OPERATING INSTRUCTIONS

FLOWSIC200
Flow Velocity Monitor

Description
Installation
Operation

SICK
Sensor Intelligence.

Document information

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Manufacturer
SICK Engineering GmbH
Bergener Ring 27 · 01458 Ottendorf-Okrilla · Deutschland
Telefon: +49 35 20552410
Fax: +49 35 20552450
E-mail: info.pa@sick.de

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Legal Information
Subject to change without notice.

Safety alert symbol

Danger (general)

Danger through mains voltage

Warning levels / signal words

DANGER
Indicates an hazardous situation which – if not avoided – will result in serious injury or death.

WARNING
Indicates an hazardous situation which – if not avoided – could result in serious injury or death.

CAUTION
Indicates an hazardous situation which – if not avoided – could result in minor or moderate injury.

NOTICE
Indicates a hazard or unsafe practice which could result in property damage.

Information symbols

Important technical information on electric or electronic functions

Supplementary information

Link to information at another place

FLOWSIC200

1 Important Notes

Main hazards
Responsibility of user
Safety instructions and protection measures

1.1 Main hazards

Danger from electrical equipment

The FLOWSIC200 measuring system is an item of electrical equipment designed for use in industrial power installations.

WARNING: Danger by mains voltage

- ► When working on power connections or on live components, make sure that the power supply is switched off.
- ► If necessary, replace shock protection measures before reconnecting the power supply.

1.2 Intended use

The present Operating Instructions describe the FLOWSIC 200 measuring system designed for contactless measurements of flow velocity and air temperature in any kind of tunnels, e.g. road and railway tunnels.

Correct use

- ► The system is operated in accordance with the technical data and specifications regarding assembly, connection, ambient, and operating conditions (see the documentation supplied, the order documents, device documents, and rating plates)
- ► All of the measures required to maintain the device, e.g. maintenance and inspection, transport and storage, are provided.
- ⊗ Do not change or remove any components at this and in the device if this is not described or specified in official information of the manufacturer. Otherwise:
  - the device could become a danger
  - the device is out of every guarantee of the manufacturer.

1.3 Responsibility of user

1.3.1 General information

Designated users

The FLOWSIC200 measuring system may only be 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.

Special local conditions

- ► Observe the valid legal regulations as well as the technical rules deriving from implementation of these regulations applicable for the respective equipment during work preparation and performance.
- ► Carry out work according to the local conditions specific for the equipment as well as operational hazards and regulations.

Retention of documents

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

1.3.2 Safety instructions and protection measures

Suitable safety equipment

NOTICE:

Suitable safety equipment and personal protection measures must be available in accordance with the potential hazard and must be used by the personnel.

The ultrasonic transducers of the type FLOWSIC200 H and FLOWSIC200 H-M have high sonic power.

- ► Use suitable ear protection when working on sender/receiver units.
- ⊗ Don‘t bring the unprotected ear directly in the sonic beam.

Preventive measures for safe operation

NOTICE:

- ► The operator must ensure that any failure or malfunction does not lead to damaging or dangerous operating
- ► In order to prevent device failure, the specified maintenance actions must be carried out by qualified and experienced service staff in regular intervals.

Detecting malfunctions

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

- Indication of warnings (e.g. at strong pollution)
- Significant drift of measured values
- Increased power consumption
- Increased temperature of system components
- Acting fuses, circuit breakers and safety switches
- Development of smell or smoke

Preventing damages

NOTICE:

To prevent malfunctions, which can cause personal injury or damage to the system either directly or indirectly, the operator must ensure that

- ► The maintenance personnel responsible can reach the site immediately, and at any time,
- ► The maintenance personnel is sufficiently qualified to respond to malfunctions on the FLOWSIC 200 and any resulting malfunctions (for example, if the system is used for open or closed-loop control purposes),
- ► The defective equipment can be switched off immediately if necessary,
- ► Switching off equipment does not indirectly cause further malfunctions.

FLOWSIC200

2 Product Description

System overview and operating principle
System components
Calculations
Check cycle

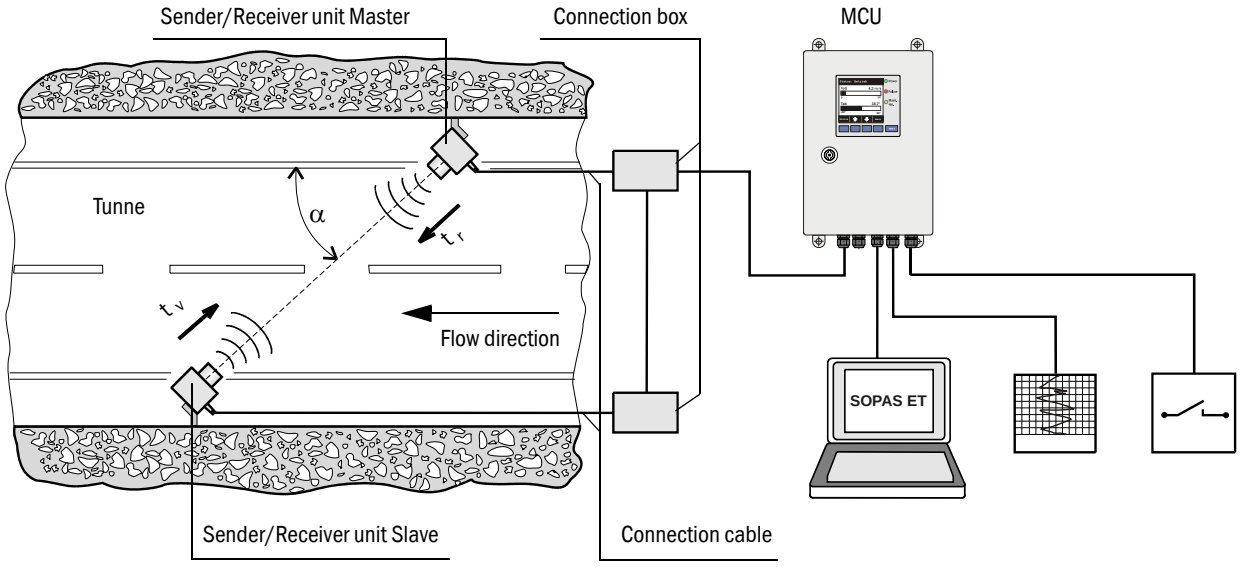
2.1 System overview and operating principle

2.1.1 System overview

The measuring system comprises the following components:

- FLSE200 sender/receiver unit
  for transmitting and receiving ultrasonic pulses
- FLSE200 mounting bracket
  for mounting the sender/receiver units to the tunnel wall
- Control unit MCU
  for control, evaluation and output of the data of the sensors connected via RS485 interface
- Connection cables Master and Slave
  for connection the sender/receiver unit with the terminalbox
- Connection box
  for connecting the connection cable

Fig. 1 FLOWSIC 200 system components



2.1.2 Communication between sender/receiver units and control unit

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

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

Fig. 2 FLSE200 - MCU: Bus version with one connected measuring system

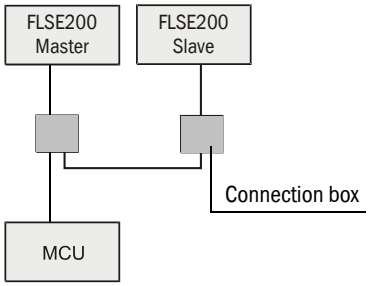
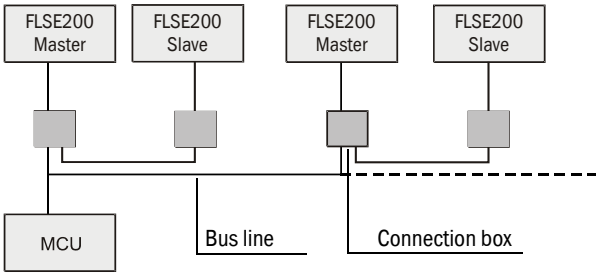


Fig. 3 FLSE200 - MCU: Bus version with several connected measuring systems



With the bus version, up to 8 sensors can be connected to a control unit MCU.

NOTICE:

- For bus wiring the manufacturer set termination has to be deactivated in those system components, that are not on the cable end.
- To ensure power supply for all connected measuring points, observe the instructions on → p. 42, §3.3.2.2.
- The S/R units of the FLOWSIC200 have to be assigned to addresses 1...7 on the hardware side (→ p. 34, §3.2.2.2).

  The physical order of the sensors on the bus does not have to be identical with the logical address assignment, it is only important, that the same address is not assigned twice.

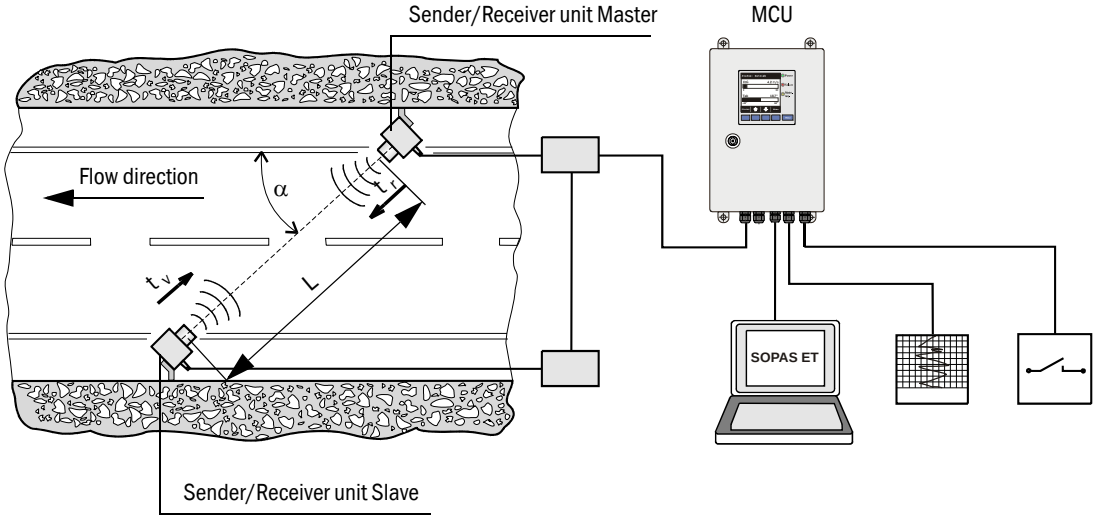
2.1.3 Operating principle

The FLOWSIC 200 operates by measuring the transit delay of an ultrasonic pulse. Sender/receiver units are mounted on both sides of the tunnel at a certain angle to the flow direction (→ Fig. 4).

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

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

Fig. 4 FLOWSIC200 operating principle



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

v = Flow velocity in m/s
L = Measuring distance (path length) in m
α = Installation angle in °
t_v =Signal transit time in the direction of the flow
t_r =Signal transit time in the direction opposite the flow

Calculating the flow velocity

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

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

The sound transmit time against the direction of flow:

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

Conversation to v:

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

i.e. a relation that only consists of the two measured transit times, and the two constants, active measuring distance and installation angle.

Calculating the air temperature

Since the sound velocity is dependent on the temperature, the gas temperature can also be calculated from the transit times.

Simultaneous measurement of flow velocity and temperature makes it possible to warn of icing when the road surface is wet and temperatures are around freezing point.

The sound velocity can be obtained by converting the formula to c:

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

The dependence of the sound velocity on the temperature can be expressed as follows with the reference sound velocity c_0 at 0 °C (= 331.4 m/s) and the air temperature ϑ in °C:

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

Thus it applies for the air temperature:

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

Fomula 2.6 shows that the obtained temperature depends on the measured transit times and, with a square relation, on the measuring path and the reference velocity of sound.

A precise temperature measurement is only possible if the measuring path L is determined very precisely, the system was calibratede (→ p. 90, §4.3.3) and if 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 necessary signal processing, digitalization and communication components. The ultrasonic transducer is firmly connected to the housing.

The sender/receiver unit is supplied with 24 V. Communication with the MCU is performed on a serial bus capable connection.

Three models of sender/receiver units are available:

Sender/Receiver unit model		
FLSE200-M	**FLSE200-HM**	**FLSE200-H**
Applications without particular requirements	Application in aggressive salty air	Application in aggressive ambient air, for large measuring sections or in case of faulty ultrasound transmission
Aluminium transducer, medium power, protective tube made of Al	Titan transducer, medium power	Titanium transducer, high power
Aluminium housing, chromated and painted in grey	Stainless steel housing	Stainless steel housing
Measuring distance 5–25 m		Measuring distance 5–40 m

The protection tubes of the FLSE200-M models aims to protect the transducer from excessive contamination and mechanical damage (i.e. during tunnel cleaning).

Fig. 5 FLSE200-M Sender/Receiver unit

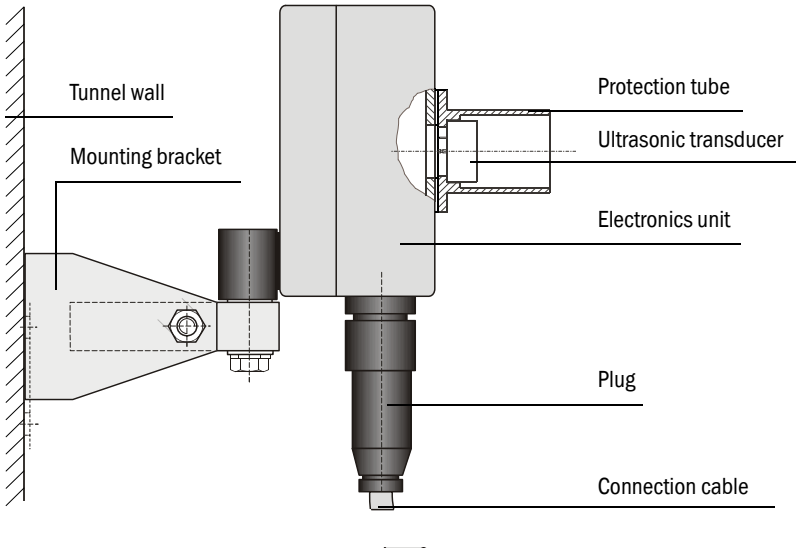
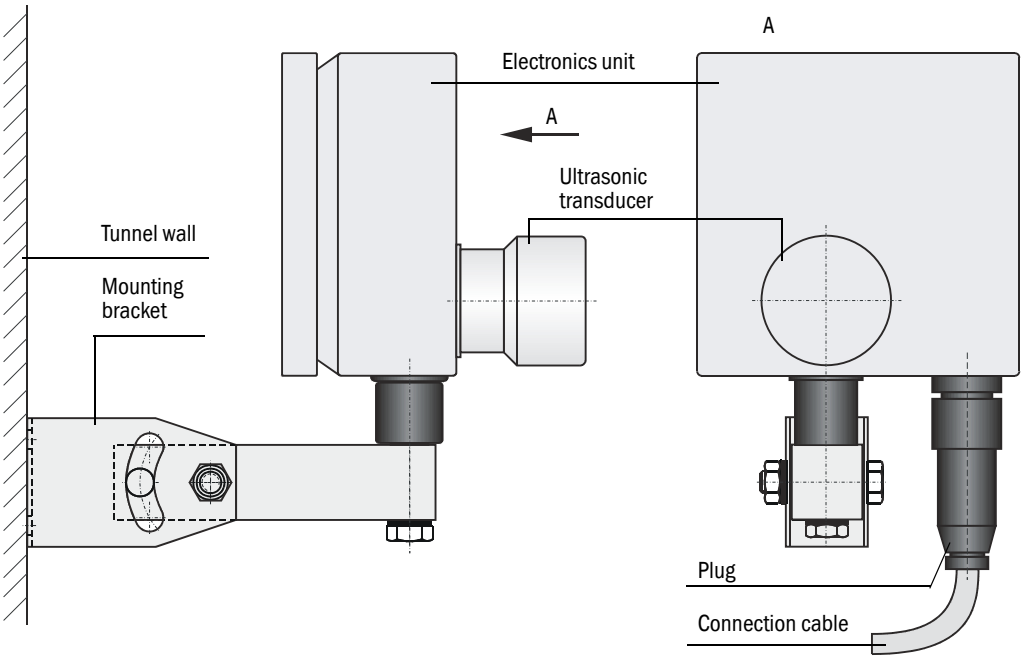


Fig. 6 FLSE200-H, FLSE200-HM Sender/Receiver unit in stainless steel housing



2.2.2 Mounting bracket

The mounting bracket is used to fix the sender/receiver unit at the tunnel wall. It allows to aligne the FLSE200 to each other with the required precision. The bracket is fixed to the wall with the help of two hexagon head screws and wall plugs.

There are two types of brackets, designed to match the individual sender/receiver unit models:

- Mounting bracket for FLSE200-M (→ p. 16, Fig. 5)
  Parts made of aluminium and stainless steel.
- Mounting bracket for FLSE200-H or FLSE200-HM (→ Fig. 6)
  All parts made of stainless steel.

2.2.3 Multi control unit (MCU)

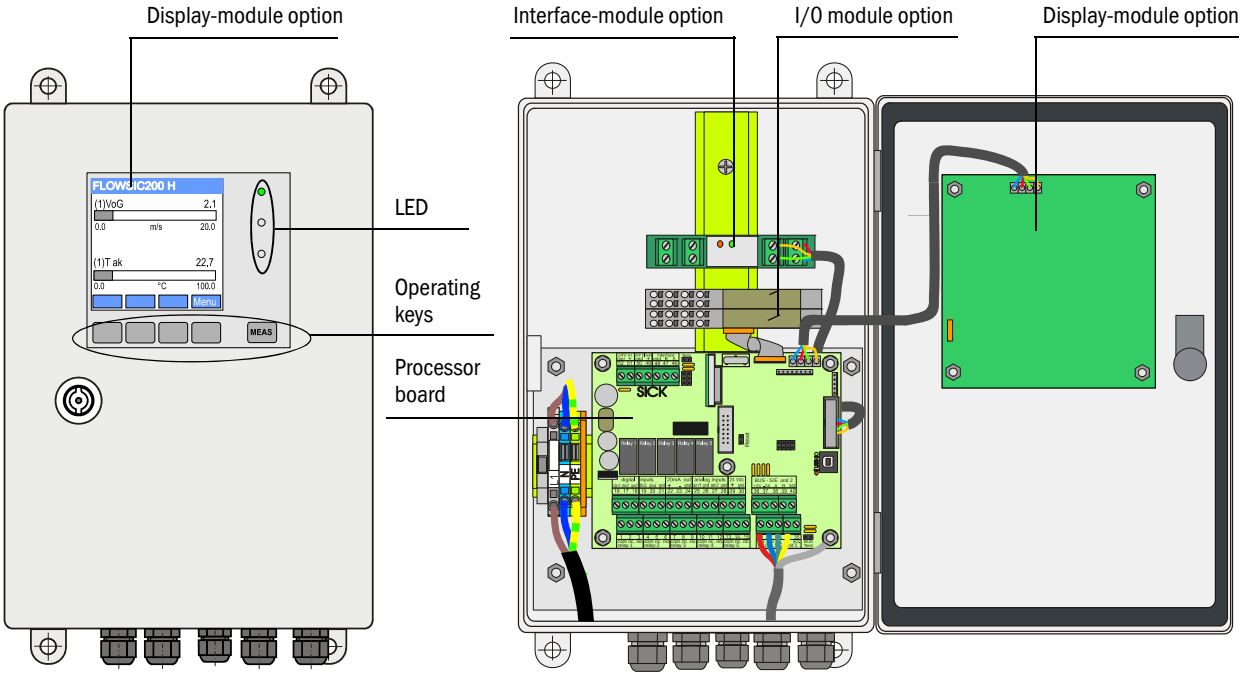
The control unit has the following functions:

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

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

The control unit is usually installed in stainless steel housing.

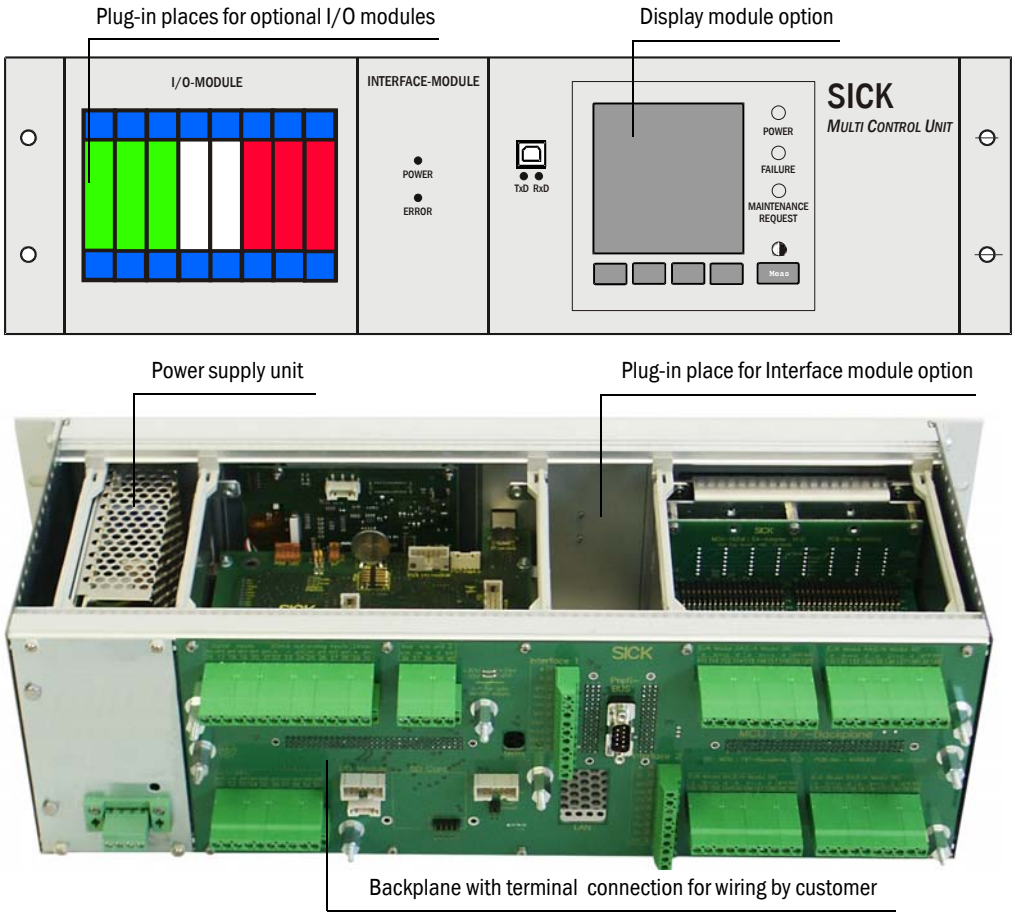
Fig. 7 Control unit MCU with options



Standard interfaces

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
1 output 0/2/4 ... 22 mA (active) for selectable output of: – Velocity – Air temperature, Resolution 0.01 mA	2 inputs 0 ... 20 mA (without electrical isolation) Resolution 0.01 mA	5 switch contacts (48 V, 1 A) to output the status signals: – Operation/Malfunction – Maintenance – Control cycle – Maintenance request – Limit value	2 inputs to connect potential-free contacts to connect a maintenance switch or trigger a check cycle	– USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and firmware updates – RS485 to connect a sensor

Fig. 8 MCU control unit in 19” rack with options



Options

The functionality of the MCU can be extended considerably by using the following options:

1 Display module
Module to display measured values and status information of the connected sensors using operating keys (capacitive sensors).

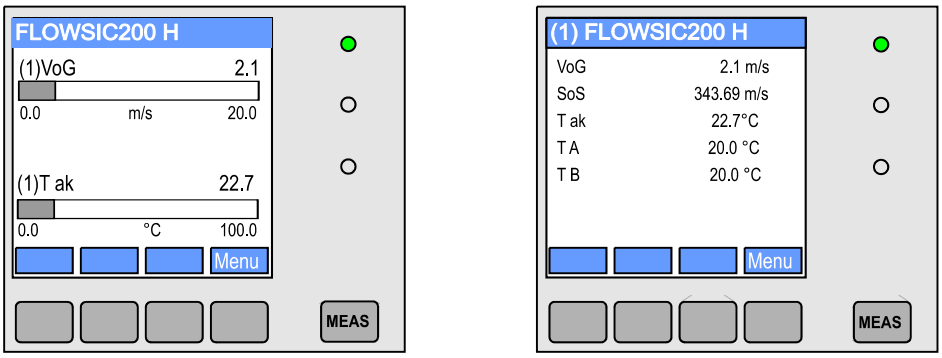
The integration of this module into reviously delivered control units can only be done by the supplier.

– Displays

Art		Anzeige von
LED	Power (green)	Power supply OK
	Failure (red)	Functional failure
	Maintenance request (yellow)	Maintenance required
LCD	Graphical display (main display)	Velocity of Gas (VoG) Acoustic temperature (T ac)
	Text display	2 measured values (see graphic display) and 6 diagnosis values

The graphic display shows two main measured values of the sender/receiver units selected at the factory or calculated values from the MCU (e.g. scaled flow velocity) as bar charts. Alternatively, up to 8 single measured values of a sender/receiver unit can be displayed (toggle with "Meas" button).

Fig. 9 LCD in graphical display (left) and in text display (right)



– Control keys

Key	Function
Meas	● Toggle between text and graphic display ● Display the contrast setting (after 2.5 s)
Arrows	Select next/previous measured value page
Diag	Display alarm or fault message
Menu	Display main menu and selection of submenus

2 I/O module

For plugging on module carriers (MCU in wall-housing) or in plug-in module (MCU in 19” rack), optionally as:

– Analog output module with 2 analog outputs 0/4 ... 22 mA to output further measured variables (load 500 Ω)
– Analog input module with 2 analog inputs 0/4 ... 22 mA to read in values from external sensors
– Digital output module with 2 digital outputs (2 channels, changeover contacts, capacity 48 V AC/DC, 5 A)
– Digital output module with 4 digital outputs (4 channels make contacts, capacity 48 V AC/DC, 0,5 A)

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

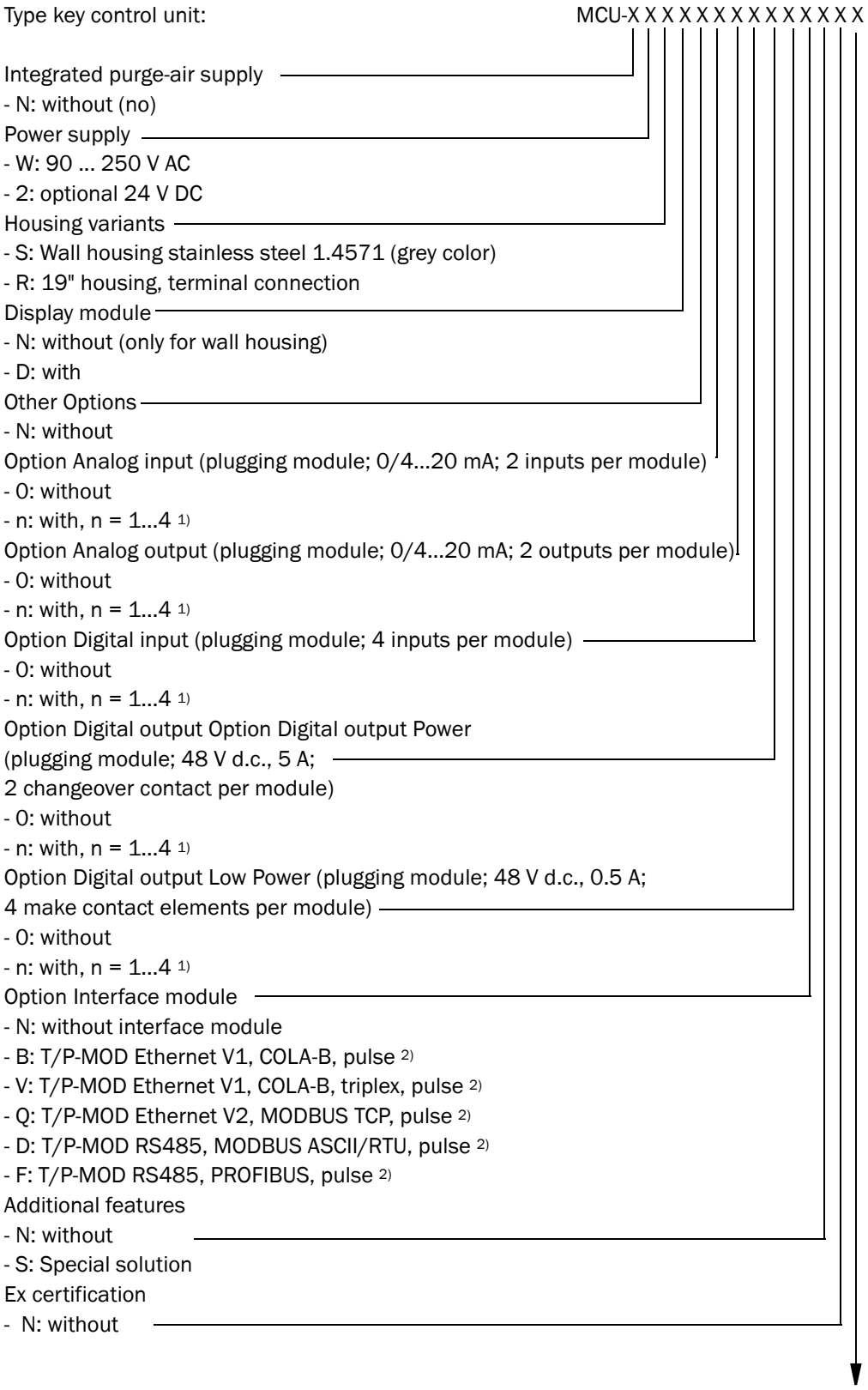
3 Interface Module

Module to pass measured values, system status and service information to higher level control systems, optional for Profibus DP or Ethernet, to plug onto hat rail (MCU in wall-housing) or on plug-in places (MCU in 19” rack). The module is connected to the connection board by an accompanying cable.

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

Type key MCU

The various configuration variants are defined by the following type key



Software
- E: Emission Monitoring

1): Up to 4 analog modules available on request

2): Pulse not available

Beispiel: MCU-NWSDN01010PNNE

- not purged
- wide-range power pack
- Wall housing stainless steel 1.4571 (grey color)
- with display module
- without other options
- without optional analog inputs
- with one additional analog output
- without optional digital inputs
- with additional digital output power
- without optional digital outputs low power
- with interface module Profibus DP
- without special features
- without ex certification
- emission monitoring

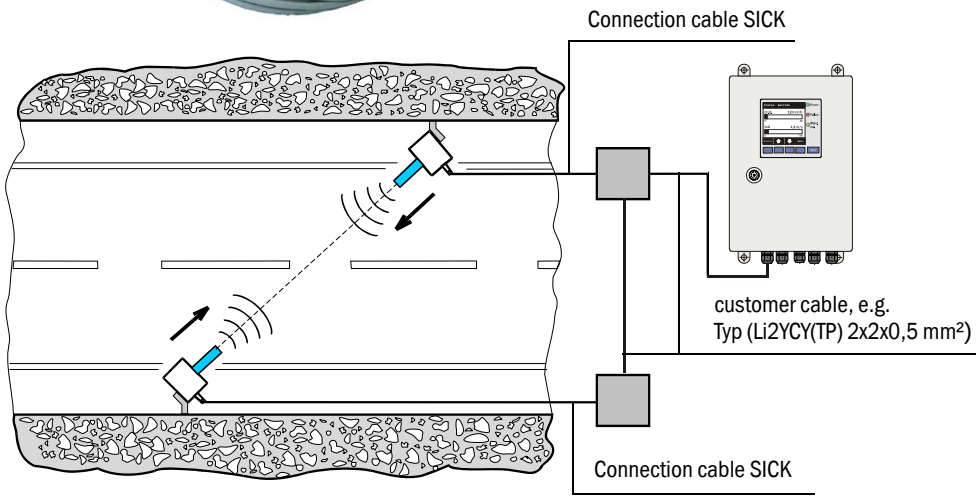
2.2.4 Connection cables

For connection of the sender/receiver units with control unit MCU a connection cable is used. The connection cable is available in different lengths.

Detailed notes for wiring and cable types are contained in → p. 40, §3.3.2.

Fig. 10 Connection cable

Connection cable halogen-free (9wires)
3 x 2 x 0,25 + 3 x 1,0 mm². length2 m, 25 m (6 ½ ft, 82 ft)
(scope of supply SICK)



2.2.5 Mounting sets

Various mounting sets are available to fasten the mounting brackets for the sender/ receiver units, terminal boxes, data repeater options and coax repeater options at the tunnel wall (or roof). The selection of a mounting set depends on the actual requirements. The table below lists the parts of the individual mounting sets and their applications.

Mounting set		Application		
Designation (Part no.)	Contents	Requirements	For component	Qty. per comp.
2D8-1.4571/PA (2031888)	– 2x Fischer plug S10 – 2x hex. head screw 8x50 A4	No particular	– Mounting bracket for FLSE200-M – Mounting bracket for FLSE200-HM – Mounting bracket for FLSE200-H	1
2M8-1.4571 (2031891)	– 2x plug SLM 8N A4 – 2x hex. head screw 8x55 A4	Stainless steel only	– Mounting bracket for FLSE200-M – Mounting bracket for FLSE200-HM – Mounting bracket for FLSE200-H	1
			– Terminal box in stainless steel housing	2
2M8-1.4529 (2031886)	2x Fischer tie bolt FAZ 8/10 C	Aggressive ambient air	– Mounting bracket for FLSE200-M – Mounting bracket for FLSE 200-M, material 1.4529 – Mounting bracket for FLSE200-M stainless steel housing – Mounting bracket for FLSE200-H, FLSE200-HM – Mounting bracket for FLSE200-H, FLSE200-HM, material 1.4529	1
4D8-1.4571/PA (2031889)	– 4x Fischer plug S10 – 2x hex. head screw 8x50 A4	No particular	Terminal box in stainless steel housing	1
2D4-1.4571/PA (2031890)	– 2x Fischer plug S6 – 2x round head screw 3.5x40 A4		Terminal box	1
4M8-1.4529 (2031887)	4x Fischer tie bolt FAZ 8/10 C	Aggressive ambient air	– Terminal box in stainless steel housing	1

2.3 Calculations

2.3.1 Flow velocity calibration

If the measured velocity does not correspond with the average flow velocity in the entire cross-sectional area of the tunnel, the FLOWSIC200 can be calibrated by way of a network measurement with a reference measuring system. Regression coefficients Cv2, Cv1 and Cv0 are calculated from the measured values determined by the two measuring systems and entered during parameterization of the FLOWSIC200 system (→ p. 90, §4.3.3). The device will then calculate the calibrated flow velocity v from the value x measured by the FLOWSIC 200 in accordance with the following formula:

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

If calibration is not necessary, Cv2, Cv0 = 0, Cv1 = 1 (default setting). In this case, x represents the true flow velocity.

2.3.2 Temperature calibration

The FLOWSIC200 temperature measurement can be calibrated by way of a reference measurement using a separate temperature sensor (e.g. Pt100). However, this is normally not necessary, because the active measuring distance can be determined very precisely (± 1 cm, see formula 2.6, → page 15).

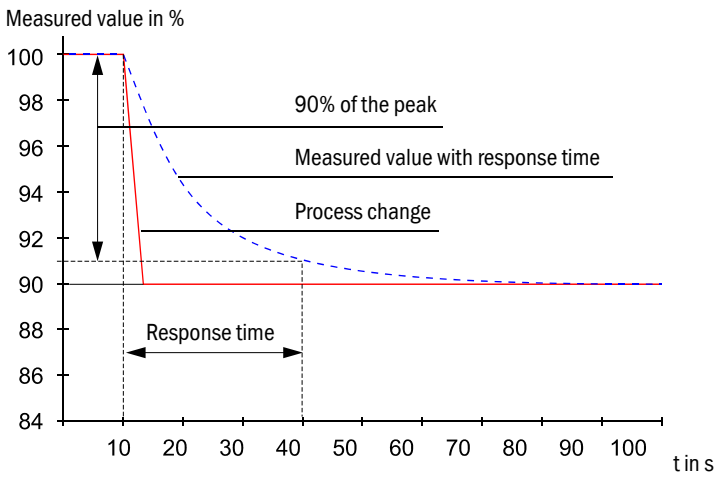
2.3.3 Response time

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

A special response time is used to measure the gas velocity and gas temperature. The response time of the volumetric flow is identical to that of the gas velocity.

Fig. 11 Response time



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 to produce an output signal of the same accuracy. As a result, the response time is higher than the set time (within certain limits).

2.4 Check cycle

You can trigger a check cycle on the FLOWSIC200 to test whether the device components are functioning correctly. The check cycle can also be triggered automatically (you can set the interval using the SOPAS ET operating software) and/or via a binary input (→ p. 18, §2.2.3).

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

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

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

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

2.4.1 Zero-point check

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

If the device is operating correctly, the exact zero point must be calculated here. This check comprises a full check of all the system components, including the transducers. A warning is output for offsets greater than approx. 0,25 m/s (0.8 ft/s) (depending on the measuring distance and the temperature). In this case, you should check the transducers and electronic components.

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

2.4.2 Span test

At the electronic zero point test, the time difference between both directions of signal transmission is generated. It is calculated with the installation parameters gas temperature, measuring distance and speed of sound and a velocity offset is calculated at the zero point

This offset is added to the chosen span value and is output. The span value can be set to between 50 and 70 % in steps of 1 % using the SOPAS ET operating software (factory setting 70 %).

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

2.4.3 Check cycle 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. It can be changed with the SOPAS ET operating software (→ p. 70, §4.2.5).
- This output is only expedient for measured values that depend on velocity (flow velocity).

FLOWSIC200

3 Assembly and Installation

Project planning
Mounting
Installation

3.1 Project planning

3.1.1 Planning steps

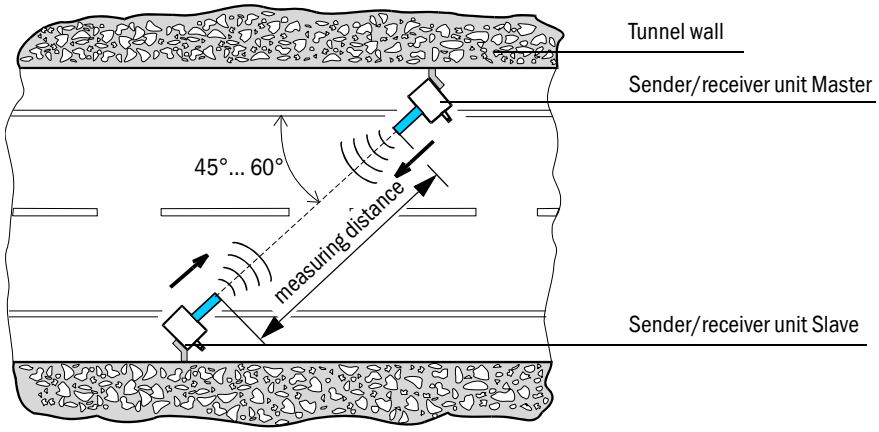
Before you install the measuring system, complete the following planning steps:

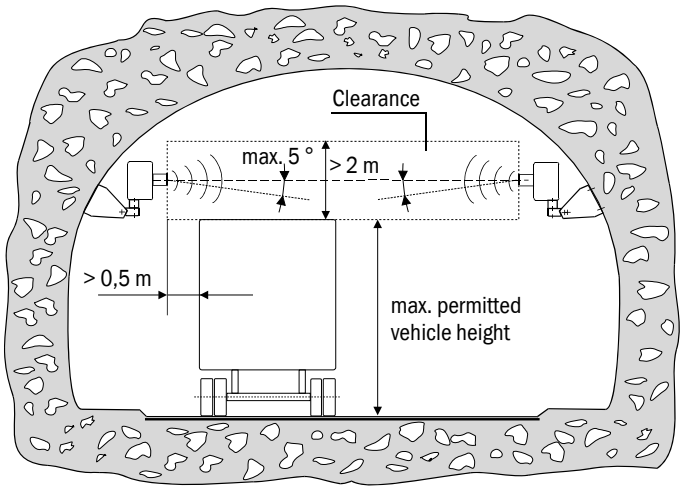
- Decide on the location for the measurement.
- Select the system components on the basis of your application conditions and requirements, as described in → p. 16, §2.2
- Specify the mounting positions for the sender/receiver units, MCU and terminal box.
- Plan the power supply.

3.1.2 Requirements on the mounting position for sender/receiver units

The sender/receiver units A and B must be mounted to opposing tunnel walls, adequately high above the road and shifted laterally (→ Fig. 12). The angle between tunnel axis and measuring axis should not be greater than 60° (minimum 45 °).

Fig. 12 Mounting positions for sender/receiver units

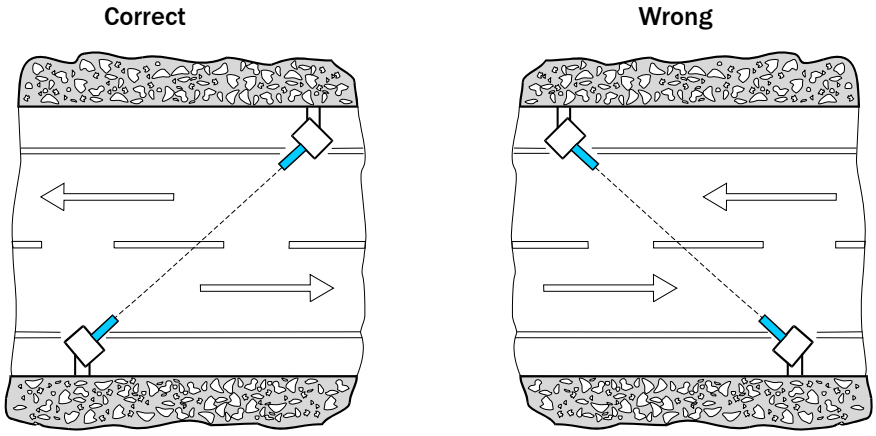




WARNING:

- The measuring distance between opposing sender/receiver units must be free from any installations to ensure undisturbed sound propagation (observe clearance as shown → p. 30, Fig. 12).
- Also ensure the minimum distance to vehicles passing by (→ p. 30, Fig. 12).
- The sender/receiver units must further be positioned so that a minimum of spray and dirt can contaminate the transducers, i.e. along the direction of traffic flow (→ Fig. 13).

Fig. 13 Positioning of the sender/receiver units



- If the measuring axis is very low above ground due to the actual site conditions, so that the max. permitted vehicle height penetrates the required clearance, measurement can be interrupted during traffic jams.
- If the necessary distance between measuring axis and tunnel roof cannot be guaranteed (in particular the case with square cross-sections), sound reflection at the tunnel roof may lead to measurement errors.

This effect can be diminished by turning the measuring axis of the two transmitter/receiver units down by about 5 ° (→ p. 30, Fig. 12) or by attaching sound-absorbing material to the tunnel roof.

3.2 Mounting

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

- ► Attaching the mounting brackets for the sender/receiver units.
- ► Configuring bus systems (if existing).
- ► Mounting sender/receiver units, terminal boxes and MCU.

WARNING:

- ► When carrying out the installation work, observe the relevant safety regulations and safety instructions in Chapter 1 at all times.
- ► If possible, carry out any assembly work while the tunnel is closed.
- ► Take suitable protective measures against possible hazards.

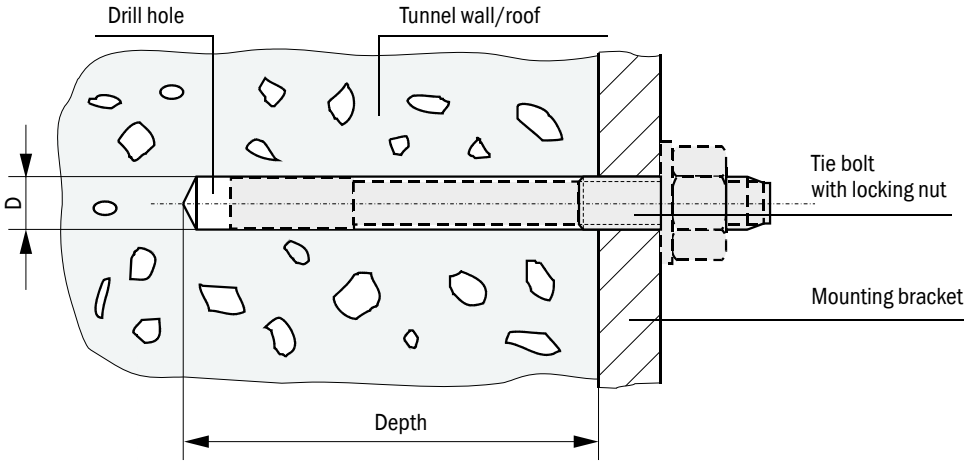
All Dimensions are indicated in mm.

3.2.1 Attaching the mounting brackets for the sender/receiver units

Attach the mounting brackets to the tunnel walls or roof using the correct mounting set (for available mounting sets see → p. 24, §2.2.5). Proceed as follows:

- ► Drill two holes at a distance of 40 mm (for drill hole details see → Fig. 14).
- ► Insert plugs (mounting sets 2D4/2D8/4D8-1.4571/PA, 2M8-1.4571) or tie bolts (mountings sets 2M8/4M8-1.4529).
- ► Fasten the brackets using hexagon head screws or nuts.

Fig. 14 Drill hole dimensions



Mounting set	Dia.	Depth	Notes
2D4-1.4571/PA	6	≥40	The plug should be flush with the tunnel wall/roof
2D8/4D8-1.4571/PA	10	≥70	
2M8-1.4571	12	≥60	
2M8/4M8-1.4529	8	≥65	The tie bolt must not protrude more than 12 mm from the tunnel wall/roof.

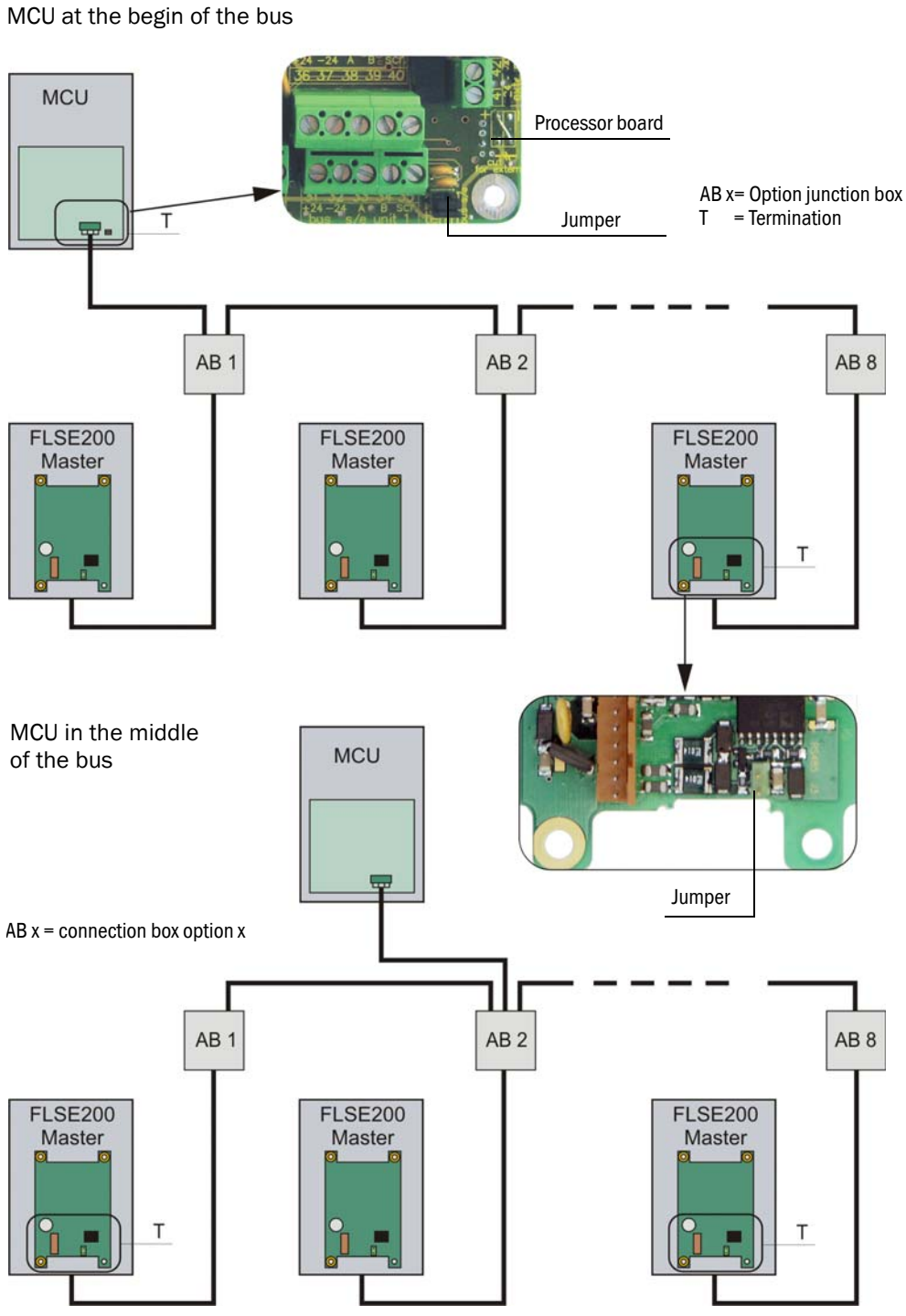
3.2.2 Configuring bus systems

3.2.2.1 Checking/configuring the termination

The connection between the sender/receiver units and the MCU must be terminated at the begin and end with resistors. These are already on the circuit boards (jumper).

For checking/changing the termination, open the MCU and sender/receiver units, put the jumper to the respective pins depending on the arrangement of the MCU, and then close the device components.

Figure 15 Termination of bus wiring



3.2.2.2 Bus addressing

On bus systems (several pairs of sender/receiver units on one MCU), the required bus address of a sender/receiver unit (master only) can be assigned by the hardware or software (→ p. 91, Fig. 4.3.4). Hardware addressing is read in with the start of the SOPAS ET program and has a higher priority than software addressing.

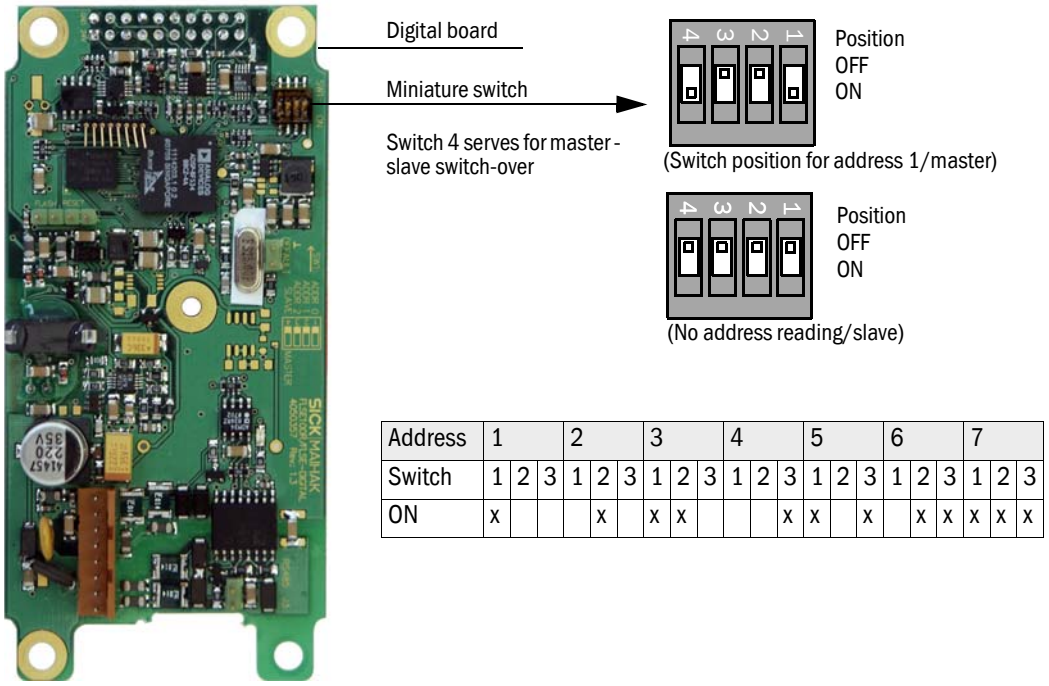
Bus address and sensor number in the MCU are always identical.

> ***NOTICE:***
> For bus systems it must be ensured that the bus address of the master FLSE200 is correct.
> The sender/receiver units must have different addresses. Identical addresses of several units cause the aborting of the communication with the MCU!

As standard, the address is set by means of a miniature switch on the digital board in the sender/receiver unit (3 switches for hexadecimal addressing of 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.

Figure 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	x	x

3.2.3 Mounting the sender/receiver units

Mount the sender/receiver units to the brackets attached to the walls. Positioning with the connection cable from below shall be preferred (→ Fig. 17, → p. 36, Fig. 19 and → p. 37, Fig. 21).

The sender/receiver units can be turned vertically and horizontally in a wide range to facilitate precise alignment (→ p. 37, §3.2.4). This allows a simple adaptation to the local conditions, such as pitch of the tunnel wall and road surface or bends.

The horizontal turning range can be reduced and extended using the two bores in the section of the mounting bracket which is directly connected with the sender/receiver unit.

FLSE200-M sender/receiver unit

Fig. 17 Upright arrangement with connection cable from below

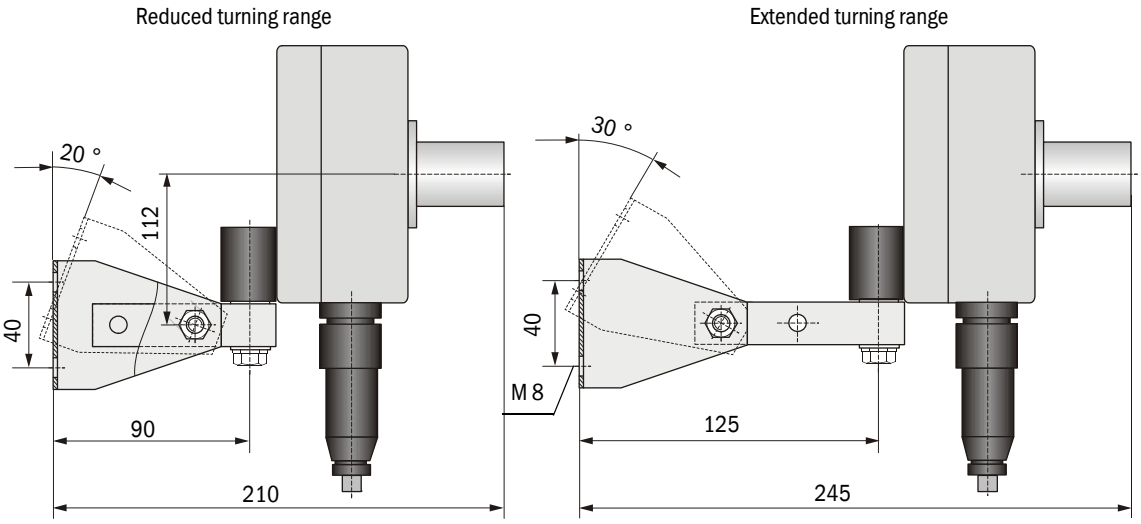


Fig. 18 Upright arrangement with connection cable from above

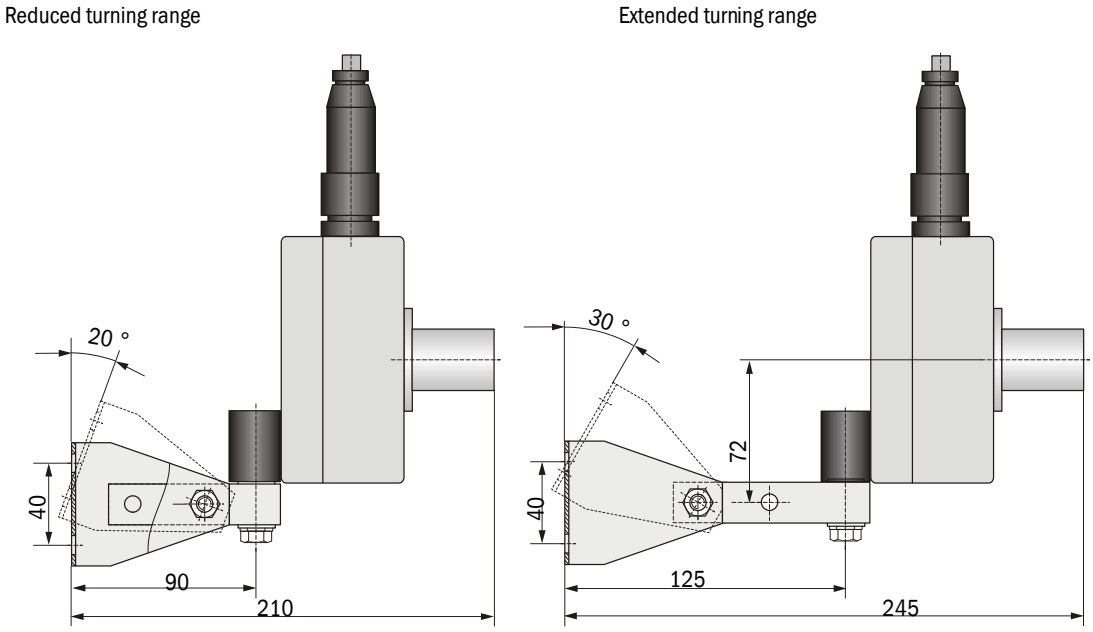


Fig. 19 Suspended arrangement with connection cable from below

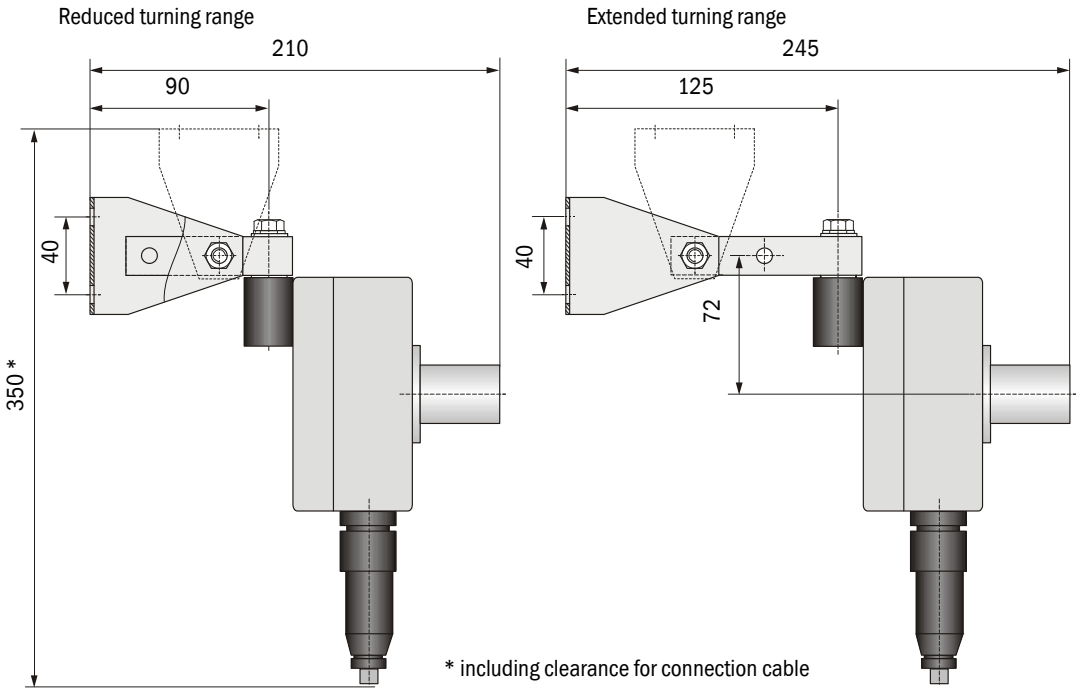
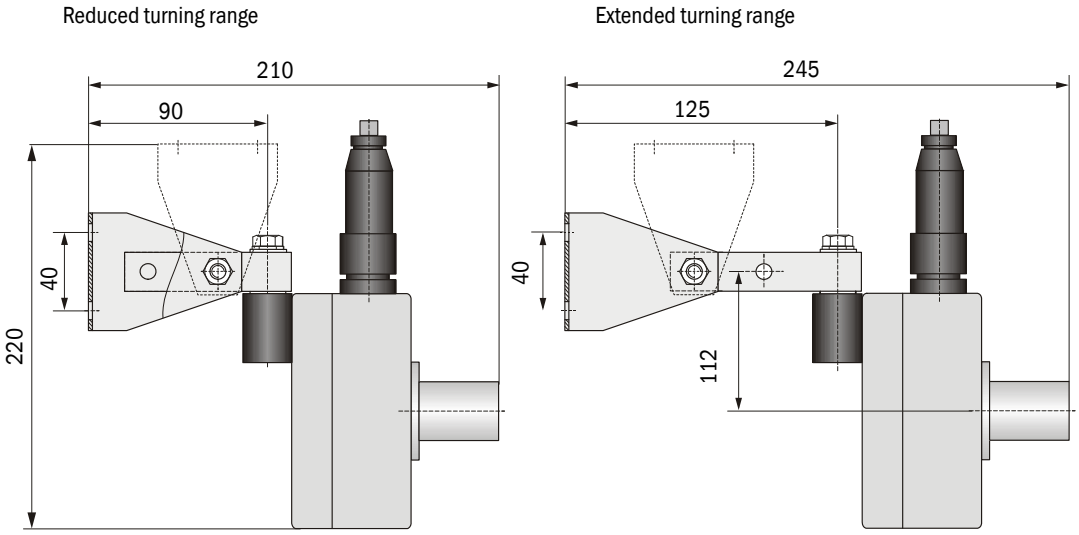
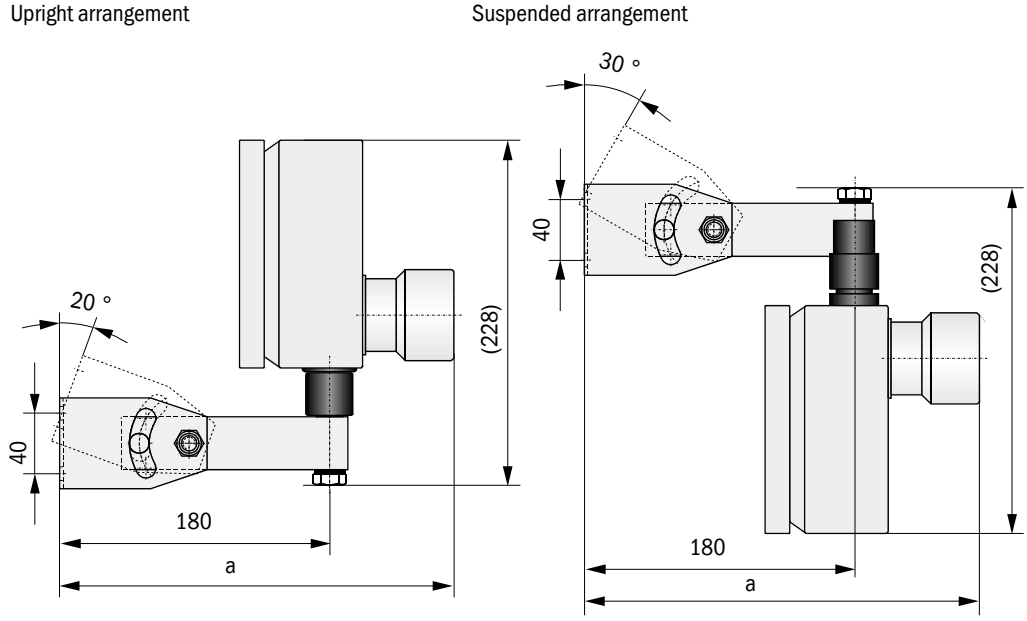


Fig. 20 Suspended arrangement with connection cable from above



FLSE200-H, FLSE200-HM

Fig. 21 Mounting the FLSE200-H / FLSE200-HM



FLSE200-H FLSE200-HM
a = 263

3.2.4 Aligning the sender/receiver units

After being mounted, the sender/receiver units must be aligned to match their transmission axes (→ Fig. 22 und → p. 38, Fig. 23).

Fig. 22 Misalignment tolerance in the direction of flow

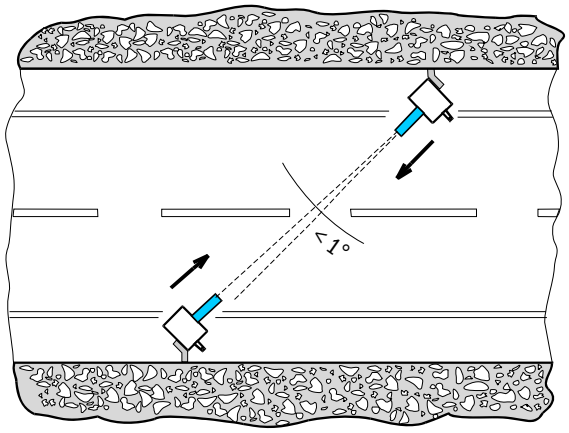
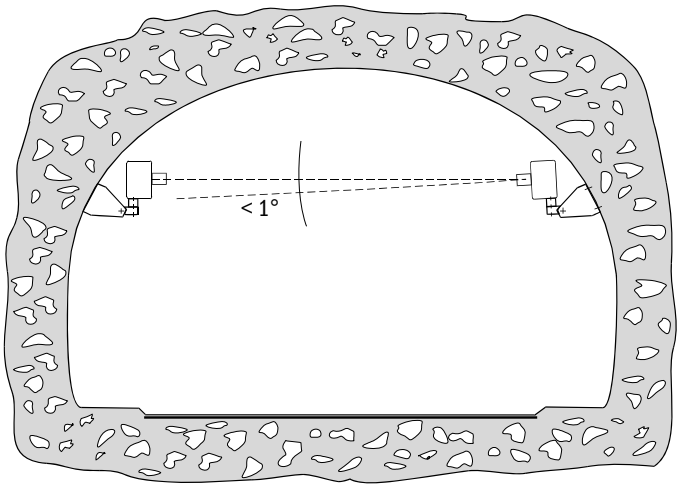


Fig. 23 Horizontal misalignment tolerance



In exceptional cases, both transmitter/receiver units can be turned down by up to 5° (→ p. 30, §3.1.2).

Align the transmitter/receiver units in two steps:

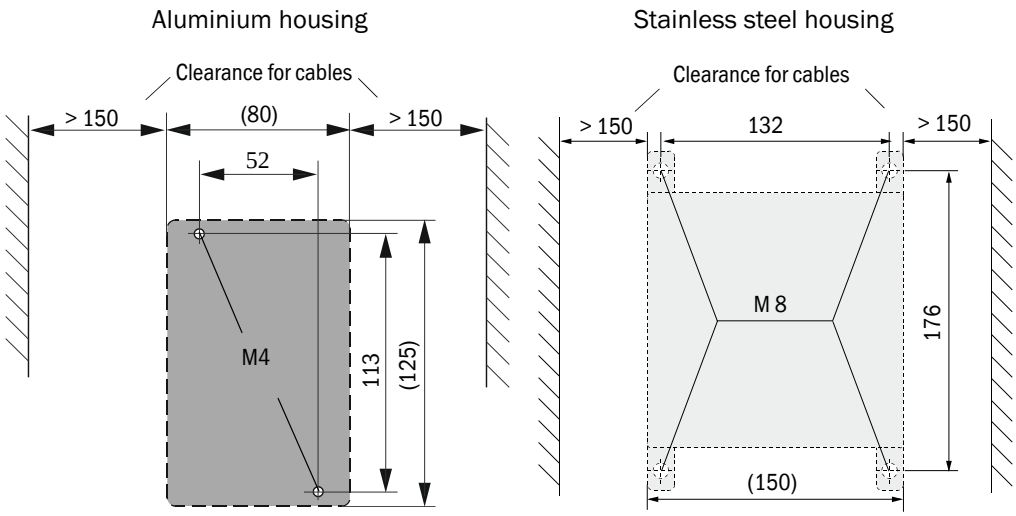
1 Rough alignment using a string or the eye.

2 Fine alignment using a laser pointer or similar device.

3.2.5 Mounting the terminal box

Mount these component on a level base (tunnel wall or roof) as shown in → Fig. 24. Use the correct mounting set (→ p. 24, §2.2.5). For drill hole specifications and details on mounting see → p. 32, Fig. 14.

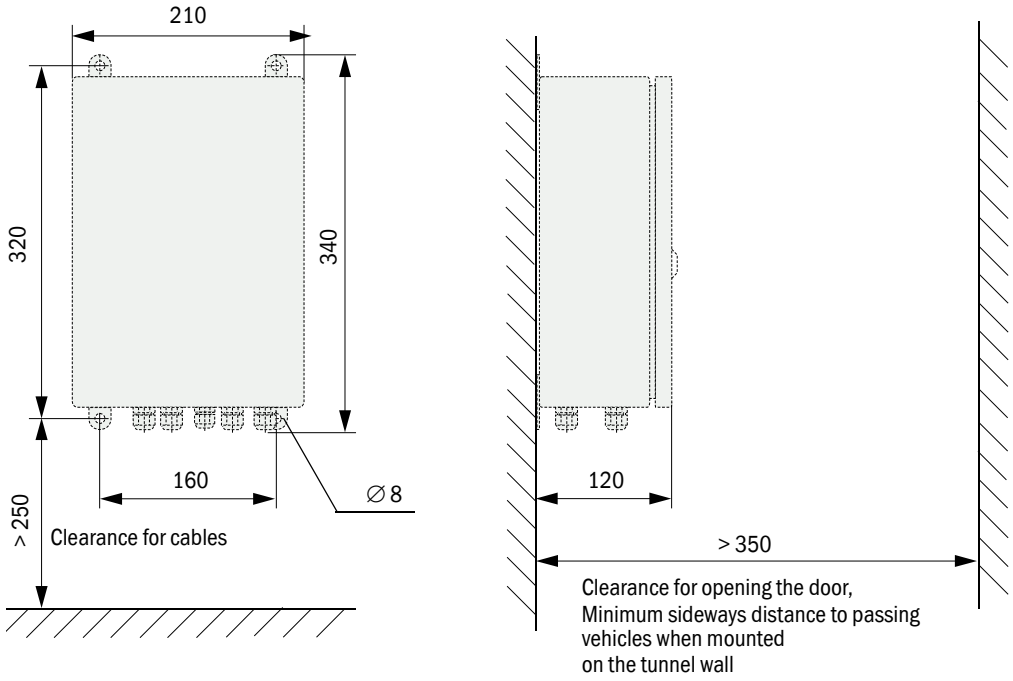
Fig. 24 Mounting dimensions for terminal box



3.2.6 Mounting the MCU control unit

Mount the control unit in a vertical, level, easily accessible and protected location according to Fig. 25.

Fig. 25 Mounting dimensions of the MCU



The respectively suitable mounting sets can be used to the fastening (→ p. 24, §2.2.5; installation → p. 32, Fig. 14).

- The MCU control unit can be installed at a distance of up to 1000 m (3280 ft) away from the sender/receiver units using suitable cables (→ p. 40, §3.3.2) (use bus wiring as shown in pg. 45, Fig. 29; the length is the total length of all the cables).
- We recommend installing the MCU in an operational room 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 when carrying all assembly work.
- Take suitable protection measured against possible local or plant-specific hazards.

3.3.1 General instructions, prerequisites

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

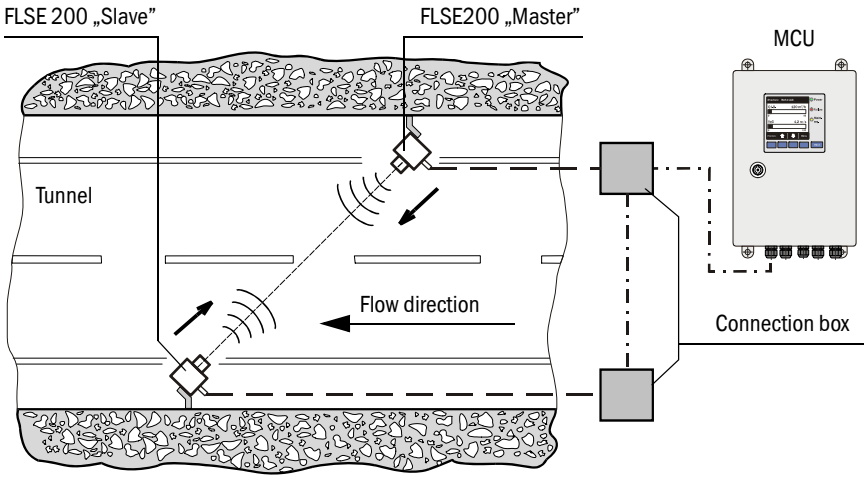
All of the installation work must be carried out by the customer. This includes:

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

- Plan adequate cable cross-sections (→ p. 42, §3.3.3).
- The cable ends with the connectors for connecting the transmitter/receiver units must have adequate reserve length.
- Unused cable connectors must be protected from moisture and dirt (screw on protective caps).

3.3.2 Notes for wiring

Fig. 26 Wiring



— — Connection cable FLSE200 (SICK scope of delivery SICK)

– · – · – Connection cable between MCU and connection boxes (customer wiring)

3.3.2.1 Cable specification

Connection of	Data transmission	FLSE200 power supply	Cable type
Sender/receiver unit and connection box (SICK scope of supply)	Connection FLSE200 Master: 2 pairs of wires (twisted pair), effective capacity core/core I< 110 pF/m, core cross-section ≥ 0,25 mm²	1 pair of wires with core cross section 1 mm²	UNITRONIC FD P BUS Combi 3 x 2 x 0,25 mm² + 3 x 1 mm²
	Connection FLSE200 Slave: 2 pairs of wires (twisted pair), effective capacitycore/core I< 110 pF/m, core cross-section ≥ 0,25 mm²		
• MCU and connection box (customer wiring) • connection box - connection box (customer wiring)	1 pair of wires (twisted pair), effective capacity core/core < 110 pF/m, core cross-section ≥ 0,25 mm²	1 pair of wires with core cross-section ≥ 0,5 mm² (AWG 20)	e.g. UNITRONIC Li2YCYv (TP) 2 x 2 x 0,5 mm² or equal

Recommended cable types for customer wiring of MCU and connection boxes

1 UNITRONIC LiYCY (TP) 2 x 2 x 0,5 mm²
1 pair of wires for RS 485, 1 pair of wires for transducer power supply;
not suitable for underground installation (protected laying required if necessary)

2 UNITRONIC Li2YCYv (TP) 2 x 2 x 0,5 mm²
1 pair of wires for RS 485, 1 pair of wires for transducer power supply;
alternativ to item 1; suitable for underground installation

3 UNITRONIC Bus FD P Combi 3 x 2 x 0,25 + 3 x 1,0 mm²
1 pair of wires for RS 485, 1 pair of wires with cross-section 1,0 mm² for transducer power supply, fpr cable length up to 1000 m at connection of 2 measuring points.

4 Special cable type ASS 4 x 2 x 0,5 mm²
1 pair of wires for RS 485, 1 - 3 for transducer power supply;
Silicone, halogen-free, great temperature stability (heat and cold), red sheating (similar to RAL 3000);
Accessory:
Braided cable sleeving PA-S 4, black; to provide mechanical protection and to cover the sheating colour if necessary.

- ► Manufacturer of UNITRONIC cables: LAPP-Kabel
- ► Manufacturer of special cable: metrofunk KABEL-UNION GmbH
- ► Cables of other manufacturers are useable if they have the same specification.
- ► We recommend to coordinate the wiring of 1 MCU with several measuring points (up to 8) with the manufacturer (→ p. 18, §2.2.3).
- ► For the standard wiring (bus wiring) the manufacturer set termination has to be deactivated in those system components, that are not on the cable end.

NOTICE:

- ► We cannot grant any warranty for proper function of the system if you use cables which do not comply with above specifications.
- ► Cables must be routed without changing to other cable types in between. Ensure continuous screening.
- ► Telecommunications cables such as A-2YF(L)2Y.. are not suitable.

3.3.2.2 Cable lengths

At wiring with several connected measuring points (→ p. 13, Fig. 3) the maximum possible cable lengths is reduced depending on the number of connected measurements as follows:

Number of measurement points	Cable type 2 x 2 x 0,5 mm² (e.g. UNITRONIC Li2YCYv(TP))	Cable type 3 x 2 x 0,25 + 3 x 1,0 mm² (e.g. UNITRONIC FD P BUS Combi)
1	1000 m	1000m
2	500 m	1000 m
3	330m	660 m
4	250 m	500 m
5	200 m	400 m

Longer cable lengths can be realized in the following manner:

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

To ensure reliable power supply at large cable lengths the following specification of the FLOWSIC200 have to be considered:

Supply of sender/reveiver units	Typ 200M	Typ 200H, 200HM
Current consumption per FSLSE200	35,5 mA	38 mA
Needed voltage at FLSE200	18 - 24 VDC	18 - 24 VDC

NOTICE:
The maximum cable length is 1000 m even if using larger core diameters.

2 Use MCU with high performance power supply

All solutions are available from the manufacturer on request.

3.3.3 Connecting sender/receiver units and connection boxes

Connect those components as shown in pg. 45, Fig. 29:

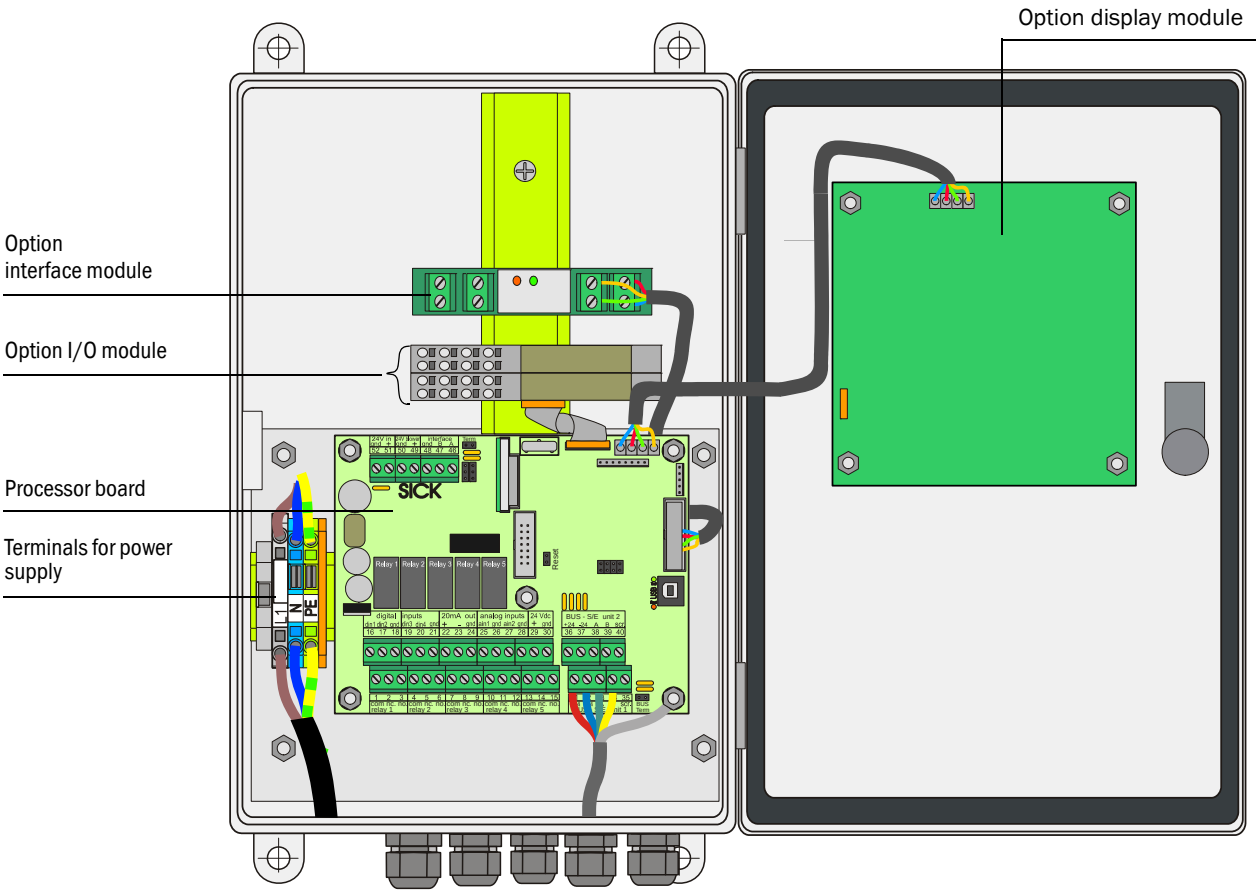
- between sender/receiver unit and connection box using the cables with connector included in the delivery,
- between terminal boxes and MCU with customer cable.

WARNING:

- ► Check any wiring again before you turn on the power supply. Otherwise the sender/receiver units may be damaged.
- ► Always disconnect the system from the power supply before you modify the wiring.

3.3.4 Connecting the control unit in wall-housing

Fig. 27 Component configuration in the MCU (with options)



Necessary activities

- ► Connect the cables as shown in → p. 45, Fig. 29.
- ► Connect the cables for status signals (operation/malfunction, warning, maintenance, check cycle; analog output, and external maintenance switch according to the requirements (→ p. 45, Fig. 29, → p. 46, Fig. 30, Fig. 31, Fig. 32).

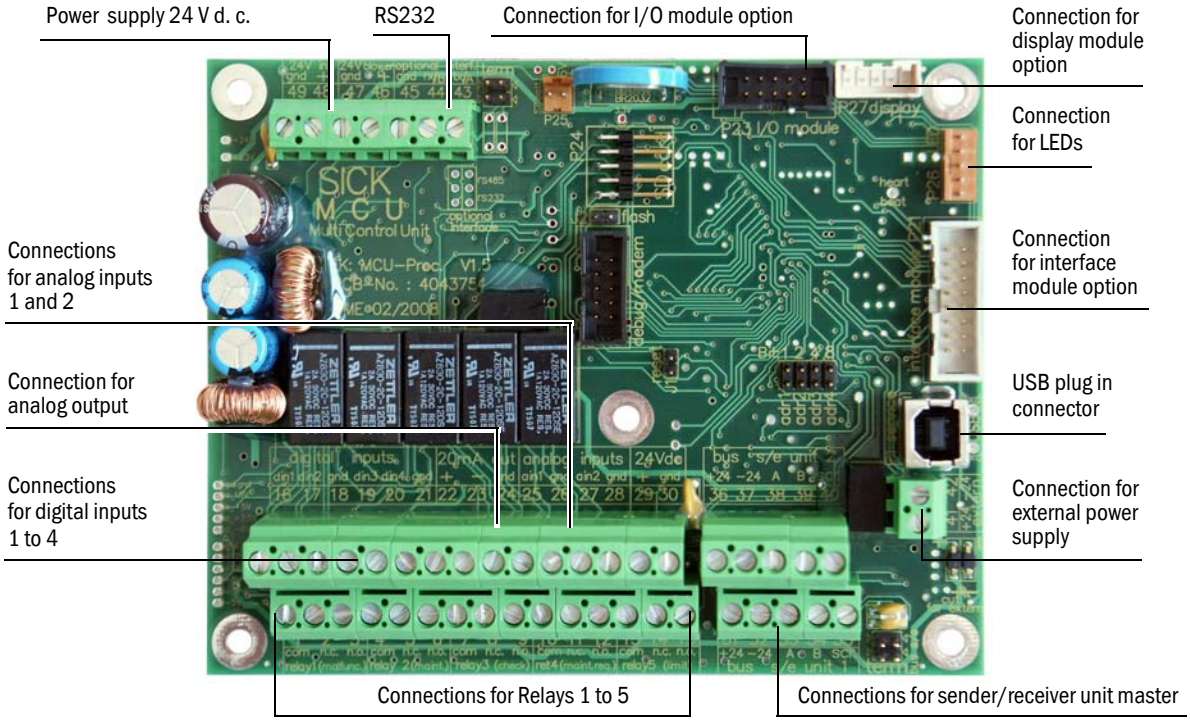
> ***NOTICE:***
> ► Only use cables with twisted-pairs and screen (e.g. UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm² from LAPPKabel; not suitable for underground laying).

- ► Connect the power supply cable to terminals L1, N, PE (→ Fig. 27).
- ► Seal cable entries not in use with blind plugs.

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

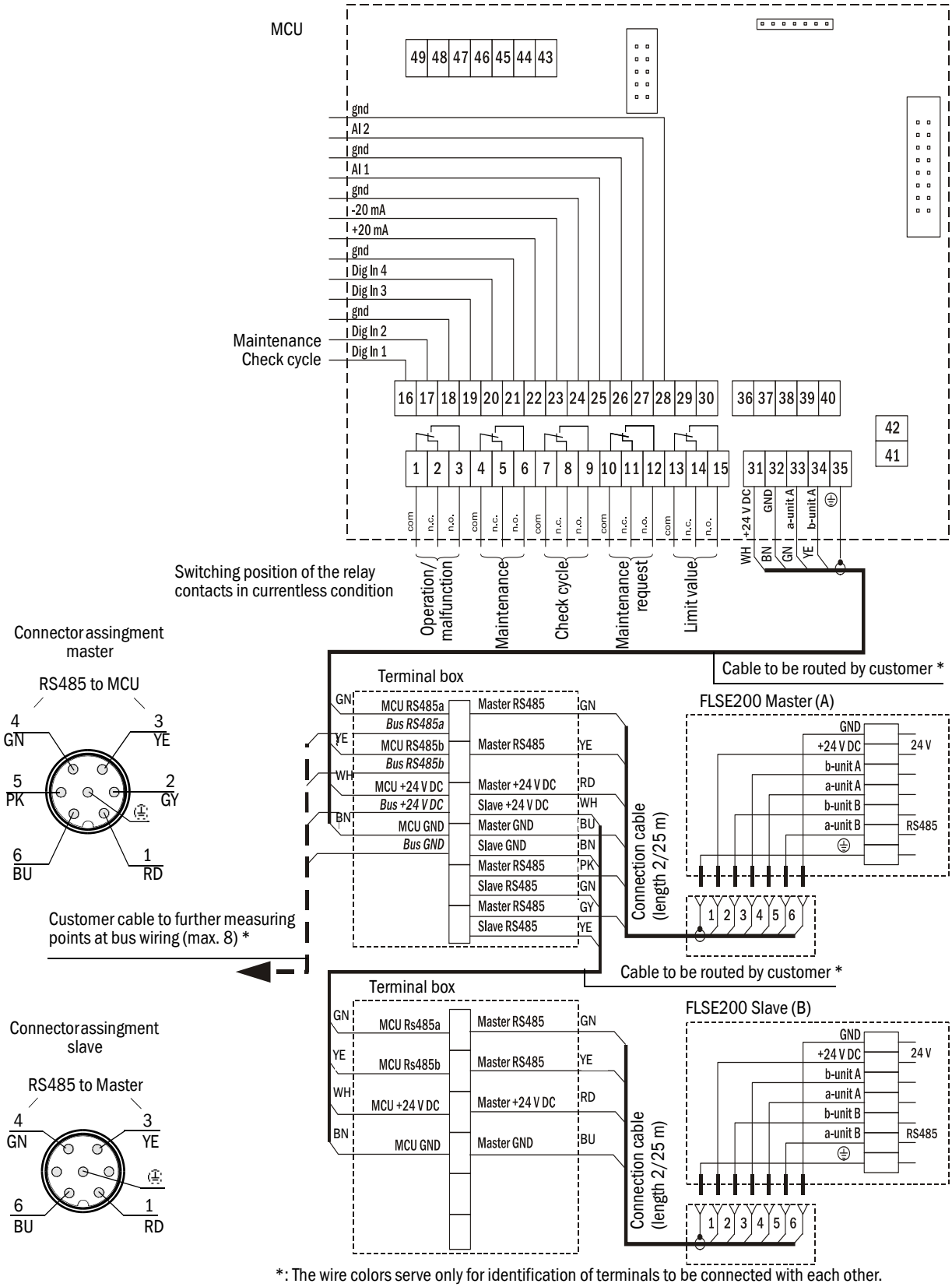
MCU processor board connections

Fig. 28 MCU processor board connections



Bus wiring

Fig. 29 Bus wiring



*: The wire colors serve only for identification of terminals to be connected with each other.

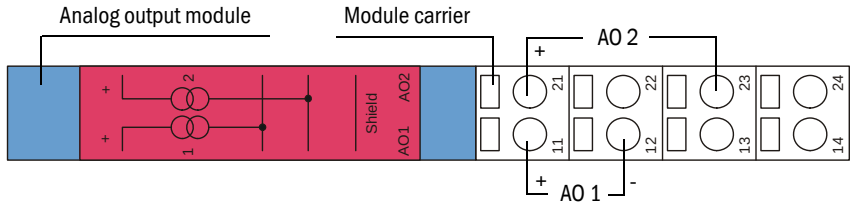
Fitting and connecting optional Interface and I/O modules

Plug interface modules and module carriers for I/O modules onto the hat rail in the MCU (→ p. 43, Fig. 27) and connect to the associated connection on the processor board with the cable with plug-in connector (→ p. 46, Fig. 30). Then plug the I/O module on the module carrier.

Connect I/O modules using the terminals on the module carrier (→ Fig. 30, Fig. 31, Fig. 32), the Profibus module using the terminals on the module and the Eternet module via customer provided network cable..

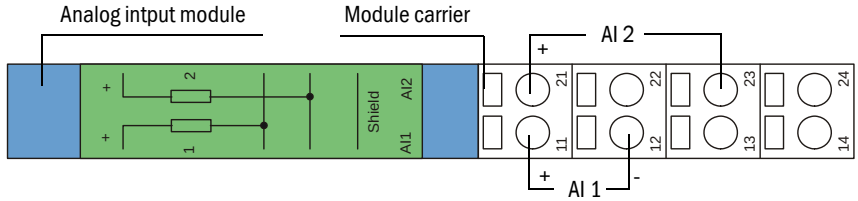
- Terminal assignment AO module

Fig. 30 Terminal assignment analog output module



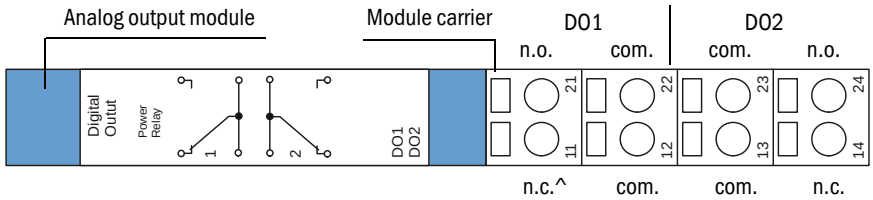
- Terminal assignment AI module

Fig. 31 Terminal assignment analog input module



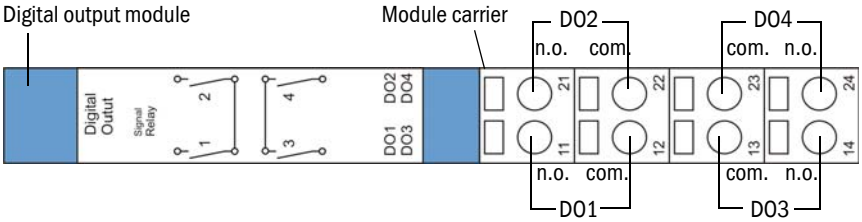
- Terminal assignment DO module (2 changeover contacts)

Fig. 32 Terminal assignment digital output module



- Terminal assignment DO module (4 NO contacts)

Fig. 33 Terminal assignment digital output module (4 NO contacts)



- Terminal data

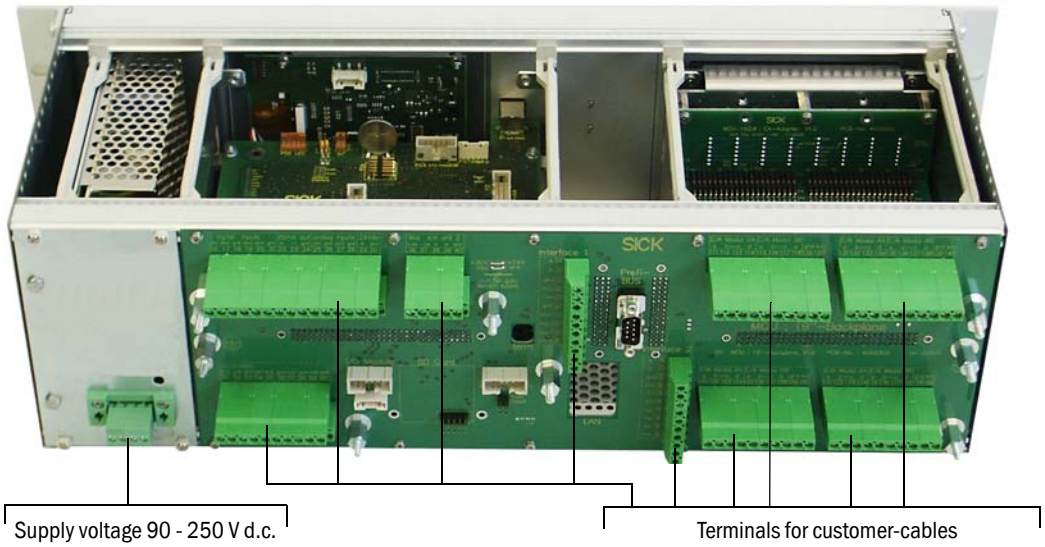
Connection	Module type				
	2x analog input	2x analog output	2x digital input	Digital output	Digital output
				2 changeover contacts	4 NO contacts
	Assignment				
11	AI 1+	AO 1+	DI 1+	n.c. relay 1	n.o. relay 1
12	AI 1-	AO 1-	gnd	com. relay 1	com. relay 1
13	AI 2-	AO 2-	gnd	com. relay 2	com. relay 3
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 DC	15 V DC	5.5 V DC	30 V AC/DC	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 19" rack

Fig. 34 Connections on the MCU in 19" rack)



Function	Connection	Terminal no.
Output relay 1 (operation/malfunction)	com	1
	n.c.[1)]	2
	n.o.[2)]	3
Output relay 2 (maintance)	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	dig in 1	16
	dig in 2	17
	gnd	18
	dig in 3	19
	dig in 4	20
	gnd	21
Analog output	+	22
	-	23
	gnd	24
Analog input	AI 1	25
	gnd	26
	AI 2	27
	gnd	28

Function	Connection	Terminal no.
Connections for sender/receiver unit master	+24	31 (36)
	-24	32 (37)
	RS485 A	33 (38)
	RS485 B	34 (39)
	scr	35 (40)
Input power supply 24V d.c. 3)	24 V	41
	gnd	42
Output power supply 24V d.c. 3)	24 V	43
	gnd	44
Input 30 V galv. separated	+	45
	-	46
RS232/485 3)	tx/ta	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)

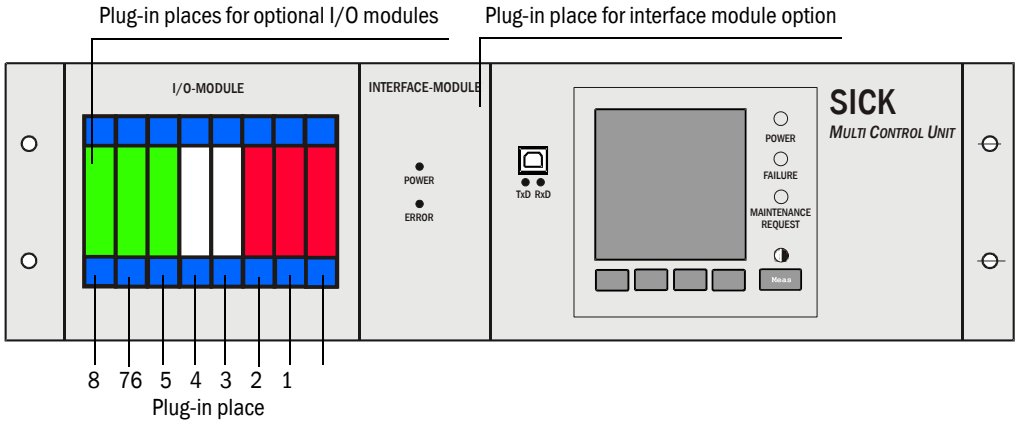
2): open in currentless condition (normal open)

3): Use only after clarifying with manufacturer

Installing and connecting optional I/O modules

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

Fig. 35 Plug-in places for optional modules



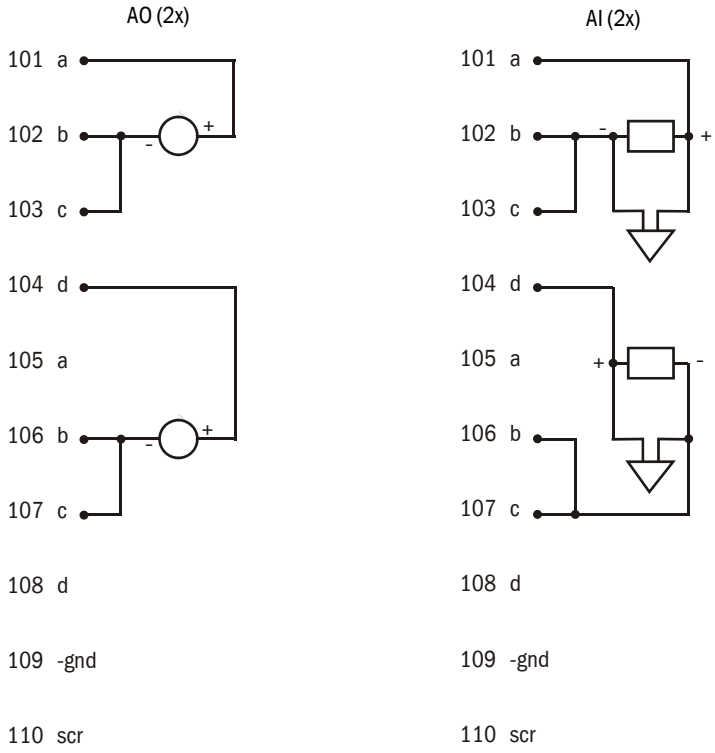
The MCU contains 8 plug-in-places for optional I/O modules. The connection of these modules (analog and digital types) is carried out at the terminals 101-180.

Followingly the connection of the modules is represented exemplarily to plug-in place 1.

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

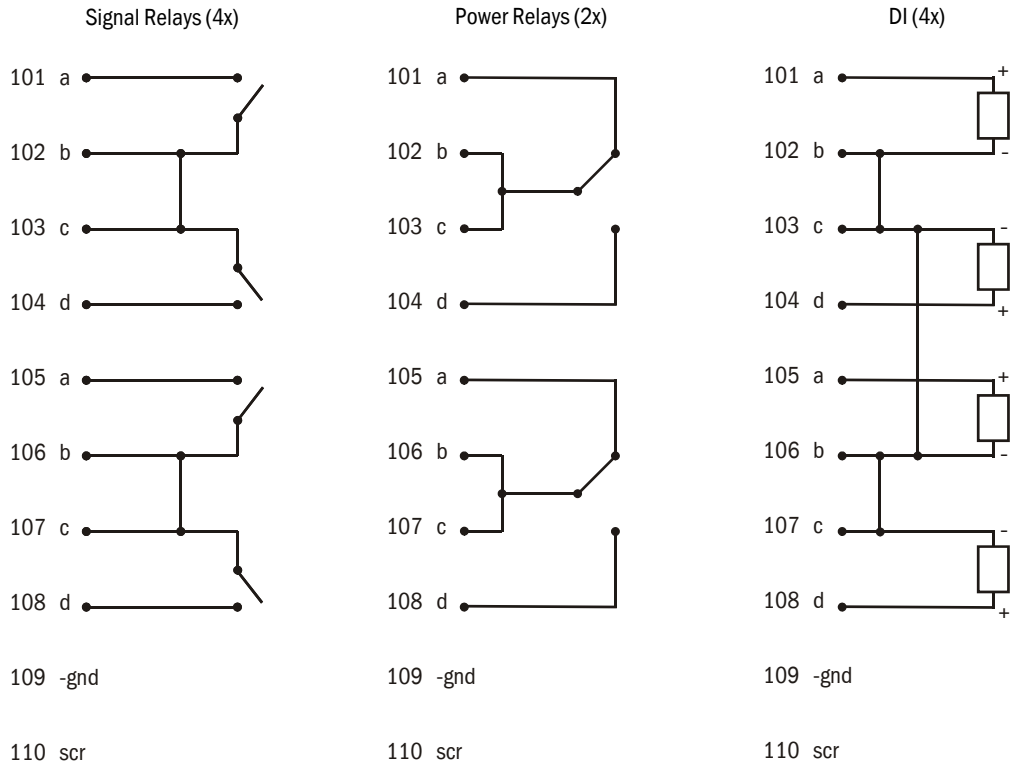
- Connection of analoge module

Fig. 36 Connection of analog module at plug-in place 1 (terminals 101-110)



- Connection of digital module

Fig. 37 Connection of digital module at plug-in place 1 (terminals 101-110)



FLOWSIC200

4 Commissioning and Parameterization

General
Standard commissioning procedure
Extended Commissioning
Operation / Configuration with Option LCD Display

4.1 General

4.1.1 General notes

Commissioning essentially entails entering the plant data (for example, the measuring path, installation angle), configuring the parameters for the output variables and response times, and, if necessary, setting the check cycle (→ p. 70, §4.2.5). A zero-point adjustment is not required.

Additional calibration of the velocity measurement by means of a network point measurement using a reference system (for example, a pitot tube flowmeter) is only necessary if the velocity profile along the measurement axis is not representative for the entire cross-section. The calculated regression coefficients can then be easily entered in the device (→ p. 90, §4.3.3).

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

4.1.2 Installing the SOPAS ET operation and configuration software

For installing, you need administrator rights.

Prerequisites

- Laptop/PC with:
  - Processor: 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 operating and parameter program (SOPAS ET) as well as the USB driver (scope of delivery) must be installed on the Laptop/PC.
- The power supply must be switched on.

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

Install the SOPAS ET program

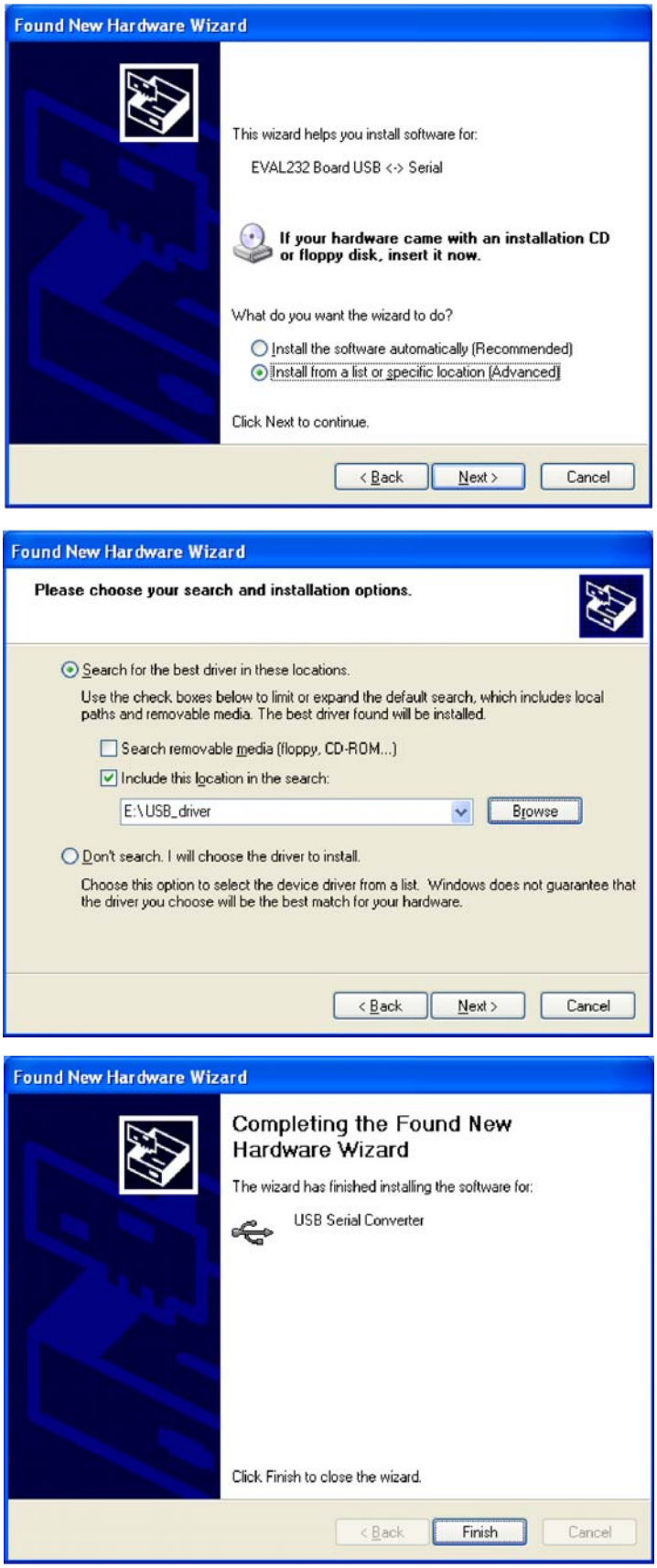
Insert the delivered CD in the PC drive, select the language, select "Software" and follow the instructions.

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

Install the USB driver

A special software driver is required for communication between the operating and parameter program SOPAS ET and the measuring system via the USB interface. Connect the MCU to the supply voltage and to the PC via USB cable to install the driver. A message appears on the display that new hardware has been detected. Then insert the delivered CD in the PC drive and follow the installation instructions (→ p. 55, Fig. 38). The driver can also alternatively be installed by using the hardware installation program of the Windows system control.

Fig. 38 Installing the USB driver



4.1.3 Connecting to the device

► Connect the USB cable to the MCU(P) control unit (→ Fig. 44§4.1.3) and the laptop/PC.

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

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

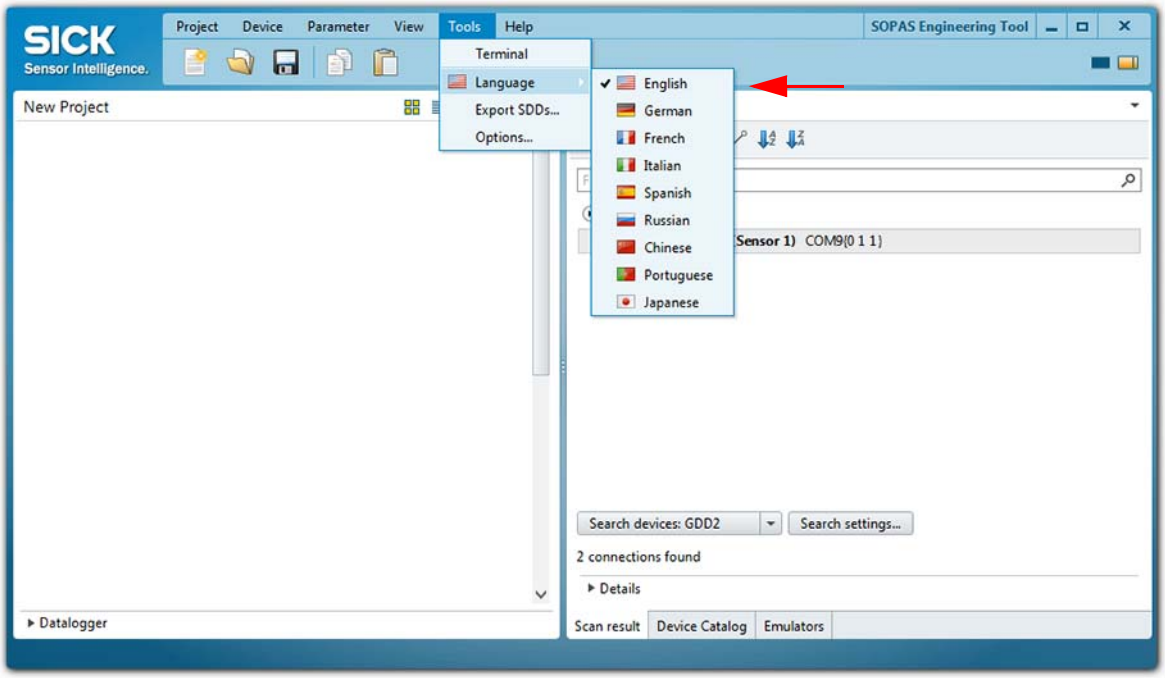
► The start page is displayed.

4.1.3.1 Changing the language

► If required, select the desired language in the “Tools / Language” menu (→ p. 56, Fig. 39).

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

Fig. 39 Changing the language

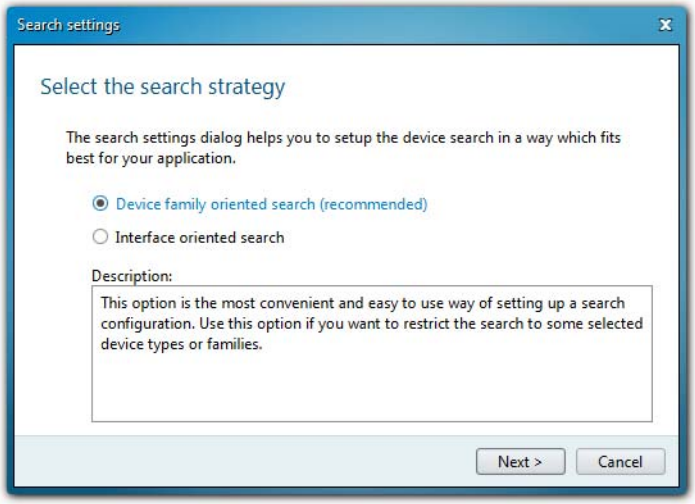


4.1.3.2 **Connecting to the device via the “Device family” mode (recommended search settings)**

1 Click “Search settings”.

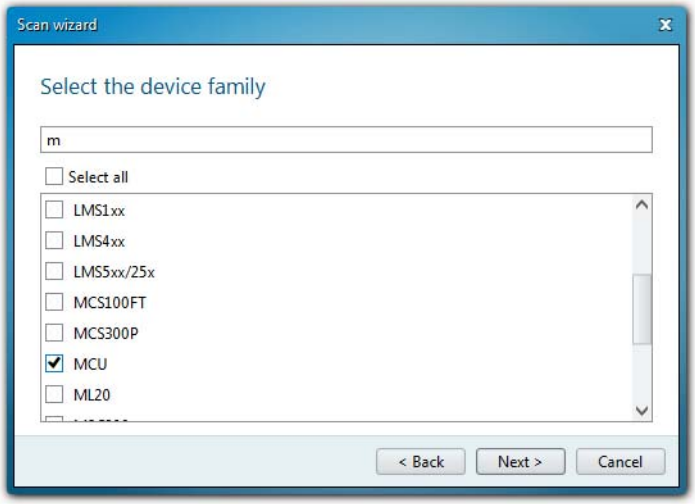
2 Select search mode “Device family oriented search” and click “Next”.

Fig. 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:

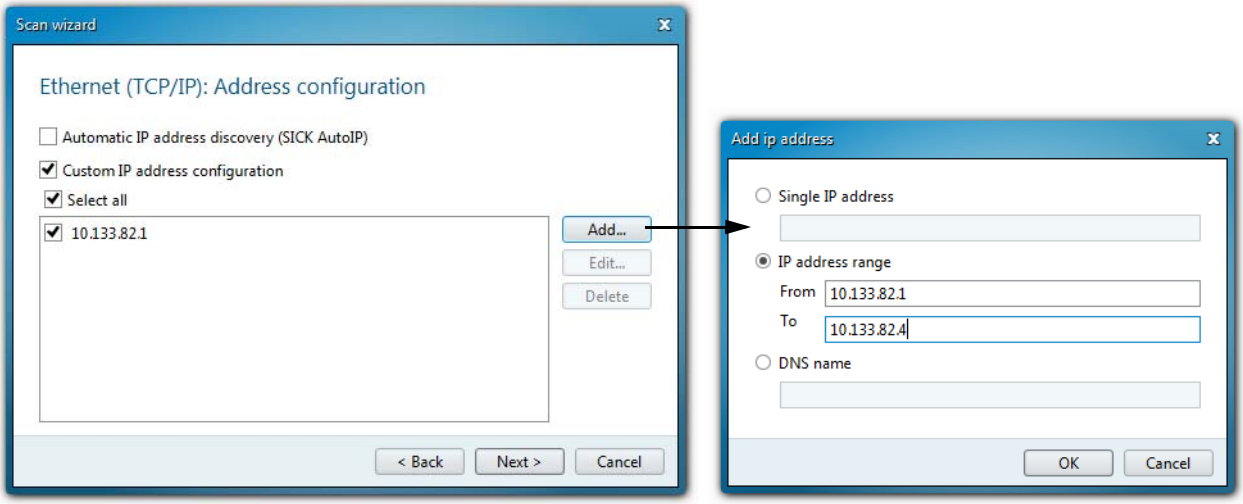
NOTICE:
MCU(P) does not support automatic recognition of IP addresses (SICK AutoIP), the IP addresses therefore have to be configured manually.

► Click “Add”.

An IP address specified by the customer is entered at the factory if the address is available when the device is ordered. If not, standard address 192.168.0.10 is entered.
To change the IP address, see → p. 89, §4.3.2.3.

- ► Enter the IP address of the device or the IP address range when several devices are used and confirm with “OK” (→ p. 58, Fig. 42). The IP addresses shown are exemplary.
- ► Click “OK”.

Fig. 42 Connection settings for connection via Ethernet (example)



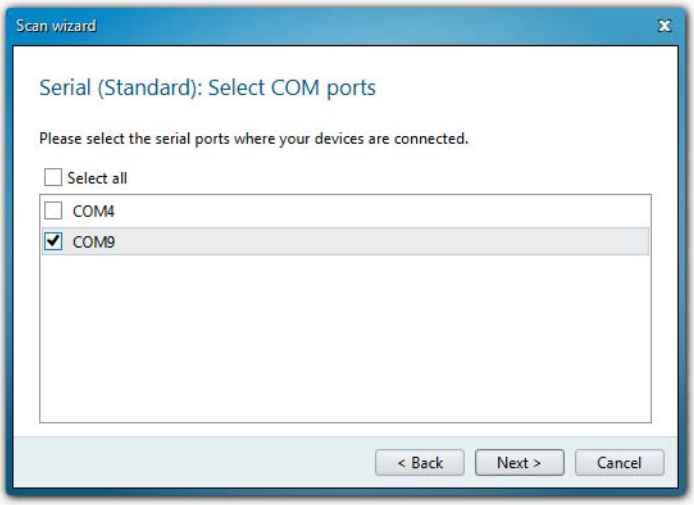
5 Click “Next”.

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

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

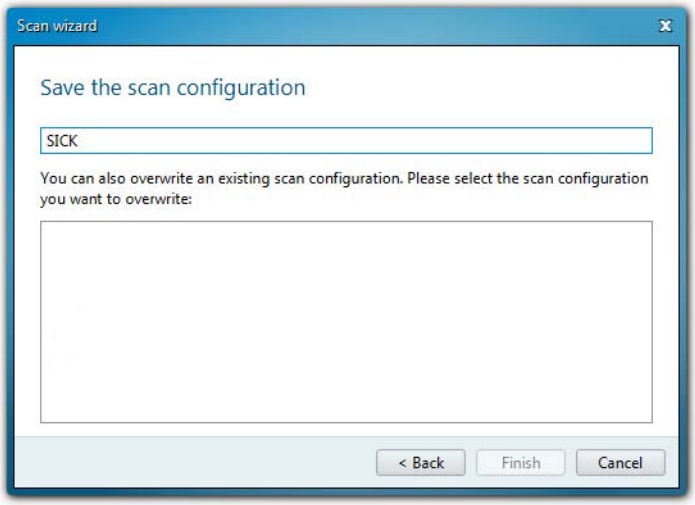
- ► If you are not sure which COM ports are used, select all COM ports.

Fig. 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 device search is finished (→ p. 62, Fig. 50).

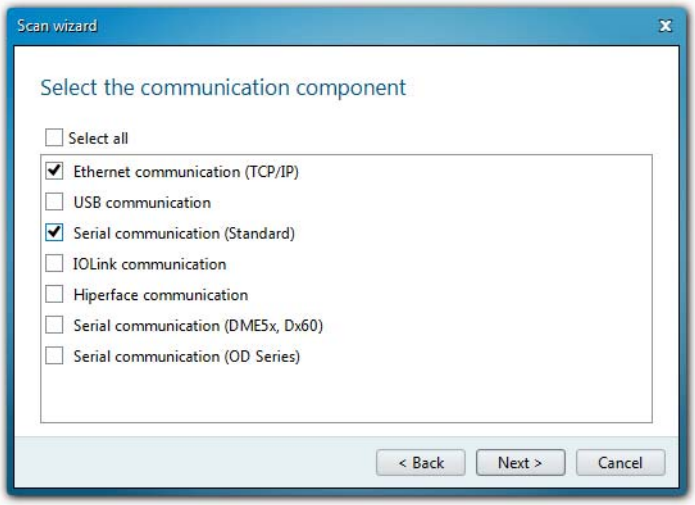
Fig. 44 Saving the scan settings



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

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

Fig. 45 Selecting the communication components

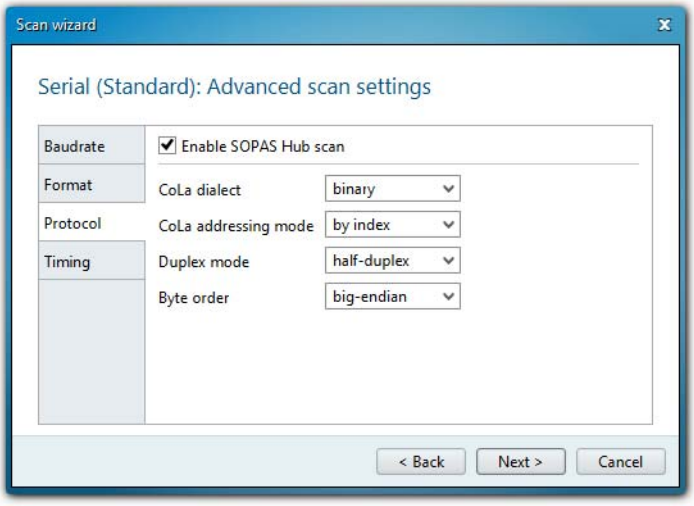


4 Configure the interfaces and click “Next”.

Ethernet communication

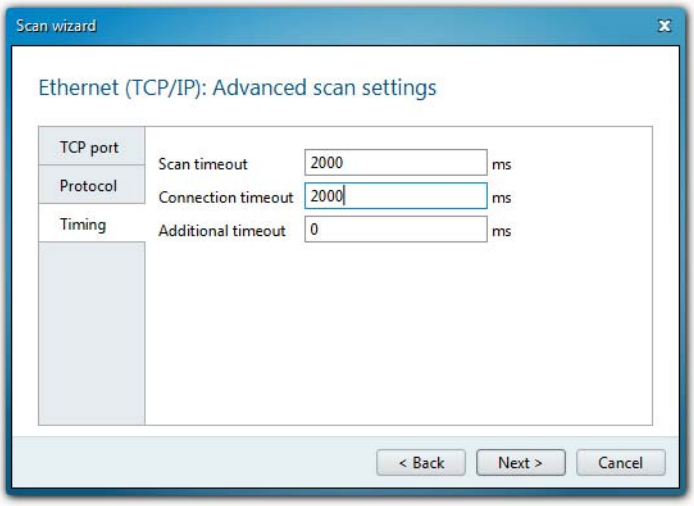
- ► Select “Custom IP address configuration”.
- ► Click “Add”.
- ► Enter the IP address of the device or the IP address range when several devices are used and confirm with “OK”.
- ► Select TCP port 2111 in the “TCP port” directory.
- ► Define the protocol settings in the “Protocol” directory according to → p. 60, 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

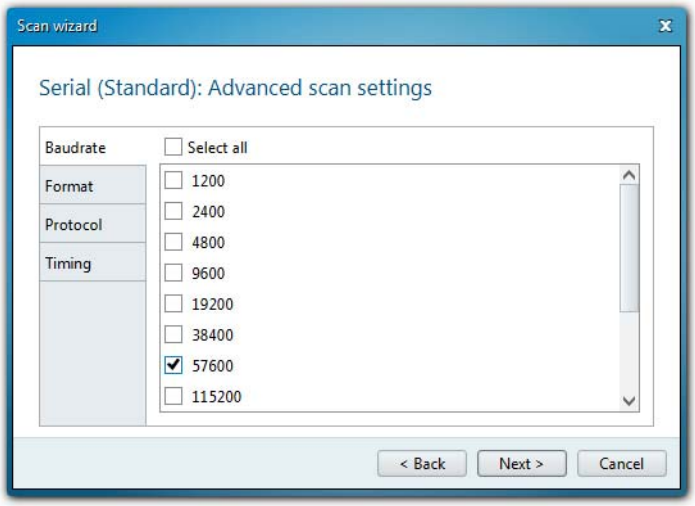


Serial communication (when connected via USB)

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

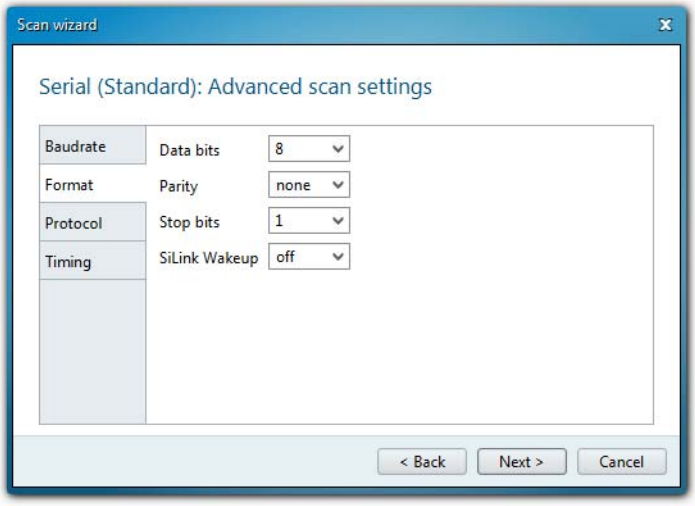
- ► Select the COM ports used.
- ► If you are not sure which COM ports are used, select all COM ports.
- ► Define the baudrate settings in the “Baudrate” directory according to → p. 61, Fig. 48.

Fig. 48 Defining the baudrate



- ► Configure the data format in the “Format” directory according to → p. 61, Fig. 49.

Fig. 49 Configuring the data format

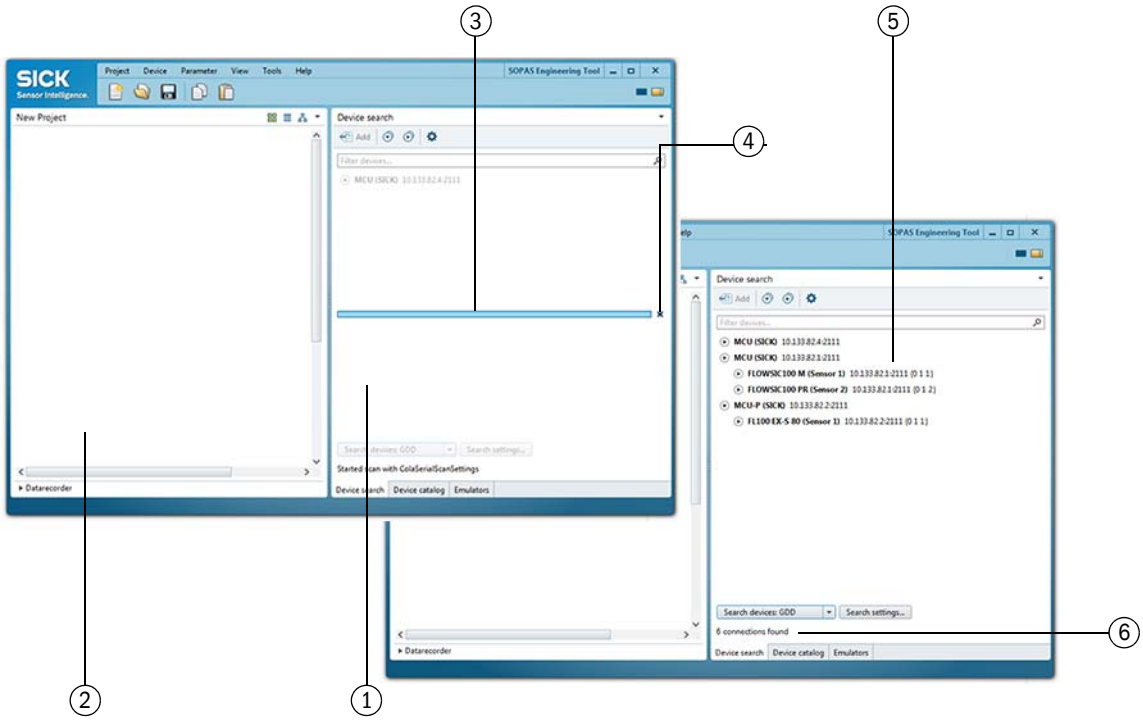


- ► Define the protocol settings in the “Protocol” directory according to → p. 59, Fig. 45.
- ► Define the timeout settings in the “Timing” directory according to → p. 60, Fig. 46.

5 To save the scan settings, enter a name and click “Finish” (→ p. 59, Fig. 44).
SOPAS ET starts the device search. The devices found are displayed in the “Device search” area when device search is finished (→ p. 62, 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. 64, Fig. 52).

Fig. 51 Device selection

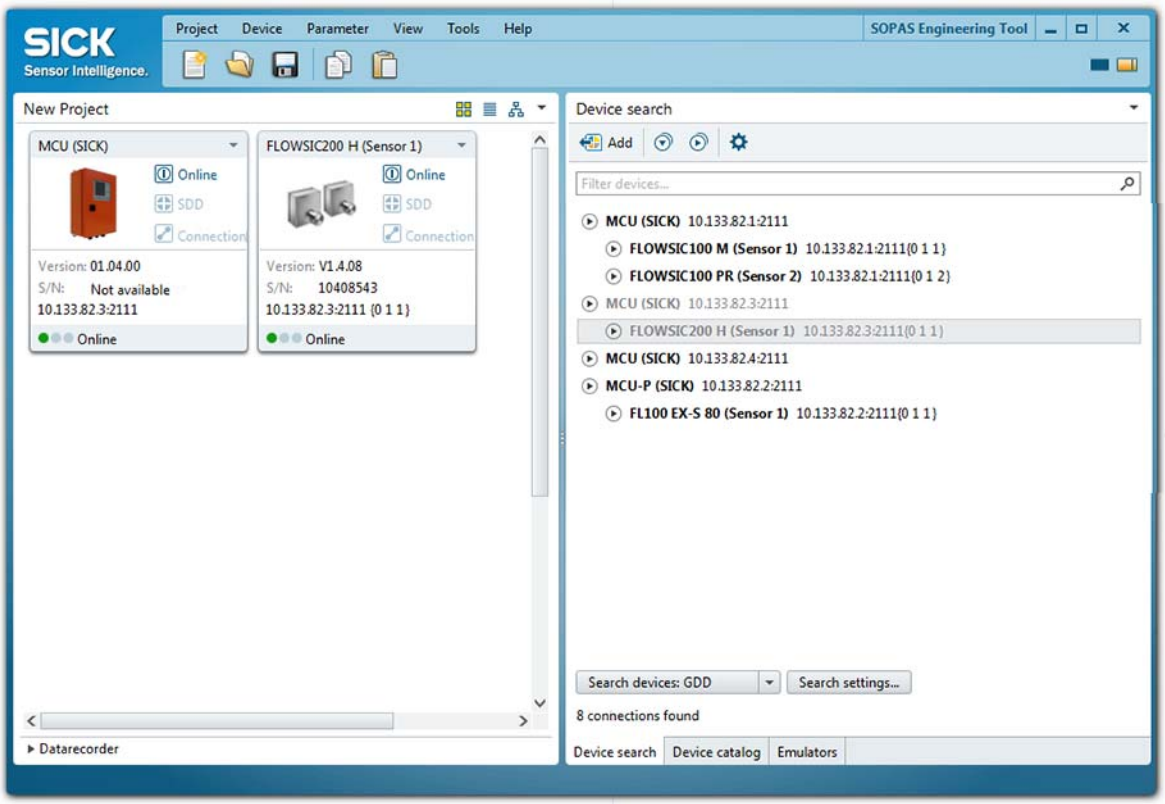


Fig. 52 Device context menu

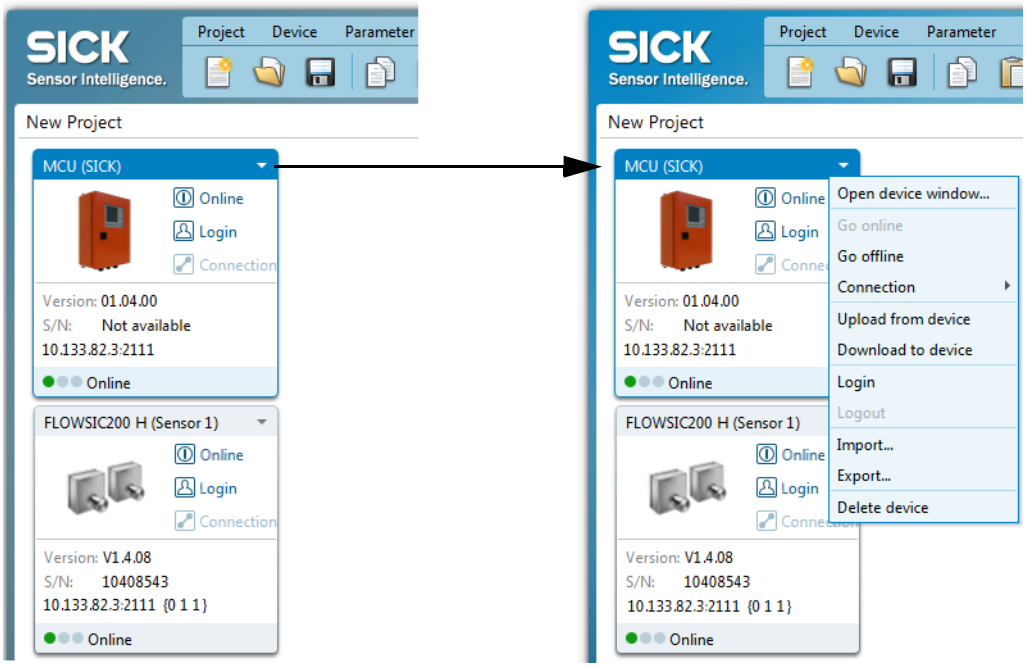


Table 1 Contents of device context menu

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 down-loaded 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.

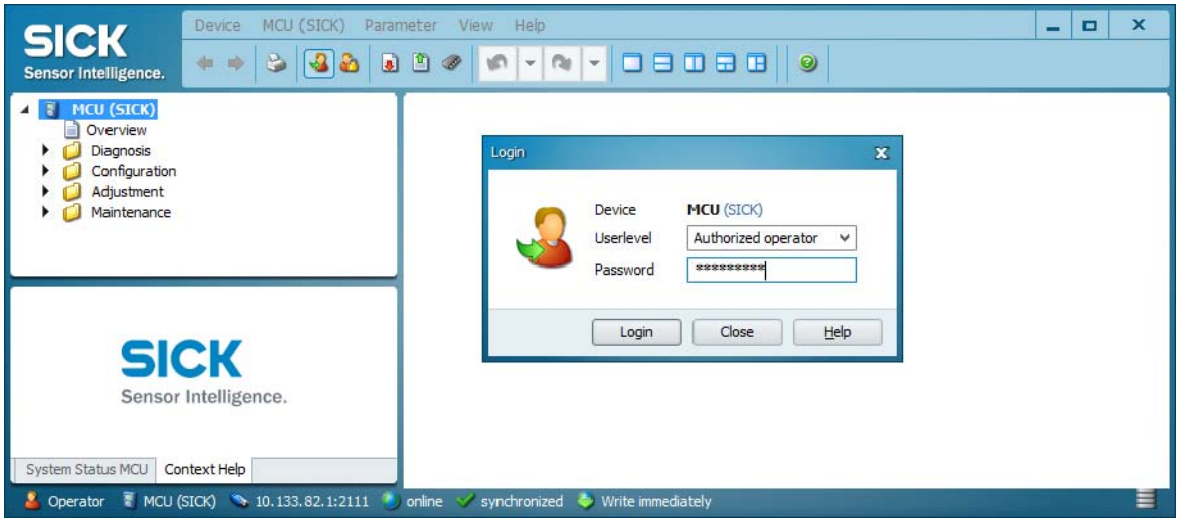
Password

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	Operator	Displays measured values and system states
1	Authorized Client	Displays, inquiries as well as start-up resp. adjustment to customer-specific demands and diagnosis of necessary parameters
2	Service	Displays, inquiries as well as all parameters required for service tasks (e.g. diagnosis and clearance of possible malfunctions)

The Level 1 password is contained in the Annex.

Fig. 53 Entering the password



4.2 Standard commissioning procedure

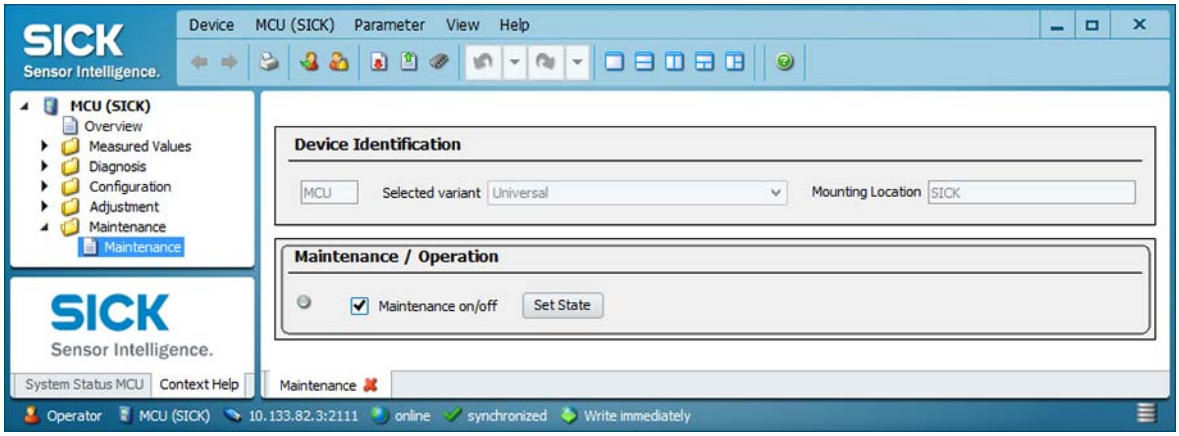
This Section describes all the settings that are essential to ensure that the device functions correctly.

Until the installation data (→ p. 66, §4.2.1) has been fully entered, the error message "Error Parameter" is output.

The following steps are required to enter/change parameters:

- Connect the measuring system to the SOPAS ET program, scan the network and move the required device file ("MCU", "FLOWSIC200 M/FLOWSIC200 H/FLOWSIC200 H-M") to the project(→ p. 62, §4.1.4).
- Enter the password level 1 (→ p. 62, §4.1.4), and open the "Maintenance/Maintenance" directory (MCU) or "Maintenance/Maintenance Status" directory (sender/receiver unit).
- Activate the "Maintenance on/off" check box (MCU) or "Sensor Maintenance" (sender/receiver unit), and click on "Set State".

Fig. 54 Switching to Maintenance Mode



4.2.1 Assigning the sensor

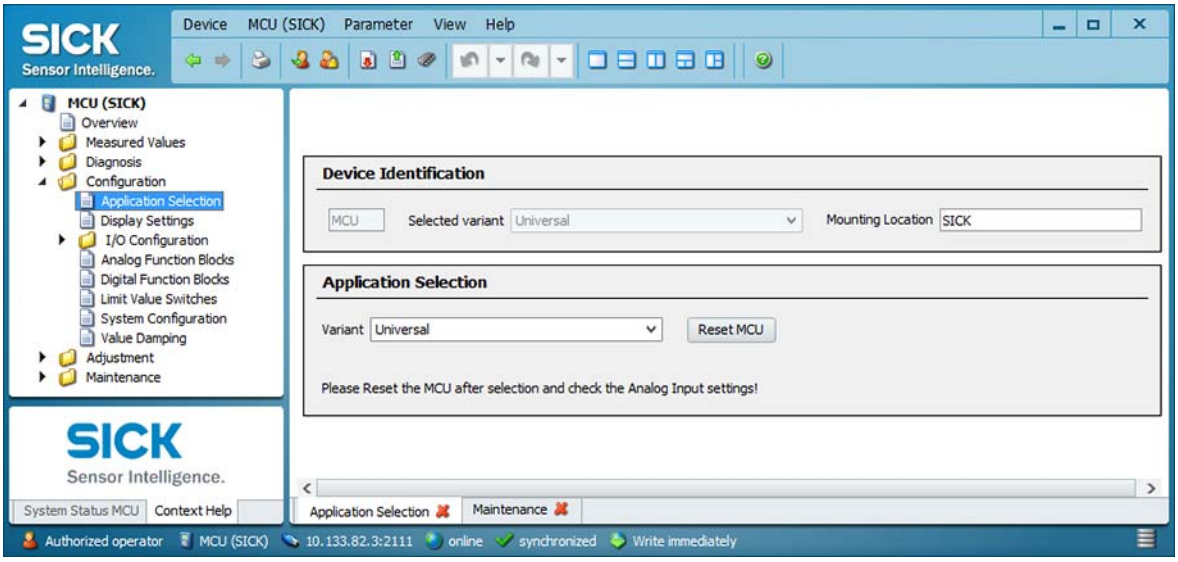
The MCU must be assigned to the connected sender unit. A malfunctions is signalised in case of unconformity. If the setting is not possible at the factory (e.g. when several devices are delivered at the same time or the MCU is swapped later), the assignment must be made after installation. The following steps are then necessary:

- ► Select "MCU" device file and open to the "Configuration / Application selection“ directory (→ p. 66, Fig. 55) and check whether the type shown in the "Variant" window is the right one ("Universal (Bus)" for FLOWSIC200).

> ***NOTICE:***
> The MCU must be connected to the sender/receiver units.

- ► If this is not so, set the measuring system to "Maintenance" mode, select "Service" password level and enter "service".
- ► Select "Universal (Bus)" in the "Variant" drop-down list ("Application selection" group), click on "Reset MCU" and restart the measuring system.

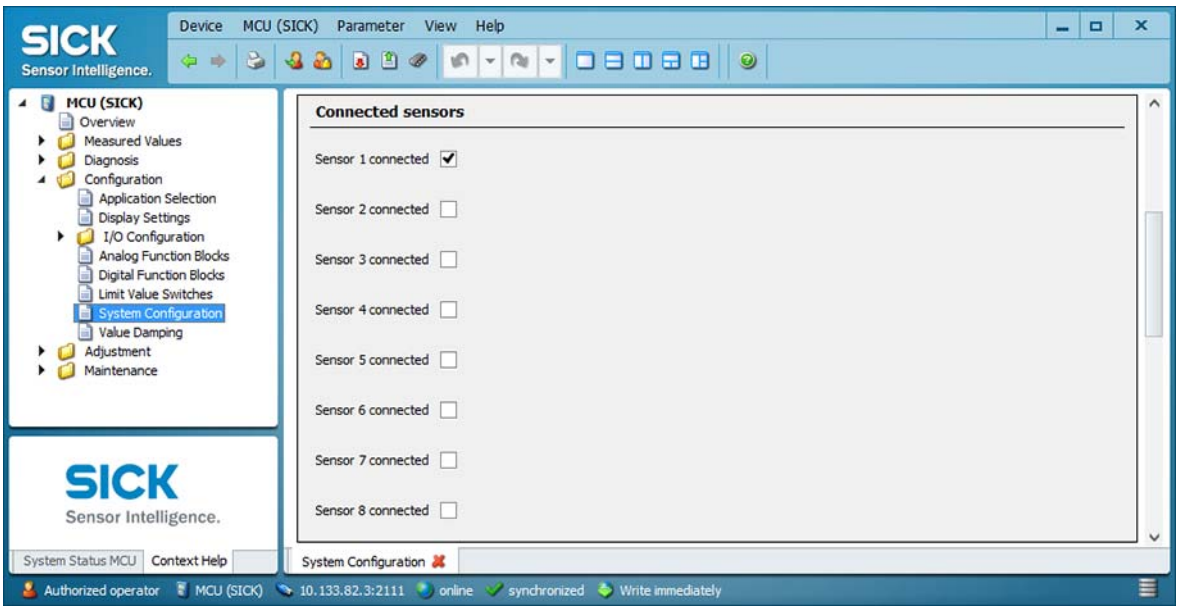
Fig. 55 Assigning the sensor



4.2.2 Activating connected sender/receiver units

All sender/receiver units units connected to the MCU must be activated in the "Connected sensors" group in the "Configuration /System Configuration" directory (correct if necessary).

Fig. 56 "Configuration / System Configuration" directory (example for settings)



4.2.3 Assigning the measuring system to the installation location

Sender/receiver unit and MCU can be assigned to the respective measuring place obviously.

- For MCU:

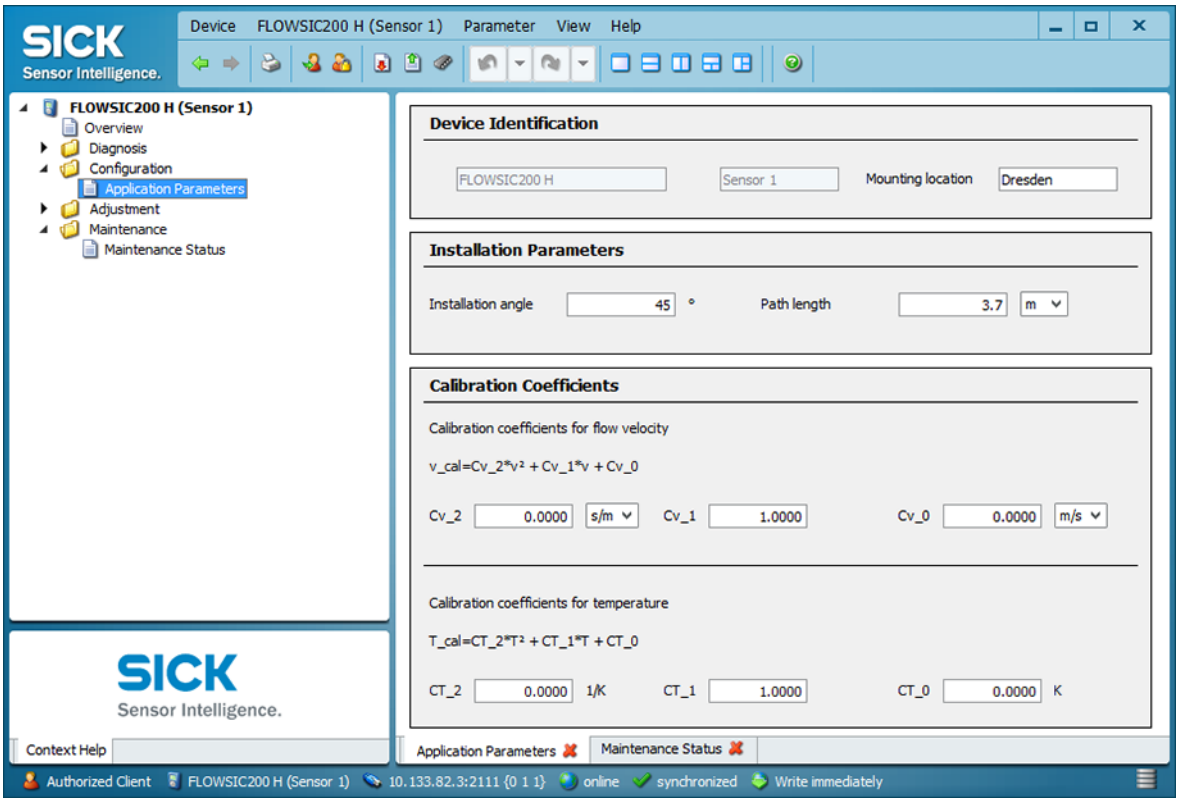
  Select "Configuration / Application selection“ directory (→ p. 66, Fig. 55), set the measuring system to "Maintenance" mode (→ p. 65, §4.2) and select "the password level 1 (→ p. 62, §4.1.4).

- For sender/receiver units:

  Open the device file "FLOWSIC200 M", "FLOWSIC200 H" or "FLOWSIC200 H-M" , open the "Configuration / Application Parameters" directory, set the sender/receiver units to "Maintenance" mode and enter the password level 1.

- Enter the desired name in the "Mounting location" text field.

Fig. 57 "Configuration / Application Parameters" directory



4.2.4 Entering application data

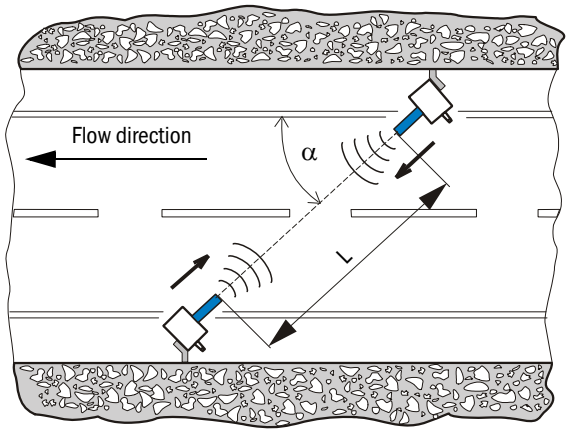
Before a measurement can be started, you have to select the system of units (metric or imperial units) and enter the application parameters (measuring distance, installation angle). The following steps have to be carried out:

- Open the the "FLOWSIC200 M", "FLOWSIC200 H" or "FLOWSIC200 H-M" device file.
- Set the sender/receiver units to "Maintenance" mode and enter the password level 1 (→ p. 62, §4.1.4).
- Select the "Configuration / Application Parameters" directory (→ p. 68, Fig. 57).
- Enter path length and installation angle in the "Installation parameter" group (→ p. 68, Fig. 57). The settings are uploaded to the FLOWSIC200 after switching from "Maintenance" to "Measurement".

The application parameter settings are converted automatically if you change the system of units.

For setting application parameters the following is valid:

Fig. 58 Basic parameters

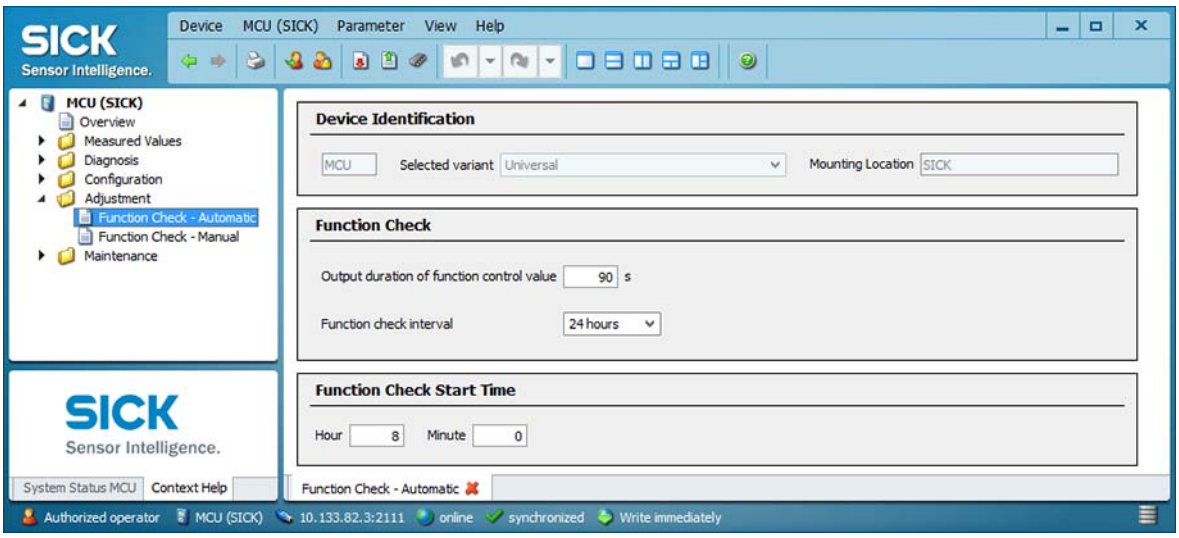


Windows	Parameter
Installation angle	α Angle between the measurement axis and flow direction
Path length	L Distance between the transducers

4.2.5 Determining the check cycle

Open the "MCU" device file and select the "Adjustment / Function Check - Automatic" directory for modifying interval time, control value output on the analog output and the starting timepoint for automatic check cycle.

Fig. 59 "Adjustment / Function Check - Automatic" directory (example for settings)



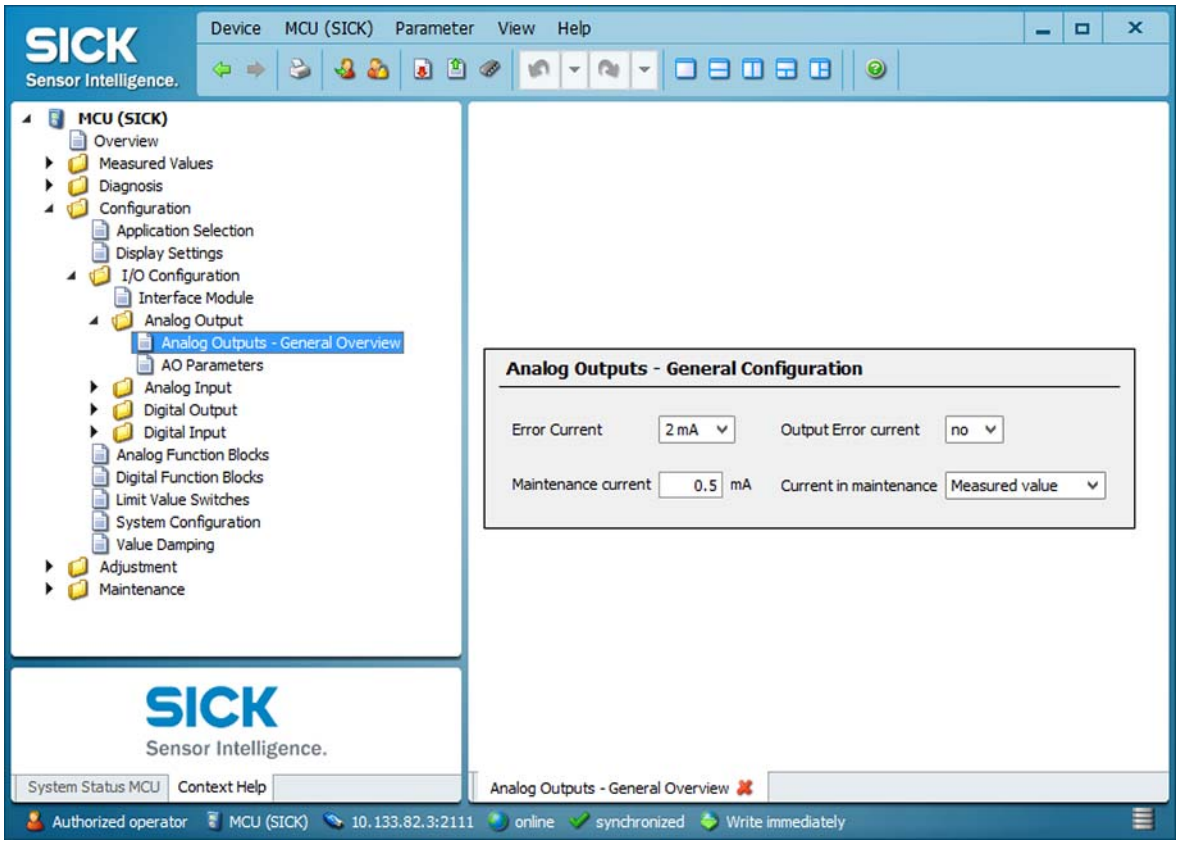
Entry field	Parameter	Remark
Output duration of function control value	Value in seconds	Output duration of control values
Function check interval	Time between two check cycles	→ p. 26, §2.4
Function check start time	Hours	Defining a start timepoint in hours and minutes
	Minutes	

4.2.6 Configuring the analog output

Basic settings

The current to be output at the analog output in status "Maintenance" or "Malfunction" can be set in the "Configuration / I/O-Configuration / Analog Output / Analog Outputs - General Overview" directory.

Fig. 60 "Overview" submenu (example for settings)

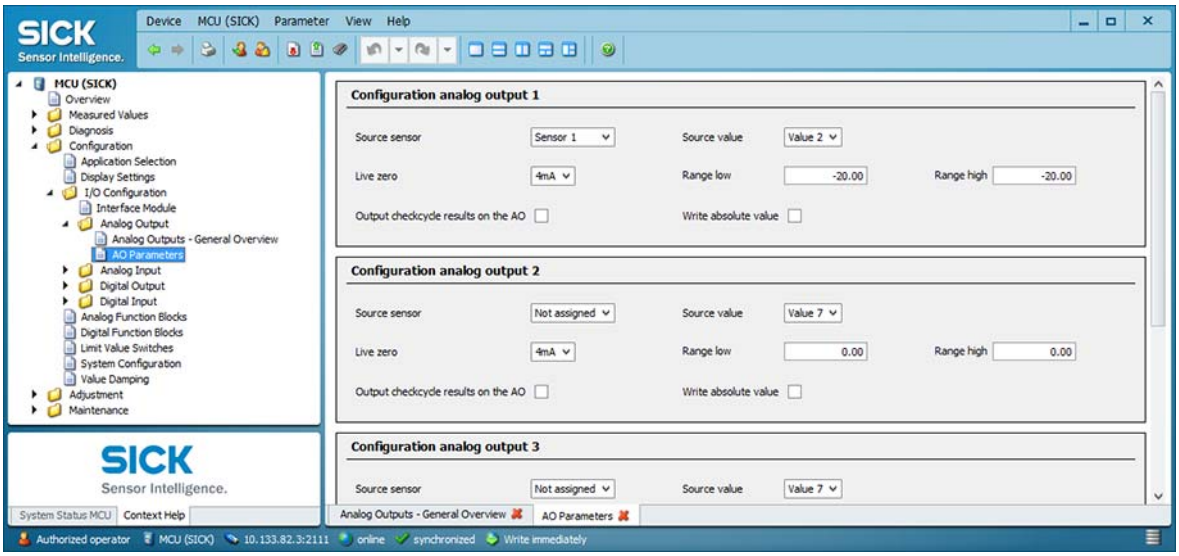


Entry field	Parameter	Remark
Error Current	Value < Live Zero (LZ) or > 20 mA	mA value to be output in "Malfunction" state (error case) (size depends on connected evaluation system).
Output Error current	yes	The error current is output.
	no	The error current is not output.
Maintenance current	Value if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

Parameterization

The "Configuration / I/O Configuration / Analog Output / AO Parameters" directory allows to assign the signal source (measuring signal of a sender/receiver unit) to the standard analog output (AO) as well as to define the values for Live Zero and measuring range.

Fig. 61 "AO Parameters" submenu



Entry field	Parameter	Remark
Source sensor	Sensor 1 to 8	Sender/receiver unit whose output signal has to be assigned to the analog output.
Source value	Measured value 1	Volume flow in operating conditions*
	Measured value 2	Gas 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 noise ratio A
	Measured value 8	Signal noise ratio B
Live Zero	Zero point (0, 2 or 4 mA)	Select 2 or 4 mA to ensure being able to differentiate between measured value and switched off device or interrupted current loop.
Range low	Lower measuring range limit	Physical value at live zero
Range high	Upper measuring range limit	Physical value at 20 mA
Output check cycle results on the AO	Inactive	Control values (→ p. 26, §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	It's distinguished between positive and negative measured values.
	Active	The amount of the measured value is output.

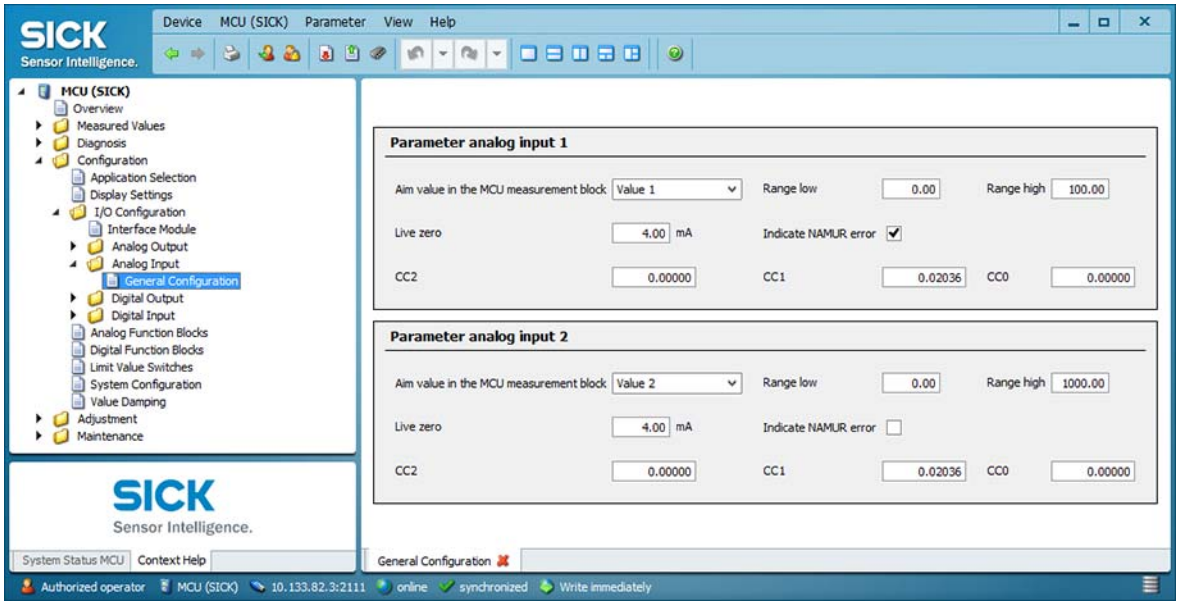
*not relevant for FLOWSIC200

4.2.7 Configuring the analog inputs

The "Configuration / I/O-Configuration / Analog input / General Configuration" directory allows the assignment of the standard analog inputs (groups "Parameter analog input 1" and "Parameter analog input 2") to measured values for possible scaling, and to define the respective measurement range.

> ***NOTICE:***
> The correction factors CC2, CC1 and CC0 are predefined by the manufacturer and only may be changed by the SICK service.

Fig. 62 "Configuration / I/O Configuration / Analog input / General Configuration" directory (example for settings)

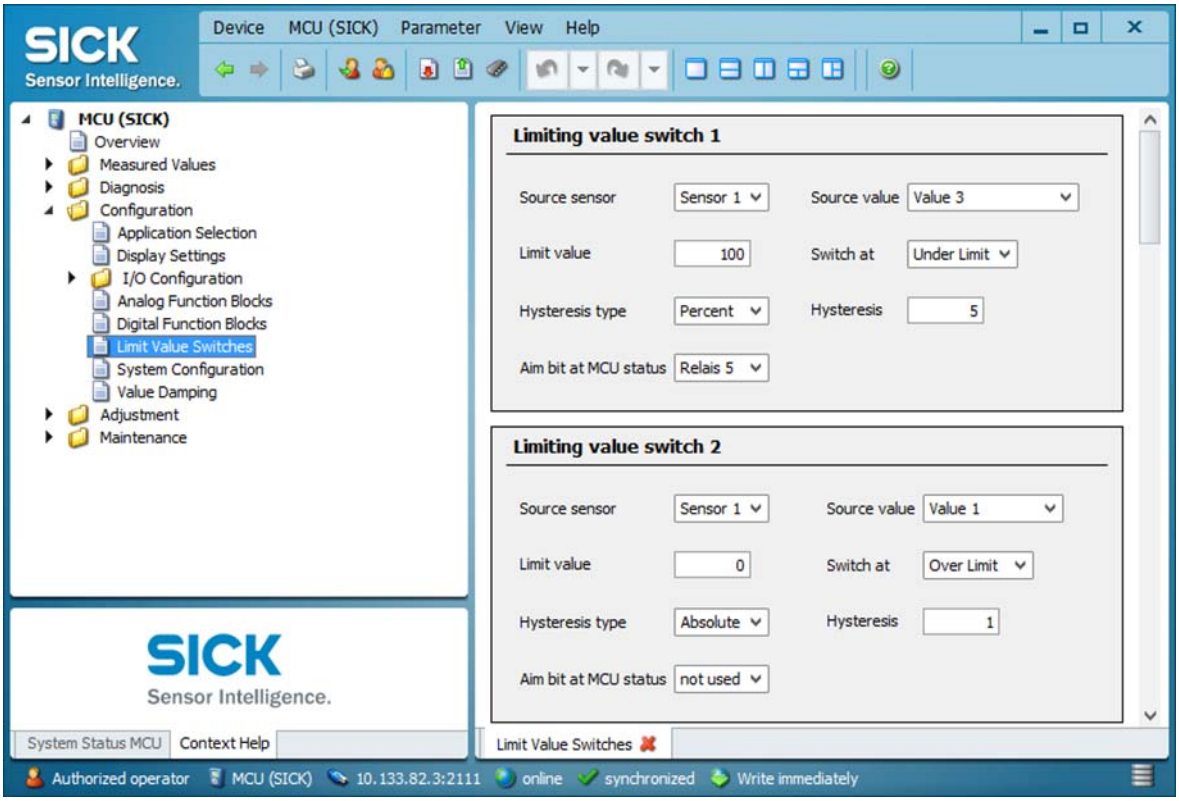


Entry field	Parameter	Remark
Aim value in the MCU measurement block	Value1 to 8	Variable to be assigned to the selected analog input
Range low	Lower measuring range limit	Physical value at live zero
Range high	Upper measuring range limit	Physical value at 20 mA
Live zero	Zero point value > 0 mA)	Specification of the mA value for measurement range beginning
Indicate NAMUR error	inactiv	No error is signalized for underflow or exceeding of the set current range (LZ to 20 mA).
	activ	An error is signalized for underflow or exceeding of the set current range (LZ to 20 mA).
CC2	square correction factor	Correction factors (predefined by the manufacturer) for calibrating the input variable Change only by SICK service!
CC1	linear correction factor	
CC0	absolute correction factor	

4.2.8 Configuring the limit value relay

Select the "Configuration / Limit Value Switches" directory for parameterization.

Fig. 63 ”Configuration / Limit Values Switches” directory



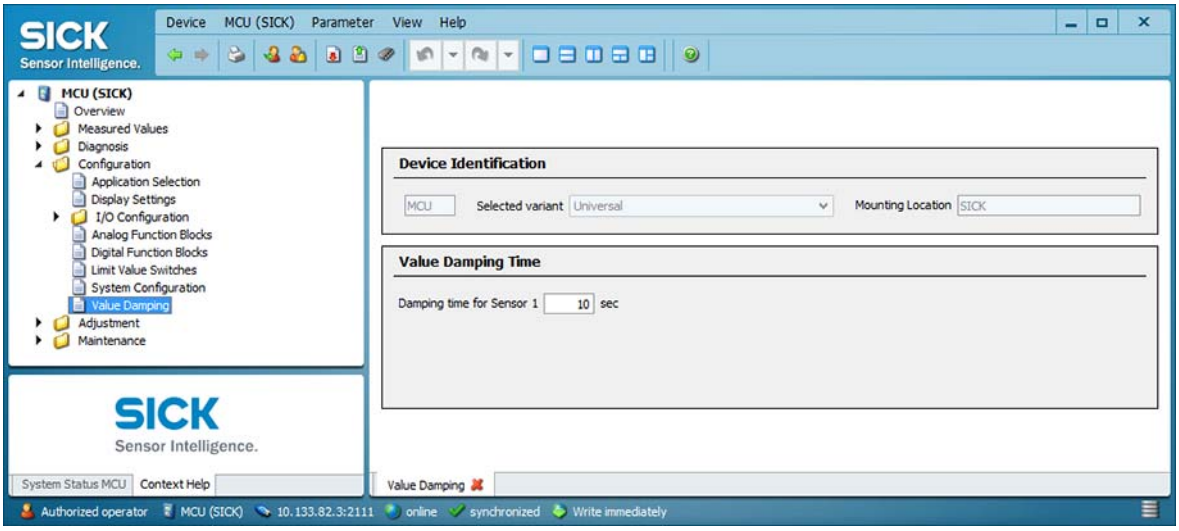
Entry field	Parameter	Remark
Source sensor	Sensor 1 to 8 MCU	Sensor to whose output signal a limit value shall be assigned
Source value	Measured value 1	Volume flow in operating conditions*
	Measured value 2	Gas velocity
	Measured value 3	Sound velocity
	Measured value 4	Acoustic temperature
	Measured value 5	Temperature A*
	Measured value 6	Temperature B*
	Measured value 7	Signal noise ratio A
	Measured value 8	Signal noise ratio B
Limit value	Value	The limit value relay switches when the entered value is exceeded or fallen below.
Switch at	Over Limit	Specification of the switching direction
	Under Limit	
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	Defines a tolerance for resetting the limit value relay
Zielbit	Relais 5	Aim bit = special memory in the MCU for monitoring limit values

*not relevant for FLOWSIC200

4.2.9 Setting the response time

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

Fig. 64 "Configuration / Value Damping" directory (display for one connected measurement system)



Field	Parameter	Remark
Response time Sensor 1	Value in s	Response time for the selected measured variable (→ p. 18, §2.2.3)

If more sender/receiver units are connected, a separate window exists for every measurement system for the individual setting of the response time.

4.2.10 Output of flow direction

To output the flow direction the measuring range must be set in the ”Configuration / I/O Configuration / Analog Output / AO Parameters” directory to a negative and a positive range. The zero point is then between the two end values. Underrun or exceeding of the zero point can than signalised additionally with the limit value (→ p. 74, §4.2.8).

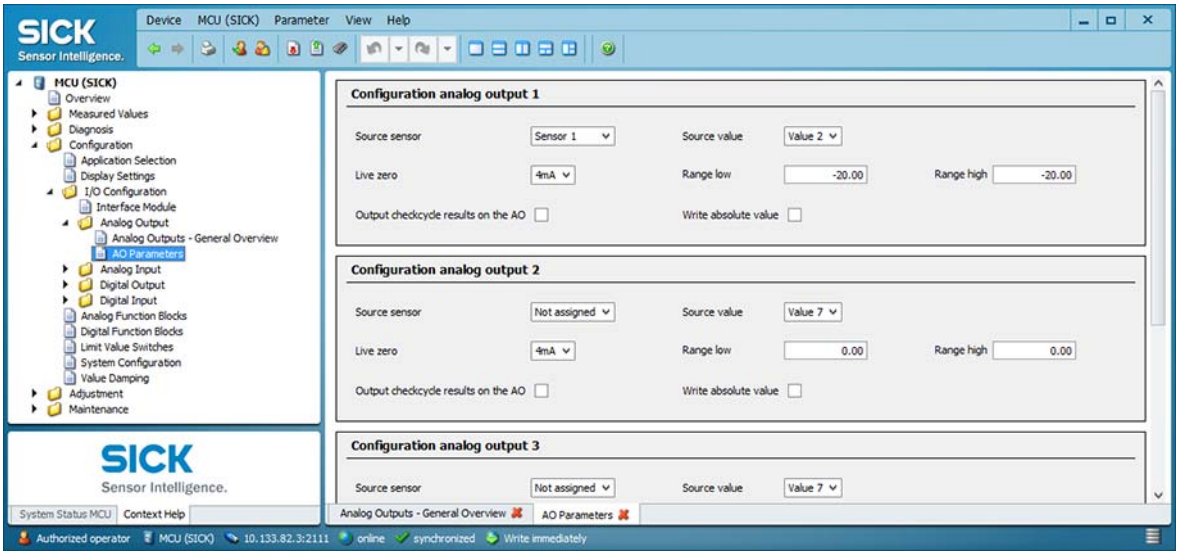
Example:

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

The live zero value (= Range low) corresponds to a physical value of -20 m/s, the 20 mA value (= Range high) to a physical value of +20 m/s.

For LZ = 4 mA the zero point is 12 mA.

Fig. 65 ”Configuration / I/O Configuration / Analog Output / AO Parameters” directory



It‘s also possible to output only the sum of the measured value. To do so, activate the "Write absolute value” checkbox.

> ***NOTICE:***
> The limit relay must be parameterised absolutely to output the sum, otherwise it‘s not possible to signalize underrun or exceeding of the zero point.

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 trouble shooting)
  This allows saving not only device parameters but also data logs.
- Saving as a device file
- Stored parameters can be processed without attached device and transferred into the device to a later time again.

See the Service Manual for a description.

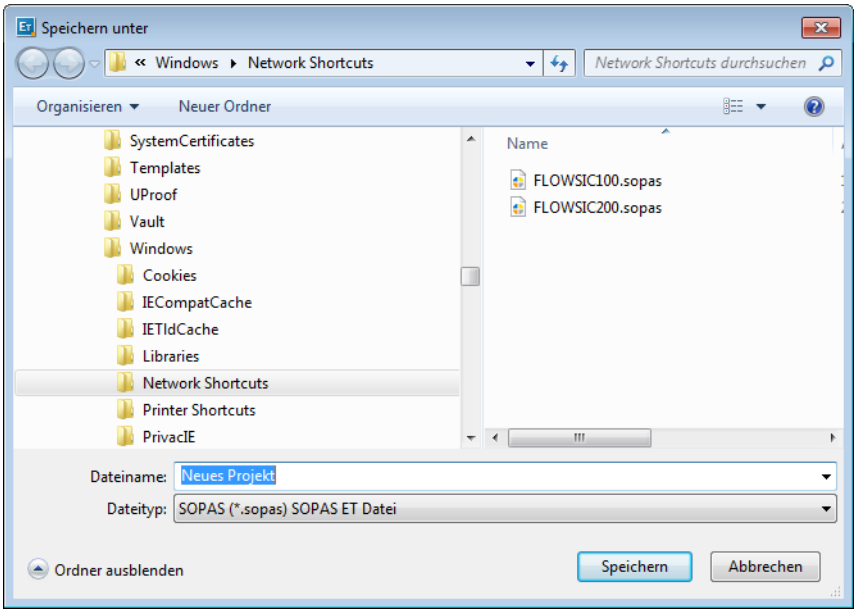
- Saving as a protocol
  Device data and parameters are recorded in the Parameter protocol.
  A Diagnosis protocol can be created for analysis of the device function and recognition of possible malfunctions.

Saving as a project

At frequent connections to the device we recommend to store a "project". For a renewed connection it is then only necessary to open this "project". All before stored data are transmitted automatically into the SOPAS ET.

For saving select the "Project / Export Device" menu and define 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 sampling point involved (name of the company, equipment name).

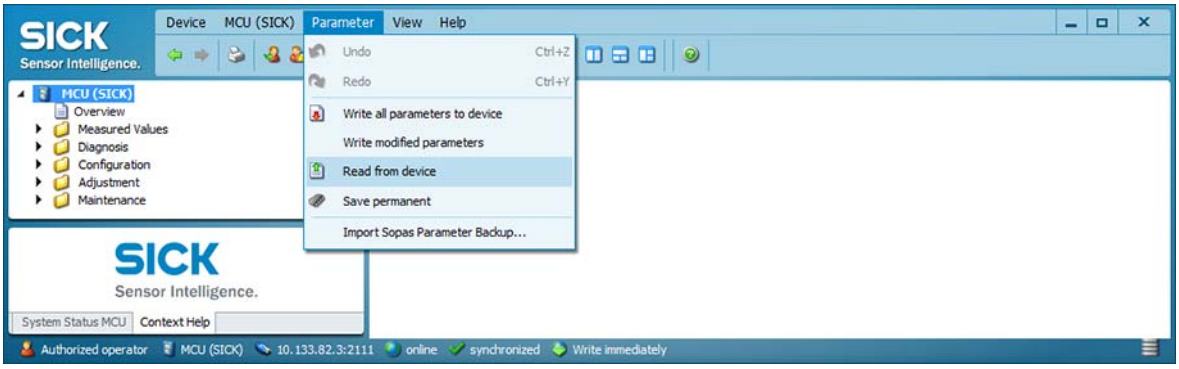
Fig. 66 "Project / Save Project" menu



Saving as a protocol

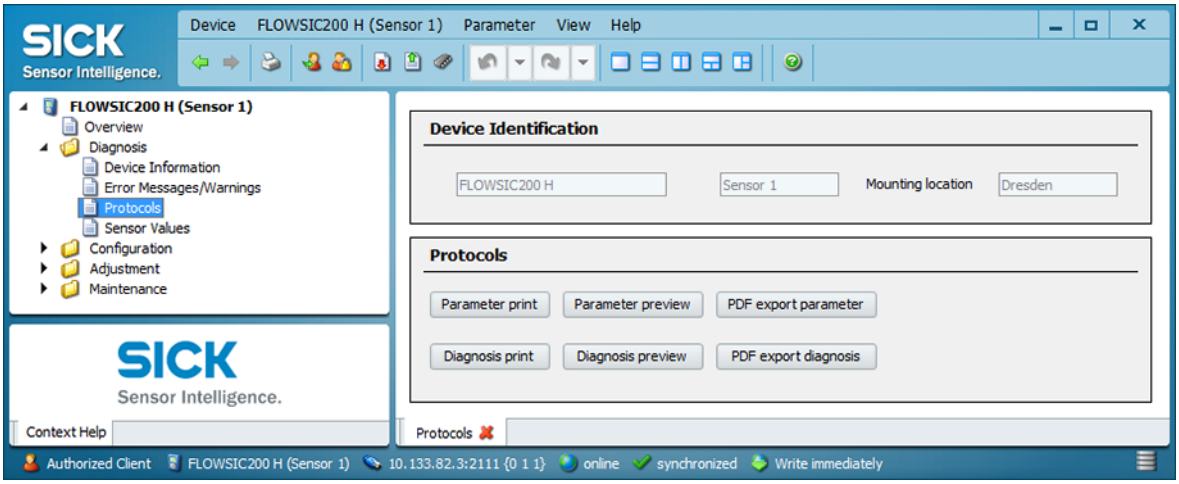
► Select device and actualize the device parameters using the "Upload all Parameters from Device" menu.

Figure 67 Actualising the device parameters



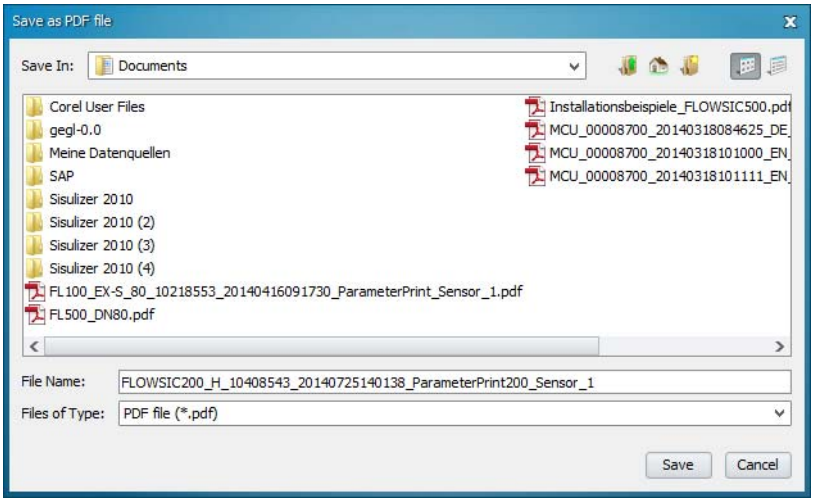
► Select the "Diagnosis / Protocols" directory and click the button for the desired type of registration.

Figure 68 "Diagnosis / Protocols" directory



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

Figure 69 Specifying file name and storage location



Parameter protocol example

Fig. 70 FLOWSIC200 H Parameter protocol (example)

FLOWSIC200 - Parameter Protocol

Device type: FLOWSIC200 H
Mounting location: Dresden
Sensor 1

Device Information

Device type	FLOWSIC200 H
Firmware version	01.4.08
Parameter CRC (HEX)	0CD4
SN S/R-Unit Master	10408543
SN S/R-Unit Slave	10408544

Application Parameters

Path length	3.7000m
Installation angle	45.00°
Velocity Cv_0	0.0000m/s
Velocity Cv_1	1.0000
Velocity Cv_2	0.0000s/m
Temperature CT_0	0.0000
Temperature CT_1	1.0000
Temperature CT_2	0.0000
Fix temperature	5.00°C
Norm. speed of sound	331.500m/s

Device Parameters

Transmit Parameters	
Transmit frequency A (Master)	17.5kHz
Transmit frequency B (Slave)	17.5kHz
Total periods A (Master)	8.0
Total periods B (Slave)	8.0
Activation periods A (Master)	8.0
Activation periods B (Slave)	8.0
Retarding attenuation A (Master)	10.0
Retarding attenuation B (Slave)	10.0
Amplitude A (Master)	0.8
Amplitude B (Slave)	0.8
Sensortype	18kHz
System runtime A (Master)	280.0µs
System runtime B (Slave)	280.0µs
Signal Processing	
Lower fraction	35%
Upper fraction	50%
Number of averaged signals	10
Median buffer size	15
Average median	70%
Multiburst	1
Measuring cycle	500ms
Transmit delay B (Slave)	200ms
Gain	
Gain level A (Master)	30dB
Gain level B (Slave)	30dB
Target amplitude	60%
Damping	10
Gain control deactivated	no
Receiving Window	
Window size	2000
Precounter	0.00ms
Control deactivated	no
Limits	
Limit warning	80%
Limit malfunction	97%
Limit SNR	15dB
Plausib. threshold	20%
Limit range	60.00m/s
Limit. max. transd. temp.	250.0°C
Low flow cut off	1.0m/s
Serial Interface	
Baud rate	57600baud
Bus address	1
Response delay	10ms

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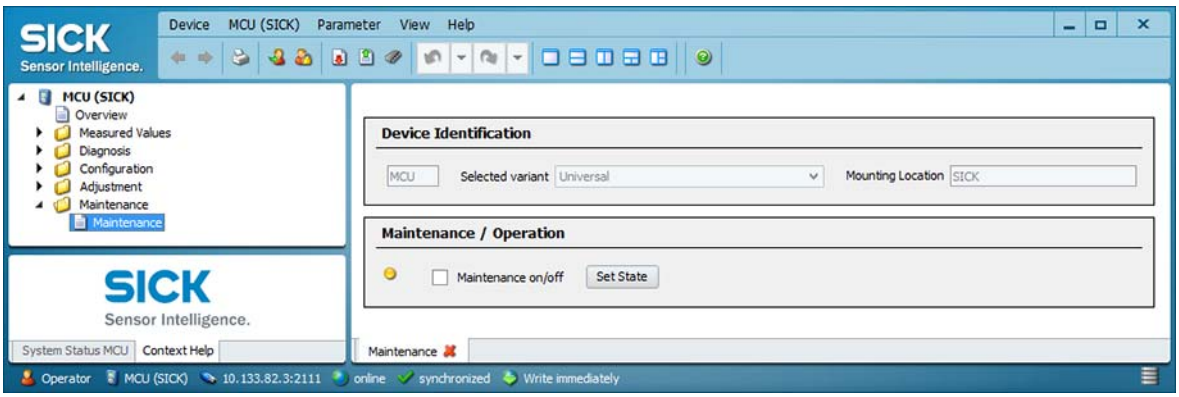
4.2.12 Starting normal measuring operation

Set the measuring system to "Measurement" mode after entering/modifying parameters. To do this, switch to the "Maintenance / Maintenance" directory, deactivate the "Maintenance on/off" checkbox and click "Set State" Standard start-up is now completed.

Fig. 71 Setting the operational state



Signal Form

Checking the signal form makes it possible to ascertain the quality of the received ultrasonic signals. To view the signal form on the screen, open the "FLOWSIC200 M" , "FLOWSIC200 H" or "FLOWSIC200 H-M" device file and select the "Diagnosis/Sensor Values" directory ("Measurement" Mode).

The "Signal Display" screen displays alternating the ultrasonic signals of both transducers as unconditioned signal and as envelope.

If the option "View Envelope" is checked, the envelopes of both transducers are displayed. The signal shape should match the shapes in the → p. 81, Fig. 72 to → p. 82, Fig. 75, depending on the device type.

Types FLSE200-M

Fig. 72 Burst form HF-signal (unconditioned signal)

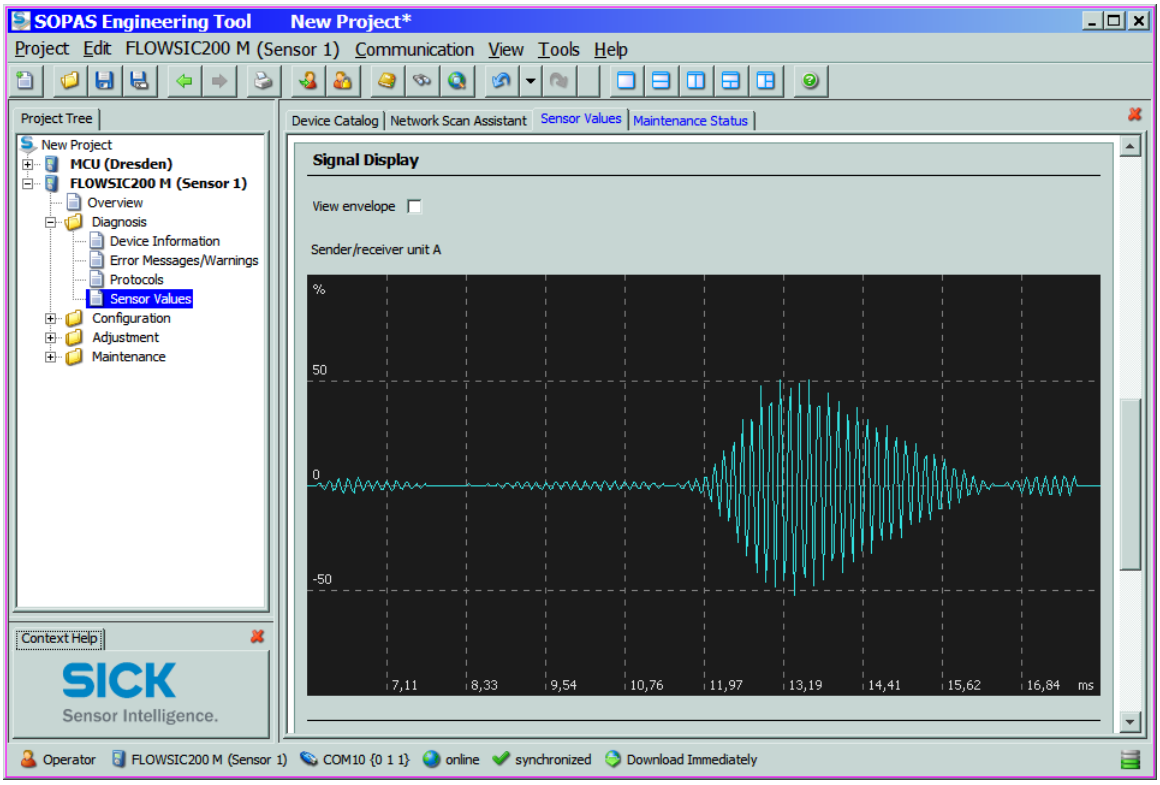
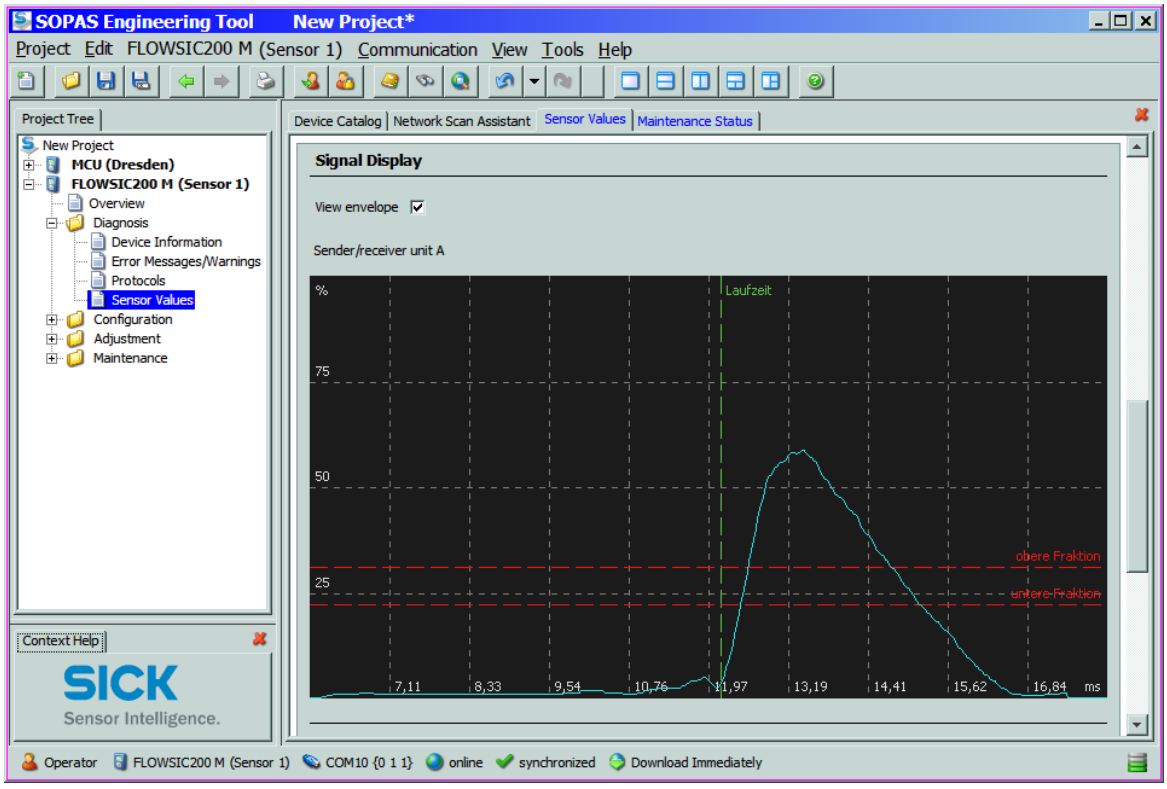


Fig. 73 Burst form demodulated signal (envelope)



Type FLSE200-H and FLSE200-HM

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

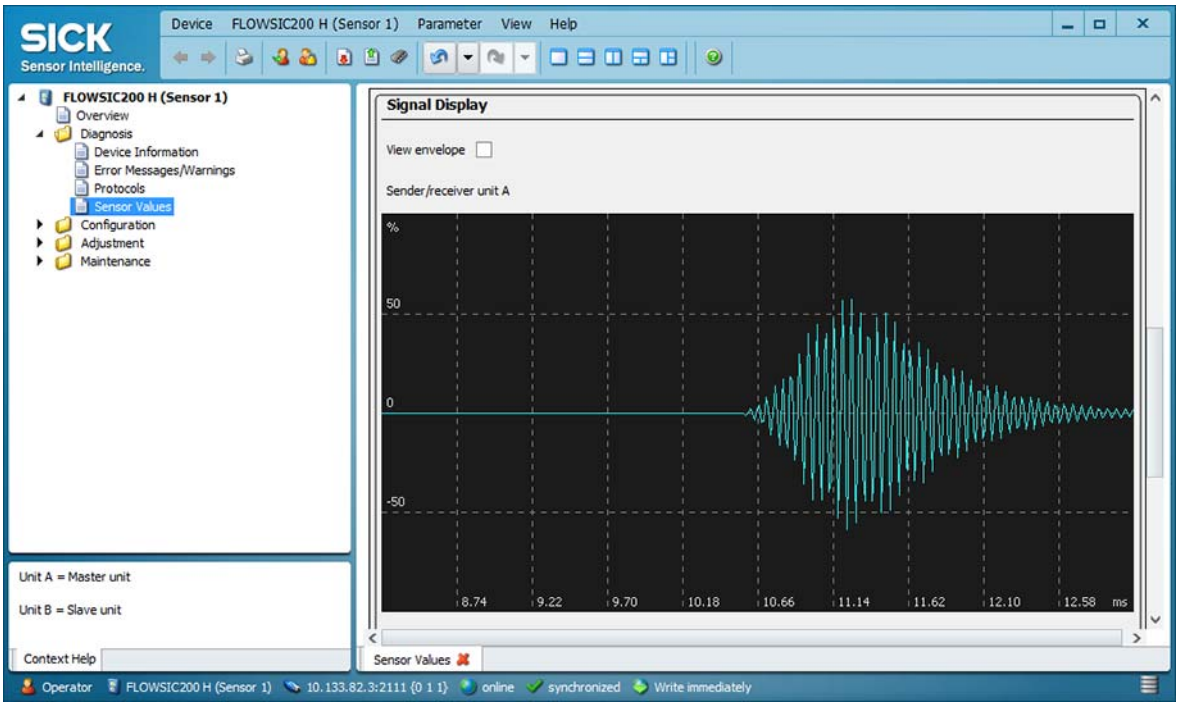
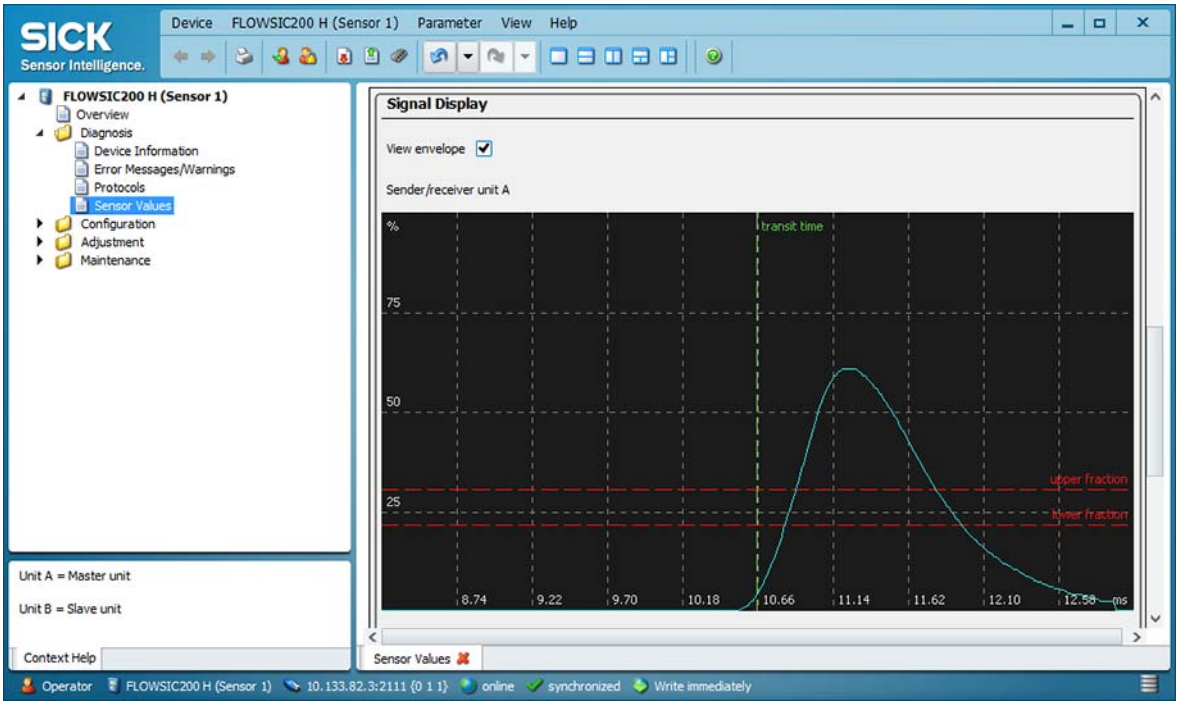


Fig. 75 Burst form demodulated signal (envelope)

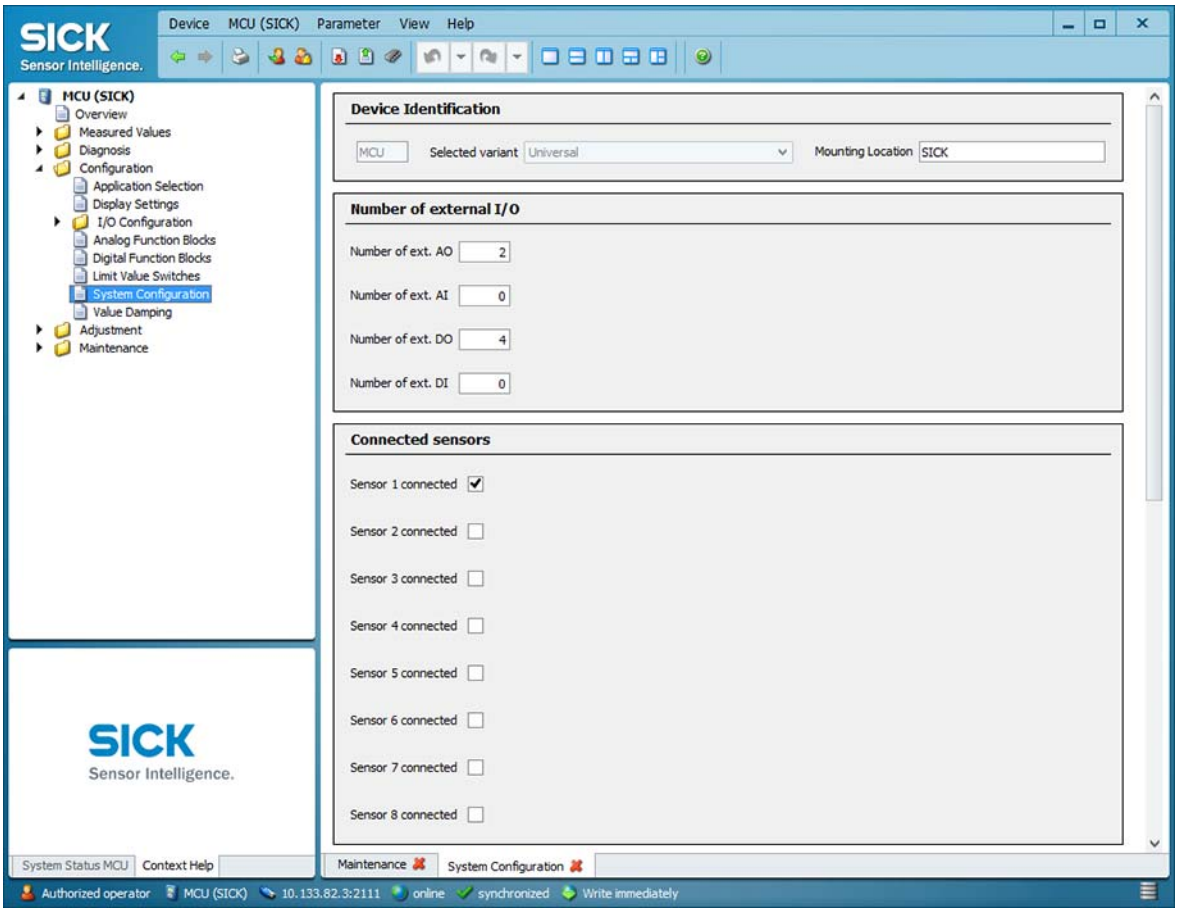


4.3 Extended Commissioning

4.3.1 Parameterizing analog and digital output modules

The modules installed in the MCU must be activated for this. Open the "MCU" device, select the ”Configuration / System Configuration” directory and check whether the number of outputs set in the ”Number of external I/O” group corresponds to the existing outputs (correct if necessary).

Fig. 76 ”Configuration / System Configuration” directory (example for settings)



4.3.1.1 Optional analog outputs

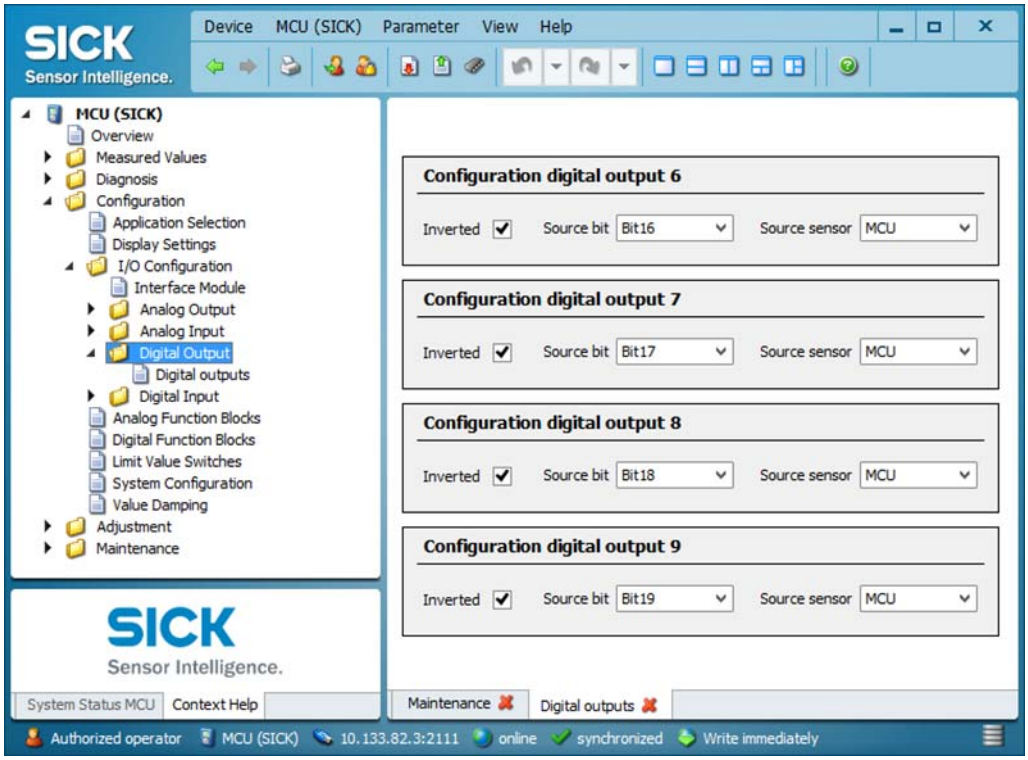
Settings can be carried out according to p. 71, §4.2.6 (→ p. 72, Fig. 61).

The basic settings ("Analog Outputs - General Overview" subdirectory; → p. 71, Fig. 60) apply to all available analog outputs in the same manner.

4.3.1.2 Optional 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

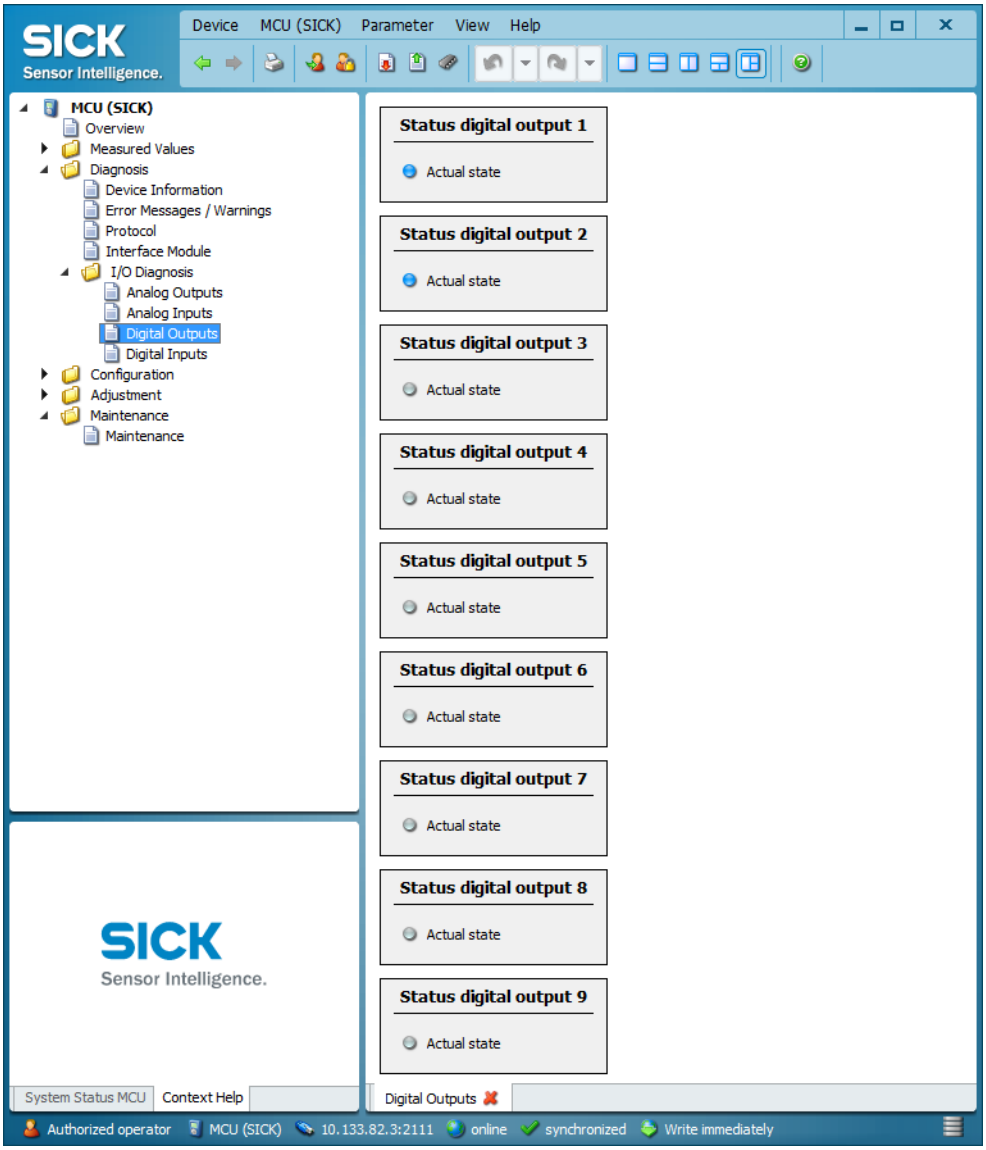


Field	Parameter	Remark
inverted	inactive	Specification of the switching direction
	active	
Source bit	Bit 0	Malfunction
	Bit 1	Maintenance
	Bit 2	Maintenance request
	Bit 3	Function check
	Bit 7	Operation (no malfunction)
	Bit 16 to 31	Aim bit of the limit value switch (→ p. 86, Fig. 79)
Source sensor		Selection of the component: - Sensor 1 8 8 if the device status shall be output - MCU if limit values shall be signalized

Checking settings

The current status of every relay is shown in the "Diagnosis / I/O / Digital Outputs" directory.

Fig. 78 "Diagnosis / I/O / Digital Outputs" directory



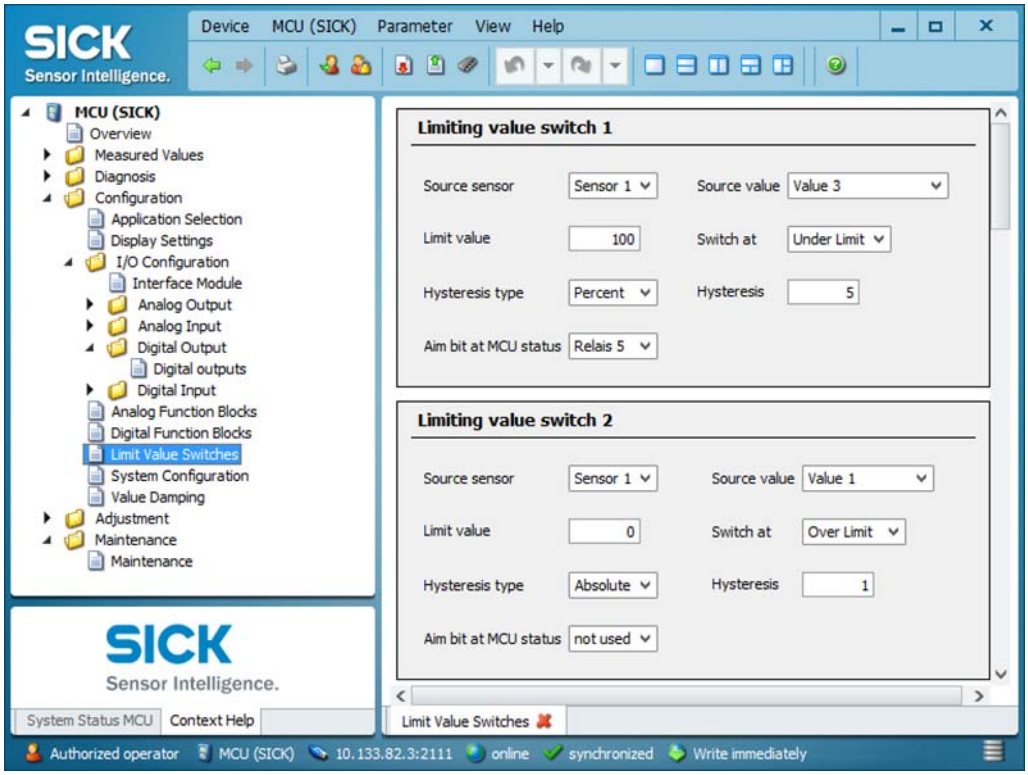
To check whether the relays switch as intended, measurement values which exceed the parameterised limits must be produced.

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

4.3.1.3 **Assigning and setting of limit value switches to optional digital outputs**

Select the ”Configuration / Limit Values Switches” directory” for assigning. Settings can be carried out according to p. 74, §4.2.8.

Fig. 79 ”Configuration / Limit Values Switches” directory



4.3.2 Configuring optional interface modules

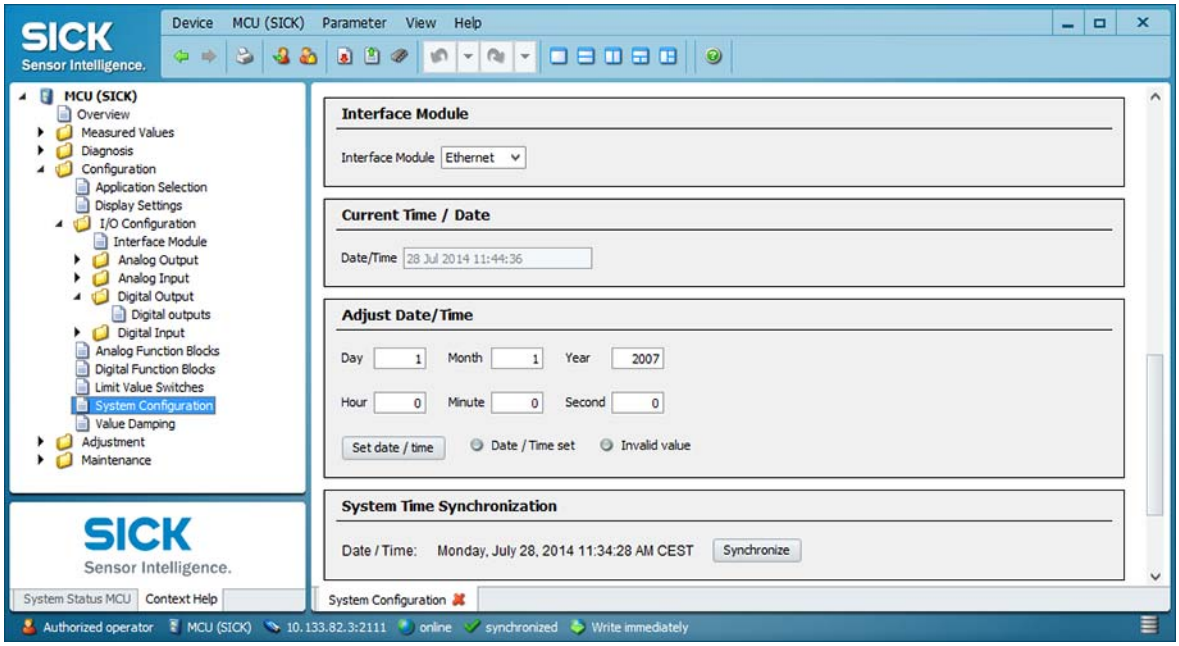
4.3.2.1 General information

For detailed information on the particular module options, see document „8017550 - Interface Documentation FLOWSIC200“.

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

- Select "MCU" device file, set the measuring system to "Maintenance" mode and enter the Level 1 password (→ p. 62, §4.1.4).
- Switch to the "Configuration / System Configuration" directory.
  The Interface module installed is shown as "Interface Module".
- Configure the Interface module according to requirements.
- Resume measuring operation.

Fig. 80 "Configuration / System Configuration" directory



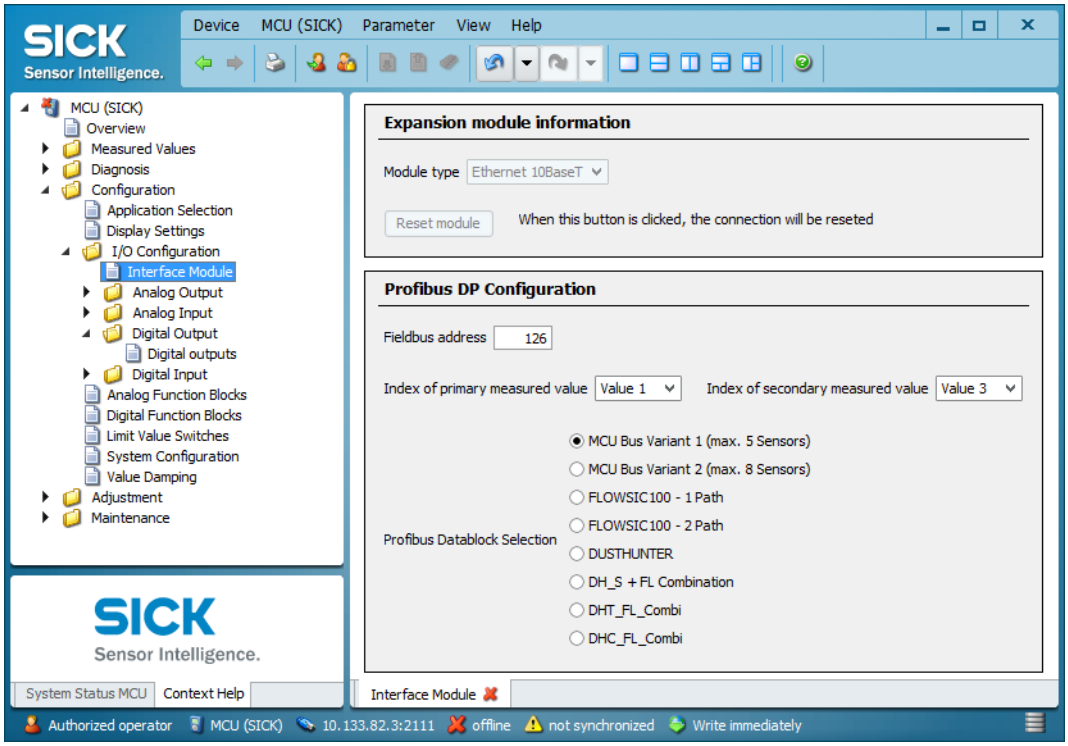
GSD file and measured value assignment are available for the Profibus DP module on request.

4.3.2.2 Changing the field bus address for Profibus DP modules

Interface modules Profibus DP are set at the factory to the field bus address 126. The followings steps are necessary to change it:

- ► Secure in the "Configuration / System Configuration" directory (→ p. 87, Fig. 80) that the interface module is set to "Profibus DP" (group "Interface Module").
- ► Switch to the "Configuration / I/O Configuration / Interface Module" directory and enter the new address in the "Field bus address" window (group "Profibus DP Configuration").

Fig. 81 "Configuration / I/O Configuration / Interface Module" directory



***NOTICE:* Communication via the Profibus interface**

- ► If different sensors (e.g. FL200 and VICOTEC450) are connected to the MCU, a maximum number of 5 connected sensors can be read out via Profibus. In this case, up to two measured values can be read out for every sensor.
- ► If 6 to 8 sensors are connected to one MCU, measured values can only be read out via Profibus if all sensors are of the same type (e. g. 6 x FL200). In this case, only the main measured value can be read out.
- ► All measured values of a sensor can only be read out in a single sensor configuration (one FL200 is connected to the MCU).

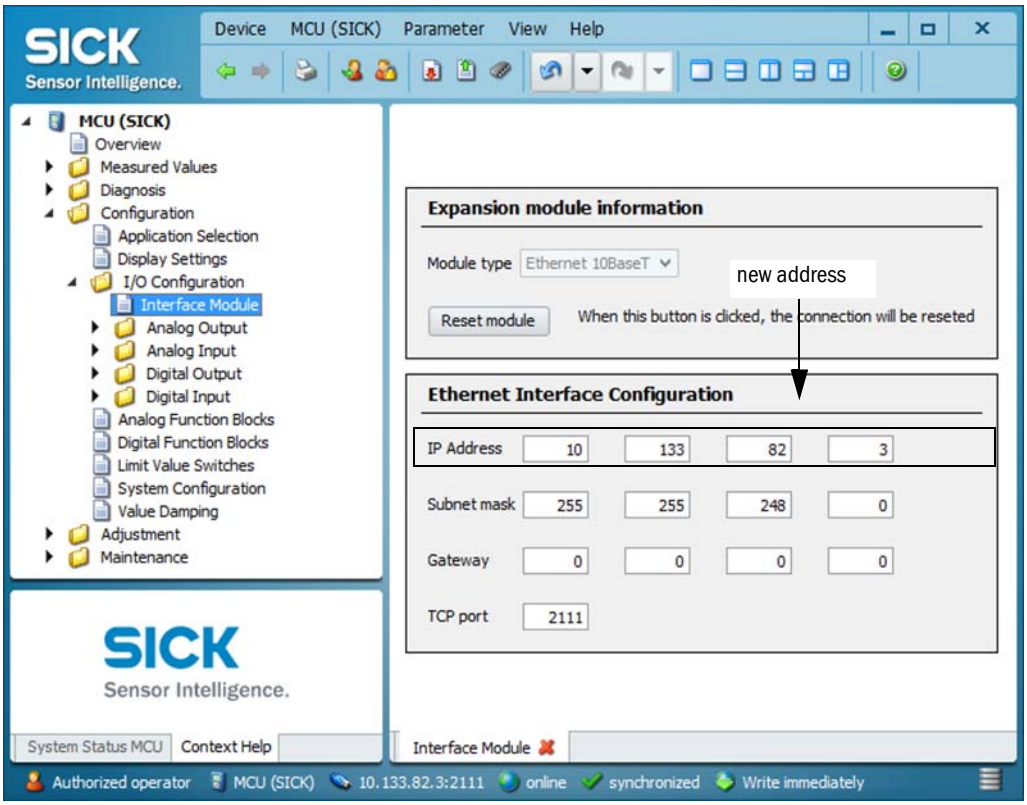
4.3.2.3 Setting the Ethernet module parameters

Assigning the Ethernet module a new IP address

An IP address specified by the customer is entered at the factory when the address is available when the device is ordered. Otherwise the standard address 192.168.0.10 is entered.

- ► Select the "Configuration / IO Configuration / Interface Module" directory.
- ► Enter the desired network configuration in the "Ethernet Interface Configuration“ group and click "Reset module" under "Expansion module information".

Fig. 82 "Configuration / IO Configuration / Interface Module" directory



Assigning the new IP address to the SOPAS ET program

- ► Connect the device → p. 56, §4.1.3.

4.3.3 Entering additional variables for Measured Value Calculation and Calibration

This Section describes parameter settings that are necessary for calibrating air velocity and temperature measurements. To do this, open the "FLOWSIC200 M", "FLOWSIC200 H" or "FLOWSIC200 H-M" device file and select the "Configuration / Application Parameters" directory (→ p. 68, Fig. 57). Then set the measuring system to "Maintenance" mode and enter the password level 1.

Entering calibration coefficients for velocity measurements

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

The default settings are: Cv_0 (absolute) = 0, Cv_1 (linear) = 1, Cv_2 (square) = 0,

Calibration of temperature measurement

The precision of acoustic temperature measurements conducted with the FLOWSIC200 is a square function of the measuring path and the speed of sound of the real gas under normalized conditions (→ p. 14, §2.1.3). Exact acoustic temperature measurements are only possible if the speed of sound of the real gas remains constant at a reference temperature.

The speed of sound can be configured in the User Access Level ‘‘Service" (see Service Manual). Per default it is set to 331.5 m/s (1087 ft/s).

To calibrate the measurement, determine the value pairs from separately measured gas temperature (for example, with PT100 sensor) and display on the LCD at a minimum of two different gas temperatures. Convert the calculated values to absolute temperatures (add 273.15 K). You can then use a regression function to calculate the coefficients (for two pairs by linear, with more value pairs also by square regression). Enter CT_2, CT_1 and CT_0 in the "Calibration coefficients / Calibration coefficients for temperature" group.

The default settings are CT_2 = 0, CT_1 = 1, CT_0 = 0.

Example:

Messung	FLOWSIC display		Measured value PT100	
	T in °F	$T_{absolute}$ in K	T in °KF	$T_{absolute}$ in K
1	262	401	239	388
2	367	459	337	443

$$T_{KAL} = CT\_1 \cdot T_{FLOWSIC} + CT\_0$$

$$CT\_1 = \frac{T2_{PT100} - T1_{PT100}}{T2_{FLOWSIC} - T1_{FLOWSIC}}$$

$$CT\_0 = \frac{1}{2} \cdot (T2_{PT100} + T1_{PT100} - CT\_1 \cdot (T2_{FLOWSIC} + T1_{FLOWSIC}))$$

$CT\_1 = 0{,}9483$

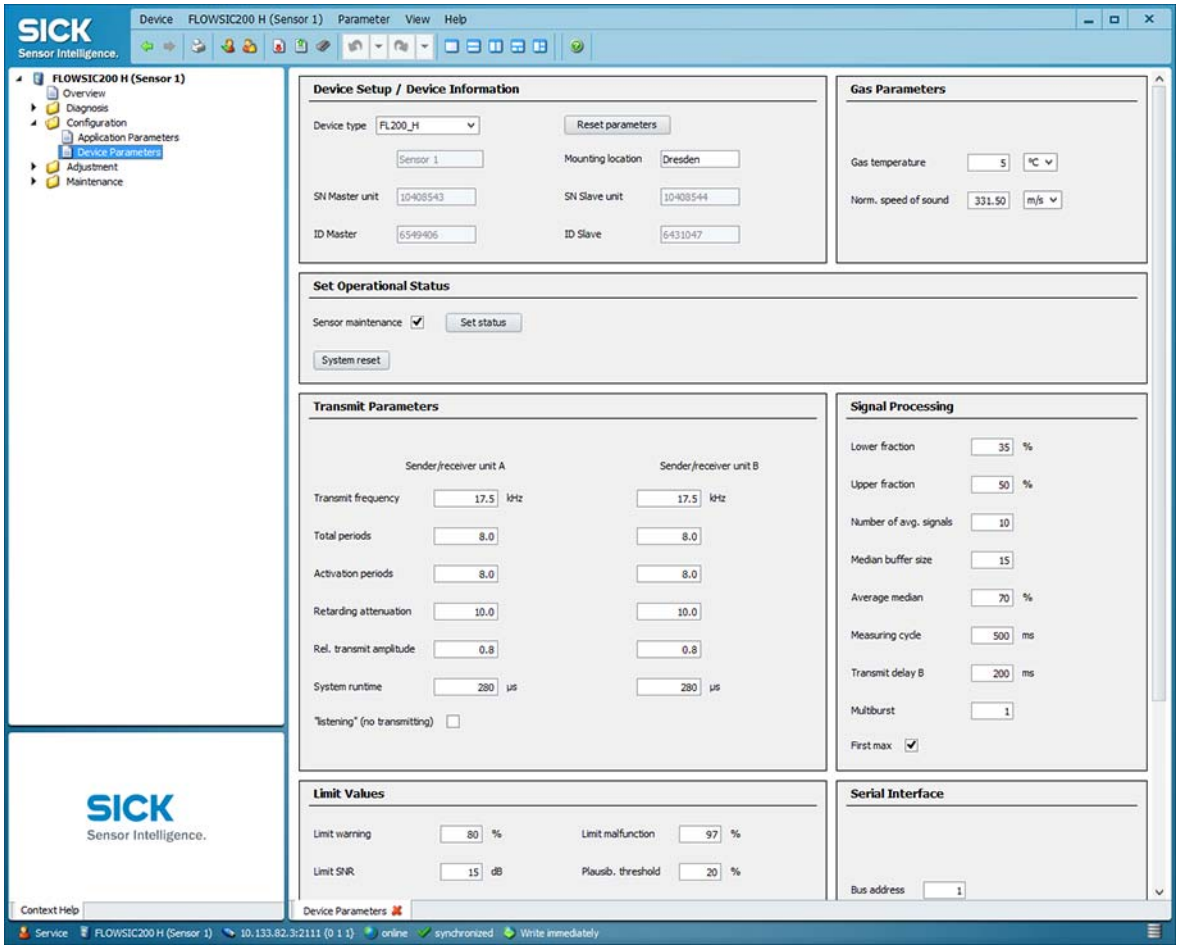
$CT\_0 = 7{,}7310$

4.3.4 Bus addressing via SOPAS ET program

As an alternative to hardware addressing (→ p. 34, §3.2.2.2), the addresses can also be assigned in the in the SOPAS ET program. To do so, connect the measuring system to the program, select the device file “FLOWSIC200 M“, "FLOWSIC200 H-M" or “FLOWSIC200 H“ and set the measuring system into maintenance mode (→ p. 65, §4.2).

Address 0 must be set on the miniature switch (→ p. 34, Fig. 16).

Figure 83 “Configuration / Device Parameters” menu



NOTICE:

For bus systems it must be ensured that the bus address of the master FLSE200 is correct.

The sender/receiver units must have different addresses. Identical addresses of several units cause the aborting of the communication with the MCU!

NOTICE:

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

4.4 Operation / Configuration with Option LCD Display

4.4.1 General Usage

The display and operation interface of the LCD display containt the functional elements displayed in Fig. 84.

Fig. 84 Functional elements LCD display

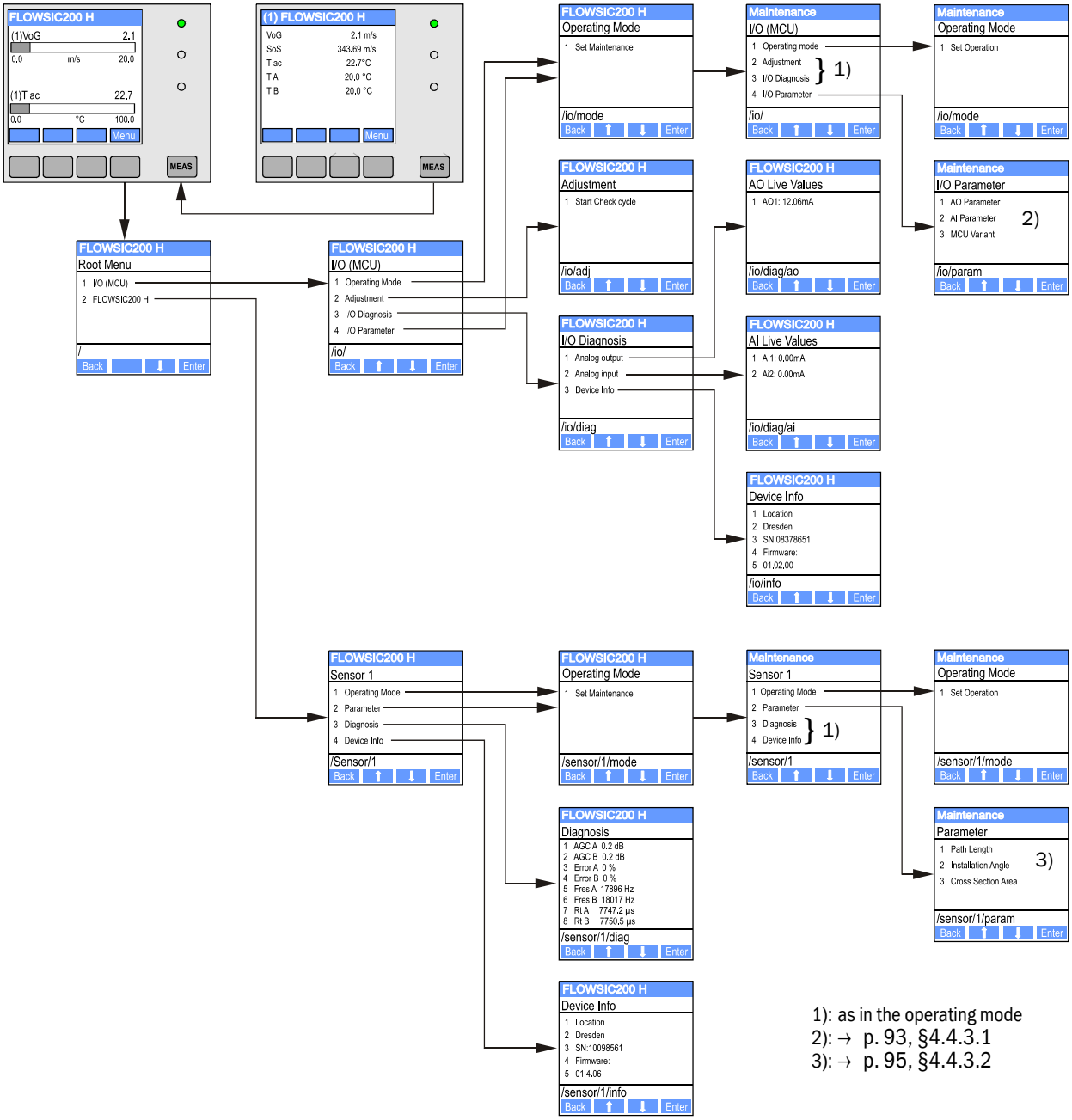
Key functions

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

Key	Function
Diag	Display diagnostic information (warnings and errors at start from the main menu, sensor information on start from the diagnostic menu; → p. 93, Fig. 85) This function is activ in case of warning or error status only.
Back	Go one menu up
Arrow ⇑	Scroll up
Arrow ⇓	Scrollen down
Enter	Start an action that was chosen with the arrow keys (go to submenu, affirmation of selected parameter at configuration)
Start	Start an action.
Save	Save a changed parameter.
Meas	• Toggle between indication of the measurement values in bar (graphics display) or text form When connecting several measuring units to the MCU the measurement values of the individual measuring units are shown after each other. • Display the contrast setting (press the key minimum 2.5 s)

4.4.2 Menu Structure

Fig. 85 LC-Display menu structure



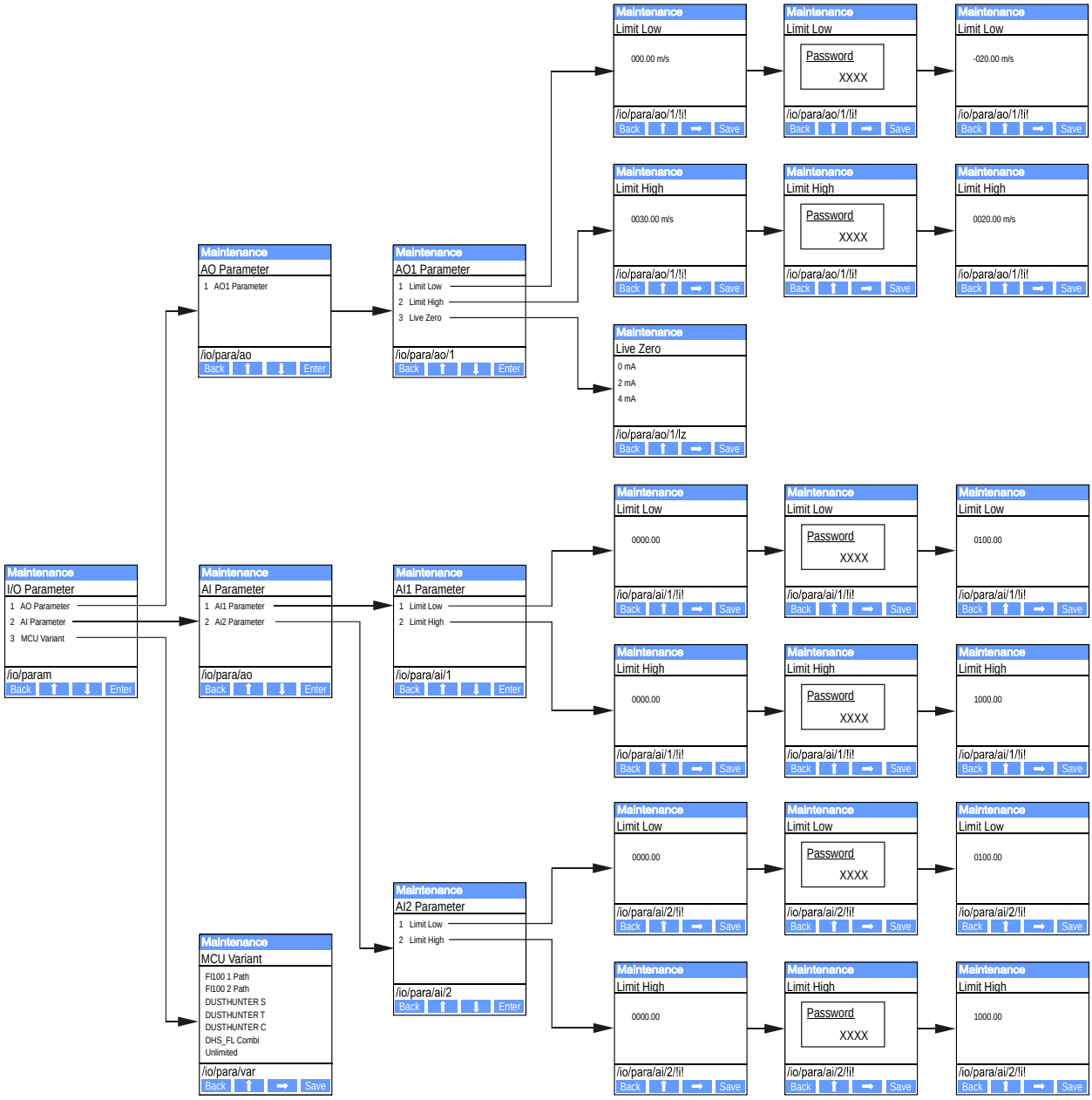
4.4.3 Parameter setting

4.4.3.1 MCU

Analo outputs / analog inputs

- ► Set the MCU in maintenance mode and call the "I/O Parameter" submenu.
- ► Select the desired parameter and enter the default password "1234" using the "^" (scrolls from 0 to 9) and/or "→" (moves the cursor to the right) buttons.
- ► Select the desired value using the "^" and/or "→" buttons and write it to the device with "Save" (confirm 2x).

Fig. 86 Menu structure for setting the analog output / input parameters and assigning the MCU variant



Assigning the MCU variant

The following steps are required to assign the MCU later to the existing sender unit of the FLOWSIC200 (→ p. 66, §4.2.1), :

- ► Set the MCU in maintenance mode, select the "MCU Variant" submenu, and select the type "Universal (Bus)".
- ► Enter the default password and store the type with „Save” (confirm 2x).

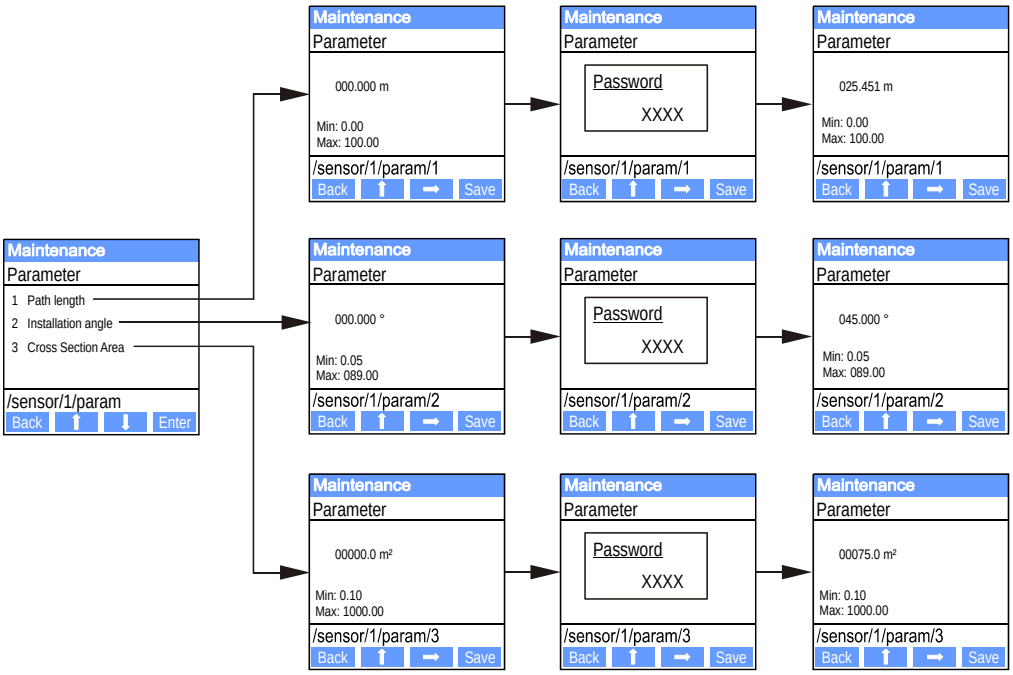
The other assigning possibilities are not practicable here.

4.4.3.2 **Sender/receiver units**

The following steps are required to enter the installation parameter:

- ► Set the sender/reciever unit into "Maintenance" and select the "Parameter" submenu.
- ► Choose the parameter to be entered and set the default password "1234".
- ► Select the calculated coefficient using the "^" and/or "→" buttons and write it to the device with "Save" (confirm 2x).

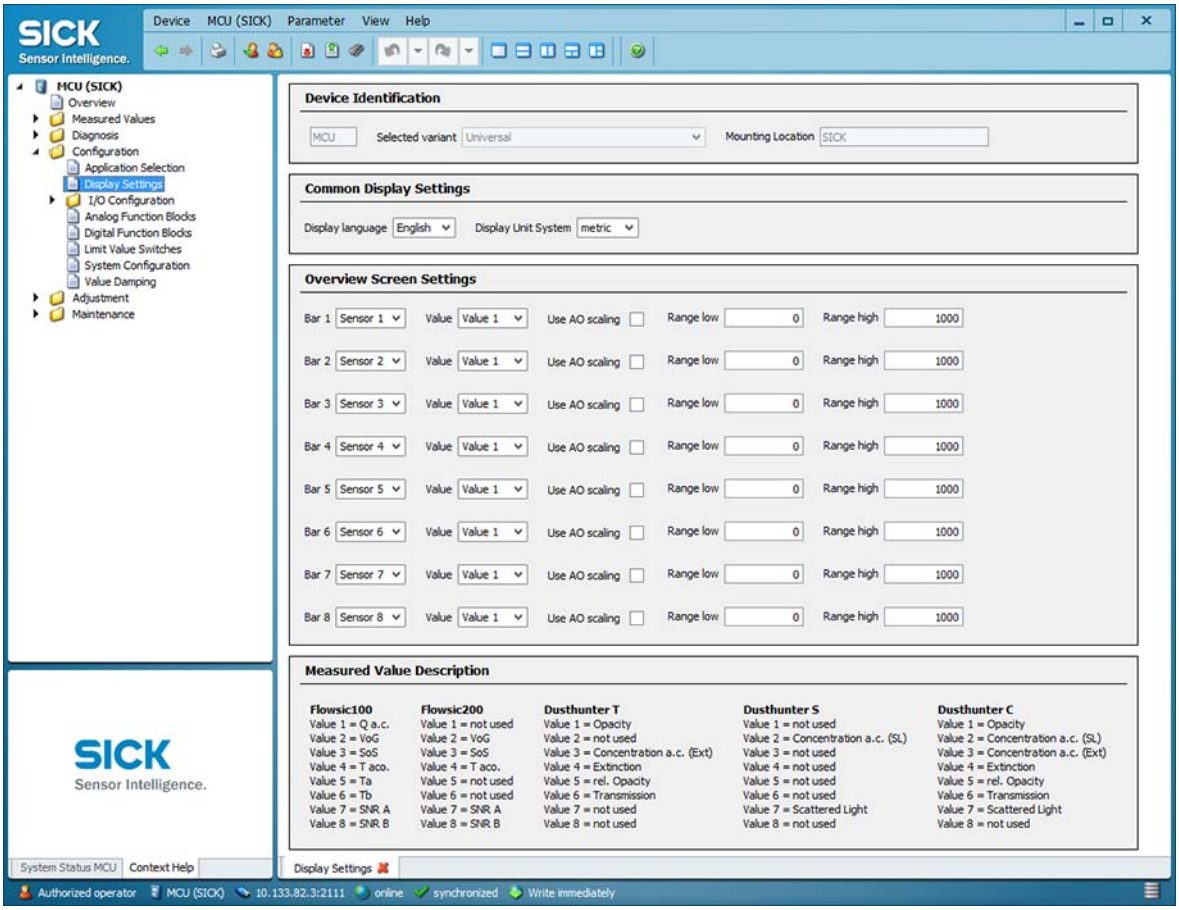
Fig. 87 Entering the regressions coefficients



4.4.4 Using SOPAS ET to modify display settings

To modify factory settings, open the "MCU" device file, enter the Level 1 password and Select the "Configuration /Display Settings“ directory.

Fig. 88 "Configuration/Display Settings“ directory



Window	Entry field	Significance
Common Display Settings	Display Language	Language version shown on the LC-Display
	Display Unit System	Unit of measurement system used in displays
Overview Screen Settings	Bar 1 to 8	Sensor address for the first measured value bar in the graphic display
	Value	Measured value index for the respective measured value bar
	Use AO scaling	When activated, the measured value bar is scaled to the associated analog output. If not activated, define the limit values separately
	Limit low	Values for separate scaling of the measured value bar independent of the analog output
	Limit High	

*For assignment of value index to measured value → p. 71, §4.2.6.

FLOWSIC200

5 Maintenance

General Notes
Instructions for Tunnel Cleaning

5.1 General Notes

Maintenance Strategy

Like any other electronic measuring system, the FLOWSIC200 requires regular maintenance. Regular checks and the preventive replacement of wear parts can considerably prolong the life of the installation and are a crucial factor for measuring reliability. Thanks to its measuring principle and system design, the FLOWSIC200 requires only little maintenance work.

Maintenance Actions

Routine maintenance actions are confined to cleaning the system components to remove dirt from external surfaces.

Set the FLOWSIC200 in the "Maintenance" mode before you start maintenance actions. You can do this by using an external maintenance switch (connection to the digital input 1), by using the operating and configuration software SOPAS ET or the display option (→ p. 91, §4.3.4).

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

NOTICE:
The ultrasonic transducers of the FLSE200-M are very sensitive to contact. Avoid direct contact during cleaning actions (clean by blowing out gently, or using a soft brush, no compressed air!).

Maintenance Intervals

The maintenance intervals depend son the specific conditions at the plant, and have to be defined by the plant operator. Usually the maintenance intervals are more than 24 weeks.

At type FLOWSIC200 H and FLOWSIC200 H-M a maintenance interval up to 5 years is possible at use within the specification limits.

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

Maintenance Agreement

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

5.2 Instructions for Tunnel Cleaning

If you have installed FLSE200-M transmitter/receiver units, always prevent water from getting in contact with the ultrasonic transducers. To ensure this, cover the protective tubes with the caps included in the delivery.

No particular preventive measures are required for FLSE200-H or FLSE200-HM type transmitter/receiver units.

If you use automatic tunnel cleaning equipment (brush cleaning), go around the transmitter/receiver units at an adequate distance to avoid misalignment.

FLOWSIC200

6 Malfunctions

General
Sender/receiver units
Malfunctions

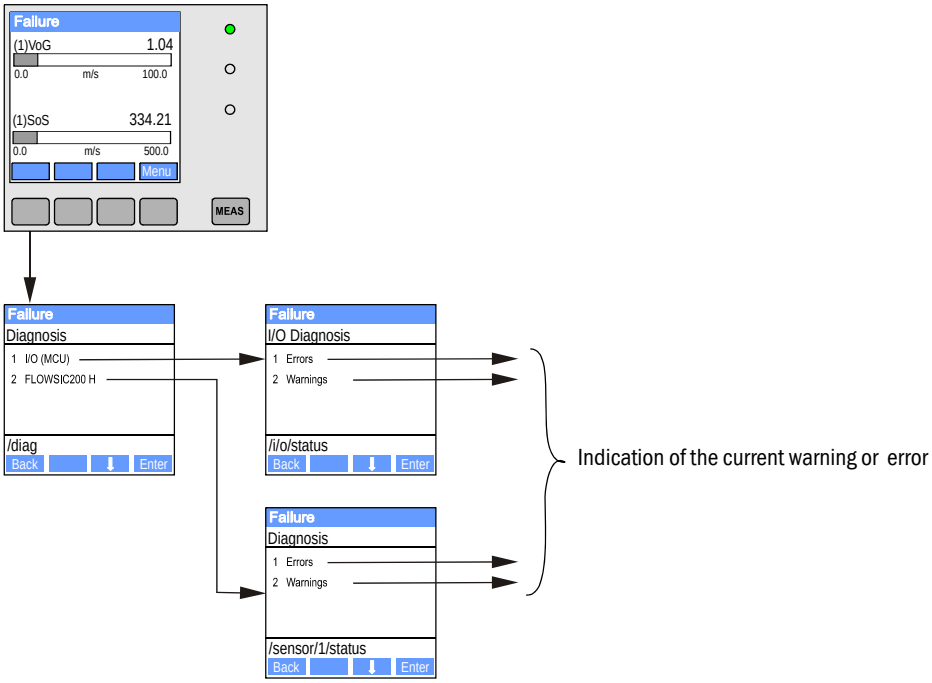
6.1 General

Warning or error messages are output in the following manner:

- On the MCU, the respective relay is switched on (→ p. 45, Fig. 29).
- If the optional LCD is installed, "Maintenance requ." or "Failure" is displayed in the status bar (→ p. 92, §4.4.1). In addition, the respective LED shines ("MAINTENANCE REQUEST" for warnings, "FAILURE" for errors).

  Possible causes are shown as a short information after pressing the key "Diag" on the menu "Diagnosis" and selecting the device ("MCU" or "Vicotec450").

Fig. 89 Display at the LCD



Detailed status information about the current device statust is provided by the "Diagnosis / Errors/Warnings" directory. Connect the measuring system to the SOPAS ET program and start the device file "FLOWSIC200 M/FLOWSIC200 H/FLOWSIC200 H-M" or "MCU" (→ p. 64, § and → p. 62, §4.1.4) to display the relevant information.

The significance of the individual messages is described in more detail in a separate window after moving the cursor to the respective display. Clicking on the display shows a short description of possible causes and corrections under "Help" (→ p. 104, Fig. 90, → p. 105, Fig. 91).

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 device failure.

Warning messages do not imply a malfunction of the measuring system. The current measured value is still output via the analog output.

See the service manual for more detailed description of the messages and possibilities for the remedying.

6.1.1 Implausible measured values

In some cases, the FLOWSIC200 provides measured values that do not seem plausible in comparison with projected or otherwise measured values or that have excessively high short-time variations.

Symptom	Possible cause	Action
The measured values are stable, but the calculated speed is (seemingly) incorrect	▶ Incorrect parameter setting of path length and installation angle ▶ Wrongregression factors ▶ Measuring axis not optimal for existing flow conditions	▶ Check parameter settings. ▶ Check installation situation (→ p. 30, §3.1.1). ▶ Calibrate velocity measurement (→ p. 90, §4.3.3).
Measured temperature value is (seemingly) incorrect	Path length not determined or entered exactly	▶ Check the transducer - transducer distance ▶ Calibrate the temperature measurement (→ p. 90, §4.3.3).
Measured values are correct on average, but too unsteady or with peaks	Measuring values are disturbed by traffic conditions (measuring distance is influenced by high vehicles)	▶ Check installation situation (→ p. 30, §3.1.1). ▶ Contact SICK service.

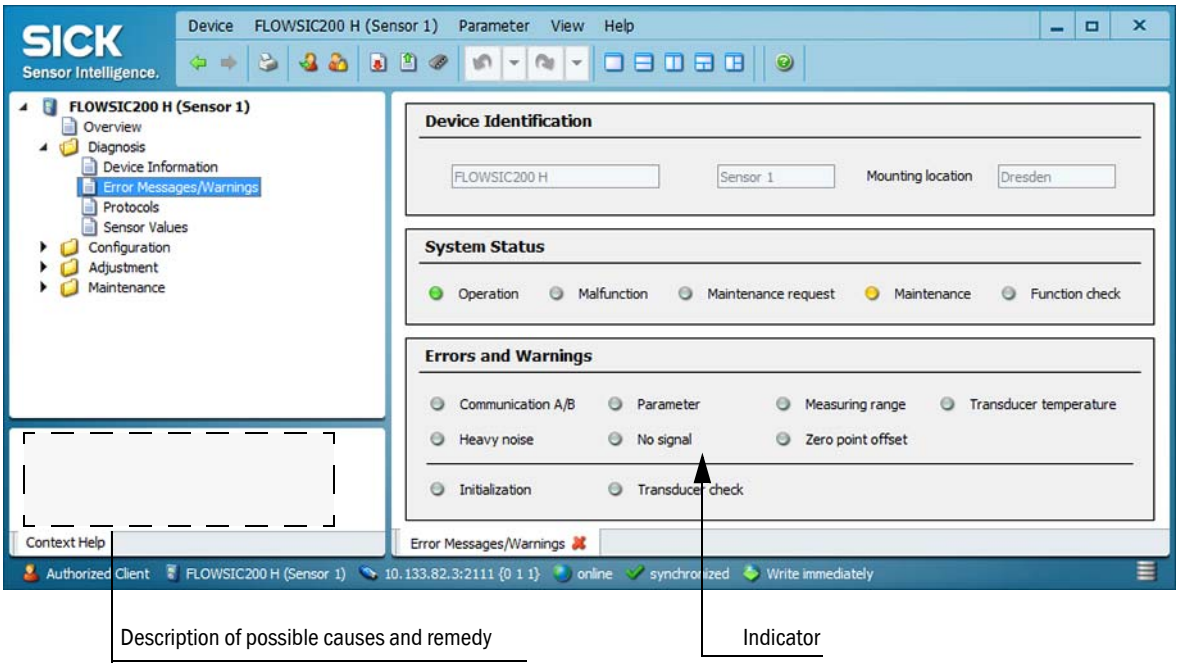
6.1.2 General system malfunctions

Symptom	Possible cause	Action
No indication on LC display of control unit (option)	▶ No supply voltage ▶ Defective fuse ▶ Connection cable not connected correctly or defective ▶ Defective plug connector ▶ Processor board or LC display defective	▶ Check the power supply.. ▶ Check the fuse. ▶ Check plug connectors and cables. **WARNING:** ▶ For all work under voltage, always observe the valid safety precautions! ▶ Contact SICK service.
Analog output on live zero	▶ The device has malfunction(s). ▶ Incorrect parameter settings	▶ Check the device status ▶ Check the device for malfunctions and correct, if possible. ▶ Check the parameter settings. ▶ Contact SICK service.
No analog signal or output of a fixed value smaller than live zero	▶ Defective D/A converter ▶ Device not in measuring mode	▶ Contact SICK service.
No communication between measuring system and SOPAS ET program	▶ Wrong COM port on the PC ▶ Incorrect parameter setting of interface ▶ USB driver not installed correctly or not at all	▶ Check the interface settings (→ p. 87, §4.3.2) ▶ Exit the SOPAS ET program, make a restart and establish connection again ▶ Contact SICK service.

6.2 Sender/receiver units

Warning and error messages in the SOPAS ET program

Fig. 90 "Diagnosis / Error Messages/Warnings" directory



Warning or error messages currently existing or appeared earlier and stored in the error memory can be shown by selection of "actual" or "memory" in the "Selection" window ("Device malfunction" group).

The following malfunctions can be removed under circumstances at site.

SOPAS ET	Possible cause	Action
Communication A/B	• Connection cables not correctly connected • Cables doesn't match the required specification • Both sender/receiver units are set to master or slave • One sender/receiver unit is defective	▶ Check the cabling (→ p. 40, §3.3)
Parameter	• Device has not yet been parameterized • The basic parameters entered were set to 0 after the type change	▶ Enter the installation data (again) (→ p. 65, §4.2)
Measuring range	The measuring range configured is exceeded.	▶ Check the parameter settings.

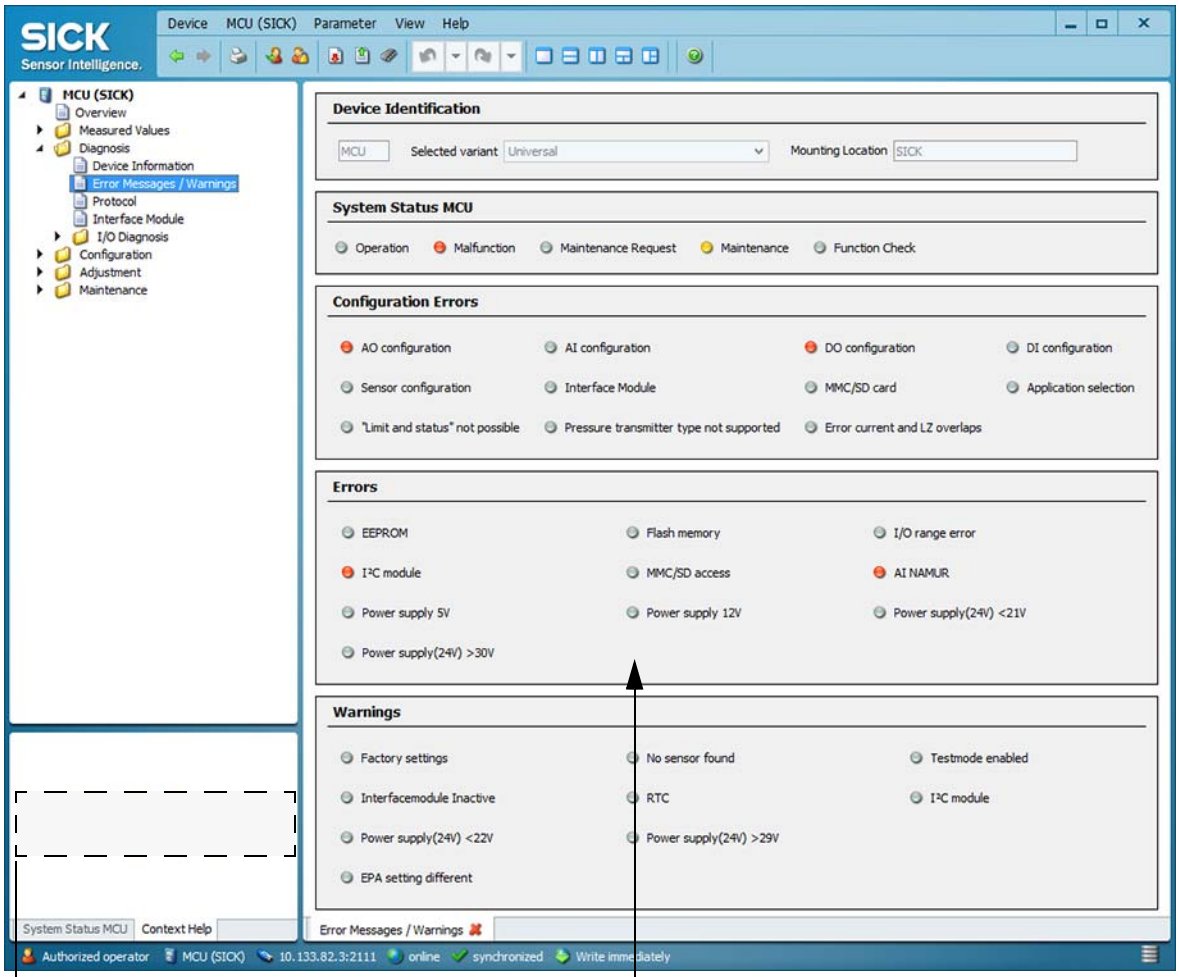
6.3 Control unit

Malfunctions

Symptom	Possible cause	Action
No display on the LCD (option)	▶ No supply voltage ▶ Defective fuse	▶ Check the power supply. ▶ Contact SICK service.

Warning and error messages in the SOPAS ET program

Fig. 91 "Diagnosis / Errors/Warnings" directory

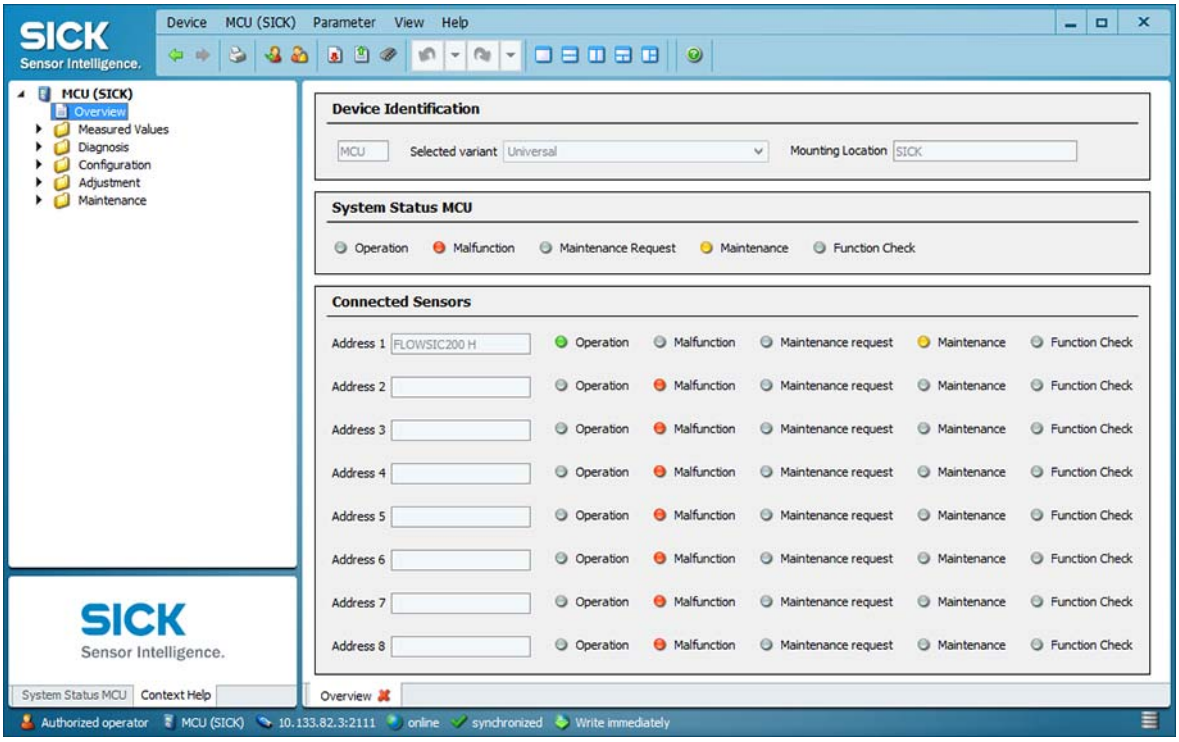


The following malfunctions can be removed under circumstances at site.

Message	Significance	Possible cause	Action
AO configuration	The number of optional modules does not match the number of analog outputs with parameter settings.	▶ No parameters set for AO ▶ Connection error ▶ Module failure	▶ Check the parameter settings (→ p. 71, §4.2.6). ▶ Contact the manufacturer.
AI configuration	The number of optional modules does not match the number of analog inputs with parameter settings.	▶ No parameters set for AI ▶ Connection error ▶ Module failure	▶ Check the parameter settings → p. 73, §4.2.7). ▶ Contact the manufacturer.

Message	Significance	Possible cause	Action
DO configuration	The number of optional modules does not match the number of digital outputs with parameter settings.	▶ No parameters set for DO ▶ Connection error ▶ Module failure	▶ Check the parameter settings → p. 83, §4.3.1). ▶ Contact the manufacturer.
Sensor configuration	The number of available sensors does not match the number of connected sensors.	▶ Sensor failure ▶ Communication problems on RS485 line	▶ Check addressing and availability of the sensors (→ p. 106, Fig. 92). ▶ Correct sensor selection (→ p. 83, Fig. 76). ▶ Contact the manufacturer.
Interface module	No communication via interface module	▶ No parameters set for module ▶ Connection error ▶ Module failure	▶ Check the parameter settings (→ p. 89, §4.3.2.3). ▶ Contact SICK service.
Variant configuration error	MCU setting doesn't match attached sensor	▶ Sensor type was changed	▶ Correct application settings (→ p. 66, §4.2.1).
Testmode enabled	MCU is in test mode.		▶ Disable the "System Test" status ("Maintenance" directory)

Fig. 92 "Overview" directory



FLOWSIC200

7 Specification

Technical Data
Dimensions, Part Numbers
Accessories
Consumable parts for 2-Year Operation
Password

7.1 Technical Data

Measured value acquisition		
Measured variables	Flow velocity, air temperature	
Measuring range	-20 ... + 20 m/s; continuously variable; greater range on request	
Typical accuracy [1]	± 0,1 m/s	
Response time t_{90}	1 ... 300 s; freely selectable	
Displays		
LCD	Measured variables, warning and malfunction messages	
LED	Power, failure, maintenance request	
Installation		
Measuring distance Transducer–Transducer	FLSE200-M, FLSE200-HM	5 - 25 m
	FLSE200-H	5-40 m
Installation angle	For measuring sections of up to 10 m: 45 °, for greater measuring sections 60°	
Air temperature	-40 ... +60°C	
Humidity	< 100 %	
Cable length between FLSE200 and MCU.	max. 1000 m [2]	
Output signals		
Analog outputs	0/2/4 ... 22 mA, max. load 750 Ω., resolution 0.01 mA; additional analog outputs with I/O modules option	
Digital outputs	5 potential-free outputs (change over contact) for status signals: operation/malfunction, maintenance, check cycle, maintenance request, limit; load capability 48 V, 1 A; additional relay outputs with I/O modules option	
Input signals		
Analog inputs	2 inputs 0 ... 20 mA (without galvanic separation); resolution 0.01 mA; additional analog inputs with I/O modules option	
Digital inputs	4 potential-free contacts for connection of maintenance switch, activation check cycle; additional digital inputs with I/O modules option	
Interfaces		
USB 1.1, RS 232 (on terminals)	For measured valuee retrieval, configuration and firmware update via PC/laptop with SOPAS ET	
RS485	For connection of sender/receiver unit	
Optional interface-module	For communication with host PC, optionally for RS485, Profibus, USB, Ethernet	
Power supply		
Operation 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	
Type of protection	FLSE200: IP66, MCU: IP65	

[1]: The precision depends on calibration, installation conditions, flow profile, temperature and length of the measuring section

[2] For operation with standard parameter settings (Factory settings).

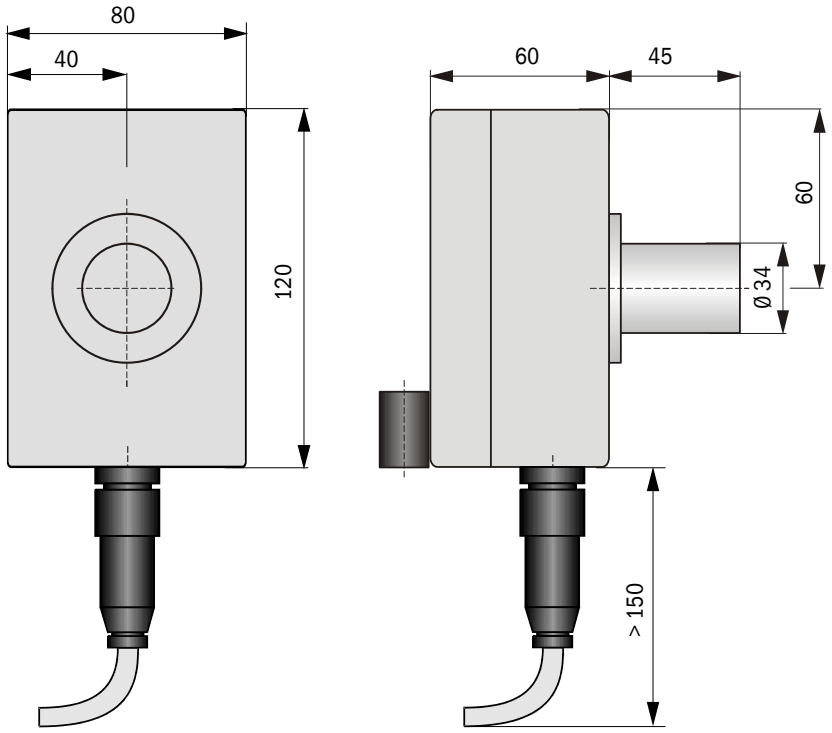
7.2 Dimensions, Part Numbers

All Dimensions are indicated in mm.

7.2.1 Sender/Receiver Units

FLSE200-M

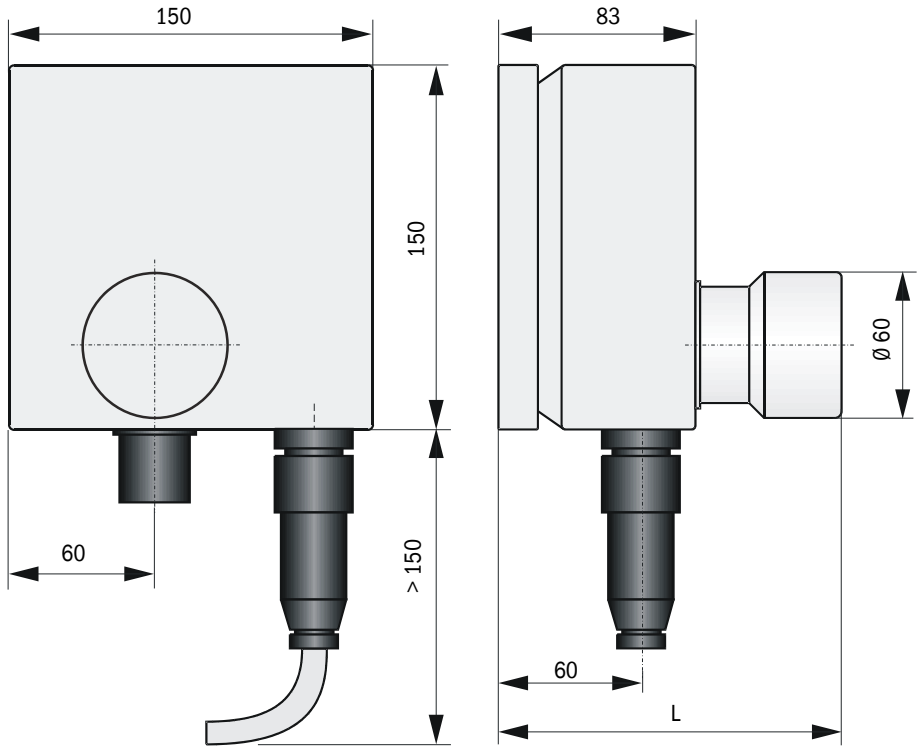
Fig. 93 Sender/receiver unit FLSE200-M



Name	Number	Part Number
FLSE200-M sender/receiver unit	2	1044804

FLSE200-H, FLSE200-HM

Fig. 94 Sender/receiver unit FLSE200-H, FLSE200-HM

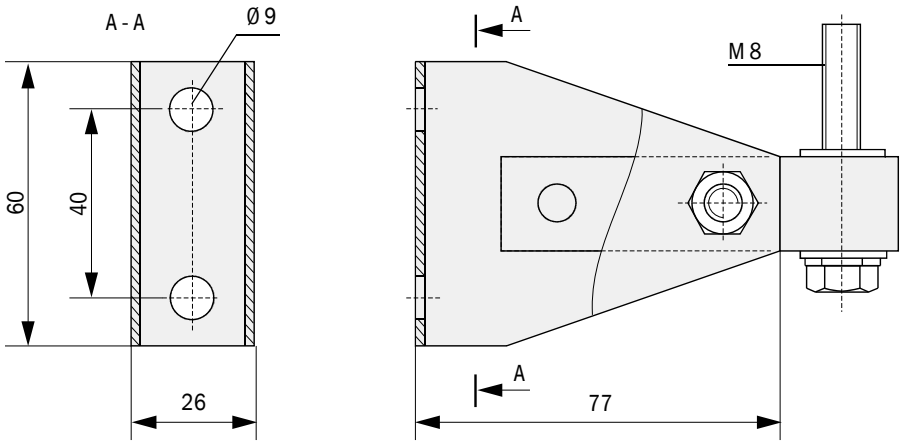


Name	Part Number
Sender/receiver unit FLSE200-HM	1057565
Sender/receiver unit FLSE200-H	1044842

7.2.2 Mounting Bracket

FLSE200-M Mounting Bracket

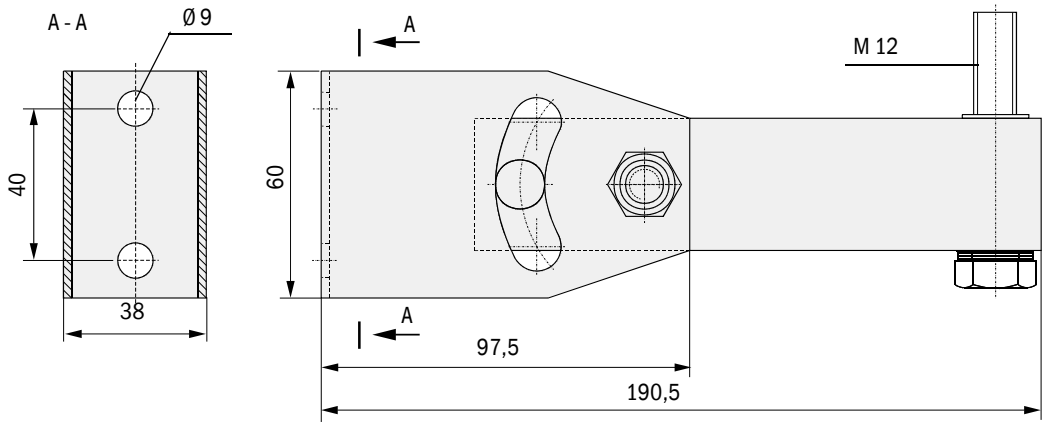
Fig. 95 FLSE200-M mounting bracket



Name	Part Number
Mounting bracket for FLSE200-M	7042039
Mounting bracket for FLSE 200-M, material 1.4529	2031880

Mounting Bracket for FLSE200-H, FLSE200-HM

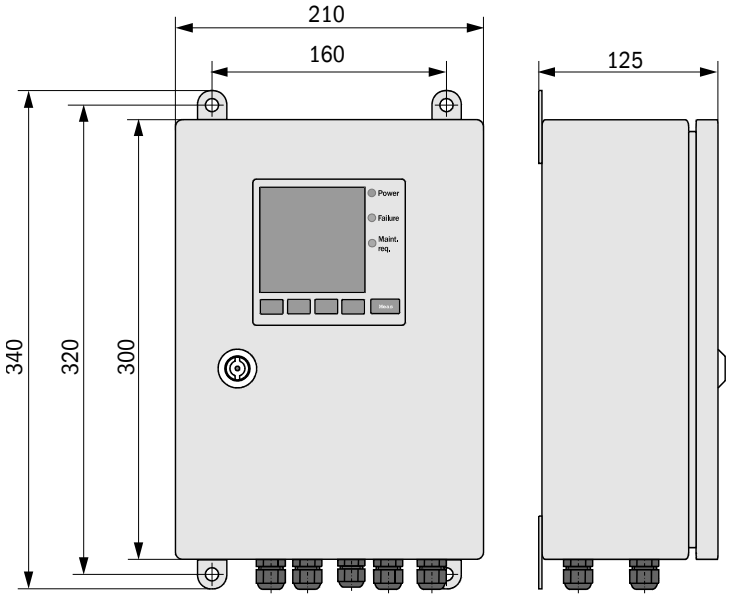
Fig. 96 Mounting bracket for FLSE200-H, FLSE200-HM



Name	Part Number
Mounting bracket for FLSE200-H, FLSE200-HM	7042077
Mounting bracket for FLSE200-H and FLSE200-HM, material 1.4529	2031881

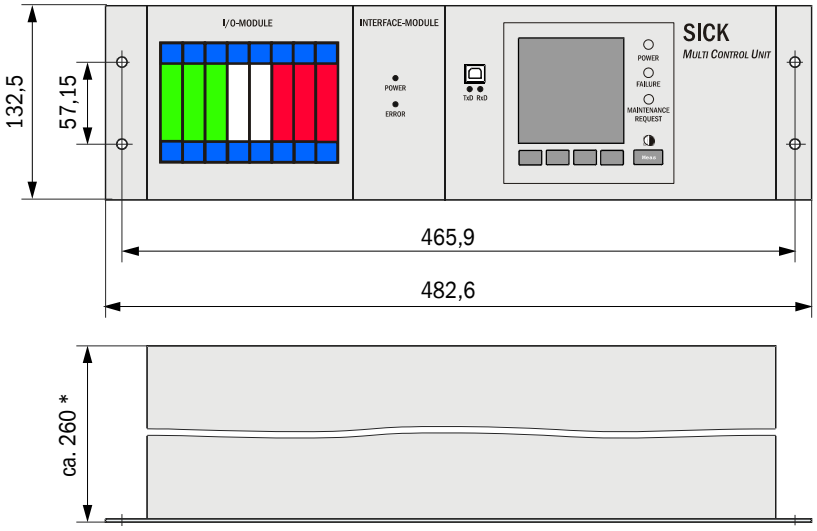
7.2.3 Control Unit MCU

Fig. 97 Control unit MCU (with display module option)



Name	Part Number
Control unit MCU-NWSN	1046298
Control unit MCU-N2SN	1046299
Control unit MCU-NWSD	1046113
Control unit MCU-N2SD	1046115

Fig. 98 Control unit MCU 19" slide-in unit (with display module option)



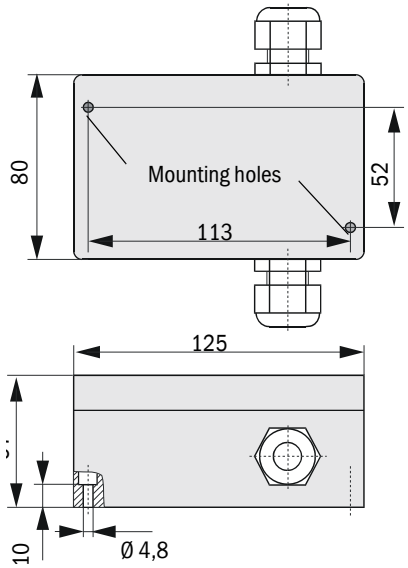
*: Space for cabling included

Name	Part Number
Control unit MCU-NWTD in 19"-rack	1046288
Control unit MCU-N2RD in 19"-rack	1046116

7.2.4 Connection box

In aluminium case

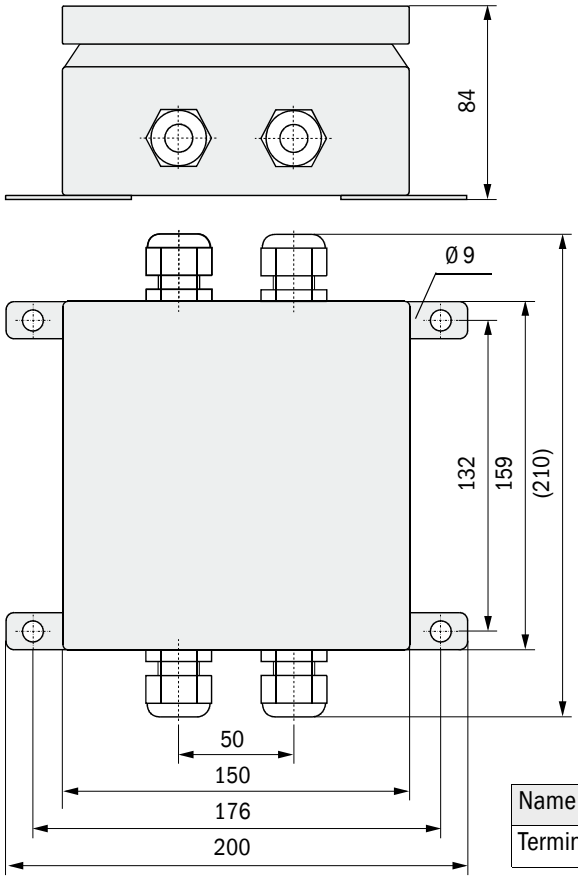
Fig. 99 Connection box



Name	Part Number
Connection box	2046418

Stainless steel housing

Fig. 100 Connection box in stainless steel case



Name	Part Number
Terminal box stainless steel housing	2048067

7.3 Accessories

7.3.1 Accessories for mounting

Name	Part Number
Mounting set 2M8-1.4529	2031886
Mounting set 4M8-1.4529	2031887
Mounting set2D8-1.4571/PA	2031888
Mounting set 4D8-1.4571/PA	2031889
Mounting set 2D4-1.4571/PA	2031890
Mounting set 2M8-1.4571	2031891

7.3.2 Connection cable sender/receiver unit - connection box

Name	Number	Part Number
Connection cable, length 2 m, halogen-free	2	2048074
Connection cable, length 25 m, halogen-free	2	2048075

7.4 Options

7.4.1 Options for control unit MCU

Name	Part Number
Module analog input (AI), 2 channels, 100 Ω, 0/4...22 mA, galv. isolated (80 V difference)	2034656
Module analog output (AO), 2 channels, 500 Ω, 0/4...22 mA, galv. isolated per module	2034657
Module digital output, 2 channels changeover contacts	2034659
Module digital output, 4 channels make contact)	2034661

Additional options options for control unit MCU in wall housing

Name	Part Number
Module carrier (one required for each AI, AO, DI or DO module)	6028668
Connection cable for optional I/O modules	2040977
Interface module, Profibus DP, with connection cable for MCU	2048920
Interface module, Ethernet, with connection cable for MCU	2055719
Interface module, Ethernet triplex, with connection cable for MCU	2072693
Interface module, Modbus RS485, with connection cable for MCU	2048958
Interface module, Modbus TCP, with connection cable for MCU	2059546

Additional options options for control unit MCU in 19” rack

Name	Part Number
I/O module carrier for installation of max. 4 AO/AI and max. 4 DO/DI modules	2050589
Interface module 19“, Profibus DP, with connection cable for MCU	2049334
Interface module 19“, Ethernet, with connection cable for MCU	2048377
Interface module 19“, Modbus RS485, with connection cable for MCU	2050674

7.4.2 Miscellaneous

Name	Part Number
Hook wrench	7042115
Distance measuring device DME 2000	1010578

7.5 Consumable parts for 2-Year Operation

Name	Number	Part Number
Transducer with tube for FLSE200-M	2	7042043

7.6 Password

SICK

Passwort „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 Funktionsumfanges wird das

Passwort **sickoptic** benötigt.

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

8013271/YSA5/V1-4/2016-07

Australia
Phone +61 3 9457 0600
1800 334 802 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0)22 36 62 28 8-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0)2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail marketing@sick.com.br

Canada
Phone +1 905 771 14 44
E-Mail information@sick.com

Czech Republic
Phone +420 2 57 91 18 50
E-Mail sick@sick.cz

Chile
Phone +56 2 2274 7430
E-Mail info@schadler.com

China
Phone +86 4000 121 000
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-2515 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Gemany
Phone +49 211 5301-301
E-Mail info@sick.de

Great Britain
Phone +44 (0)1727 831121
E-Mail info@sick.co.uk

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail office@sick.hu

India
Phone +91–22–4033 8333
E-Mail info@sick-india.com

Israel
Phone +972-4-6881000
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 (0)3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603 808070425
E-Mail enquiry.my@sick.com

Netherlands
Phone +31 (0)30 229 25 44
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 837 40 50
E-Mail info@sick.pl

Romania
Phone +40 356 171 120
E-Mail office@sick.ro

Russia
Phone +7-495-775-05-30
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 (0)1-47 69 990
E-Mail office@sick.si

South Africa
Phone +27 11 472 3733
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321
E-Mail info@sickkorea.net

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886 2 2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2645 0009
E-Mail tawiwat@sicksgp.com.sg

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail info@sick.ae

USA/Mexico
Phone +1(952) 941-6780
1 (800) 325-7425 – tollfree
E-Mail info@sick.com

Vietnam
Phone +84 8 62920204
E-Mail Ngo.Duy.Linh@sicksgp.com.sg

More representatives and agencies
at **www.sick.com**

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