OPERATING INSTRUCTIONS

DUSTHUNTER SF100
Dust Concentration Monitor

Description
Installation
Operation

SICK
Sensor Intelligence.

Document Information

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Legal information
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Warning Symbols

Hazard (general)

Hazard by voltage

Hazard by laser radiation

Warning Levels / Signal Words

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

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

CAUTION
Hazard or unsafe practice which *could* result in personal injury or property damage.

NOTICE
Hazard which *could* result in property damage.

Information Symbols

Important technical information for this product

Supplementary information

Link to information at another place

DUSTHUNTER SF100

1 Important Information

Main hazards
Intended use
Responsibility of user

1.1 Main hazards

1.1.1 Hazards from hot and/or aggressive gases and/or high pressure

The optical subassemblies are fitted directly on the gas-carrying duct. On equipment with low hazard potential (no danger to health, ambient pressure, low temperatures), the installation or removal can be performed while the equipment is in operation providing the valid regulations and equipment safety notices are observed and suitable protective measures are taken.

WARNING: Danger from exhaust gas

- ► On equipment with gases detrimental to health, high pressure or high temperatures, the sender unit and scattered light receiver components fitted on the duct may only be installed/removed when the equipment is at a standstill.

1.1.2 Hazards through electrical equipment

The DUSTHUNTER SF100 measuring system is operational equipment for use in industrial high-voltage current plants.

WARNING: Danger through mains voltage

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

1.1.3 Hazards through laser beam

WARNING: Hazards through laser beam

- ⊗ Never look directly into the beam path
- ⊗ Do not point the laser beam at persons
- ► Pay attention to laser beam reflections.

1.2 Intended use

Purpose of the device

The DUSTHUNTER SF100 measuring system only serves continuous measurement of dust concentrations in exhaust gas and exhaust air plants.

Correct use

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

Restrictions of use

- ⊗ The DUSTHUNTER SF100 measuring system is not approved for use in potentially explosive atmospheres.

1.3 Responsibility of user

1.3.1 General information

Designated users

The DUSTHUNTER SF100 measuring system may only be installed and operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

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 information and protective measures

Protection devices

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

Behavior during purge air failure

The purge air supply serves to protect optical subassemblies fitted on the duct against hot or aggressive gases. Leave the supply switched on when the equipment is at a standstill. Optical subassemblies can be severely damaged in a short time if the purge air supply fails.

> ***NOTICE:***
> The user must ensure that:
> - ► The purge air supply runs reliably and continuously
> - ► Failure of the purge air supply is immediately detected (e.g. by using pressure monitors)
> - ► Optical subassemblies are removed from the duct if the purge air supply fails and the duct opening is closed off (e.g. with a flange cover)

Preventive measures for operating safety

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

Recognizing malfunctions

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

- Warning displays (e.g. heavy contamination)
- Significant drifts in measured results
- Increased power consumption
- Higher temperatures of system components
- Monitoring devices triggering
- Smells or smoke emission

Avoiding damage

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

DUSTHUNTER SF100

2 Product Description

Measuring principle, measured variables
Device components
Device configuration

2.1 Measuring principle, measured variables

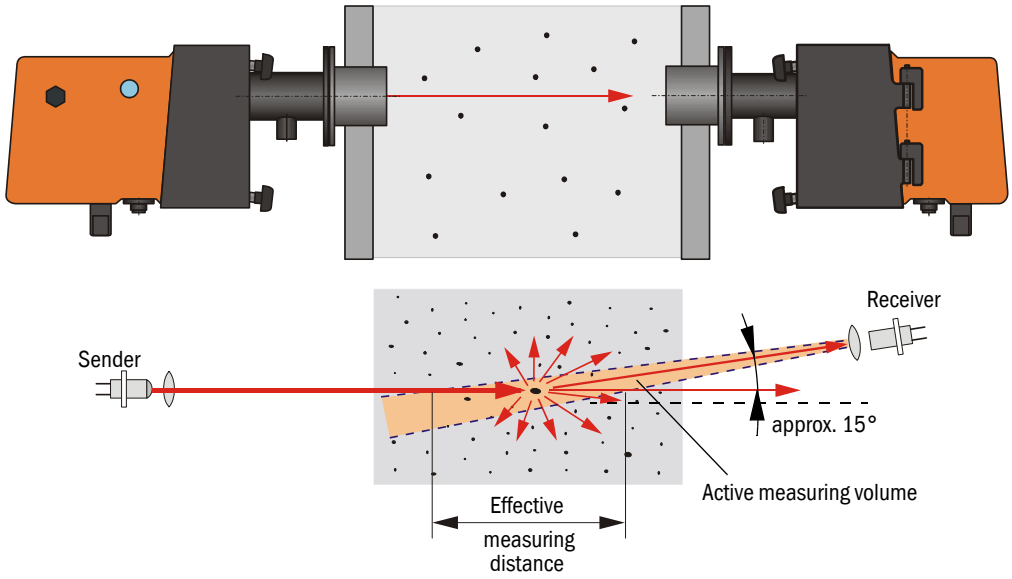
2.1.1 Functional principle

The measuring system operates as scattered light measuring device with forward dispersion.

A laser diode beams the dust particles in the gas flow with modulated light in the visual range (wavelength approx. 650 nm). A highly sensitive receiver registers the light scattered by the particles, amplifies the light electrically and feeds it to the measuring channel of a microprocessor as central part of the measuring, control and evaluation electronics. The measuring volume in the gas duct is defined through the intersection of the sender beam sent and the receive aperture. The effectice measuring distance depends on the design of the receiver (→ p. 19, §2.2.2, → p. 108, §7.1).

In the same manner as for transmission measurement, continuous monitoring of the sender output registers smallest changes in brightness of the light beam sent which then serves to determine the measurement signal.

Figure 1 Measuring principle



Determining the dust concentration

Measured scattered light intensity (SL) is proportional to dust concentration (c). Scattered light intensity not only depends on the number and size of particles but also on the optical characteristics of the particles and therefore the measuring system must be calibrated using a gravimetric comparison measurement for exact dust concentration measurement. The calibration coefficients determined can be entered directly in the measuring system as

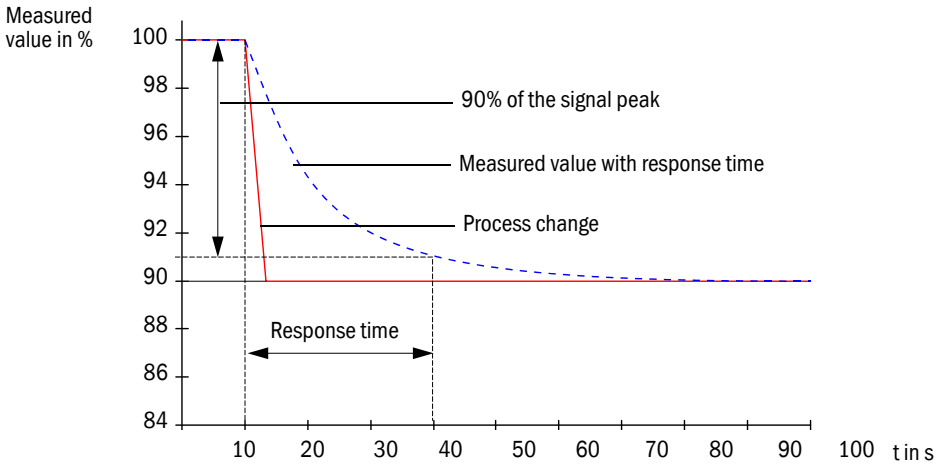
$$c = cc2 \cdot SL^2 + cc1 \cdot SL + cc0$$

(Entry → p. 72, §4.4.7; standard factory setting: cc2 = 0, cc1 = 1, cc0 = 0).

2.1.2 Response time

The response time is the time required to attain 90% of the signal peak after a sudden change in the measurement signal. It can be set anywhere between 1 and 600 s. As the response time increases, transient measured value fluctuations and interruptions are damped stronger and stronger which "smoothes out" the output signal.

Figure 2 Response time



2.1.3 Function control

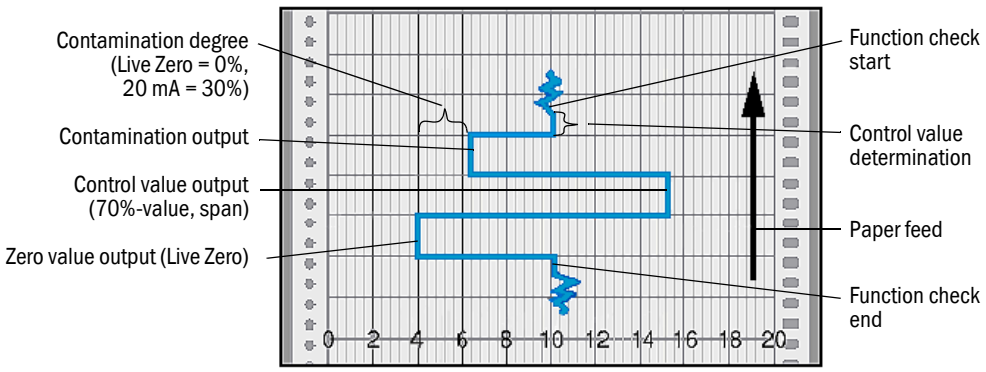
A function check can be triggered at fixed intervals as from a definable starting timepoint for an automatic function check of the measuring system. The setting can be made using the SOPAS ET operating program (→ p. 67, §4.4.3). Any unallowed deviations from normal behavior that may occur are signaled as errors. A function check triggered manually can help localize possible error causes should a device malfunction occur.

Further information → Service Manual

A function check comprises:

- Approx. 30 s measurement of contamination on optical interfaces, zero and control value
  The measurement time depends on the increase in contamination value (change > 0.5% → measurement is repeated up to 2 times).
- Every 90 s (standard value) output of values determined (output duration is configurable, → p. 67, §4.4.3).

Figure 3 Function check output on a plotter



- The duration can be set as a parameter (→ p. 67, §4.4.3).
- The analog output must be activated to output control values on the analog output (→ p. 67, §4.4.3).
- The value measured last is output on the analog output during control value determination.
- If the control values are not output on the analog output, the current measured value is output when control value determination has completed.
- During a function check the relay 3 (→ p. 42, Fig. 26) is activated and the green LED in the control window of the sender/receiver flashes (→ p. 19, Fig. 7).
- A function check is not started when the measuring system is in "Maintenance" mode.
- "Function control" is displayed on the LC-Display of the control unit during the function check.
- If the start timepoint or cycle interval are changed, a function check timed between parameter setting and new start timepoint is still carried out.
- Changes to the interval time are first effective after the next start timepoint.

Zero value measurement

The laser diode is switched off for zero point control so that no signal is received. This means possible drifts or zero point deviations are detected reliably in the overall system (e.g. due to an electronic defect). An error signal is generated when the "zero value" is outside the specified range.

Control value measurement (Span test)

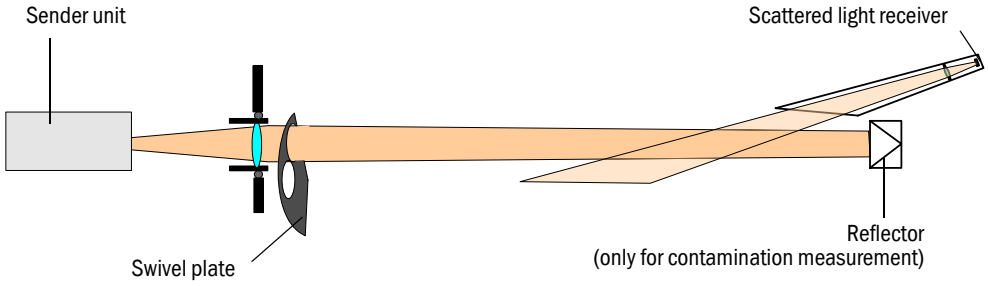
Laser beam intensity changes between 70 and 100% during control value determination. The light intensity received is compared against the standard value (70%). The measuring system generates an error signal for deviations greater than ±2%. The fault message is cleared again when the next function check runs successfully. The control value is determined with high precision through statistical evaluation of a high number of intensity changes.

The value calculated theoretically (70%) is output for very low dust concentrations (< approx. 1 mg/m³).

Contamination measurement

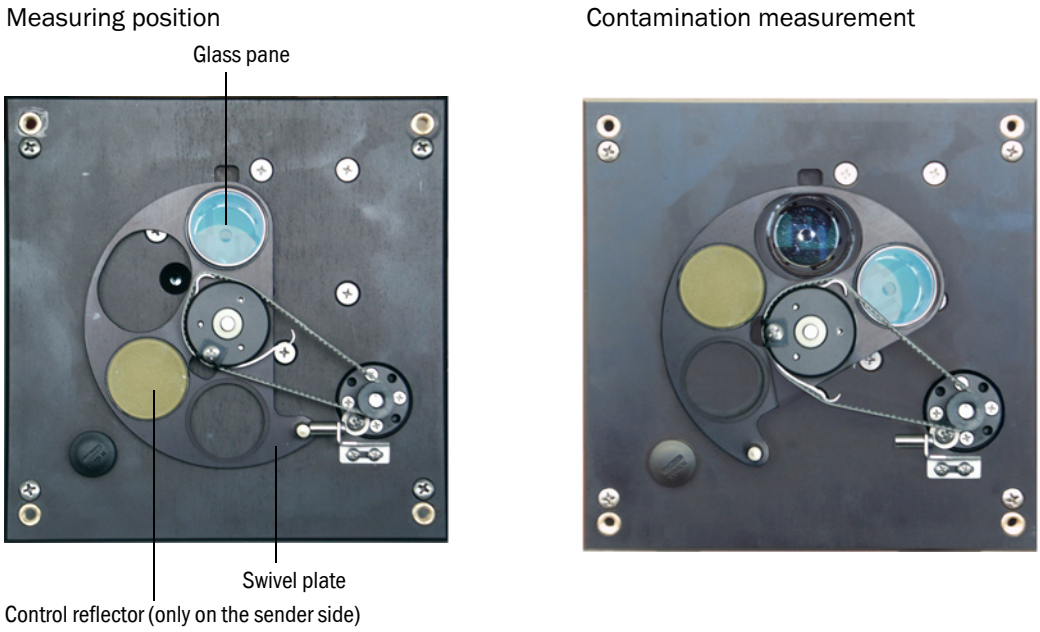
The glass panes positioned in the sender beam during normal measurement are swiveled away during contamination determination. The measured value determined and the value defined as factory setting are used to calculate a control factor. This serves to completely compensate any contamination that occurs.

Figure 4 Contamination measurement principle



For contamination values < 30% a value between live zero and 20 mA proportional to contamination is output on the analog output. If this value is exceeded, the status "Malfunction" is output (on the analog output the error current; → p. 66, §4.4.2, → p. 68, §4.4.4).

Figure 5 Swivel plate settings on the sender unit

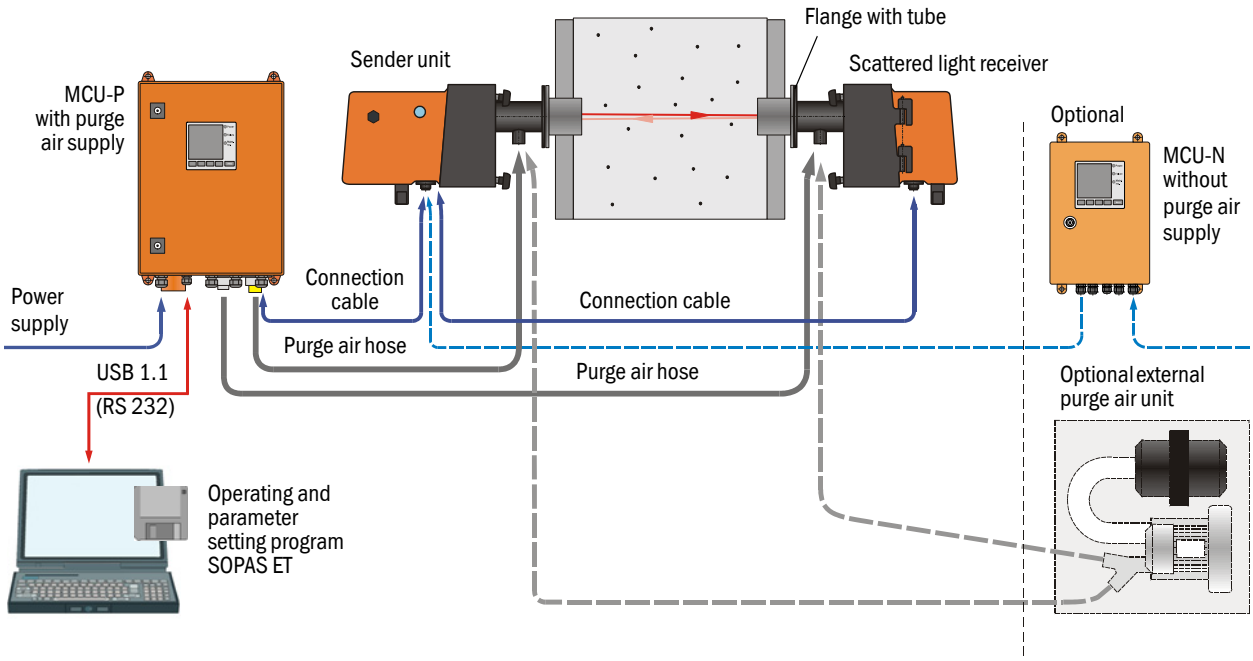


2.2 Device components

Measuring system DUSTHUNTER SF100 comprises the components (→ Fig. 6):

- Sender unit DHSF-T
- Connection cable to connect the sender unit to the control unit (lengths 5 m, 10 m)
- Scattered light receiver DHSF-R
- Connection cable to connect the scattered light receiver to the sender unit (lengths 5 m, 10 m, 20 m)
- Flange with tube
- Control unit MCU to control, evaluate and output the data of the sender unit(s) connected via the RS485 interface
  - With integrated purge air supply, for internal duct pressure -50 ... +2 hPa
  - Without purge air supply, therefore additionally required:
- Optional external purge air unit, for internal duct pressure -50 ... +30 hPa
- Purge air hose DN25 for supply by control unit MCU-P

Figure 6 DUSTHUNTER FS100 device components



Communication between sender unit and MCU

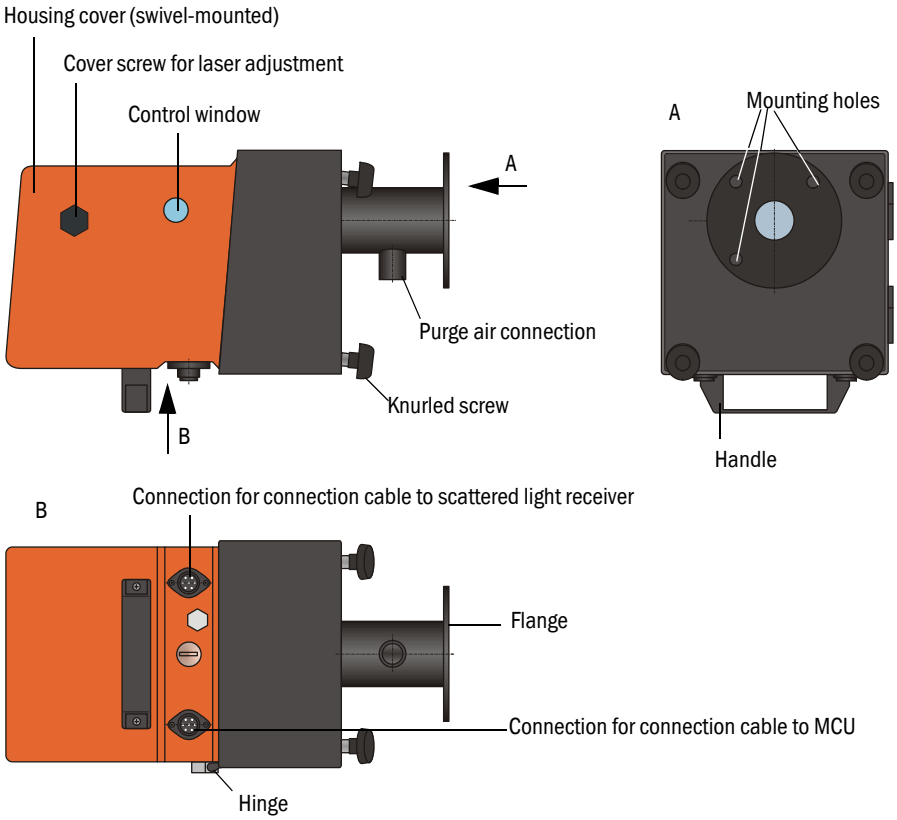
As standard, each sender unit is connected to one control unit via the connection cable.

2.2.1 Sender unit

The sender unit contains the optical and electronic subassemblies to send the light beam as well as to process and evaluate the signals. Data transfer to and voltage supply (24 V DC) from the control unit run via a shielded cable with 4 wires with plug-in connector. An RS485 interface is available for service purposes. Clean air to cool the device and keep the optical surfaces clean is fed via a purge air connection.

The sender unit is fastened to the duct with a flange with tube (→ p. 18, Fig. 6).

Figure 7 Sender unit DHSF-T



The alignment of the optical axes as well as the current device state (operation/ malfunction) are shown in the control window.

The housing with fitted sender unit can be swiveled to the side after the knurled screws have been loosened. Optics, electronics and mechanical components can then be easily accessed for maintenance work.

For correct measurement of the scattered light intensity, the laser beam can be readjusted to various duct diameters after the cover screw has been loosened.

2.2.2 Scattered light receiver

Two versions are available to adapt to different internal duct diameters. A type code identifies the versions:

Scattered light receiver: DHSF-Rx

Measuring path:

- 0: Short (0.5 ... 3 m)
- 1: Long (2.5 ... 6 m)

Figure 8 Scattered light receiver for short measuring paths

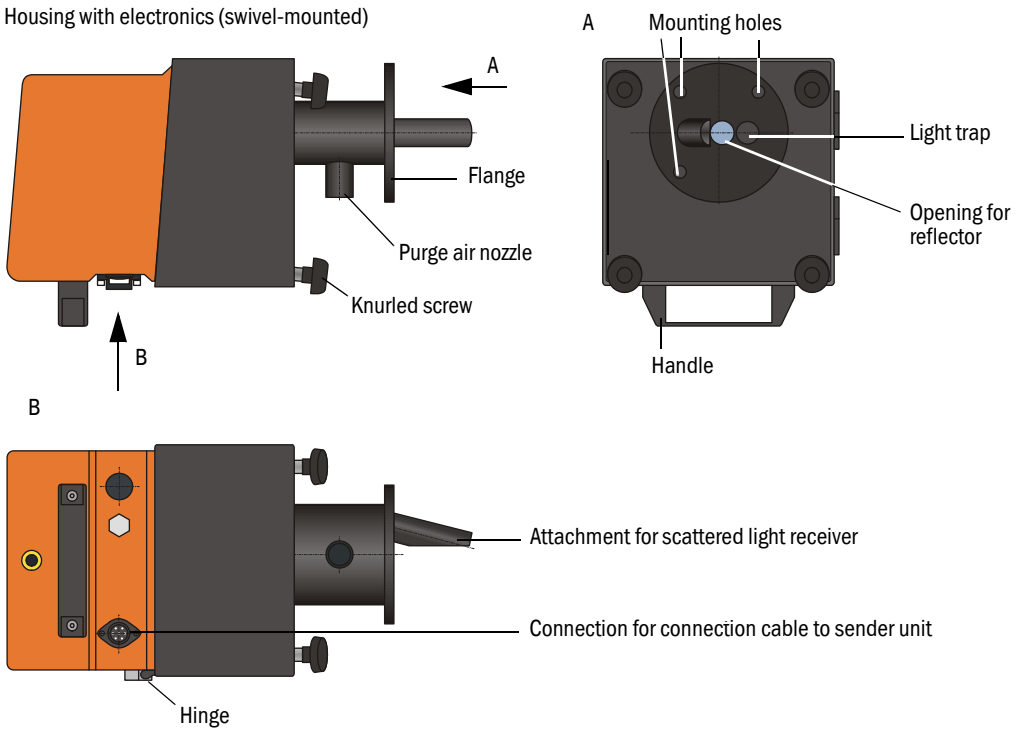
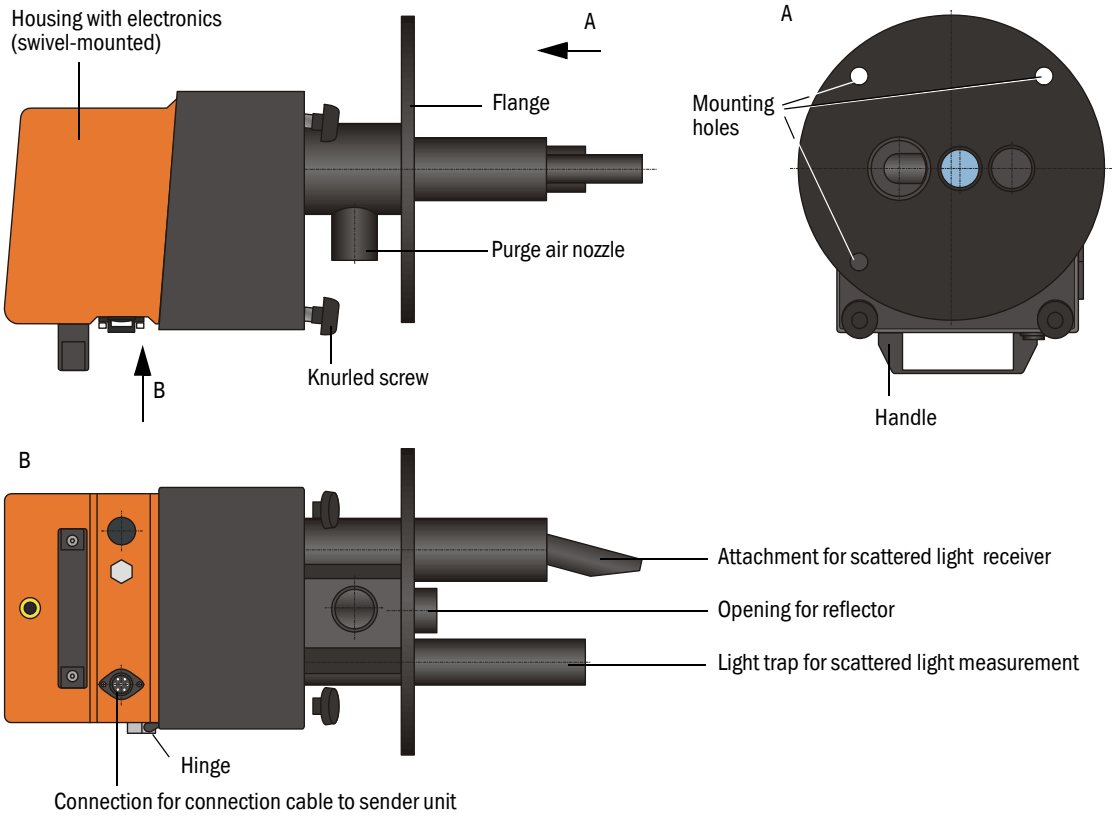


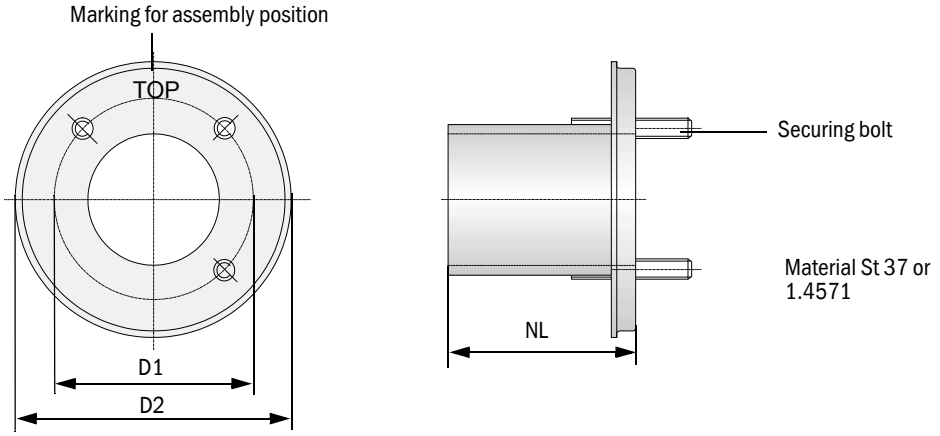
Figure 9 Scattered light receiver for long measuring paths



2.2.3 Flange with tube

The flanges with tube serve to fit the sender unit and scattered light receiver on the duct wall. These are available in various sizes (partial circle diameter D1), types of steel and graded nominal lengths (NL). Selection depends on the components to be fitted (→ active measuring path), wall and isolation thickness of the duct wall (→ nominal length) and the duct material (→ Fig. 10).

Figure 10 Flange with tube



2.2.4 MCU control unit

The control unit has the following functions:

- Control of the data traffic and processing of the measuring unit data connected via the RS485 interface
- Signal output via analog output (measured value) and relay outputs (device status)
- Signal input via analog and digital inputs
- Power supply for the connected measuring unit via 24 V switch-mode power supply with wide range input
- Communication with higher level control systems via optional modules

Equipment and device parameters can be set easily and conveniently via a USB interface using a PC and a user-friendly operating program. The parameters are stored reliably even in the case of a power failure.

The control unit has a sheet steel housing as standard.

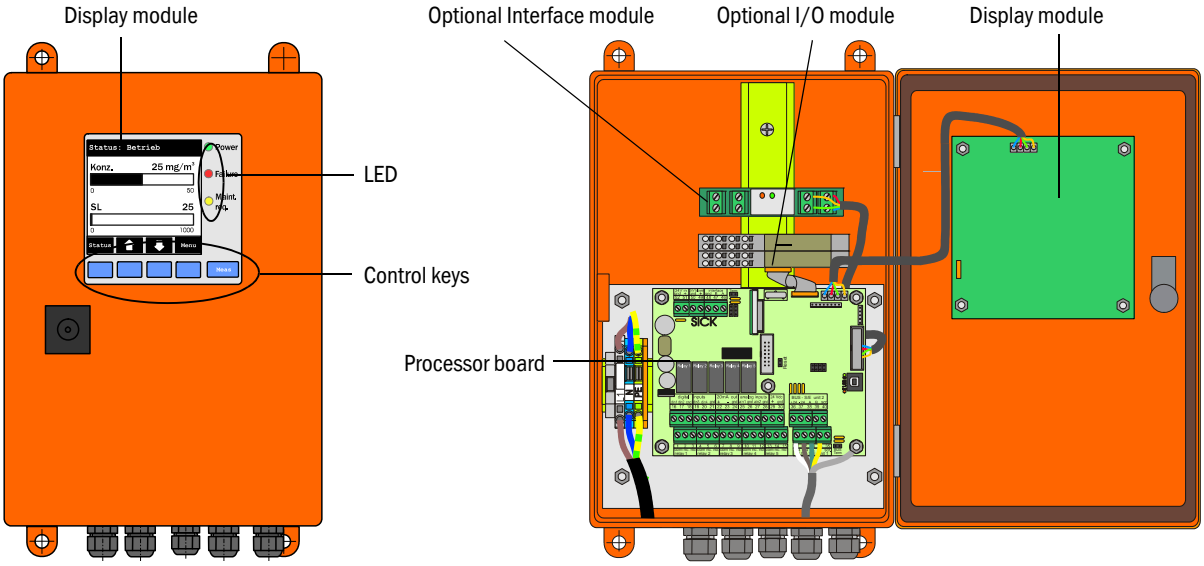
Standard interfaces

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
3 outputs 0/2/4...22 mA (electrically isolated, active) to output: ● Dust concentration SL a.c. ● Dust concentration SL s.c. ● Scattered light intensity Resolution 12 bits	2 inputs 0...20 mA (Standard; without electric isolation) Resolution 10 bits	5 changeover contacts (48 V 1A) to output status signals: ● Operation/malfunction ● Maintenance ● Function check ● Maintenance request ● Limit value	4 inputs to connect potential-free contacts (e.g. to connect a maintenance switch or trigger a function check)	● USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and software updates. ● RS485 for sensor connection

Versions

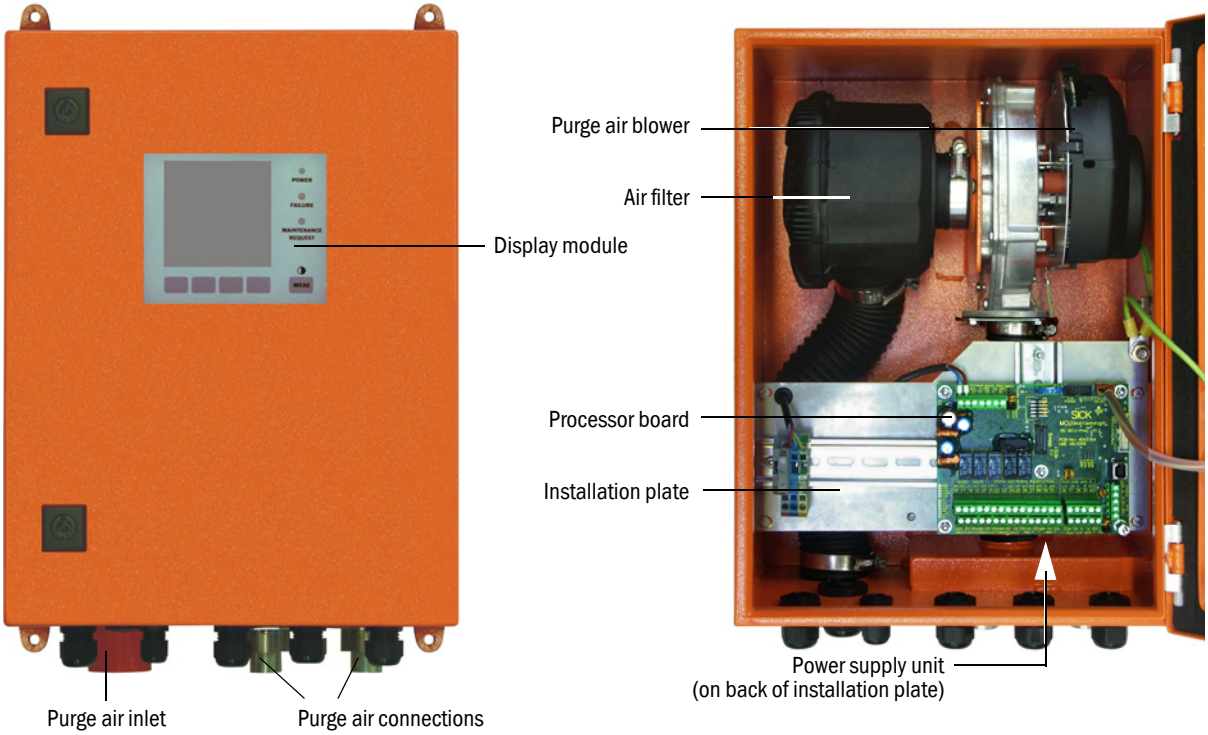
- Control unit MCU-N without purge air supply

Figure 11 Control unit MCU-N with options



- Control unit MCU-P with integrated purge air supply
  This version is also fitted with a purge air blower, air filter and purge air connection to connect the purge air hose to the sender unit.

Figure 12 Control unit MCU-P with integrated purge air supply



The purge air hose (standard lengths 5 and 10 m (→ p. 118, §7.3.3)) is a separate part of the measuring system (must be ordered separately).

Display module

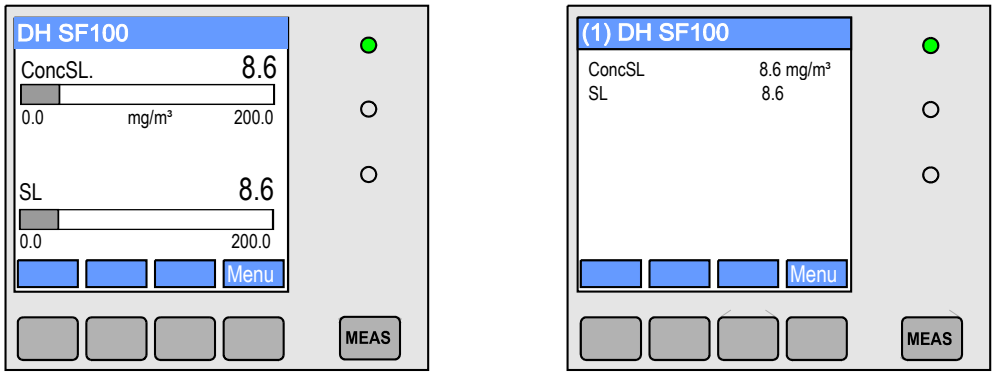
Module to display measured values and status information of the connected sender unit, selection via control keys.

- Displays

Type		Display
LED	Power (green)	Voltage supply OK
	Failure (red)	Function fault
	Maintenance request (yellow)	Maintenance requirement
LC display	Graphic display (main screen)	– Dust concentration – Scattered light intensity
	Text display	2 measured values (see graphic display) and 8 diagnosis values (→ p. 85, Fig. 76)

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

Figure 13 LC-Display with graphic (left) and text (right) display



- 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

I/O module

Apart from the standard analog output, the DUSTHUNTER SF100 has an Analog module with two outputs 0/4 ... 22 mA (max. load 500 Ω) integrated to output further measured variables. The module is plugged onto a module carrier connected to the processor board with a special cable.

Options

1 1x Analog Input module with two inputs 0/4 ... 22 mA to read-in values from external sensors (gas temperature, internal duct pressure, moisture, O_2) to calculate the dust concentration in standard state.

   An additional module carrier docked to the existing ones is required for this option.

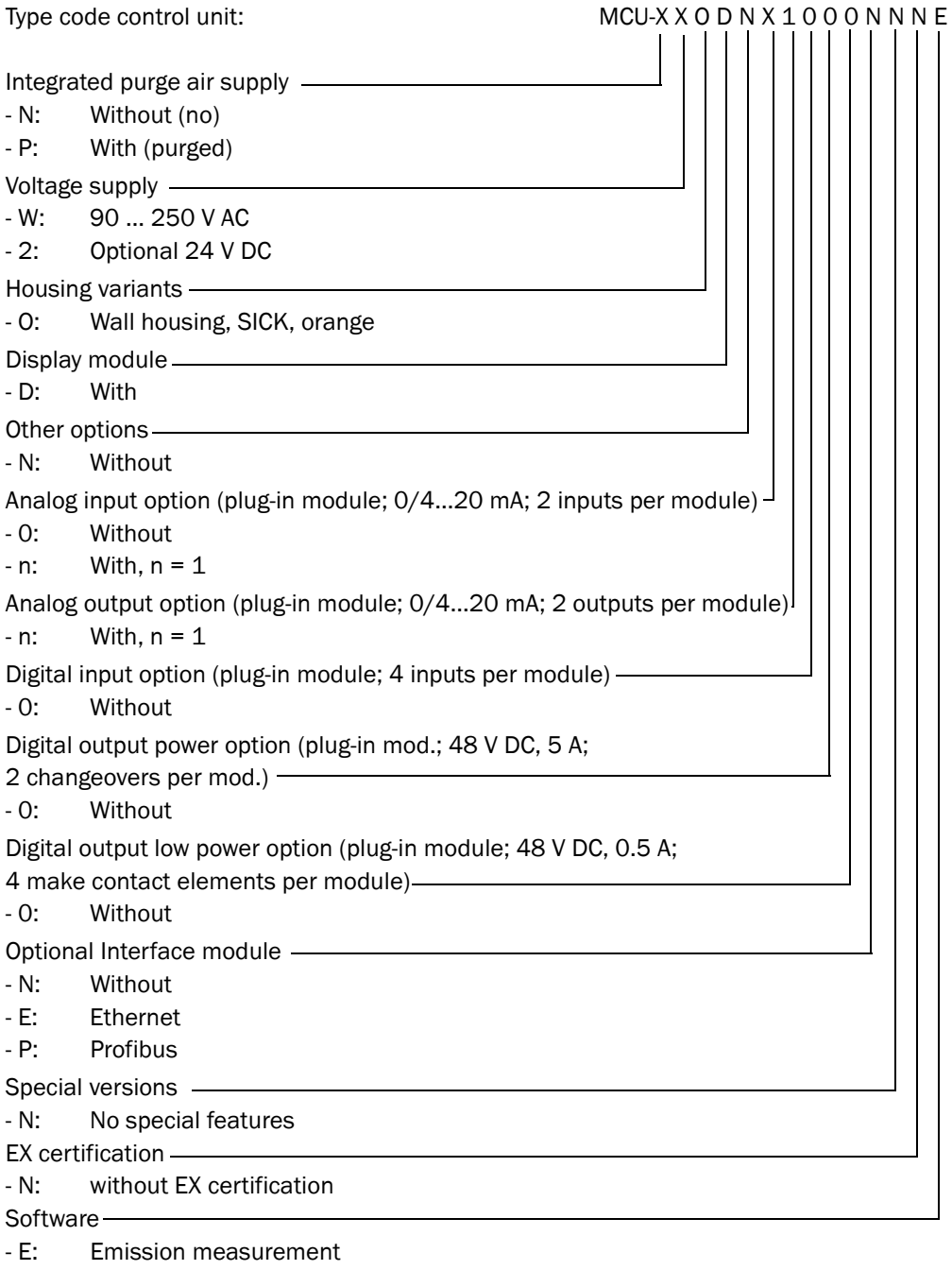
2 Interface module

   Module to pass on measured values, system status and service information to higher level control systems, optionally for Profibus DP V0 or Ethernet, to plug onto hat rails. A corresponding cable serves to connect the module to the connection board.

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

Type code

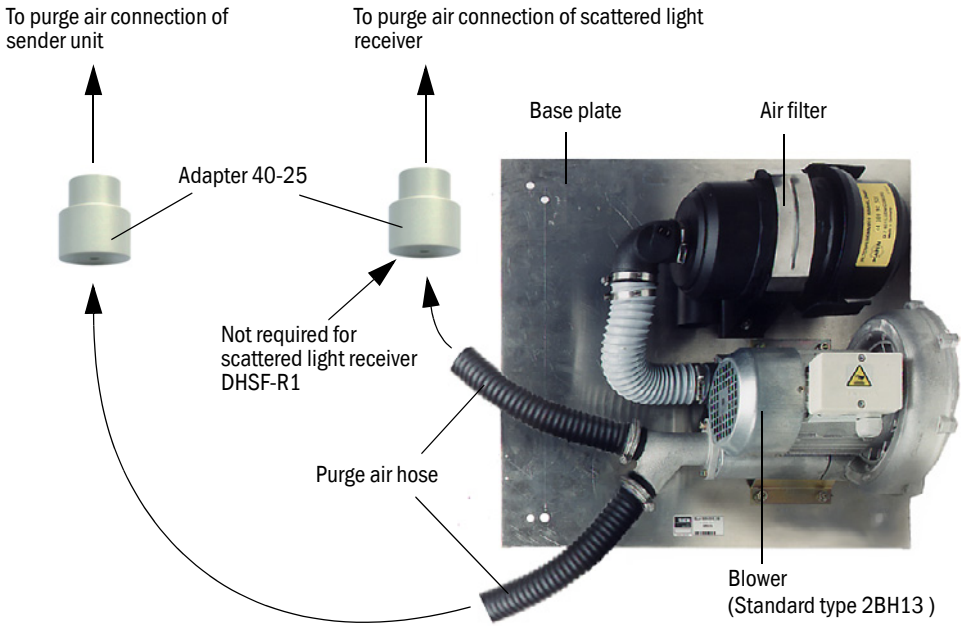
The following type code defines the various configuration options in the same manner as for sender units and scattered light receivers:



2.2.5 Optional external purge air unit

The control unit with integrated purge air supply cannot be used when the internal duct pressure is greater than +2 hPa or when using the DHSF-R1 scattered light receiver for long measuring paths. Use the optional external purge air unit in this case. It has a powerful blower and can be used for excess pressure in the duct up to 30 hPa. The scope of delivery includes a purge air hose with 40 mm nominal diameter (length 5 m or 10 m).

Figure 14 Optional external purge air unit with adapter



A weatherproof cover is available for use outdoors (→ p. 117, Fig. 7.2.6).

2.2.6 Installation accessories (order separately)

Purge air supply

Component	Supply by MCU-P control unit			Supply by external purge air option		
	for sender unit	for scattered light receiver		for sender unit	for scattered light receiver	
		DHSF-R0	DHSF-R1		DHSF-R0	DHSF-R1
Purge air hose DN25	1x	1x	-	-		
Purge air hose DN40	-		1x	1x	1x	1x
Adapter 40-25	-			1x	1x	-

Purge air hoses can have different lengths.

Connection cables

One cable each is necessary for the connection of the sender unit to the MCU and the scattered light receiver to the sender unit. The respective lengths are 5 or 10 m (for connecting the scattered light receiver to the sender unit also 20 m).

Weatherproof covers

Weatherproof covers are available for sender units and scattered light receivers used outdoors (→ p. 117, Fig. 99).

2.2.7 Test equipment for linearity test

A linearity test can serve to check the correct function of transmission measurement (see Service Manual). In this case, filter glasses with defined transmission values are positioned in the beam path and the values compared against those measured by the DUSTHUNTER SF100. Compliance within the allowed tolerance means the measuring system is working correctly. The filter glasses with holder required for the check are deliverable including a carrying case.

2.3 Device configuration

The device components required for a measuring system depend on the respective application conditions. The following Table should serve to assist you in your selection.

Sender unit, scattered light receiver, flange with tube

> ***NOTICE:***
> The scattered light receiver may not look out of the flange tube. The at most possible wall and isolation thickness is limited with that on the values listed in the table.

Distance flange - flange	Maximum wall and isolation thickness	Sender unit	Scattered light receiver	Flange with tube		Cable for scattered light receiver
				Sender unit	Scattered light receiver	
0,5 ... 3 m	40 mm	DHSF-T	DHSF-R0	Flange with tube k100 NL 130/240/500 mm	Flange with tube k100 NL 110 mm	x
2,5 ... 6 m	270 mm		DHSF-R1		Flange with tube k225 NL 350 mm	

Voltage and purge air supply

Internal duct pressure	Distance MCU - sender unit or scattered light receiver	Connection and supply components	
		Purge air	Voltage
up to +2 hPa	max. 3 m	MCU-P + purge air hose DN 25 (to sender unit) and purge air hose DN 40 (to scattered light receiver)	
> +2 hPa		Optional external purge air unit + adapter 40-25 (for sender unit)	MCU-N

DUSTHUNTER SF100

3 Assembly and Installation

Project planning
Assembly
Installation

3.1 Project planning

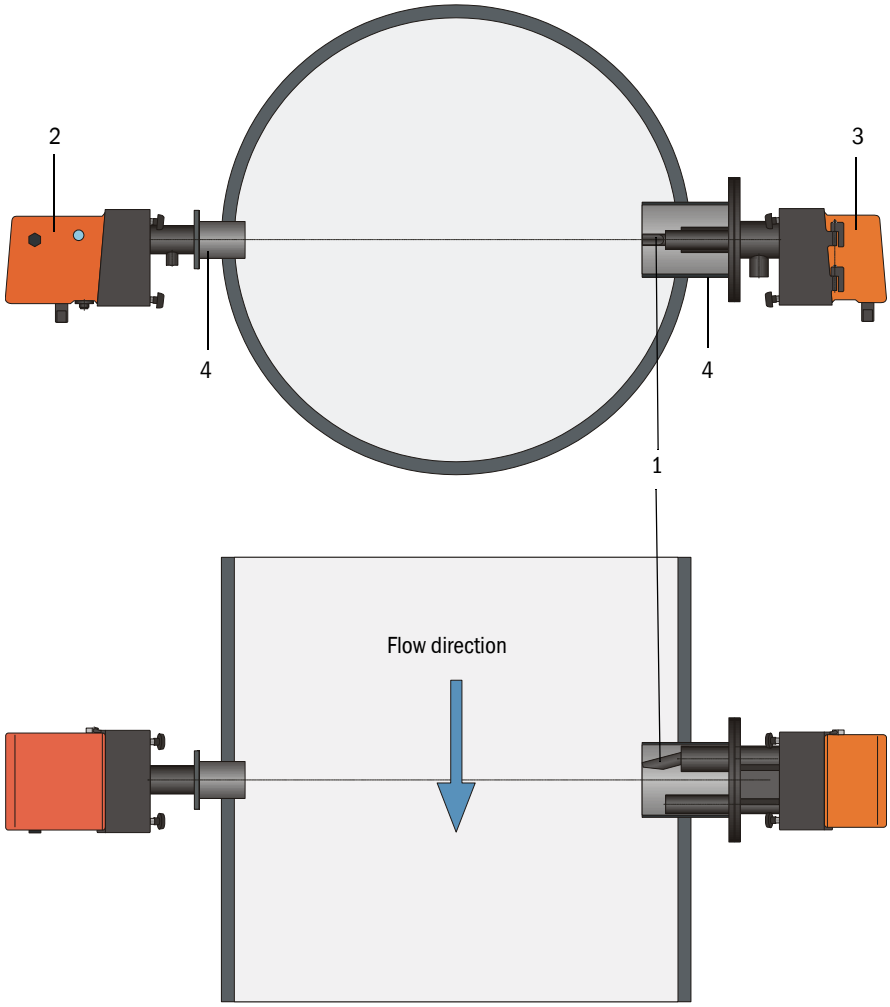
The following Table provides an overview of the project planning work necessary as prerequisite for trouble-free assembly and subsequent device functionality. You can use this Table as a Checklist and check off the completed steps.

Task	Requirements		Work step	☐
Determine the measuring and installation location for the device components	Inlet and outlet paths according to DIN EN 13284-1 (inlet at least 5x hydraulic diameter d_h, outlet at least 3x d_h; distance to stack opening at least 5x d_h	For round and square ducts: d_h = duct diameter For rectangular ducts: d_h = 4x cross-section divided by circumference	– Follow specifications for new equipment – Select best possible location for existing equipment; – For too short inlet/outlet paths: Inlet path > outlet path	☐
	– Uniform flow distribution – Representative dust distribution	Whenever possible, no deflections, cross-section variations, feed and drain lines, flaps or fittings in the area of the inlet and outlet paths	If conditions cannot be ensured, define flow profile according to DIN EN 13284-1 and select best possible location	☐
	Assembly position for sender unit and scattered light receiver	Do not fit vertically on horizontal or slanted ducts; max. measuring axis angle to horizontal 45°	Select best possible location	☐
	Accessibility, accident prevention	The device components must be easily and safely accessible	Provide platforms or pedestals as required	☐
	Installation free of vibrations	Acceleration < 1 g	Eliminate/reduce vibrations through suitable measures	☐
	Ambient conditions	Limit values according to Technical Data	If necessary: – Provide weatherproof covers/sun protection – Enclose or lag device components	☐
Select the purge air supply	Sufficient primary purge air pressure depending on internal duct pressure	– Up to +2 hPa, control unit with integrated purge air supply – Above +2 hPa to +30 hPa, optional external purge air unit	Select supply type	☐
	Clean intake air	Whenever possible, low amount of dust, no oil, moisture or corrosive gases	Select best possible location for air intake Determine required purge air hose length	☐
Select device components	Measuring path, duct wall thickness with insulation	Sender unit, scattered light receiver, flange with tube	– Select components according to Configuration Table (→ p. 27, §2.3); – if necessary, plan additional measures to fit the flange with tube (→ p. 32, §3.2.1)	☐
	Internal duct pressure	Type of purge air supply		
	Fitting locations	Cable and purge air hose lengths		
Plan calibration openings	Access	Easy and safe	Provide platforms or pedestals as required	☐
	Distances to measuring level	No mutual interference between calibration probe and measuring system	Plan sufficient distance between measuring and calibration level (approx. 500 mm)	☐
Plan power supply	Operating voltage, power requirements	According to Technical Data (→ p. 108, §7.1)	Plan adequate cable cross-sections and fuses	☐

Installation of sender unit and scattered light receiver at horizontal pipes

Sender unit and scattered light receiver must be installed according to Fig. 15 to prevent that particles come by the flow into the attachment (1) of the scattered light receiver and contaminate the optics with that. The flanges with tube (4) have to be welded correspondingly.

Figure 15 Installation of sender unit and scattered light receiver at horizontal pipes (view for long measuring paths)



3.2 Assembly

Carry out all assembly work onsite. This includes:

- Fitting the flange with tube
- Fitting the control unit
- Fitting the optional external purge air unit.

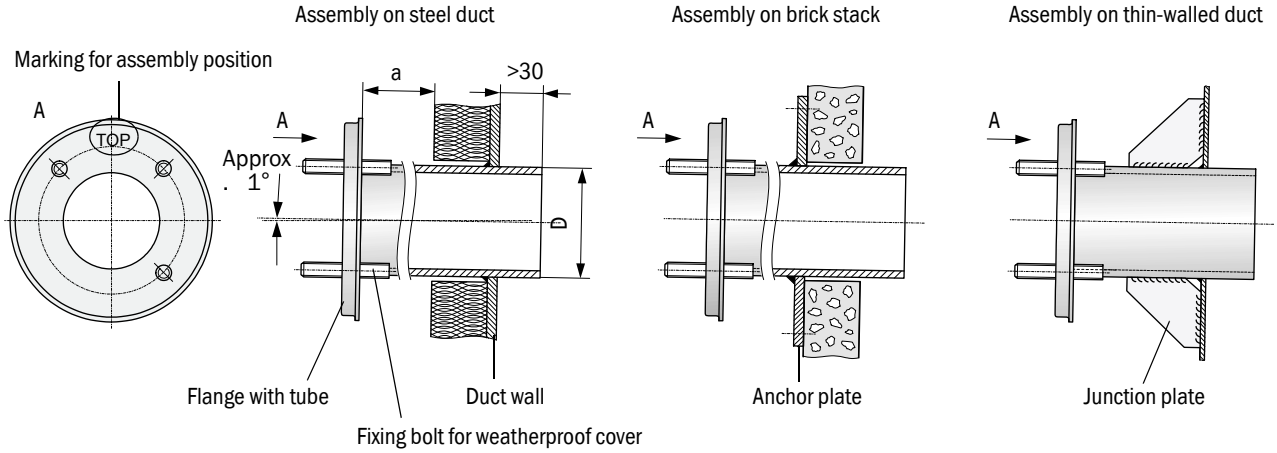
WARNING:

- Observe the relevant safety regulations as well as the safety notices in Section 1 during all assembly work.
- Only carry out assembly work on equipment with hazard potential (hot or aggressive gases, higher internal duct pressure) when the equipment is at a standstill.
- Take suitable protection measures against possible local hazards or hazards arising from the equipment.

All dimensions specified in this Section are shown in mm.

3.2.1 Fitting the flange with tube

Figure 16 Fitting the flange with tube



Component	D
DHSF-T sender unit	Ø 76
DHSF-R0 scattered light receiver	
DHSF-R1 scattered light receiver	Ø 159

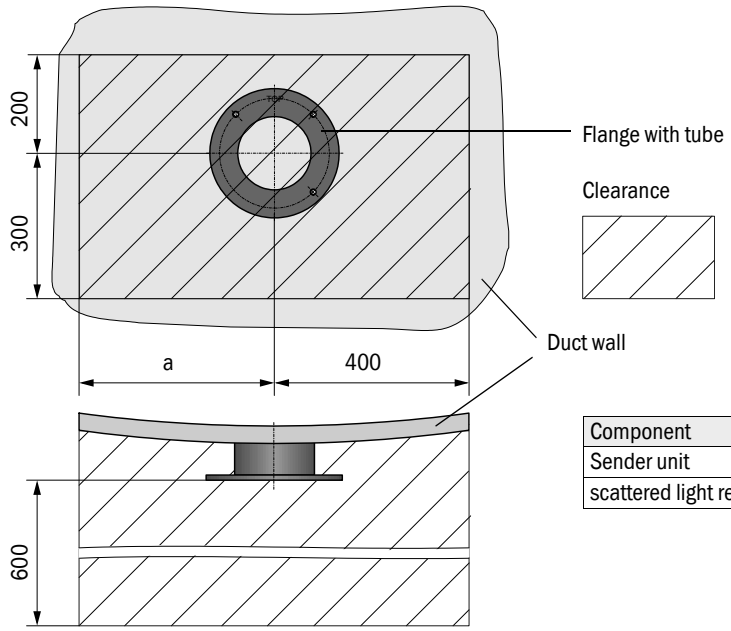
Dimension a must be large enough so that a weatherproof cover can be fitted easily when necessary (approx. 40 mm).

Work to be performed

► Measure the fitting location and mark the assembly location.

Leave enough clearance around the flange with tube to fit the sender unit and scattered light receiver (→ Fig. 17).

Figure 17 Clearance for sender unit and scattered light receiver (dimensions in mm)



Component	a
Sender unit	400 mm
scattered light receiver	350 mm

► Remove insulation (when fitted)

► Cut suitable openings in the duct wall; bore large enough holes in brick or concrete stacks (flange tube diameter (→ p. 113, Fig. 94).

> ***NOTICE:***
> ⊗ Do not let separated pieces fall into the duct.

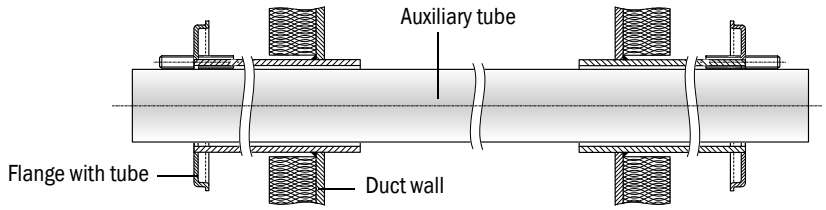
► Insert the flange with tube in the opening so that the "Top" marking points upwards (→ p. 32, Fig. 16).

► Align the flanges with tube roughly to each other and weld on with a few welding spots (on the anchor plate for brick or concrete stacks, insert junction plates for thin-walled ducts → p. 32, Fig. 16).

► Use a suitable tube (for narrower ducts) or the adjusting device from SICK to align the flange tubes to each other exactly after welding (→ p. 34, Fig. 18); axes deviation to each other max. ± 1°.

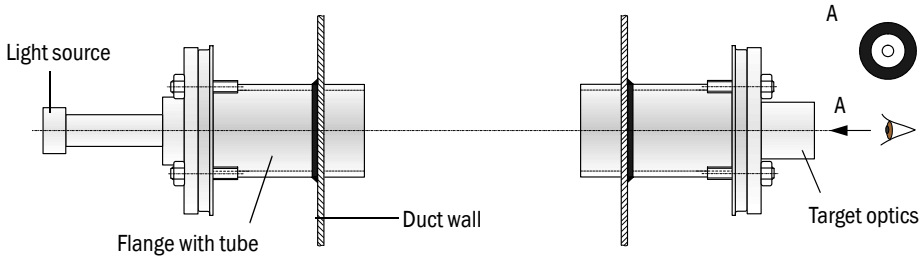
Figure 18 Aligning the flange with tube

Aligning with auxiliary tube



Aligning with adjusting device

(→ p. 118, §7.3.6; also available on loan)



Use the target optics to align the flange so that the light spot of the lamp appears in the center of the target optics.

- ► Finally, weld the flange tubes tight all-round and, at the same time, check for exact alignment and correct when necessary. When using the adjusting device, assemble both the flange plate with light source and the flange plate with target optics before welding the second flange tube.
- ► Close off the flange opening after fitting to prevent gas escaping.

3.2.2 Fitting the MCU control unit

Fit the control unit in a protected location that is easily accessible (→ Fig. 19). Observe the following points during fitting:

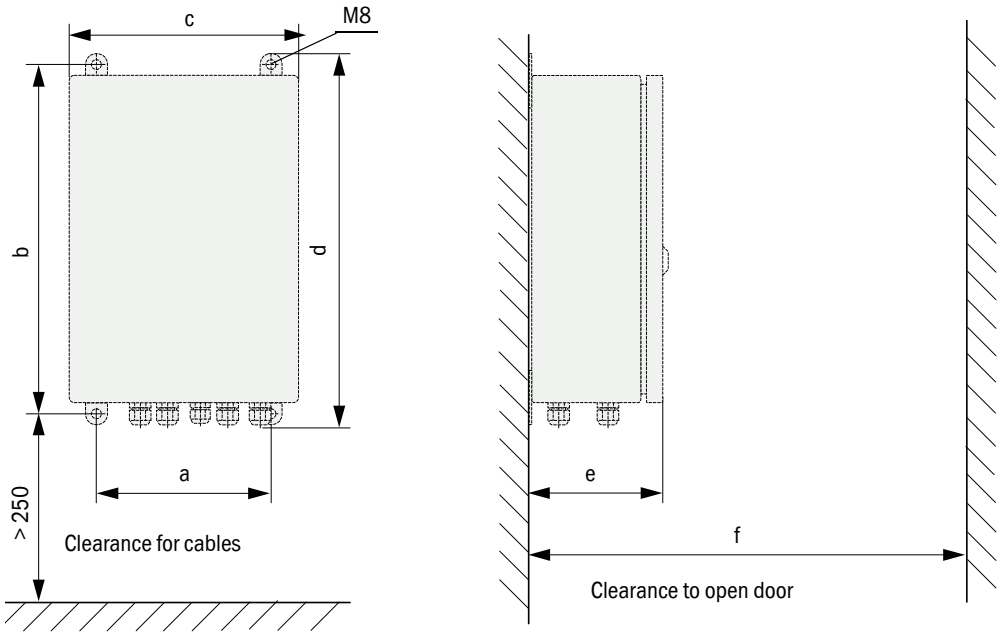
- Maintain the ambient temperature according to the Technical Data; take possible radiant heat into consideration (shield when necessary).
- Protect against direct sunlight.
- Whenever possible, choose an assembly location with minimum vibrations; dampen any vibrations when necessary.
- Leave enough clearance for cables and opening the door.

Using a suitable cable (→ p. 38, §3.3.1), the MCU-N control unit (without integrated purge air supply) can be located up to 1000 m away from the sender unit. We therefore recommend fitting the MCU in a control room (measuring station or similar) to ensure free access to the MCU. This considerably simplifies communication with the measuring system in order to set parameters or to locate malfunction or error causes.

It is advantageous to provide weather protection (tin roof or similar), to be made onsite, for use outdoors.

Assembly dimensions

Figure 19 MCU assembly dimensions



Dimension	Control unit type	
	MCU-N	MCU-P
a	160	260
b	320	420
c	210	300
d	340	440
e	125	220
f	> 350	> 540

MCU-N:Control unit without purge air supply
MCU-P:Control unit with purge air supply
(→ p. 21, §2.2.4)

Requirements when using the MCU-P control unit

The following is applicable in addition to the general specifications:

- Install the MCU-P control unit at a location with clean air whenever possible. The air intake temperature must correspond to specifications in the Technical data (→ p. 108, §7.1). In unfavorable conditions, lay an air intake hose to a location with better conditions.
- The purge air hoses to the sender unit and scattered light receiver should be as short as possible.
- Whenever possible, lay the purge air hoses so that no water can collect.
- We recommend using the optional external purge air unit when the sender unit and scattered light receiver are more than 10 m away from the control unit.

3.2.3 Fitting the optional external purge air unit

Consider the following points when selecting the assembly location:

- Install the purge air unit at a location with clean air whenever possible. The air intake temperature must correspond to specifications in the Technical data (→ p. 108, §7.1). In unfavorable conditions, lay an air intake hose or pipe to a location with better conditions.
- The fitting location must be easily accessible and meet all safety regulations.
- Install the purge air unit only as far as necessary below the flange with tube for the sender unit and scattered light receiver so that the purge air hoses can be laid downwards (avoids water collecting).
- Provide sufficient clearance to exchange the filter element.
- Provide sufficient space to attach and remove the weatherproof cover when installing the purge air unit outdoors → Fig. 20).

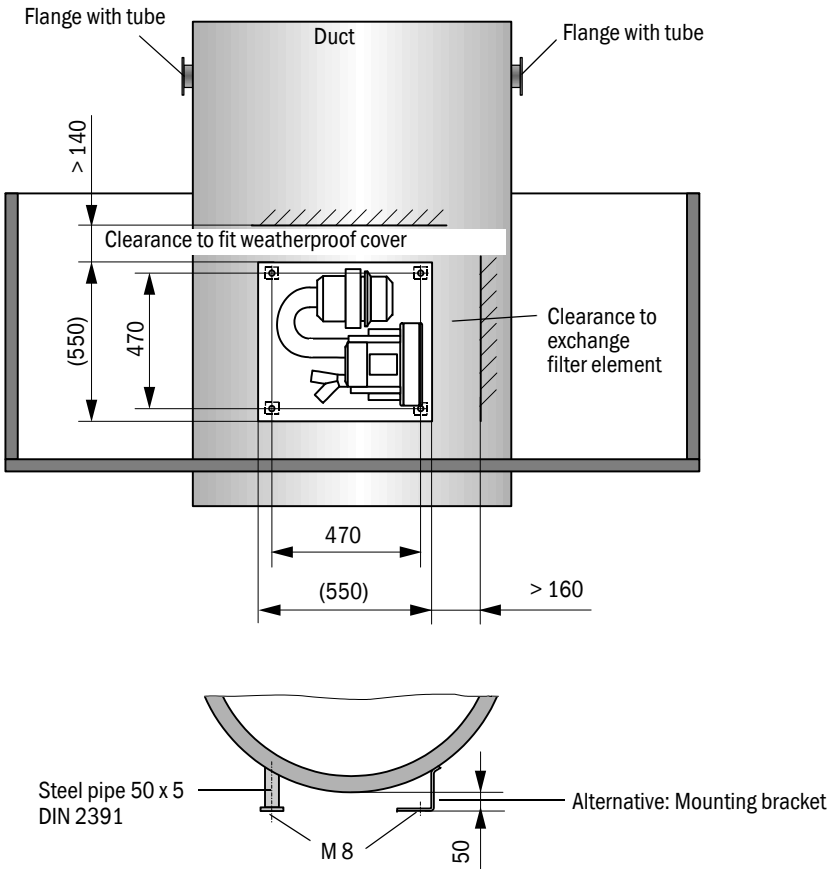
Assembly work

► Prepare holder (→ Fig. 20).

► Fasten purge air unit with 4 M8 screws.

► Check whether the filter element is fitted in the filter housing otherwise fit when necessary.

Figure 20 Purge air unit layout and assembly dimensions (dimensions in mm)



3.2.4 Fitting the weatherproof cover

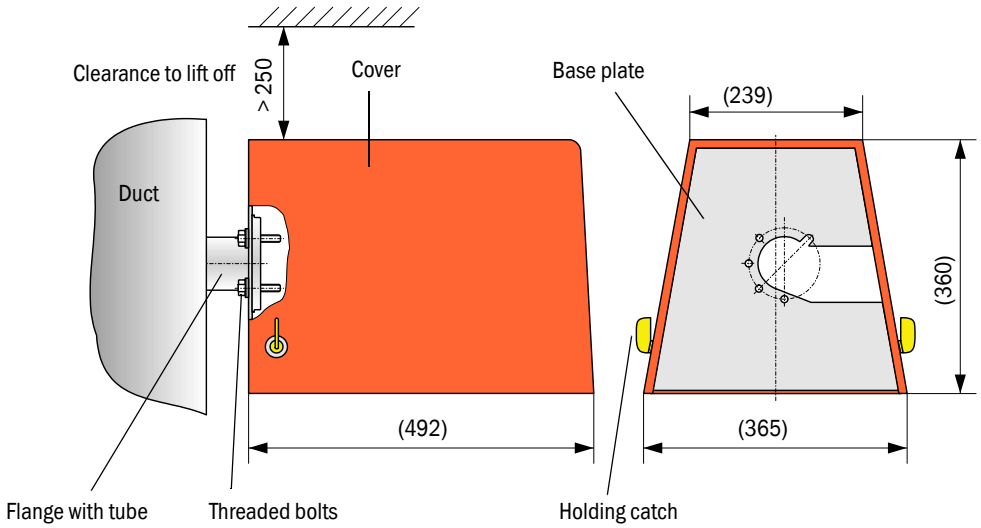
Weatherproof cover for analyzer

This weatherproof cover serves to protect the sender unit and scattered light receiver (see → p. 117, Fig. 99). It comprises a base plate and a cover.

Assembly:

- ► Push the base plate sideways onto the flange with tube, slot onto the threaded bolts of the duct-side surface of the flange plate and screw tight (→ Fig. 21).
- ► Put the cover on from above.
- ► Insert the side holding catches into the counterpieces, twist and lock in.

Figure 21 Fitting the weatherproof cover for analyzer (dimensions in mm)



Weatherproof cover for external purge air unit

The weatherproof cover (→ p. 117, Fig. 98) comprises a cover and locking set.

Assembly:

- ► Mount the locking pins from the locking set on the base plate.
- ► Put the weatherproof cover on from above.
- ► Insert the holding catches into the counterpieces from the side, twist and lock in.

3.3 Installation

WARNING:

- ► Observe the relevant safety regulations as well as the safety notices in Section 1 during all installation work.
- ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.

3.3.1 General information, prerequisites

All assembly work previously described must be completed (as far as applicable) before starting installation work.

Carry out all installation work onsite unless otherwise explicitly agreed with SICK or authorized representatives. This includes laying and connecting the power supply and signal cables, installing switches and mains fuses and connecting the purge air supply.

- Plan adequate line cross-sections (→ p. 108, §7.1).
- Cable ends with plugs to connect the sender unit must have sufficient free length.

3.3.2 Connecting/starting the optional external purge air unit

Work to be performed

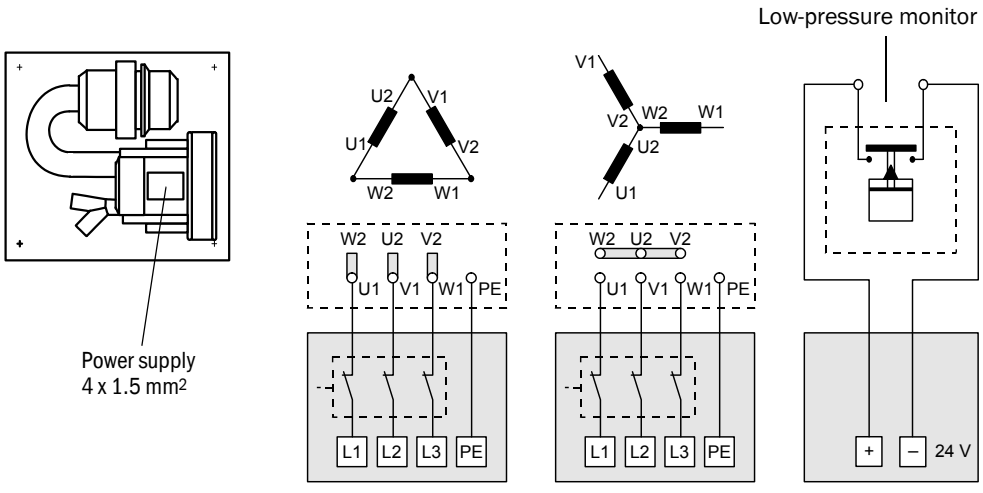
► Compare mains voltage and frequency with the specifications on the type plate on the purge air motor.

NOTICE:

► Only connect when these match!

► Connect the power supply cable to the purge air motor terminals (refer to the supplementary sheet on the purge air motor and lid of the motor terminal box for terminal allocation; principle illustration → Fig. 22).

Figure 22 Electrical connection of the external purge air unit



► Connect protective conductor to terminal.

- Set motor circuit breakers according to the blower connection data (see Technical Data for purge air unit) to a value 10% above the rated current.

> ***NOTICE:***
> In case of doubt and for special versions, the Operating Instructions delivered with the motor have priority over other specifications.

- Check the function and running direction of the blower (purge air flow direction must match the arrows on the inlet and outlet openings on the blower). For wrong direction on 3-phase motors: Swap mains connections L1 and L2.
- Connect the pressure controller (option) to monitor purge air feed.

> ***NOTICE:***
> - Use a fail-safe power supply (standby unit, rails with redundant supply)
> - Fuse the purge air unit separate from the other system components. Use fuses according to the rated current (see Technical Data for purge air unit). Fuse each phase separately.
> Use circuit breakers to prevent phase failures on one side.

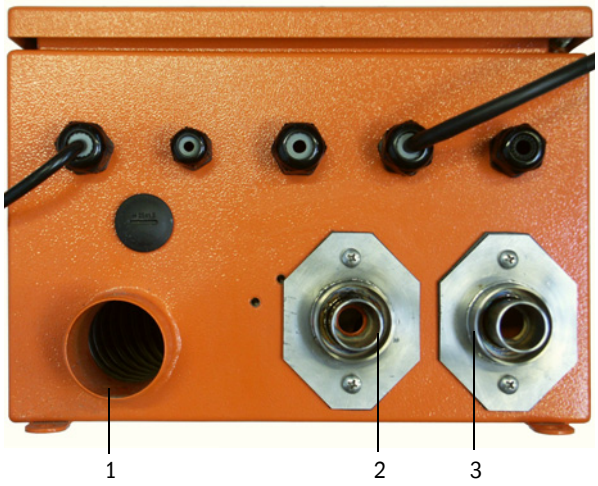
3.3.3 Installing the purge air supply

- ► Lay the purge air hoses with shortest paths and free of bends, shorten as required.
- ► Maintain sufficient distance from hot duct walls.

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

Connect the purge air hose to the purge air outlets on the underside of the MCU-P (→ Fig. 23) and secure with a strap retainer. Set the purge air outlets as shown (correct when necessary).

Figure 23 Control unit underside with integrated purge air supply

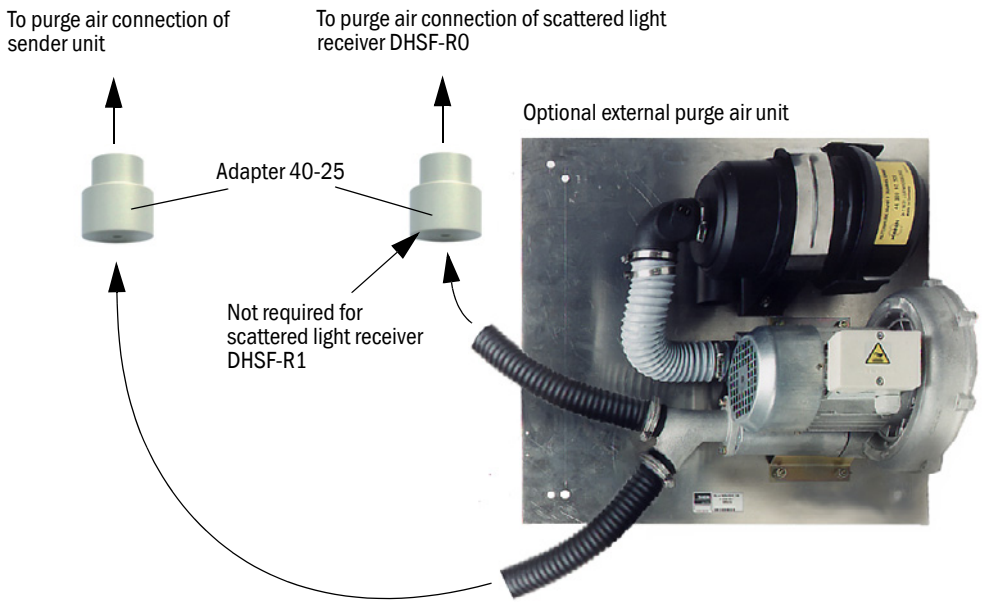


1 Purge air inlet
2 DN 25 purge air outlet for sender unit and DHSF-R0 scattered light receiver
3 DN 40 purge air outlet for DHSF-R1 scattered light receiver

Optional external purge air unit

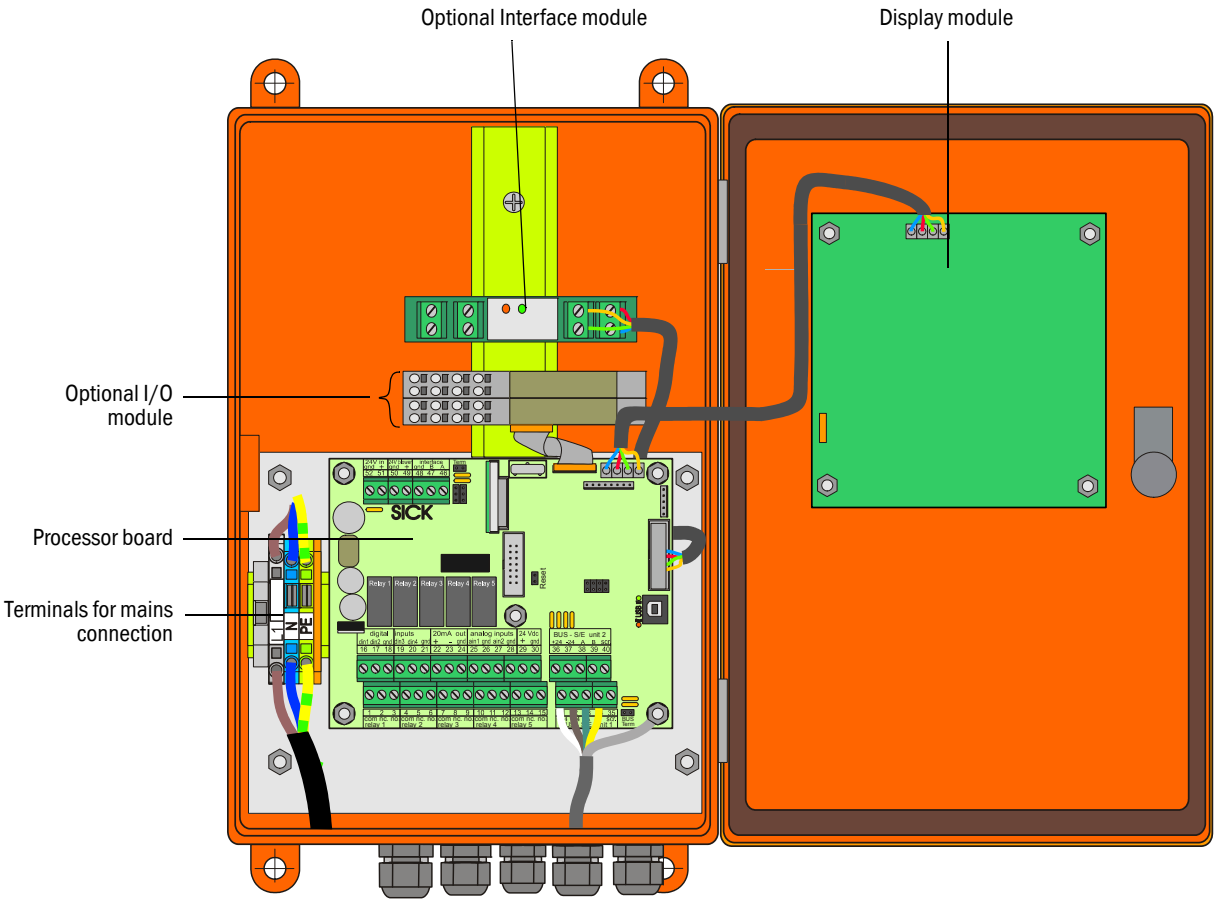
Connect the DN 40 purge air hose to the Y-distributor of the purge air unit and to the adapter, and secure with D32-52 hose clamps.

Figure 24 Connecting the optional external purge air unit



3.3.4 Connecting the MCU control unit

Figure 25 Component layout in the MCU (without purge air supply, with options)



Work to be done

- ► Connect connection cable according to → p. 43, Fig. 28.

> If an onsite cable is to be used, it must be connected to a suitable 7-pole socket → p. 42, Fig. 27; SICK Part No.: 7045569).

- ► Connect cables for status signals (operation/malfunction, maintenance, function check, maintenance request, limit value), analog output, analog and digital inputs according to requirements (→ p. 43, Fig. 28, Fig. 29 and Fig. 30).

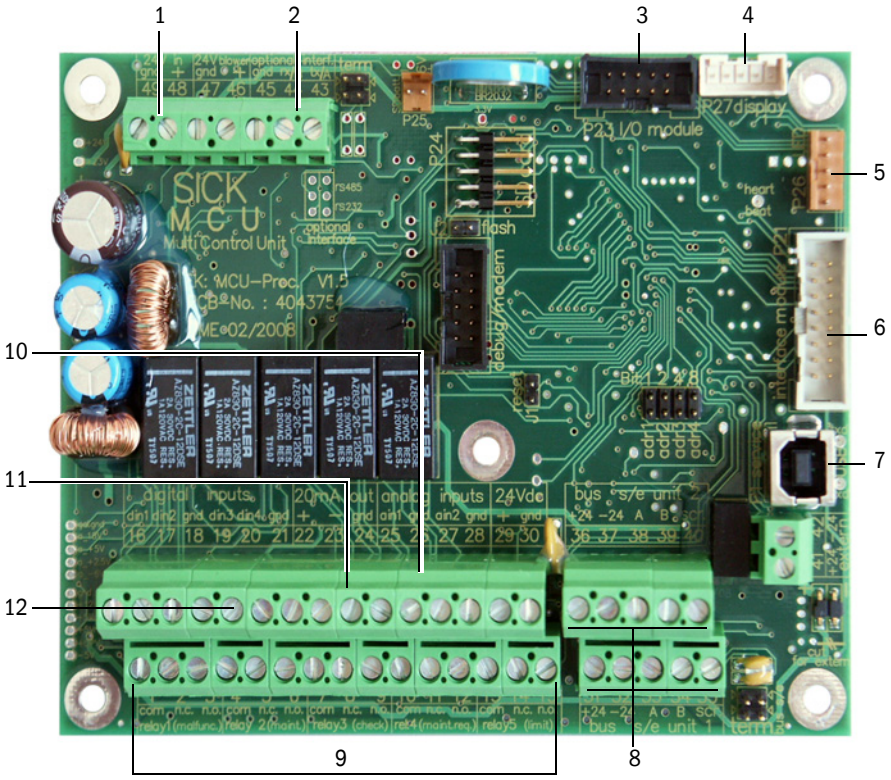
> ***NOTICE:***
> ► Only use cables with twisted-pairs and screen (e.g. UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm² from LAPPKabel; 1 pair of wires for RS 485, 1 pair of wires for power supply; not suitable for underground laying).

- ► Connect power cable to terminals L1, N, PE of the MCU (→ p. 41, Fig. 25).
- ► Lock not used cable bushings with blind stoppers.

> **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

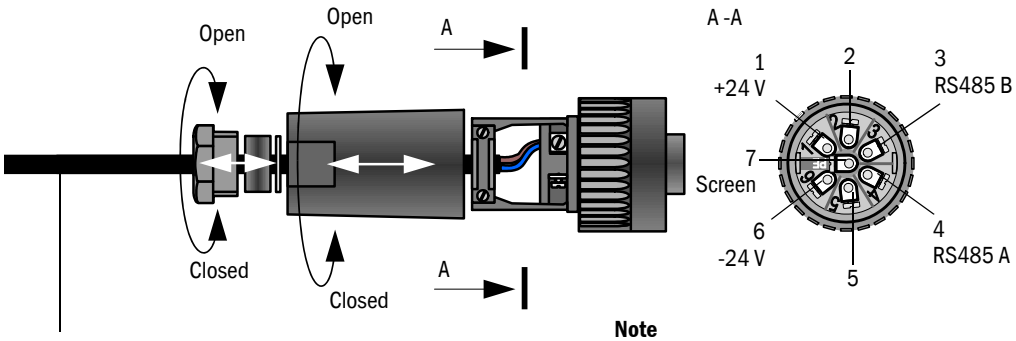
Figure 26 MCU processor board connections



1 Supply voltage 24 V d.c.
2 RS232
3 Connection for optional I/O module
4 Connection for Display module
5 Connection for LEDs
6 Connection for optional Interface module
7 USB plug connector
8 Connections for measuring unit
9 Connections for relays 1 to 5
10 Connections for analog inputs 1 and 2
11 Connection for analog output
12 Connections for digital inputs 1 to 4

Onsite connection cable connection to MCU

Figure 27 Plug-in connector connection on onsite cable

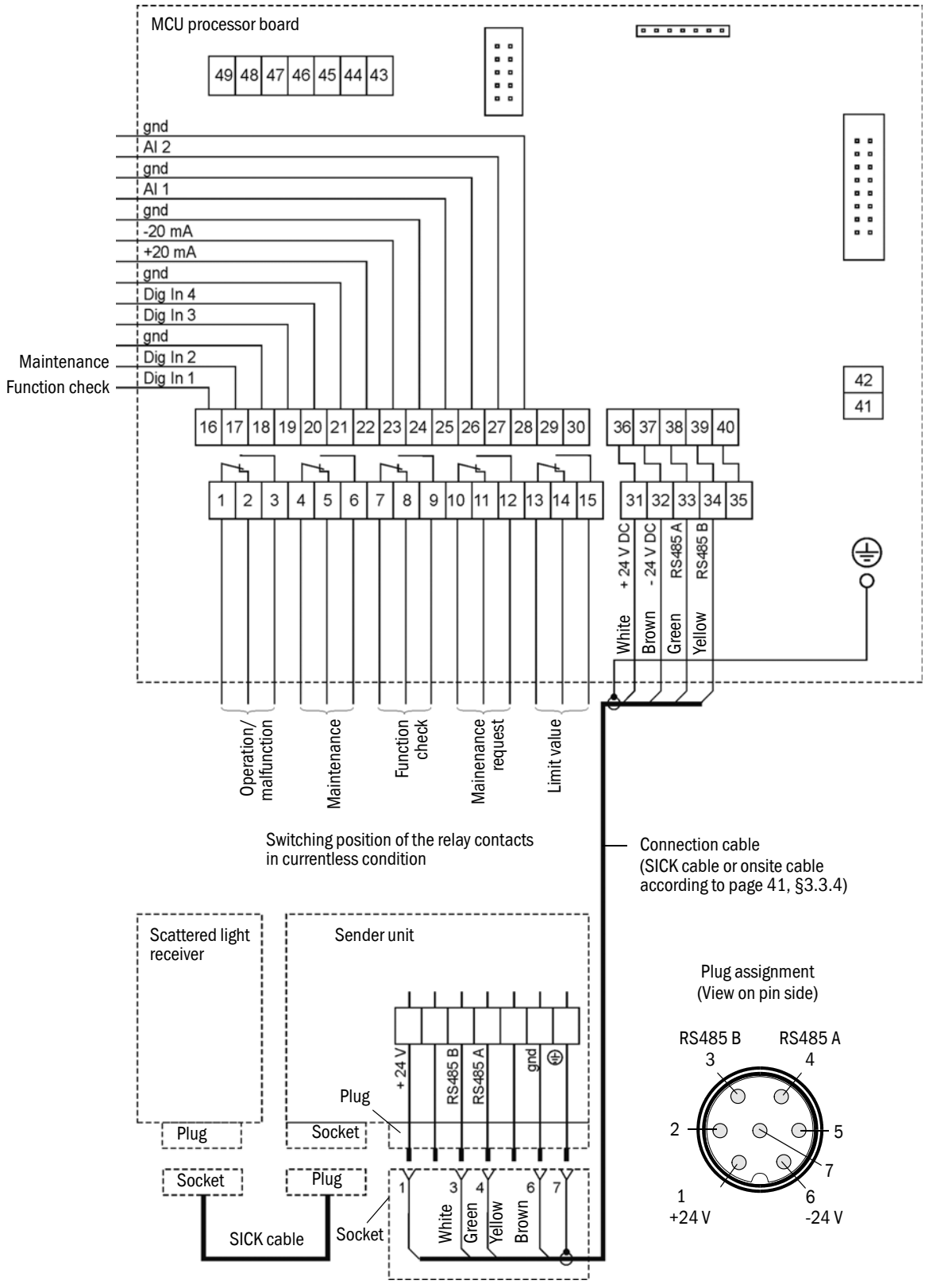


Cable provided by customer according to page 41, §3.3.4

Note
To open, connect the plug-in connector to the plug on the sender unit.

Connections between MCU, sender unit and scattered light receiver

Figure 28 Standard connection



3.3.5 Connecting the scattered light receiver

Connect the cable belonging to this component (→ p. 118, §7.3.2) to the sender unit and scattered light receiver and screw tight.

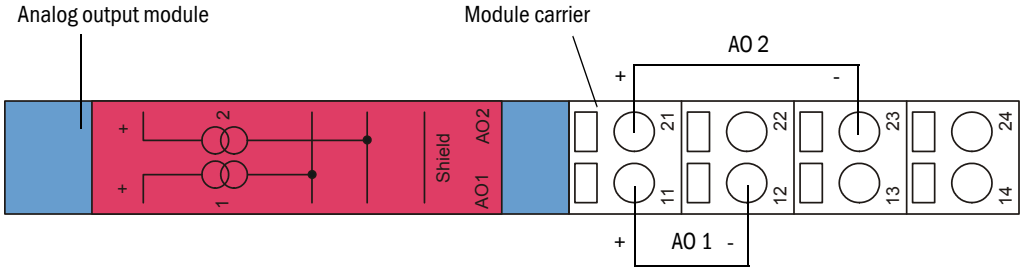
3.3.6 Fitting and connecting optional Interface and I/O modules

Plug interface modules and module carriers for I/O modules onto the hat rail in the MCU (→ p. 41, Fig. 25) and connect to the associated connection on the processor board with the cable with plug-in connector (→ p. 42, Fig. 26). Then plug the I/O module on the module carrier.

Connect I/O modules using the the terminals on the module carrier (→ Fig. 29, Fig. 30), the Profibus module using the terminals on the module and the Eternet module via customer provided network cable.

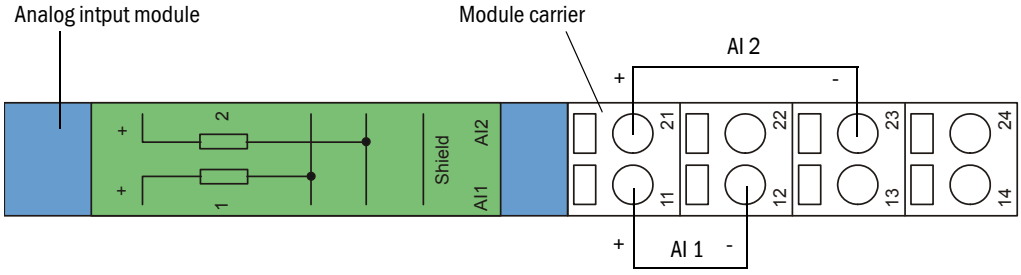
Terminal assignment AO module

Figure 29 Terminal assignment analog output module



Terminal assignment AI module

Figure 30 Terminal assignment analog input module



DUSTHUNTER SF100

4 Start-up and Parameter Settings

Basics
Application specific settings
Installing the sender unit and scattered light receiver
Setting standard parameters
Setting the Interface module parameters
Operating/setting parameters via the LC-Display

4.1 Basics

4.1.1 General information

Assembly and installation must have been completed according to Section 3 before starting the work described in the following.

Start-up and parameter setting comprise:

- Setting the measuring system to the duct dimensions
- Fitting and connecting the sender unit and scattered light receiver
- Customizing parameter settings according to the respective requirements.

To achieve exact measurement, the measuring system must first be calibrated using a gravimetric comparison measurement (→ p. 72, §4.4.7) before being used for continuous measurement of dust content.

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

4.1.2 Installing the operating and parameter program SOPAS ET

Administrator rights are required to install the program.

Requirements

- Laptop/PC with:
  - Processor: Pentium III (or comparable type)
  - USB interface (alternative - RS232 via adapter)
  - Working memory (RAM): At least 256 MB
  - Operating system: MS Windows ME/2000/XP/Vista (not Windows 95/98/NT)
- USB interface cable to connect the Laptop/PC to the measuring system (MCU).
- The operating and parameter program as well as the USB driver (scope of delivery) must be installed on the Laptop/PC.
- The power supply must be switched on.

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

Install the SOPAS ET program

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

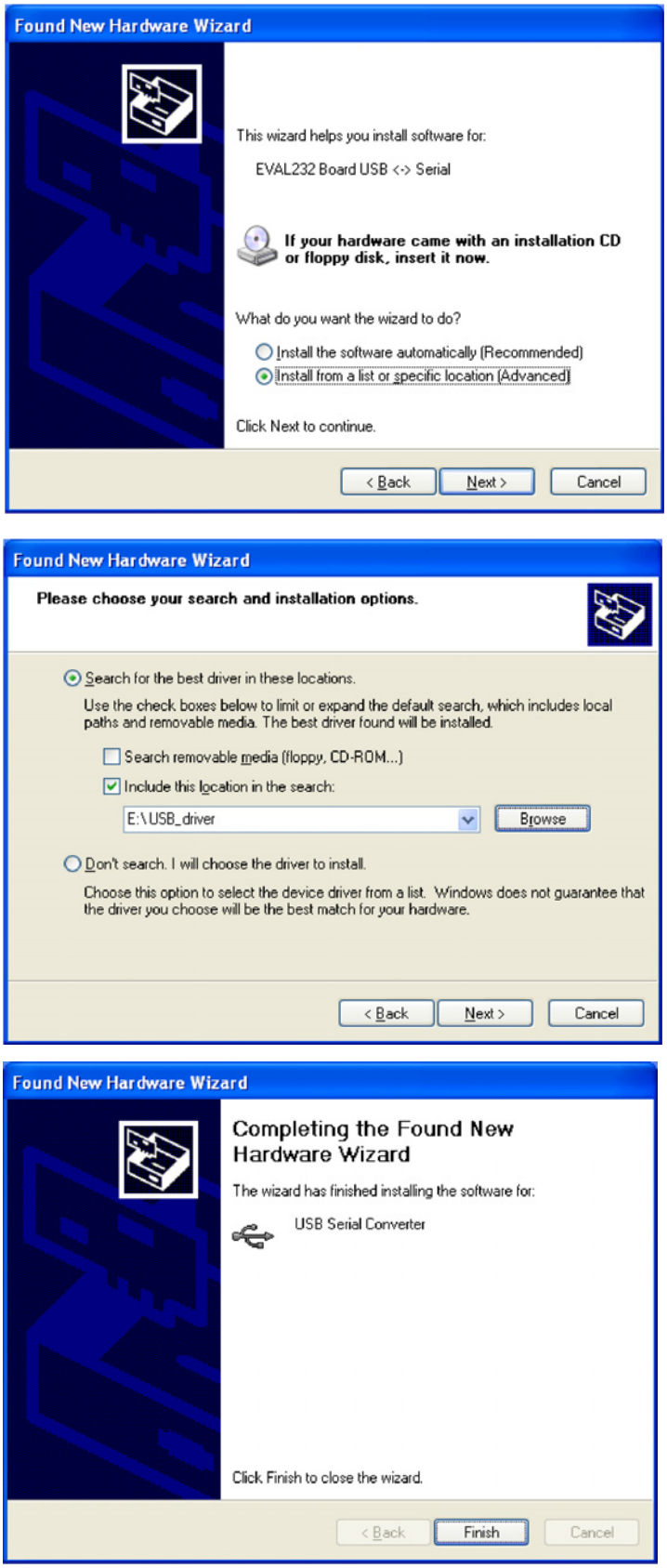
Install the USB driver

A special software driver is required for communication between the operating and parameter program SOPAS ET and the measuring system via the USB interface. 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. 47, Fig. 31).

The driver can also alternatively be installed by using the hardware installation program of the Windows system control.

The USB driver creates a new COM port which has to be used for connecting the SOPAS ET program to the device (→ p. 49, §4.1.3.2).

Figure 31 Installing the USB driver

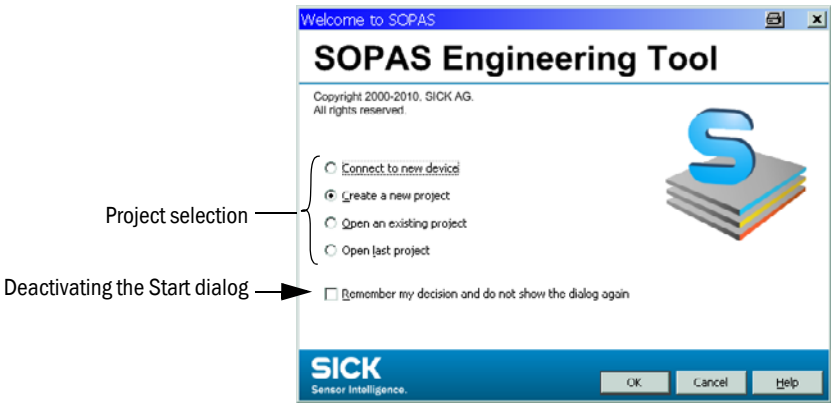


4.1.3 Connecting to the device

4.1.3.1 Basic settings

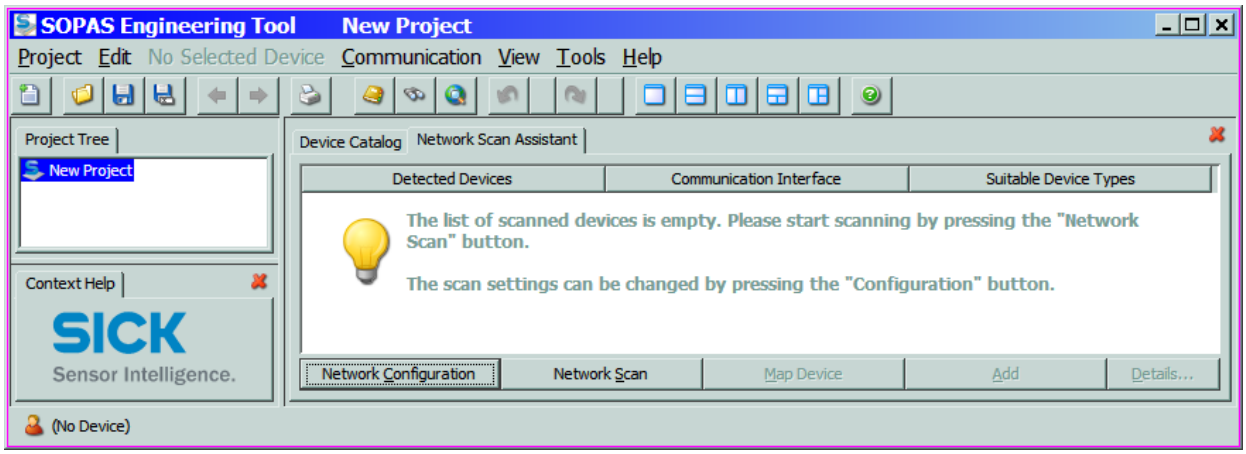
- ► Connect the USB cable to the MCU control unit (→ p. 42, Fig. 26) and the Laptop/PC.
- ► Start the program in the "SICK\SOPAS" start menu.
- ► The Start dialog appears on the screen (can be suppressed for further program usage).

Figure 32 Start dialog



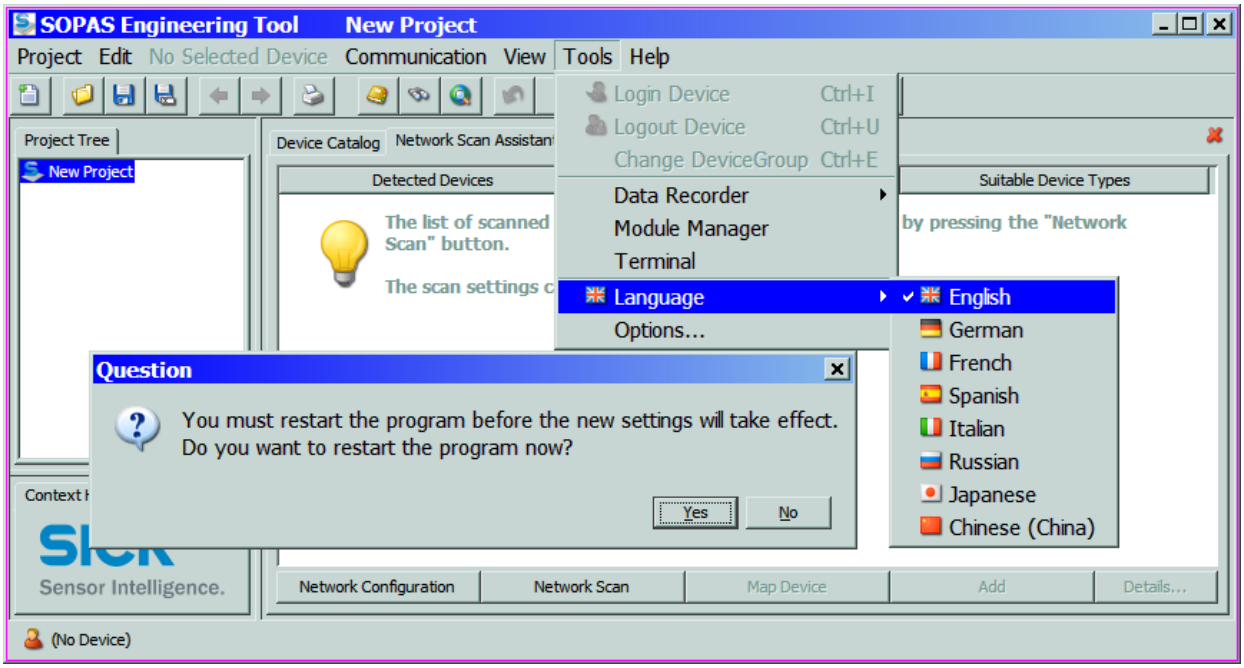
The following Start menu appears after confirmation with "OK".

Figure 33 Start menu



- ► If required, select the desired language in the "Tools / Language" menu (→ p. 49, Fig. 34), confirm with "OK", and restart the program .

Figure 34 Change of language settings

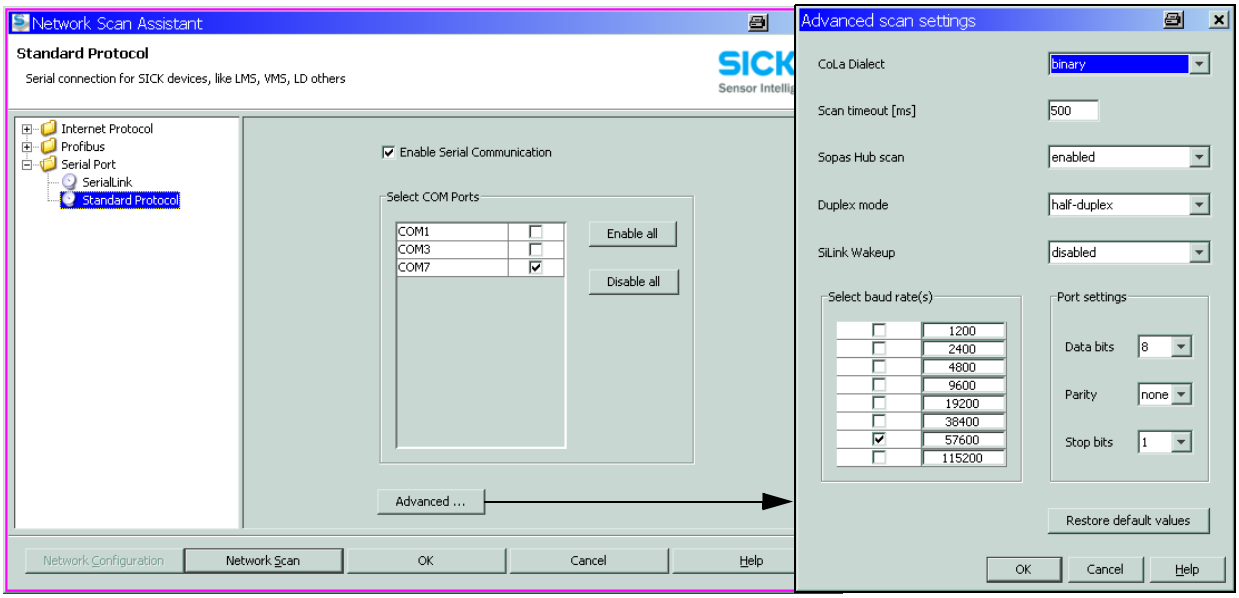


4.1.3.2 Configuring the interface

COM Port

- ► Click the "Network Configuration" button in the start menu (→ p. 48, Fig. 33) and select „Standard Protocol”.
- ► Select the COM port in the "Select COM Ports" group that appears after connection of MCU and Laptop/PC, click the "Advanced..." button and configure according to → Fig. 35 (settings only required during the first connection to the measuring system).

Figure 35 COM port selection and configuration

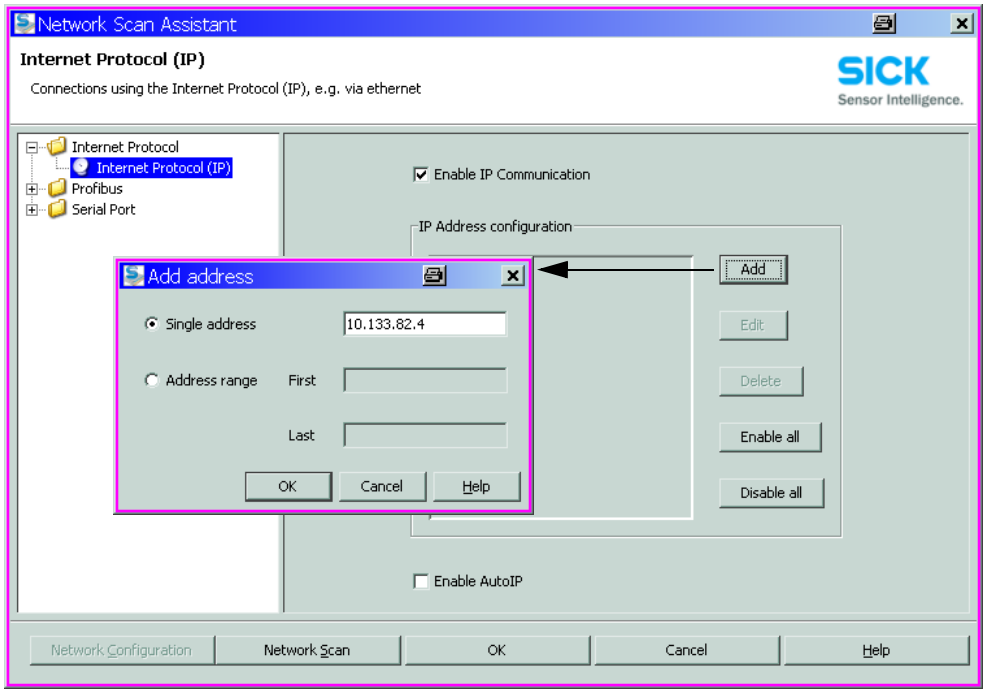


Ethernet

The Ethernet interface module (→ p. 118, §7.3.6) must be installed in the MCU (→ p. 44, §3.3.6) and configured (→ p. 80, §4.5.2) to get a connection to the measuringg system via Ethernet.

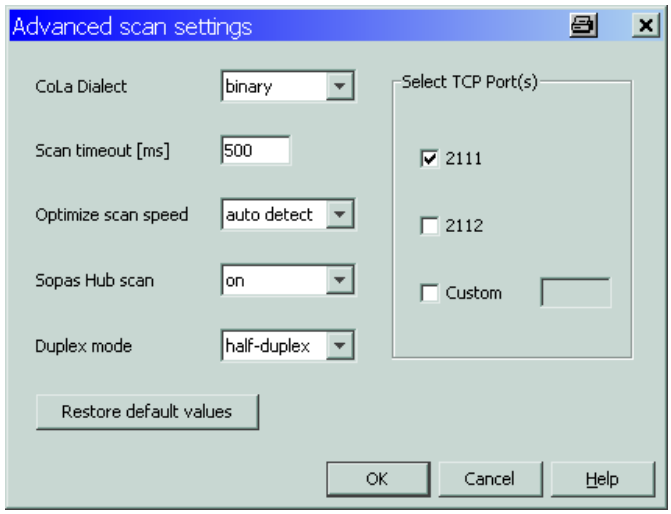
- ► Click the "Network Configuration" button in the start menu (→ p. 48, Fig. 33) and select "Internet Protocol (IP)".
- ► Click the "Add "button, enter the IP address and confirm with "OK".

Figure 36 Ethernet interface selection (example settings)



- ► Click the "Advanced..." button and configure the interface according to Fig. 37.

Figure 37 Configuring the Ethernet interface

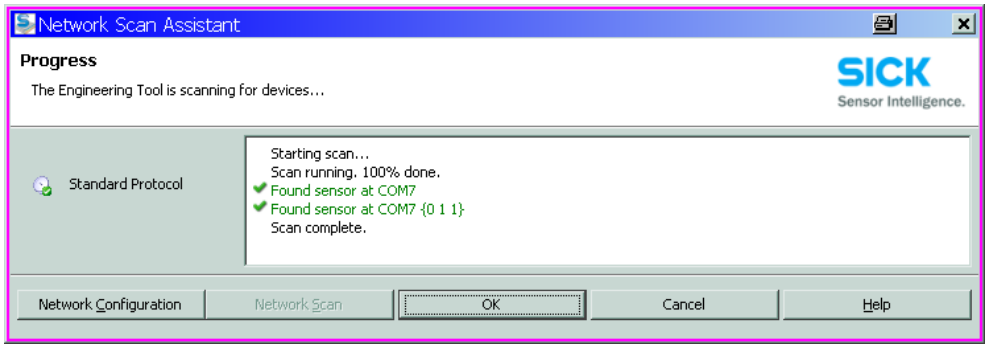


4.1.3.3 **Establish connection via "Network Scan Assistant" directory**

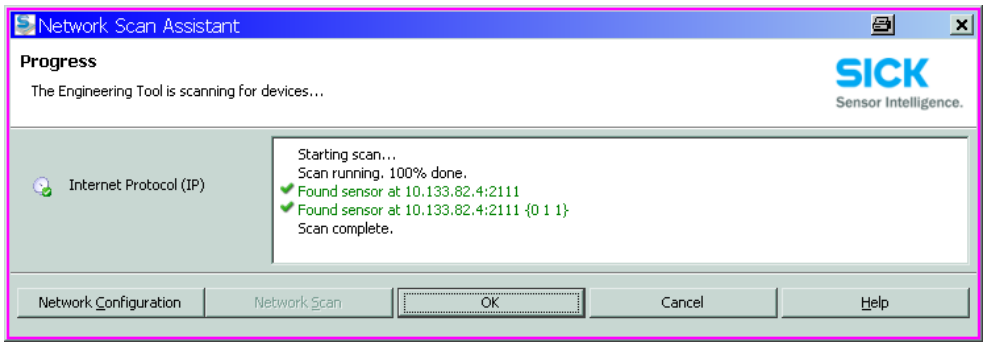
► Click the "Network Scan" button in the "Network Scan Assistant" directory.

Bild 38 Search for connected devices

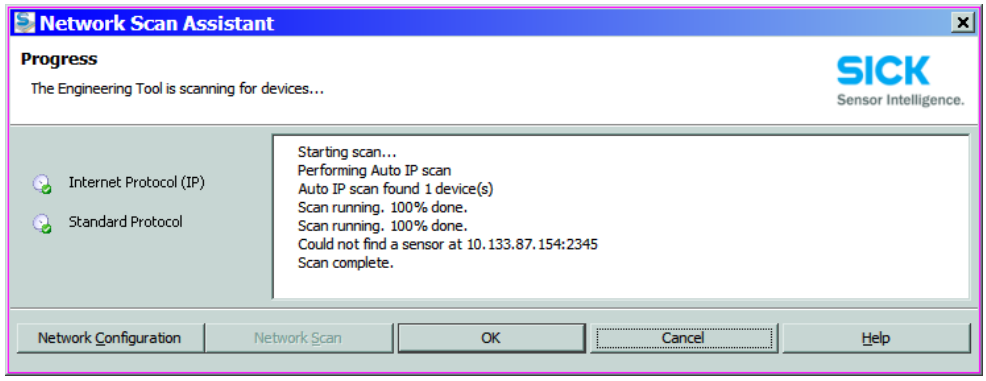
Connection via COM port



Connection via Ethernet



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



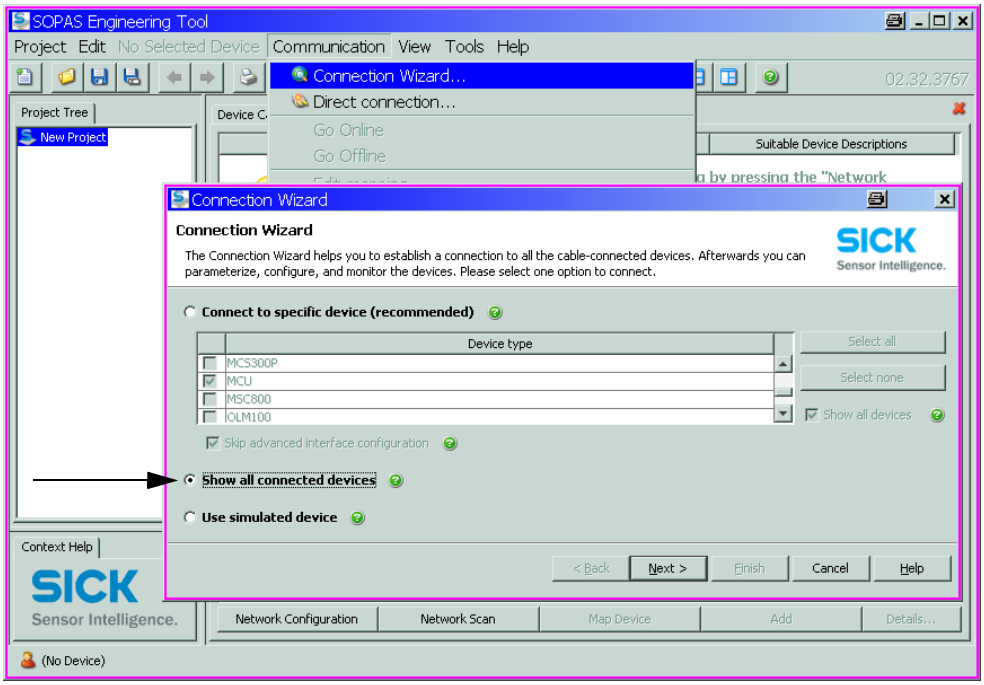
Problems with Ethernet connection can be caused by incorrect addressing → contact system administrator.

► Confirm search for connected devices with "OK".

4.1.3.4 Establish connection via "Connection Wizard" menu (valid for SOPAS ET Version 02.32)

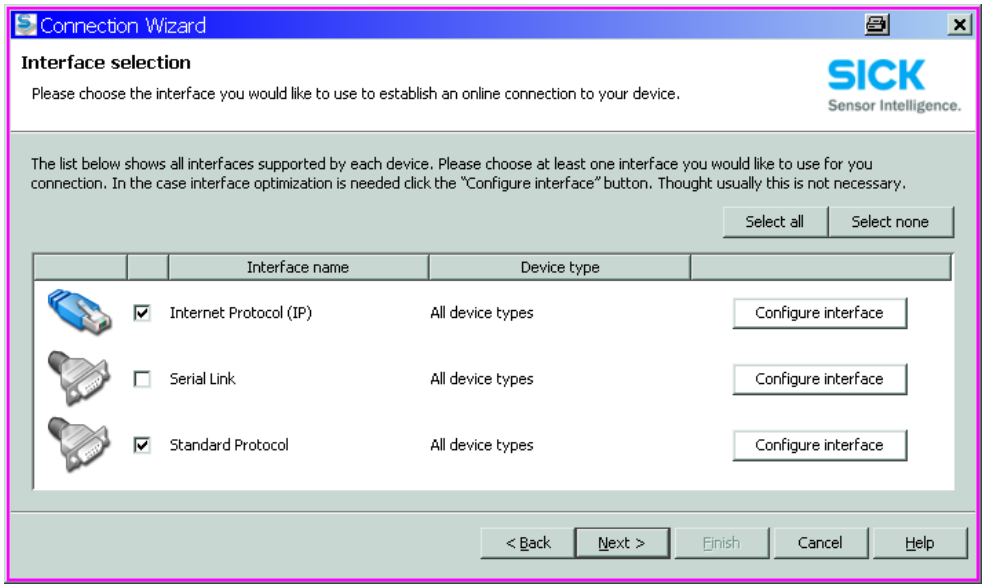
► Select "Communication / Connection Wizard" menu and activate "Show all connected devices".

Figure 39 "Communication / Connection Wizard" menu



► Click "Next >" button and select the interface ("Standard Protocol" for connection via COM port, "Internet Protocol (IP)" for connection via Ethernet).

Figure 40 Interface selection

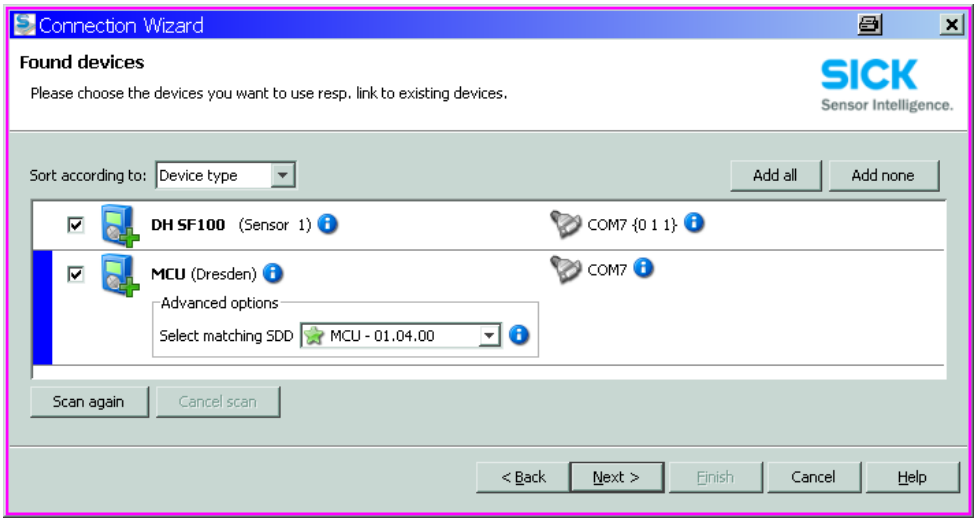


► Check interface configuration for setting according to page 49, §4.1.3.2 and change accordingly if necessary.

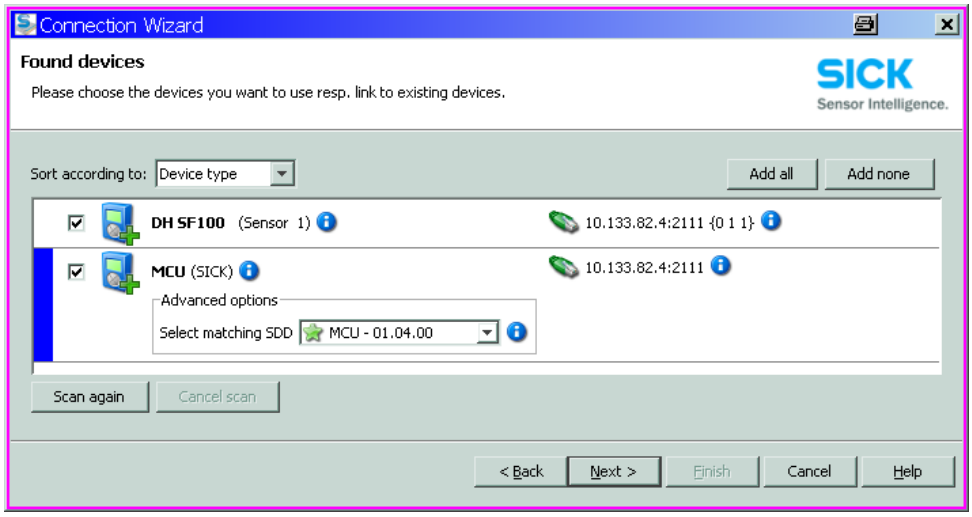
► Click "Next >" button.

Figure 41 Search for connected devices

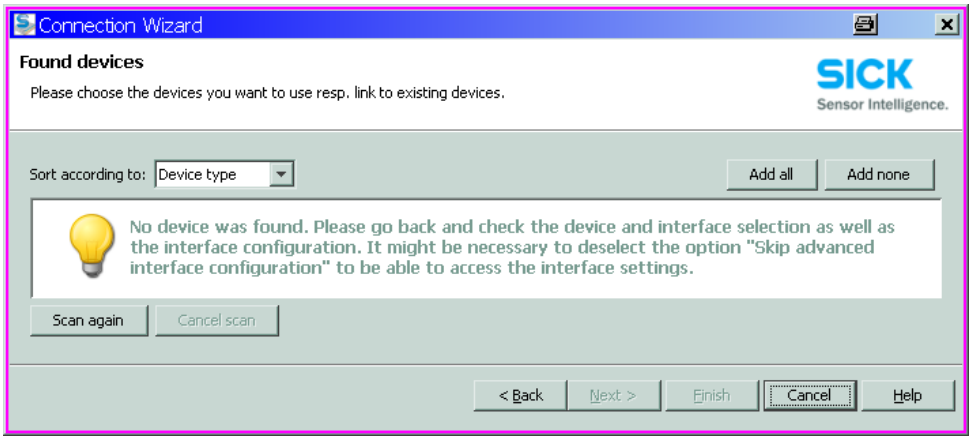
Connection via COM port



Connection via Ethernet



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

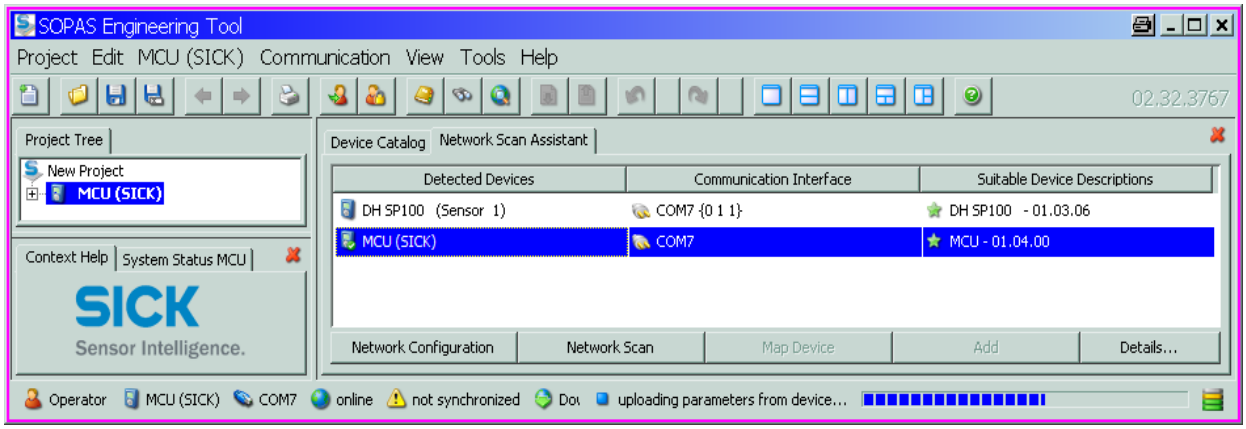


4.1.3.5 Selecting the device

Connection via COM port

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

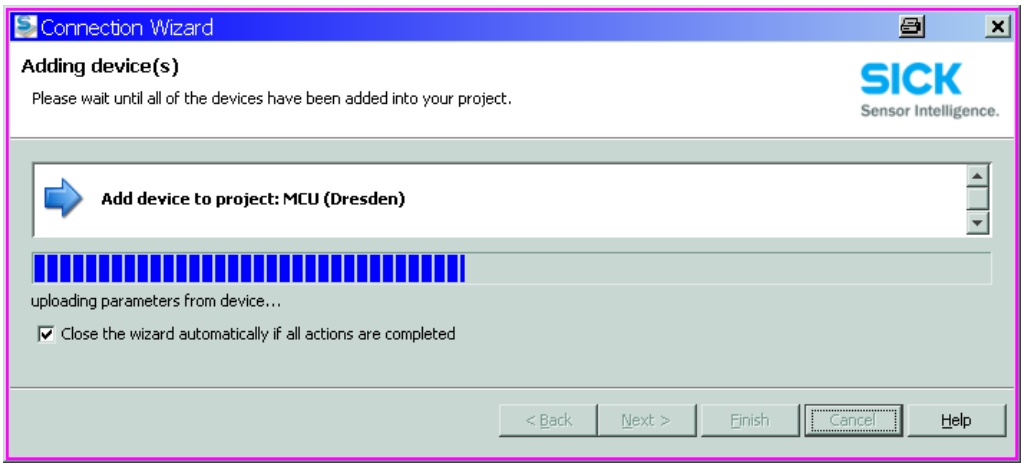
Figure 42 Selecting the device file



Connection via "Connection Wizard" menu

Activate the checkbox of the required device file in the "Connection Wizard / Found devices" (→ p. 53, Fig. 41) and Click "Next >" button. This transfers the device file to the "Project Tree" window.

Figure 43 Transferring the device file



4.1.4 Information on using the program

Password

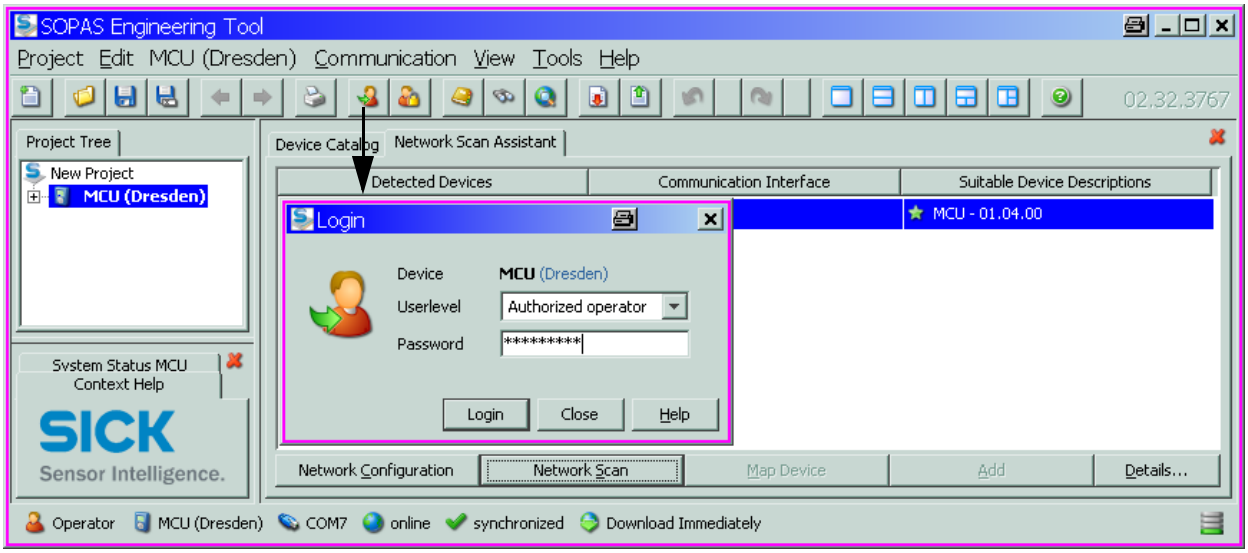
Certain device functions are first accessible after a password has been entered (→ p. 55, Fig. 44). Access rights are assigned in 3 levels:

User level		Access to
0	Operator	Displays measured values and system states
1	Authorized Operator (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)

*): Depends on the program version

The Level 1 password is contained in the Annex.

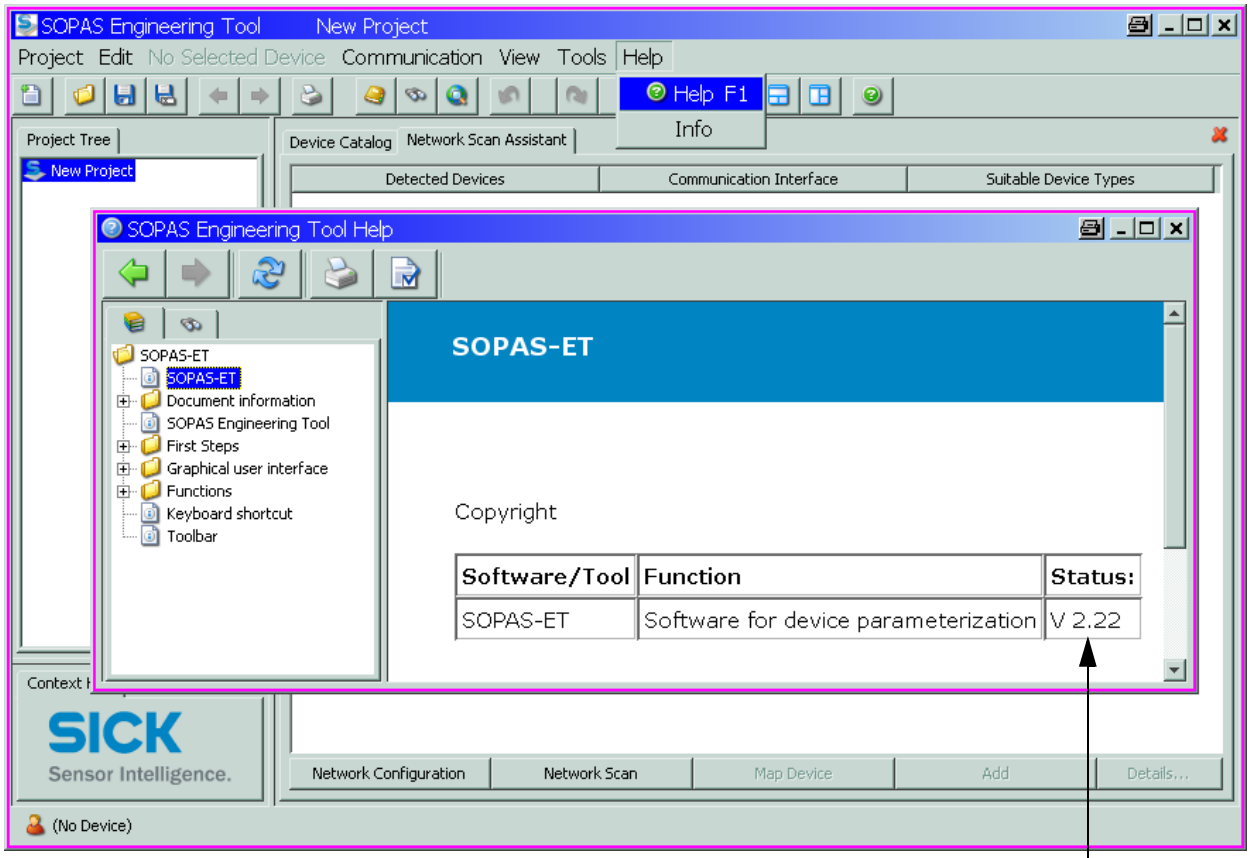
Figure 44 Password entry



4.1.5 Online help

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

Figure 45 Online help



4.2 Application specific settings

The measuring system must first be set to the respective internal duct diameter to ensure that the sender light beam is aimed at the scattered light receiver. For this, the automatic self-alignment and the laser beam must be adjusted.

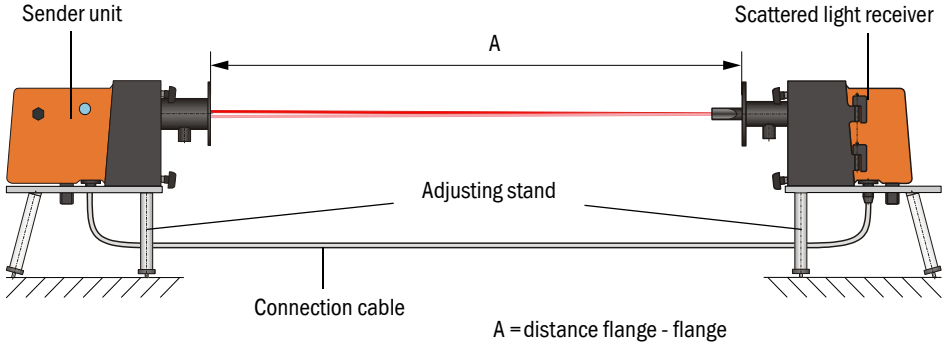
4.2.1 Preparatory work

► Assemble the measuring system away from the installation location at a place as dust-free as possible with available power supply.

There are two options:

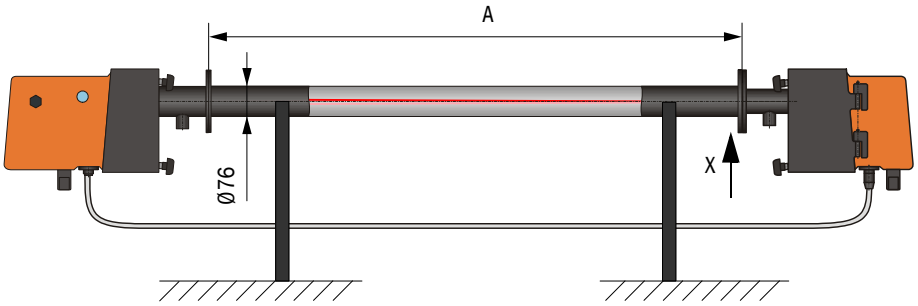
– Using the optional adjusting stand

Figure 46 Creating a smoke-free path with adjusting stands



– Onsite installation of a "zero tube" (tube with suitable diameter with flanges)

Figure 47 Creating a smoke-free path with a zero tube



X: Dimensions between flange and tube according to scattered light receiver type (→ p. 111, §7.2.2, → p. 113, §7.2.3)

► Connect the sender unit to the MCU and the scattered light receiver to the sender unit using the accompanying cables.

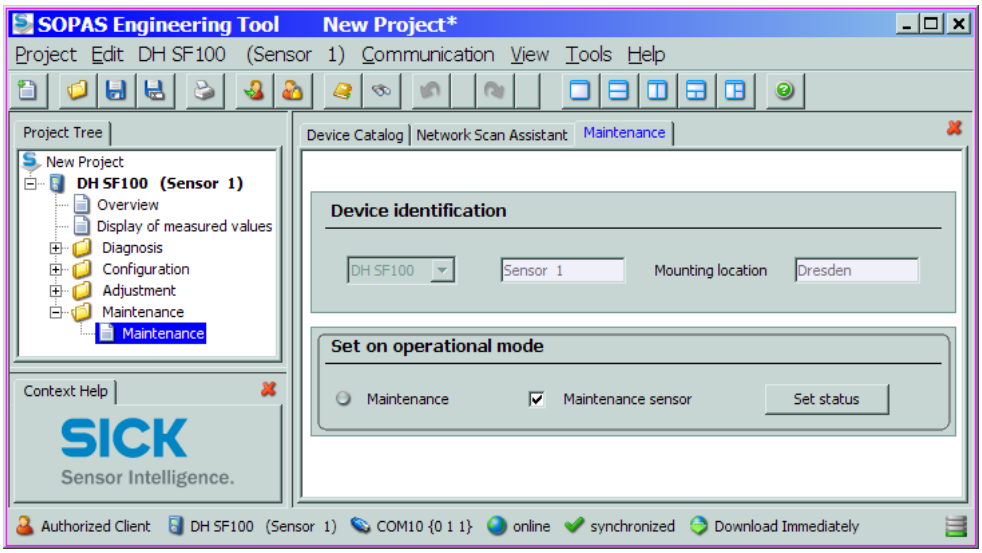
► Connect the MCU to the supply voltage.

- ► Start the SOPAS ET program and connect to the measuring system (→ p. 48, §4.1.3).
- ► Select the "DH SF100" device file and move it to the "Project Tree" window (→ p. 52, §4.1.3.4)..

> The respective device type connected is displayed automatically

- ► Enter the Level 1 password (→ p. 52, §4.1.3.4), activate the "Maintenance Sensor" check-box in the "Maintenance / Maintenance" directory and click "Set State"

Figure 48 Setting "Maintenance" mode

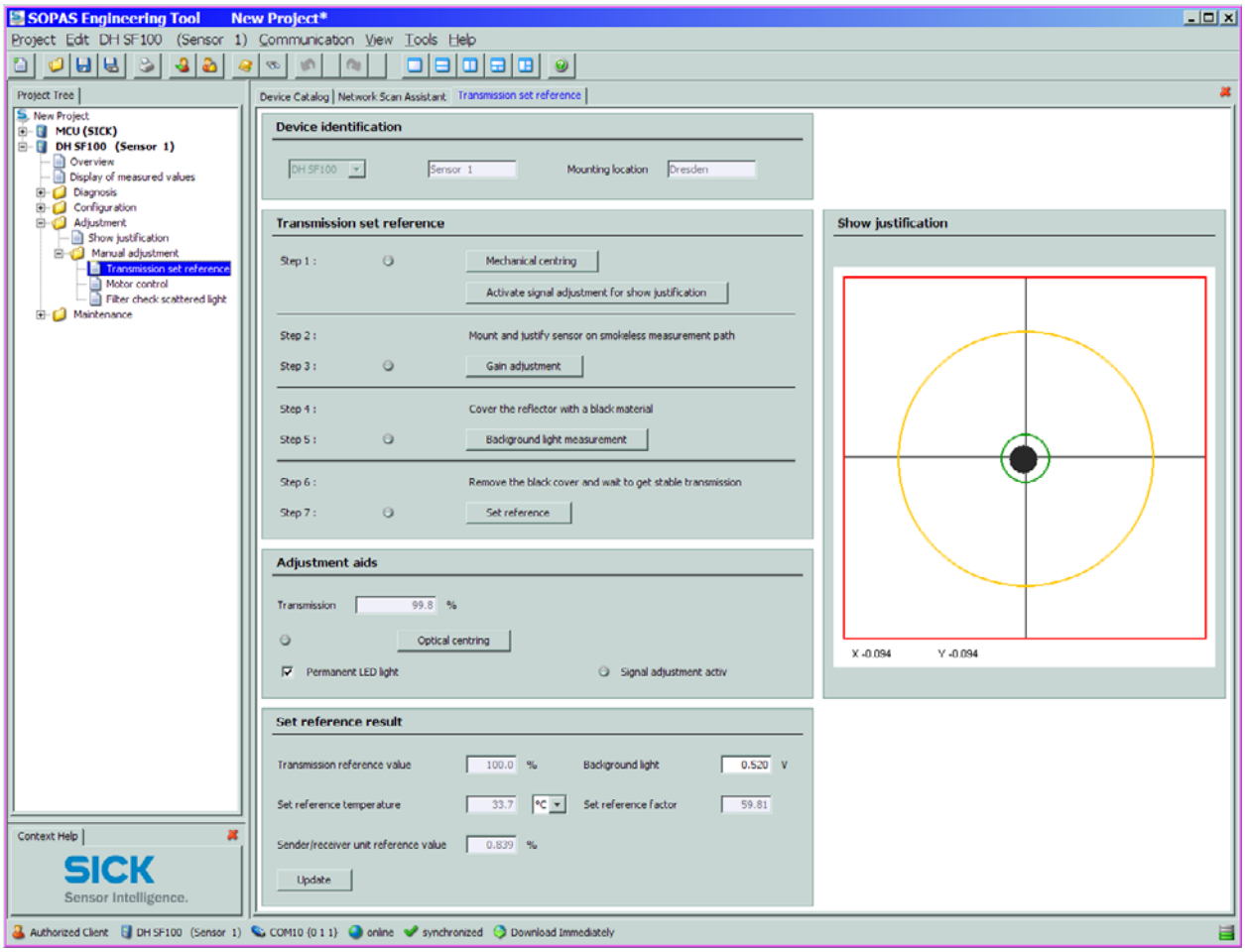


- ► Clean the optical boundary surfaces on sender unit and scattered leght receiver (→ p. 92, §5.2.1 und → p. 95, §5.2.2).
- ► Wait approx. 30 min before starting the following work (measuring system must be in operation conditions).

4.2.2 Scaling the automatic self-alignment

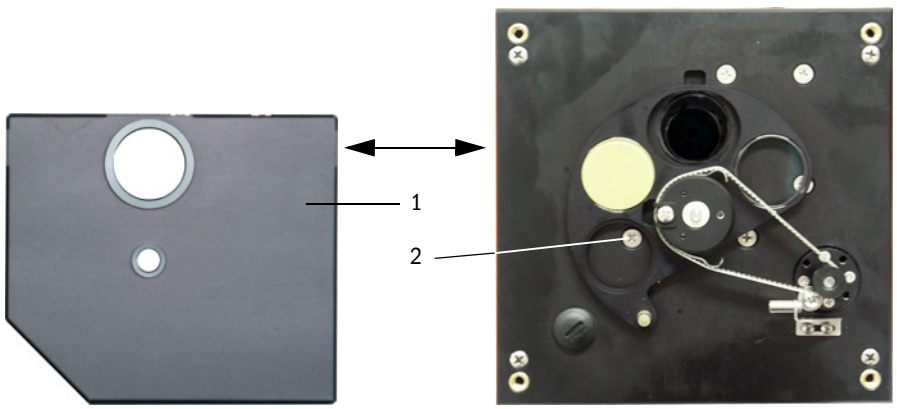
► Select the "Adjustment / Manual Adjustment / Transmission set reference“ directory and activate the "Permanent LED light“ checkbox.

Figure 49 "Adjustment / Manual Adjustment / Transmission set reference“ directory



► Loosen the knurled screws on the sender unit, swivel the electronic unit to the side, remove the swivel plate cover (1) and screw the cover screw (2) out of the focussing opening.

Figure 50 Cover screw for focussing opening

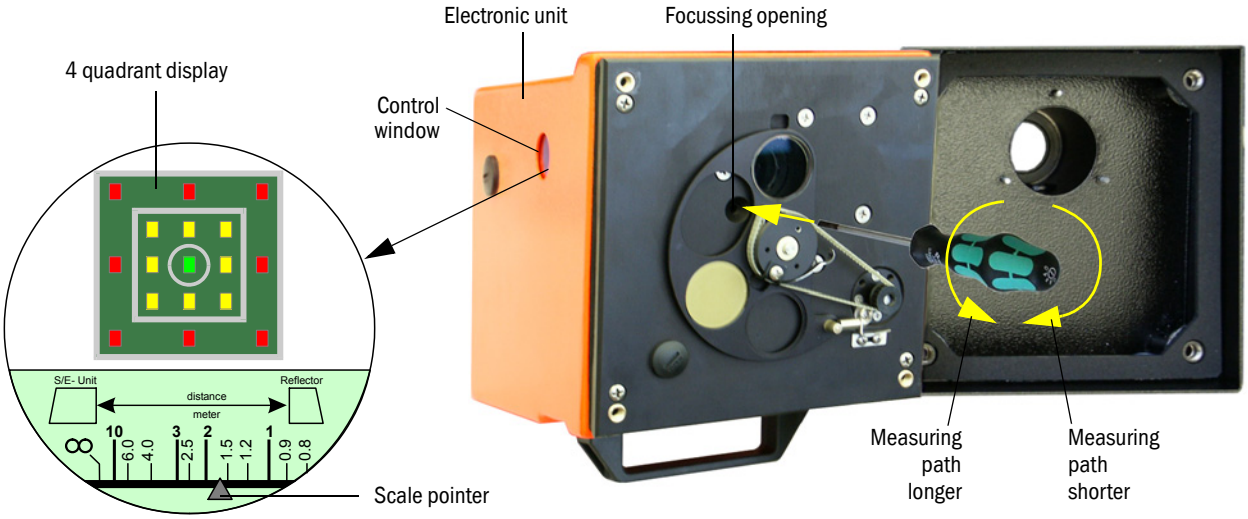


► Insert a screwdriver in the focussing opening and set the adjustment screw so that the scale pointer in the control window points to the distance between the optical surfaces of sender unit and scattered light receiver.

Measuring distance 0.5 ... 3 m: Distance = measure A in Fig. 46 + 343 mm

Measuring distance 2.5 ... 6 m: Distance = measure A in Fig. 46 + 348 mm

Figure 51 Focussing the sender light beam



The scale illumination lights up when the measuring system is switched to "maintenance"or up to 10 min after device reboot.

► Screw in the cover screw of the focussing opening again, swivel the electronic unit back and lock with the knurled screws.

► Click "Mechanical centring" (‚Step 1‘) in the "Adjustment / Manual Adjustment / Transmission set reference“ directory (→ p. 59, Fig. 49).

► Align the optical axes of the sender unit and scattered light receiver to each other.

Align the sender unit so that the sender spot lies on the middle of the opening for the reflector (→ p. 20, Fig. 8). Align the scattered light receiver so that the sender spot (1) can be seen in the centrical marking in the middle of the control window (2) on the back of the housing (3).

Figure 52 Sender spot on scattered light receiver side

► Deactivate the "Permanent LED light“ checkbox (→ p. 59, Fig. 49).

- ► Check the alignment.

  The optical axes are aligned exactly, if:

  – the green LED in the 4 quadrant display in the control window of the sender/receiver unit shines(→ p. 60, Fig. 51),

  – in the "Adjustment / Manual Adjustment / Transmission set reference“ directory (→ p. 59, Fig. 49), the sender spot (black circular area in the "Show justification" window) is inside the green circle.

  Only rough alignment is necessary because an internal self-alignment is fitted. Click the "Optical centring" button in the "Adjustment / Manual Adjustment / Transmission set reference“ directory (group "Adjustment aids") to start automatic fine adjustment.

- ► For the automatic self-alignment, adjust the receiver amplifier to the current measuring distance. For this, carry out the steps listed in the "Transmission reference value" group in the "Adjustment / Manual Adjustment / Transmission set reference“ directory (→ p. 59, Fig. 49) after each other. The corresponding indication changes to yellow when step 1 to 7 is in process.
- ► Check whether the transmission is shown as 100% in the "Transmission reference value" window after this process completes (→ p. 59, Fig. 49). Click "Set reference" at smaller deviations (< approx. 1%), repeat the normalization at greater deviations.

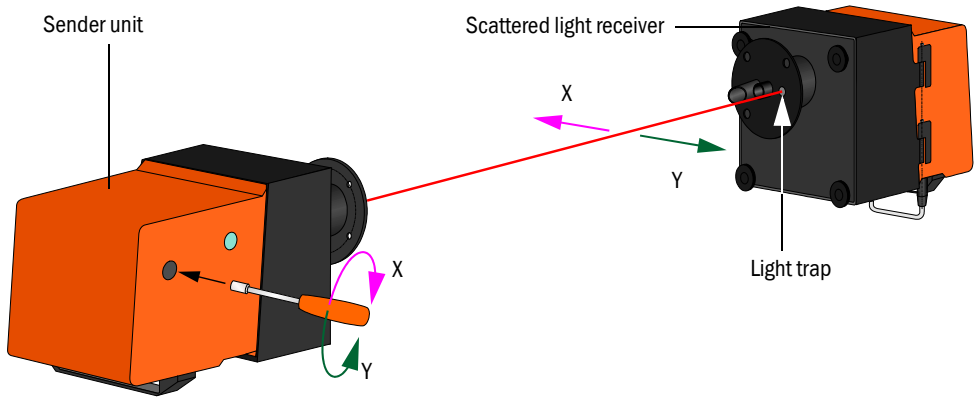
4.2.3 Adjusting the laser beam for scattered light measurement

- ► Take off the sender unit cover and use an SW 7 socket wrench to set the adjusting nut so that the laser beam disappears in the light trap on the scattered light receiver.

NOTICE:
Don't change the alignment of sender unit and scattered light receicer.

Sender unit and scattered light receiver must be connected via the connection cable, otherwise no laser beam can be seen.

Figure 53 Aligning the laser beam to the light trap

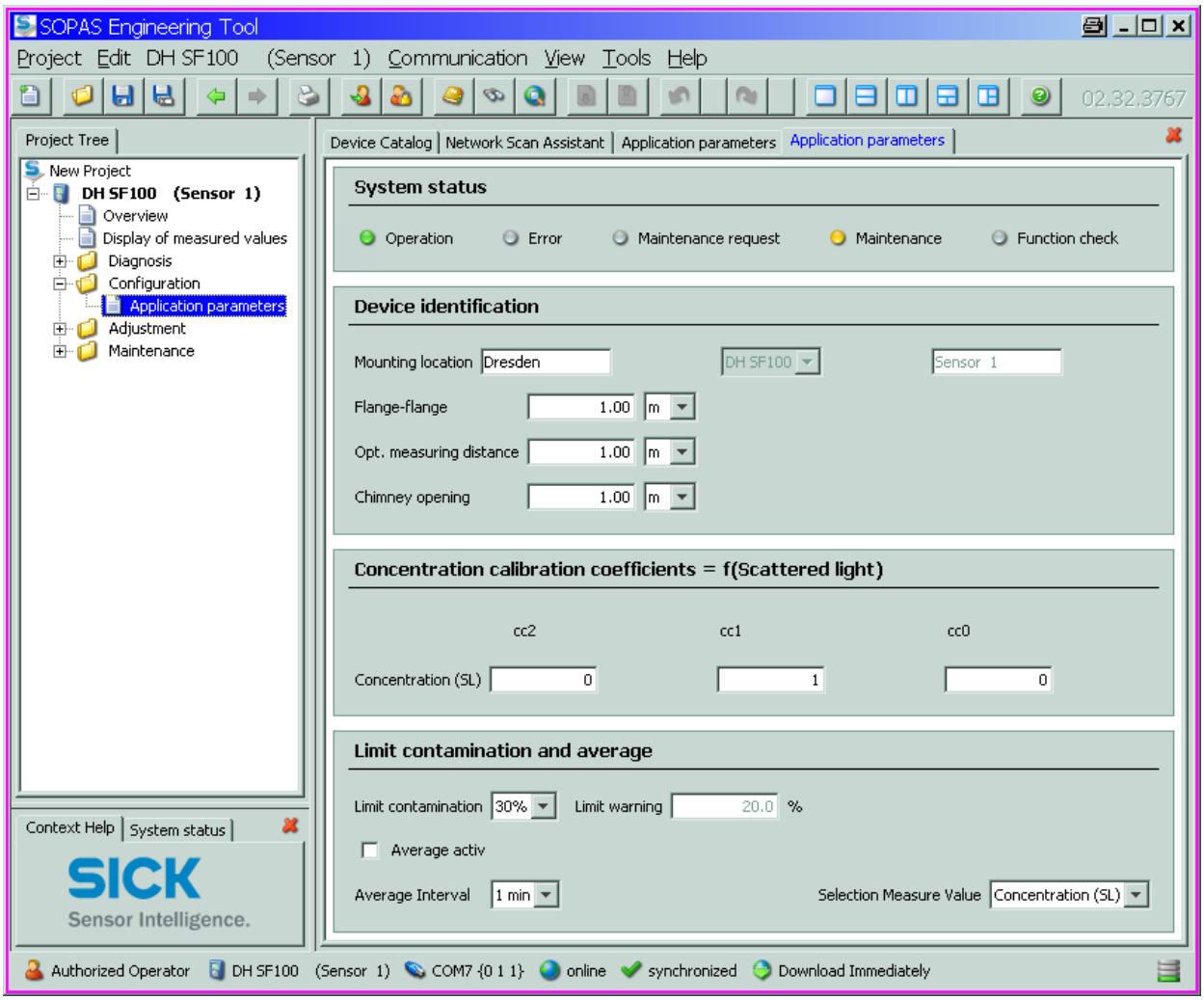


- ► Put the cover back on.

4.2.4 Assigning the sender unit to the installation location

The sender unit can be assigned to the respective measuring place obviously. To do so, select the ""Configuration / Application parameters" directory and enter the desired data in the "Mounting location" entry field under "Device Identification".

Figure 54 "Configuration / Application parameters" directory



4.3 Installing the sender unit and scattered light receiver

Remove sender unit and scattered light receiver from the smoke-free path and take the components to the measuring location when the work described before is completed.

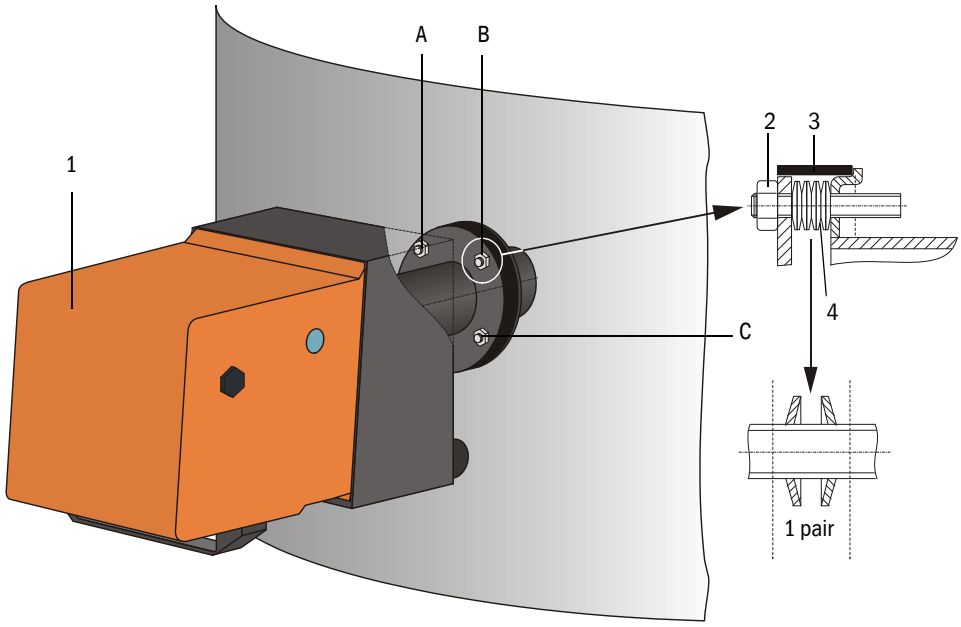
4.3.1 Connecting the sender unit and scattered light receiver to the purge air supply

- ► Check whether the purge air supply is available (the flow direction must be correct and the purge air hoses fitted tight on the connections).
- ► For purge air supply by the MCU-P control unit, push the DN 25 purge air hose onto the connections of the sender unit and scattered light receiver and secure with D20-32 hose clamps; with the optional external purge air unit, push the 40-25 adapters onto the respective connections and secure with D20-32 hose clamps.

4.3.2 Fitting and connecting the sender unit and scattered light receiver on the duct

- ► Attach the sender/receiver unit and reflector to the flange with tube and fasten with the accompanying assembly kit (→ p. 118, §7.3.4). Screw the self-locking nuts as tight as possible.

Figure 55 Fitting the sender unit / scattered light receiver on the duct



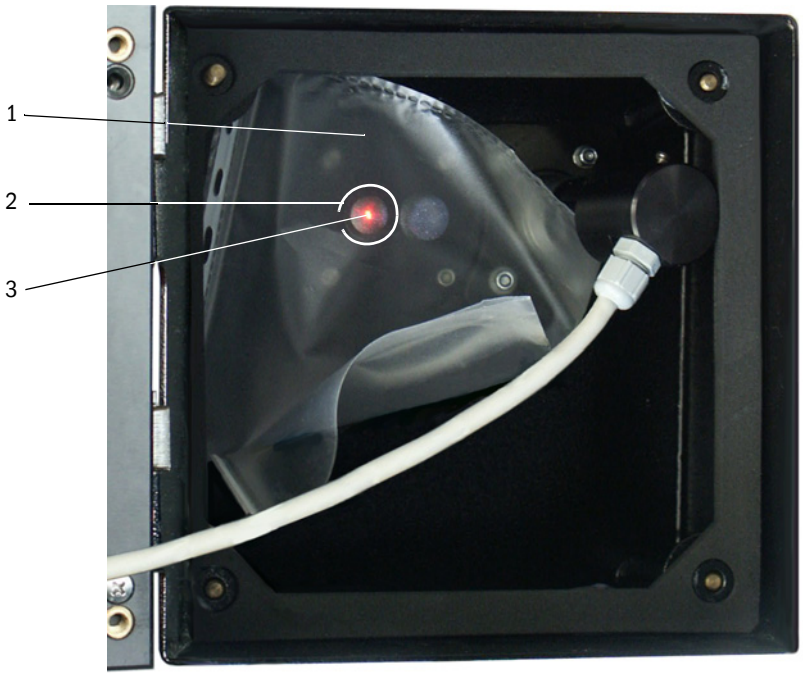
1 Sender unit
2 Self-locking nut
3 Sealing tape
4 Cup springs (4 pairs)
A Horizontal alignment
B Fixing point
C Vertical alignment

- ► Connect the cable MCU - sender unit and the cable sender unit - scattered light receiver at the respective connectors (→ p. 19, Fig. 7, → p. 20, Fig. 8 and → p. 20, Fig. 9) and screw tight.
- ► Start the SOPAS ET program and connect to the measuring system, select the "DH SF100" device file and move it to the "Project Tree" window.
- ► Enter the Level 1 password and set the sender unit to "Maintenance"mode.
- ► Click "Mechanical centring" (‚Step 1‘) in the "Adjustment / Manual Adjustment / Transmission set reference“ directory (→ p. 59, Fig. 49).
- ► Align the optical axes of the sender unit and scattered light receiver according to Fig. 55 so that the sender spot is in the middle of the control window on the back of the housing of the scattered light receiver (→ p. 60, Fig. 52).
- ► Check that the laser beam disappears into the light trap on the scattered light receiver. To do this, loosen the knurled screws, swivel the housing to the side, hold a transparent foil (1) over the light opening (2) and check whether the laser beam (3) can be seen in the center of the opening.

WARNING: Hazards when looking at the laser beam

⊗ Never look directly into the laser beam.

Figure 56 Laser beam in light trap opening



- ► Readjust the laser beam according to S. 61, Bild 53 when this is not the case.

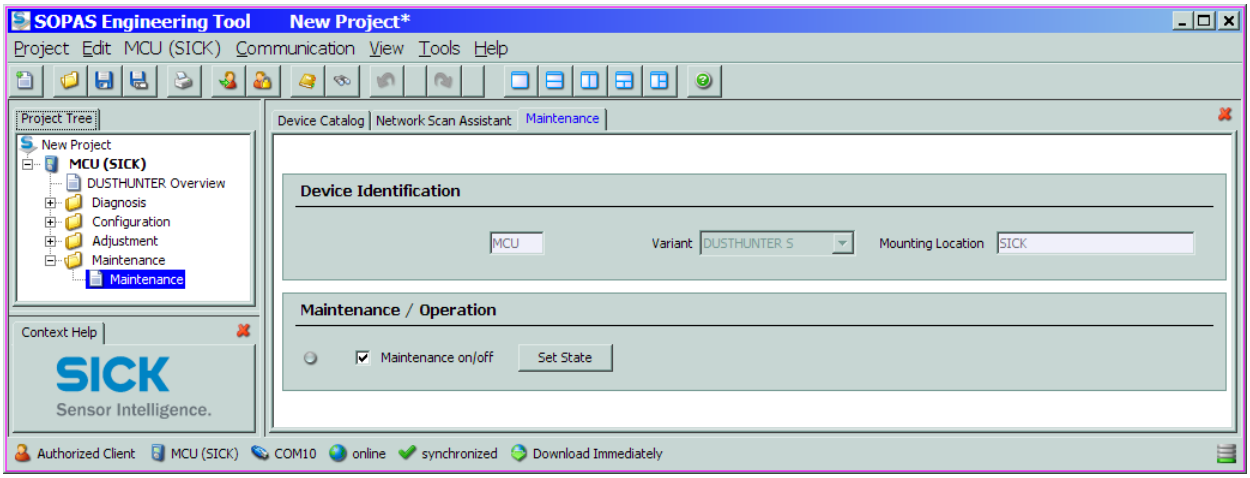
4.4 Setting standard parameters

4.4.1 Assigning the MCU to the sender unit

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:

- ► Connect the measuring system to the SOPAS ET program, select "MCU" device file and move it to the "Project Tree" window (→ p. 54, §4.1.3.5).
- ► Enter the Level 1 password (→ p. 55, §4.1.4) and set the measuring system to "Maintenance" mode (activate the "Maintenance on/off" checkbox in the "Maintenance / Maintenance" directory and click "Set State").

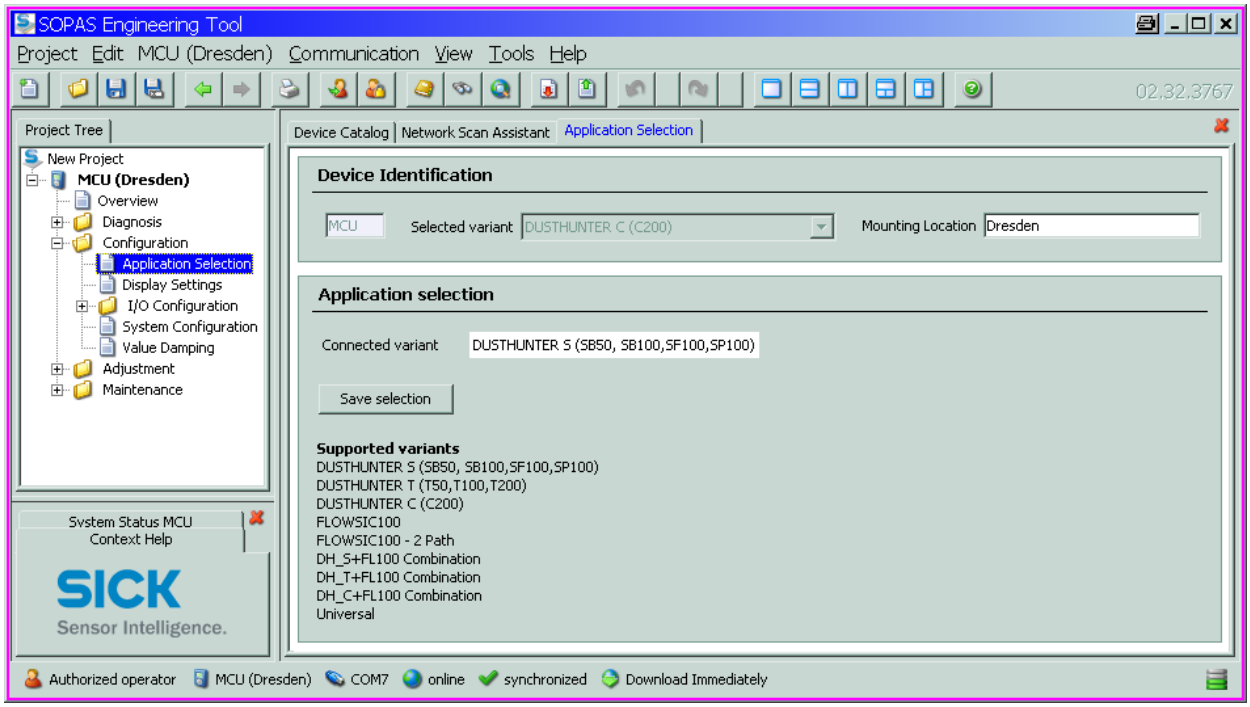
Figure 57 Setting "Maintenance" mode



- ► Switch to the "Configuration / Application selection“ directory.
- ► The basis type of the connected sender/receiver unit is shown in the window "Connected variant" (group "Application selection"). Click "Safe selection" to assign the MCU.

> The sender unit must be connected to the MCU.

Figure 58 Assigning the MCU to the sender/receiver unit



4.4.2 Factory settings

Parameter		Value	
Function check		Every 8 h; output of check values (90 s for every value) on standard analog output	
Analog output (AO) [mA]	Live zero (LZ)	4	
	Upper measuring range value (MBE)	20	
	Current during maintenance	0.5	
	Current by malfunction	21 (optional 1)	
Response time		60 s for all measured variables	
Measured variable	Output on AO	Value at LZ	Value at MBE
Dust concentration [mg/m³]	1	0	200
Scattered light intensity	2	0	200
Scattered light intensity	3	0	500
Regression coefficients (only for dust concentration)		0.00 / 1.00 / 0.00	

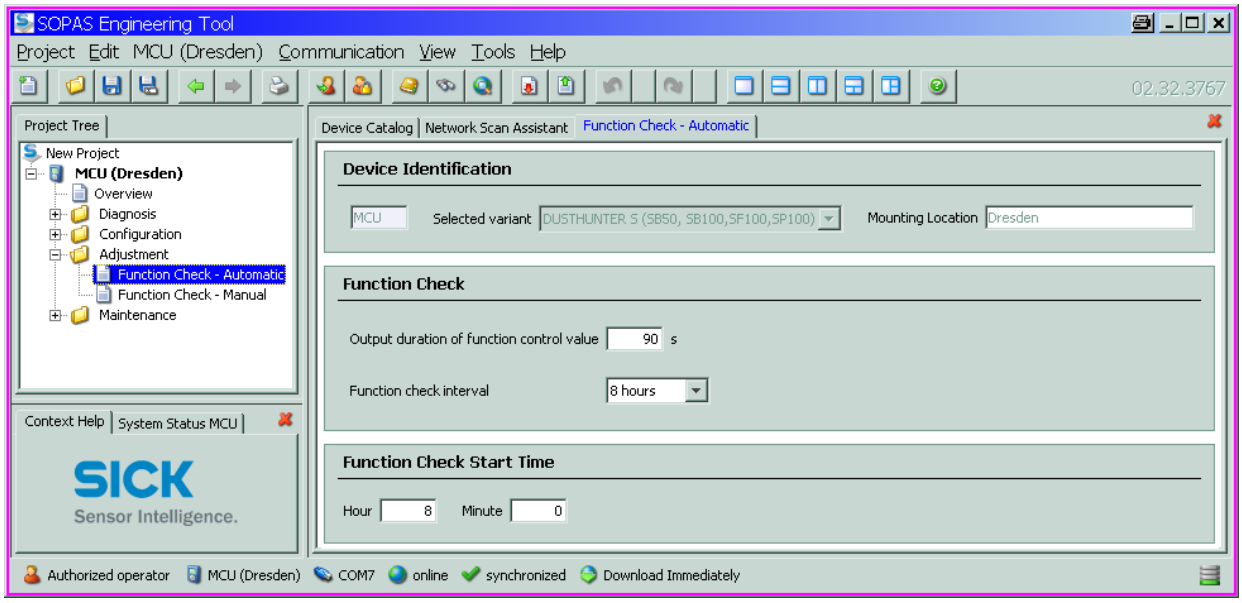
The steps required to modify these settings are described in the following Sections. Prerequisite: The device data are located in the "Project Tree" window, the Level 1 password has been entered and "Maintenance" mode set.

4.4.3 Determining the function check

Interval time, control value output on the analog output and the starting timepoint for automatic function checks can be modified in the "Adjustment / Function Check - Automatic" directory.

Default values → p. 65, §4.4

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



Entry field	Parameter	Remark
Function check output duration	Value in seconds	Output duration of control values
Check interval Function check	Time between two function checks	→ p. 15, §2.1.3
Function check start time	Hours	Defining a start timepoint in hours and minutes .
	Minutes	

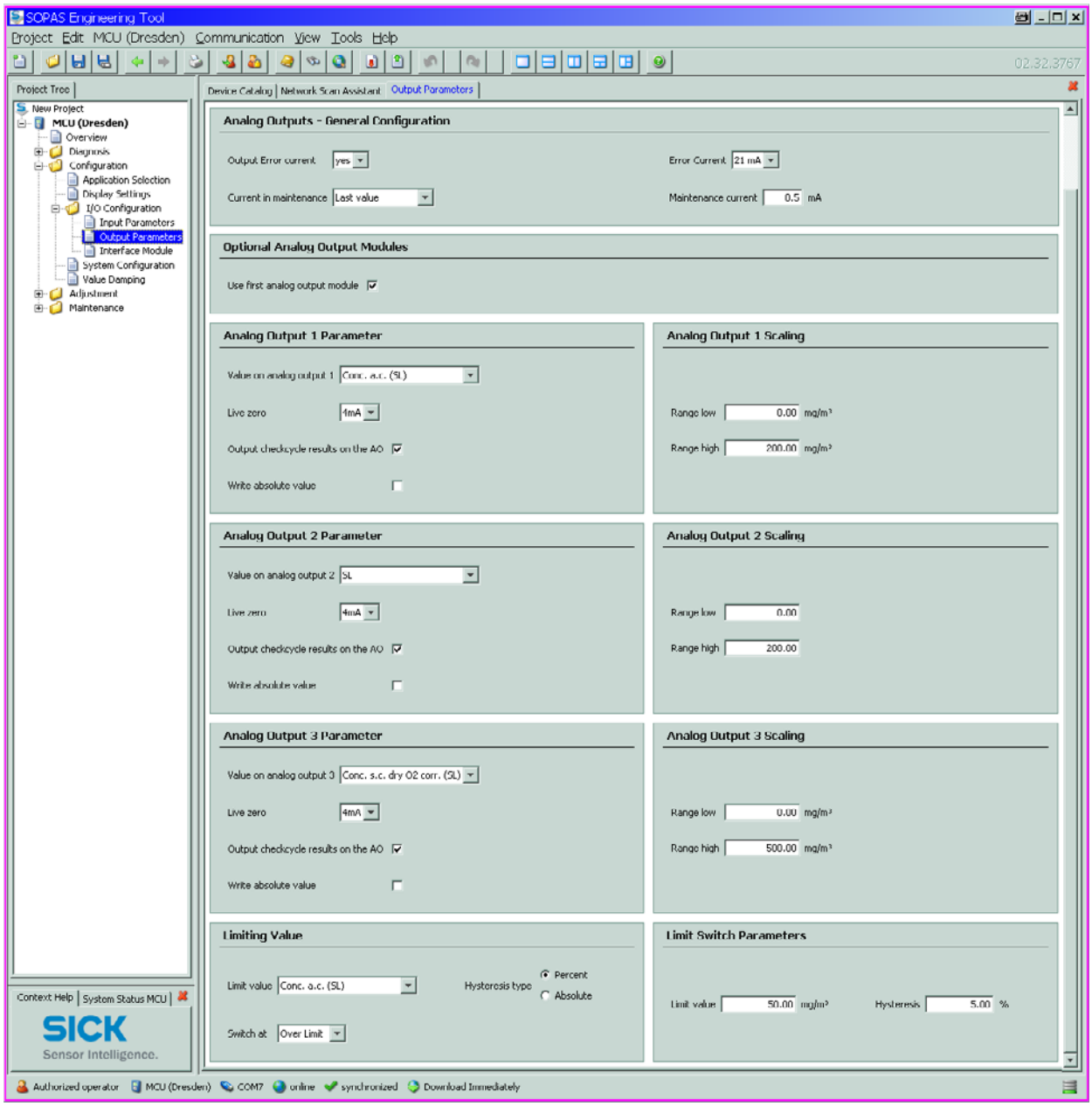
The value measured last is output during control value determination (→ p. 16, Fig. 3).

4.4.4 Setting the analog outputs parameters

Select the "Configuration / IO Configuration / Output Parameters" directory to set the analog outputs.

- Default values → p. 66, §4.4.2
- In order to output the dust concentration under standard conditions ("Conc. s.c." (SL)), set the parameters for the analog inputs according to §4.4.5.

Figure 60 "Configuration / IO Configuration / Output Parameters" directory



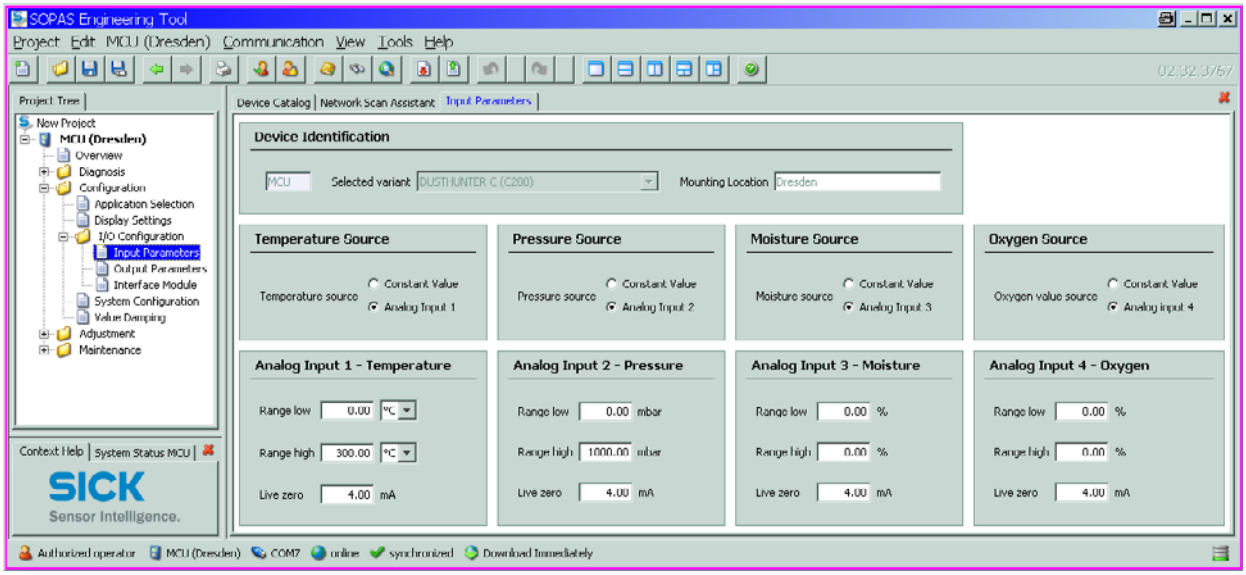
Field		Parameter	Remark	
Analog Outputs -General Configurationn	Output Error current	yes	Error current is output.	
		no	Error current is not output.	
	Error Current	Value < Live Zero (LZ) or > 20 mA	mA value to be output in "Malfunction" state (error case) (size depends on connected evaluation system).	
	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".	
	Maintenance current	Whenever possible, value ≠ LZ	mA value to be output in "Maintenance" state	
Optional Analog Output Modules	Use first analog output module	Inactive	Not permitted for DUSTHUINTER SF100 (AO 2 and AO 3 available per default).	
		Active	Opens the fields to set parameters for AO 2 and AO 3 (standard on DUSTHUNTER SF100)	
Analog Output 1 Parameter	Value on analog output 1	Conc. a.c.(SL)	Dust concentration under operating (actual) conditions (based on scattered light intensity)	The selected measured variables are output on the analog output.
		Conc. s.c.(SL)	Dust concentration under standard conditions (based on scattered light intensity)	
		SL	Scattered light intensity	
	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.	
	Output function check results on the AO	Inactive	Control values (→ p. 15, §2.1.3) are not output on the analog output .	
		Active	Control values are output on the analog output.	
	Write absolute value	Inactive	It‘s distinguished between positive and negative measured values.	
		Active	The amount of the measured value is output.	
Analog Output 1 Scaling	Range low	Lower measuring range limit	Physical value at live zero	
	Range high	Upper measuring range limit	Physical value at 20 mA	
Limiting Value	Limit value	Conc. a.c.(SL)	Dust concentration under operating (actual) conditions (based on scattered light intensity)	Select the measured variable for which a limit value is to be monitored..
		Conc. s.c.(SL)	Dust concentration under standard conditions (based on scattered light intensity)	
		SL	Scattered light intensity	
	Hysteresis Type	Percent	Assignment of the value entered in the "Hysteresis Type" field as relative or absolute value of defined limit value	
		Absolute		
	Switch On	Over Limit	Specification of the switching direction	
		Under Limit		
Limit Switch Parameter	Limit value	Value	The limit value relay switches when the entered value is exceeded or underflown.	
	Hysteresis	Value	Defines a tolerance for resetting the limit value relay	

Set the parameters for "Analog Output 2(3) Parameter" and "Analog Output 2(3) Scaling" in the same manner as for "Parameter Analog Output 1" and "Analog Output 1 Scaling".

4.4.5 Setting the analog inputs parameters

Select the "Configuration / IO Configuration / Input Parameters" directory to set the analog inputs.

Figure 61 "Configuration / IO Configuration / Input Parameters" directory

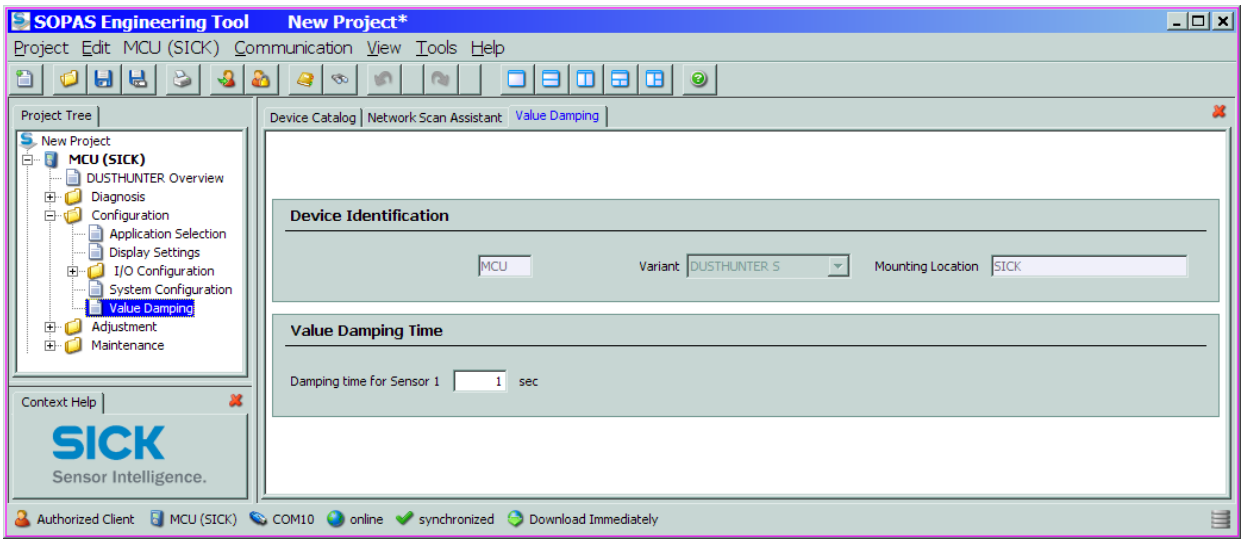


Field	Parameter	Remark
Temperature Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the "Constant Temperature" field to enter the scaling value in °C (°F for imperial units) or K .
	Analog Input 1	The value from an external sensor connected to analog input 1 (standard scope of delivery) is used to calculate the scaled value. This parameter opens the "Analog Input 1 - Temperature" field to set the parameters for the lower and upper range limit values and the Live Zero value.
Pressure source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the "Constant Pressure" field to enter the scaling value in mbar (=hPa).
	Analog Input 2	The value from an external sensor connected to analog input 2 (standard scope of delivery) is used to calculate the scaled value. This parameter opens the "Analog Input 2 - Pressure" field to set the parameters for the lower and upper range limit values and the Live Zero value.
Moisture Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the "Constant Moisture" field to enter the scaling value in %.
	Analog input 3	The value from an external sensor connected to analog input 3 (optional module required) is used to calculate the scaled value. This parameter opens the "Analog Input 3 - Moisture" field to set the parameters for the lower and upper range limit values and the Live Zero value.
Oygen Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the "Constant Oygen" field to enter the scaling value in %.
	Analog Input 4	The value from an external sensor connected to analog input 3 (optional module required) is used to calculate the scaled value. This parameter opens the "Analog Input 4 -Oxygen" field to set the parameters for the lower and upper range limit values and the Live Zero value.

4.4.6 Setting the response time

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

Figure 62 "Configuration / Value Damping" directory



Field	Parameter	Remark
Response time Sensor 1	Value in s	Response time for the selected measured variable (→ p. 15, §2.1.2) Setting range 1 to 600 s

4.4.7 Calibrating for dust concentration measurement

> ***NOTICE:***
> The steps described here serve to avoid input errors. Carrying out comparison measurements demands special knowledge that cannot be described in detail here.

For exact dust concentration measurement, the relation between the primary measured variable scattered light intensity and the actual dust concentration in the duct must be established. To do this, the dust concentration must be determined based through a gravimetric comparison measurement according to EN 13284-1 or comparable regulations and set in relation to the scattered light values measured at the same time by the measuring system.

Activities

- ► Select "MCU" device file, set the measuring system to "Maintenance" mode and enter the Level 1 password (→ p. 55, §4.1.4).
- ► Select the "Configuration / IO Configuration / Output Parameter" directory (→ p. 68, Fig. 60) and assign the "Scattered light intensity" measured variable to one of the three analog outputs available.
- ► Estimate the measuring range required for the dust concentration in operational state and enter this in the "Analog Output 1 *(2/3)* Scaling" field assigned to the selected analog output to output the scattered light intensity value.
- ► Switch "Maintenance" off.
- ► Carry out the gravimetric comparison measurement according to EN 13284-1 or comparable regulations.
- ► Determine regression coefficients from the mA values of the analog output for "Scattered light intensity" and the dust concentrations act. measured gravimetrically.

$$c = K2 \cdot I_{out}^{\,2} + K1 \cdot I_{out} + K0 \qquad (1)$$

c:	dust concentration in mg/m³
K2, K1, K0:	regression coefficients of the function c = f (Iout)
Iout:	current output value in mA

$$I_{out} = LZ + SL \cdot \frac{20mA - LZ}{MBE} \qquad (2)$$

SL:	measured scattered light intensity value
LZ:	Live Zero
MBE:	defined upper range limit (entered value for 20 mA; normally 2.5 x fixed limit value)

► Enter the regresssion coefficients

There are two possibilities:

– Direct input of K2, K1, K0 into a measurement computer.

> ***NOTICE:***
> The coefficient set entered in the sender unit and measuring range entered in the MCU may not be changed in this case any more. If the LCD option is used, the dust concentration is displayed in mg/m³ as an uncalibrated value.

– Use of the regression function of the measurement system (no measurement computer necessary).

In this case the correlation to the scattered light intensity has to be determined. To do so, calculate the regression coefficients cc2, cc1, cc0 to be entered in the measurement system from K2, K1, K0.

$$c = cc2 \cdot SL^2 + cc1 \cdot SL + cc0 \qquad (3)$$

By using (2) in (1), the result is as follows:

$$c = K2 \cdot \left(LZ + SL \cdot \frac{20mA - LZ}{MBE}\right)^2 + K1 \cdot \left(LZ + SL \cdot \frac{20mA - LZ}{MBE}\right) + K0$$

Using (3), the result is as follows:

$$cc0 = K2 \cdot LZ^2 + K1 \cdot LZ + K0$$

$$cc1 = (2 \cdot K2 \cdot LZ + K1) \cdot \left(\frac{20mA - LZ}{MBE}\right)$$

$$cc2 = K2 \cdot \left(\frac{20mA - LZ}{MBE}\right)^2$$

Enter then the determined regression coefficients cc2, cc1 and cc0 in the "Configuration / Application parameters" directory (→ p. 62, Fig. 54) (Set the sender unit into "Maintenance" mode, enter level 1 password and switch the unit back to "Measurement" mode after setting the coefficients).

> This method allows changing the parameters for the selected measuring range as desired.

4.4.8 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

  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

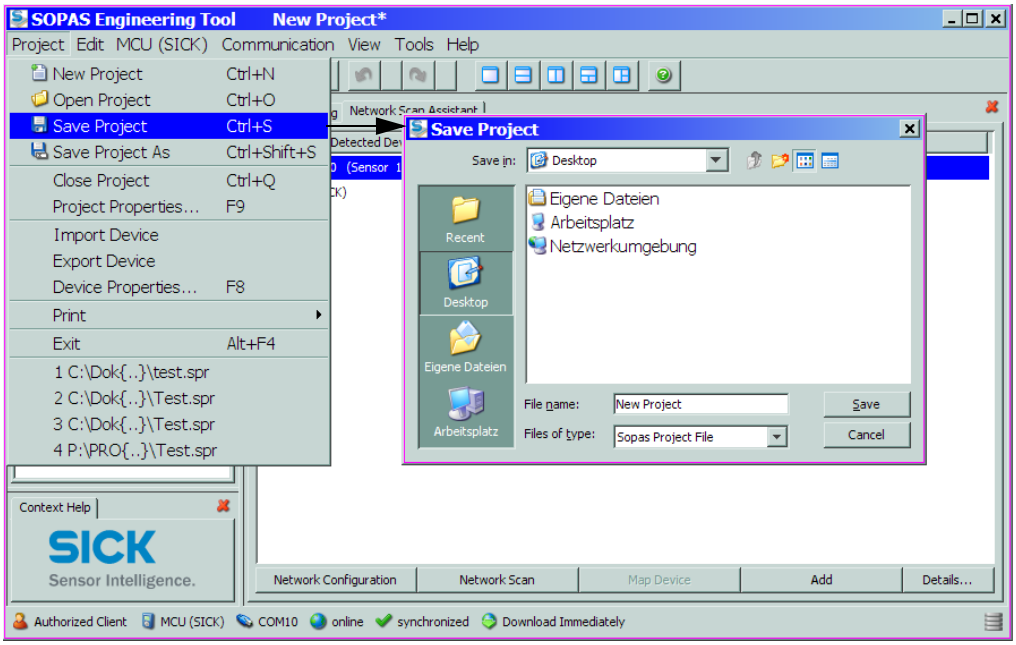
  Device data and parameters are recorded in the Parameter protocol.
  A Diagnosis protocol can be created for analysis of the device function and recognition of possible malfunctions.

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).

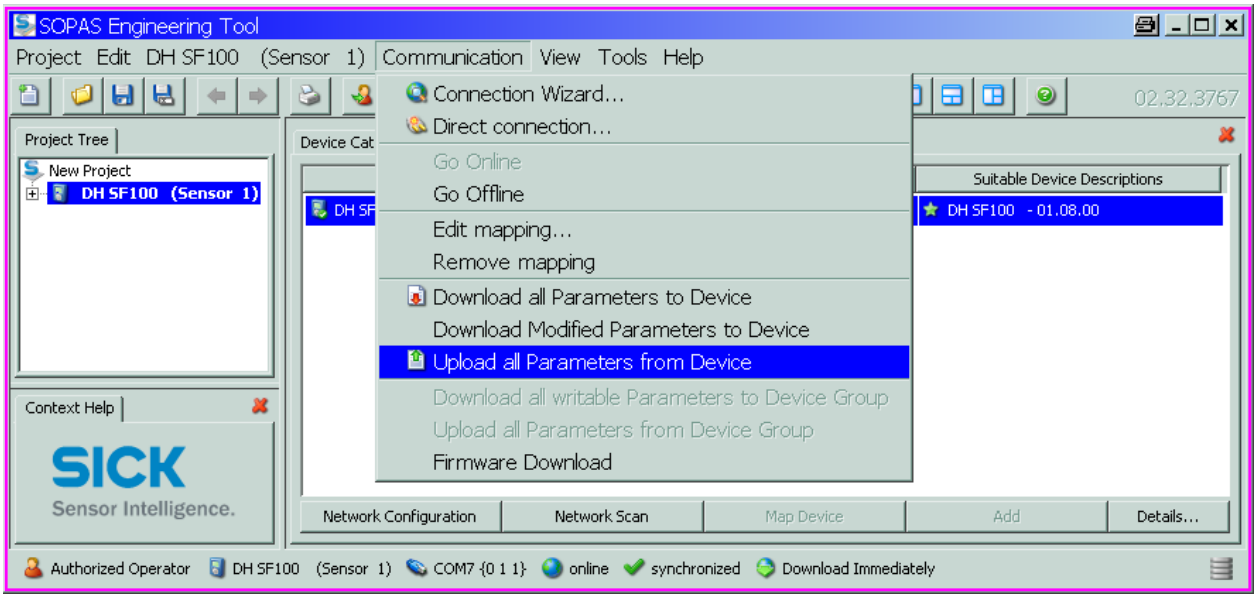
Figure 63 "Project / Save Project" menu



Saving as a protocol

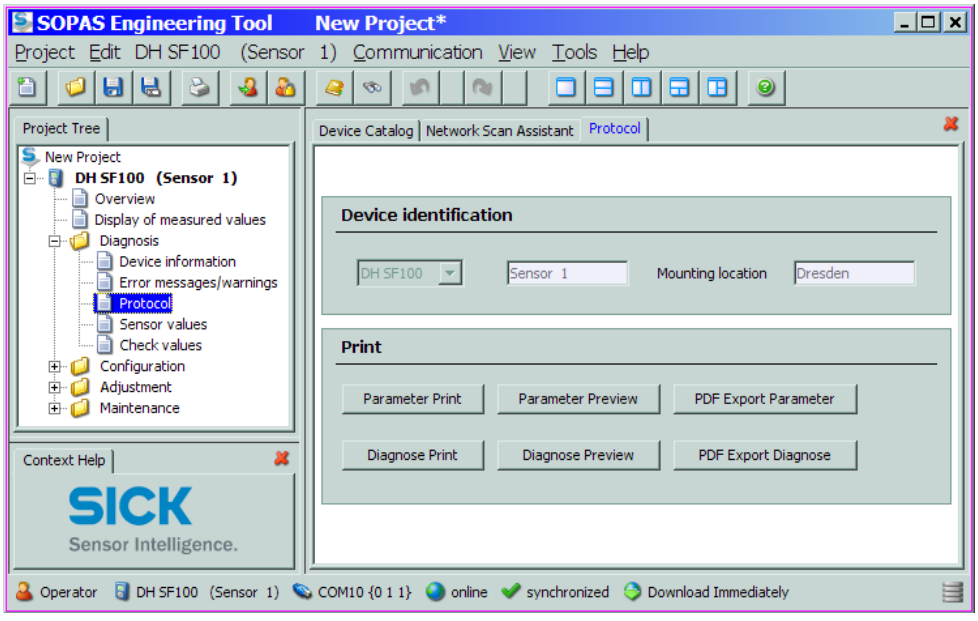
► Select device and actualize the device parameters using the "Upload all Parameters from Device" menu.

Figure 64 Actualising the device parameters



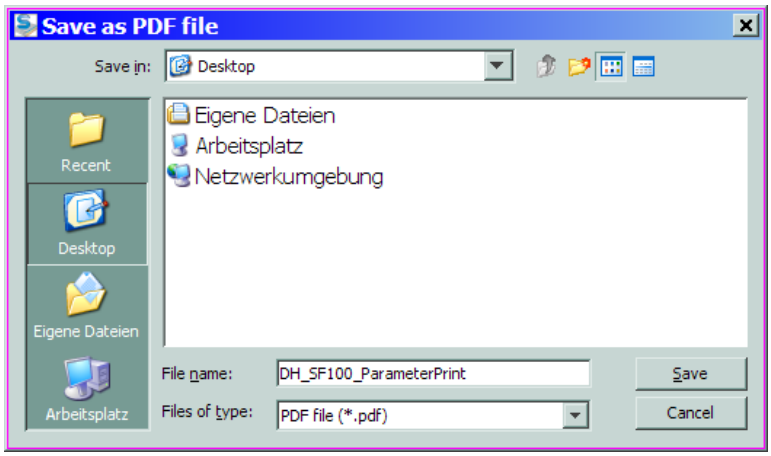
► Select the "Diagnosis / Protocols" directory and click the button for the desired type of registration.

Figure 65 "Diagnosis / Protocols" directory



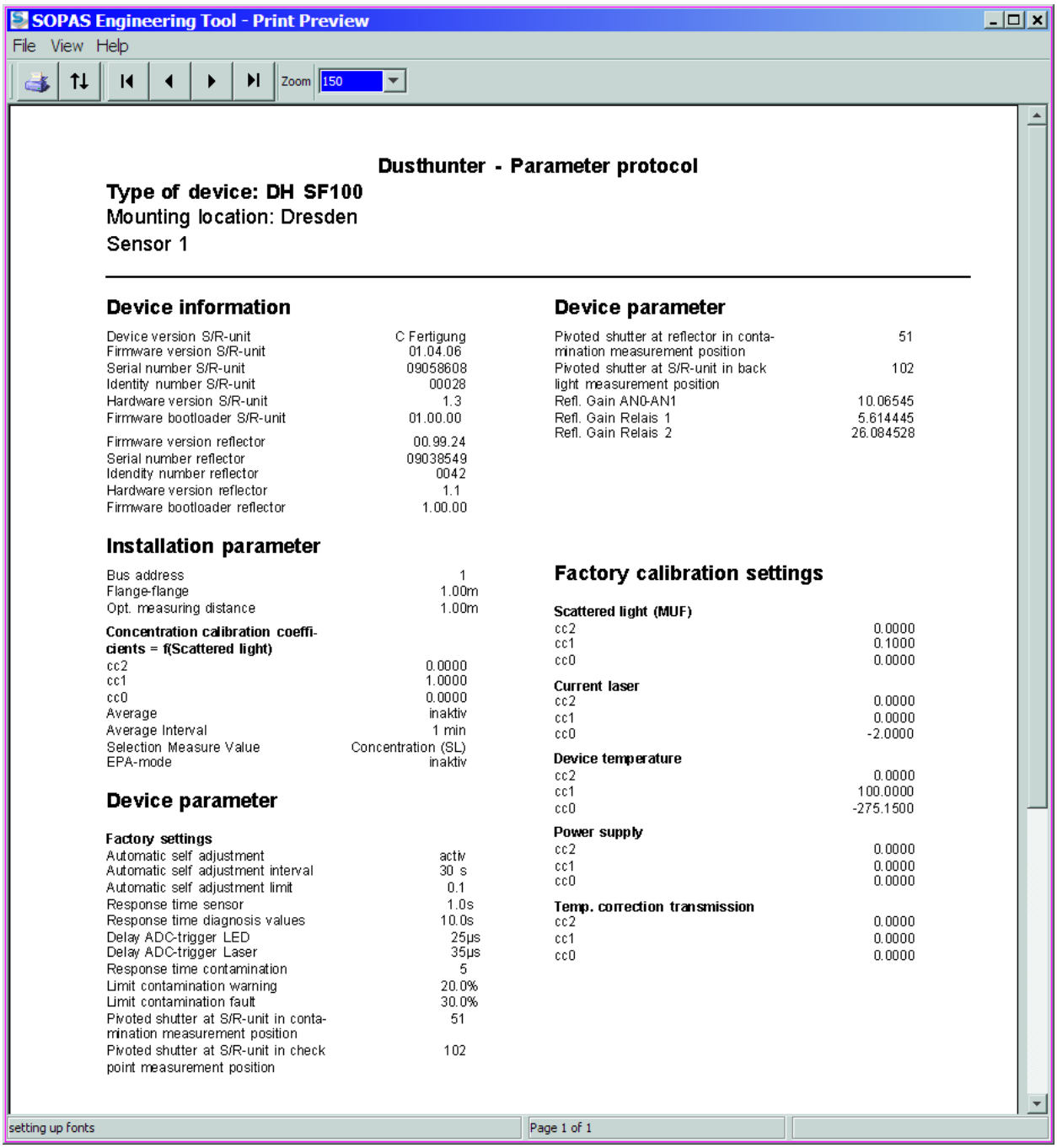
The file name and storage location must be specified for export to a PDF file.

Figure 66 Specifying file name and storage location



Parameter protocol example

Figure 67 DUSTHUNTER SF100 Parameter protocol (example)



SOPAS Engineering Tool - Print Preview

File View Help

Zoom 150

Dusthunter - Parameter protocol

Type of device: DH SF100
Mounting location: Dresden
Sensor 1

Device information

Device version S/R-unit	C Fertigung
Firmware version S/R-unit	01.04.06
Serial number S/R-unit	09058608
Identity number S/R-unit	00028
Hardware version S/R-unit	1.3
Firmware bootloader S/R-unit	01.00.00
Firmware version reflector	00.99.24
Serial number reflector	09038549
Idendity number reflector	0042
Hardware version reflector	1.1
Firmware bootloader reflector	1.00.00

Installation parameter

Bus address	1
Flange-flange	1.00m
Opt. measuring distance	1.00m
Concentration calibration coefficients = f(Scattered light)	
cc2	0.0000
cc1	1.0000
cc0	0.0000
Average	inaktiv
Average Interval	1 min
Selection Measure Value	Concentration (SL)
EPA-mode	inaktiv

Device parameter

Factory settings	
Automatic self adjustment	activ
Automatic self adjustment interval	30 s
Automatic self adjustment limit	0.1
Response time sensor	1.0s
Response time diagnosis values	10.0s
Delay ADC-trigger LED	25µs
Delay ADC-trigger Laser	35µs
Response time contamination	5
Limit contamination warning	20.0%
Limit contamination fault	30.0%
Pivoted shutter at S/R-unit in contamination measurement position	51
Pivoted shutter at S/R-unit in check point measurement position	102

Device parameter

Pivoted shutter at reflector in contamination measurement position	51
Pivoted shutter at S/R-unit in back light measurement position	102
Refl. Gain AN0-AN1	10.06545
Refl. Gain Relais 1	5.614445
Refl. Gain Relais 2	26.084528

Factory calibration settings

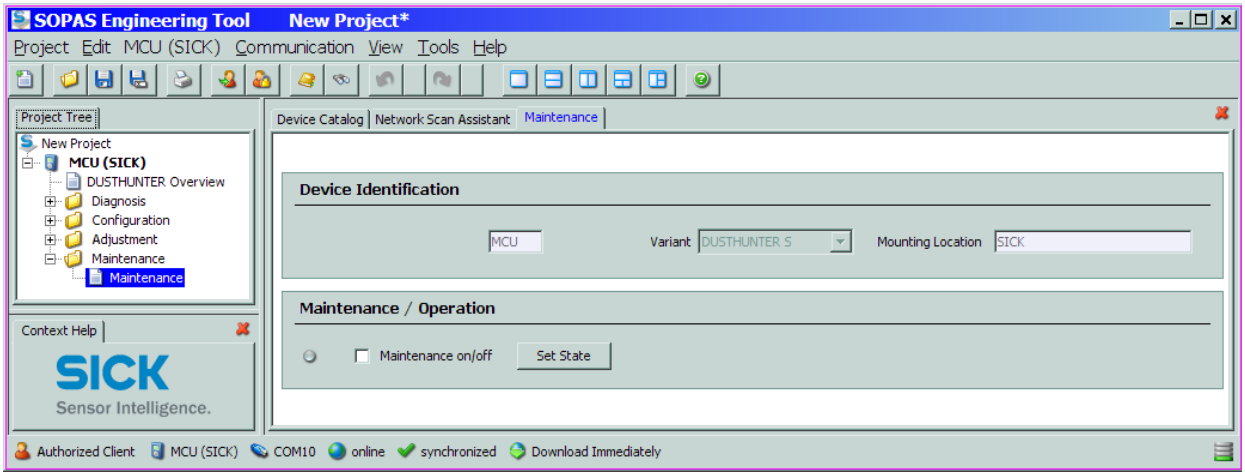
Scattered light (MUF)	
cc2	0.0000
cc1	0.1000
cc0	0.0000
Current laser	
cc2	0.0000
cc1	0.0000
cc0	-2.0000
Device temperature	
cc2	0.0000
cc1	100.0000
cc0	-275.1500
Power supply	
cc2	0.0000
cc1	0.0000
cc0	0.0000
Temp. correction transmission	
cc2	0.0000
cc1	0.0000
cc0	0.0000

setting up fonts Page 1 of 1

4.4.9 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" (→ Fig. 68). Standard start-up is now completed.

Figure 68 Setting the operational state



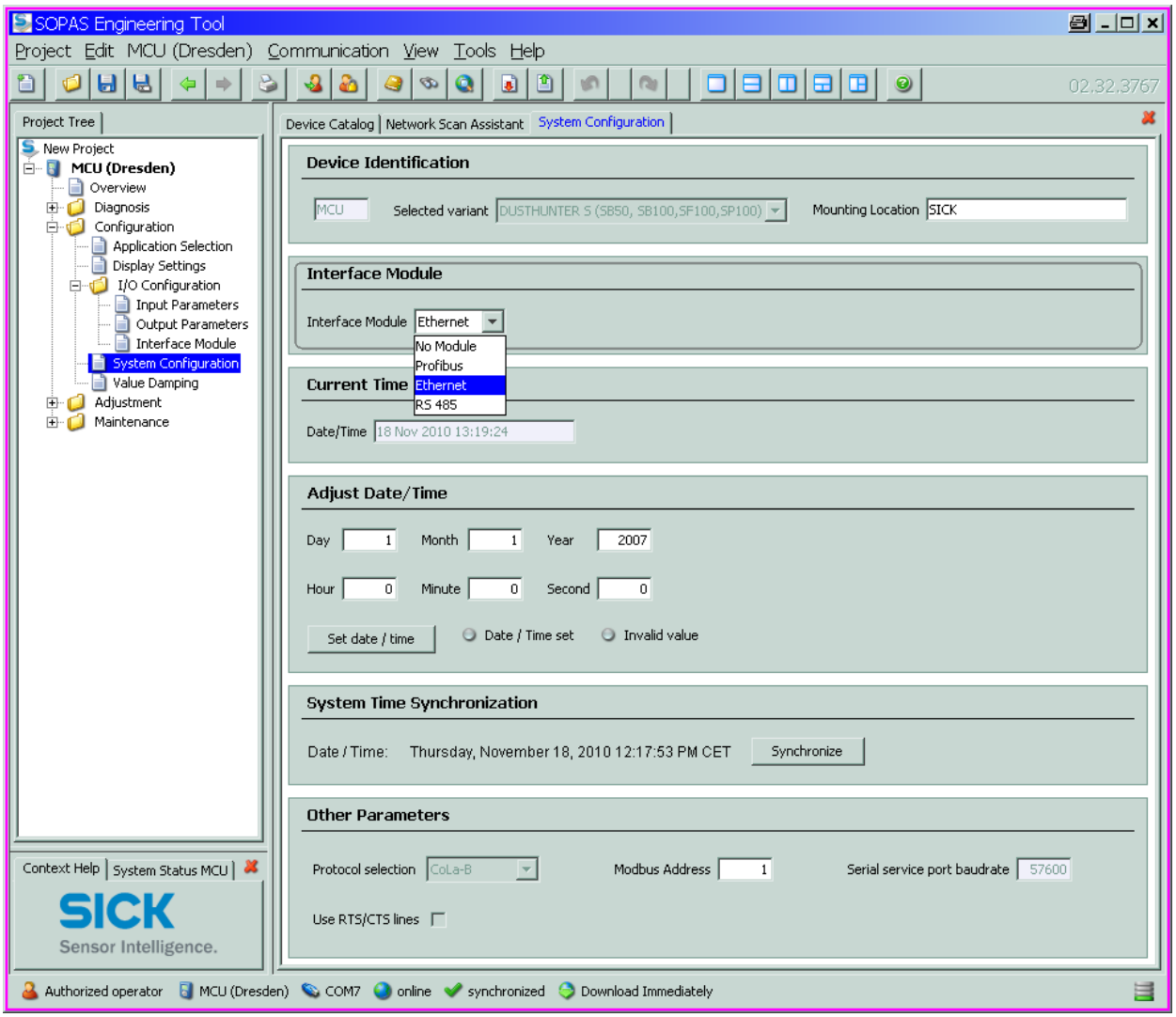
4.5 Setting the Interface module parameters

4.5.1 General information

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

- ► Select "MCU" device file, set the measuring system to "Maintenance" mode and enter the Level 1 password (→ p. 55, §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.

Figure 69 "Configuration / System Configuration" directory



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

4.5.2 Setting the Ethernet module parameters

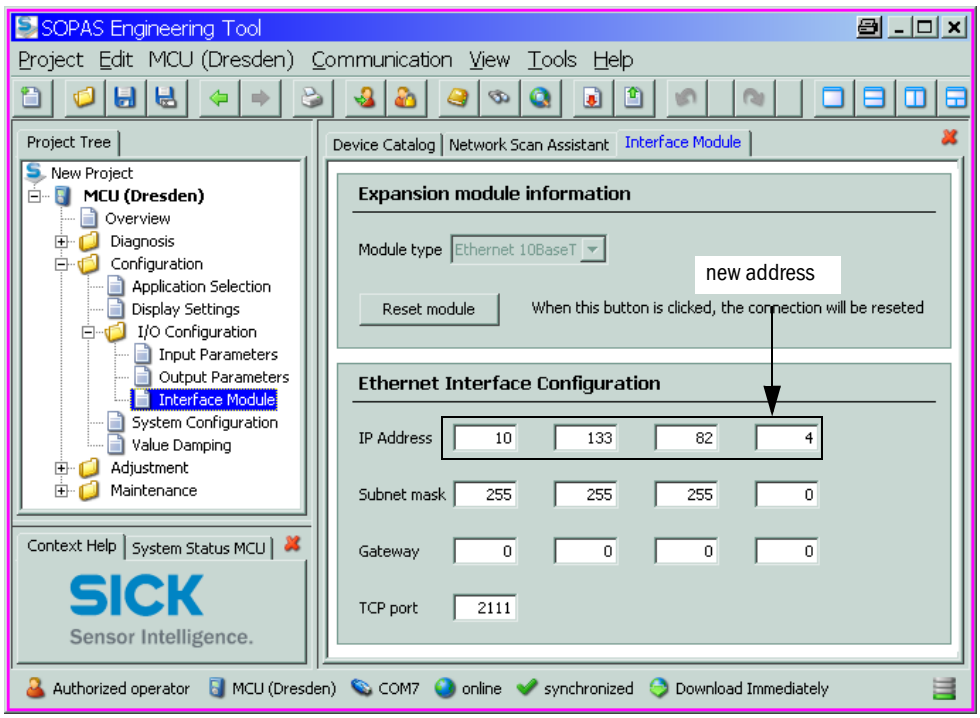
> ***NOTICE:***
> For communication via Ethernet exists a risk of unwanted access to the measuring system.
> ► Operate the measurement system only behind a suitable protective equipment (eg. Firewall).

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".

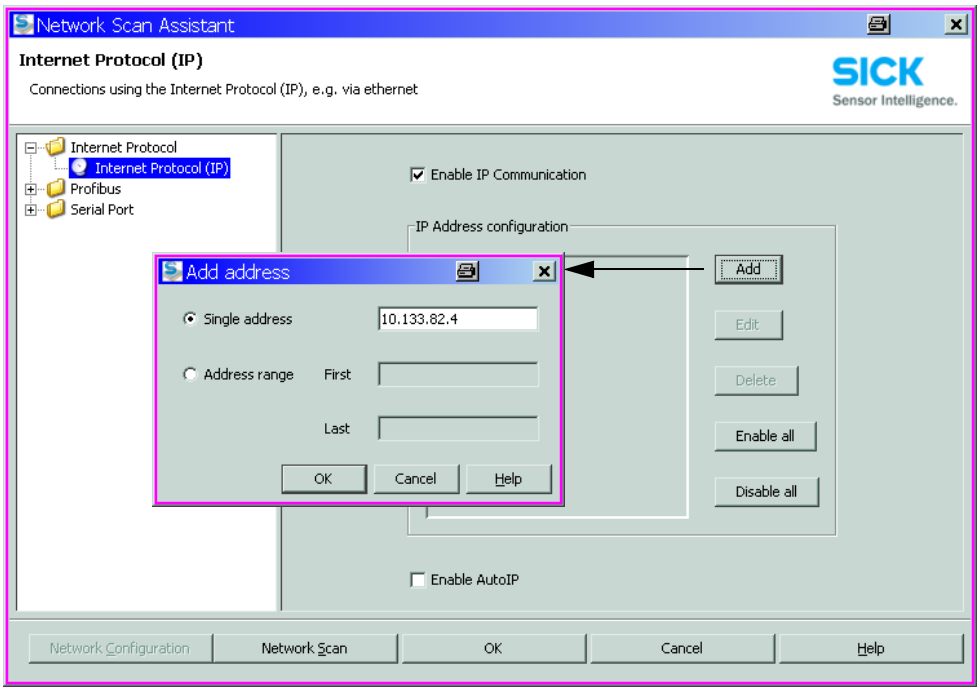
Figure 70 Assigning the Ethernet module a new IP address



Assigning the new IP address to the SOPAS ET program

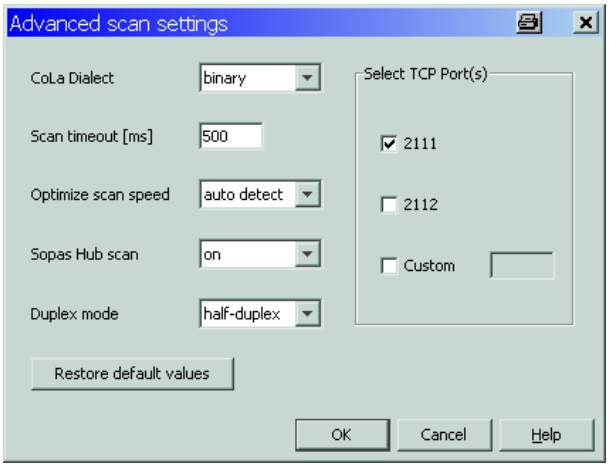
- ► Select the "Network Scan Assistant" register and click "Network Configuration".
- ► Select the "Internet Protocol (IP)" directory, set the "Enable IP Communication" entry field to active and click "Add".
- ► Enter the new IP address set in the "Configuration / IO Configuration /Interface Module" directory and confirm with "OK".

Figure 71 Entering the IP address (example)



- ► Click "Advanced..." in the "Internet Protocol (IP)“ window.
- ► Select port address "2111" and confirm with "OK" (all other settings and values according to Fig. 72).

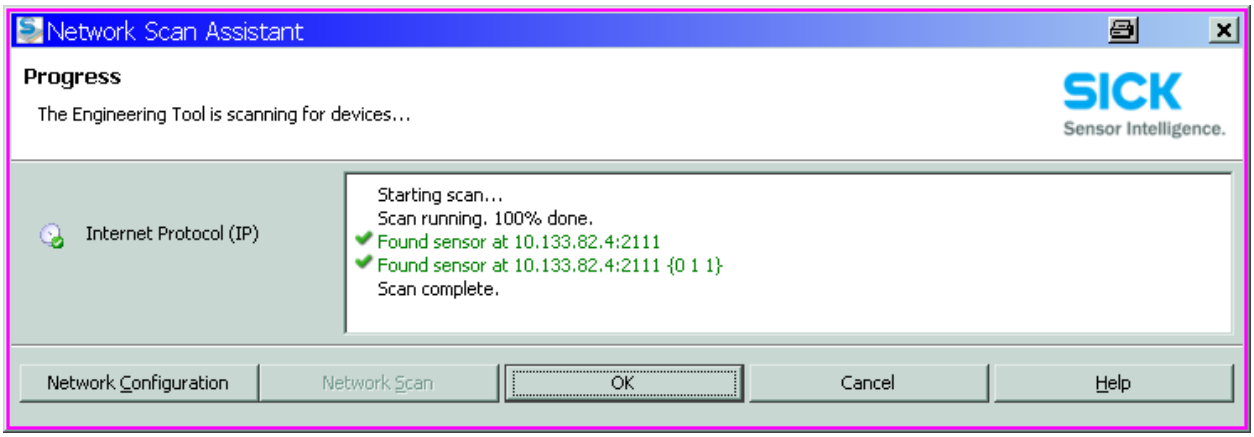
Figure 72 Specifying the TCP port



- ► Activate only the required TCP-Port.
- ► Activate the checkbox "Custom" and enter the port number in the window besides this if a TCP port shall be used different from 2111 or 2112.

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

Figure 73 Network scanning



NOTICE:

During communication on Ethernet disturbances in the data transfer can appear which are not caused by the measuring system.

- ► If measured values are transferred exclusively via Ethernet and used to control processes, disturbances are possible in the plant operation for which the manufacturer of the DUSTHUNTER SF100 is not responsible.

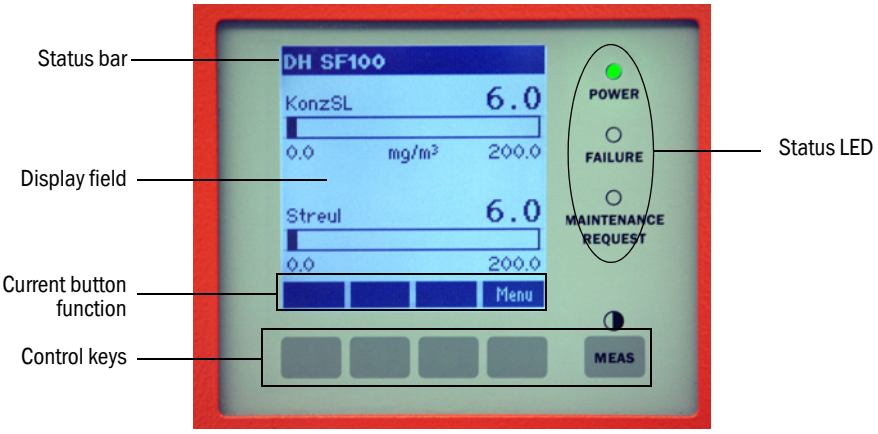
Increase the value in field "Scantimeout" from 500 ms to 3000 ms if disturbances appear in the Ethernet communication.

4.6 Operating/setting parameters via the LC-Display

4.6.1 General information on use

The display and operating interface of the LC-Display contains the functional elements shown in Fig. 74.

Figure 74 LC-Display functional elements



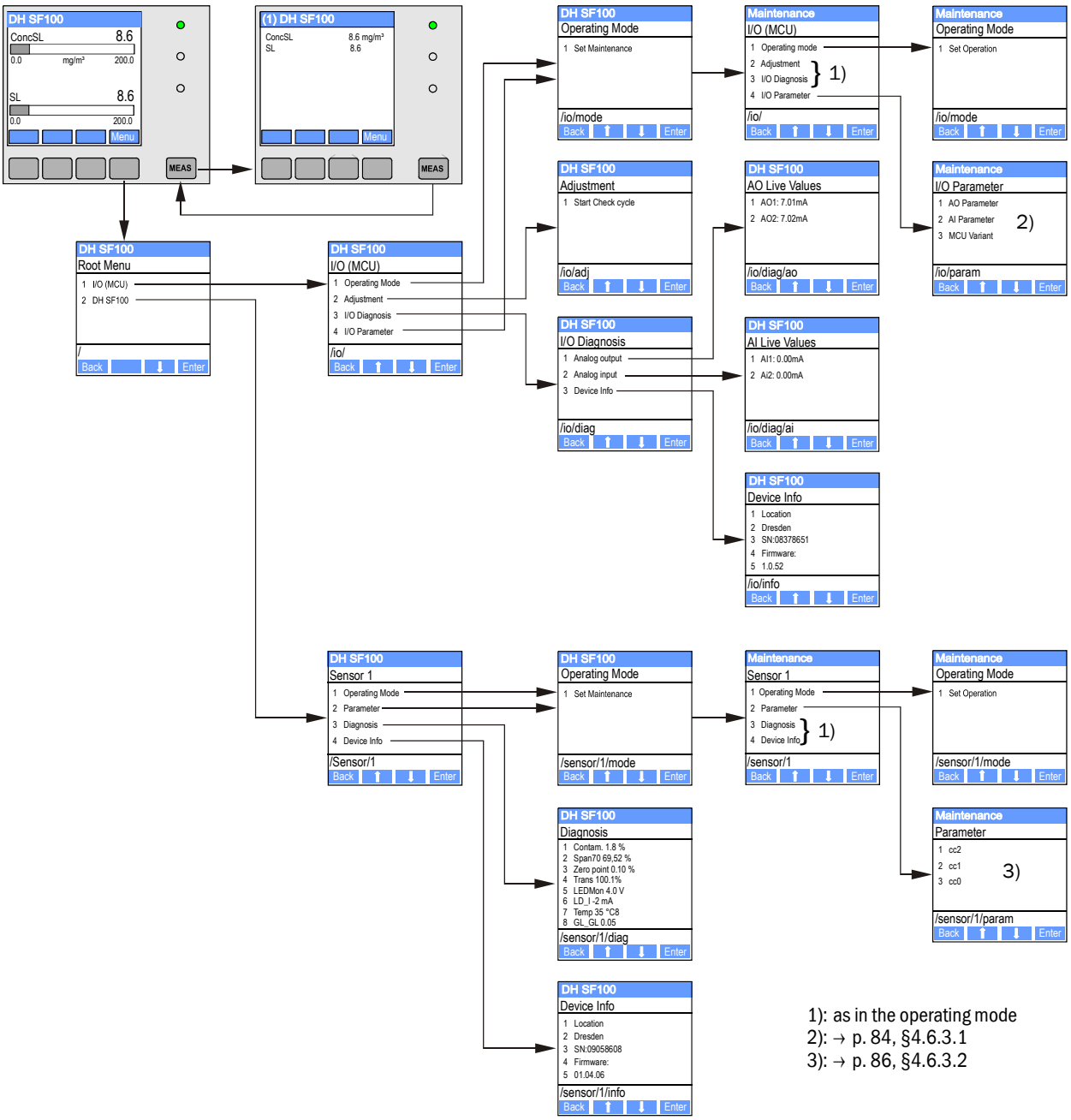
Button functions

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

Button	Function
Diag	Display diagnostic information (warnings and errors during a start using the Main menu, sensor information during a start using the Diagnostics menu; see → p. 84, Fig. 75)
Back	Switch to higher level menu
Arrow ⇑	Scroll up
Arrow ⇓	Scroll down
Enter	Execution of the action selected with an arrow button (switch to a submenu, confirm parameter selected during parameter setting)
Start	Start an action
Save	Store a changed parameter
Meas	Toggle between main measurement values to sensor measurement values Display the contrast setting (after 2.5 s)

4.6.2 Menu structure

Figure 75 LC-Display menu structure



1): as in the operating mode
2): → p. 84, §4.6.3.1
3): → p. 86, §4.6.3.2

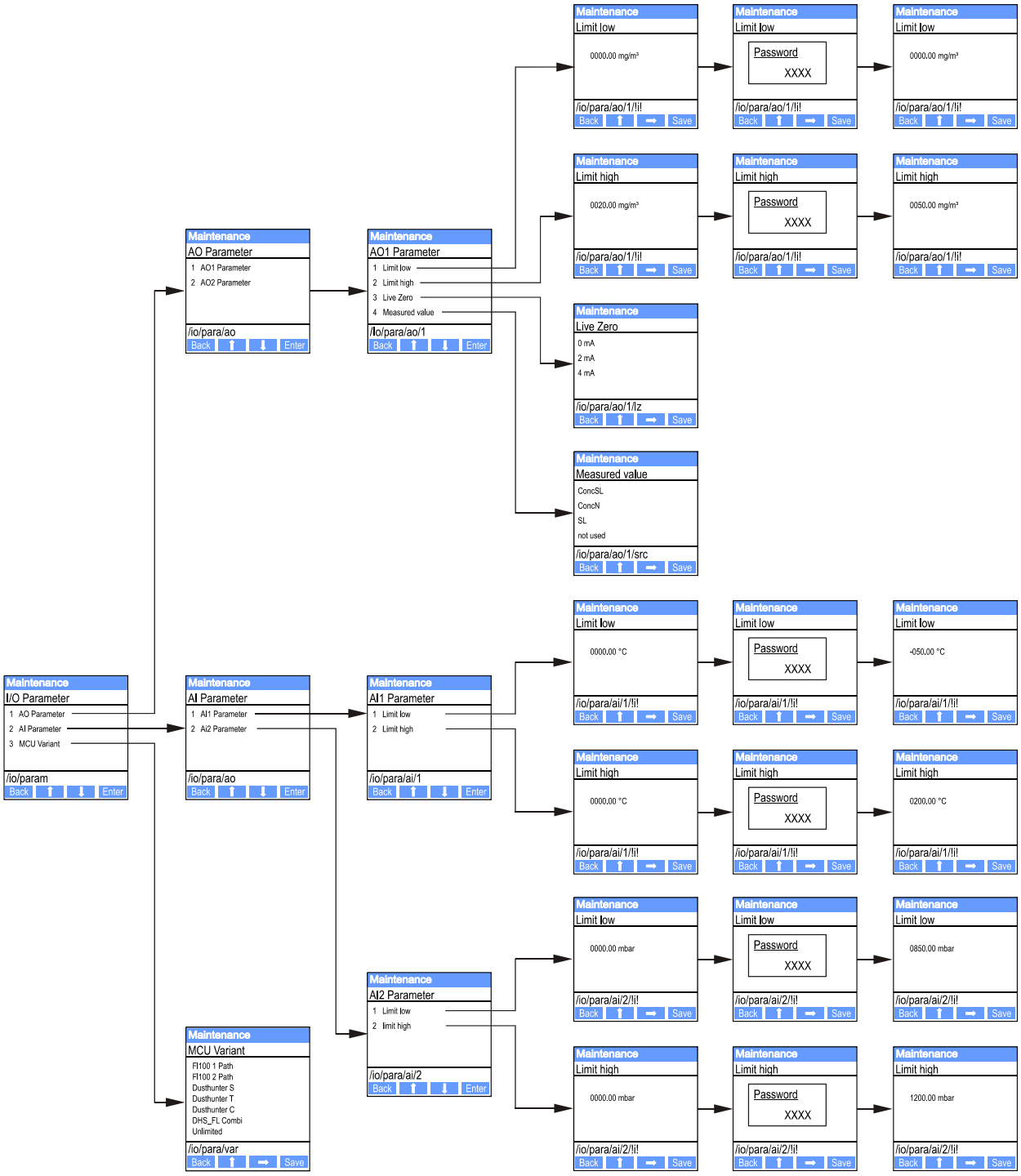
4.6.3 Parameter setting

4.6.3.1 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).

Figure 76 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 DUSTHUNTER SF100 (→ p. 65, §4.4.1), :

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

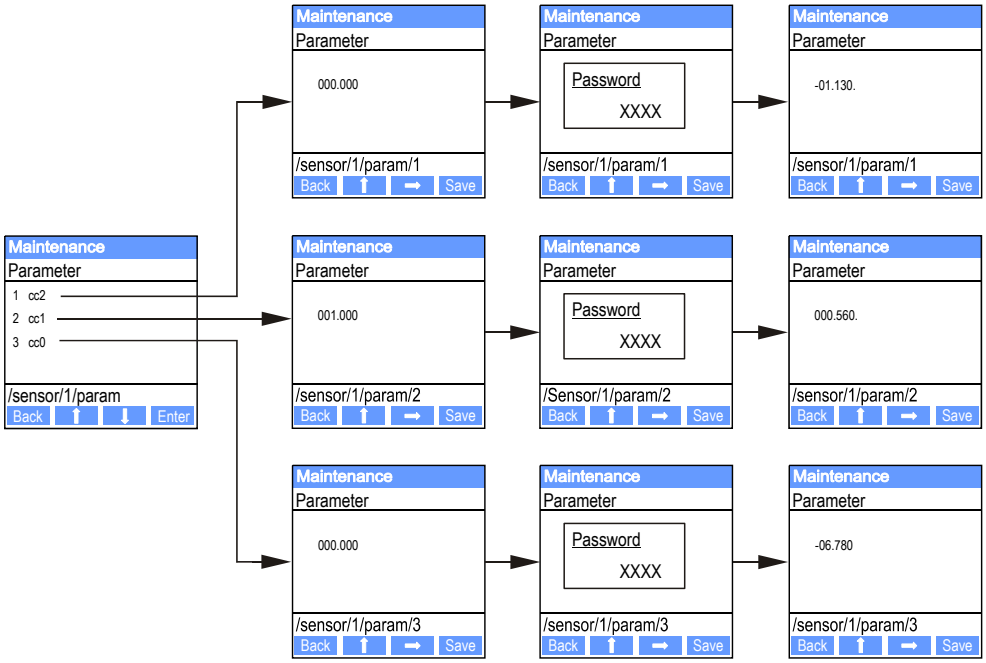
The other assigning possibilities are not practicable here.

4.6.3.2 **Sender unit**

The following steps are required to enter the regression coefficients:

- ► Set the sender unit into "Maintenance" and select the "Parameter" submenu.
- ► Choose the parameter to be entered and set the default password "1234".
- ► Select the calculated coefficient (→ p. 72, §4.4.7) using the "^" and/or "→" buttons and write it to the device with "Save" (confirm 2x).

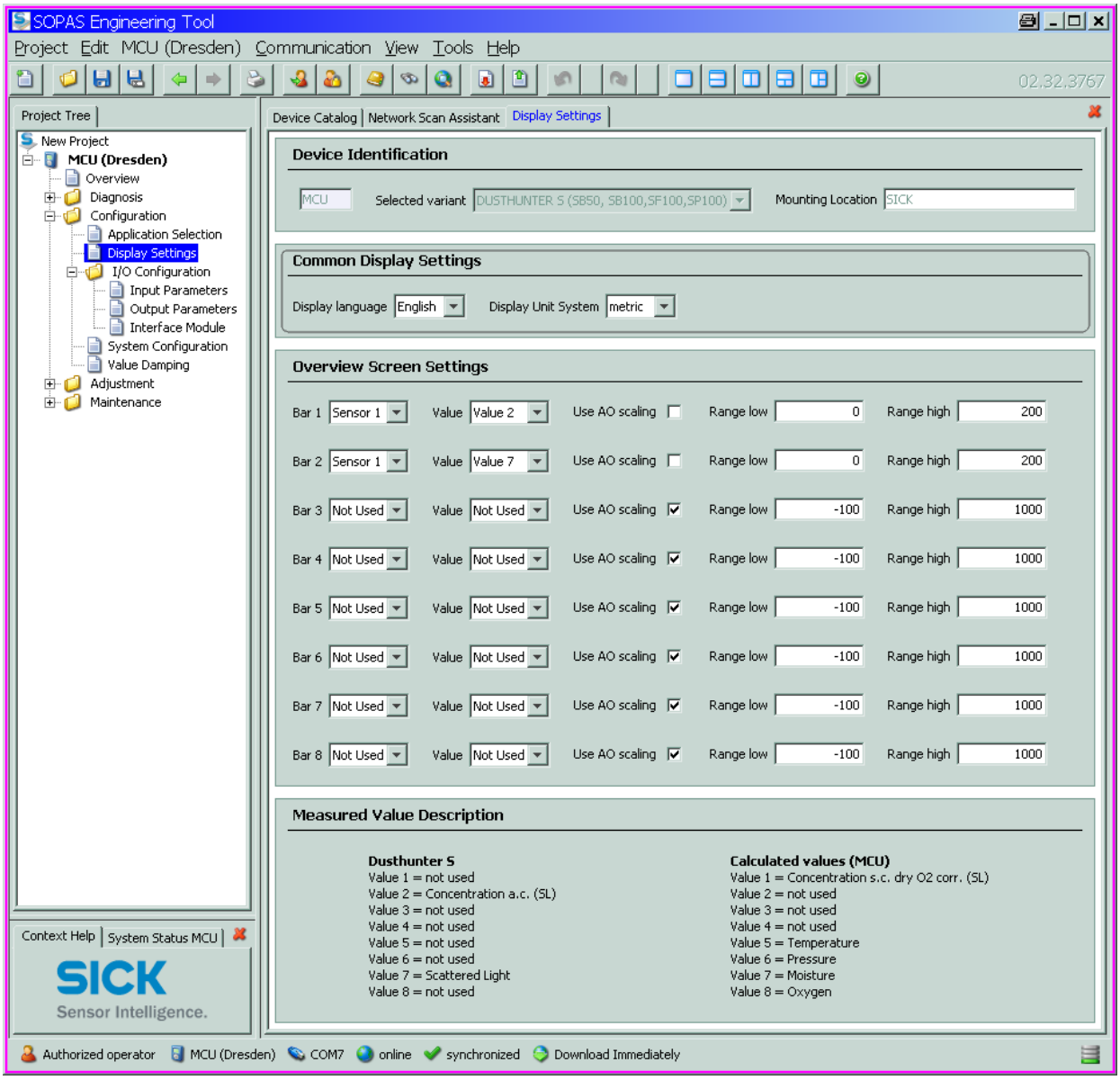
Figure 77 Entering the regressions coefficients



4.6.4 Using SOPAS ET to modify display settings

To modify factory settings, select device file "MCU" in the "Project tree“ window, enter the Level 1 password and Select the "Configuration /Display Settings“ directory.

Figure 78 "Configuration/Displayeinstellungen“ 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	

Measured value assignment

MCU measured value	Sender unit measured value
Value 1	Not used
Value 2	Concentration a.c. (SL)
Value 3	Not used
Value 4	Not used
Value 5	Not used
Value 6	Not used
Value 7	Scattered light
Value 8	Not used
MCU Value 1	Concentration s.c.

DUSTHUNTER SF100

5 Maintenance

General
Maintenance on the sender unit and scattered light receiver
Maintenance on the purge air supply
Shutdown

5.1 General

The maintenance work to be carried out consists of:

- Cleaning work (→ p. 92, §5.2),
- Securing the purge air supply function (→ p. 96, §5.3),
- Checking/correction the optical alignment of sender unit and scattered light receiver (→ p. 59, §4.2.2 and → p. 61, §4.2.3).

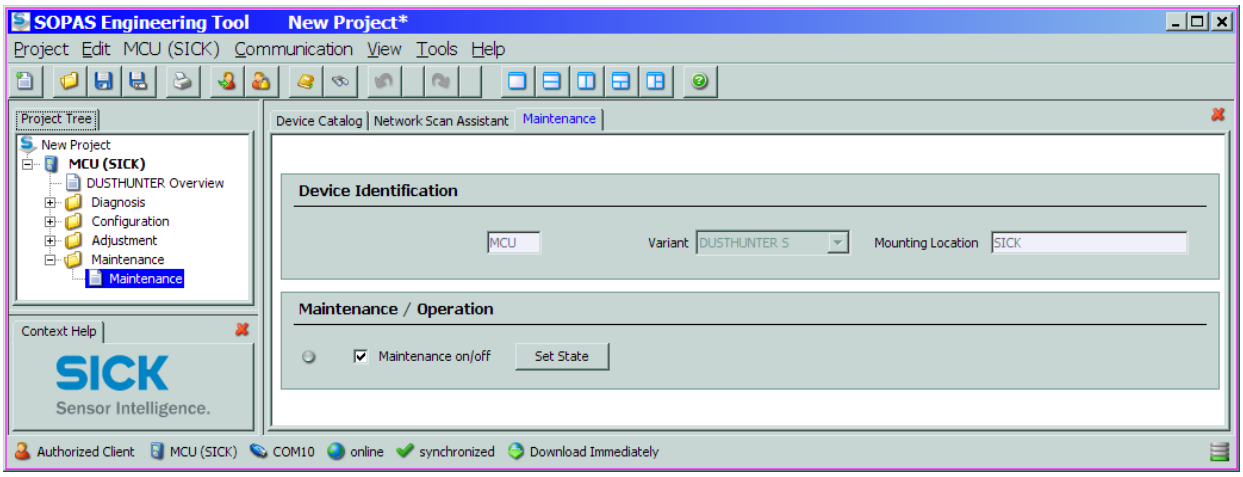
Take the following steps to set the measuring system to "Maintenance" mode before starting maintenance work:

► Connect the measuring system via the USB cable to the laptop/PC and start the SOPAS ET program.

► Click the "Network Scan" button in the "Network Scan Assistant" tab, select "MCU" device file and move it to the "Project Tree" window (→ p. 54, §4.1.3.5).

► Switch to the "Maintenance/Maintenance" directory, activate the "Maintenance on/off" checkbox in the "Maintenance / Operation" group and click "Set State" (see → Fig. 79).

Figure 79 Setting "Maintenance" mode



WARNING:
Observe the relevant safety regulations as well as the safety notices (→ p. 10, §1.3) during all work.

Resume measuring operation after completing the work (deactivate the "Maintenance on/off" checkbox in the "Maintenance / Operation" window and click "Set State").

- The "Maintenance" mode can also be set by using the keys on the LC display on the MCU (→ p. 84, §4.6.2) or connecting an external maintenance switch to the terminals for Dig In2 (17, 18) in the MCU (→ p. 41, §3.3.4).
- During "Maintenance", a function check is not performed.
- The control window on the back of the scattered light receiver (→ p. 60, Fig. 52) is illuminated for easier check of the optical alignment.
- The value set for "Maintenance" is output on the analog output (→ p. 68, §4.4.4). This also applies in case of malfunction (signalised at the relay output).
- The "Maintenance" state is reset when there is a voltage failure. In this case, the measuring system switches automatically to "Measurement" after the operating voltage is switched on again.

Maintenance intervals

The equipment operator must specify the maintenance intervals. The period depends on existing operating parameters such as dust content and state, gas temperature, how the equipment is run and ambient conditions. Therefore only general recommendations can be made here. Normally, the maintenance intervals are about 4 weeks during the initial period and can be steadily incremented to up to a year depending on the respective conditions. The equipment operator must specify the specific work to be carried out and its performance in a Maintenance Manual.

Maintenance contract

Scheduled maintenance work can be carried out by the equipment operator. Only qualified personnel according to Section 1 should be allowed to do the work. If desired, SICK Service or authorized Service support centers can carry out all maintenance work. SICK offers cost-effective maintenance and repair contracts. SICK carries out all maintenance and repair work within the framework of such an agreement. Any repairs will be made by specialists onsite whenever possible.

Auxiliary means required

- Brush, cleaning cloth, cotton swabs
- Water
- Replacement air filter, preliminary filter (for suction)

5.2 Maintenance on the sender unit and scattered light receiver

NOTICE:

- ► Do not damage any device parts during maintenance work.
- ► Do not interrupt the purge air supply.

Clean the outside of the sender unit and scattered light receiver in regular intervals. Remove deposits with water or mechanically using suitable auxiliary means.

Clean the optical boundary surfaces when deposits can be seen or before contamination reaches the 20% warning limit value (30% for malfunction).

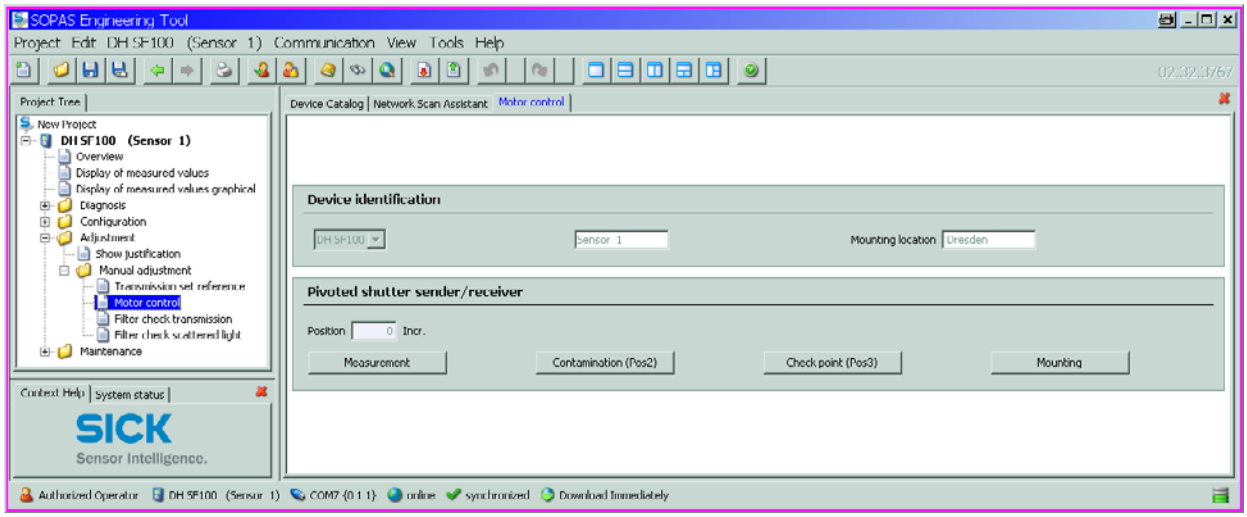
In addition to cleaning, check the alignment of optical axes and correct if necessary (→ p. 59, §4.2.2, → p. 61, §4.2.3, → p. 63, §4.3.2).

5.2.1 Maintenance on the sender unit

- ► Switch the sender unit to maintenance mode (→ p. 58, Fig. 48) and enter level 1 password.
- ► Loosen the knurled screws and swivel the housing to the side.
- ► Check assembly flange and purge air nozzle for contamination, and clean if necessary.
- ► Lock the assembly flange with cover (→ p. 118, §7.3.7).
- ► Switch to the "Adjustment / Manual Adjustment / Motor Control " directory and click "Mounting" at "Pivoted shutter sender/receiver".

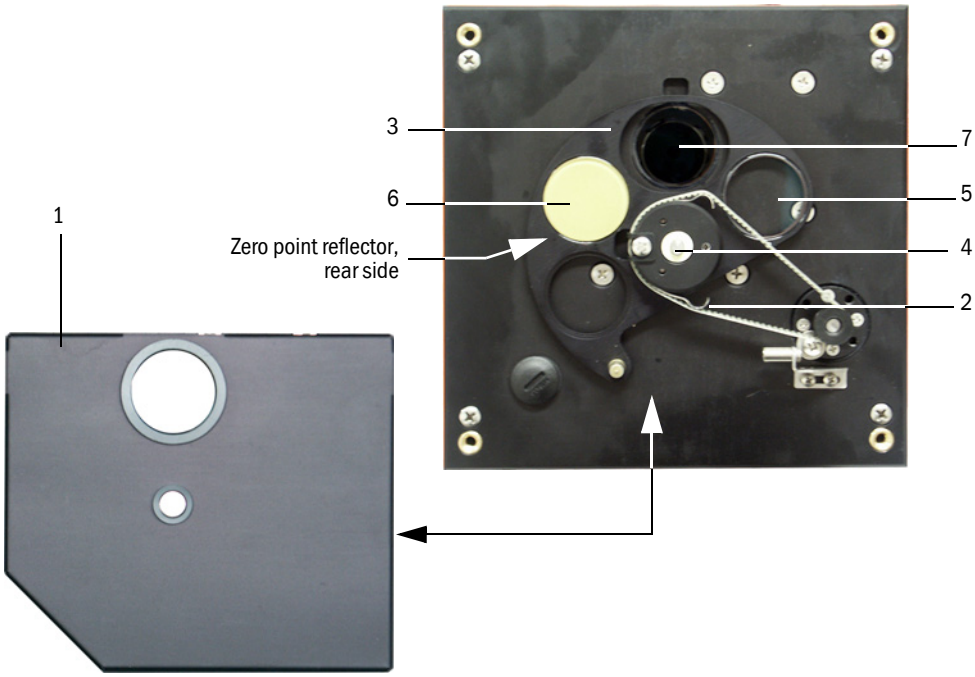
  The swivel plate moves then to the cleaning position.

Figure 80 "Adjustment / Manual Adjustment / Motor control" directory



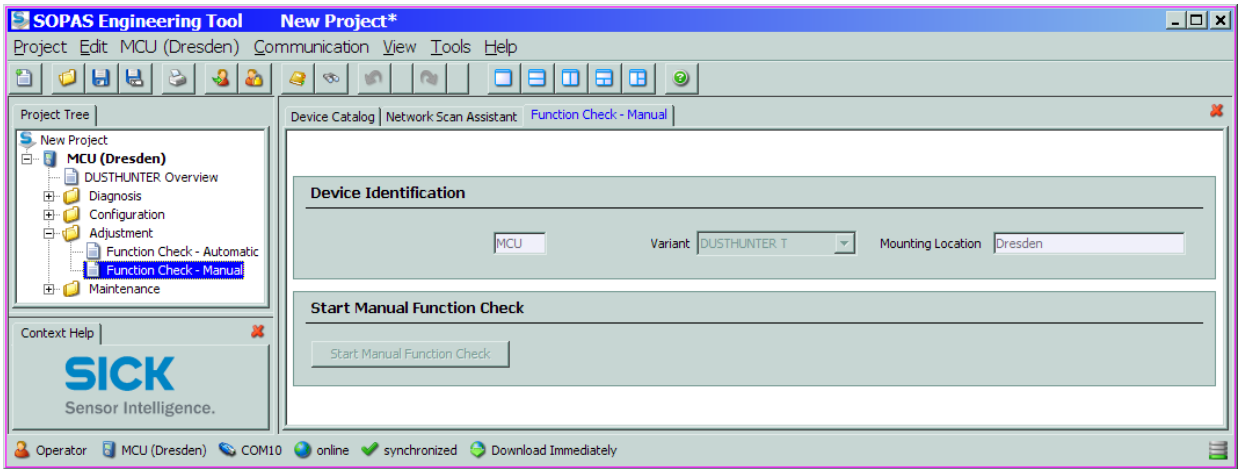
- ► Remove swivel plate cover (1), press the tension spring (2) and take swivel plate (3) off the axis (4).
- ► Carefully clean glass pane (5) (both sides), zero point reflector (6) and sender optics (7) with an optics cloth.

Figure 81 Cleaning the optical interfaces on the sender unit



- ► Lay the toothed belt on the drive axis, press the the tension spring and push the swivel plate back onto the axis.
- ► Initate a function check (move the "MCU" device file to the "Project Tree" window (→ p. 54, §4.1.3.5), open the "Adjustment / Function Check -Manual" directory and click "Start Manual Function Check").

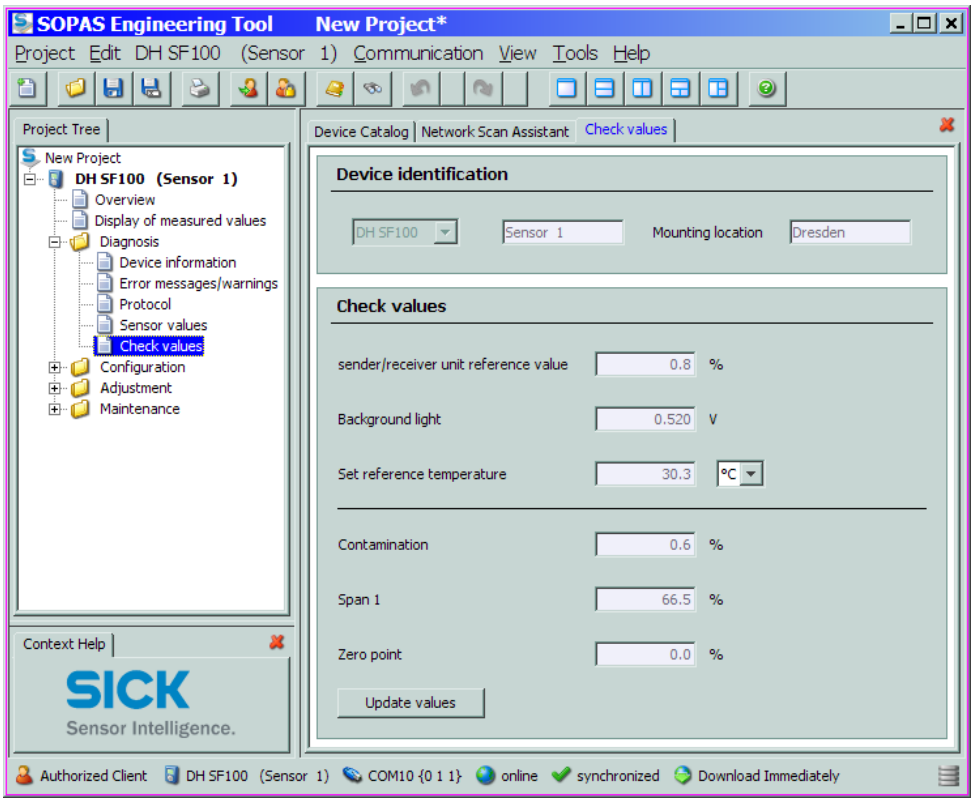
Figure 82 "Adjustment / Function Check -Manual" directory



The function check can also be triggered by using the keys on the LC display of the MCU (→ p. 84, §4.6.2).

► Select the "DH SF100" device file in the "Project Tree" window, open the "Diagnosis / Check values" subdirectory and check the contamination value.

Figure 83 "Diagnosis / Check values" subdirectory



► Store the measured values for contamination, zero point and span in the device by clicking "Update values" ("Check values" group) if they are within the allowed range; if not, repeat cleaning and check once more the contamination value by triggering a renewed function check.

- The contamination value can also be displayed on the LC display of the MCU (initiate a function check and switch to the "SF100/Diagnosis" menu; → p. 84, §4.6.2).
- If the contamination value does not sink below the value for warning in spite of several cleaning processes, the device is probably defective → contact the SICK Service.

► Put the swivel plate cover back on, remove the cover from the assembly flange, swivel the housing back in and lock in with the knurled screws.

► Move the swivel plate back into the measuring position. To do this, click "Measurement" in the "Adjustment / Manual adjustment / Motor control“ directory (→ p. 92, Fig. 80).

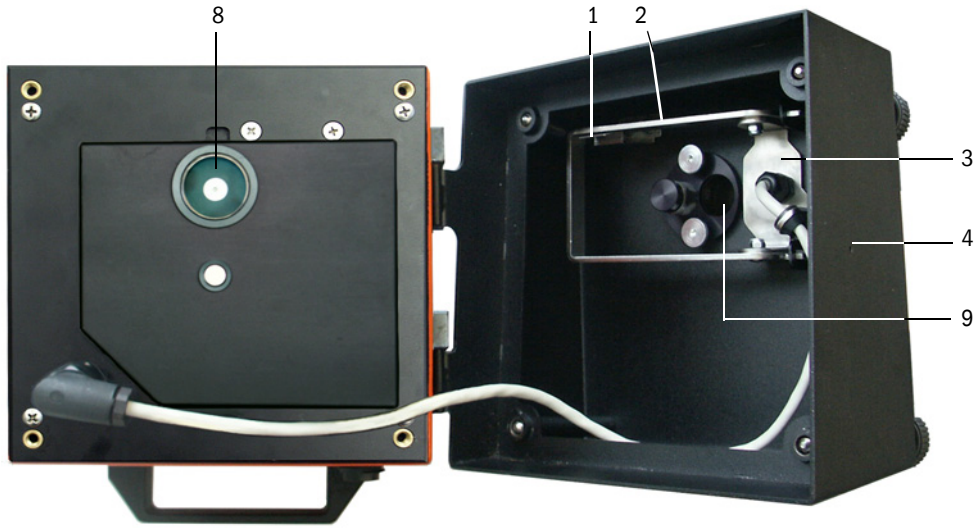
► Resume measuring operation.

5.2.2

Performing maintenance on the scattered light receiver

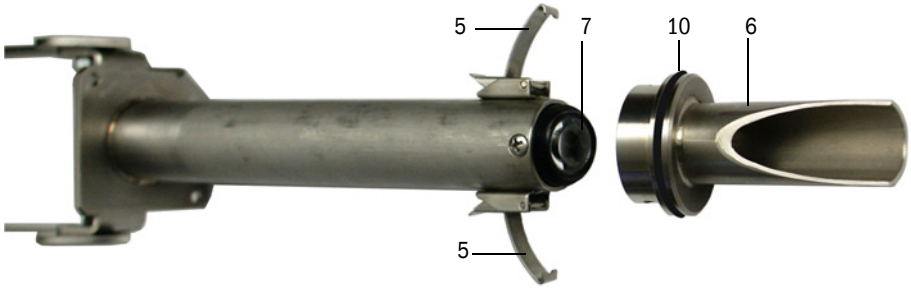
- Switch the measuring system to maintenance mode (→ p. 90, §5.1), loosen the knurled screws and swivel the housing to the side.
- Press the spring (1) to the side, pull the clamp (2) to the front and pull the scattered light receiver optic (3) carefully out of the tubus.
- Lock the assembly flange with cover (→ p. 118, §7.3.7).
- Open the grips (5) at the scattered light receiver optic for large measuring distances and remove the attachment (6).
- Carefully clean the lens of the scattered light receiver (6) and reflector optics (7) with an optics cloth.
- Check ligth trap (9) and O ring (10), and clean if necessary.
- Remove the cover from the assembly flange, put the scattered light receiver optic back in and fasten it.
- Swivel the housing back and lock with the knurled screws.
- Resume measuring operation.

Figure 84 Cleaning the optical interfaces on the scattered light receiver



Scattered light receiver for short measuring distances

Scattered light receiver for long measuring distances



5.3 Maintenance on the purge air supply

Maintenance work to be carried out:

- Inspecting the entire purge air supply
- Cleaning the filter housing
- Replacing the filter element, if necessary.

The dust load and wear on the filter element depend on the degree of contamination of the intake ambient air. It is therefore not possible to specify precise time intervals for these tasks. We recommend the inspection of the purge air supply after start-up at short intervals (approx. 2 weeks) and to optimize the maintenance intervals over a longer operating time.

NOTICE:

Irregular or insufficient maintenance of the purge air supply can cause it to fail and thus cause severe damage to the sender unit.

- ► Always ensure purge air supply when the optical components sender unit and scattered light receiver are fitted on the duct.
- ► Disassemble the connected components before exchanging damaged purge air hoses (→ p. 99, §5.4).

Inspection

- ► Check the running noise of the blower at regular intervals; increases in the noise level can indicate a blower failure.
- ► Check that all hoses are secure and free of damage.
- ► Check the filter element for contamination.
- ► Exchange the filter element when:
  - Severe contamination (deposits on the filter surface) is visible
  - The purge air volume is reduced considerably as compared to operation with a new filter.

The purge air supply does not have to be switched off to clean the filter housing or to replace the filter element, i.e. the components can remain on the duct.

5.3.1 Control unit with integrated purge air supply

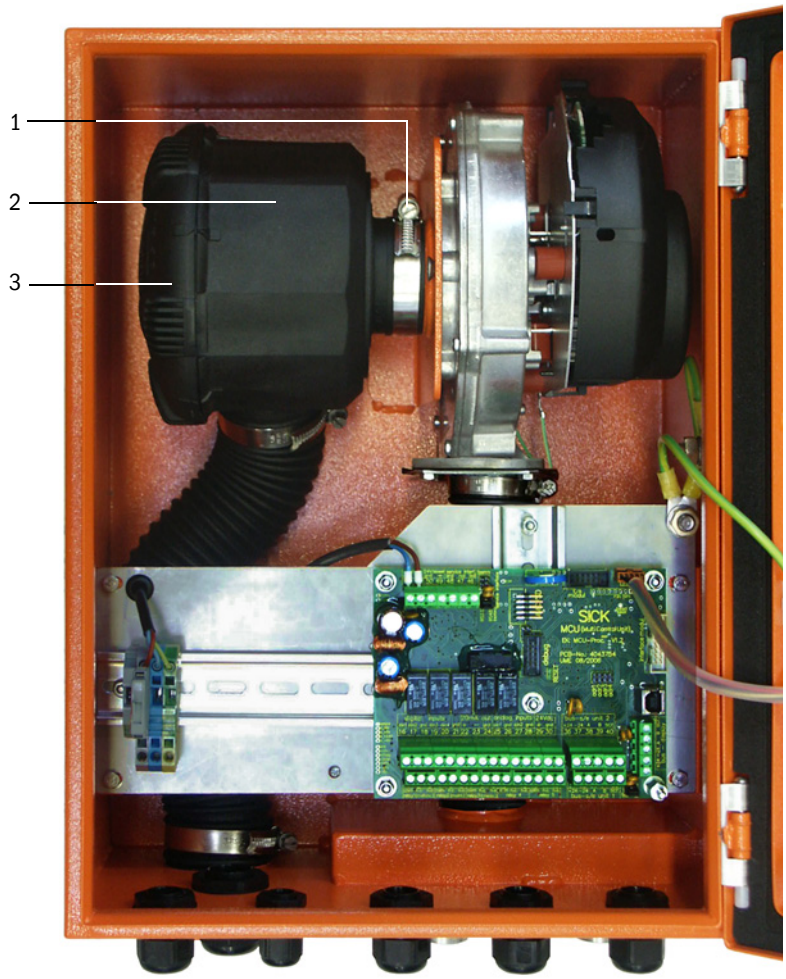
Cleaning or replacing the filter element

- ► Open the door of the connection unit with the appropriate key.
- ► Open the strap retainer on filter outlet (1) and pull the filter housing (2) off connection piece.
- ► Remove the filter housing.
- ► Rotate the filter housing cover (3) in the "OPEN" arrow direction and remove the cover.
- ► Take out the filter element and replace with a new element.
- ► Clean the inside of the filter housing and the filter housing cover with a cloth and brush.

> ***NOTICE:***
> ► For wet cleaning, use only a water-soaked cloth and then dry the parts well.

- ► Insert new filter element.
  Spare part: Filter element C1140, Part No. 7047560
- ► Mount the cover on the filter housing cover and rotate opposite to the direction of the arrow until it clicks into place.
- ► Reinstall the filter housing in the connection unit.

Figure 85 Exchanging the filter element for the control unit with purge air supply

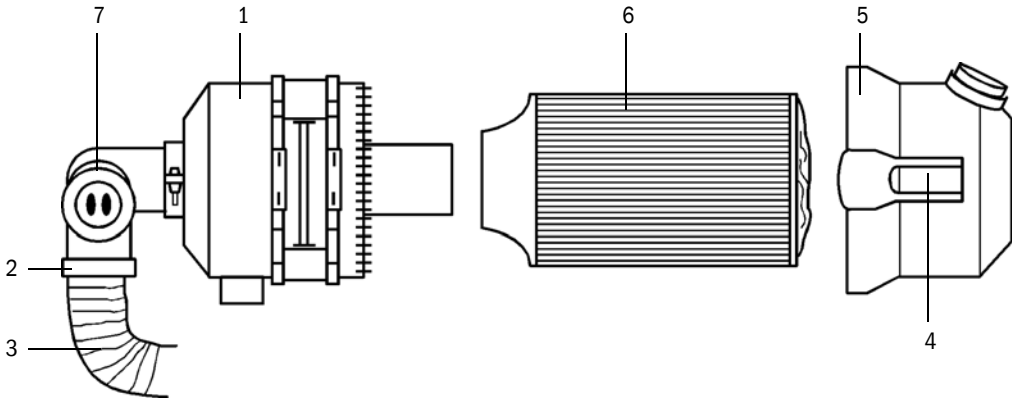


5.3.2 Optional external purge air unit

> ***NOTICE:***
> The purge air unit must be serviced at the latest when the low-pressure sensor (7) at the filter outlet switches (→ Fig. 86).

Replacing the filter element

Figure 86 Replacing the filter element



- ► Clean the filter housing (1) outside.
- ► Loosen hose clamp (2) and clamp the purge air hose (3) at a clean location.

> ***NOTICE:***
> ► Place the end of the hose in a safe place so that foreign objects cannot be sucked in (this will cause irreparable damage to the blower), but do not close the end of the hose! During this time, unfiltered purge air enters the purge air connection.

- ► Press the two quick-release snap locks (4) and remove the filter housing cover (5).
- ► Remove filter element (6) by pulling and twisting it counterclockwise at the same time.
- ► Clean the inside of the filter housing and the filter housing cover with a cloth and brush.

> ***NOTICE:***
> ► For wet cleaning, use only a water-soaked cloth and then dry the parts well.

- ► Insert the filter element by twisting and pressing it clockwise at the same time.
  Spare part: Filter element Micro-Top element C11 100, Part No. 5306091
- ► Mount the filter housing cover, ensuring that it is aligned correctly with the housing, and snap the quick-release snap locks into place.
- ► Reconnect the purge air hose to the filter outlet using the hose clamp.

5.4 Shutdown

The measuring system must be shut down:

- Immediately when the purge air supply fails
- If the equipment is to be shutdown for a longer period of time (as from approx. 1 week)

> ***NOTICE:***
> Never switch off or interrupt the purge air supply when the sender unit and scattered light receiver are fitted on the duct.

Work to be performed

- ► Loosen the connection cable to the MCU.
- ► Dismantle the sender unit and scattered light receiver from the duct.

> **WARNING:**
> - ► Observe the relevant safety regulations as well as the safety notices in Section 1 during all disassembly work.
> - ► Only carry out disassembly work for measuring systems on equipment with hazard potential (hot or aggressive gases, higher internal duct pressure) when the equipment is at a standstill.
> - ► Take suitable protection measures against possible local hazards or hazards arising from the equipment.
> - ► Secure switches that should not be switched on again for safety reasons with signs and safeguards to prevent unintentional switching.

- ► Close off the flange with tube with a blind flange.
- ► Switch off the purge air supply.
- ► Loosen the hose clamps and pull the purge air hose off the connections and secure the hose ends against dirt and moisture.
- ► Disconnect the control unit from mains voltage.

Storage

- ► Store dismantled device parts in a clean, dry location.
- ► Use suitable auxiliary means to protect the connection cable plug-in connector against dirt and moisture.
- ► Secure purge air hoses against penetration by dirt and moisture.

DUSTHUNTER SF100

6 Malfunctions

General
Sender unit
Control unit

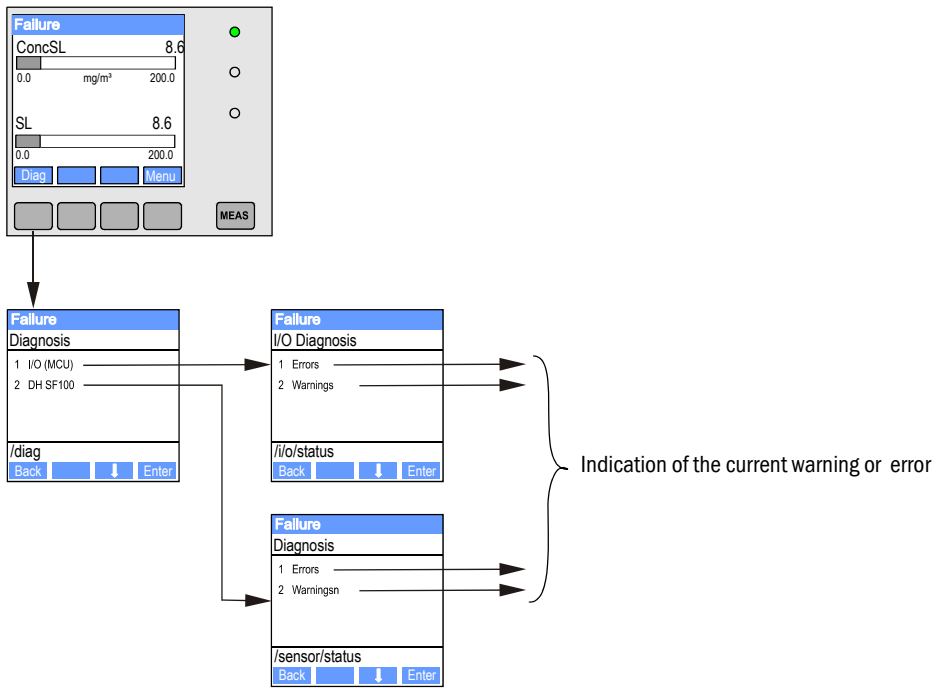
6.1 General

Warning or error messages are output in the following manner:

- On the MCU, the respective relay is switched on (→ p. 43, Fig. 28).
- "Maintenance requ." or "Failure" is displayed in the status bar of the LCD (→ p. 83, §4.6.1). 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 file ("MCU" or "DH SF100").

Figure 87 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 "DH SF100" or "MCU" device file (→ p. 54, §4.1.3.5) 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. 103, Fig. 88, → p. 105, Fig. 89).

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.

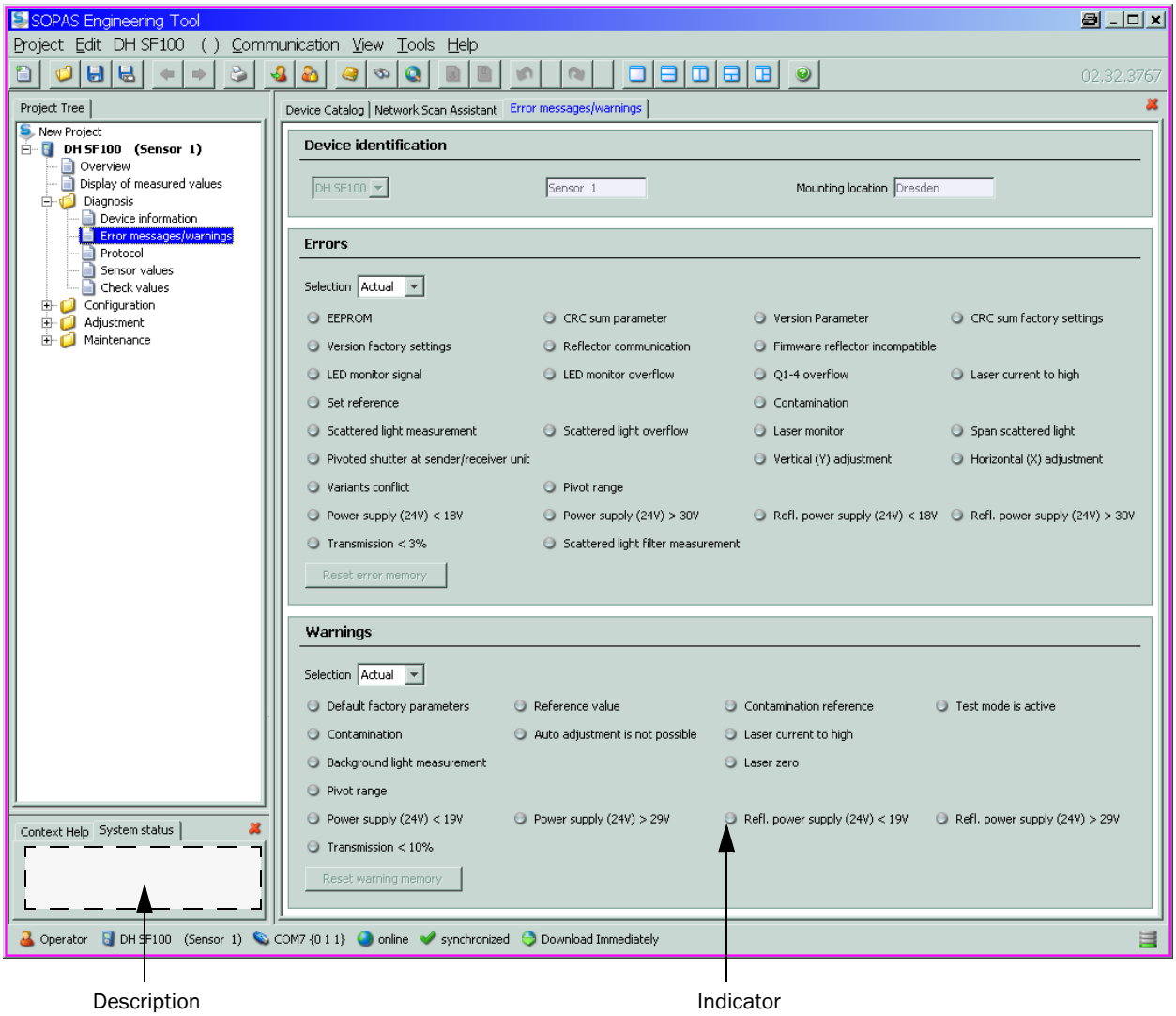
6.2 Sender unit

Malfunctions

Symptom	Possible cause	Action
● LEDs of the sender unit are not on ● No laser beam	● No supply voltage ● Connection cable not connected correctly or defective ● Defective plug connector	▶ Check plug connectors and cable. ▶ Contact SICK service.

Warning and error messages in the SOPAS ET program

Figure 88 "Diagnosis / Errors/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.

The following malfunctions can be removed under circumstances at site.

Message	Significance	Possible cause	Action
Reflector communication	No connection between sender unit and scattered light receiver	● Connection cable not connected or not connected correctly ● Defective connection cable ● Defectice reflector ● RS485 interface of the sender unit defective	▶ Check connection cable. ▶ Contact SICK service.
LED monitor overflow	Overdriving of the monitor channel when scaling	Incorrect alignment of the optical axes of sender unit and reflector	▶ Check/correct alignment. ▶ Repeat scaling.
Q1-4 overflow	Group signal of quadrant measurement too high	● Measuring system not yet scaled ● Changed alignment of optical axes ● Reduced active measuring path	▶ Scale measuring system. ▶ Check/correct alignment. ▶ Contact SICK service.
Set reference	Scaling not possible	Measurement or monitor signal too low (contamination, incorrect alignment)	▶ Check/correct alignment. ▶ Clean the optical surfaces (→ p. 92, §5.2).
Contamination	Current contamination value is higher than the permitted limit value (→ p. 108, §7.1)	● Deposits on the optical surfaces ● Unclean purge air	▶ Clean the optical surfaces (→ p. 92, §5.2). ▶ Check purge air filter and replace, if required (→ p. 96, §5.3). ▶ Contact SICK service.
Power supply (24 V) < 18 V Power supply (24 V) < 19 V	Supply voltage too low	● Cabel provided by customer doesn‘t match the specification (→ p. 41, §3.3.4) ● Voltage loss on the connection cable (core cross-section too low in relation to the cable length)	▶ Check the connection cable. ▶ Contact SICK Service.

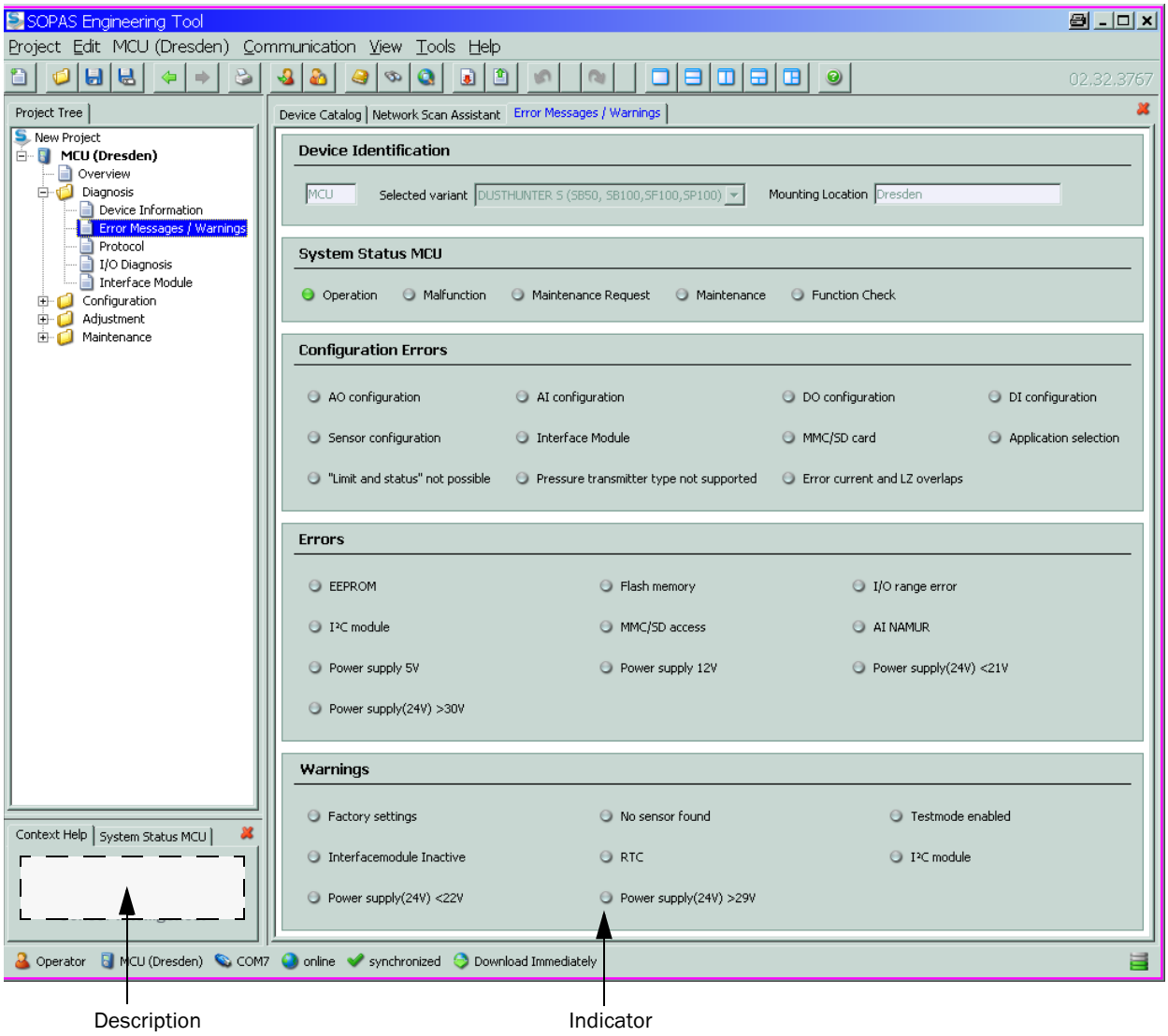
6.3 Control unit

Malfunctions

Symptom	Possible cause	Action
No display on the LCD	● No supply voltage ● Cable to the LCD not connected or damaged ● Defective fuse	▶ Check the power supply. ▶ Check the connetction cable. ▶ Exchange the fuse (T 2 A). ▶ Contact SICK service.

Warning and error messages in the SOPAS ET program

Figure 89 "Diagnosis / Errors/Warnings" directory



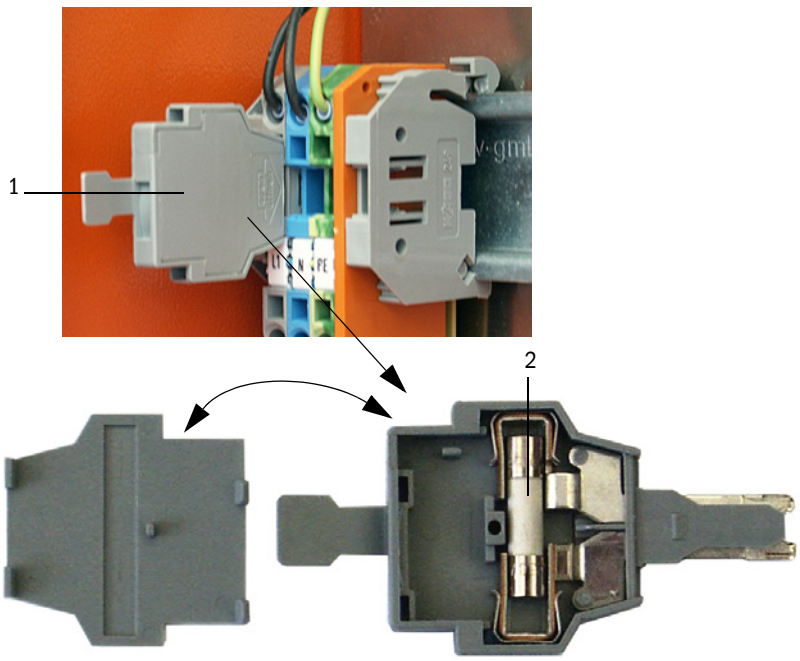
The following malfunctions can be removed under circumstances at site.

Message	Significance	Possible cause	Action
AO configuration	The number of configured analog outputs does not match the number of connected outputs.	● No parameters set for AO ● Connection error ● Module failure	▶ Check the parameter settings (→ p. 68, §4.4.4). ▶ Contact SICK service.
AI configuration	The number of configured analog inputs does not match the number of connected outputs.	● No parameters set for AI ● Connection error ● Module failure	▶ Check the parameter settings (→ p. 70, §4.4.5). ▶ Contact SICK service.
Interface Module	No communication via interface module	● No parameters set for module ● Connection error ● Module failure	▶ Check the parameter settings (→ p. 80, §4.5.2). ▶ Contact SICK service.
No sensor found	sender unit was not recognized	● Communication problems on RS485 line ● Supply voltage problems	▶ Check the system settings. ▶ Check the connection cable. ▶ Check the power supply. ▶ Contact SICK service.
Variant configuration error	MCU setting doesn't match attached sensor	● Sensor type was changed	▶ Correct application settings (→ p. 65, §4.4.1).
Testmode enabled	MCU is in test mode.		▶ Deactivate the "System Test" status ("Maintenance" directory)

Replacing the fuse

- ▶ Disconnect the measuring system from the mains.
- ▶ Open the door of the MCU, remove and open the fuse bracket (1).
- ▶ Replace the defective fuse (2) against a new one (→ p. 118, §7.3.7).
- ▶ Close the fuse bracket and install.
- ▶ Close the door and connect the power supply.

Figure 90 Replacing the fuse



DUSTHUNTER SF100

7 Specifications

Technical Data
Dimensions, Part Nos.
Accessories
Consumable parts for 2-years operation
Password

7.1 Technical Data

Measured Value Recording		
Measured variable	Scattered light intensity Dust concentration output in mg/m³ after gravimetric comparison measurement	
Measuring range (freely adjustable)	Smallest range: 0 ... 5 mg/m³ Largest range: 0 ... 200 mg/m³	Higher on request
Uncertainty[1)]	±2 %	
Response time	1 ... 600 s; freely selectable	
Application Data		
Distance flange - flange [2)]	With scattered light receiver DHSF-R0: With scattered light receiver DHSF-R1:	0.5...3 m 2.5...6 m
Effective measuring distance [3)]	With scattered light receiver DHSF-R0: With scattered light receiver DHSF-R1:	approx. 0.1 m approx. 0.3 m
Gas temperature (above dew point)	-40 ... 300°C	Higher on request
Internal duct pressure	-50 hPa ... +2 hPa -50 hPa ... +30 hPa	MCU control unit Optional external purge air unit
Ambient temperature	-40 ... +60°C -40 ... +45°C	Sender unit, scattered light receiver, MCU-N control unit MCU-P control unit, intake temperature for purge air
Function Check		
Automatic self-test	Linearity, drift, aging, contamination Contamination limit value: From 20% warning: From 30% malfunction	
Manual linearity check	Using reference filters	
Output Signals		
Analog output	3 outputs 0/2/4 ... 22 mA, max. load 750 Ω;resolution 10 bits; electrically isolated	
Relay output	5 potential-free outputs (changeover contacts) for status signals; load 48 V, 1 A;	
Input Signals		
Analog input	2 inputs 0...20 mA (standard; without electric isolation); resolution 10 bits; 2 further analog inputs by using I/O modules (option, → p. 21, §2.2.4)	
Digital input	4 inputs to connect potential-free contacts (e.g. for external maintenance switch, triggering function checks)	
Communication Interfaces		
USB 1.1, RS 232 (on terminals)	For measured value inquiries and software updates per PC/laptop using the operating program	
RS485	To connect the sender unit	
Optional Interface module	To communicate with the Host PC, optional for Profibus, Ethernet	
Energy Supply		
Control unit	Power supply: Power consumption:	90...250 V AC, 47...63 Hz; opt. 24 V DC ± 2 V Max. 30 W without purge air supply Max. 70 W with purge air supply
Sender unit	Power supply: Power consumption:	24 V from control unit Max. 17 W
Optional external purge air unit (with blower 2BH13)	Voltage supply: Rated current: Motor rating:	200 ... 240 V/345...415 V at 50 Hz; 220...275 V/380...480 V at 60 Hz 2.6 A/Y 1.5 A 0.37 kW at 50 Hz; 0.45 kW at 60 Hz

1): In temperature range - 20 °C ... +50 °C
2): Upper limit only with distortion-free fitting
3): → p. 14, Fig. 1

Weight		
Sender unit	10 kg	
scattered light receiver	6.5 kg 8.0 kg	DHSF-R0 DHSF-R1
Control unit	13.5 kg 3.7 kg	MCU-P MCU-N
Optional external purge air unit	14 kg	
Misc.		
Protection class	IP 66 IP 54	Sender unit, scattered light receiver, control unit Optional external purge air unit
Connection cable length	5 m, 10 m, 20 m 4)	Other lengths on request
Purge air hose length	5 m, 10 m	Other lengths on request
Laser	Degree of protection 2; capacity < 1 mW; wavelength between 640 nm and 660 nm	
Purge air feed volume	Max. 20 m³/h Max. 63 m³/h	MCU control unit Optional external purge air unit

4): for connecting the scattered light receiver to the sender unit

Compliances

The technical design of this device complies with the following EU directives and EN standards:

- EU Directive NSP 2006/95/EC
- EU Directive EMC 2004/108/EC

Applied EN standards:

- EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 61326, Electrical equipment for measurement technology, control technology and laboratory use - EMC requirements

Electrical protection

- Insulation: Protection class 1 according to EN 61010-1.
- Insulation coordination: Measuring category II according to EN 61010-1.
- Contamination: The control unit operates safely in an environment up to degree of contamination 2 according to EN 61010-1 (usual, non-conductive contamination and temporary conductivity by occasional moisture condensation).
- Electrical energy: The wiring system to the mains supply voltage of the system must be installed and fused according to the relevant regulations.

Approvals

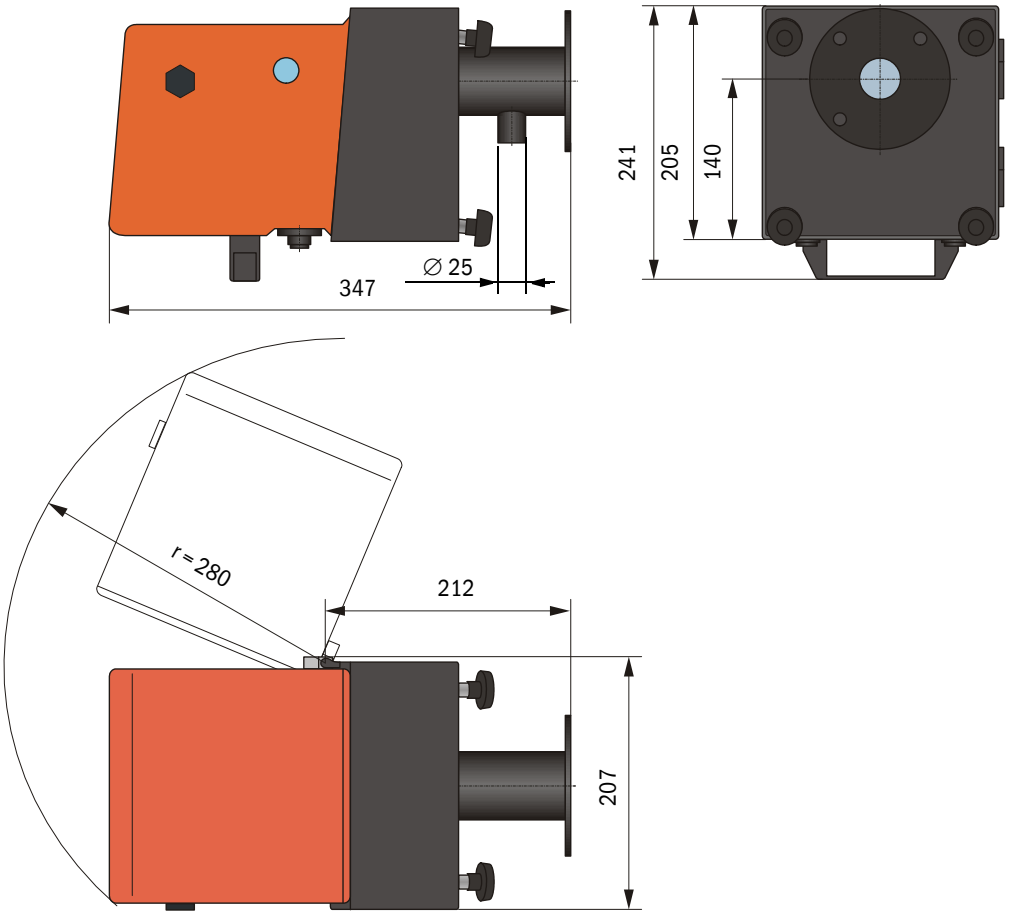
The measuring system is approved according to EN 15267 and may be used for continuous emission monitoring in plants requiring approval and plants according to the 27th FICA.

7.2 Dimensions, Part Nos.

All measures are specified in mm.

7.2.1 Sender unit

Figure 91 Sender unit

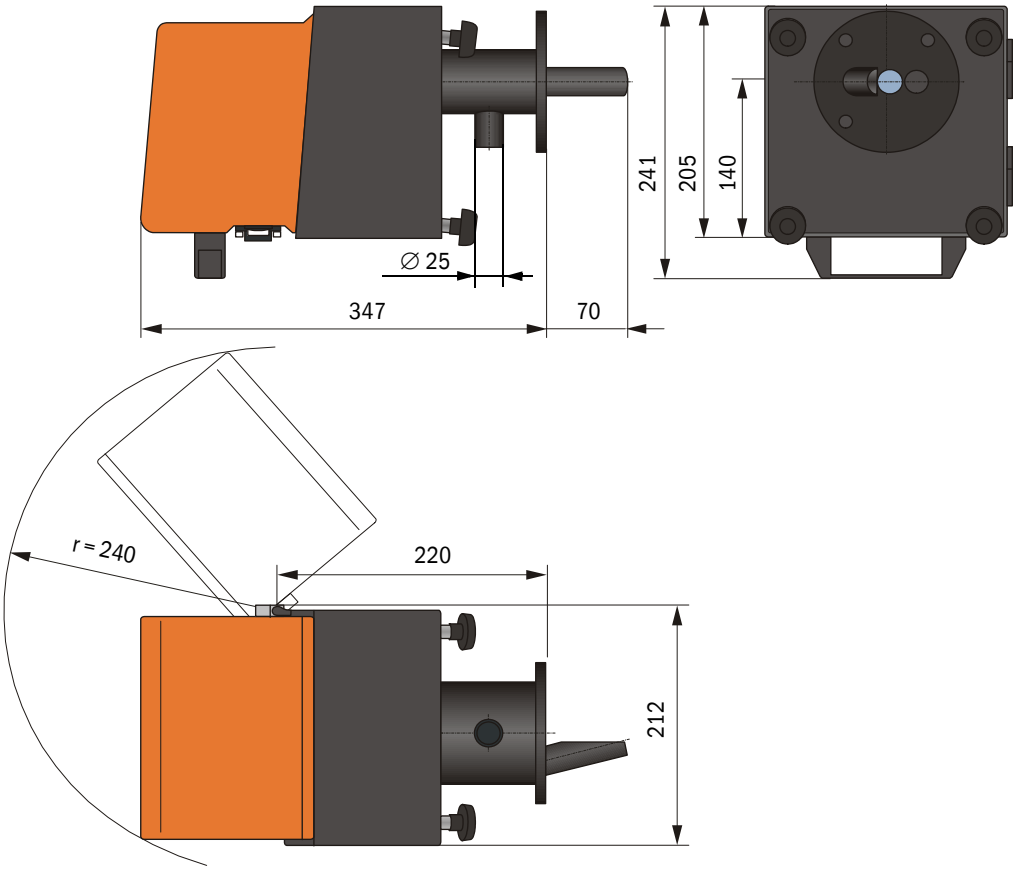


Name	Part No.
DHSF-T sender unit	1043899

7.2.2 Scattered light receiver

Scattered light receiver DHSF-R0 for short measuring paths

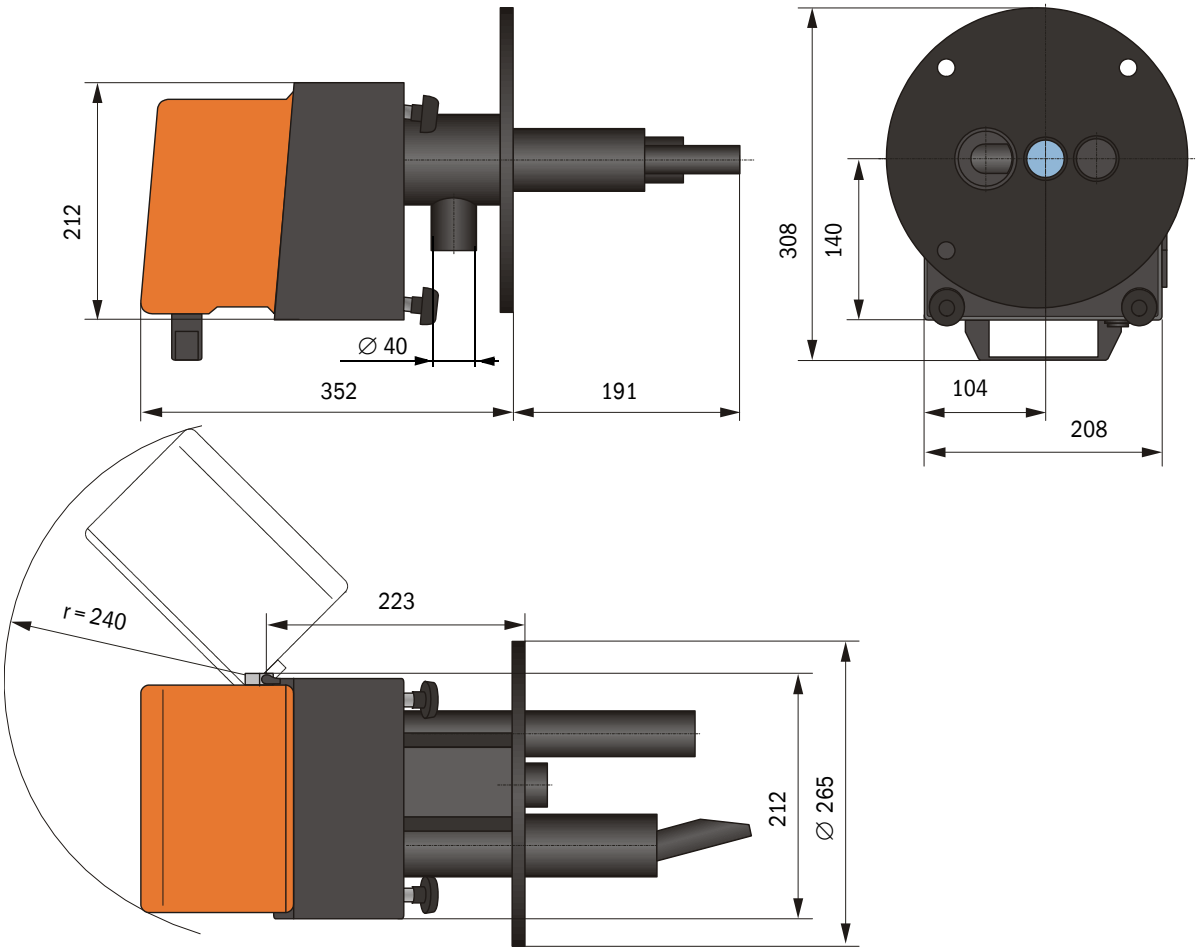
Figure 92 Scattered light receiver DHSF-R0



Name	Part No.
DHSF-R0 scattered light receiver	1043900

Scattered light receiver DHSF-R1 for long measuring paths

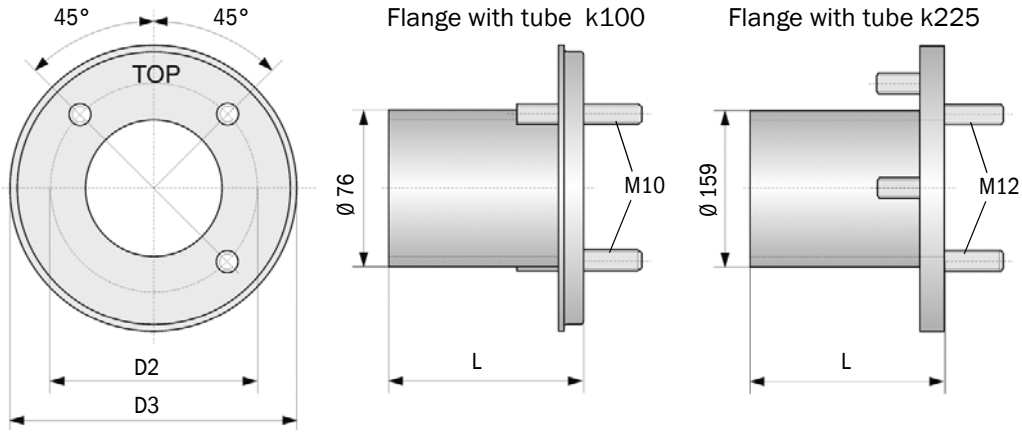
Figure 93 Scattered light receiver DHSF-R1



Name	Part No.
DHSF-R1 scattered light receiver	1043901

7.2.3 Flange with tube

Figure 94 Flange with tube



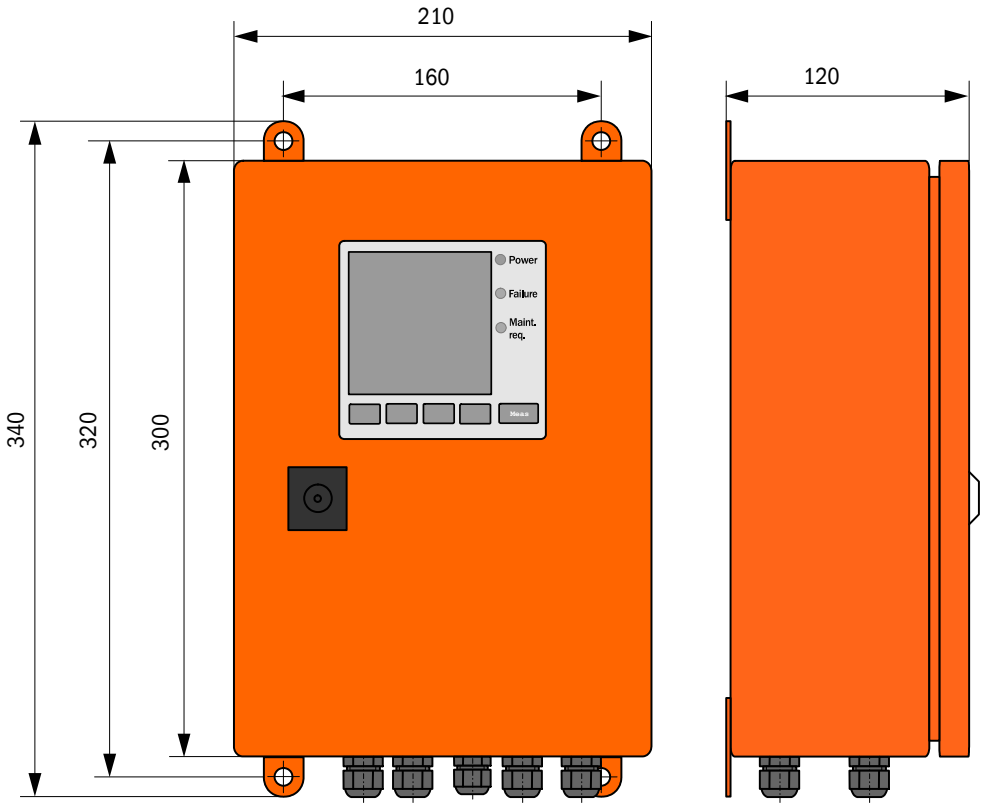
Dimension	Flange with tube	
	k100	k225
D2	Ø 100	Ø 225
D3	Ø 130	Ø 265
L	110, 130, 240, 500	350

Name	Part No.	Usage on
Flange type k100		
Flange with tube, Di = 70.2 Length 130 mm, St37	2017845	DHSF-T
Flange with tube, Di = 70.2 Length 240 mm, St37	2017847	
Flange with tube, Di = 70.2 Length 500 mm, St37	2017849	
Flange with tube, Di = 70.2 Length 130 mm, 1.4571	2017846	
Flange with tube, Di = 70.2 Length 240 mm, 1.4571	2017848	
Flange with tube, Di = 70.2, length 500 mm, 1.4571	2017850	
Flange with tube, Di = 70.2 Length 110 mm, St37	2054535	DHSF-R0
Flange with tube, Di = 70.2 Length 110 mm, 1.4571	2054536	
Flange type k225		
Flange with tube, Di = 152 Length 350 mm, St37	2045418	DHSF-R1
Flange with tube, Di = 152 Length 350 mm, 1.4571	2045420	

7.2.4 MCU control unit

MCU-N control unit without purge air supply

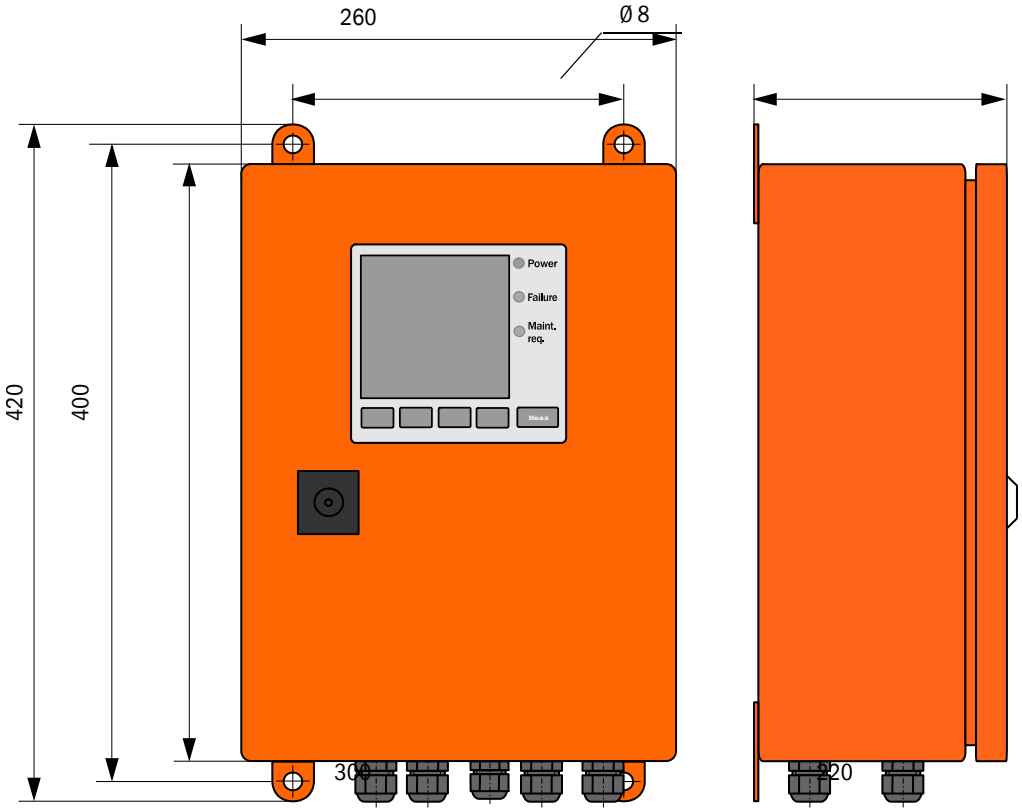
Figure 95 MCU-N control unit



Name	Part No.
Control unit MCU-NWODN01000NNNE in wall housing (orange), Supply voltage 90 ... 250 V AC, without purge air unit, with display	1045001
Control unit MCU-N2ODN01000NNNE in wall housing (orange), Supply voltage 24 V DC, without purge air unit, with display	1045003

Control unit MCU-P with integrated purge air supply

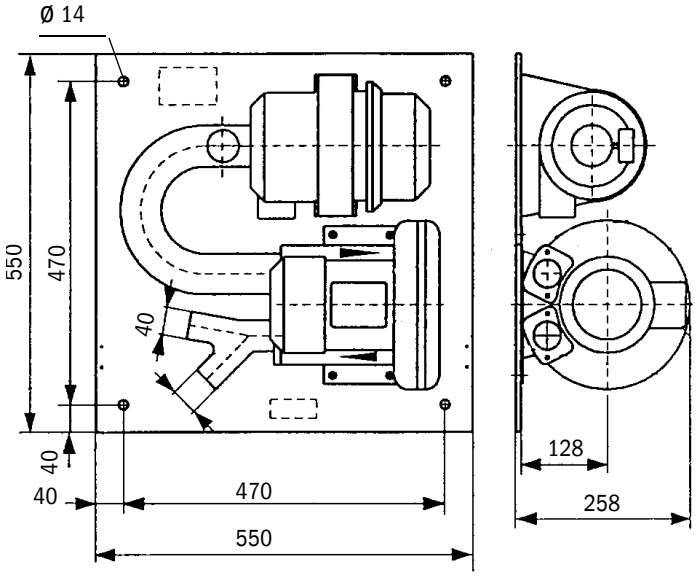
Figure 96 MCU-P control unit



Name	Part No.
Control unit MCU-PWODN01000NNNE in wall housing (orange), Supply voltage 90 ... 250 V AC, with purge air unit, with display	1045002
Control unit MCU-P2ODN01000NNNE in wall housing (orange), Supply voltage 24 V DC, with purge air unit, with display	1045004

7.2.5 Optional external purge air unit

Figure 97 Optional external purge air unit

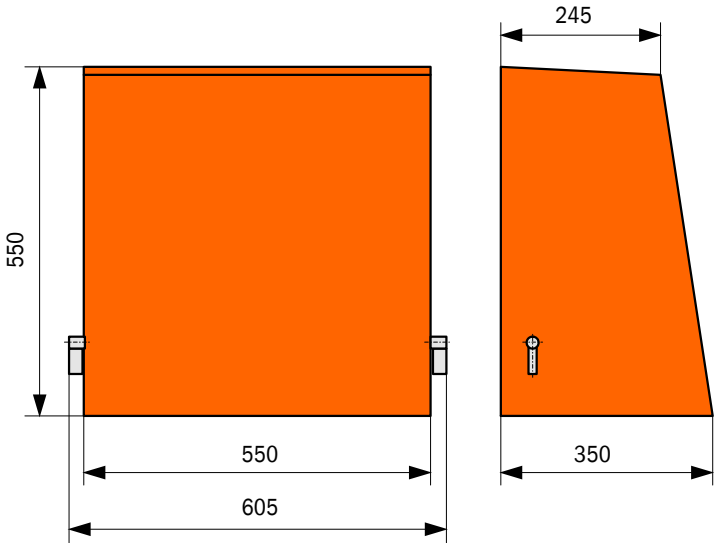


Name	Part No.
Purge air unit with blower 2BH13 and purge air hose, length 5 m	1012424
Purge air unit with blower 2BH13 and purge air hose, length 10 m	1012409

7.2.6 Weatherproof cover

Weatherproof cover for external purge air unit

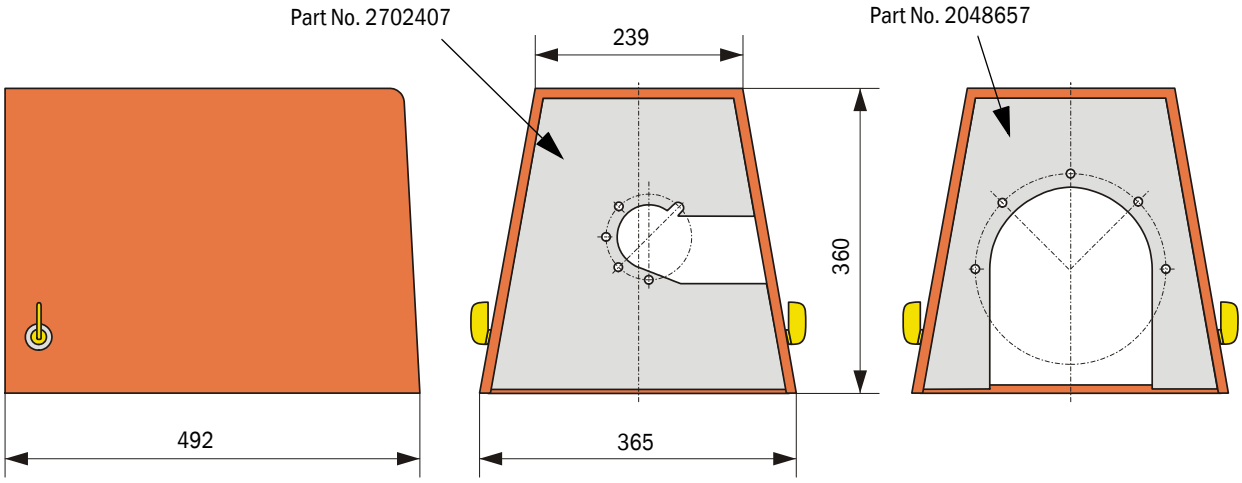
Figure 98 Weatherproof cover for external purge air unit



Name	Part No.
Weatherproof cover for purge air unit	5306108

Weatherproof cover for sender unit and scattered light receiver

Figure 99 Weatherproof cover for analyzer



Component	Part No.	Usage on
Weatherproof cover for analyzer	2702407	DHSF-T, DHSF-R0
Weatherproof cover flange k225	2048657	DHSF-R1

7.3 Accessories

7.3.1 Connection cable, sender unit - MCU

Name	Part No.
Connection cable, length 5 m	7042017
Connection cable, length 10 m	7042018

7.3.2 Connection cable, sender unit - scattered light receiver

Name	Part No.
Connection cable, length 5 m	2045416
Connection cable, length 10 m	2045417
Connection cable, length 20 m	2048674

7.3.3 Purge air supply

Name	Part No.
Purge air hose DN 40, yard good	5304683
Purge air hose DN 25, length 5 m	2046091
Purge air hose DN 25, length 10 m	7047536
Adapter 40-25	7047814
Hose clamp D20-32	7045039
Hose clamp D32-52	5300809

7.3.4 Assembly parts

Name	Part No.
Assembly kit, flange - analyzer	2018183
Assembly kit receiver (for scattered light receiver DHSF-R1)	2060477

7.3.5 Device check accessories

Name	Part No.
Check filter set	2049590
Adjusting stand	2042907

7.3.6 Options for MCU control unit

Name	Part No.
Analog input module, 2 channels, 100 Ω, 0/4...22 mA, electrically isolated	2034656
Module carrier (for AI module)	6028668
Connection cable for optional I/O modules	2040977
Interface, Profibus module DP V0	2040961
Interface, Ethernet module	2040965
Connection cable for Interface module	2040976

7.3.7 Misc.

Name	Part No.
Optical adjusting device for flange assembly	1700462
Cover	2052377
Set of fuses T 2 A (for MCU with mains supply)	2054541
Set of fuses T 4 A (for MCU with 24 V supply)	2056334

7.4 Consumable parts for 2-years operation

7.4.1 Sender unit and scattered light receiver

Name	Number	Part No.
Sealing tape	4	4704676
Sealing tape 235x50x2 (for DHSF-R1)	2	4058792

7.4.2 Control unit MCU with integrated purge air supply

Name	Number	Part No.
Filter element C1140	4	7047560
Optics cloth	4	4003353

7.4.3 Optional external purge air unit

Name	Number	Part No.
Filter element Micro-Topelement C11 100	4	5306091
Optics cloth	4	4003353

7.5 Password

SICK

Passwort „Autorisierter Bediener“

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 operator"

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.

DUSTHUNTER SF100

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