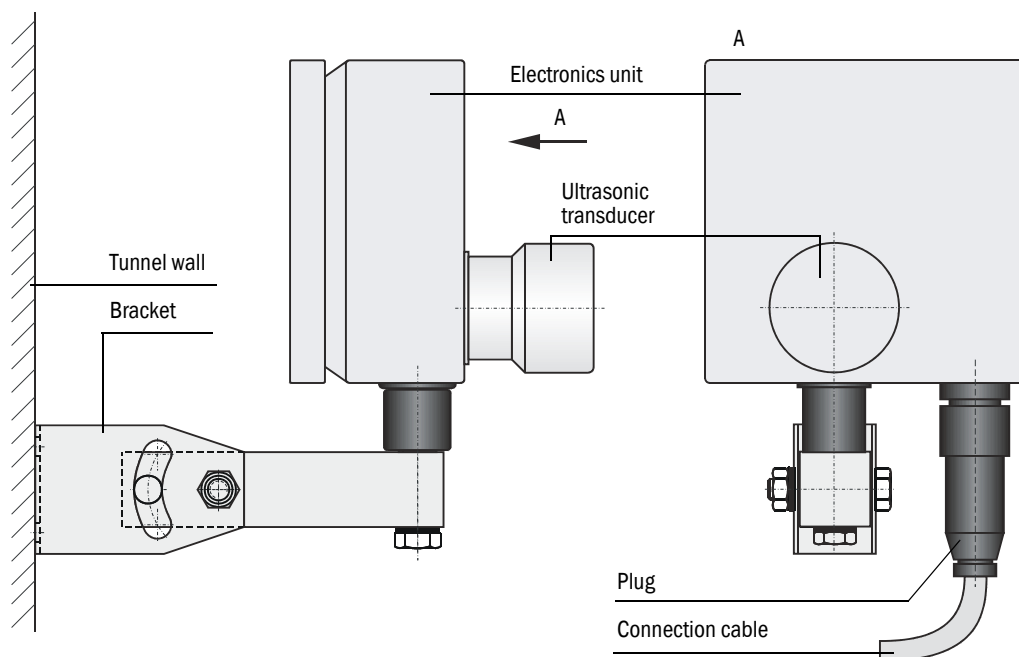


Fig. 6 FLSE200-H, FLSE200-HM sender/receiver unit



2.2.2 **Bracket for sender/receiver unit**

The bracket serves mounting the sender/receiver unit. It also allows the FLSE200s to be aligned with each other with the required accuracy. Two hexagonal bolts and dowels serve to fasten the bracket on the tunnel wall (or ceiling).

The brackets are adapted to the respective sender/receiver unit design, i.e. there are two types:

- ▶ Bracket for FLSE200-M (→ p. 18, Fig. 5)
Parts made of stainless steel and aluminium.
- ▶ Bracket for FLSE200-H or FLSE200-HM (→ Fig. 6)
All parts made of stainless steel.

2.2.3 **MCU control unit**

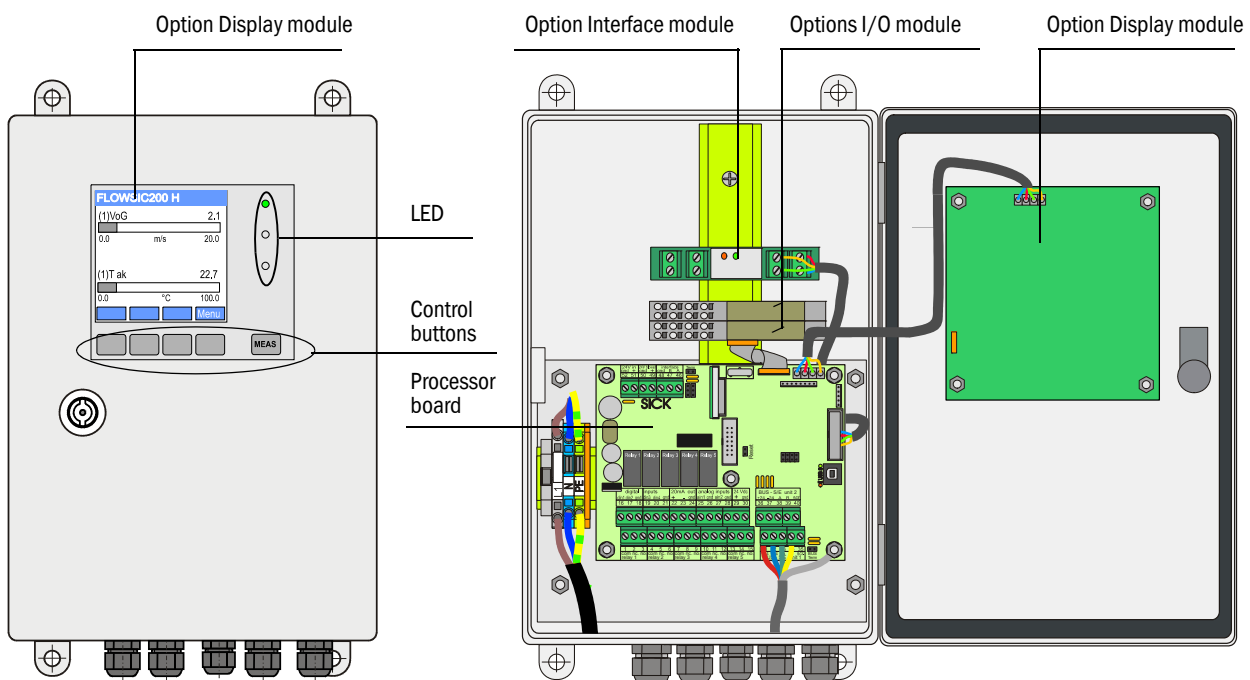
The control unit has the following functions:

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

System 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 stainless steel housing.

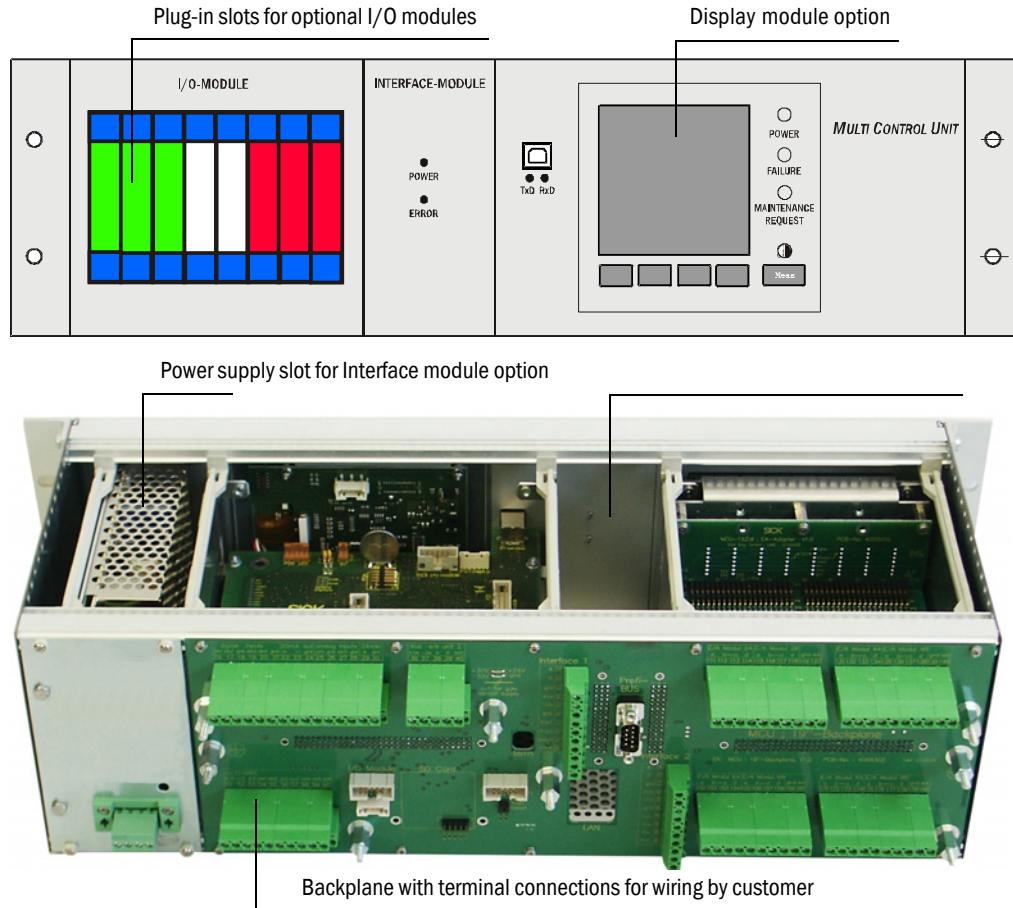
Fig. 7 MCU control unit options



Standard interfaces

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
1 output 0/2/4...22 mA (electrically isolated, active); for selectable output of measured variables: - Velocity - Air temperature Resolution 0.01 mA	2 inputs 0 ... 20 mA (Standard; without electric isolation) Resolution 0.01 mA	5 NC contacts (48 V, 1 A) to output status signals: - Operation/malfunction - Maintenance - Check cycle - Maintenance request - Limit value/direction	2 inputs to connect potential-free contacts for a maintenance switch or triggering a check cycle	- USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and software updates - RS485 for sensor connection

Fig. 8 MCU control unit in 19" housing with options



Options

The options described in the following can considerably expand the functionality of the MCU:

1 Display module

Module to display measured values and status information of the connected sender/receiver unit(s) using control buttons (capacitive sensors).

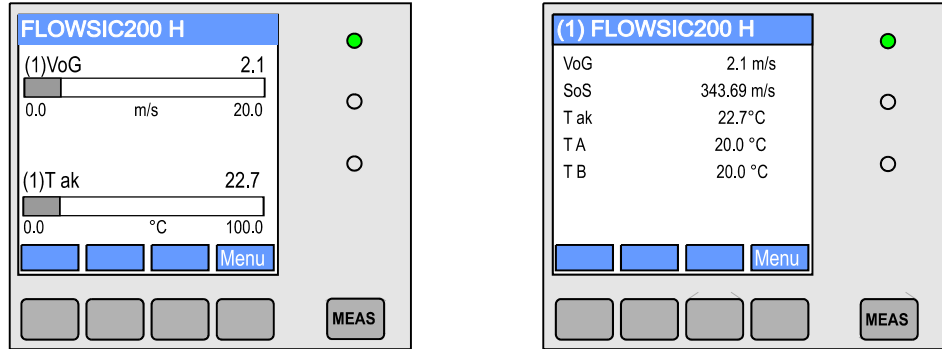
+i The integration of this module into already delivered control units can only be done by the supplier.

- Displays

Type		Display
LED	Power (green)	Voltage supply OK
	Failure (red)	Function fault
	Maintenance request (yellow)	Maintenance request
LC display	Graphic display (main display)	- Flow velocity - Air temperature
	Text display	2 measured values (see graphic display) and 6 diagnosis values

In the graphic display, two factory-preselected main measured values of a connected sensor pair are shown in a bar graph. Alternatively, up to 8 single measured values of a sender/receiver unit can be displayed (toggle with “Meas” button).

Fig. 9 LC display with graphic (left) and text (right) display



– Control buttons

Button	Function
Meas	<ul style="list-style-type: none"> – Toggles between text and graphic display – Displays the contrast settings (after 2.5 s)
Arrows	Selects next/previous measured value screen
Status	Displays alarm or error messages
Menu	Displays main menu and selection of submenus

2 I/O module

For plugging onto module carrier (MCU in wall-mounted housing) or in slide-in module (MCU in 19" housing), optionally as:

- Analog output module with 2 outputs 0/4 ... 22 mA to output further measured variables (load 500 Ω)
- Analog input module with 2 inputs 0/4 ... 22 mA to read in values from external sensors
- Digital output module with 2 outputs (NC contact, contact load 48 V AC/DC, 5 A)
- Digital output module with 4 outputs (NO contact, contact load 48 V AC/DC, 0,5 A)

+i

- ▶ One module carrier is required per module (to plug in on the 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.
- ▶ A maximum of 8 I/O modules can be plugged in, of which a maximum of 4 modules of the same type.

3 Interface module

Module to pass on measured values, system status and service information to higher level control systems, optionally for Profibus DP V0, Ethernet or MODBUS, to plug onto a hat rail (MCU in a wall housing) or slot (MCU in 19" housing). The module is connected to the connection board with an associated cable.

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

Type code

The various configuration options are defined by the following type code:

Type code - control unit:

Control unit type code: MCU-X

X X X X X X X X X X X X X X

Integrated purge air supply

- N: Without blower

Power supply

- W: 90 ... 250 V AC

- 2: Optional 24 V DC

Housing variants

- S: Wall-mounted housing, painted, gray stainless steel 1.4571 or equivalent

- R: 19" housing, terminal connection

Display module

- N: Without (only variant in wall-mounted housing)

- D: With

Other options

- N: Without

Optional analog input (plug-in module; 0/4...20 mA; 2 per module)

- 0: Without

- n: With, n = 1, 2 ¹⁾

Optional analog output (plug-in module; 0/4...20 mA; 2 per module)

- 0: Without

- n: With, n = 1...2 ¹⁾

Optional digital input (plug-in module; 4 inputs per module)

- 0: Without

- n: Number on request

Option - digital output power (plug-in module; 48 V DC, 5 A; 2 NC contacts per module)

- 0: Without

- n: Number on request

Option - digital output low power (plug-in module; 48 V DC, 0.5 A; 4 NO contacts per module)

- 0: Without

- n: Number on request

Optional Interface module

- N: Without Interface module

- B: T/P-MOD Ethernet V1, COLA-B, pulse 2)

- V: T/P-MOD Ethernet V1, COLA-B, 3-fold, pulse 2)

- Q: T/P-MOD Ethernet V2, MODBUS TCP, pulse 2)

- D: T/P-MOD RS485, MODBUS ASCII/RTU, pulse 2)

- F: T/P-MOD RS485, PROFIBUS, pulse 2)

Special features

- N: Without special version

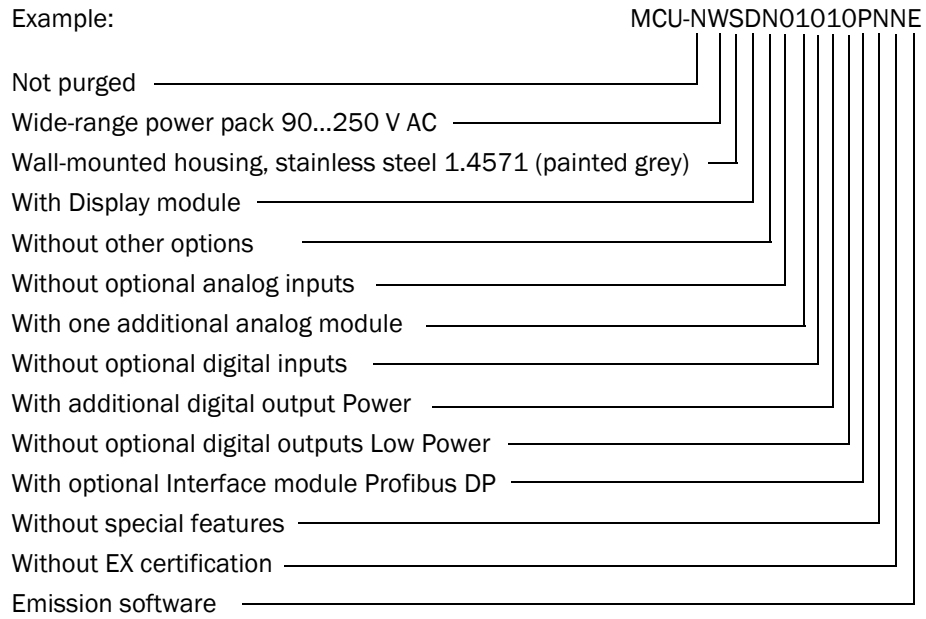
- S: Special solution

EX certification

- N: Without EX certification

Software _____
 - E: Emission

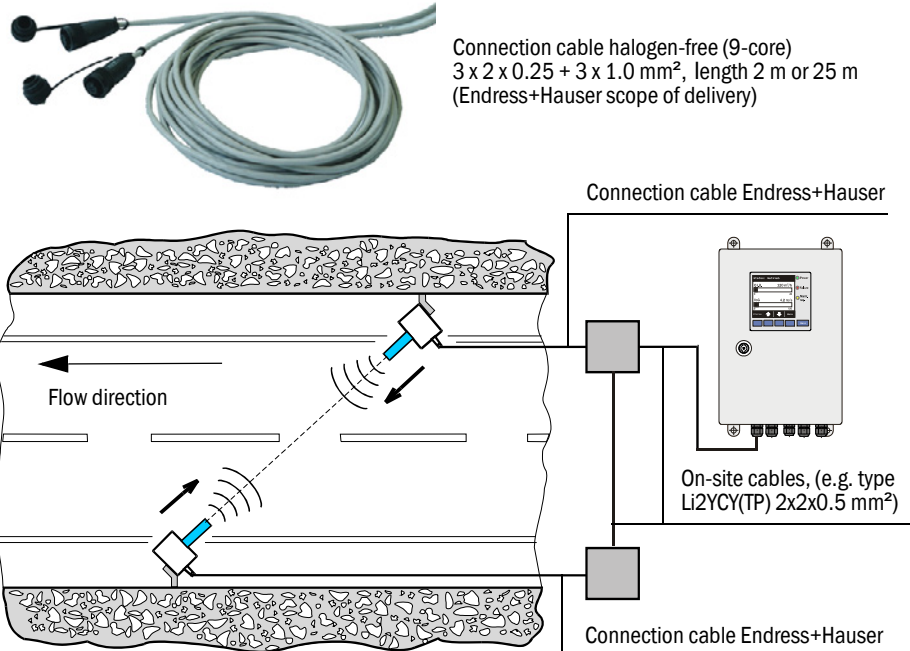
- 1): Up to 4 analog modules on request
- 2): Pulse not available



2.2.4 **Connection cable**

The sender/receiver units are connected to the junction boxes using cables included in the scope of delivery. The junction boxes must be connected to the MCU control unit using cables provided by the customer (information on cable types and wiring → p. 43, §3.3.2).

Fig. 10 Connection cable



2.2.5

Mounting kit

Various mounting kits are available for mounting the bracket assemblies for the sender/receiver unit and junction box on the tunnel wall or ceiling. Selection depends on the actual requirements. The Table below lists the respective parts and their usage options.

Mounting kit		Usage		
Designation (Part No.)	Components	Requirements	For component	Qty. per comp.
2D8-1.4571/PA (2031888)	- 2x Fischer dowel S10 - 2x hexagon wood-screw 8*50 A4	No special	- Bracket for FLSE200-M - Bracket for FLSE200-HM - Bracket for FLSE200-H	1
2M8-1.4571 (2031891)	- 2x dowel SLM 8N A4 - 2x hexagon screw 8*55 A4	Stainless steel only	- Bracket for FLSE200-M - Bracket for FLSE200-HM - Bracket for FLSE200-H	1
			- Junction box in stainless steel housing	2
2M8-1.4529 (2031886)	2x Fischer tie bolt FAZ 8/10 C	Aggressive ambient air	- Bracket for FLSE200-M - Bracket for FLSE200-M Material 1.4529 - Bracket for FLSE200-HM - Bracket for FLSE200-H and FLSE200-HM 1.4529	1
4D8-1.4571/PA (2031889)	- 4x Fischer dowel S10 - 4x hexagon wood-screw 8*50 A4	No special	- Junction box in stainless steel housing	1
2D4-1.4571/PA (2031890)	- 2x Fischer dowel S6 - 2x round head wood-screw 3.5*40 A4		- Junction box	1
4M8-1.4529 (2031887)	4x Fischer tie bolt FAZ 8/10 C	Aggressive ambient air	- Junction box in stainless steel housing	1

2.3 **Computations**

2.3.1 **Flow velocity calibration**

When the measured velocity does not agree with the mean value of the flow velocity in the entire tunnel cross-section, the FLOWSIC200 can be calibrated by a network measurement with a comparison measuring system. Regression coefficients Cv2, Cv1 and Cv0 are determined from the measured values of the two measuring systems, which are entered into the FLOWSIC200 during parameterization (→ p. 92, §4.3.3). The device then calculates the calibrated flow velocity v from measured value x of the FLOWSIC200 according to the following formula:

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

If no calibration is required, Cv2, Cv0 = 0, Cv1 = 1 (default factory setting). The value x then corresponds to the representative velocity.

2.3.2 **Temperature calibration**

The calibration of the temperature measurement with the FLOWSIC200 can be done by a comparison measurement with a separate temperature sensor (e.g. Pt100), but is generally not necessary, since the active measuring distance can be determined extremely accurately (± 1 cm) (see formula 2.6, → p. 16, §2.1.3).

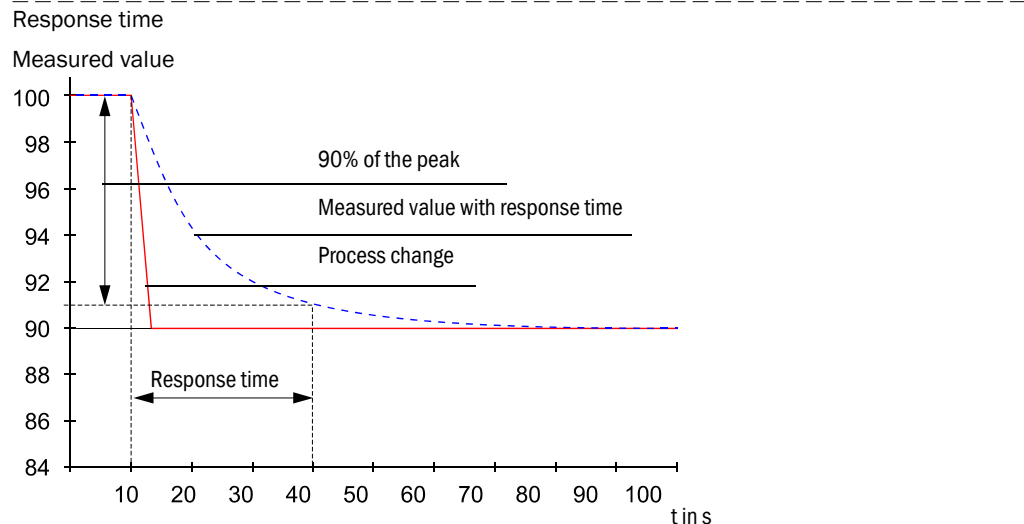
2.3.3 **Response time**

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 (→ Fig. 11).

The response time can be set to any value in the range 1...300 (typical: 60 ... 90 s). Setting a higher response time provides better attenuation of transient fluctuations in the measured value and interference to produce a “smoother” output signal.

There is a separate response time for the measurement of flow velocity and air temperature respectively.

Fig. 11



+i The response time should be regarded as a guide value. If the signal quality of the ultrasonic pulses is poor, the FLOWSIC200 requires more measured values for an output signal of the same accuracy. As a result, the response time is higher, within certain limits, than the set time.

2.4 Check cycle

A check cycle can be triggered on the FLOWSIC200 to test whether the device components are functioning correctly. The check cycle can also be triggered automatically (the interval can be set using SOPAS ET) and/or via a digital input (→ p. 20, §2.2.3). Any deviations from normal behavior are output as a warning or error.

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

The check cycle comprises a zero point control 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, when the display module option is used, indicated by the text "Check cycle" on the display.



- ▶ 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 when the check runs correctly).
- ▶ To trigger a zero point control and span test, as well as a check cycle via a digital input, a contact must be closed at the corresponding terminals for at least 2 s.
- ▶ Automatic check cycles are carried out periodically from the configured 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 digital input occur at the same time, only the cycle triggered first takes effect.

2.4.1 Zero point check

A special circuit arrangement in the sender/receiver units ensures transmission signals from the transducers can be read back without delay and with the original waveform. These transmission signals are received as reception signals, amplified, demodulated, and evaluated. If the device is operating correctly, the exact zero point is 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 path and gas temperature). In this case, check the transducers and electronic components. If the signal amplitude or waveform does not match the expected values, the transducers or electronic components are defective and, in this case, an error message is output.

2.4.2 Span test

During the electronic zero point test, the time difference between both directions of signal transmission is determined and computed with the system parameters gas temperature, measuring distance and sound velocity as a velocity offset at the zero point. This offset is added to the selected span value and output. The span value can be set to between 50 and 70% in 1% steps using SOPAS ET (default value from the factory 70%). The complete measuring system will respond in the prescribed manner when all system components are intact.

2.4.3

Check cycle output on the analog output

A check cycle is output as follows:

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



- ▶ The output duration of 90 s is the default factory setting. The value can be changed in SOPAS ET (→ p. 77, §)
- ▶ The output is only useful for velocity-dependent measured values (flow velocity).

FLOWSIC200

3 Assembly and installation

Project planning

Assembly

Installation

3.1 **Project planning**

3.1.1 **Planning steps**

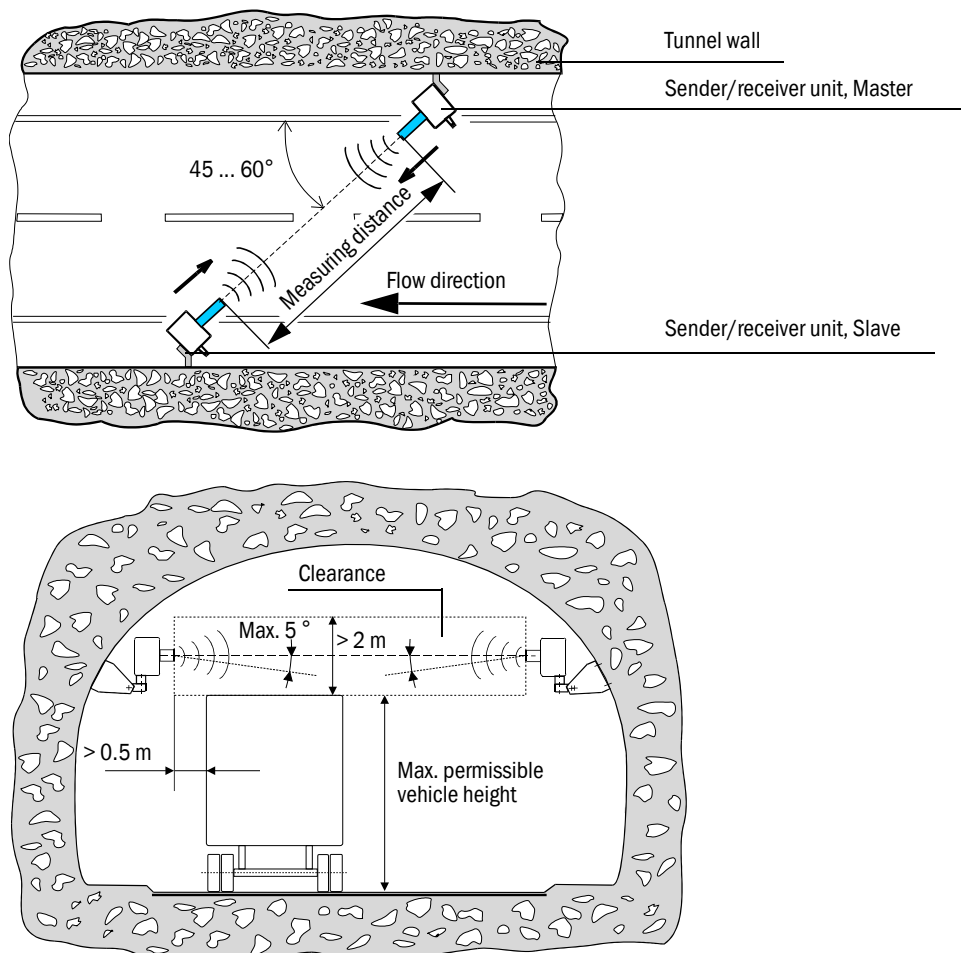
Plan the following before starting assembly and installation work:


- ▶ Determine measuring location(s).
- ▶ Select system components according to → p. 18, §2.2 meeting the conditions of use and customer requirements.
- ▶ Define installation locations for sender/receiver units, MCU and junction boxes.
- ▶ Plan power supply.

3.1.2 **Requirements for the installation location for the sender/receiver units**

The master and slave sender/receiver units must be installed on opposite tunnel walls at a sufficient height above the road surface, offset to the side (→ Fig. 12). The angle between the measuring axis and tunnel axis should not be significantly greater than 60° (minimum value 45°).

Fig. 12 Installation location for sender/receiver units

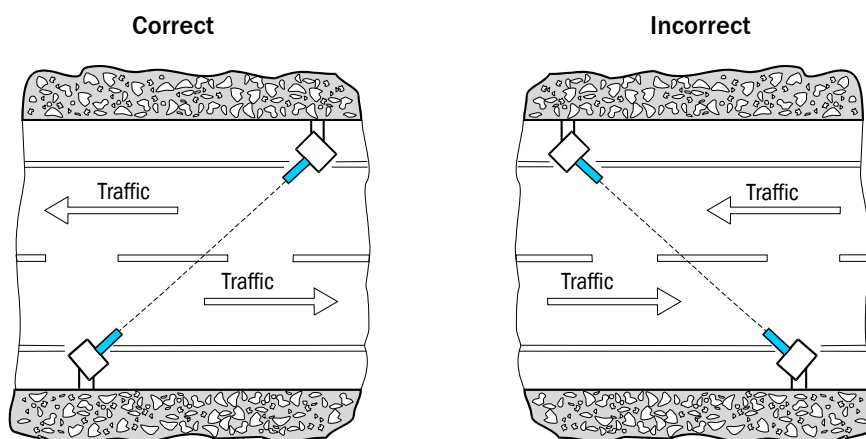


 **WARNING:**

- ▶ The measuring distance between the opposite sender/receiver units must be free of fixtures or similar to ensure unobstructed sound propagation (observe clearance as specified in → p. 32, Fig. 12).
- ▶ The minimum distance to passing vehicles must be maintained (→ p. 32, Fig. 12).
- ▶ Arrange the sender/receiver units so that as little splash water and dirt as possible can hit the transducers, i.e. with the direction of travel of the vehicles (→ Fig. 13).

Fig. 13

Arrangement of sender/receiver units




- ▶ If, due to structural conditions, the measurement axis has to be set so low that the maximum permissible vehicle height reaches into the necessary clearance, the measurement can be interrupted in the event of traffic congestion.
- ▶ If the required distance between the measurement axis and tunnel ceiling cannot be maintained, especially in the case of rectangular tunnel cross-sections, sound reflections can occur on the tunnel ceiling with resulting measurement disturbances.

This can be remedied by slightly tilting the measuring axis of both sender/receiver units downward by max. 5° (→ p. 32, Fig. 12) or by installing sound-absorbing materials on the tunnel ceiling.

3.2 Assembly


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

- ▶ Fitting the brackets for the sender/receiver units.
- ▶ Configuring the bus systems (when used).
- ▶ Fitting the sender/receiver units, junction boxes and MCU.



WARNING:

- ▶ Observe the relevant safety regulations as well as the safety notices in Section 1 during all assembly work!
- ▶ If possible, only carry out assembly work when the tunnel is closed!
- ▶ Take suitable protective measures against possible hazards!



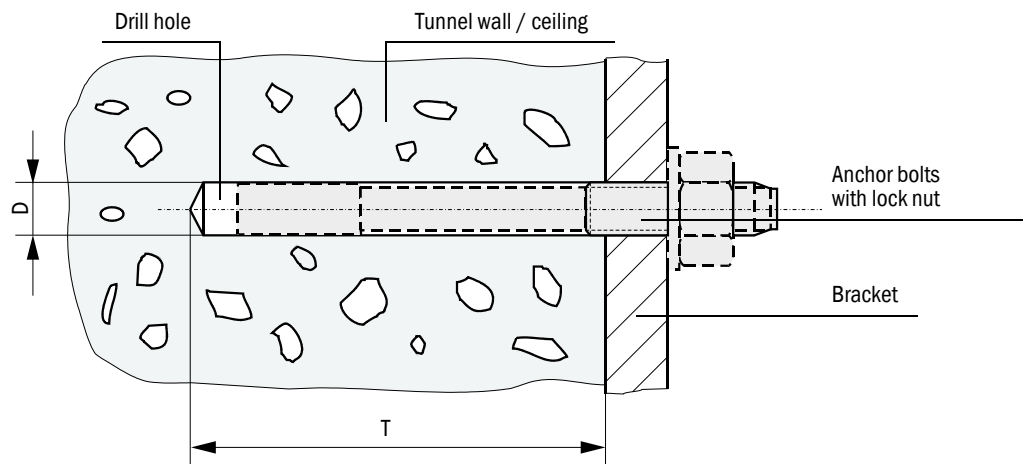
All dimensions in mm.

3.2.1 Fitting the brackets for the sender/receiver units

The brackets are fastened to the tunnel wall/ceiling with the respective required mounting kit (selection according to Section → p. 26, §2.2.5). The following steps are then necessary:

- ▶ Drill 2 holes 40 mm apart (drill hole dimensions → Fig. 14).
- ▶ Insert anchor bolts (mounting kits 2D4/2D8/4D8-1.4571/PA, 2M8-1.4571) or anchor bolts (mounting kit 2M8/4M8-1.4529).
- ▶ Fasten the brackets with the hexagon head screws or nuts.

Fig. 14 Drill hole dimensions



Mounting kit	Dia.	Depth	Remark
2D4-1.4571/PA	6	≥40	The dowel should be flush with the tunnel wall/ceiling
2D8/4D8-1.4571/PA	10	≥70	
2M8-1.4571	12	≥60	
2M8/4M8-1.4529	8	≥65	The anchor bolt must not protrude more than 12 mm from the tunnel wall/ceiling

3.2.2 **Setting the bus systems**

3.2.2.1 **Check the termination**

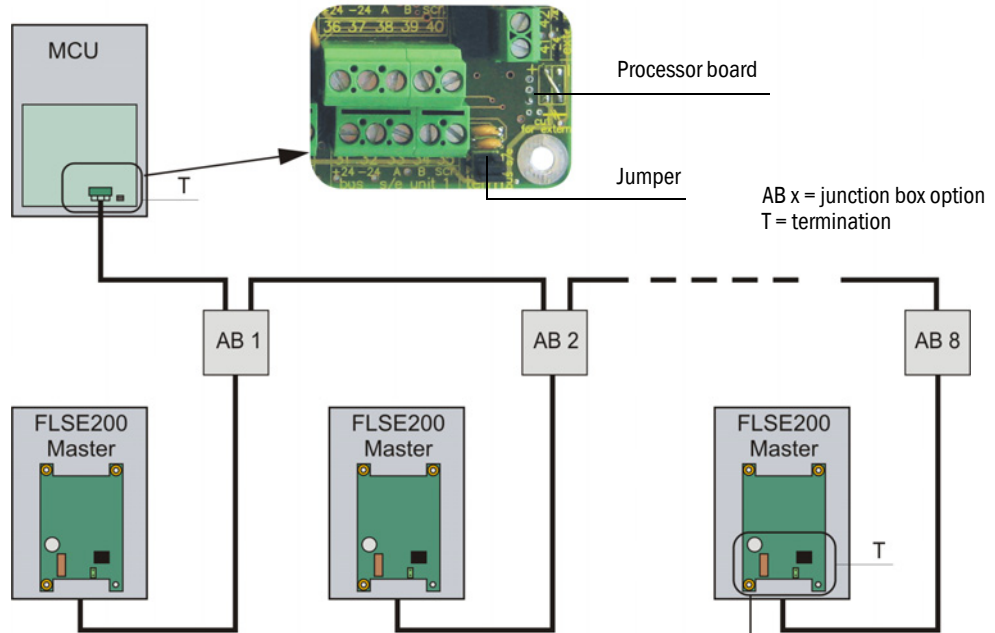
The connection between the sender/receiver units and the MCU must be terminated at both ends with resistors. These are already present on the boards (jumpers).

To check/change the termination, open the MCU and sender/receiver units, position the jumpers on the respective pins depending on the MCU layout, and then close the device components again.

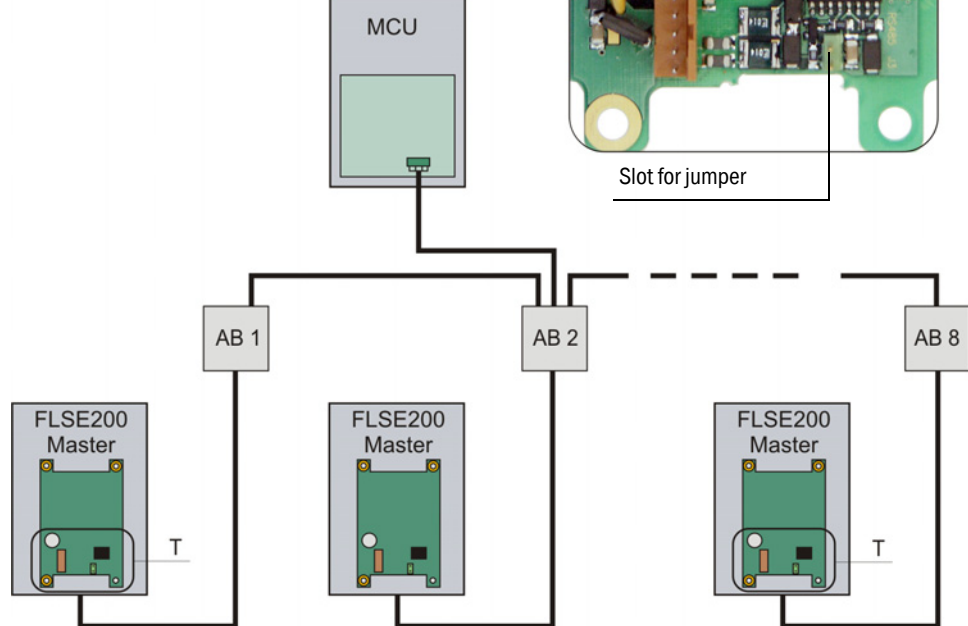
Fig. 15

Termination

MCU at bus start



MCU in bus middle



3.2.2.2 **Bus addressing via hardware setting**

The bus address of a sender/receiver unit required for the bus system can be assigned by hardware or software (→ p. 93, §4.3.4). Hardware addressing is read in when SOPAS ET starts (→ p. 56, §4.1) and has a higher priority than software addressing.

Bus address and sensor number in the MCU are always identical.

NOTICE:

For bus systems, it must be ensured that the bus addressing of the Master FLSE200 is set correctly.

The sender/receiver units must have different addresses. Identical addresses for several units cause the communication with the MCU to abort!

As standard, the address is set using a miniature switch on the digital board in the sender/receiver unit (3 switches for hexadecimal addressing from address 1 to 7; → Fig. 16). To change the address, open the sender/receiver unit and set the desired address. Then close the sender/receiver unit again.

Fig. 16 Hardware addressing of sender/receiver unit

Address	1			2			3			4			5			6			7		
Switch	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
ON	x				x		x	x					x	x		x			x	x	x

3.2.3 **Fitting the sender/receiver units**

Attach the sender/receiver units to the fitted brackets. Arrange with the connection line downwards (→ Fig. 17 and → p. 38, Fig. 19, as well as → p. 39, Fig. 21) should be preferred.

For precise alignment to each other according to → p. 39, §3.2.4, the sender/receiver units can be rotated vertically and tilted horizontally over a wide range. This allows easy adaptation to local conditions such as the slope of the tunnel wall, road inclination, curves. The two mounting holes in the part of the bracket that is directly connected to the sender/receiver unit serve to increase or extend the swivel range in the horizontal direction.

FLSE200-M sender/receiver unit

Fig. 17 Positioning with connection line from below

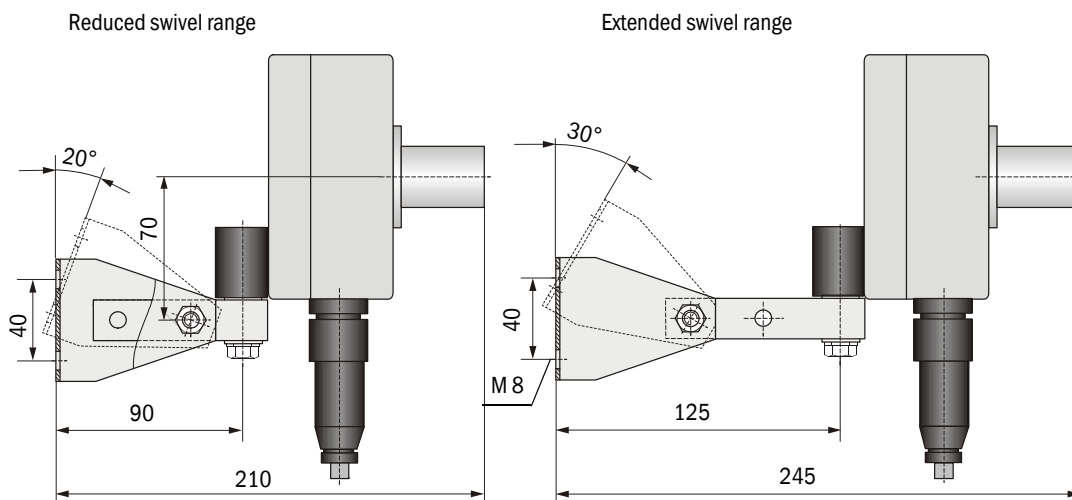


Fig. 18 Positioning with connection line from above

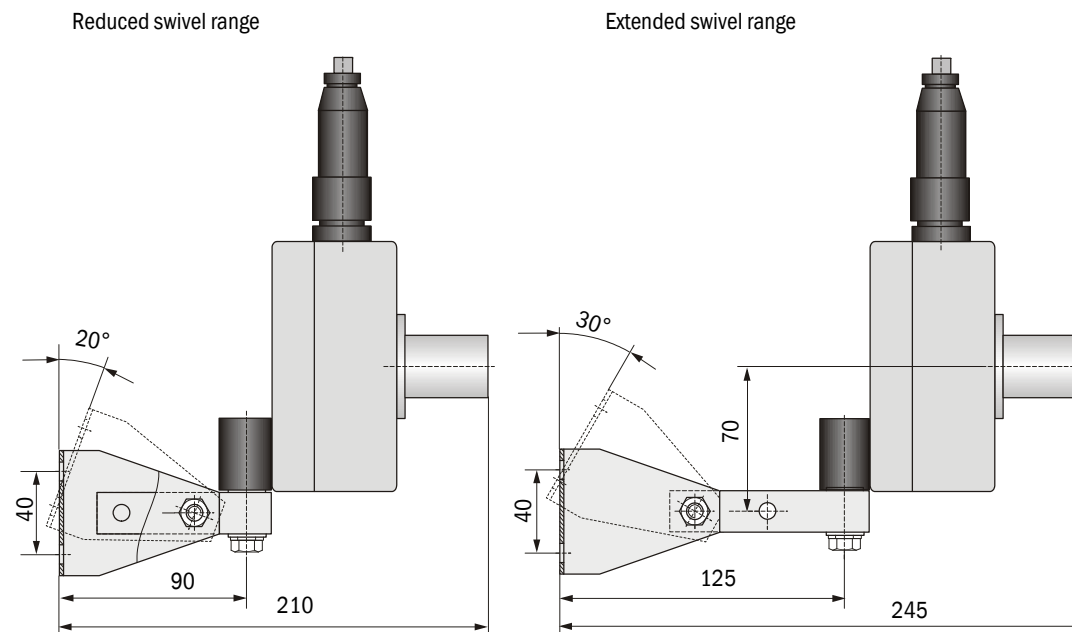


Fig. 19 Hanging positioning with connection cable from below

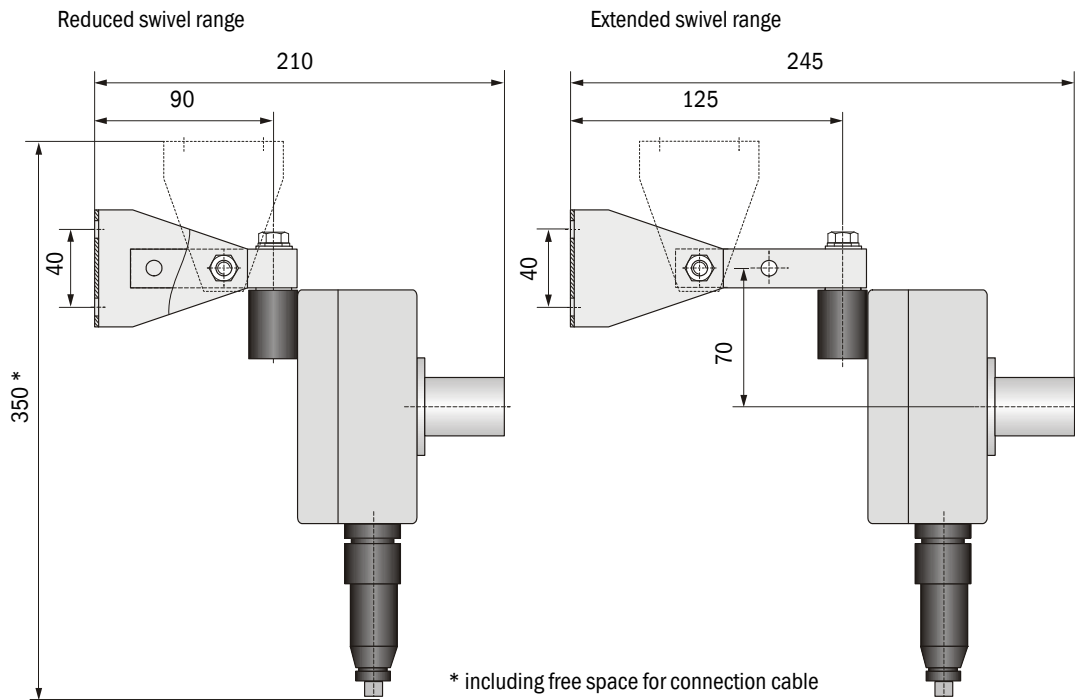
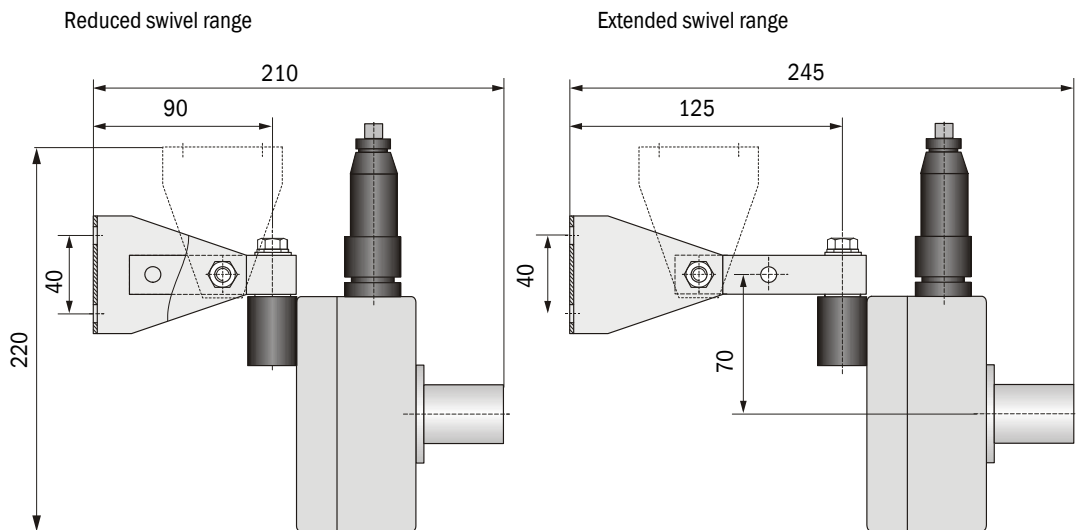


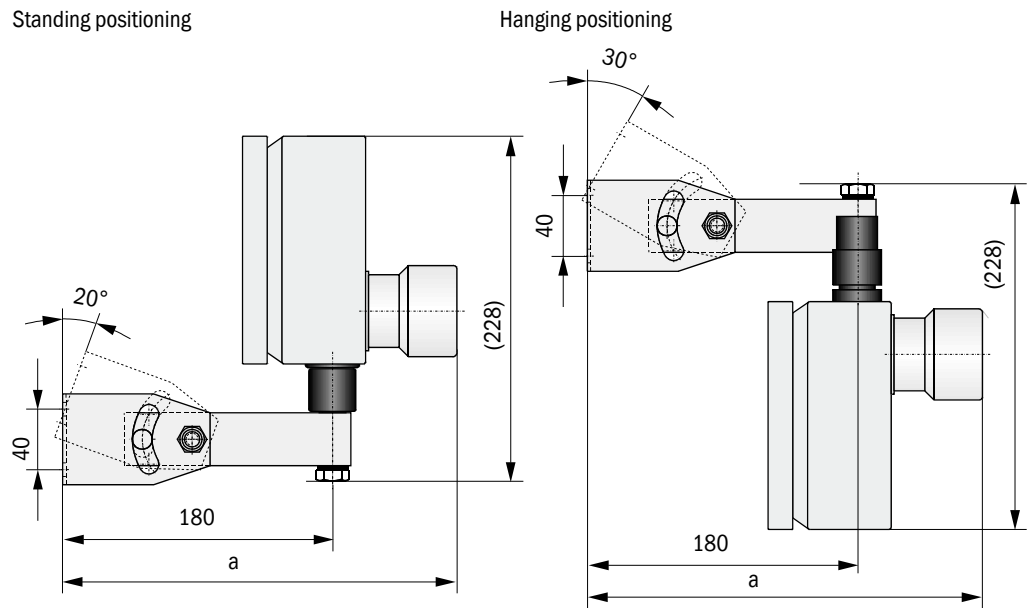
Fig. 20 Hanging positioning with connection cable from above



FLSE200-H / FLSE200-HM sender/receiver unit

Fig. 21

Installing the FLSE200-H / FLSE200-HM sender/receiver unit



FLSE200-H FLSE200-HM
a = 263

3.2.4

Aligning the sender/receiver units

After installation, the sender/receiver units must be aligned so that the respective transmission directions match (→ Fig. 22 and → p. 40, Fig. 23).

Fig. 22

Permissible swivel range in flow direction

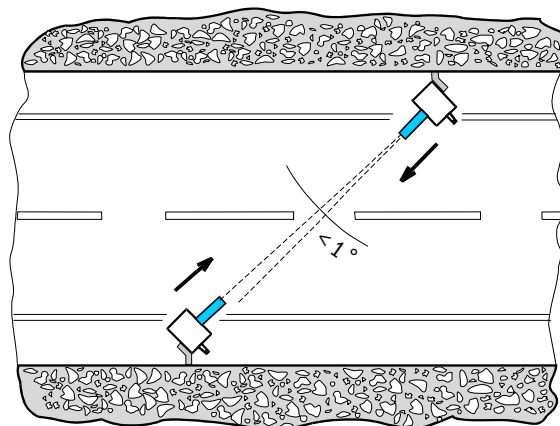
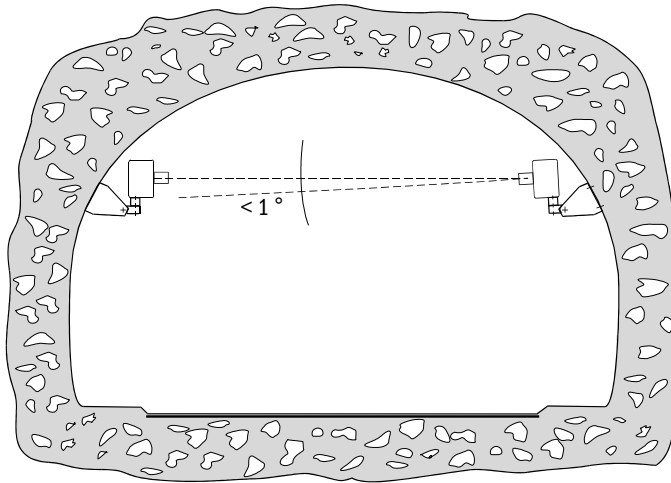


Fig. 23 Permissible horizontal swivel range



In exceptional cases, both sender/receiver units can be installed tilted downwards by up to 5° (→ p. 32, §3.1.2).

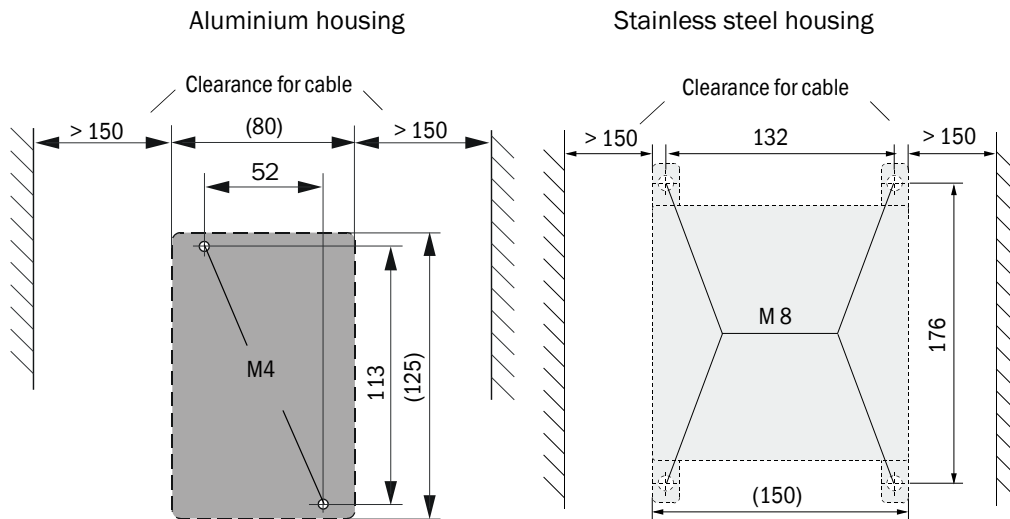
The sender/receiver units can be aligned in 2 steps:

- 1 Rough alignment with aid (string or similar) or by sight
- 2 Fine adjustment with laser pointer or similar.

3.2.5 Installing the junction box

Install this component on a level surface (tunnel wall or roof) as shown in → Fig. 24. For fastening, the respective suitable mounting kits can be used according to → p. 26, §2.2.5 (drill hole measurements and fitting → p. 34, Fig. 14).

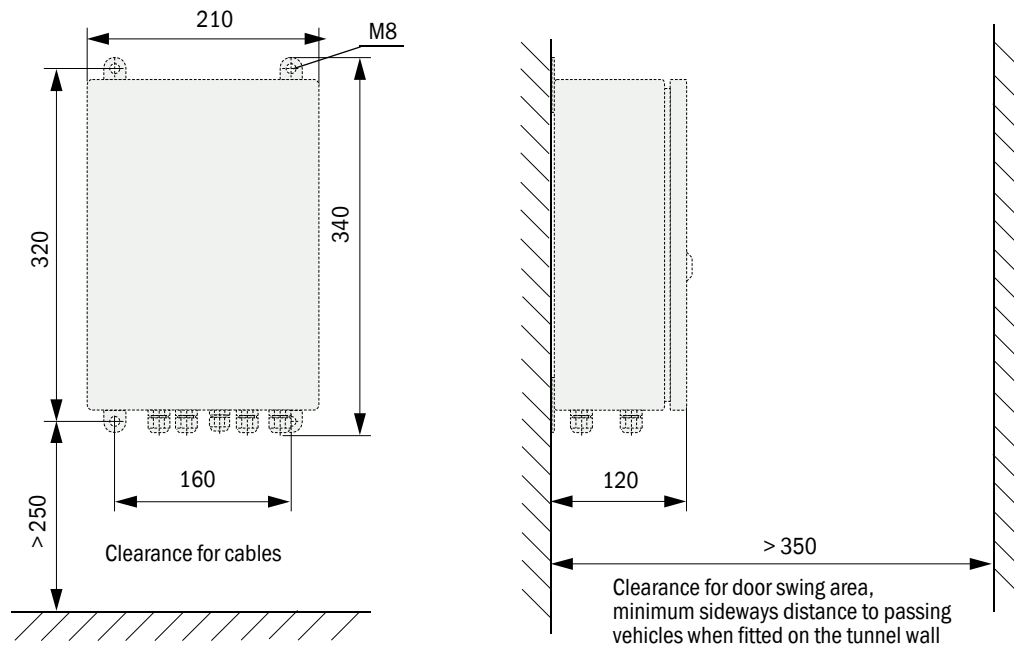
Fig. 24 Junction box installation dimensions



3.2.6 **Installing the MCU control unit**

The control unit must be mounted on a vertical, level base at an easily accessible, well protected location as shown in Fig.25.


Fig. 25 MCU installation dimensions in wall housing



The respectively suitable mounting kits can be used for fastening (→ p.26, §2.2.5; installation → p. 34, Fig. 14).


- ▶ **+i** When using suitable cables (→ p. 55, §4) , the control unit can be positioned up to 1000 m away from the sender/receiver units (use bus wiring according to p. 48, Fig. 29; length is overall length of all cables used).
- ▶ We recommend installing the MCU in a control room or similar for trouble-free communication with the FLOWSIC200.

3.3 **Installation**



WARNING:

- ▶ Observe the relevant safety regulations as well as the safety notices in Section 1 during all installation work.
- ▶ Take suitable protective measures against possible local or installation-specific hazards.
- ▶ All work may only be carried out when the device is disconnected from the power supply.
 - ▶ Before opening the cover, the device must be disconnected from the power supply.
 - ▶ Only connect the sender/receiver units to the MCU control unit as intended.



WARNING: Hazard through voltage


- ▶ The cables and wires must be permanently installed. The plant operator must provide adequate strain relief.

3.3.1 **General information, prerequisites**

The assembly work described in §3.2 must have been carried out before starting installation.


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

- ▶ Laying all the power supply and signal cables
- ▶ Connecting the power supply and signal cables to the system components



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

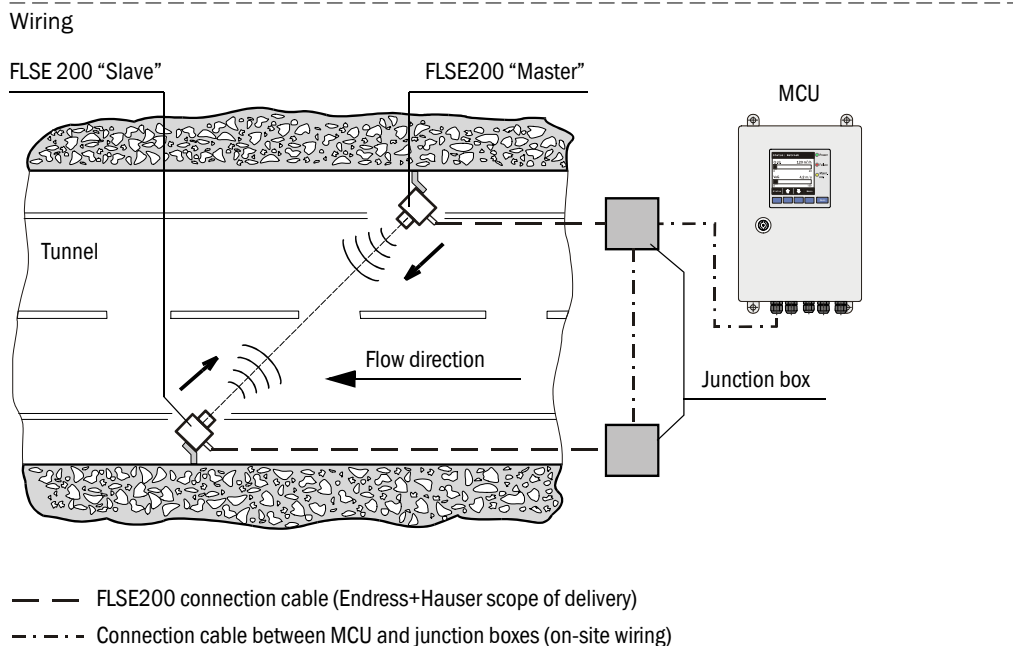
- ▶ An external line fuse must be provided during installation. Internally, the main power supply lines are designed for an overcurrent protection device up to max. 16 A.
Requirements for the external main power switch:
 - ▶ A main power switch must be provided in the installation.
 - ▶ The main power switch must be located at a suitable position and must be easily accessible.
 - ▶ The main power switch must be marked as disconnecting device for the device.



- ▶ Plan adequate cable cross-sections (→ p. 43, §3.3.2).
- ▶ The cable ends with plugs 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).

3.3.2 Information on wiring

Fig. 26




3.3.2.1 Cable specification (connection of a measuring point)


Connecting	Data transfer	Power supply FLSE200	Cable type
Sender/receiver unit and junction box (Endress+Hauser scope of delivery)	FLSE200 Master connection: 2 pairs of wires (twisted pair), operating capacitance wire/wire < 110 pF/m, wire cross-section $\geq 0.25 \text{ mm}^2$	1 pair of wires with wire cross-section 1 mm^2	UNITRONIC FD P BUS Combi 3 x 2 x 0.25 mm ² + 3 x 1 mm ²
	FLSE200 Slave connection: 1 pair of wires (twisted pair), operating capacitance wire/wire < 110 pF/m, wire cross-section $\geq 0.25 \text{ mm}^2$		
<ul style="list-style-type: none"> ▶ MCU and junction box (on-site wiring) ▶ Junction box - junction box (on-site wiring) 	1 pair of wires (twisted pair), operating capacitance wire/wire < 110 pF/m, wire cross-section $\geq 0.25 \text{ mm}^2$	1 pair of wires with wire cross-section $\geq 0.5 \text{ mm}^2$ (AWG20)	E.g. UNITRONIC Li2YCYv (TP) 2 x 2 x 0.5 mm ² or equivalent

Recommended cable types for on-site connection of MCU and junction box

- 1 UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm²
1 pair of wire for RS485, 1 pair of wire for transducer power supply;
Not suitable for underground laying (protected installation required if necessary)
- 2 UNITRONIC Li2YCYv (TP) 2 x 2 x 0.5 mm²
1 pair of wire for RS485, 1 pair of wire for transducer power supply; can be used as an alternative to Pos. 1; Suitable for underground laying
- 3 UNITRONIC Bus FD P Combi 3 x 2 x 0.25 + 3 x 1.0 mm²
1 pair of wire for RS485, 1 pair of wire with cross-section 1.0 mm² for transducer power supply, for cable lengths up to 1000 m with 2 measuring points connected
- 4 Special cable type ASS 4 x 2 x 0.5 mm²
1 pair of wire for RS485, 1 to 3 pairs of wires for transducer power supply;
Silicone, halogen-free, highly heat and cold resistant, sheath color red (similar to RAL 3000)
Accessories: Braided cable sleeving PA-S 4, black, to provide mechanical protection or to cover the sheathing color if necessary.



- ▶ Manufacturer of UNITRONIC cables: LAPP-Kabel
- ▶ Manufacturer of special cable: metrofunk KABEL-UNION GmbH
- ▶ Cables from other manufacturers can be used when they have the same transmission characteristics.
- ▶ We recommend coordinating the wiring of a control unit with several measuring points (up to 8) with the manufacturer (→ p. 20, §2.2.3).
- ▶ For standard wiring (bus wiring), the factory-set termination must be disabled in the system components not at the end of the line.

 **NOTICE:**

- ▶ The manufacturer does not assume any warranty for the proper functioning of the device when cables that do not comply with the specifications are used.
- ▶ The cables are to be laid continuously without changing to other cables or lines and shielded throughout.
- ▶ Not suitable are telephone cables such as type A-2YF(L)2Y... .

3.3.2.2 **Cable lengths**

When connecting bus versions with several sensors (→ p. 15, Fig. 3), the maximum cable length is reduced as follows depending on the number of measuring points connected:

Number of measuring points	Cable type 2 x 2 x 0.5 mm ² (e. g. UNITRONIC Li2YCYv(TP))	Cable type 3 x 2 x 0.25 + 3 x 1.0 mm ² (e.g. UNITRONIC FD P BUS Combi)
1	1000 m	1000 m
2	500 m	1000 m
3	330 m	660 m
4	250 m	500 m
5	200 m	400 m

Proceed as follows when longer cable lengths are used to connect several sensors:

- 1 Use larger diameter e.g. cable type with 3 or 4 pairs of wires and 2 pairs of wires for power supply

To ensure the power supply for long cable lengths, the following key data for the FLOWSIC200 must be observed when selecting the wire diameter:

Sender/receiver unit supply	Type 200M	Type 200H, 200HM
Current consumption per FLSE200	35.5 mA	38 mA
Required voltage to the FLSE200	18 - 24 VDC	18 - 24 VDC



NOTICE:

The maximum cable length is 1000 m even when using larger wire diameters.

- 2 Use an MCU with more powerful power supply unit

Both solutions are available from the manufacturer on request.

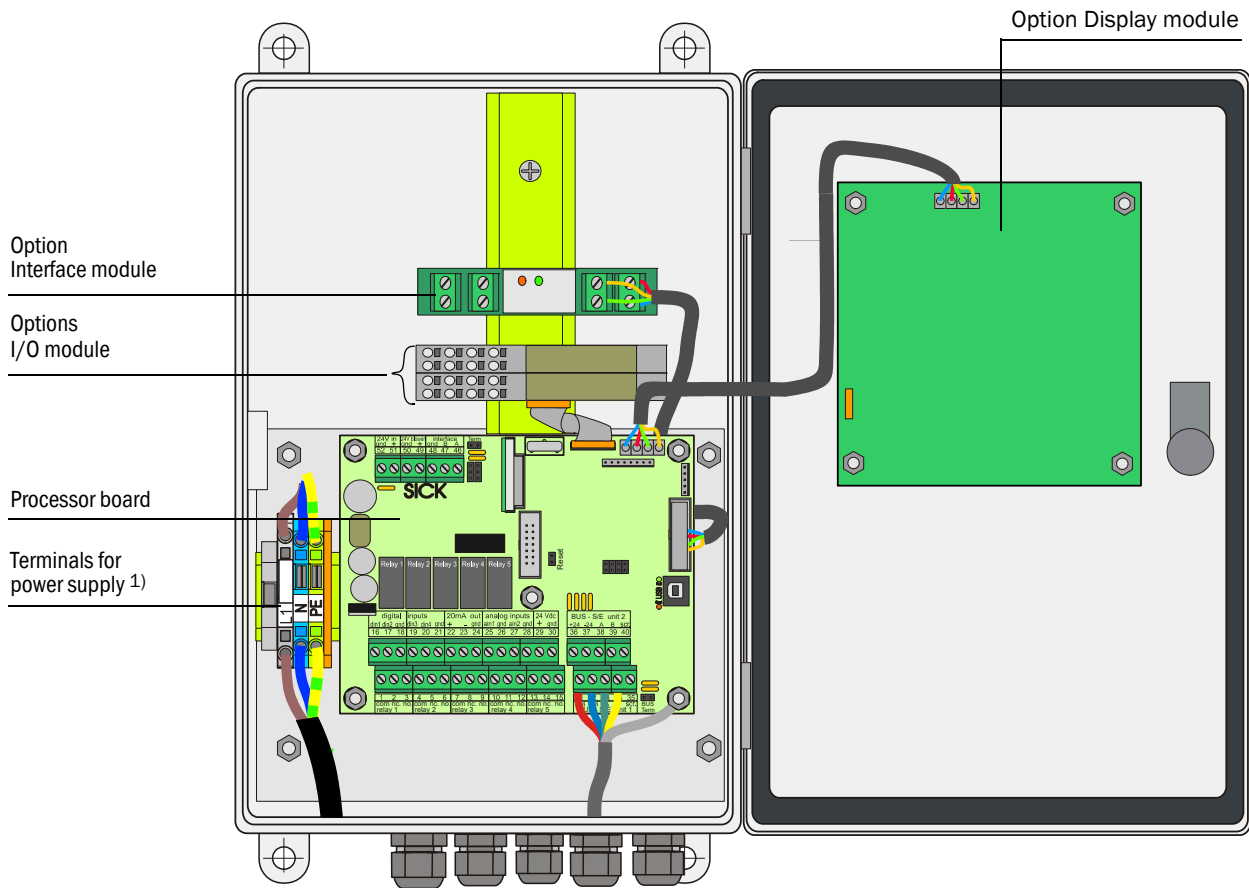
3.3.3 **Connecting sender/receiver units and junction boxes**

These components are to be interconnected as shown in p. 48, Fig. 29:

- Between the sender/receiver unit and the junction box using the cables with connector included in the scope of delivery,
- Between junction boxes and MCU with cable provided by customer.

3.3.4 Connecting the control unit with wall housing

Fig. 27 Layout of components in MCU (with options)



1) Fuse ratings, see type plate or identification plate on fuse holder.

Necessary work

- ▶ Connect connection cable as shown in → p. 48, Fig. 29.
- ▶ Connect cables for status signals (operation/malfunction, maintenance, check cycle, maintenance request, limit value), analog output, analog and digital inputs according to requirements (→ p. 48, Fig. 29, → p. 49, Fig. 30, Fig.31, Fig.32).

NOTICE:

- ▶ Only use cables with twisted pairs and shield (e.g. UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm² from LAPP-Kabel; not suitable for underground laying).

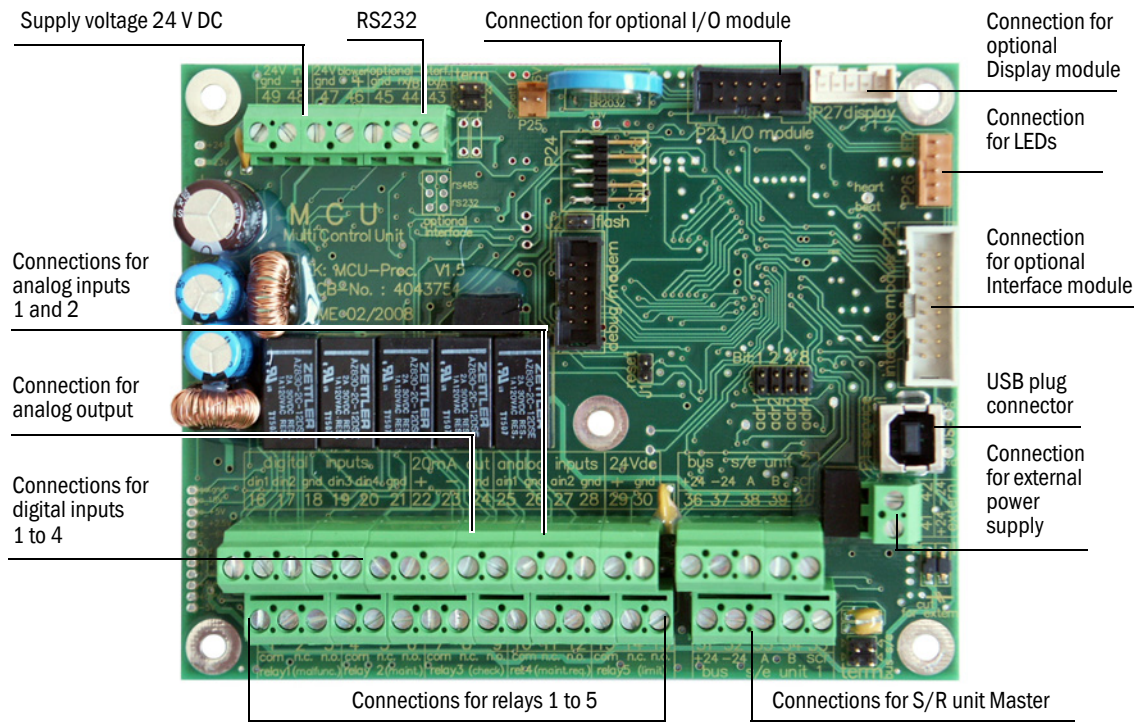
- ▶ Connect power cable to terminals L1, N, PE (→ Fig. 27).
- ▶ Close off unused cable ducts with dummy plugs.

WARNING:

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

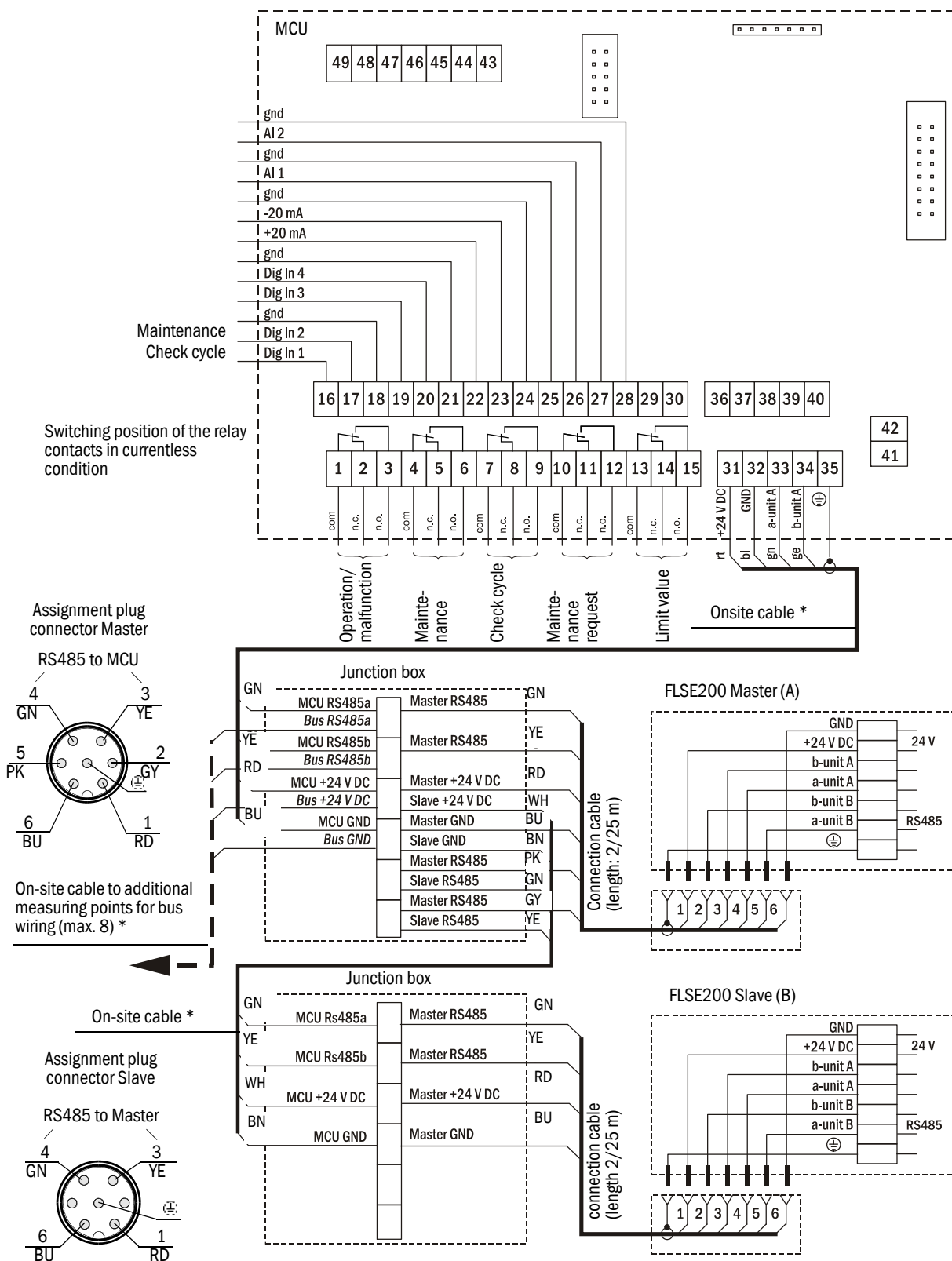
MCU processor board connections

Fig. 28 MCU processor board connections



Bus wiring

Fig. 29 Bus wiring



*: The wire colors are only used to identify the terminals to be connected with each other.

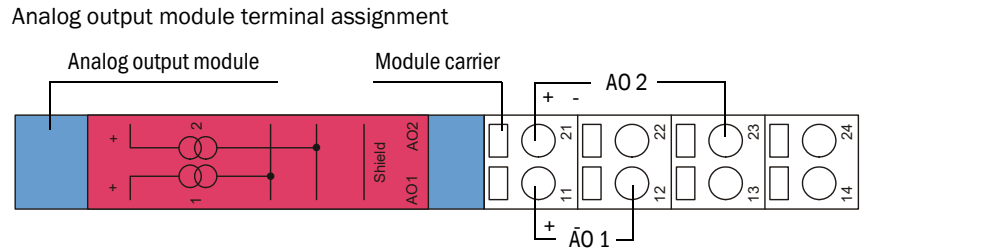
Fitting and connecting optional Interface and I/O modules

Plug Interface modules and module carriers for I/O modules onto the hat rail in the MCU (→ p. 46, Fig. 27) and connect to the associated connection on the processor board with the cable with plug-in connector (→ p. 47, Fig. 28). Then plug the I/O modules on the module carriers.

Connect the I/O modules to the terminal points on the module rack (→ Fig. 30, Fig.31, Fig.32), the Profibus module to the module terminals and the Ethernet module using on-site network cables.

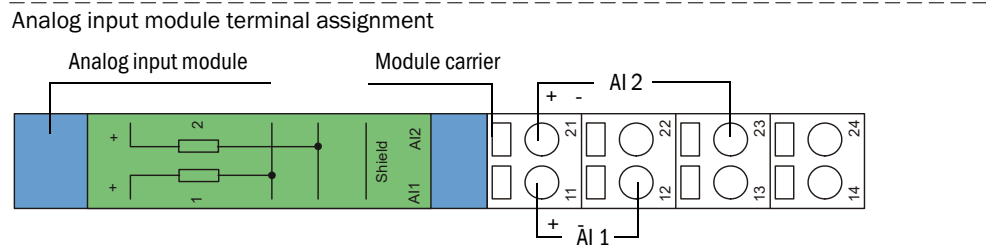
► AO module terminal assignment

Fig. 30



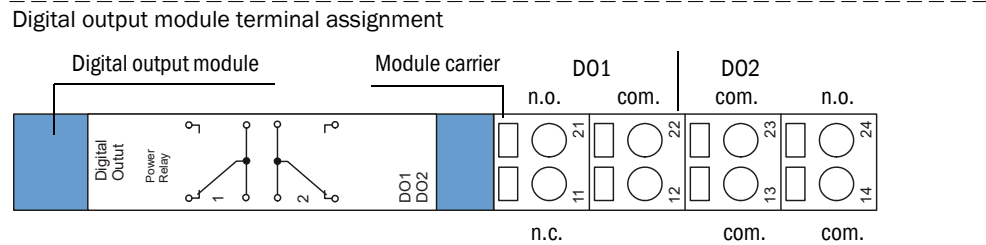
► AI module terminal assignment

Fig. 31



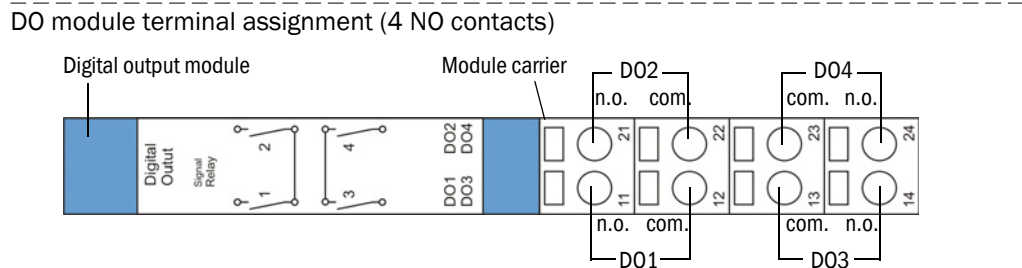
► DO module terminal assignment (2 NC contacts)

Fig. 32



► DO module terminal assignment (4 NO contacts)

Fig. 33



► Connection data

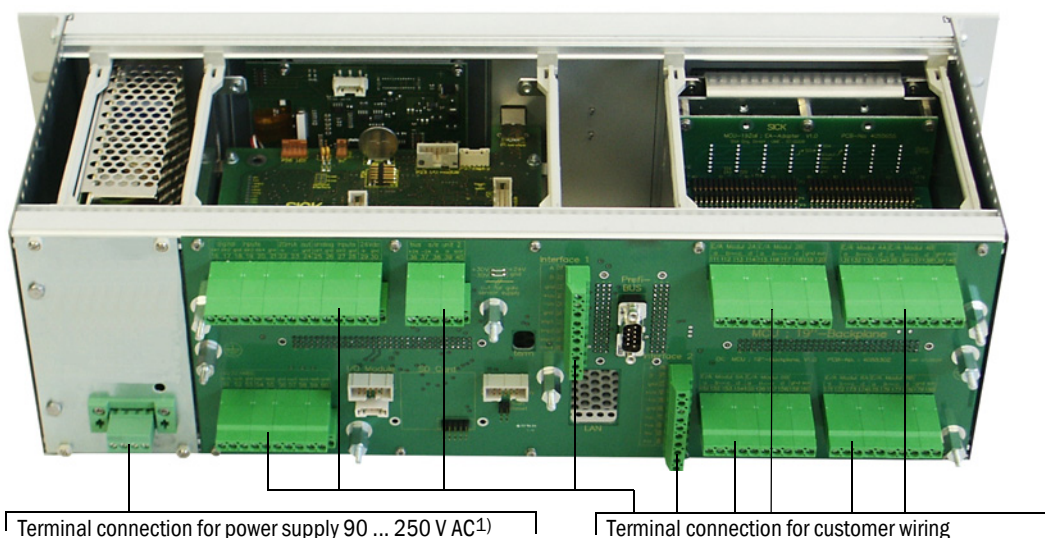
Connection	Module type				
	2x analog input	2x analog output	2x digital input	Digital output	Digital output
				2 NC contacts	4 NO contacts
Assignment					
11	AI 1+	AO 1+	DI 1+	n.c. relay 1	n.o. relay 1
12	AI 1-	AO 1-	gnd	com. relay 1	com. relay 1
13	AI 2-	AO 2-	gnd	com. relay 2	com. relay 3
14	Screen (gnd)	Screen (gnd)	DI 3+	n.c. relay 2	n.o. relay 3
21	AI 2+	AO 2+	DI 2+	n.o. relay 1	n.o. relay 2
22	AI 1-	AO 1-	gnd	com. relay 1	com. relay 2
23	AI 2-	AO 2-	gnd	com. relay 2	com. relay 4
24	Screen (gnd)	Screen (gnd)	DI 4+	n.o. relay 2	n.o. relay 4
Load					
Max. voltage	3 V d.c.	15 V d.c.	5.5 V d.c.	30 V a.c./d.c.	24 V DV
Max. current	22 mA	22 mA	5 mA	2 A	36 mA

n.c.: normal closed

n.o.: normal open

3.3.5 Connecting the control unit in the 19" housing

Fig. 34 Connections for MCU 19" variant



1) Fuse ratings, see type plate or identification plate on fuse holder.

Function	Connection	Terminal No.
Output relay 1 (operation/malfunction)	com	1
	n.c. ¹⁾	2
	n.o. ²⁾	3
Output relay 2 (maintenance)	com	4
	n.c. ¹⁾	5
	n.o. ²⁾	6
Output relay 3 (check cycle)	com	7
	n.c. ¹⁾	8
	n.o. ²⁾	9
Output relay 4 (maintenance request)	com	10
	n.c. ¹⁾	11
	n.o. ²⁾	12
Output relay 5 (limit value)	com	13
	n.c. ¹⁾	14
	n.o. ²⁾	15
Digital input	d in 1	16
	d in 2	17
	gnd	18
	d in 3	19
	d in 4	20
	gnd	21
Analog output	+	22
	-	23
	gnd	24

Function	Connection	Terminal No.
Analog input	a in 1	25
	gnd	26
	a in 2	27
	gnd	28
Connections for sender/receiver unit, Master	+24	31 (36)
	-24	32 (37)
	RS485 A	33 (38)
	RS485 B	34 (39)
	scr.	35 (40)
Input voltage supply 24V DC ³⁾	24 V	41
	gnd	42
Output voltage supply 24 V DC ³⁾	24 V	43
	gnd	44
Input 30 V electr. isolated	+	45
	-	46
RS232/485 ³⁾	tx/A	51
	rx/B	52
	gnd	53
Interface 1	A	71
	B	72
	gnd	73
	+Us	74
	-Us	75
	gnd	76
	imp+	77
	imp-	78
	res 1	79
	res 2	80

1): Closed in currentless condition (normal closed)

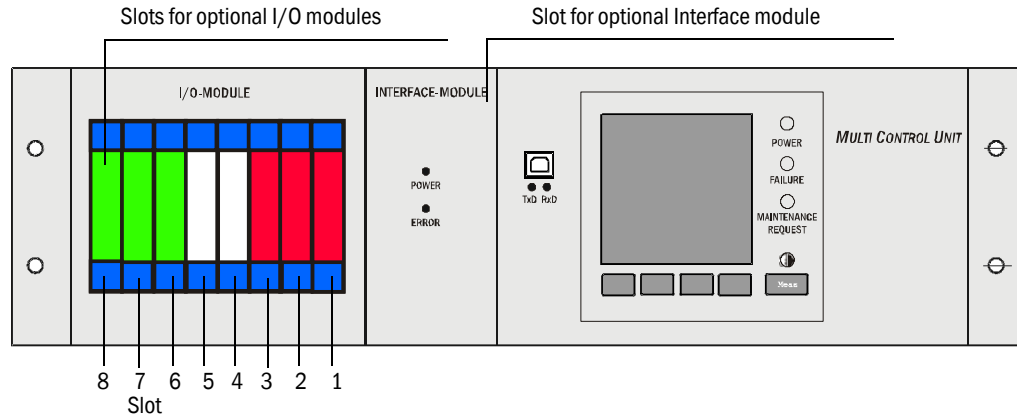
2): Open in currentless condition (normal open)

3): Only use after agreement with manufacturer

Fitting and connecting optional I/O modules

Connect the optional analog and digital modules to the slots on the module carrier as from slot 1 next to each other in the sequence AO → AI → DO → DI. If single module types are not present, the next one follows according to the specified sequence.

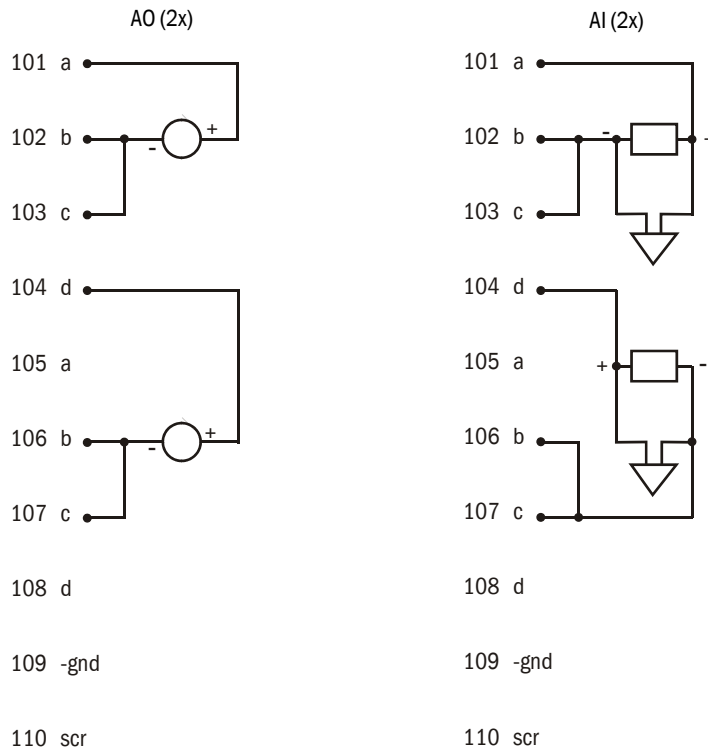
Fig. 35 Slots for optional modules



Connection is made to terminals 101 - 180 on the backplane. The following shows the I/O module connection for slot 1 as an example. Connect the I/O modules to slots 2 - 8 in the same manner.

► Analog module connection

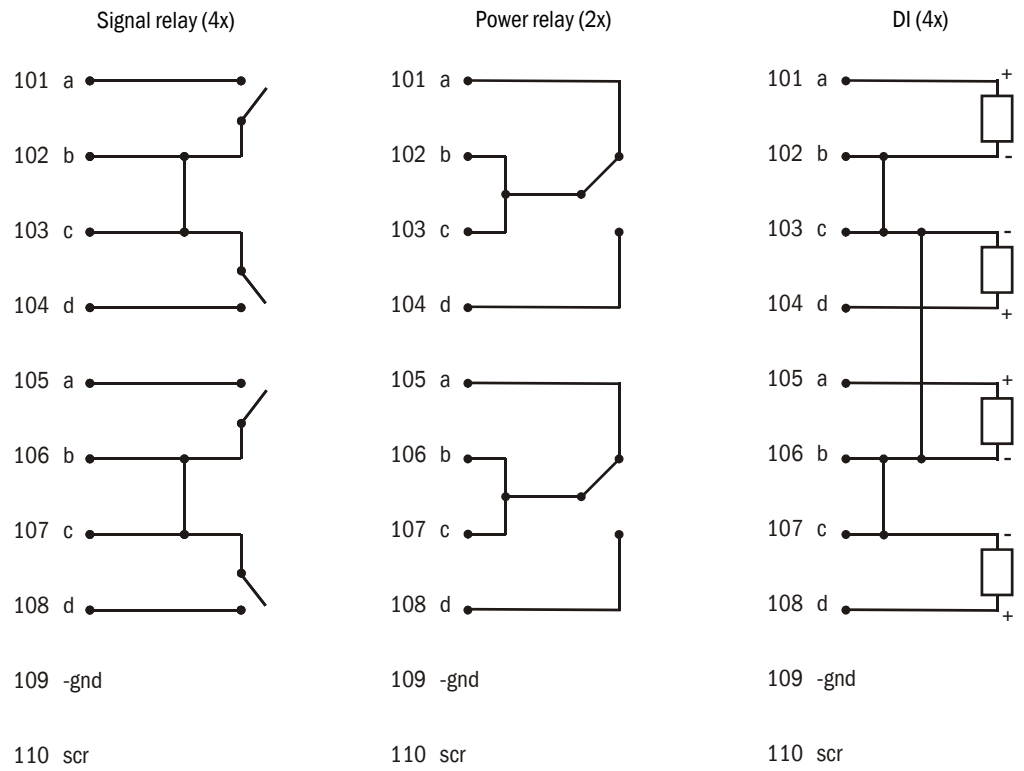
Fig. 36 Analog module on slot 1 (terminals 101 - 110)



► Digital module connection

Fig. 37

Digital module on slot 1



FLOWSIC200

4 Commissioning and parameterization

Basics

Standard commissioning procedure

Advanced commissioning

Operating / parameterization with the LC display option

4.1 Basics

4.1.1 General information

Commissioning primarily comprises entering system data (e.g. measuring distance, installation angle), parameter settings for output variables and reaction times and, if required, setting the check cycle (→ p. 72, §4.2.5). A zero adjust is not required.

Additional calibration of the velocity measurement by means of network point measurement using a reference system (for example, dynamic pressure probe) is then only necessary when the velocity profile along the measuring axis is not representative for the entire cross-section. The regression coefficients determined can then be entered into the device without problems (→ p. 92, §4.3.3).

The “SOPAS Engineering Tool” (SOPAS ET) is supplied with the device for parameterizing the system parameters. The required settings can be easily configured using the software menus. Further functions are also available (e.g., data storage, graphic displays).

4.1.2 Installing the SOPAS ET program



Administrator rights are required for the installation.

Prerequisites

- ▶ Laptop/PC with:
 - Processor: At least Pentium III 500 MHz (or comparable type)
 - USB interface (alternative - RS232 via adapter)
 - Working memory (RAM): At least 1 GB
 - Operating system: MS-Windows XP, VISTA, Windows 7 and Windows 8 (32/64 bit)
 - Free memory: 450 MB
- ▶ USB interface cable to connect the laptop/PC to the measuring system (MCU).
- ▶ The SOPAS ET software as well as the USB driver (scope of delivery) must be installed on the laptop/PC.
- ▶ The voltage supply must be switched on.

Installing SOPAS ET

Insert the enclosed CD into the disk drive on the PC, select the language, choose “Software” and follow the instructions.



If the startup screen does not appear, run the “setup.exe” file.

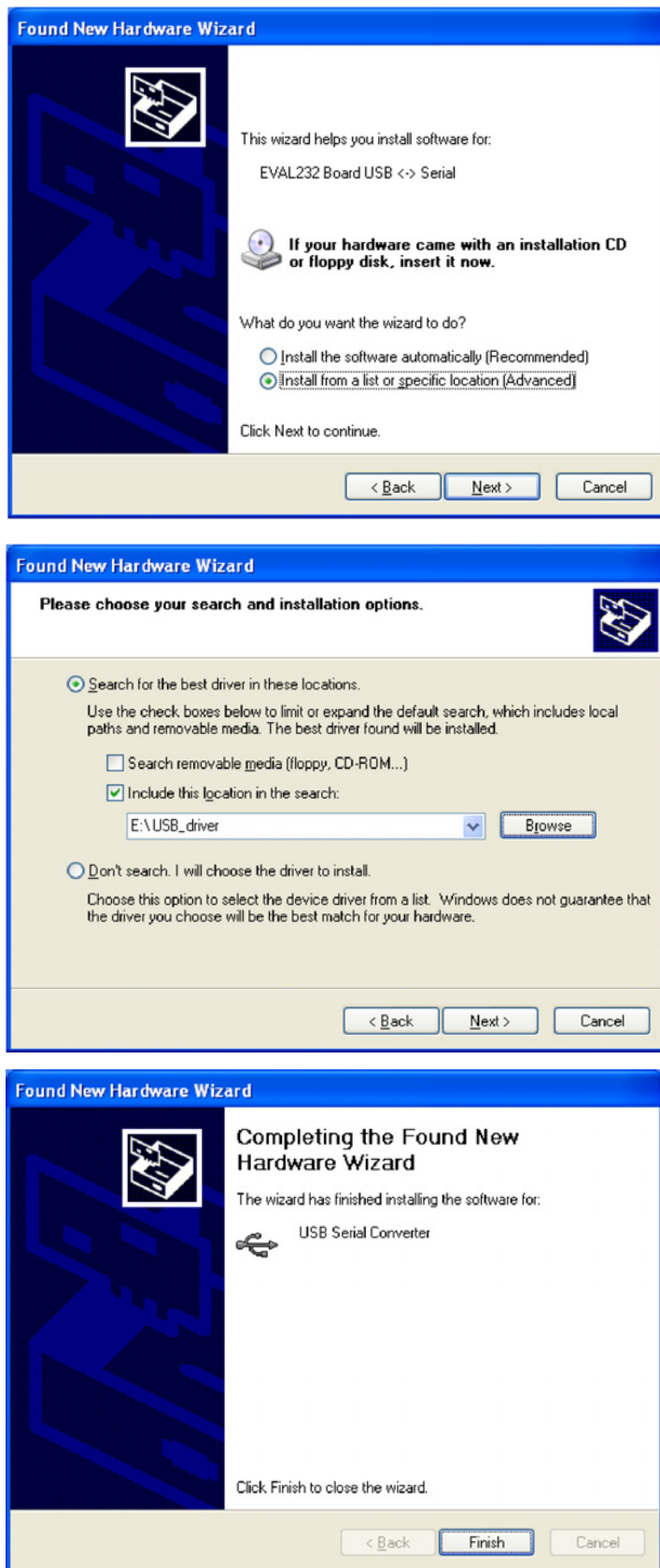
Installing the USB driver

A special driver is required for communication between SOPAS ET and the measuring system via USB interface.

For installation on the laptop/PC, the power supply of the MCU must be switched on and the USB connector must be connected to the PC.

A message appears on the computer screen that new hardware has been found. Now insert the supplied CD into the drive on the PC and follow the installation instructions (→ p. 57, Fig. 38). Alternatively, the driver can also be installed via the hardware installation program in the Windows Control Panel.

Fig. 38 Installing the USB driver



4.1.3 Connecting to the device

- ▶ Connect the USB cable to the MCU(P) control unit (→ p. 47, Fig. 28) and the laptop/PC.

**NOTICE:**

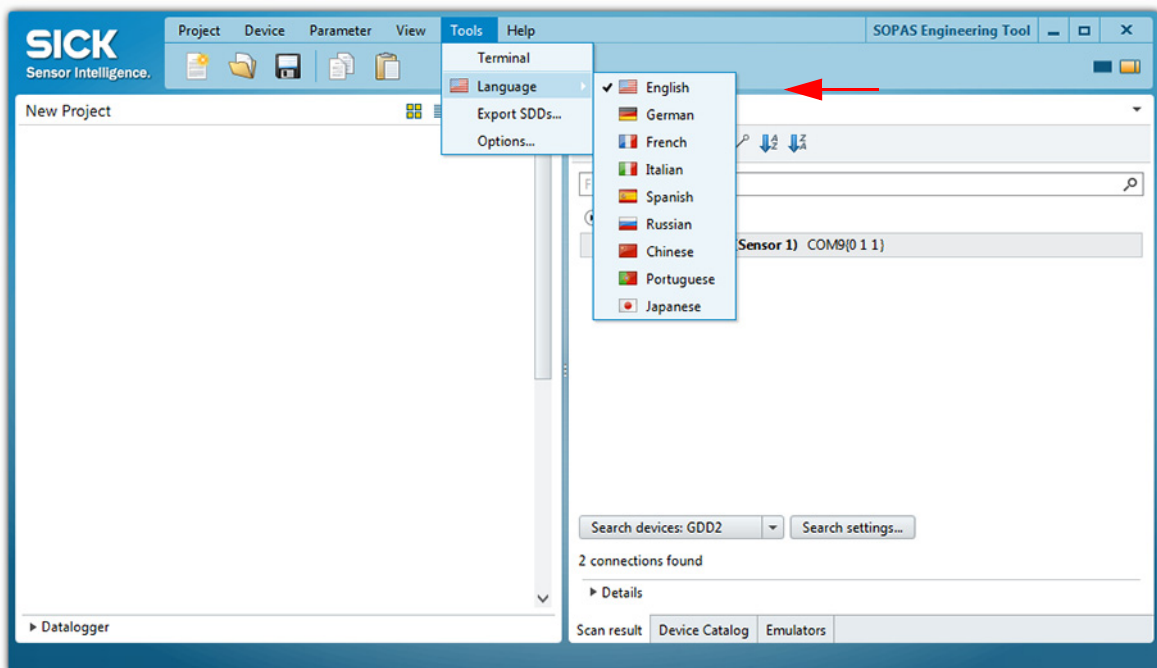
The MCU(P) is connected via USB to the laptop/PC.
A serial interface (COM port) is simulated via which the connection is made.

- ▶ Start the software from the “SICK\SOPAS” start menu.
- ▶ The start page is displayed.

4.1.3.1 Changing the language

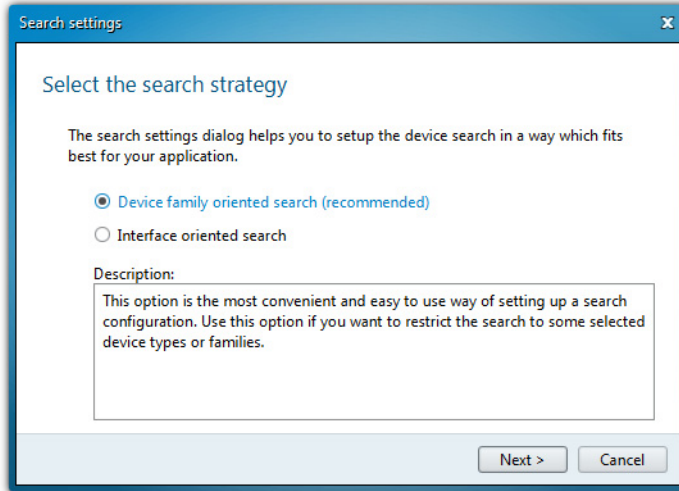
- ▶ If required, set the desired language in the “Tools / Language” menu (→ p. 58, Fig. 39).
- ▶ Confirm the dialog shown with “Yes” to restart SOPAS ET with the changed language.

Fig. 39 Changing the language setting



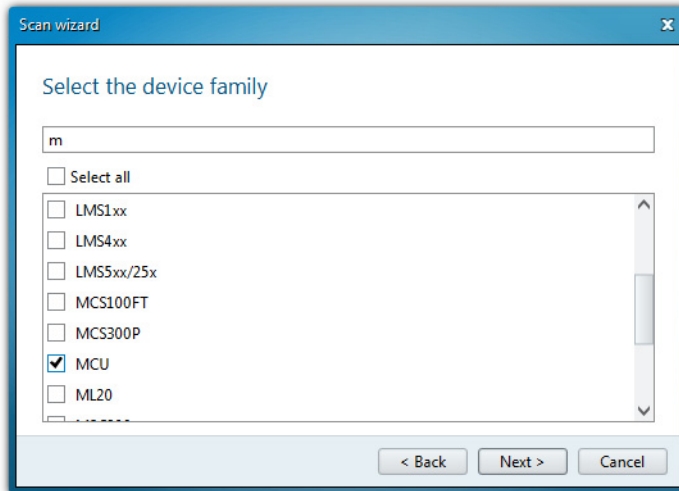
- 4.1.3.2 **Connecting to the device via the “Device family” mode (recommended search settings)**
- 1 Click “Search settings”.
 - 2 Select search mode “Device family oriented search” and click “Next”.

Fig. 40 Selecting the search mode




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

Fig. 41 Selecting the device family




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



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

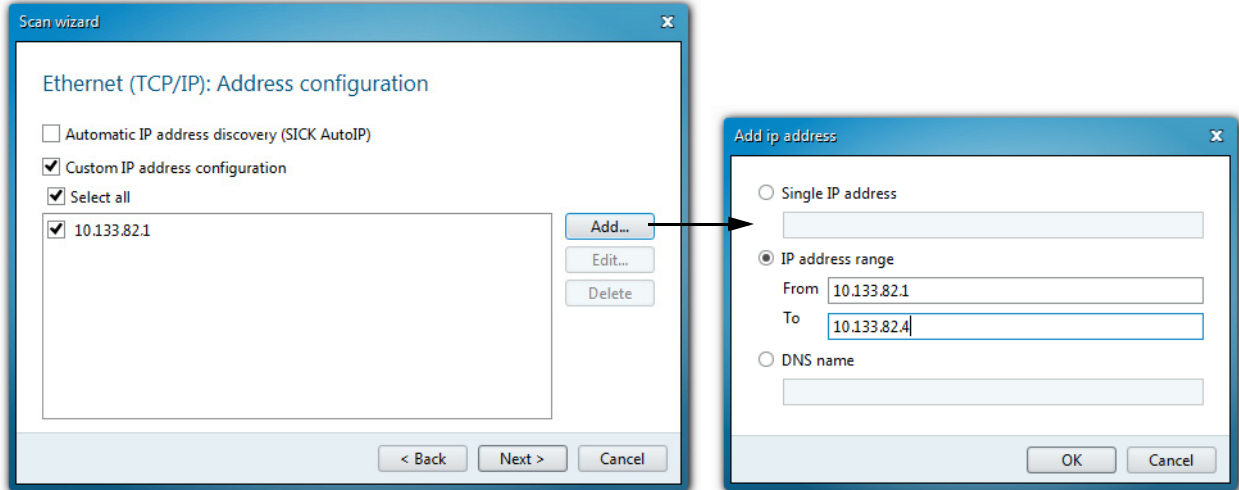
- ▶ Click “Add”.



An IP address specified by the customer is entered at the factory when the address is available when the device is ordered. If not, standard address 192.168.0.10 is entered.
To change the IP address, see → p. 91, §4.3.2.3.

- ▶ Enter the IP address of the device or the IP address range when several devices are used (→ p. 60, Fig. 42). The IP addresses shown are exemplary.
- ▶ Click “OK”.

Fig. 42 Connection settings for connection via Ethernet

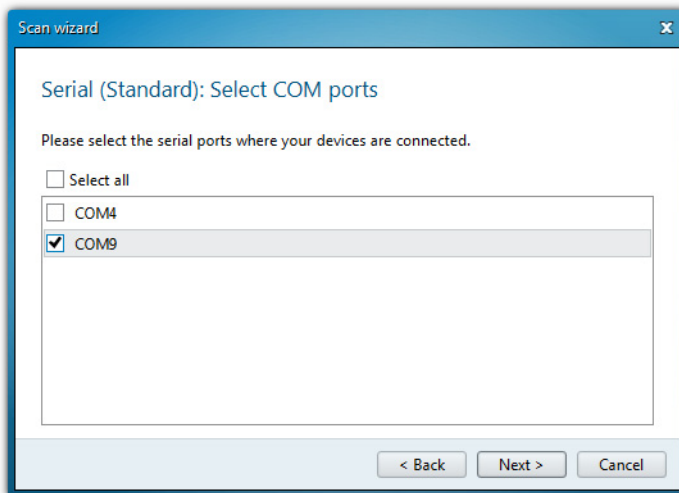


- 5 Click “Next”.
- 6 When devices are connected via serial connections (COM ports), select the COM ports used and click “Next”.

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

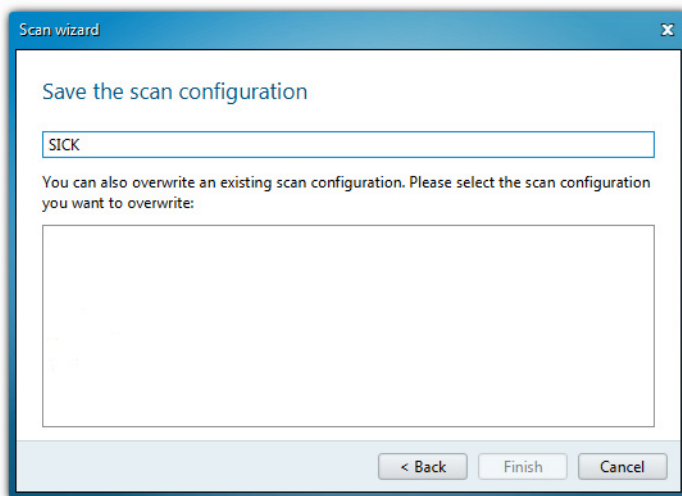
- ▶ If you are not sure which COM ports are used, select all COM ports.

Fig. 43 Selecting COM ports



- 7 To save the search settings, enter a name and click “Finish”. SOPAS ET starts the device search. The devices found are displayed in the “Device search” area when the device search is finished (→ p. 64, Fig. 50).

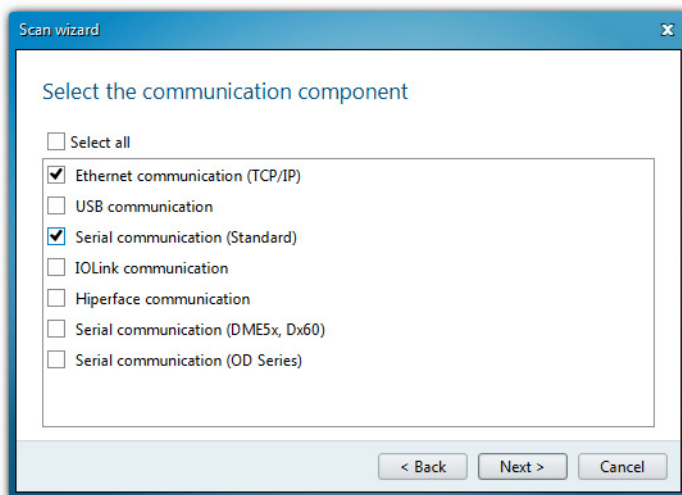
Fig. 44 Saving the search settings



4.1.3.3 Connect to the device with advanced mode

- 1 Click "Search settings".
- 2 Select search mode "Interface oriented search".
- 3 Select the communication interfaces where the search is to be made and click "Next".

Fig. 45 Selecting the communication interface

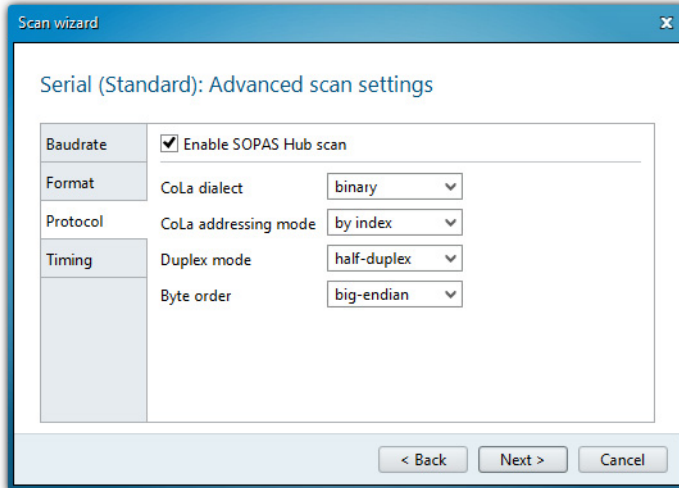


- 4 Configure the interfaces and click "Next".

Ethernet communication

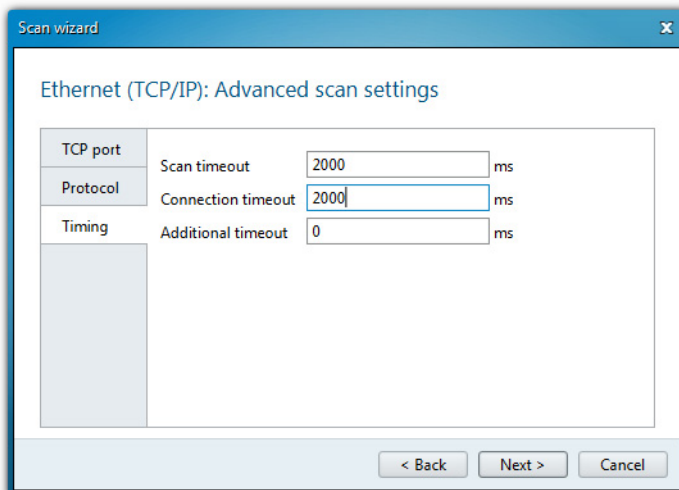
- ▶ Select “Custom IP address configuration”.
- ▶ Click “Add”.
- ▶ Enter the IP address of the device or the IP address range when several devices are used and confirm with “OK”.
- ▶ Select TCP port 2111 in the “TCP port” directory.
- ▶ Define the protocol settings in the “Protocol” directory according to → p. 62, Fig. 46.

Fig. 46 Defining the protocol settings




- ▶ Define the timeout settings in the “Timing” directory according to → Fig. 47.

Fig. 47 Defining the timeout settings

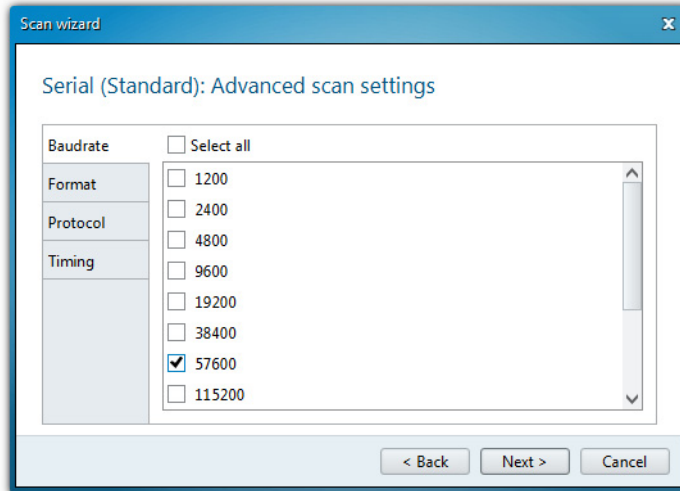


Serial communication (when connected via USB)

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

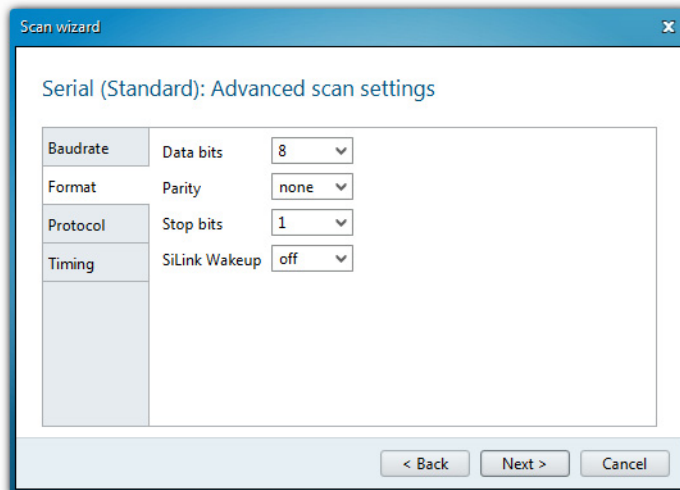
- ▶ Select the COM ports used.
- ▶ If you are not sure which COM ports are used, select all COM ports.
- ▶ Define the baud rate settings in the “Baudrate” directory according to → p. 63, Fig. 48.

Fig. 48 Selecting the baud rate



- ▶ Configure the data format in the “Format” directory according to → p. 63, Fig. 49.

Fig. 49 Configuring the data format

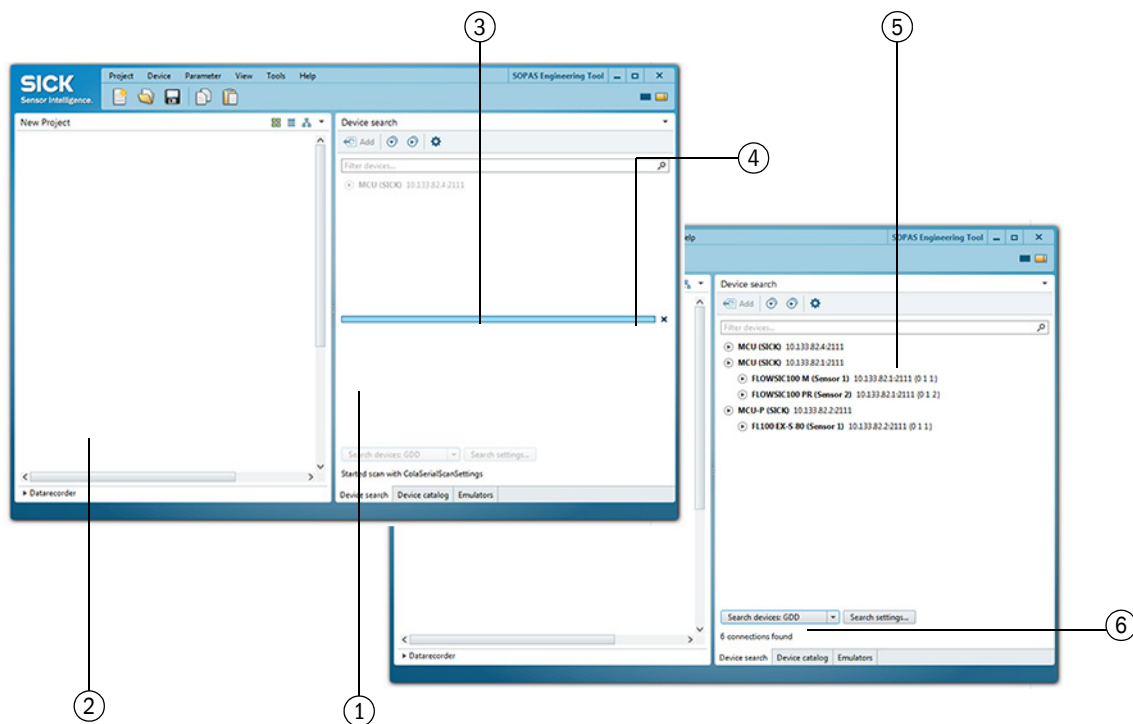


- ▶ Define the protocol settings in the “Protocol” directory according to → p. 61, Fig. 45.
- ▶ Define the timeout settings in the “Timing” directory according to → p. 62, Fig. 46.

- 5 To save the scan settings, enter a name and click “Finish” (→ p. 61, Fig. 44). SOPAS ET starts the device search. The devices found are displayed in the “Device search” area when device search is finished (→ p. 64, Fig. 50).

4.1.4 Information on using the program

Fig. 50 Overview



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

Device selection

- ▶ Move the required devices with drag-and-drop or a double-click on the required device into the project area.
 - The configuration of the devices is shown in a separate device window.
 - The device windows can be opened by a double-click on the respective device file or the context menu (→ p. 66, Fig. 52).

Fig. 51 Device selection

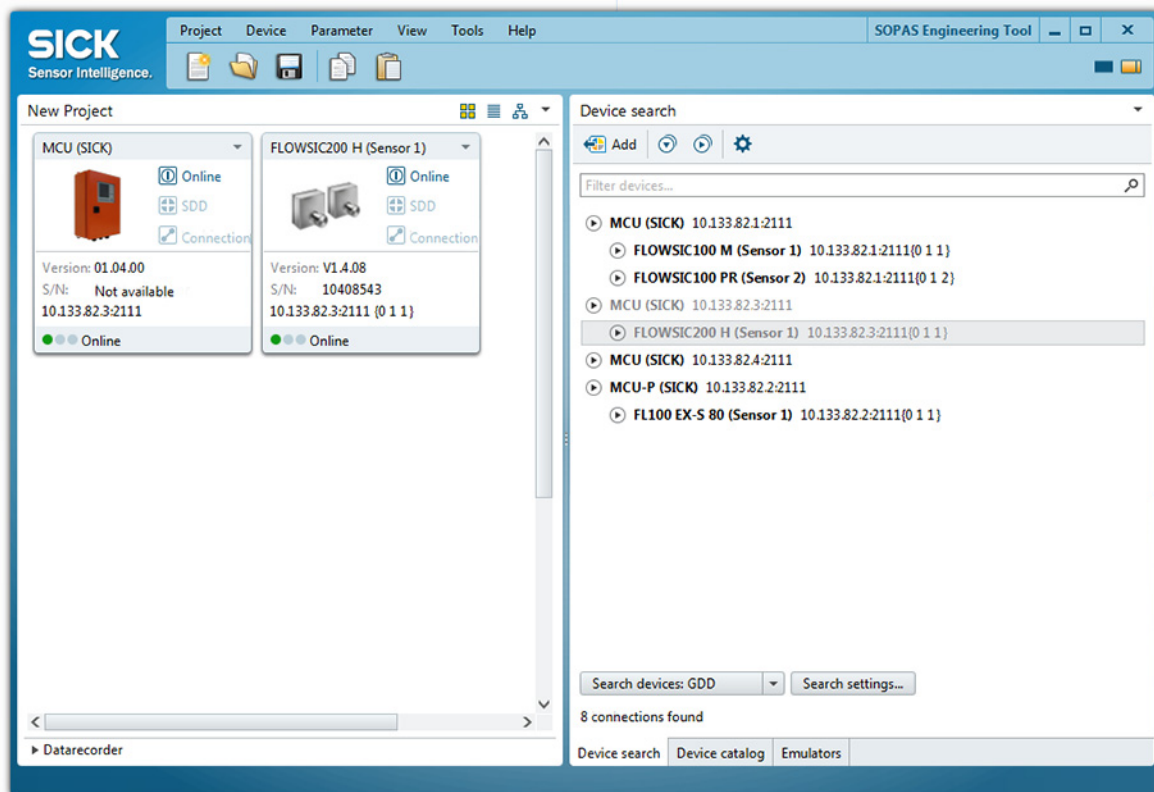


Fig. 52

Device context menu

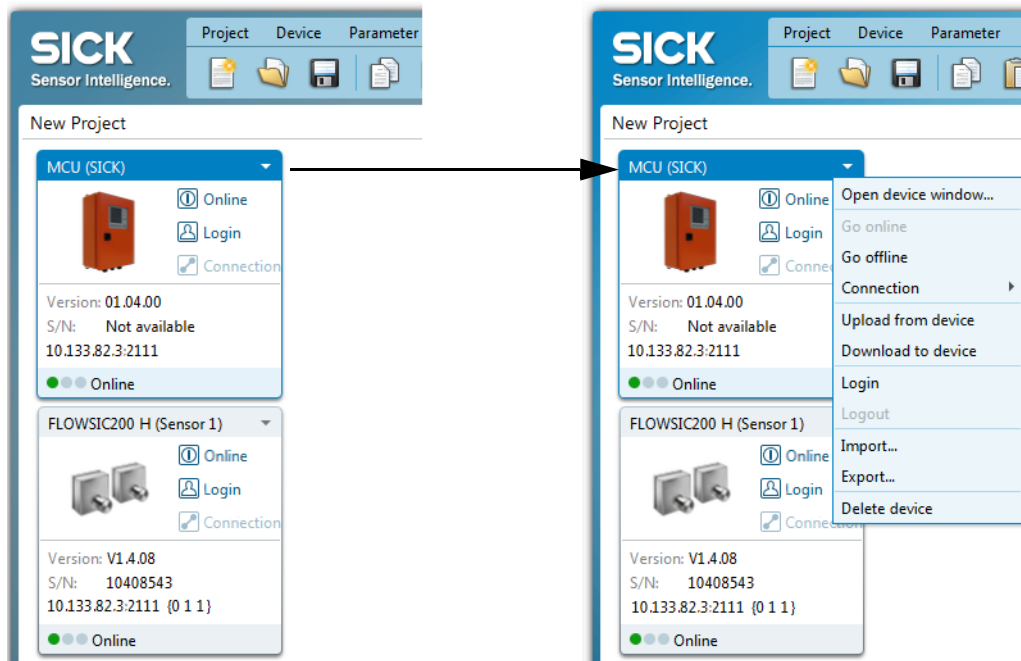


Table 1

Contents of device context menu

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

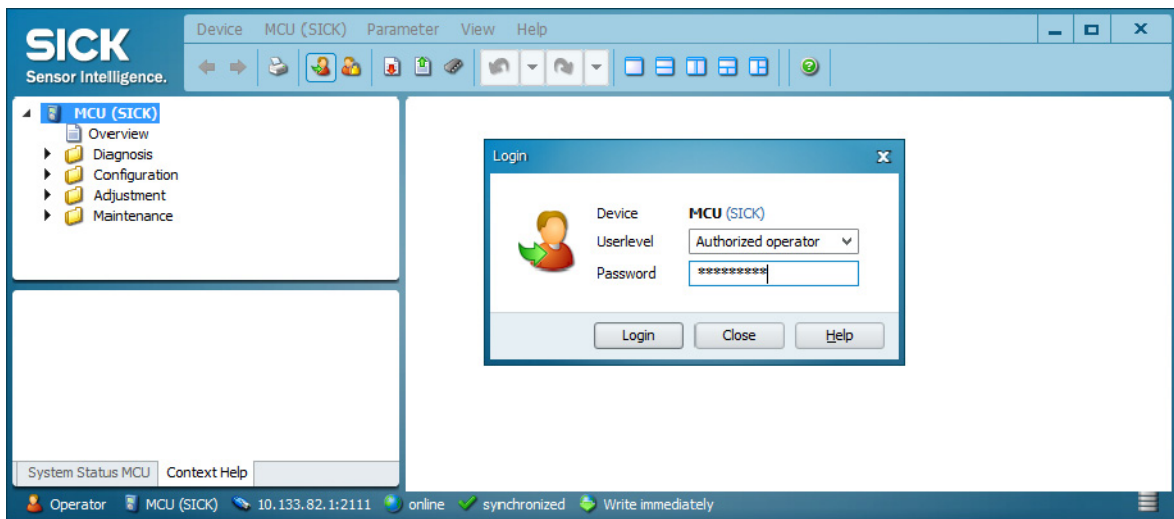
Password

Certain device functions are first accessible after a password has been entered (→ Fig. 53). Access rights are assigned in 3 levels:

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

The level 1 default password is included in the Annex.

Fig. 53 Entering the password



4.2 Standard commissioning procedure

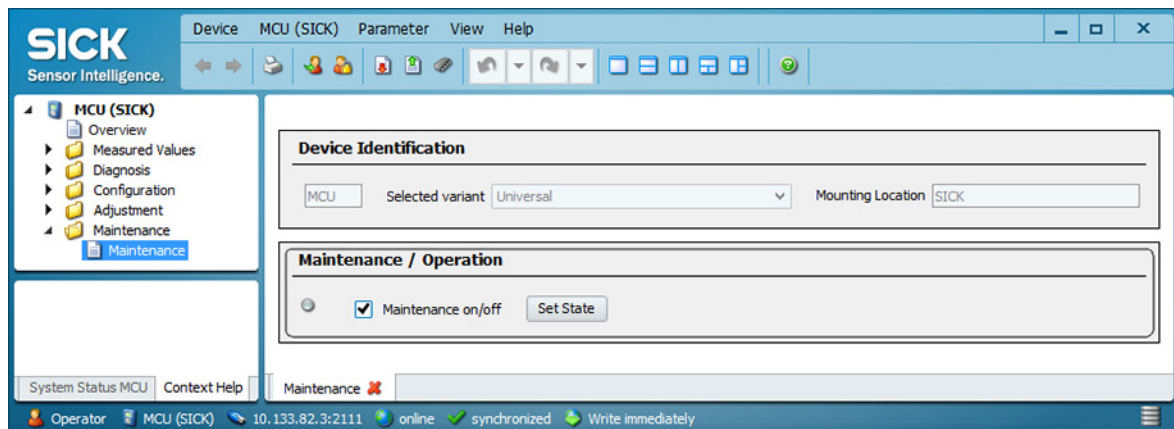
This Section describes all the settings required for the device function.

+i Error message “Error Parameter” is output as long as the plant data (→ p. 71, §4.2.4) have not been entered completely.

To set/change the parameters, carry out the following procedure:

- ▶ Connect the measuring system to the SOPAS ET program, scan the network and add the required device file (MCU, FLOWSIC200 M/FLOWSIC200 H/FLOWSIC200 H-M) to the current project (→ p. 64, §4.1.4).
- ▶ Enter the Level 1 password (→ p. 64, §4.1.4) and open directory “Maintenance / Maintenance / Operation”.
- ▶ Activate checkbox “Maintenance” (MCU) or “Sensor maintenance” (sender/receiver unit) and click “Set State”.

Fig. 54 Switching to Maintenance mode



4.2.1 Assigning sensors

The MCU must be set to the sender/receiver units to be connected. A malfunction is reported in case of a mismatch. Assignment must be made after installation when the setting is not possible at the factory (e.g., when several devices are delivered at the same time or when the MCU is swapped later). The following steps are then necessary:

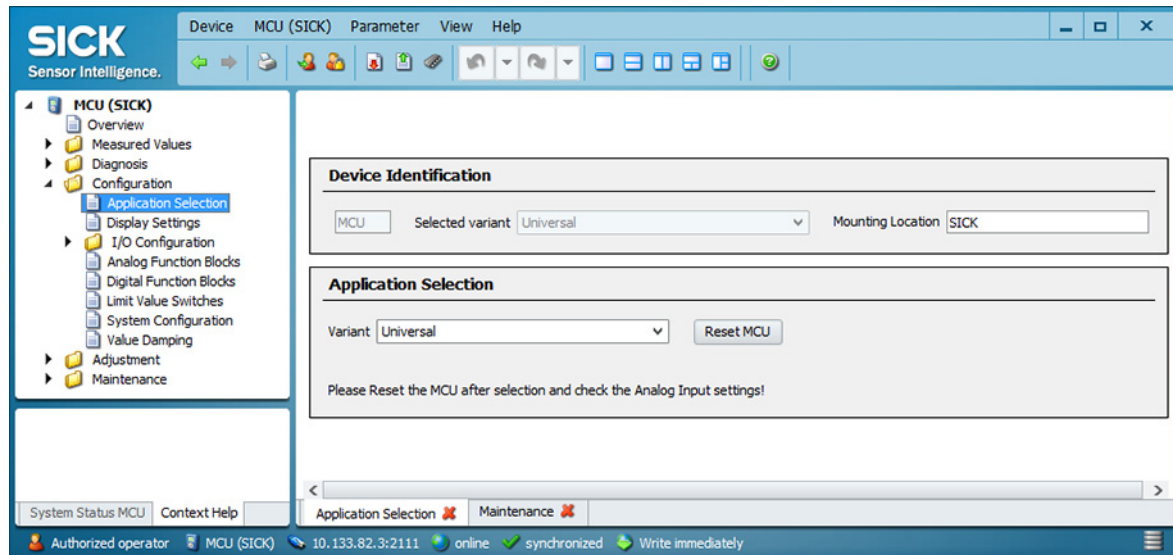
- ▶ Select device file “MCU”, open directory “Configuration / Application Selection” (→ p. 68, Fig. 55) and check the correct type is displayed in selection field “Variant” (“Universal” for FLOWVIC200).



The MCU must be connected with the sender/receiver units.

- ▶ If this not the case, set the measuring system to “Maintenance”.
- ▶ Select “Universal” in the “Variant” selection field (“Application Selection” area), click “Reset MCU” to restart the measuring system.

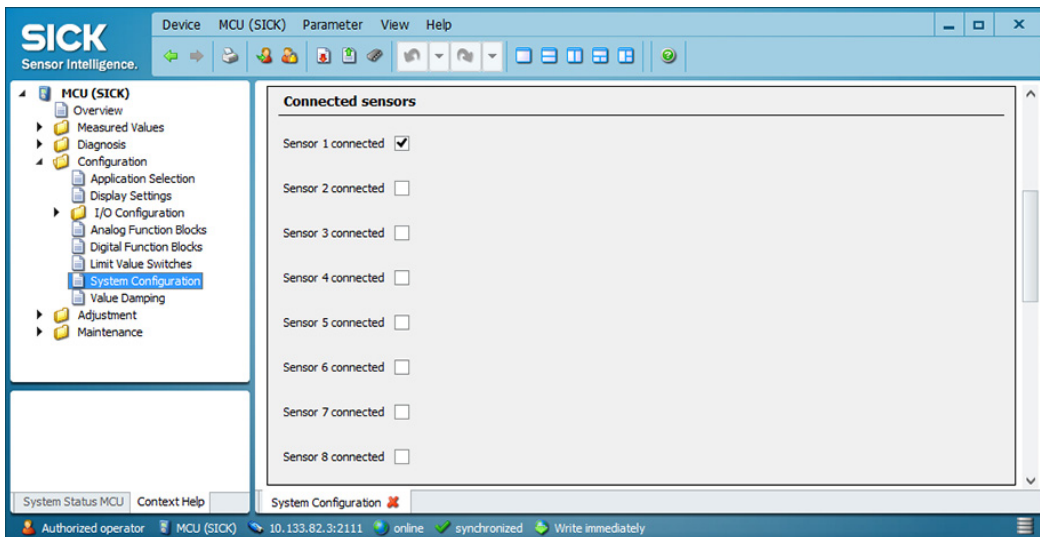
Fig. 55 Assigning sensors



4.2.2 **Activating connected sender/receiver units**

For correct communication of the MCU with all connected sender/receiver units, these must be activated in the “Configuration / System Configuration” directory in the “Connected sensors” area (if necessary, correct accordingly).

Fig. 56 Directory “Configuration / System Configuration” (settings example)

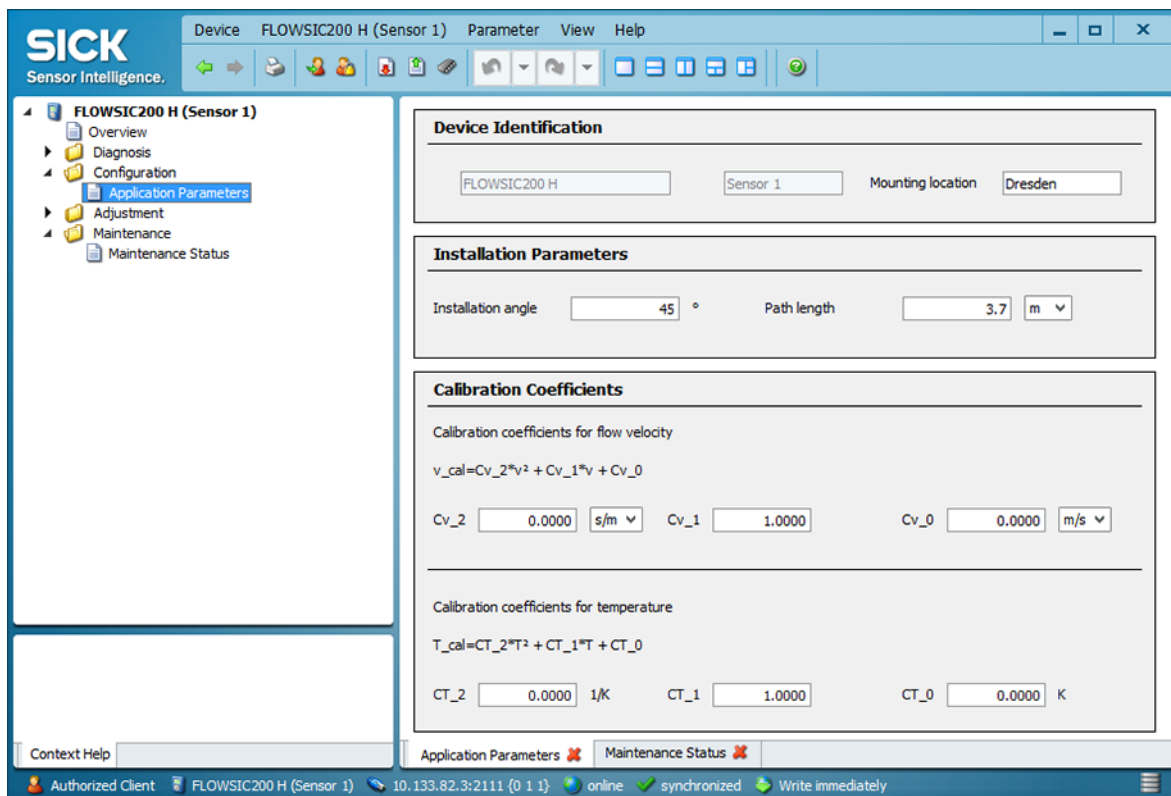


4.2.3 Assigning the measuring system to the measuring location

MCU and sender/receiver units can be clearly assigned to the respective measuring location.

- ▶ For the MCU, select directory “Configuration / Application Selection(→ p. 68, Fig. 55), set the measuring system to “Maintenance” (→ p. 67, §4.2) and enter the Level 1 password (→ p. 64, §4.1.4).
- ▶ Open device file “FLAWSIC200 M” or “FLAWSIC200 H” or “FLAWSIC200 H-M” for the sender/receiver unit, select directory “Configuration / Application Parameters”, set the sender/receiver unit to “Maintenance” and enter the Level 1 password.
- ▶ Enter the desired information in the “Mounting location” field.

Fig. 57 Directory “Configuration / Application Parameters” (settings example)



4.2.4 **Entering system data**

Basic requirement for every measurement is selecting the unit system (metric or imperial units) to be used and entering the installation parameters (measuring distance, installation angle). Carry out the following steps for setting:

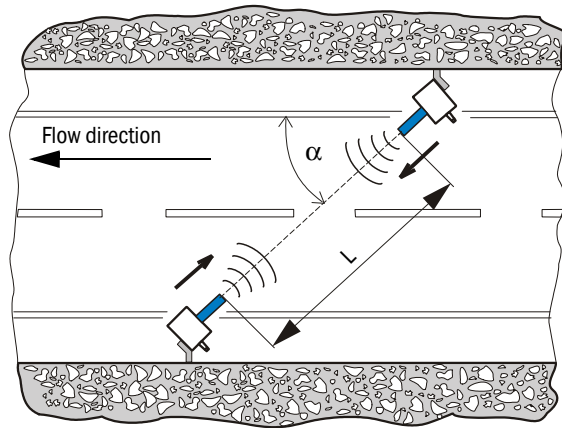
- ▶ Open device file “FLWSIC200 M”, “FLWSIC200 H” or “FLWSIC200 H-M”.
- ▶ Set the sender/receiver unit in “Maintenance” and enter the Level 1 password (→ p. 64, §4.1.4).
- ▶ Select directory “Configuration / Application Parameters“ (→ p. 70, Fig. 57).
- ▶ In field “Installation Parameters“ (→ p. 70, Fig. 57), enter the path length and installation angle (→ p. 71, Fig. 58). The settings are uploaded to the FLWSIC200 after switching from “Maintenance” to “Measurement”.

+i The installation parameter settings are converted automatically when the unit system is changed.

The following is applicable for application parameters:

Fig. 58

Basic parameters

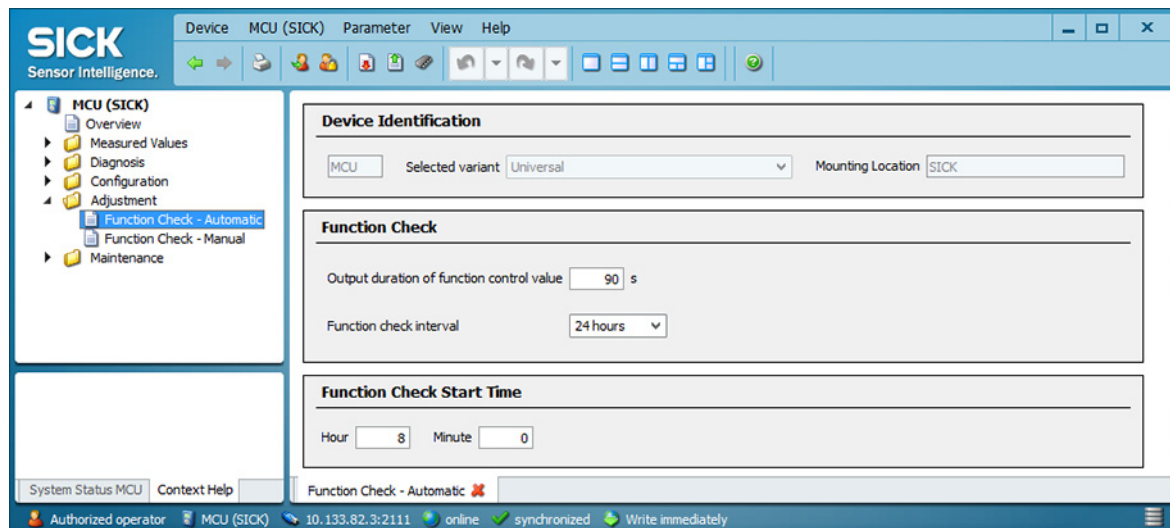


Entry field	Parameter
Installation angle	α Angle between measurement axis and flow direction
Measuring distance	L Distance transducer - transducer

4.2.5 **Setting the check cycle**

- ▶ To set/change the interval time, output of control values on the analog output and start timepoint for the automatic control cycle, open the “MCU” device file and select directory “Adjustment / Function Check - Automatic”.

Fig. 59 Directory “Adjustment / Function Check - Automatic” (settings example)



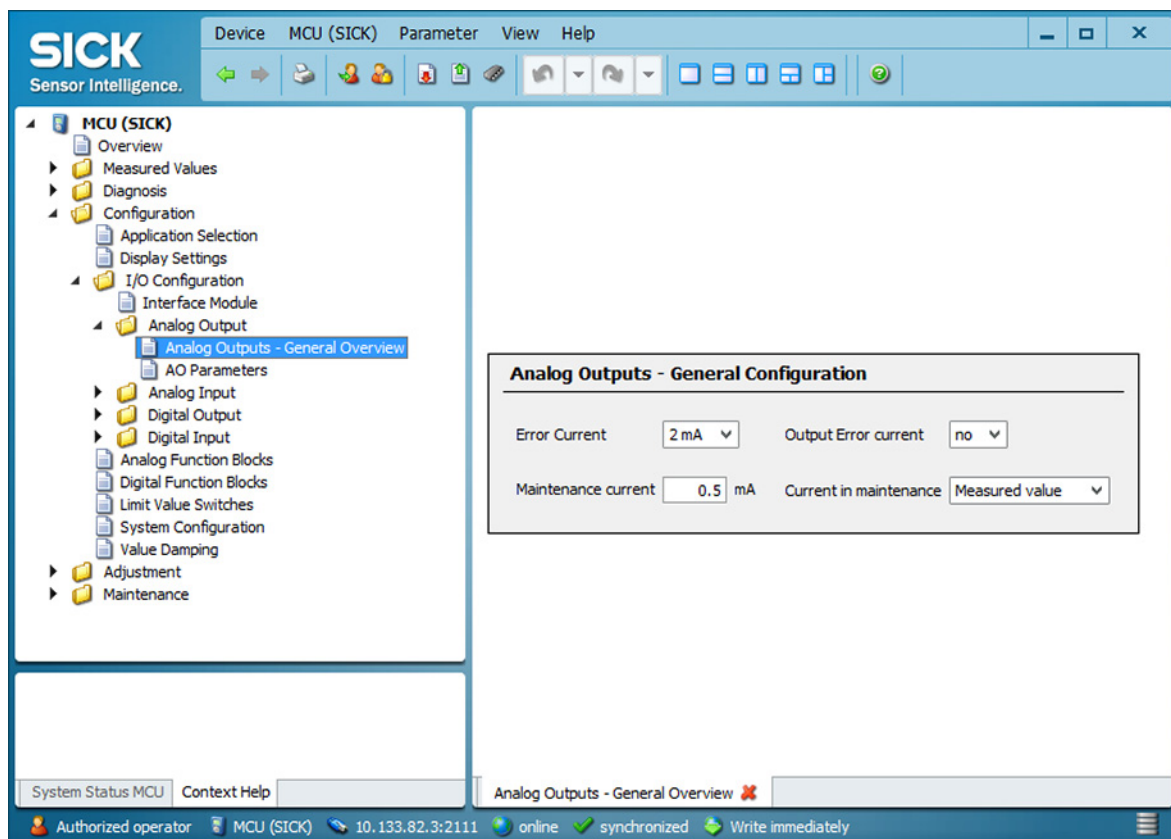
Entry field	Parameter	Remark
Output duration of function control value	Value in seconds	Output duration of check value
Function check interval	Time between two check cycles	→ p. 28, §2.4
Function Check Start Time	Hour	Define a start timepoint in hours and minutes.
	Minute	

4.2.6 **Configuring the analog output**

Basic settings

Enter the current to be output on the analog output in the “Maintenance” or “Malfunction” state in the “Configuration / I/O Configuration / Analog Output / Analog Outputs - General Overview” directory.

Fig. 60 “Overview” submenu (example for settings)

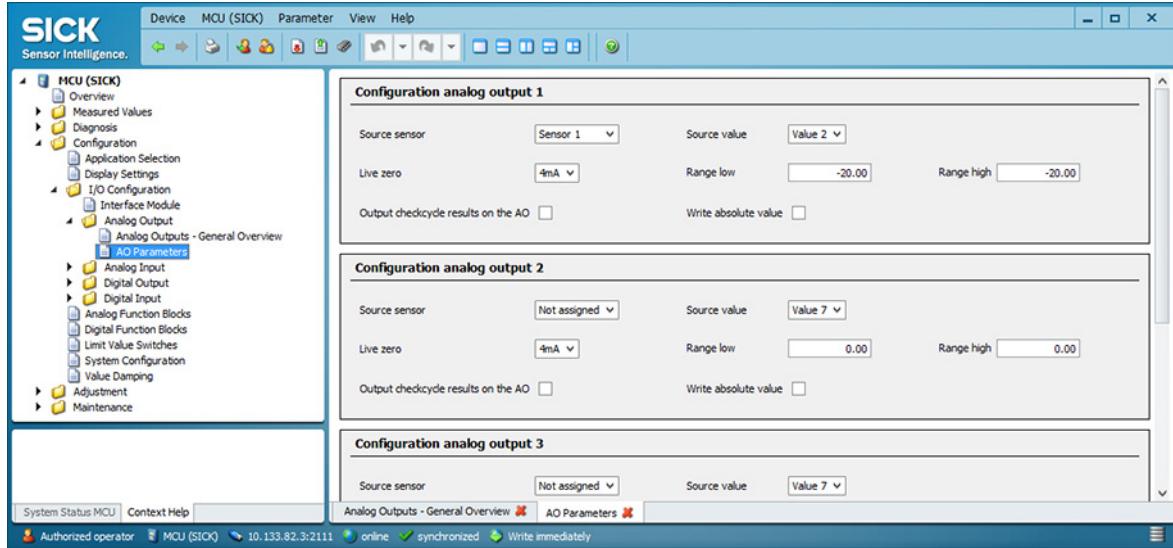


Field	Parameter	Remark
Error Current	Value < Live Zero (LZ) or > 20 mA	mA value to be output in “Malfunction” state (error case) (size depends on connected evaluation system).
Output Error current	yes	Error current is output.
	no	Error current is not output.
Maintenance current	Value if possible ≠ Live Zero	mA value to be output in “Maintenance” state
Current in maintenance	User defined value	A value to be defined is output during “Maintenance”
	Last measured value	The value measured last is output during “Maintenance”
	Measured value	The current measured value is output during “Maintenance”.

Configuration

In directory “Configuration / I/O Configuration / Analog Output / Analog Outputs”, the signal source (measuring signal of a sender/receiver unit) can be assigned to the standard analog output (AO) and live zero and measuring range can also be defined.

Fig. 61 “AO Parameters” subdirectory (example for settings)




Field	Parameter	Remark
Source sensor	Sensor 1 to 8	Sender/receiver unit whose output signal is to be assigned to the analog output.
Source value	Measured value 1	Volume flow in operating conditions*
	Measured value 2	Flow velocity
	Measured value 3	Sound velocity
	Measured value 4	Acoustic temperature
	Measured value 5	Temperature A*
	Measured value 6	Temperature B*
	Measured value 7	Signal to noise ratio A
	Measured value 8	Signal to noise ratio B
Live zero	Zero point (0, 2 or 4 mA)	Select 2 or 4 mA to differentiate clearly between measured value and device switched off, or current loop interrupted.
Range low	Lower measuring range limit	Physical value at live zero
Range high	Upper measuring range limit	Physical value at 20 mA
Output check cycle results on the AO	Inactive	Control values (→ p. 28, §2.4) are not output on the analog output.
	Active	Control values are output on the analog output (the “Output control values at AO” checkbox in the “Adjustment / Function Check - Automatic” directory must be activated).
Write absolute value	Inactive	Positive and negative measured values are differentiated.
	Active	The amount of the measured value is output.

* Not relevant for FLOWIC200

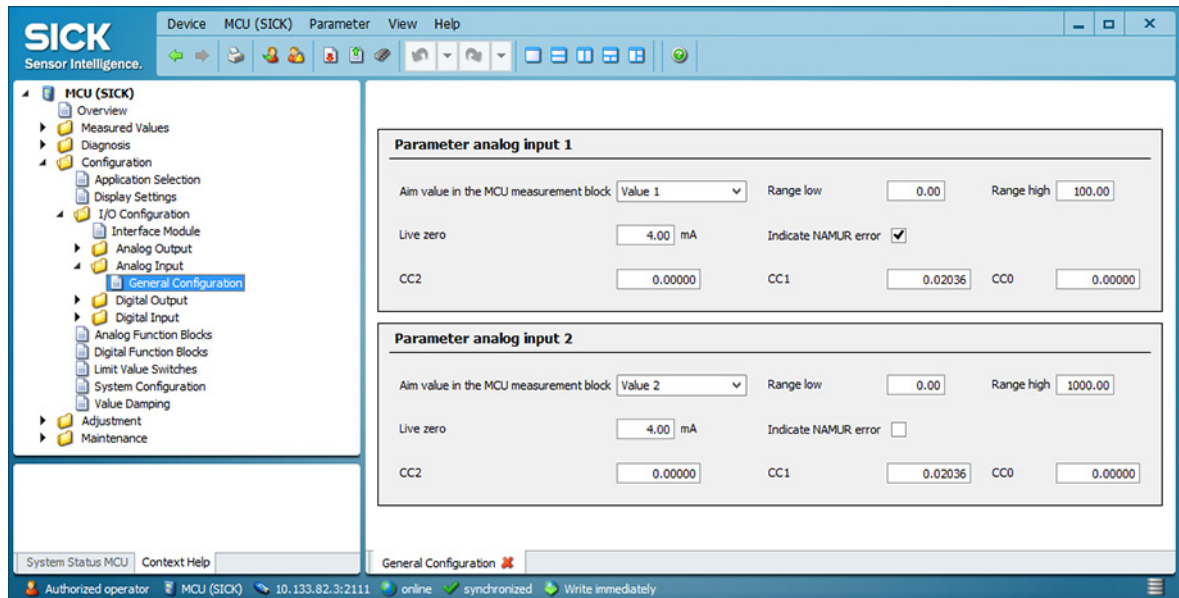
4.2.7 **Configuring the analog inputs**

In directory “Configuration / I/O Configuration / Analog Input / General Configuration”, the standard analog inputs can be assigned to any measured values to be standardized in the “Parameter analog input 1” and “Parameter analog input 2” groups, and the respective measuring range can be defined.



NOTICE:
Correction factors CC2, CC1 and CC0 are preset at the factory and may only be changed by Endress+Hauser Service.

Fig. 62 Directory “Configuration / I/O Configuration / Analog Output / Analog Input”(example)

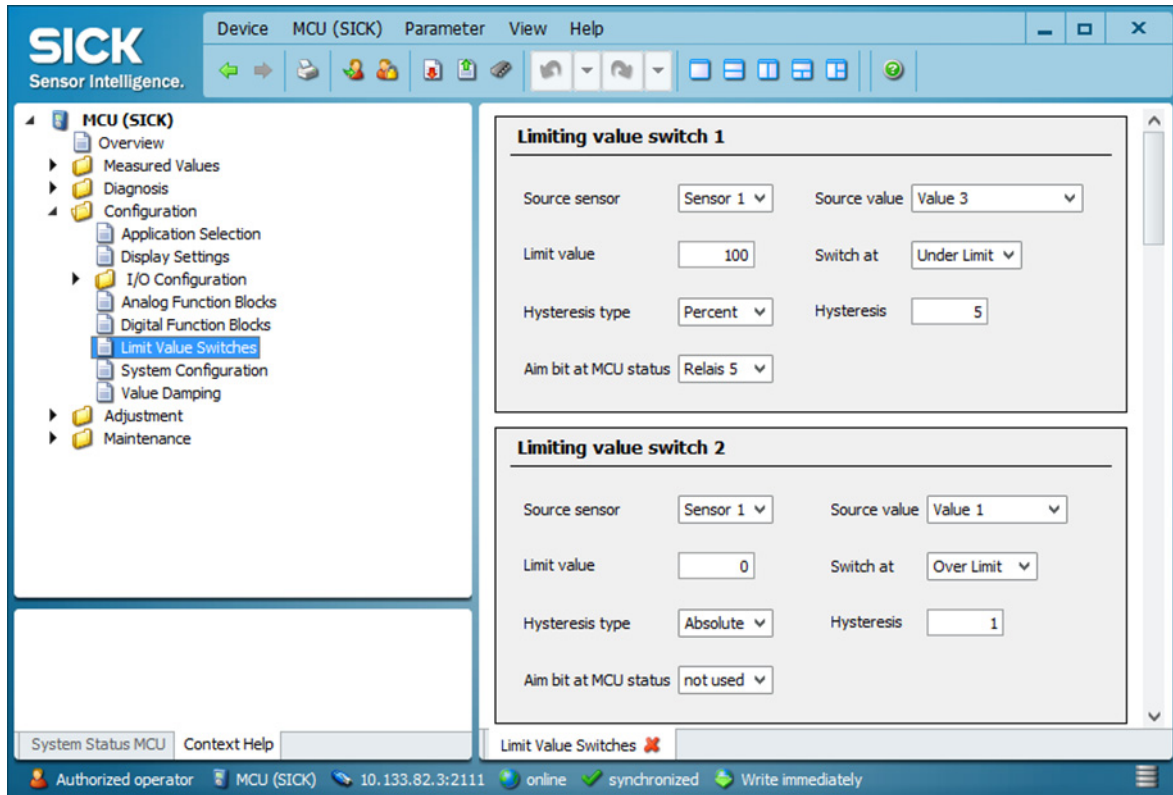


Field	Parameter	Remark
Aim value in the MCU measurement block	Measured value 1 to 8	Variable to be assigned to the selected analog input
Range low	Lower measuring range limit	Physical value at live zero
Range high	Upper measuring range limit	Physical value at maximum current
Live zero	Zero point value > 0 mA)	Specification of the mA value for measurement range start
Indicate NAMUR error	Inactive	No error is reported for underflow or overflow of the set current range (LZ to 20 mA).
	Active	An error is reported for underflow or overflow of the set current range (LZ to 20 mA).
CC2	Square correction factor	Correction factors for calibrating the input size (factory preset) Modification only by Endress+Hauser Service!
CC1	Linear correction factor	
CC0	Absolute correction factor	

4.2.8 **Configuring the limit value relay**

Select directory “Configuration / Limit Value Switches” for configuring.

Fig. 63 “Configuration / Limit Value Switches” directory



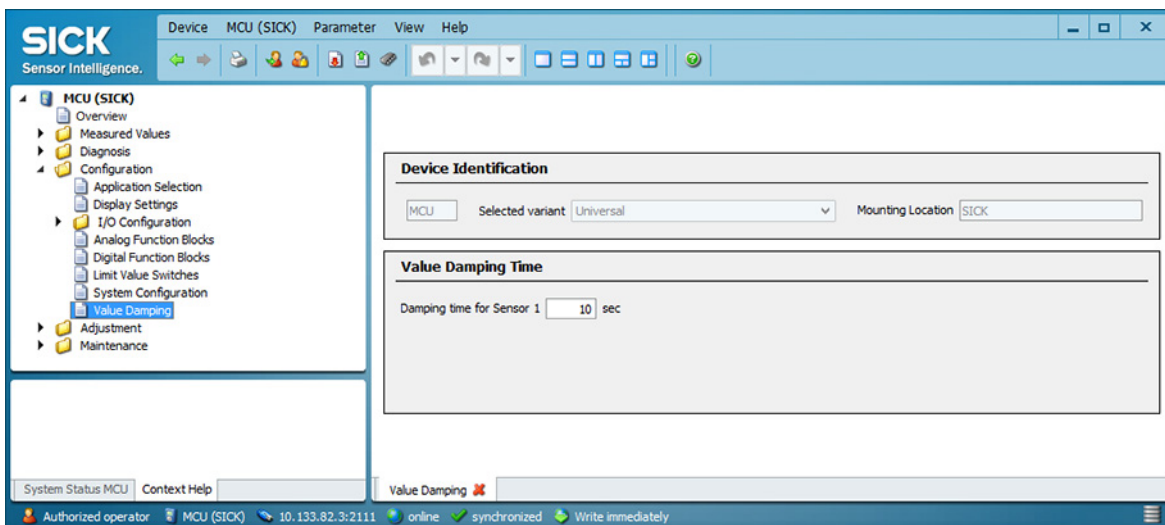
Field	Parameter	Remark
Source sensor	Sensor 1 to 8	Sensor for which a limit value is to be assigned to the output signal.
Source Value	Measured value 1	Volume flow in operating conditions*
	Measured value 2	Flow velocity
	Measured value 3	Sound velocity
	Measured value 4	Acoustic temperature
	Measured value 5	Temperature A*
	Measured value 6	Temperature B*
	Measured value 7	Signal to noise ratio A
	Measured value 8	Signal to noise ratio B
Limit value	Value	The limit value relay switches when the entered value is overflown or underflown.
Switch at	Over Limit	Define the switching direction
	Underflow	
Hysteresis type	Percent	Assignment of the value entered in the “Hysteresis type” field as relative or absolute value of defined limit value
	Absolute	
Hysteresis	Value	Define a tolerance for resetting the limit value relay
Aim bit at MCU status	Relay 5	Aim bit at MCU status = special memory in the MCU for monitoring limit values

* Not relevant for FLOWIC200

4.2.9 **Setting the response time (damping time)**

Select directory “Configuration / Value Damping” to set the response time.

Fig. 64 Directory “Configuration / Value Damping (display for a connected sender/receiver unit)



Field	Parameter	Remark
Damping time for Sensor 1	Value in s	Response time for the selected measured variable (→ p. 27, §2.3.3)

+i If several sender/receiver units are connected (→ p. 15, Fig. 3), a separate input window exits for each measuring point to set an individual response time.

4.2.10 Output flow direction

To output the flow direction, the measuring range must be set in a negative and a positive range in the “Configuration / I/O Configuration / Analog Output / Analog Outputs” directory. The zero point then lies between the two end values. Falling below or exceeding the zero point can additionally be signaled with the limit value relay (→ p. 76, §4.2.8).

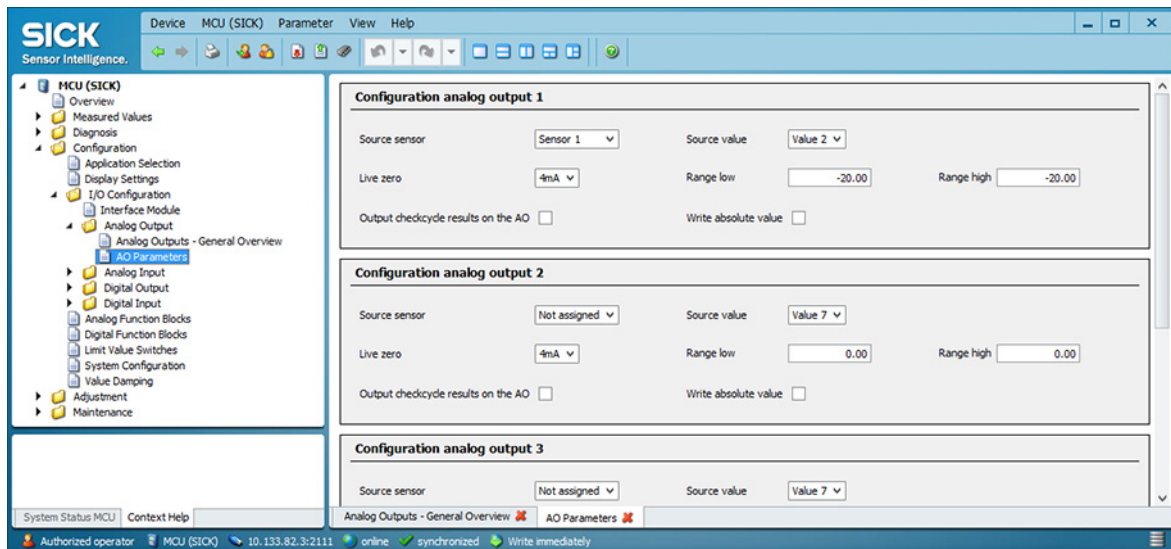
Example:

Measuring range: -20 ... +20 m/s

The Live zero value (= lower end value) corresponds to a physical value of -20 m/s, the 20 mA value (= upper end value) corresponds to a physical value of +20 m/s.

With Live zero = 4 mA, the zero point is at 12 mA.

Fig. 65 Directory “Configuration / I/O Configuration / Analog Output / Analog Outputs”



Optionally, only the amount of the measured value can be output. For this purpose, the “Write absolute value” checkbox must be activated.

**NOTICE:**


The limit value relay must be configured when the absolute value is output, otherwise no signaling of falling below or exceeding the zero point is possible.

4.2.11 **Data backup**

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

The following options are available.

- ▶ Saving as a project (particularly advantageous for diagnosis and troubleshooting)
- ▶ Not only device parameters but also data logs can be saved.
- ▶ Saving as a device file
- ▶ Saved parameters can be processed without a device connected and transferred to the device again later.

 See the Service Manual for a description.

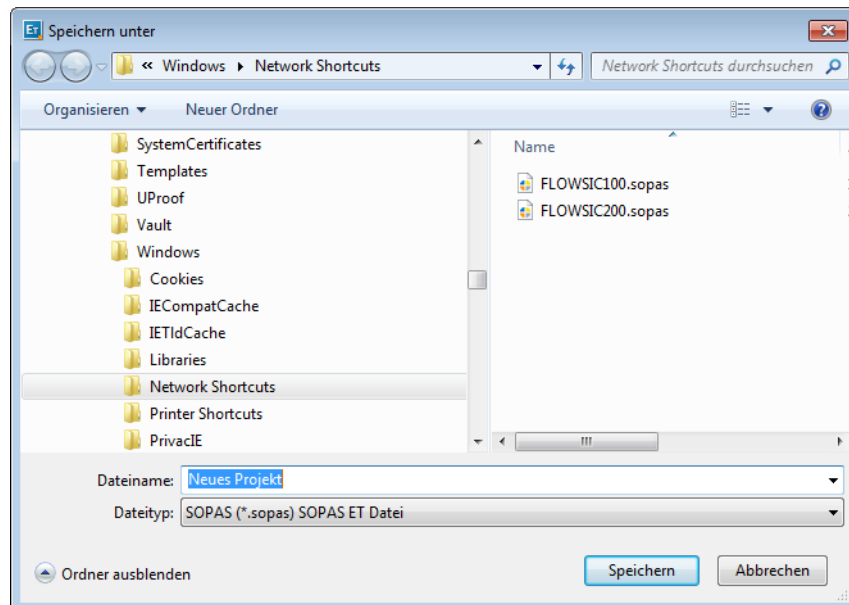
- ▶ Saving as a protocol
 Device data and parameters are registered in the Parameter protocol.
 A Diagnosis protocol can be created for analysis of the device function and recognition of possible malfunctions.

Saving as a project

It is recommended to save frequent connections as a “Project”. It is then only necessary to open this “Project” when reconnecting to the device. All data saved beforehand are then transferred automatically to SOPAS ET.

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

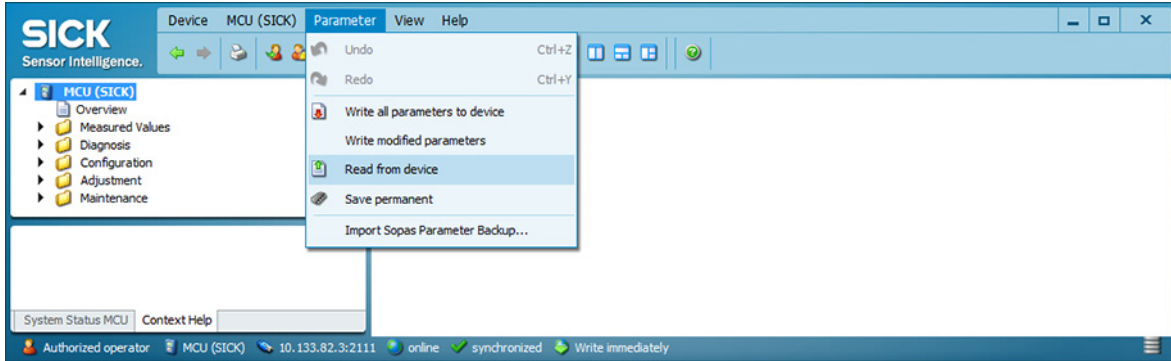
Fig. 66 Menu “Project / Save project”



Saving as a protocol

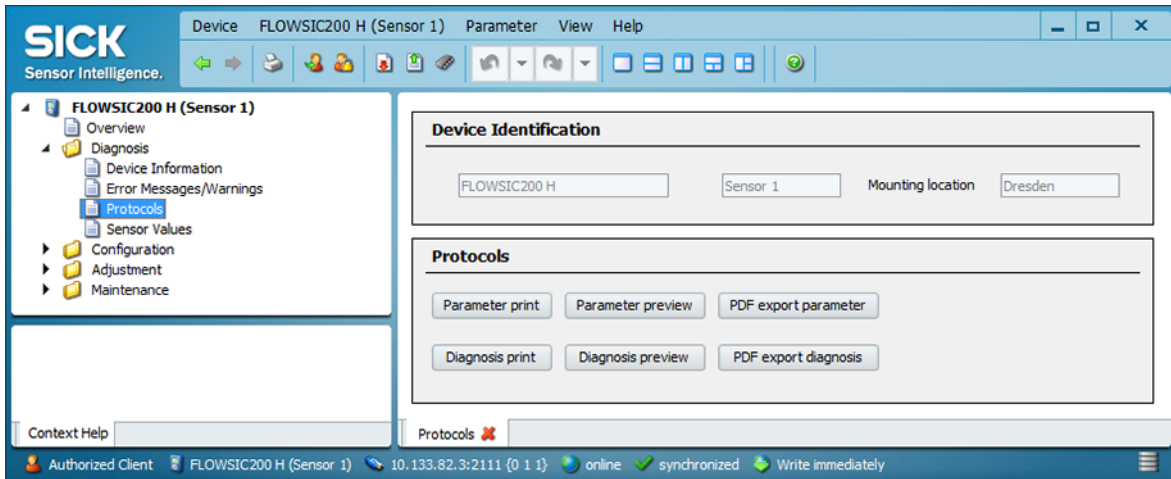
- ▶ Select device and update device data by selecting “Parameters/ Read from device” in the menu.

Fig. 67 Updating device data



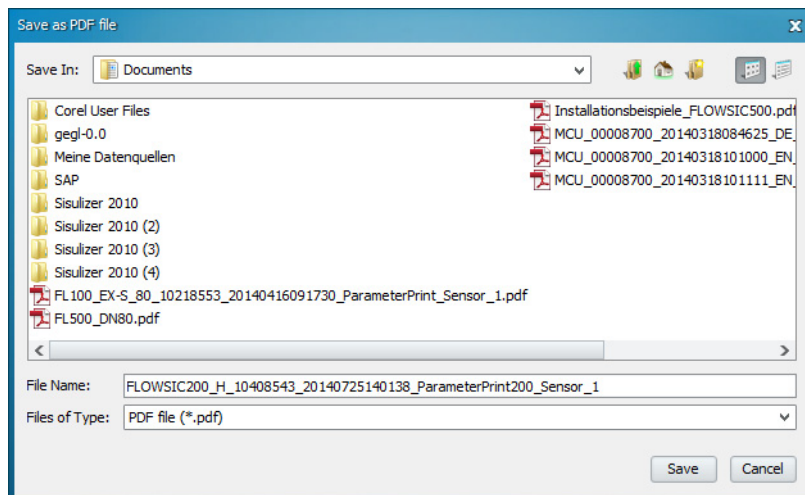
- ▶ Select directory “Diagnosis / Protocols” and click the desired protocol type.

Fig. 68 Directory “Diagnosis / Protocols”



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

Fig. 69 Specifying file name and storage location



Example of a Parameter protocol

Fig. 70

Parameter protocol (example)

MCU - Parameterprotokoll

Gerätetyp: MCU
Anbaustelle: SICK

Geräteinformation

Gerätetyp	MCU
Seriennummer	12368627
Ident Nummer	06135
Systemzeit	18 Mar 2014 09:34:52
Firmware Version	01.08.00
Hardware Version	1.8
Bootloader Version	01.00.02

Verrechnungsgrößen

Quellwerte

Quelle für Temperatur	Konstantwert
Quelle für Druck	Konstantwert
Quelle für Feuchte	Konstantwert

Konstantwerte

Konstantwert für Temperatur	20,00°C
Konstantwert für Druck	1013,25mbar
Konstantwert für Feuchte	0,00%

Justage

Kontrollzyklusintervall	8 Stunden
Kontrollzyklusausgabedauer	90s
Kontrollwerte am AO ausgeben	ja

Systemkonfiguration

Anzahl ext. AO	0
Anzahl ext. AI	0
Erweiterungsmodul	kein Modul

Erweiterungsmodul

Typ	Kein Modul gefunden
Profibusadresse	126
Modbusadresse	1
IP Adresse	192.168.000.010
Subnetzmaske	255.255.255.000
Gateway	000.000.000.000
TCP Port	2111

I/O Konfiguration

Analogausgang allgemein

Fehlerstrom Auswahl	ja
Fehlerstrom	21 mA
Wartungsstrom Auswahl	Messwertausgabe
Wartungsstrom	0,50mA
Spanwert	70%

Analogausgang 1

Live Zero	4 mA
unterer Endwert	-1,00
oberer Endwert	1,00
Kalibrierfaktor CC0	-1,6803
Kalibrierfaktor CC1	171,4620
Kalibrierfaktor CC2	0,0002
Quellwert	Gasgeschwindigkeit

Analogausgang 2

Live Zero	4 mA
unterer Endwert	-100,00
oberer Endwert	100000,00
Quellwert	Volumenstrom i.N. tr.

Analogausgang 3

Live Zero	4 mA
unterer Endwert	-20,00
oberer Endwert	20,00
Quellwert	Gasgeschwindigkeit

Analogausgang 4

Live Zero	4 mA
unterer Endwert	0,00
oberer Endwert	1,00
Quellwert	nicht verwendet

Analogausgang 5

Live Zero	4 mA
unterer Endwert	0,00
oberer Endwert	1,00
Quellwert	nicht verwendet

Analogeingang 1 (Temperatur)

Unterer Endwert	0,00°C
Oberer Endwert	0,00°C
Kalibrierfaktor CC0	-0,0300
Kalibrierfaktor CC1	0,0222
Kalibrierfaktor CC2	0,0000

Analogeingang 2 (Druck)

Unterer Endwert	0,00mbar
Oberer Endwert	0,00mbar
Kalibrierfaktor CC0	-0,0200
Kalibrierfaktor CC1	0,0222
Kalibrierfaktor CC2	0,0000

Analogeingang 3 (Feuchte)

Unterer Endwert	0,00%
Oberer Endwert	0,00%

Grenzwertschalter

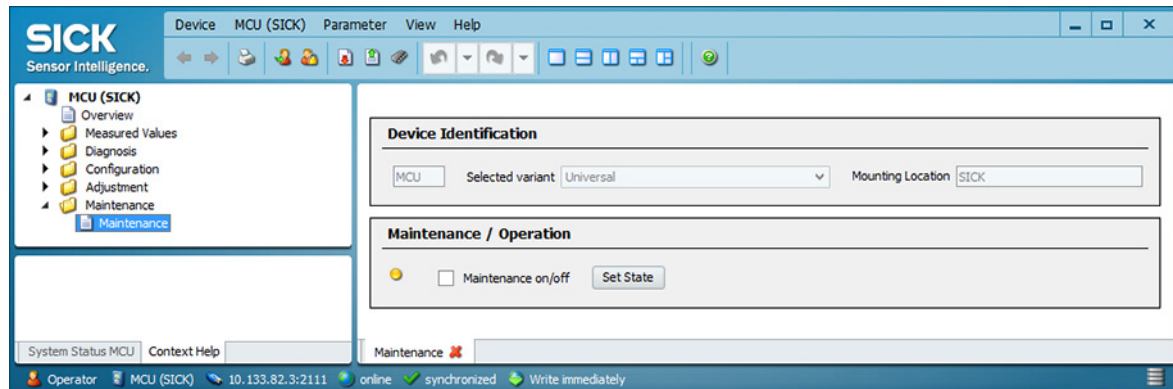
Quellwert	Gasgeschwindigkeit
Grenzwert	4,50
T90 Time	
T90 Zeit Flowsic	10.0s

4.2.12 Starting normal measuring operation

Set the measuring system to “Measurement” mode after entering or modifying parameters. By deactivating Maintenance mode, the normal measuring operation is started:

- ▶ Open directory “Maintenance/Maintenance”.
- ▶ Deactivate checkbox “Maintenance on/off” or “Sensor maintenance” (sender/receiver unit) and click “Set State”.

Fig. 71 Setting the operational state



Checking the signal waveform

Checking the signal waveform allows an assessment on the quality of the received ultrasonic signals.

For display on the screen, open the device file “FLWSIC200 M” or “FLWSIC200 H” or “FLWSIC200 H-M” and select the directory “Diagnosis/Sensor values” (operating mode “Measurement”).

The ultrasonic signals of both transducers are then displayed in the “Signal Display” field alternating as raw signal and envelope curve.

Setting the “View Envelope Curve” function shows the envelope curves of both transducers. The signal waveform should match the waveforms in the → p. 83, Fig. 72 to → p. 84, Fig. 75.

Type FLSE200-M

Fig. 72 Burst waveform HF signal (unconditioned signal)

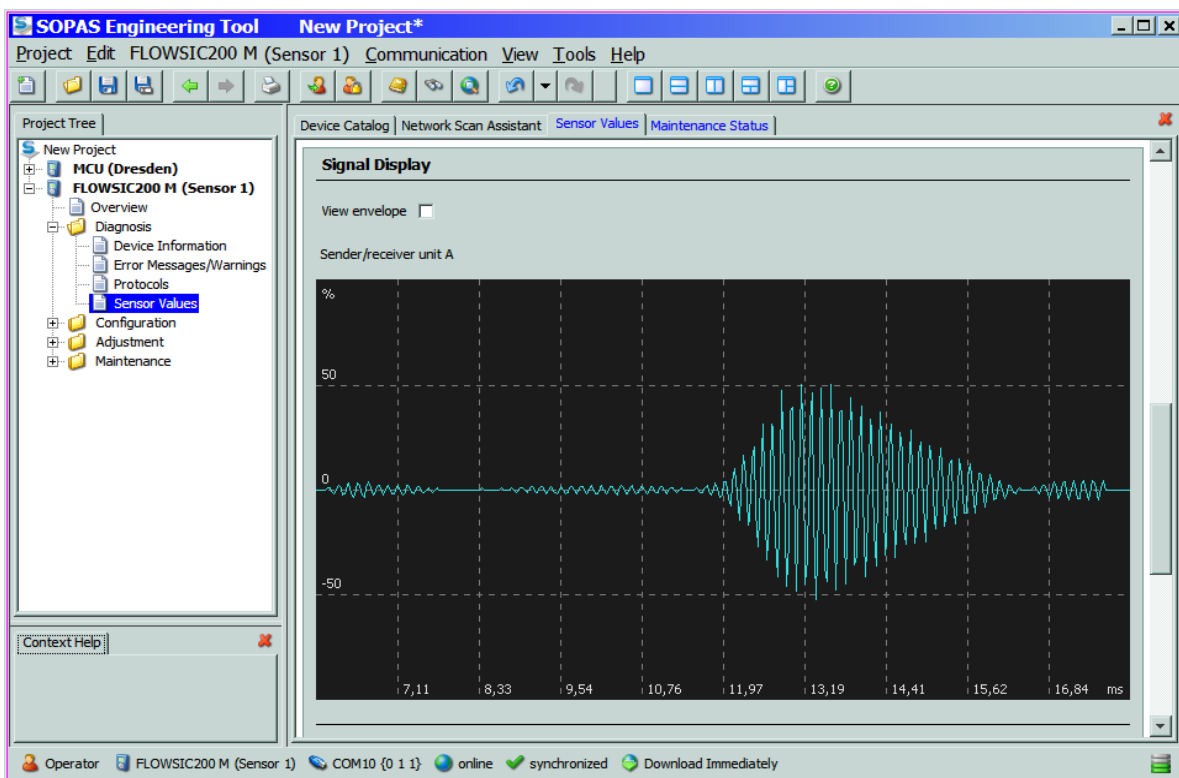
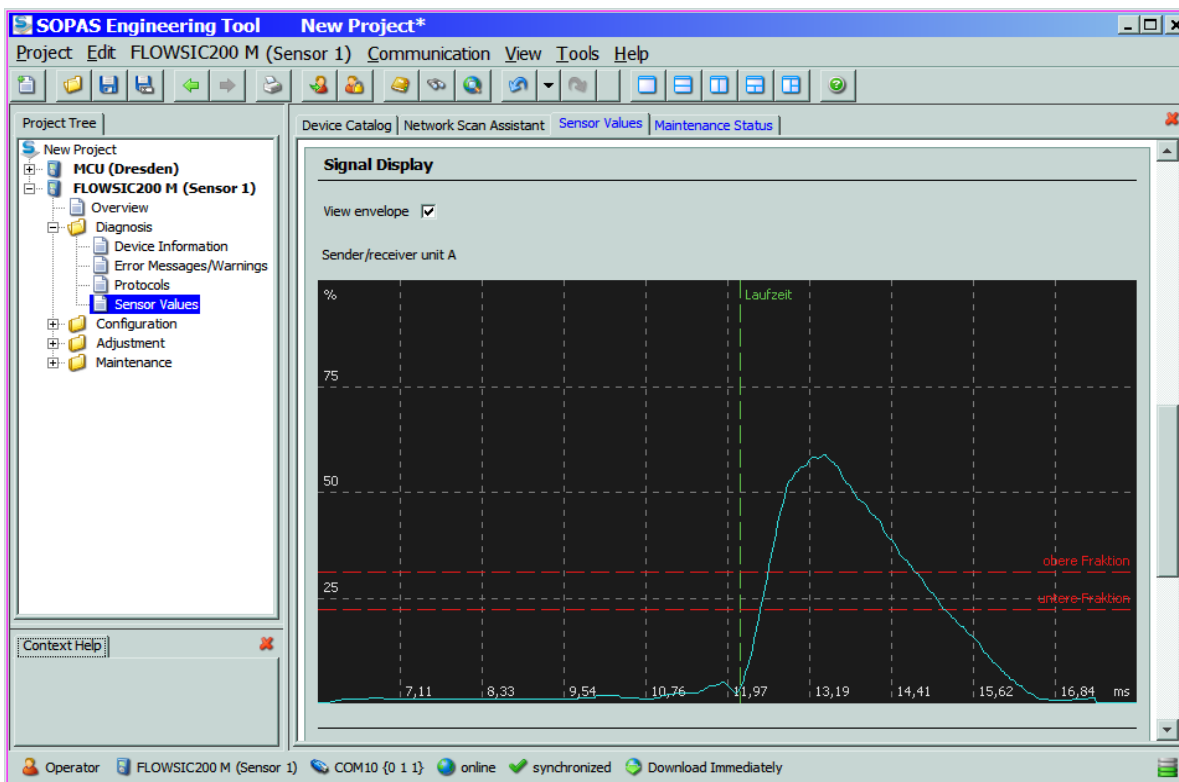


Fig. 73 Burst waveform demodulated signal (envelope)



Type FLSE200-H and FLSE200-HM

Fig. 74 Burst waveform HF-signal (unconditioned signal)

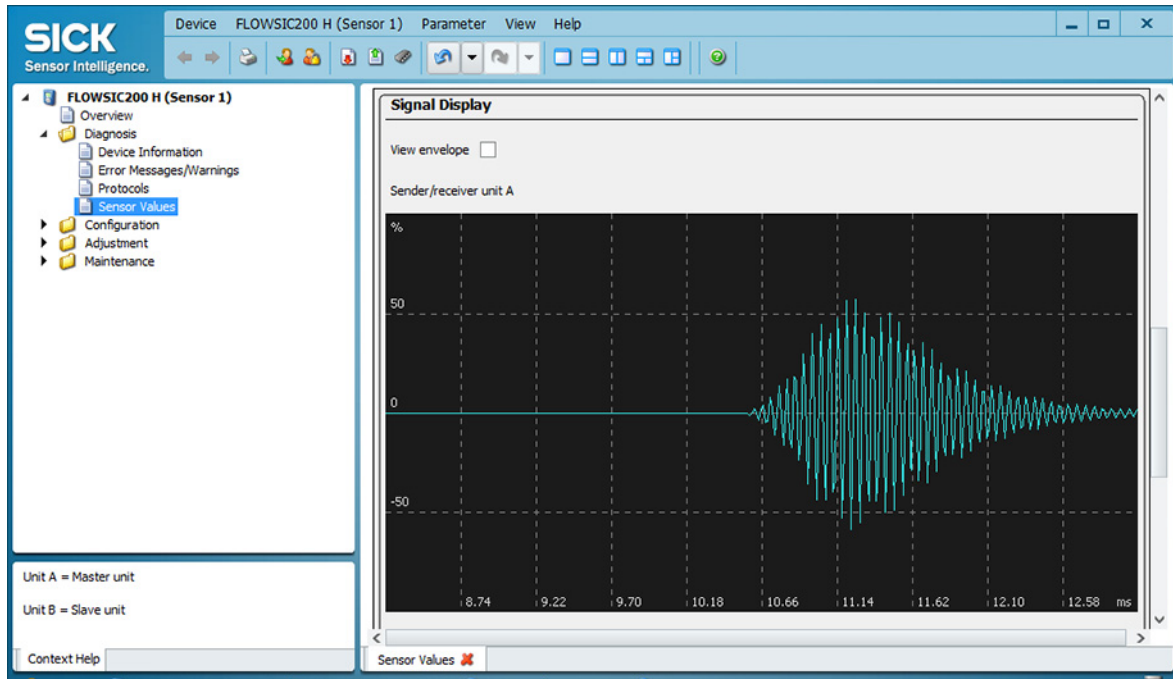
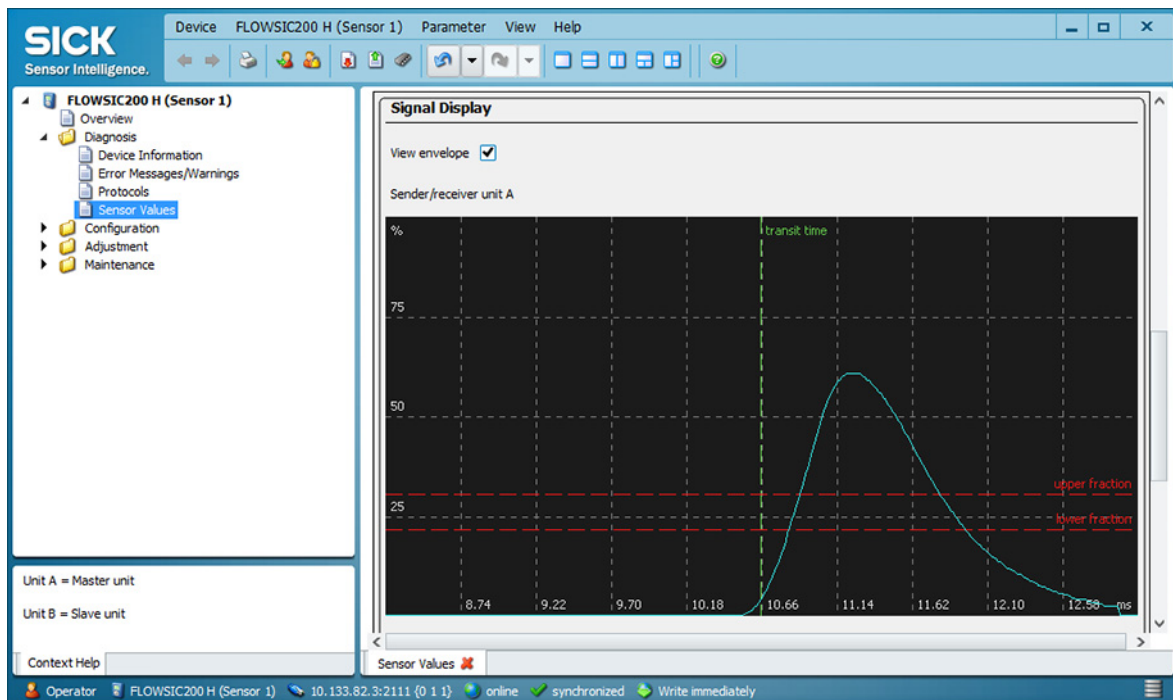


Fig. 75 Burst waveform demodulated signal (envelope)

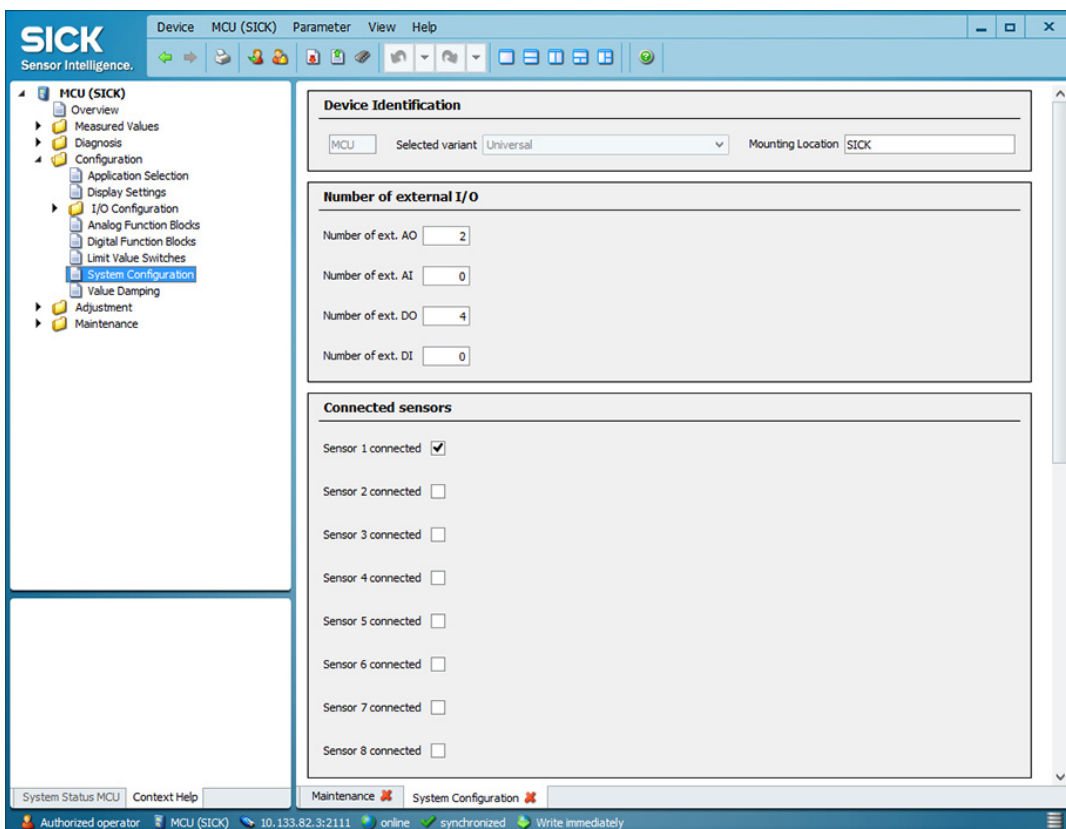


4.3 **Advanced commissioning**

4.3.1 **Parameterizing optional analog and digital output modules**

To do this, the modules installed in the MCU must be activated. To do this, open the “MCU” device file, select the “Configuration / System Configuration” directory and check whether the number of outputs entered in the “Number of external I/O” field matches the existing ones (correct if necessary).

Fig. 76 Directory “Configuration / System Configuration” (settings example)



4.3.1.1 **Analog outputs**

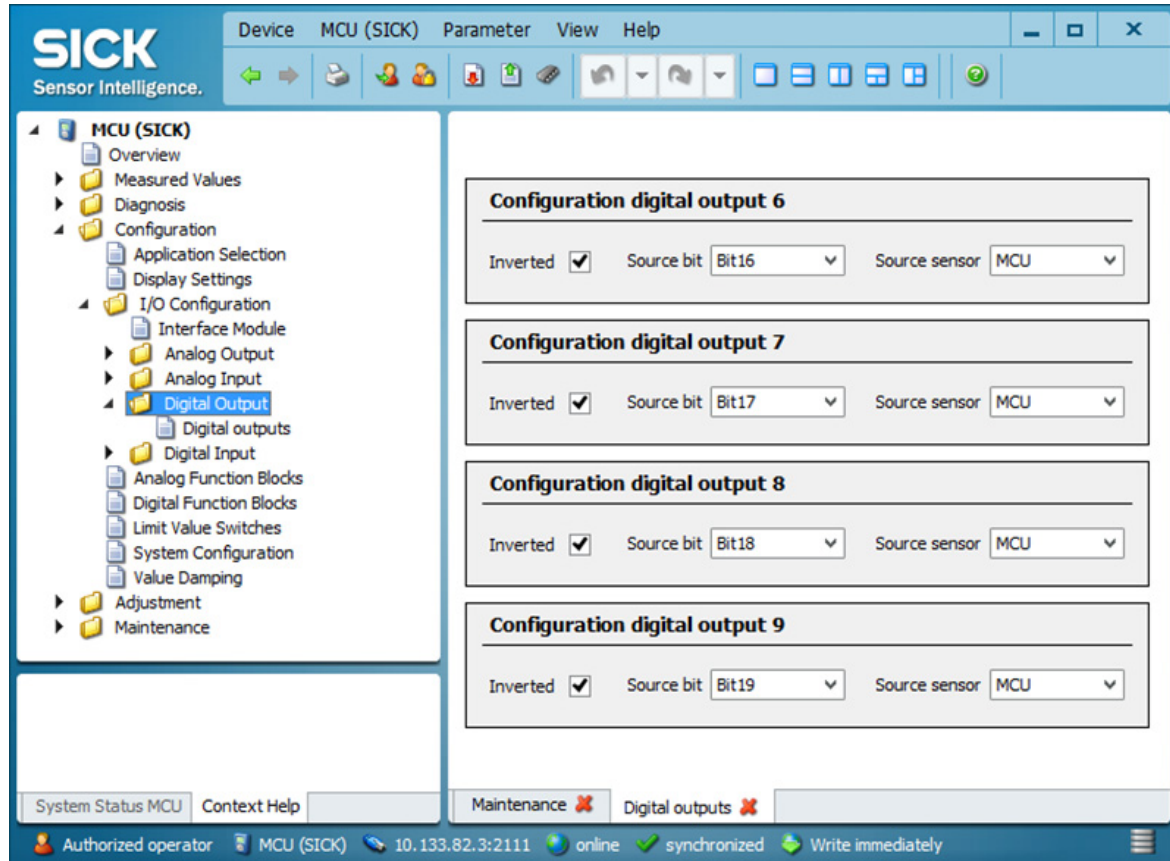
Configure in accordance with → p. 73, §4.2.6 (→ p. 74, Fig. 61).

The basic settings (subdirectory “Overview analog outputs” (→ p. 73, Fig. 60) apply to all additional analog outputs in the same way.

4.3.1.2 Digital outputs

Select the "Configuration / I/O Configuration / Digital Output / Digital outputs" directory for entering parameters.

Fig. 77 "Configuration / I/O Configuration / Digital Output / Digital outputs" directory

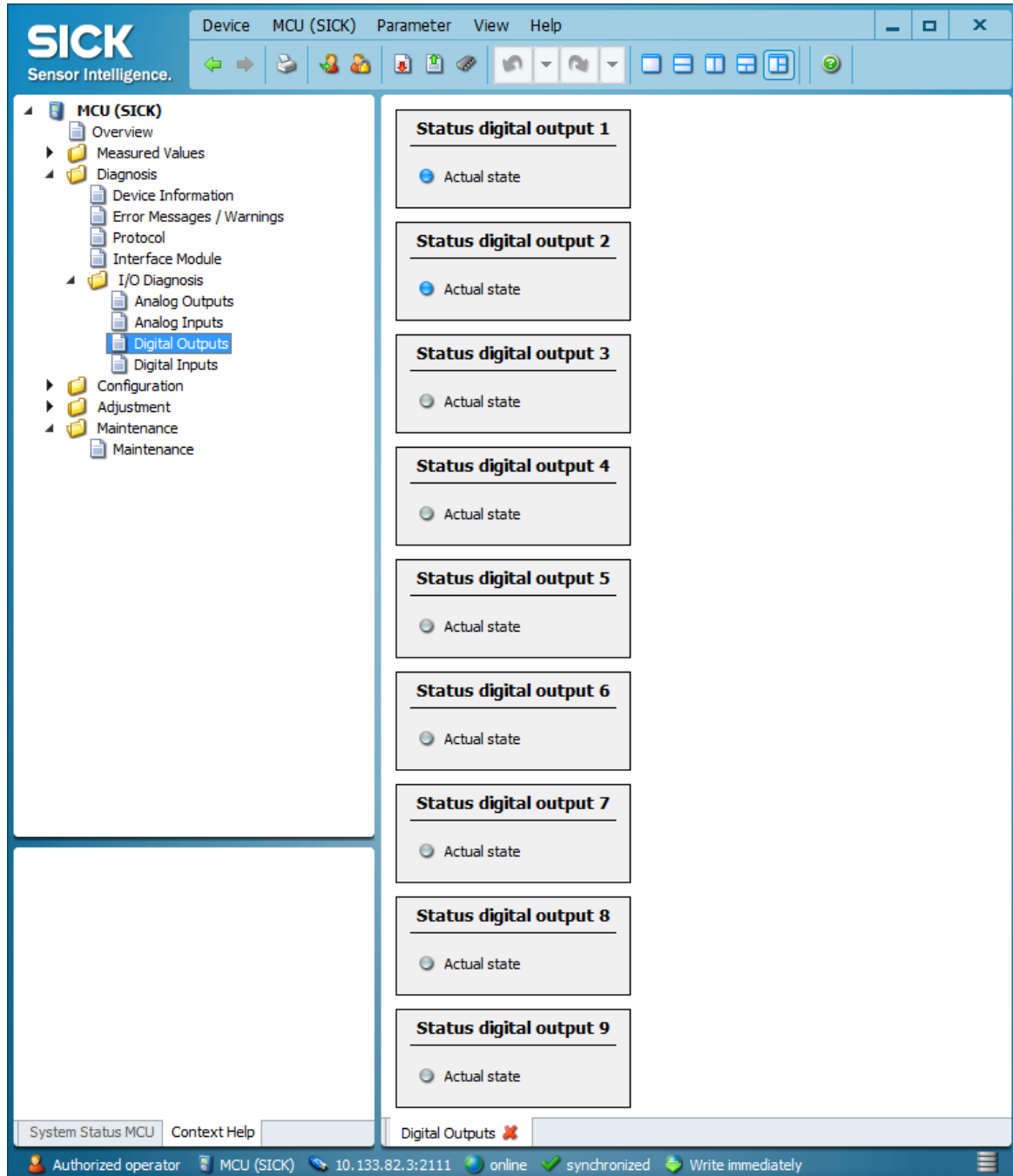


Field	Parameter	Remark
Inverted	Inactive	Define the switching direction
	Active	
Source bit	Bit 0	Malfunction
	Bit 1	Maintenance
	Bit 2	Maintenance request
	Bit 3	Function check
	Bit 7	Operation (no malfunction)
	Bit 16 to 31	Aim bit of the limit value switch (→ p. 88, Fig. 79)
Source sensor		Selection of the component: - Sensor 1 to 8 when the device status is to be output - MCU when limit values are to be signaled

Verifying settings

The current status of each relay is shown in the “Diagnosis / I/O Diagnosis / Digital Outputs” directory.

Fig. 78 “Diagnosis / I/O Diagnosis / Digital Outputs” directory



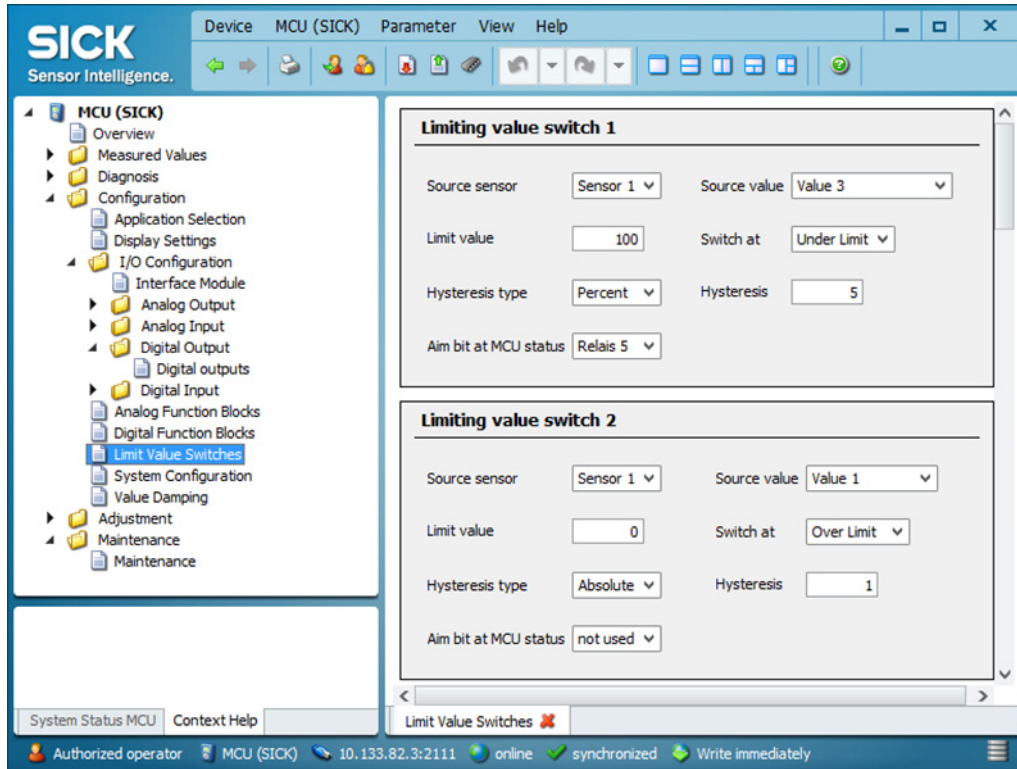
To check whether relays switch as intended, measured values which exceed the parameterized limits must be created.

In addition, a continuity tester can be connected to the respective relay output for an external check.

4.3.1.3 **Assigning and configuring limit value switches to optional digital outputs**

Select the "Configuration / Limit Values Switches" directory for assigning. Configure according to → p. 76, §4.2.8.

Fig. 79 "Configuration / Limit Values Switches" directory



4.3.2 **Configuring optional Interface modules**

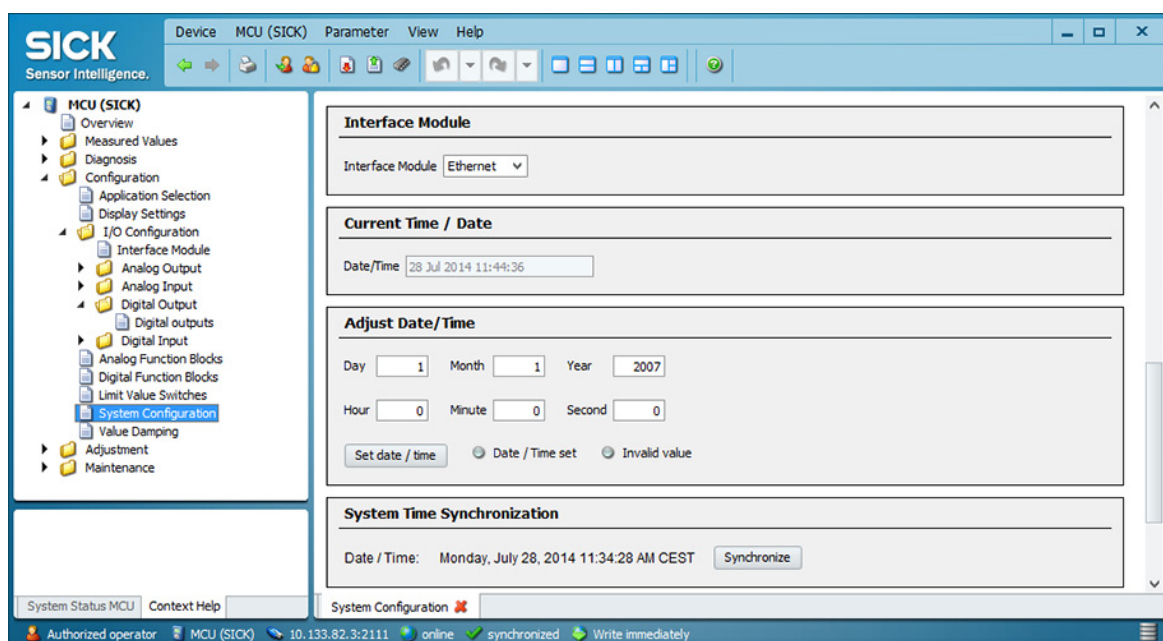
4.3.2.1 **General information**

+i For detailed information on the individual modules see “Interface documentation FLOW SIC200”.

The following steps are necessary to select and set the optionally available Interface modules Profibus DP, Ethernet, Ethernet 3-fold, Modbus RS485 and Modbus TCP:

- ▶ Select device file “MCU”, set the measuring system to “Maintenance” mode and enter the Level 1 password (→ p. 64, §4.1.4).
- ▶ Switch to the “Configuration / System Configuration” directory. The field “Interface Module” shows the installed Interface module.
- ▶ Configure the interface module according to requirements.
- ▶ Set the measuring system back to the operating state.

Fig. 80 Directory “Configuration / System Configuration”



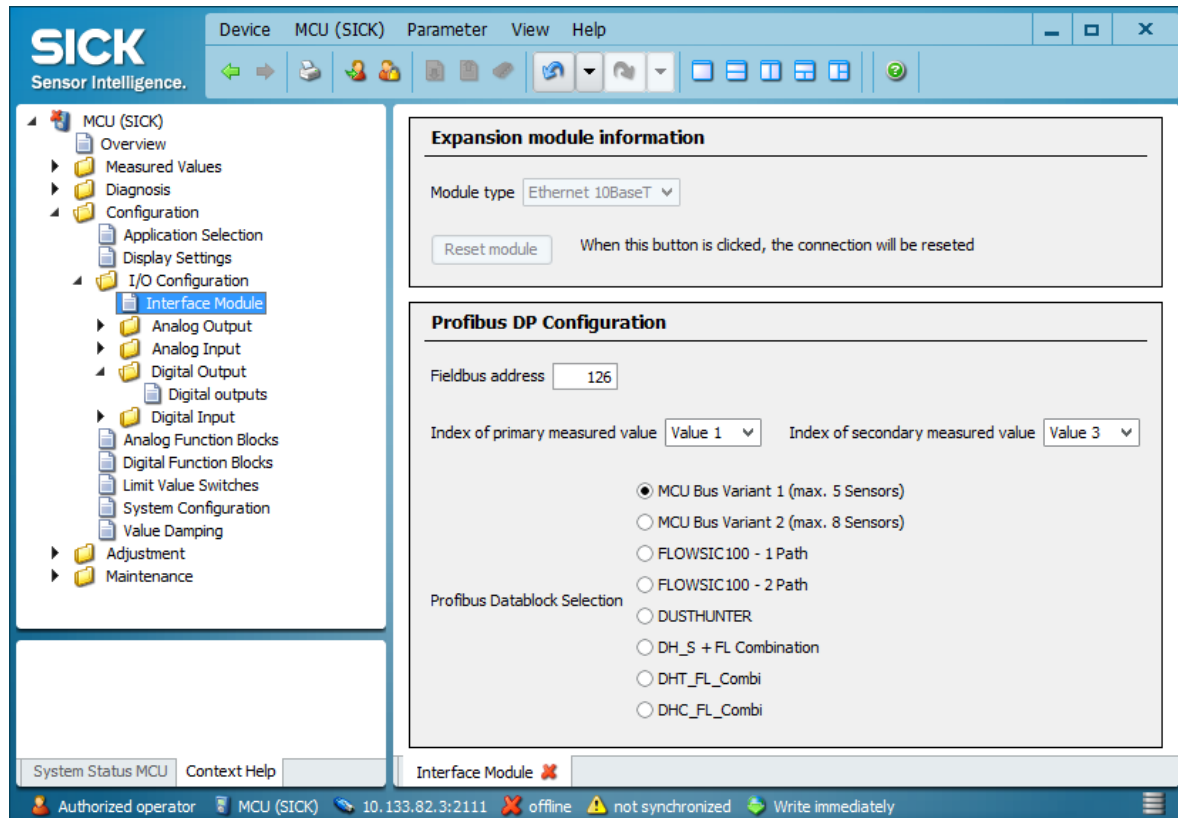
+i GSD file and measured value assignment are available for the Profibus DP module on request.

4.3.2.2 Changing the field bus address for the Profibus module

The Profibus DP interface module is set to field bus address 126 at the factory. The following steps are then necessary:

- ▶ Check in directory “Configuration / I/O Configuration” (→ p. 89, Fig. 80) that the Interface module (selection field “Interface module” is set to “Profibus DP”.
- ▶ Switch to directory “Configuration / I/O Configuration / Interface Module” and enter the new address in field “Fieldbus address” (field “Profibus DP Configuration”).

Fig. 81 Directory “Configuration / I/O Configuration / Interface Module”



NOTICE: Query via Interface Profibus

- ▶ When connecting different sensors (e.g. FL200 and VICOTEC450) to one MCU, a maximum of 5 connected sensors can be read out via Profibus. In this case, up to 2 measured values can be read out for each sensor.
- ▶ When connecting 6 to 8 sensors to one MCU, reading out the measured values via Profibus is only possible when all sensors are of the same type (e.g. 6 x FL200). Only the main measured value can be read out.
- ▶ The query of all measured values of a sensor is only possible with single sensor configuration (connection of a FL200 to a MCU).

4.3.2.3 **Configuring the Ethernet module**

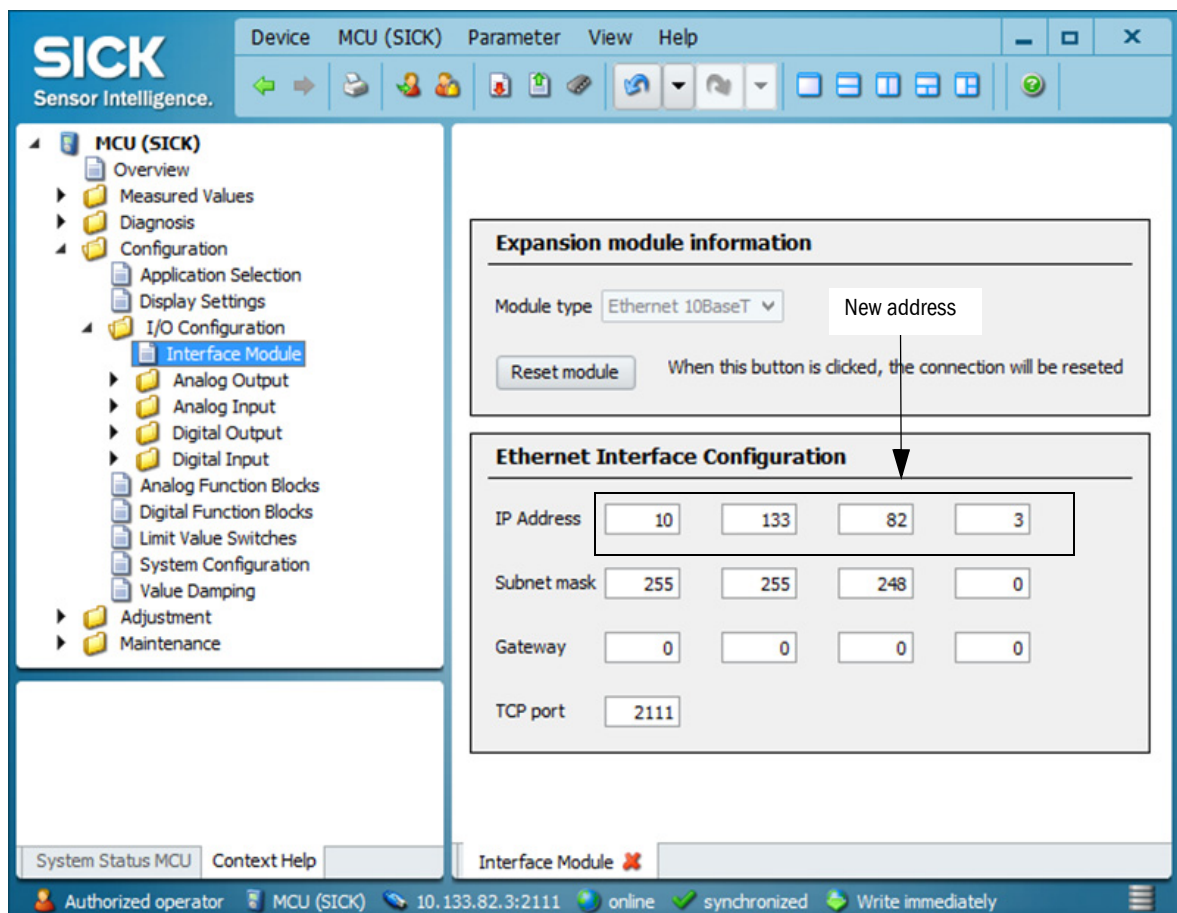
Assigning the Ethernet module a new IP address

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

The following steps are necessary to change the address:

- ▶ Set the desired network configuration in the “Ethernet Interface Configuration” field and click “Reset module” under “Expansion module information”.

Fig. 82 Directory “Configuration / I/O configuration / Interface Module” (example)



Assigning a new IP address to the SOPAS ET program

- ▶ Connect the device → p. 58, §4.1.3.

4.3.3 Calibrating velocity and temperature measurement

This Section describes the entries required for calibrating the flow velocity and temperature measurement. For input, open the device file “FLWSIC200 M”, “FLWSIC200 H” or “FLWSIC200 H-M” and select directory “Configuration / Application Parameters” (→ p. 70, Fig. 57). Then set the measuring system to “Maintenance” and enter the Level 1 password.

Enter calibration coefficients for flow velocity measurement

Enter the calibration coefficients determined with a network measurement using a reference system in field “Calibration coefficients for flow velocity“ at Cv_2 (square), Cv_1 (linear) und Cv_0 (absolute).

Default values from the factory are Cv2 = 0, Cv1 = 1, Cv0 = 0.

Calibrate temperature measurement

The accuracy of the acoustic temperature measurement with the FLWSIC200 is a square function of the measuring path and sound velocity of the real gas under standard conditions (→ p. 16, §2.1.3). Exact acoustic temperature measurement is only possible when the sound velocity of the real gas remains constant at a reference temperature.



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

To calibrate, determine the value pairs from separately measured gas temperature (for example, with PT100 sensor) and display on the LC display at a minimum of two different gas temperatures. Convert the calculated values to absolute temperatures (add 273.15 K). 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.

Default settings from the factory are CT_2 = 0, CT_1 = 1, CT_0 = 0.

Example:

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

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

$$CT_1 = \frac{T_{2PT100} - T_{1PT100}}{T_{2FLWSIC} - T_{1FLWSIC}}$$

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

$$CT_1 = 0.9483$$

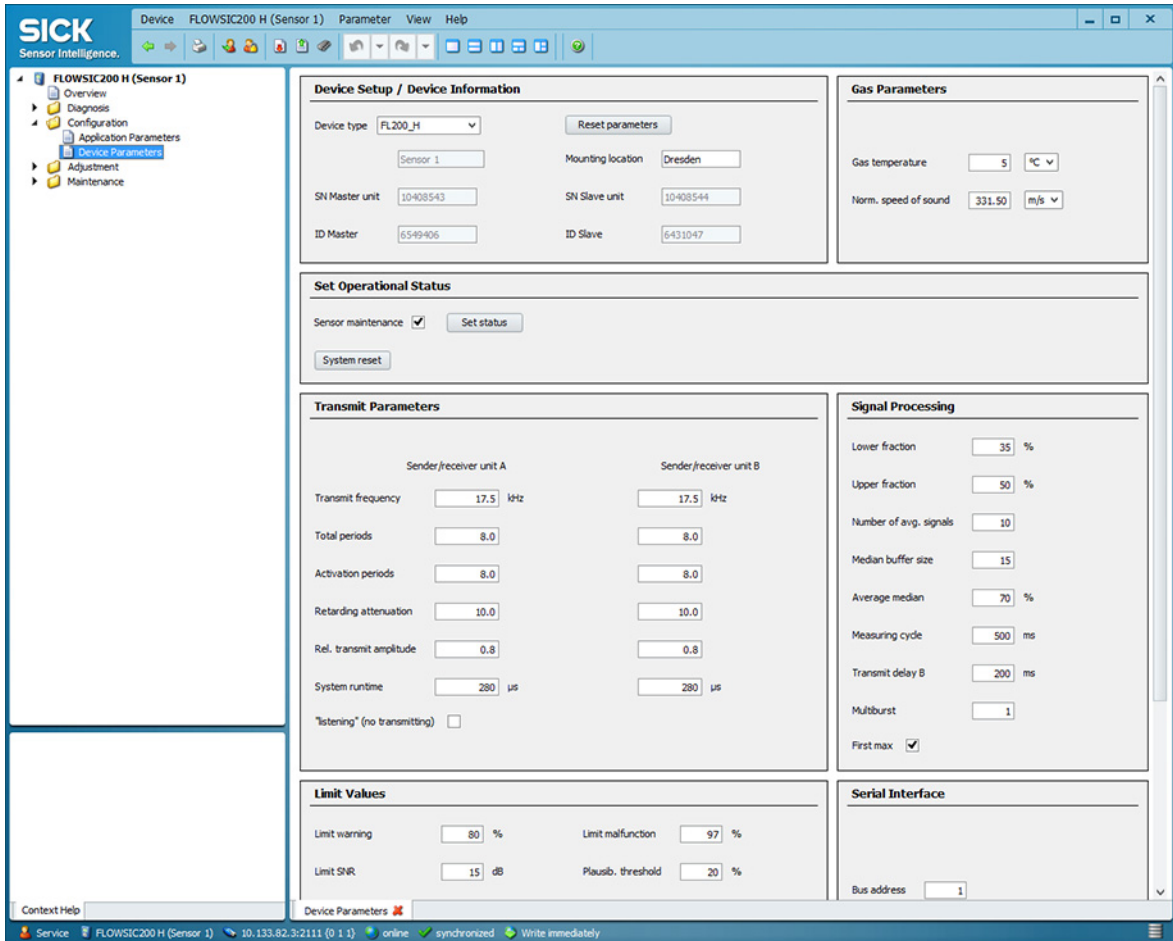
$$CT_0 = 7.7310$$

4.3.4 Bus addressing using SOPAS ET

As an alternative to addressing by hardware (→ p. 36, §3.2.2.2), the address can also be assigned in SOPAS ET (→ p. 93, Fig. 83). To do this, connect the measuring system to SOPAS ET, select device file “FLWSIC200 M”, “FLWSIC200 H” or “FLWSIC200 H-M” and set the measuring system to “Maintenance” (→ p. 67, §4.2).

The miniature switch must be set to address 0 (→ p. 36, Fig. 16).

Fig. 83 “Configuration/Device Parameters” directory



NOTICE:

For bus systems, it must be ensured that the bus addressing of the Master FLSE200 is set correctly.

The sender/receiver units must have different addresses. Identical addresses for several units cause the communication with the MCU to abort!



The default value for the bus address is always 1. Before connecting further sender/receiver units to the bus, the ones already connected must first be assigned a higher address.

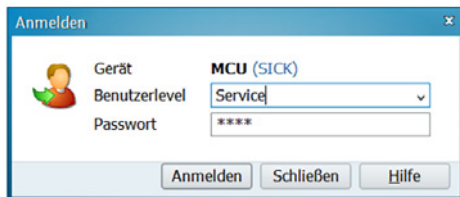
4.3.5 Configuring automatic system restart

The system can be restarted automatically after a predefined number of hours and minutes.

Setting automatic system restart

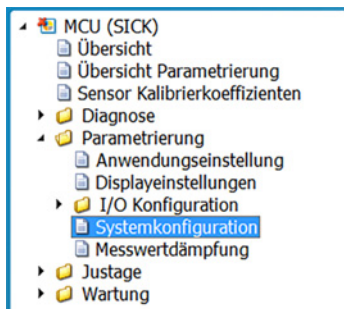
- 1 Open SOPAS ET.
- 2 Select the firmware used in the device catalog.
The automatic restart can be set from MCU firmware 01.16.00 or higher.
- 3 Open the project..

Fig. 84 Login entry



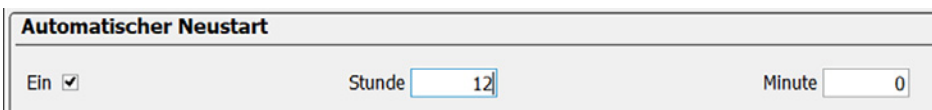
- 4 Login with user level "Service".
- 5 Switch to Maintenance mode.

Fig. 85 "System Configuration" menu item



- 6 Select the "System Configuration" menu item.

Fig. 86 "Automatic Restart"



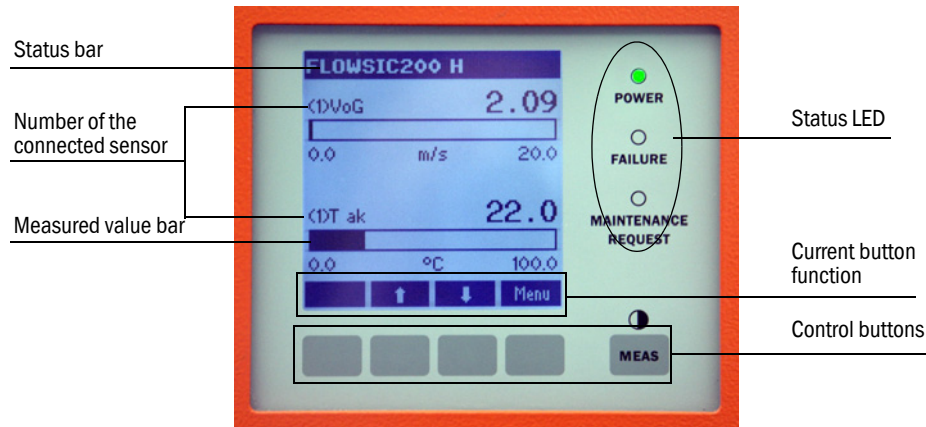
- 7 Activate "Automatic Restart".
- 8 Set hours and minutes (max. 23 hours and 59 minutes). This specification defines the time until the next restart. The time until the next restart begins when the tick is set. (Example: If the hours are set to 8 and the minutes to 0, the system will restart automatically every 8 hours).

4.4 **Operating / parameterization with the LC display option**

4.4.1 **General information on use**

The display and operation interface of the LC display contains the functional elements displayed in Fig.87.

Fig. 87 Functional elements - LC display



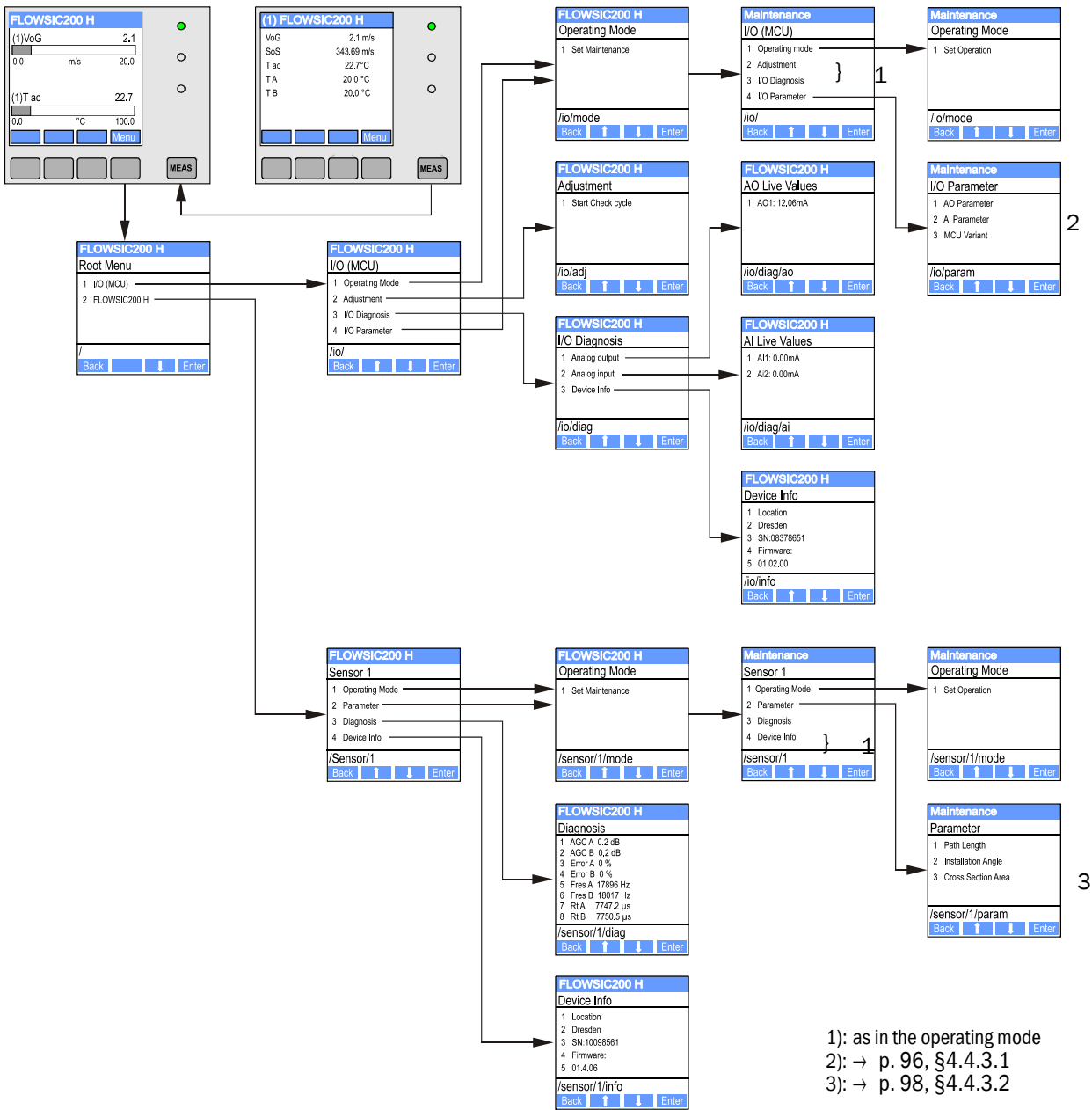
Button functions

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

Button	Function
Diag	Display diagnostic information (warnings and errors during a start using the Main menu, sensor information during a start using the Diagnostics menu; → p. 96, Fig. 88) This function is only active when warnings or malfunctions are present.
Back	Switch to the next higher level
Arrow ↑	Scroll up
Arrow ↓	Scroll down
Enter	Execution of the action selected with an arrow button (switch to a submenu, confirm parameter selected during parameter setting)
Start	Start an action
Save	Save a changed parameter
Meas	<ul style="list-style-type: none"> ▶ Toggle between display of measured values in a bar (graphics display) or in text form ▶ When sender/receiver units of several measuring points are connected to one MCU, the measured values of the individual measuring points are displayed one after the other. ▶ Display the contrast setting (press the button at least 2.5 s)

4.4.2 Menu structure

Fig. 88 Menu structure LC display (shown for FLOWIC200 H)



4.4.3 Configuring

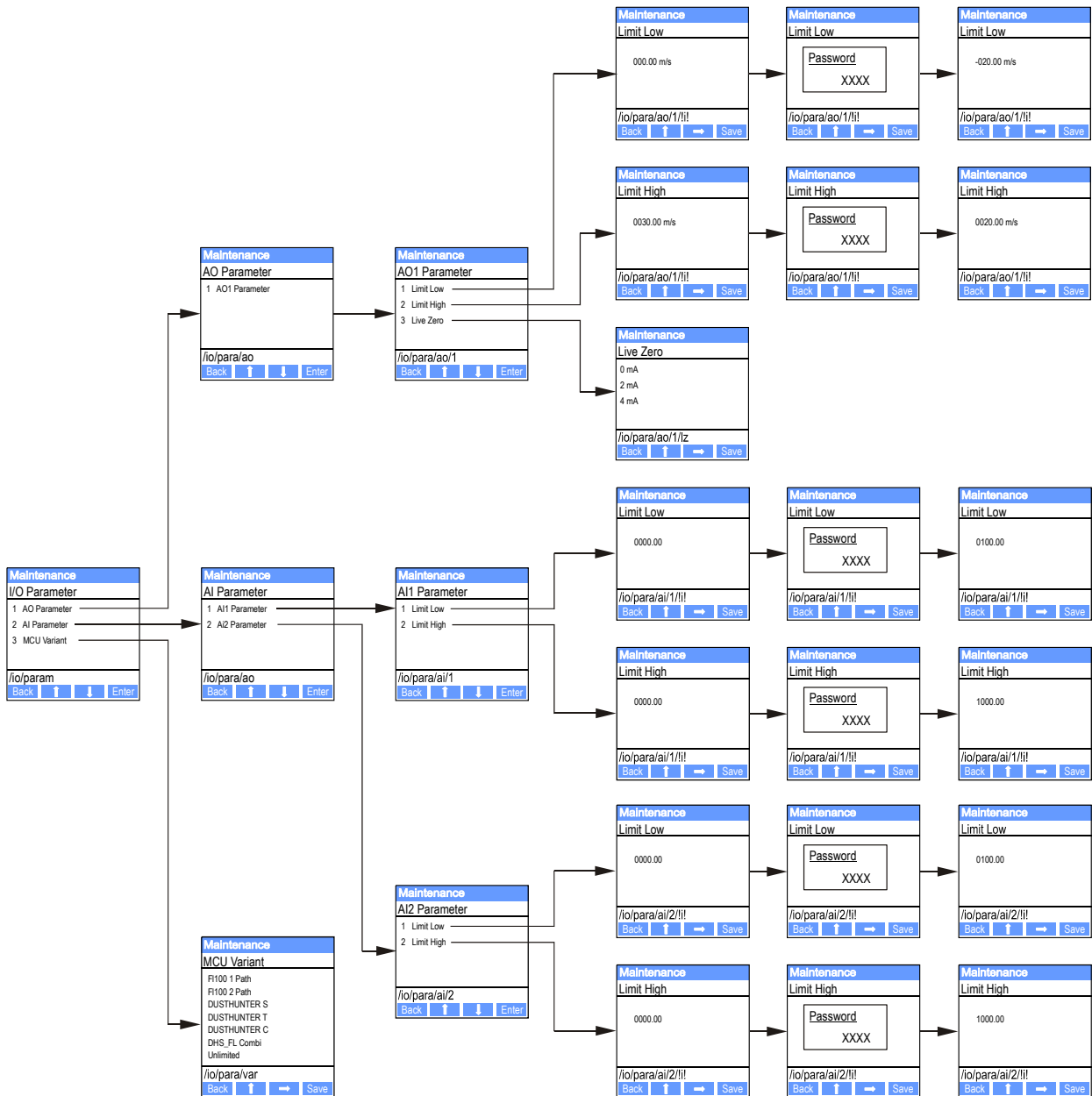
4.4.3.1 MCU

Analog outputs / inputs

- ▶ Set the MCU to “Maintenance” mode and select the “I/O Parameter” submenu.
- ▶ Select the desired parameter and enter the default password “1234” using “^” (scrolls from 0 to 9) and/or “→” (moves the cursor to the right) buttons.
- ▶ Select the desired value using “^” and/or “→” buttons and write it to the device with “Save” (confirm twice).

Fig. 89

Menu structure for parameterizing analog outputs / inputs and setting the MCU variant



Setting the MCU variant

The following steps are necessary for subsequent setting of the MCU to the sender/receiver units of the FLOWSIC200 (→ p. 68, §4.2.1):

- ▶ Set the MCU to “Maintenance” mode, select the “MCU Variant” submenu, and select the type “Universal (Bus)”.
- ▶ Enter the default password and store the type with “Save” (confirm twice).

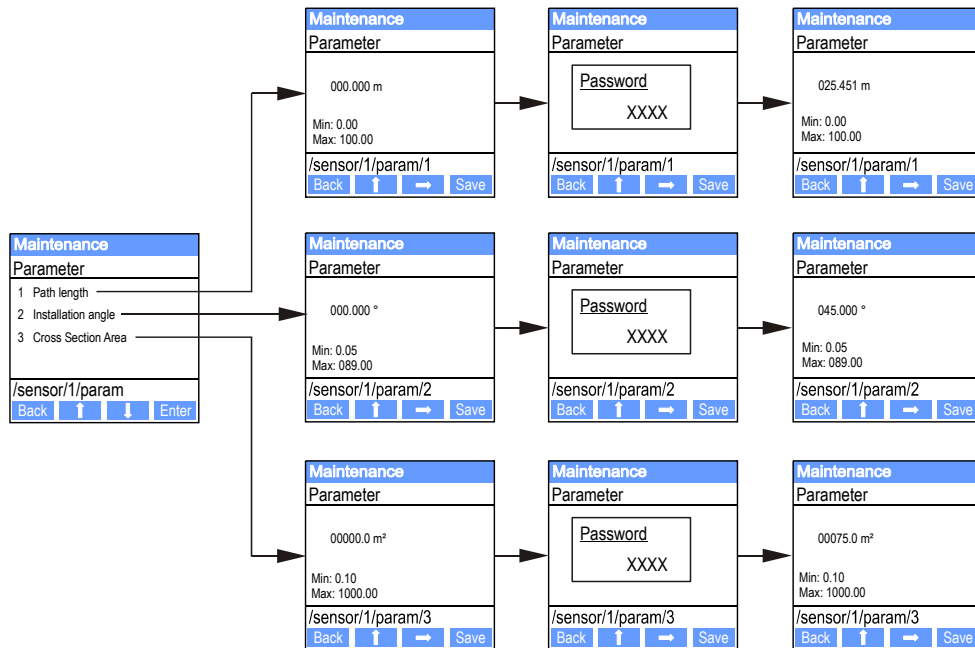
The other selection options have no significance here.

4.4.3.2 Sender/receiver units

The following steps are required to enter the system data:

- ▶ Set the sender/receiver units to “Maintenance” and select the “Parameter” submenu.
- ▶ Select the parameter to be set and enter the default password “1234”.
- ▶ Set the application-specific values (→ p. 71, §4.2.4) with buttons “^” and/or “→” and write to the device with “Save” (confirm twice).

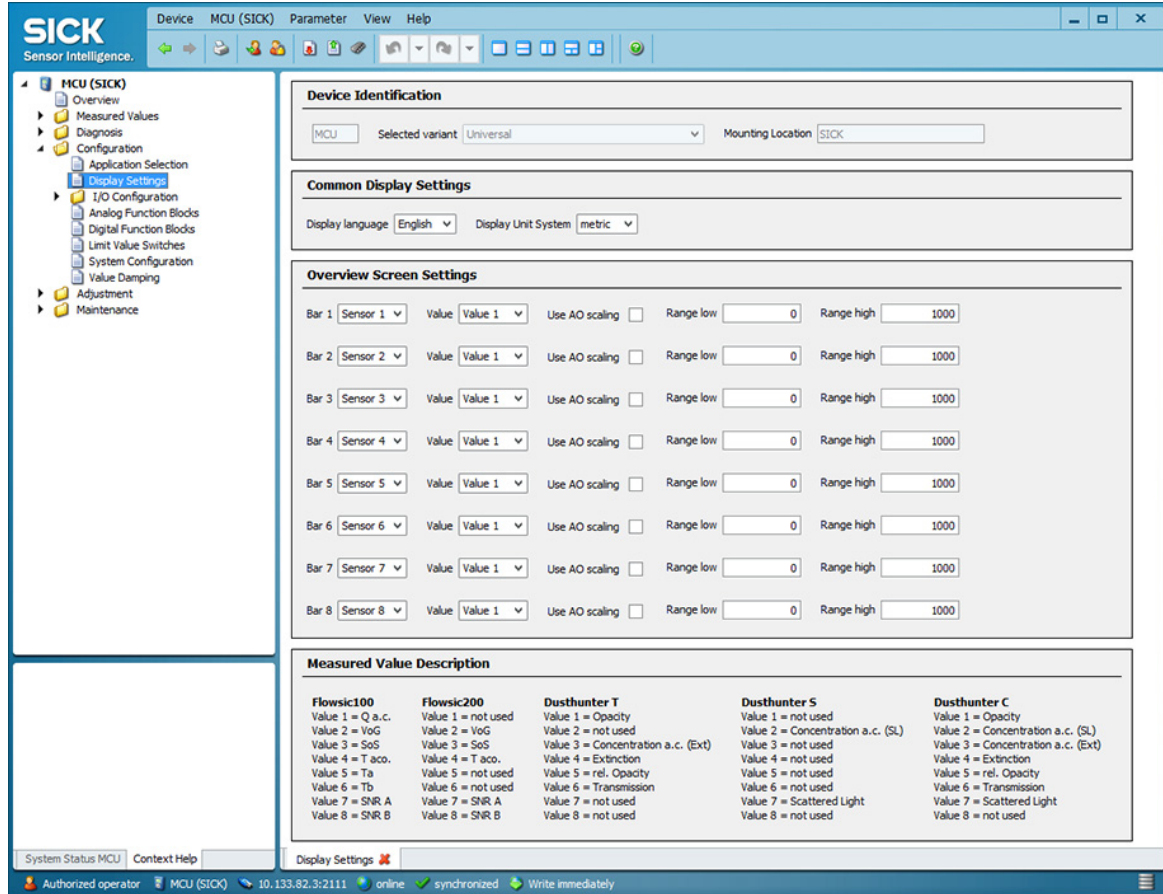
Fig. 90 Menu structure for parameterization



4.4.4 Changing the display settings with SOPAS ET

To change the factory settings, open the “MCU” device window, enter the Level 1 password and call up the “Configuration / Display Settings” directory.

Fig. 91 Directory “Configuration / Display Settings“



Section	Selection field	Significance
Common Display Settings	Display language	Language version shown on the LC display
	Display Unit System	Unit system used in displays
Overview Screen Settings	Bars 1 to 8	Sensor address for the respective measured value bar in the graphic display
	Measured value	Measured value index for the respective measured value bar
	Use AO scaling	If active, the measured value bar of the corresponding analog output is scaled. If not activated, define the limit values separately
	Range low	Values for the separate scaling of the measured value bar, independent of the analog output
	Range high	

*Assignment of measured value index to measured value→ p. 73, §4.2.6

FLOWSIC200

5 Maintenance

General
Measures to be taken when cleaning the tunnel

5.1

General**NOTICE:**

When replacing components, only use parts that have been approved by Endress+Hauser!

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

If you have questions, contact the relevant Endress+Hauser subsidiary.

Maintenance strategy

Just like any other electronic measuring system, the FLOWSIC200 requires regular maintenance. By inspecting the system regularly and replacing wear-and-tear parts in good time, the service life of the device can be lengthened significantly and ensures measurements are always reliable. Due to the measuring principle and system design, the FLOWSIC200 requires very little maintenance.

Maintenance tasks

Routine maintenance is limited to cleaning system parts from external contamination.

Before carrying out these maintenance tasks, set the FLOWSIC200 to Maintenance mode. This can be done using an external maintenance switch (connected to digital input 1), using the SOPAS ET operating and parameter program or via the LC display option (→ p. 93, §4.3.4).

Switch back to “Operation” after completing maintenance work.

**NOTICE:**

The ultrasonic transducers of the FLSE200-M sender/receiver units are extremely touch-sensitive components.

- ▶ Avoid direct contact when cleaning (for example clean by careful blowing out, soft brush; no compressed air).

Maintenance intervals

Maintenance intervals depend on the local conditions and are therefore to be determined by the plant operator. As a rule, the maintenance intervals are more than 24 weeks. For FLOWSIC200 with sender/receiver units FLSE200-H and FLSE200-HM, maintenance cycles of up to 5 years are possible when used according to specifications.

The work to be carried out by the operator as well as the completion is to be documented in a Maintenance Manual.

Maintenance agreement

Regular maintenance activities can be carried out by the plant operator. Only qualified personnel according to Section 1 should be allowed to do the work. If desired, Endress+Hauser Service or authorized Service support centers can carry out all maintenance work. Endress+Hauser offers a range of economical maintenance and repair agreements. As part of these agreements, Endress+Hauser assumes responsibility for all maintenance activities, repairs are carried out by specialists on site (as far as possible).

5.2

Measures to be taken when cleaning the tunnel

With FLSE200-M sender/receiver units installed, it is essential to prevent water from reaching the ultrasonic transducers. Safe protection is ensured by covering the protective tubes with the supplied caps.

No protective measures are required for the FLSE200-H and FLSE200-HM sender/receiver units during tunnel cleaning.

When automatic tunnel cleaning equipment (cleaning with brushes) is used, an adequate distance to the sender/receiver units must be kept to prevent possible misadjustment.

FLOWSIC200

6 Malfunctions

General information
Implausible measured values
Malfunctions

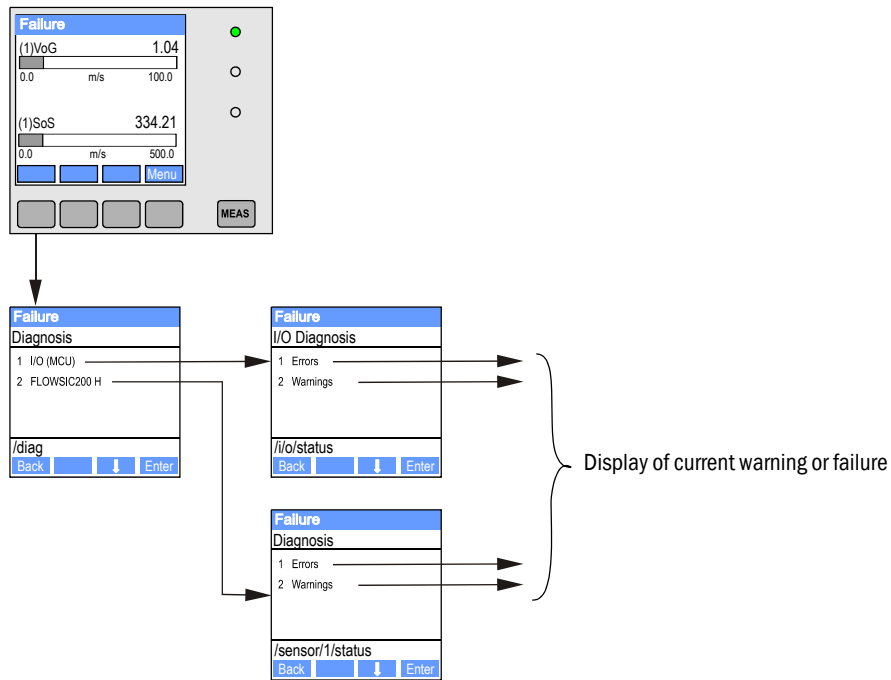
6.1 **General information**

Warnings or device malfunctions are output as follows:

- ▶ On the MCU, the respective relay is switched on (→ p. 48, Fig. 29).
- ▶ “Maintenance requ.” or “Failure” is displayed in the status bar of the MCU LC display (→ p. 95, §4.4.1). The respective LED (“MAINTENANCE REQUEST” for warning, “FAILURE” for malfunction) also goes on.

After pressing the button “Diag”, possible causes are shown as short information in the menu “Diagnosis” after selecting the device (“MCU” or “FLAWSIC200 H”).

Fig. 92 Display on the LC display



Detailed information on the current device status is provided by the “Diagnosis / Error messages / Warnings” directories. For display, connect the measuring system to SOPAS ET and start the device file “FLAWSIC200 M/FLAWSIC200 H/FLAWSIC200 H-M” or “MCU” (→ p. 58, §4.1.3 and → p. 64, §4.1.4).

Move the mouse pointer to the respective message to display more details on the significance of individual messages in a separate window. Clicking on the display shows a short description of possible causes and corrections under “Help” (→ p. 108, Fig. 93, → p. 109, Fig. 94).

Warning messages are output when internal limits for individual device functions/components are reached or exceeded which can then lead to erroneous measured values or an imminent failure of the measuring system.

+i Warning messages do not imply a malfunction of the measuring system. The current measured value continues to be output on the analog output.


+i See the Service Manual for a detailed description of messages and options for clearance.

6.1.1 **Implausible measured values**

In some cases, the FLOWSIC200 delivers measured values that do not seem plausible or have too large short-term fluctuations.

Symptom	Possible cause	Action
Measured values are stable, but calculated velocity is (seemingly) wrong	<ul style="list-style-type: none"> ▶ Incorrect parameter setting of measuring path and installation angle ▶ Incorrect regression coefficients ▶ Measuring axis not optimal for existing flow conditions 	<ul style="list-style-type: none"> ▶ Check parameter settings ▶ Check installation situation (→ p. 32, §3.1.1) ▶ Calibrate velocity measurement (→ p. 92, §4.3.3)
Measured temperature value is (seemingly) incorrect	Measuring path not determined or entered exactly	<ul style="list-style-type: none"> ▶ Check transducer - transducer distance ▶ Calibrate temperature measurement (→ p. 92, §4.3.3)
Measured values correct on average, but too unsteady or jumps	Disturbance of measured values due to traffic conditions (measuring distance influenced by high vehicles)	<ul style="list-style-type: none"> ▶ Check installation situation (→ p. 32, §3.1.1) ▶ Contact Endress+Hauser Service.

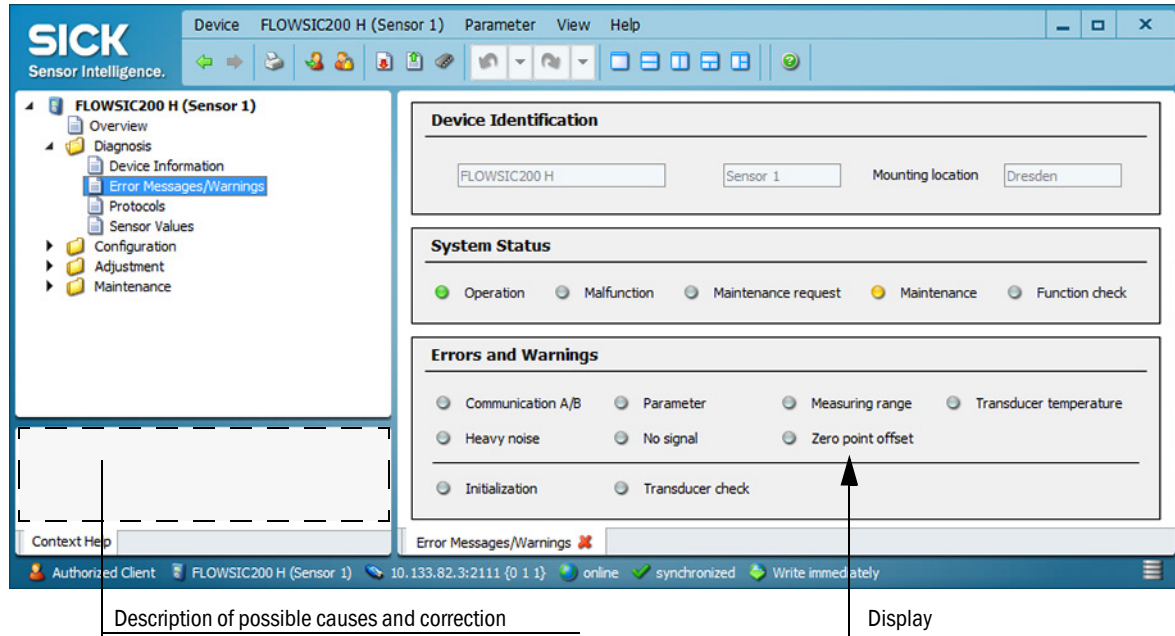
6.1.2 **General system malfunctions**

Symptom	Possible cause	Action
No indication on LC display of control unit (option)	<ul style="list-style-type: none"> ▶ No supply voltage ▶ Defective fuse ▶ Connection cable not connected correctly or defective ▶ Defective plug connector ▶ Processor LP or LC display defective 	<ul style="list-style-type: none"> ▶ Check voltage supply. ▶ Check fuse. ▶ Check plug connectors and cables. <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">  <p>WARNING:</p> <ul style="list-style-type: none"> ▶ For all work under voltage, always observe the applicable safety precautions! </div> <ul style="list-style-type: none"> ▶ Contact Endress+Hauser Service.
Analog output on Live Zero	<ul style="list-style-type: none"> ▶ Device has function fault(s). ▶ Incorrect parameter settings 	<ul style="list-style-type: none"> ▶ Check device status ▶ Check device for malfunctions and correct, if possible. ▶ Check configuration. ▶ Contact Endress+Hauser Service.
No analog signal or output of a fixed value smaller than live zero	<ul style="list-style-type: none"> ▶ Defective D/A converter ▶ Device not in measuring operation 	<ul style="list-style-type: none"> ▶ Contact Endress+Hauser Service.
No communication between measuring system and SOPAS ET	<ul style="list-style-type: none"> ▶ Wrong COM port on the PC ▶ Incorrect parameter setting of interface ▶ USB driver not installed correctly or not at all 	<ul style="list-style-type: none"> ▶ Check interface settings (→ p. 89, §4.3.2) ▶ Exit the SOPAS ET program, make a restart and establish connection again ▶ Contact Endress+Hauser Service.

6.2 **Sender/receiver unit**

Warning and error messages in SOPAS ET

Fig. 93 Directory "Diagnosis / Error Messages/Warnings"



Malfunctions listed below can probably be cleared onsite.

SOPAS ET	Possible cause	Action
Communication A/B	<ul style="list-style-type: none"> ▶ Connection cable not connected correctly ▶ Cables used do not comply with required specification ▶ Both sender/receiver units are set to Master or Slave ▶ A sender/receiver unit is defective 	▶ Check wiring (→ p. 42, §3.3)
Parameter	<ul style="list-style-type: none"> ▶ Device has not yet been configured ▶ Base parameters set to 0 after type change 	▶ Enter system data (again) (→ p. 67, §4.2)
Measuring range	Configured measuring range overrun	▶ Check parameter settings

6.3 **Control unit**

Malfunions

Symptom	Possible cause	Action
No display on the LC display (option)	<ul style="list-style-type: none"> ▶ No supply voltage ▶ Fuse defective 	<ul style="list-style-type: none"> ▶ Check voltage supply. ▶ Contact Endress+Hauser Service.

Warning and error messages in SOPAS ET

Fig. 94 Directory "Diagnosis / Error Messages / Warnings"

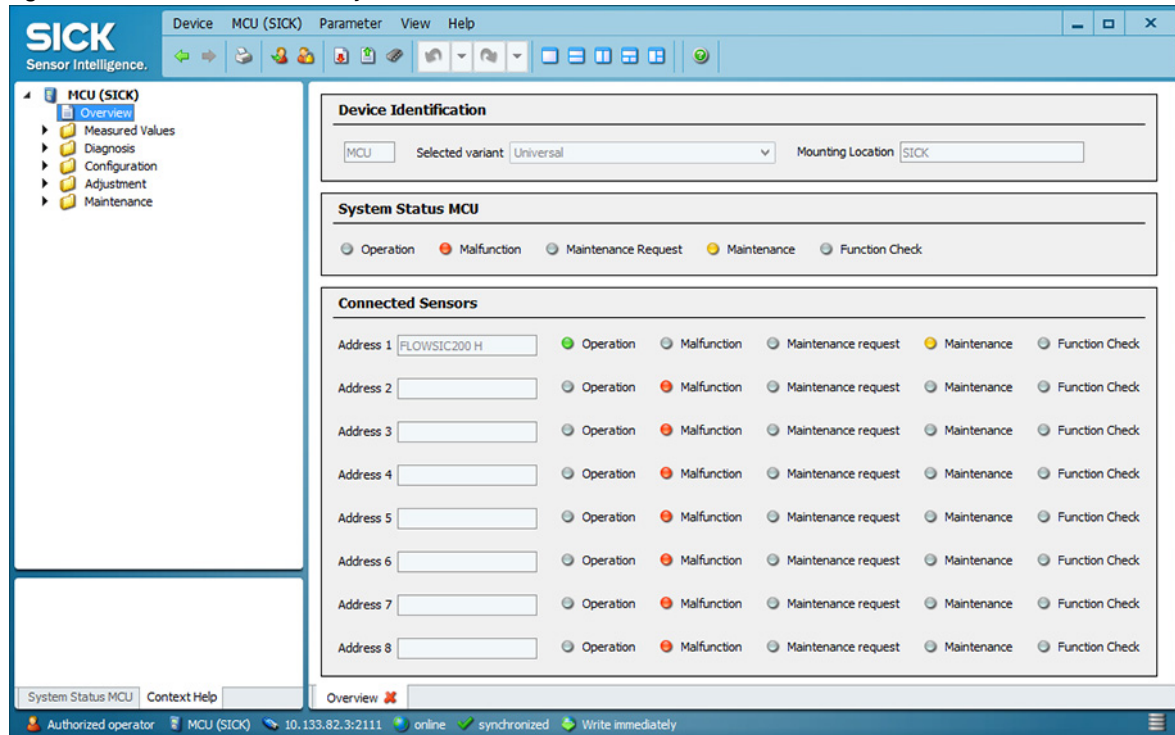
Description Display

Malfunions listed below can probably be cleared onsite.

Message	Significance	Possible cause	Action
AO configuration	Number of analog outputs configured and number of optional modules do not match.	<ul style="list-style-type: none"> ▶ AO not configured ▶ Connection error ▶ Module failure 	<ul style="list-style-type: none"> ▶ Check configuration (→ p. 73, §4.2.6). ▶ Contact Endress+Hauser Service.
AI configuration	Number of analog inputs configured and number of optional modules do not match.	<ul style="list-style-type: none"> ▶ AI not configured ▶ Connection error ▶ Module failure 	<ul style="list-style-type: none"> ▶ Check configuration (→ p. 75, §4.2.7). ▶ Contact Endress+Hauser Service.

Message	Significance	Possible cause	Action
DO configuration	Number of digital outputs configured and number of optional modules do not match.	<ul style="list-style-type: none"> ▶ DO not configured ▶ Connection error ▶ Module failure 	<ul style="list-style-type: none"> ▶ Check configuration (→ p. 85, §4.3.1). ▶ Contact Endress+Hauser Service.
Sensor configuration	Number of sensors available does not match number connected.	<ul style="list-style-type: none"> ▶ Sensor failure ▶ Communication problems on RS485 line 	<ul style="list-style-type: none"> ▶ Check sensor addressing and availability (→ p. 110, Fig. 95). ▶ Correct sensor selection (→ p. 85, Fig. 76). ▶ Contact Endress+Hauser Service.
Interface module	No communication via Interface module.	<ul style="list-style-type: none"> ▶ Module not configured ▶ Connection error ▶ Module failure 	<ul style="list-style-type: none"> ▶ Check configuration (→ p. 91, §4.3.2.3). ▶ Contact Endress+Hauser Service.
Variant configuration error	MCU setting does not match the connected sensor.	Sensor type has been changed	<ul style="list-style-type: none"> ▶ Correct application settings (→ p. 68, §4.2.1).
Testmode enabled	MCU in Test mode.		<ul style="list-style-type: none"> ▶ Deactivate “System Test” mode (“Maintenance” directory)

Fig. 95 “Overview” directory



FLOWSIC200

7 Specification

- Technical data
- Dimensions, Part Nos.
- Connection cable, sender/receiver unit - junction box
- Accessories
- Options
- Consumable parts for 2-years operation
- Password

7.1 **Technical data**

Measured value recording		
Measured variables	Flow velocity, air temperature	
Measuring range	-20 ... +20 m/s; infinitely variable; higher on request	
Typical accuracy ¹⁾	± 0.1 m/s	
Response time	1 ... 300 s; freely selectable	
Displays		
LC display	For measured variables, warning and malfunction messages	
LED	Voltage supply OK, malfunction, maintenance request	
Installation		
Measuring distance Transducer - transducer	FLSE200-M and FLSE200-HM	5 ... 25 m
	FLSE200-H	5 ... 40 m
Installation angle	Up to 10 m measuring distance 45°, for longer measuring distances 60°	
Air temperature	-40 ... +60 °C	
Moisture	< 100%	
Total cable length between FLSE200 and MCU.	Max. 1000 m ²⁾	
Output signals		
Analog output	0/2/4 ... 22 mA, max. load 750 Ω; resolution 0.01 mA further analog outputs with I/O modules (option)	
Digital outputs	5 potential-free outputs (NC contacts) for status signals operation/fault, maintenance, control cycle, maintenance requirement, limit value; contact load 48 V, 1 A; further relay outputs with I/O modules (option)	
Input signals		
Analog input	2 inputs 0 ... 20 mA (standard, without electrical isolation); resolution 0.01 mA; further analog inputs with I/O modules (option)	
Digital inputs	4 potential-free contacts for connection of maintenance switch, activation of check cycle; further digital inputs with I/O modules (option)	
Communication interfaces		
USB 1.1, RS 232 (on terminals)	For measured value inquiry, configuration and software update via PC/laptop with operating program	
RS485	For connection of sender/receiver units	
Option Interface module	Optional PROFIBUS (RS485), MODBUS (RS485, Ethernet), COLA-B (Ethernet)	
Power supply		
Operating voltage	90 ... 250 V AC; 50/60 Hz	
Power consumption	Approx. 20 W	
Ambient conditions		
Temperature range	-40 ... +60 °C	
Storage temperature	-40 ... +70 °C	
Protection class	FLSE200: IP66, MCU: IP 65	

1): The accuracy depends on calibration, installation conditions, flow profile, temperature and length of the measuring distance

2): For operation with standard configuration (factory setting)

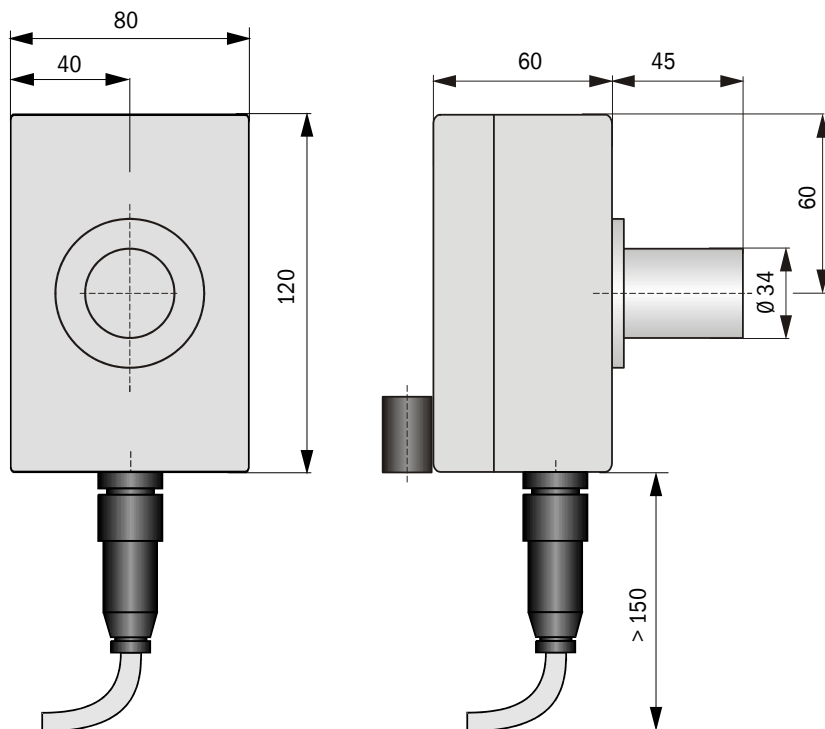
7.2 **Dimensions, Part Nos.**

All dimensions are in mm.

7.2.1 **Sender/receiver units**

FLSE200-M

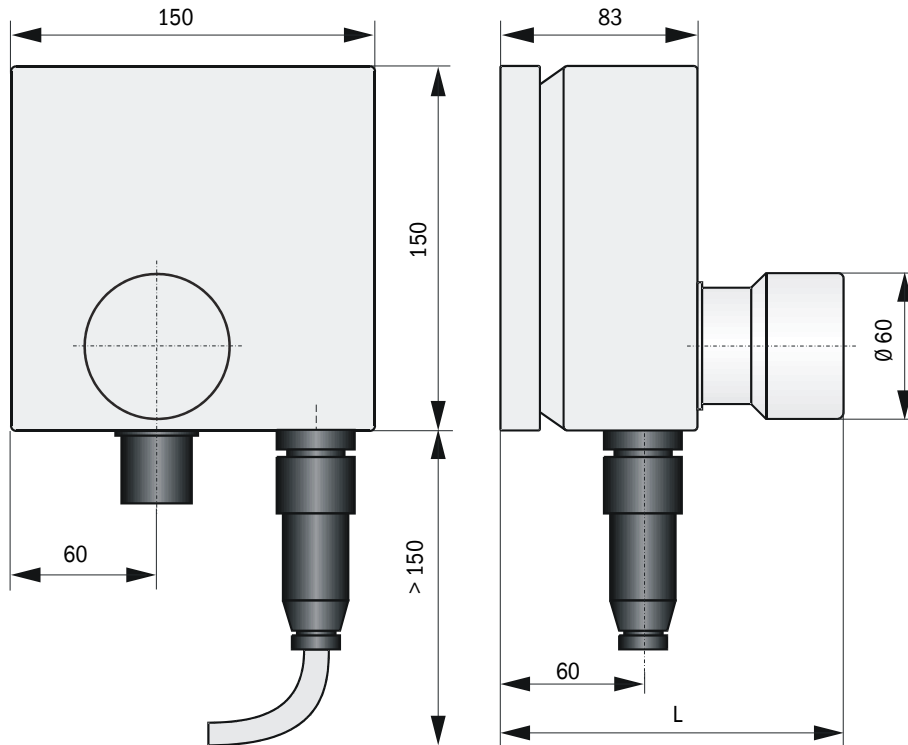
Fig. 96 FLSE200-M sender/receiver unit



Designation	Quantity	Part No.
FLSE200-M sender/receiver unit	2	1044804

FLSE200-H, FLSE200-HM

Fig. 97 FLSE200-H, FLSE200-HM sender/receiver unit

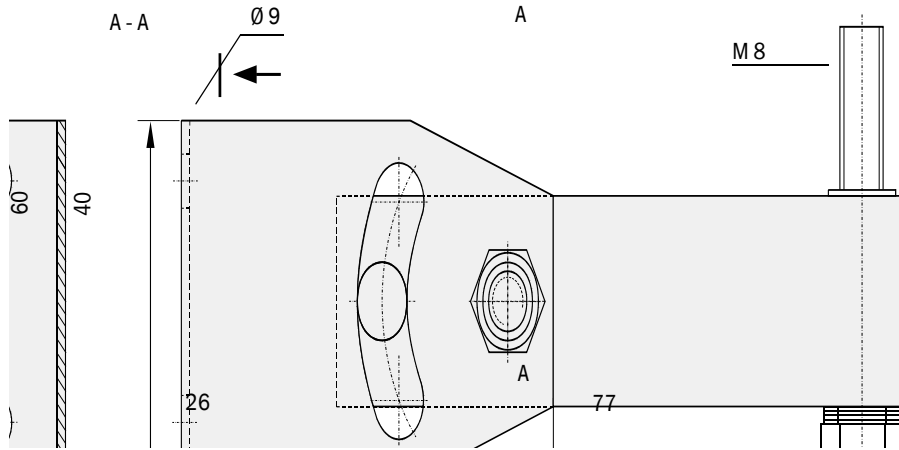


Component	Dimension L	Part No.
FLSE200-HM sender/receiver unit	141	1057565
FLSE200-H sender/receiver unit	141	1044842

7.2.2 **Bracket for sender/receiver unit**

Bracket for FLSE200-M

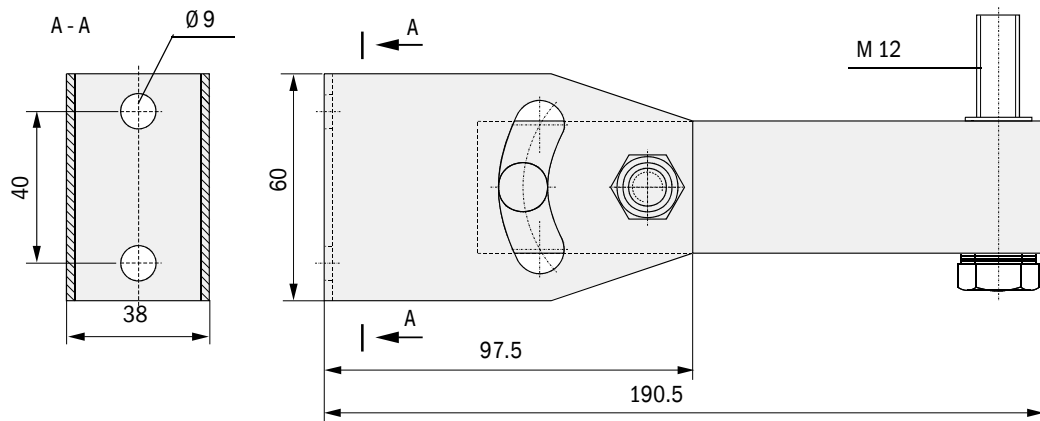
Fig. 98 **Bracket for FLSE200-M**



Designation	Part No.
Bracket for FLSE200-M	7042039
Bracket for FLSE 200-M, material 1.4529	2031880

Bracket for FLSE200-H, FLSE200-HM

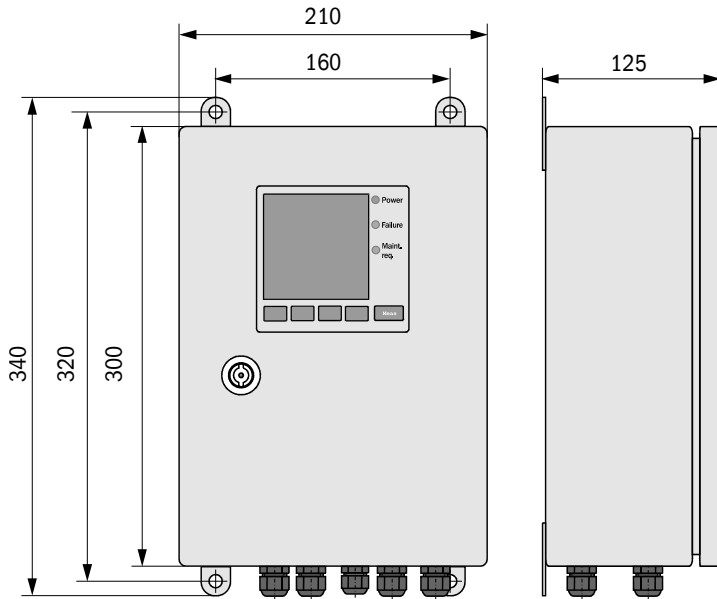
Fig. 99 **Bracket for FLSE200-H, FLSE200-HM**



Designation	Part No.
Bracket for FLSE200-H, FLSE200-HM	7042077
Bracket for FLSE200-H and FLSE200-HM, material 1.4529	2031881

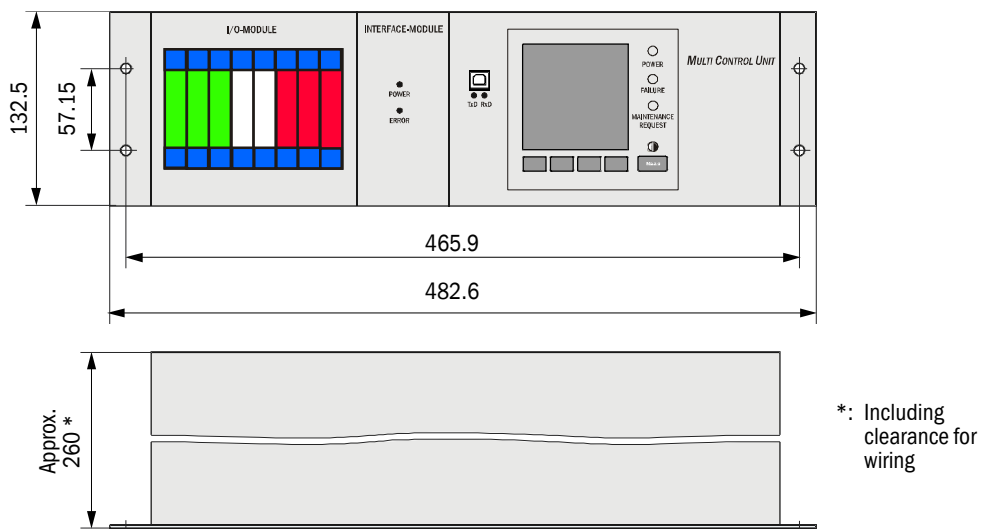
7.2.3 **MCU control unit**

Fig. 100 MCU control unit (shown with optional Display module)



Designation	Part No.
Control unit MCU-NWSN	1046298
Control unit MCU-N2SN	1046299
Control unit MCU-NWSD	1046113
Control unit MCU-N2SD	1046115

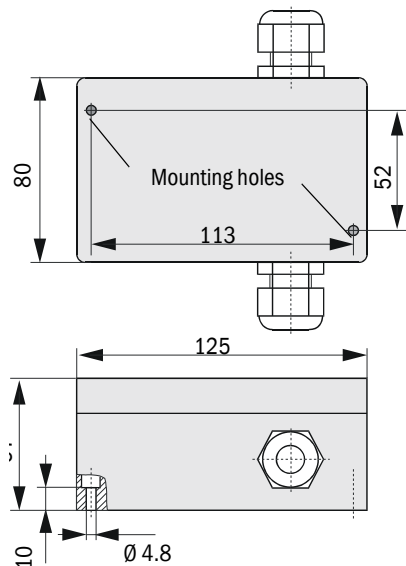
Fig. 101 MCU control unit in 19" slot (shown with Display module option)



Designation	Part No.
Control unit, MCU-NWTD in 19" housing	1046288
Control unit, MCU-N2RD in 19" housing	1046116

7.2.4 **Junction box**
In aluminium housing

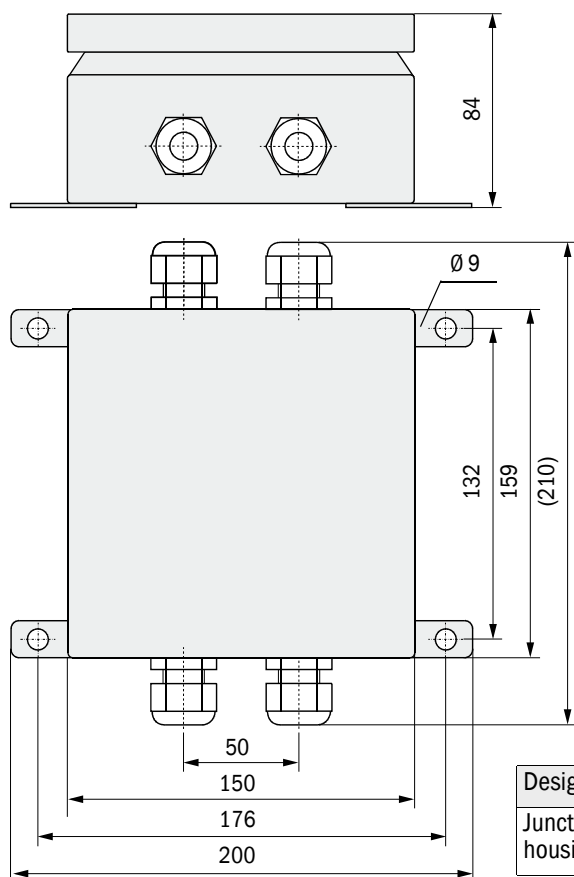
Fig. 102 Junction box



Designation	Part No.
Junction box	2046418

In stainless steel housing

Fig. 103 Junction box in stainless steel housing



Designation	Part No.
Junction box in stainless steel housing	2048067

7.3 Accessories

7.3.1 Accessories for mounting

Designation	Part No.
Mounting kit 2M8-1.4529	2031886
Mounting kit 4M8-1.4529	2031887
Mounting kit 2D8-1.4571/PA	2031888
Mounting kit 4D8-1.4571/PA	2031889
Mounting kit 2D4-1.4571/PA	2031890
Mounting kit 2M8-1.4571	2031891

7.3.2 Connection cable, sender/receiver unit - junction box

Designation	Quantity	Part No.
Connection cable, length 2 m, halogen-free	2	2048074
Connection cable, length 25 m, halogen-free	2	2048075

7.4 Options

7.4.1 MCU control unit

Designation	Part No.
Analog input module, 2 channels, 100 Ω , 0/4...22 mA, electrically isolated (80 V difference)	2034656
Analog output module, 2 channels, 500 Ω , 0/4...22 mA, electrically isolated per module	2034657
Digital output module, 2 channels as NC contact	2034659
Digital output module, 4 channels as NO contact	2034661

Additional options for MCU control unit in wall housing

Designation	Part No.
Module carrier (each for one AI, AO, DI or DO module)	6028668
Connection cable for optional I/O module	2040977
Profibus DP interface module with MCU connection cable	2048920
Ethernet interface module with MCU connection cable	2055719
Ethernet interface module, 3-fold, with MCU connection cable	2072693
Modbus RS485 interface module with MCU connection cable	2048958
Modbus TCP interface module with MCU connection cable	2059546

Additional options for MCU control unit in 19" slot

Designation	Part No.
I/O module carrier 19" (for installation of up to 4 AI/AO and DI/DO modules)	2050589
Interface module 19" Profibus DP with connection cable	2049334
Interface module 19" Ethernet with connection cable	2048377
Interface module 19" Modbus RS485 with connection cable	2050674

7.4.2

Miscellaneous

Designation	Part No.
Hook spanner	7042115
DME 2000 distance sensor	1010578

7.5

Consumable parts for 2-years operation

Designation	Quantity	Part No.
tube with transducer for FLSE200-M	2	7042043

7.6

Password

Password „Autorisierter Kunde“

Nach dem Start des Bedien- und Parametrierprogrammes SOPAS ET sind nur die Programmfunktionen verfügbar, die keinen Einfluss auf die Gerätefunktion haben.

Nicht eingewiesenes Personal kann keine Änderungen der Parameter vornehmen. Zur Nutzung des erweiterten Funktionsumfangs wird das

Password

sickoptic

benötigt.

Falls zur Eingabe eine falsche Taste gedrückt wird, muß das Fenster geschlossen und anschließend die Passwordeingabe wiederholt werden.

Password "Authorized Client"

After the start of the SOPAS ET operating and parameterization program, only menus are available which have no effect on the functioning of the device.

Untrained personnel cannot alter the device parameters. To access the extended range of functions the

password

sickoptic

must be entered

If a wrong key is pressed when entering the password, the window must be closed and then the entering repeated.

8029802/1CJ9/V2-0/2022-01

www.addresses.endress.com
