

OPERATING INSTRUCTIONS

DUSTHUNTER C200

Dust Concentration Monitor



Description
Installation
Operation



Document 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

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DUSTHUNTER C200

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/receiver unit and reflector/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 C200 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 C200 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 C200 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 C200 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 C200

2 Product Description

Measuring principle, measured variables

Device components

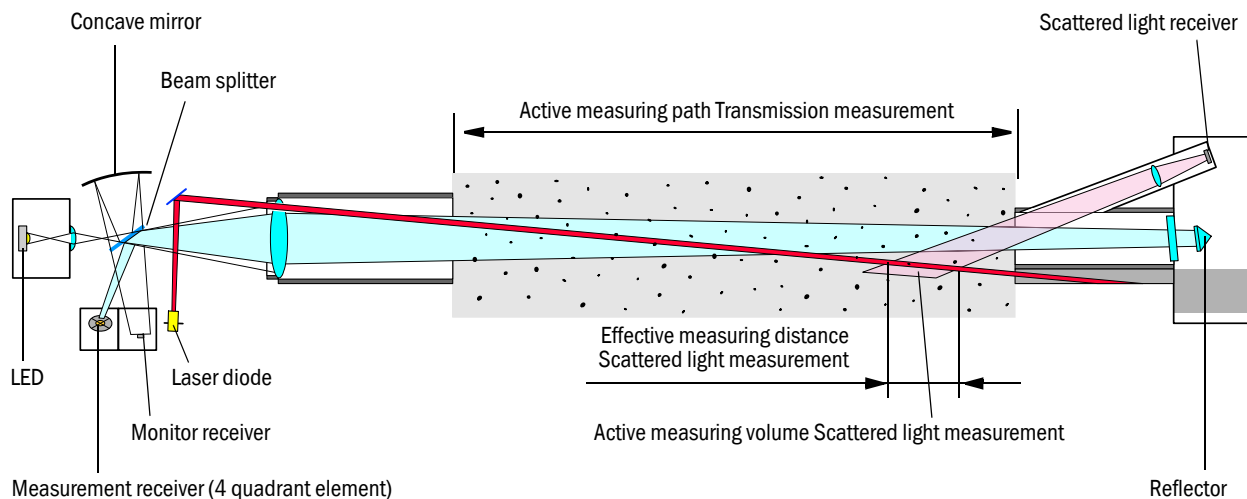
Device configuration

2.1 Measuring principle, measured variables

2.1.1 Functional principle

The DUSTHUNTER C200 measuring system operates as transmissometer with double beam path and as scattered light measuring device with forward dispersion.

Figure 1 Measuring principle with transmission and scattered light measurement with forward dispersion



2.1.1.1 Transmission measurement

A high performance LED sends light in the visible range (white light, wavelength approx. 450 to 700 nm) through the active measuring path containing particles to the reflector where it is bounced back to the receiver (→ Fig. 1). A highly sensitive measurement receiver accepts the signal weakened by particles, amplifies the signal electrically and feeds it to the measuring channel of a microprocessor as central part of the measuring, control and evaluation electronics.

Continuous monitoring of the sender output (partial beam to monitor receiver) registers the smallest changes in brightness of the light beam sent which then serves to determine the measurement signal.

Measured variables

The measuring system uses transmission (T) as primary optical measured variable. The other measured variables opacity (O), relative opacity (ROPA), extinction (E) and dust concentration (c) are derived from this variable.

Transmission, opacity, relative opacity:

$$T = N \cdot \frac{I_{\text{meas}}}{I_{\text{mon}}}$$

N = scaling constant

I_{meas} = light received

I_{mon} = monitor signal

$$O = 1 - T$$

$$\text{ROPA} = 1 - e^{E \cdot \frac{D_{D0}}{2 \cdot D_{\text{meas}}}}$$

D_{D0} = Duct diameter at the outlet

D_{meas} = active measuring path

Transmission, opacity and relative opacity are usually specified in percent.

Extinction:

$$E = \log\left(\frac{I_0}{I}\right)$$

Dust concentration:

Based on the Beer-Lambert law, the dust concentration is derived from the extinction as follows:

$$c = \frac{2,31 \cdot E}{k \cdot L} = K \cdot E$$

k = extinction constant

L = 2x active measuring path (due to double beam path)

Extinction is directly proportional to dust concentration for constant particle size and uniform dust distribution.

Particle size, dust density and dust distribution during differing load states influence transmission and extinction values and therefore the measuring system must be calibrated using a gravimetric comparison measurement for exact dust concentration measurement. The calibration coefficient determined can be entered directly in the measuring system as

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

(Entry → p. 77, §4.4.7; standard factory setting: $cc2 = 0$, $cc1 = 1$, $cc0 = 0$).

2.1.1.2 Scattered light measurement

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.

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.

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

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

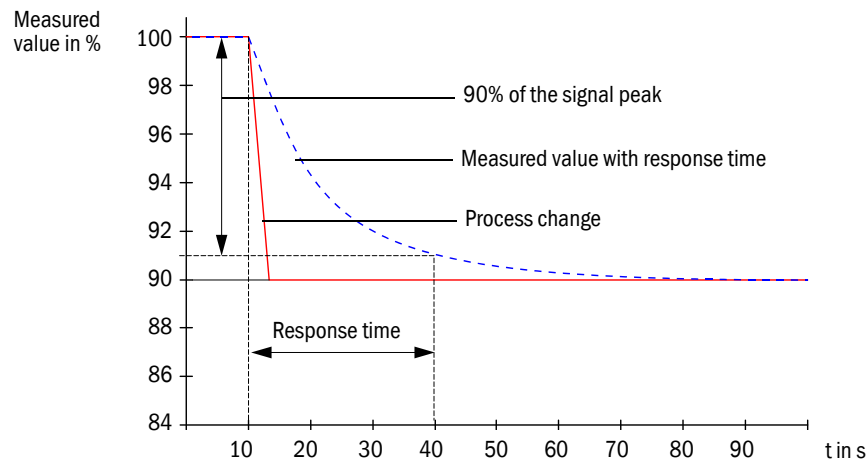
(Entry → p. 77, §4.4.7; standard factory setting: $cc2 = 0$, $cc1 = 1$, $cc0 = 0$).

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. 71, §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.

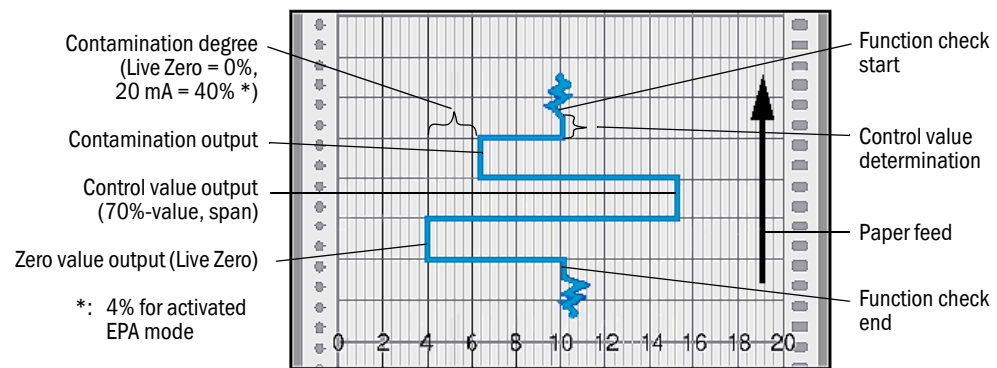


Further information → Service Manual

A function check comprises:

- Approx. 65 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 → measurement time will be longer).
- Every 90 s (standard value), output of values determined (output duration is configurable, → p. 71, §4.4.3).

Figure 3 Function check output on a plotter



- The analog output must be activated to output control values on the analog output (→ p. 71, §4.4.3, → p. 72, §4.4.4).
- 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. 44, Fig. 27) is activated and the green LED of the alignment display in the control window of the sender/receiver flashes (→ p. 20, 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 sender 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)

Sender 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 $\pm 2\%$. 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.

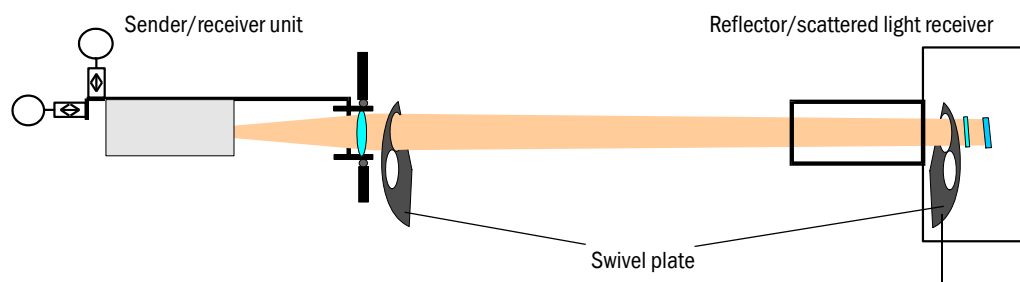
The value calculated theoretically (70%) is output for scattered light measurements at very low dust concentrations ($< \text{approx. } 1 \text{ mg/m}^3$).

Contamination measurement

The glass panes positioned in the sender beam during normal measurement are swiveled away during contamination determination (time delayed for sender/receiver unit and reflector/scattered light receiver). The values measured and the reference values determined at every scaling (→ p. 64, §4.2.3) are used to calculate the contamination value. The values measured in normal operation are reduced by the contamination value so that any contamination is compensated completely in this way.

Figure 4

Contamination measurement principle



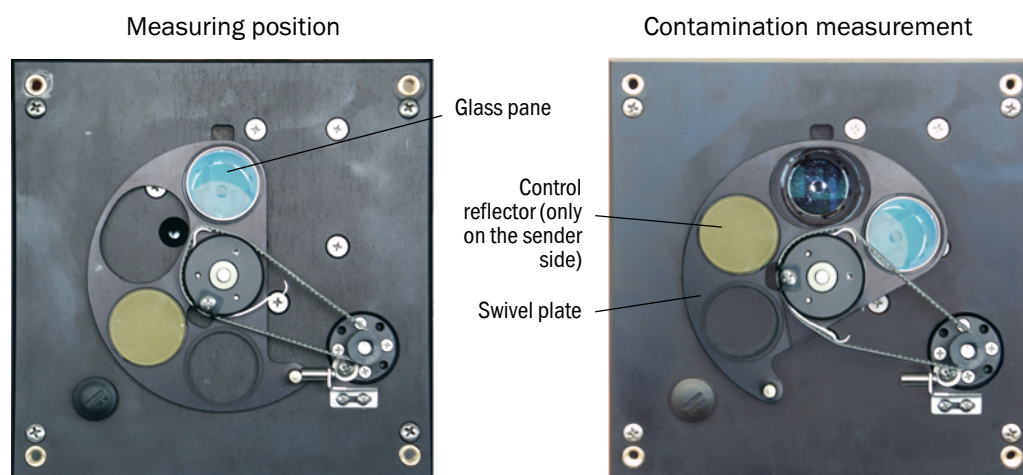
For contamination values < 40% (default value) a value between live zero and 20 mA proportional to contamination is output on the analog output. If this value is exceeded, the status "Malfunction" is output (on the analog output the error current; → p. 70, §4.4.2, → p. 72, §4.4.4).



- The contamination limit can be set freely (→ p. 65, §4.2.5) for operation of the measuring system according to European standards.
- The contamination limit for "Warning" is always 10% below the value for "Malfunction".
- The contamination limit for "Warning" is fixed at 3% and the value for "Malfunction" is fixed at 4% when operated according to EPA standard.

Figure 5

Swivel plate settings on the sender/receiver unit



2.2

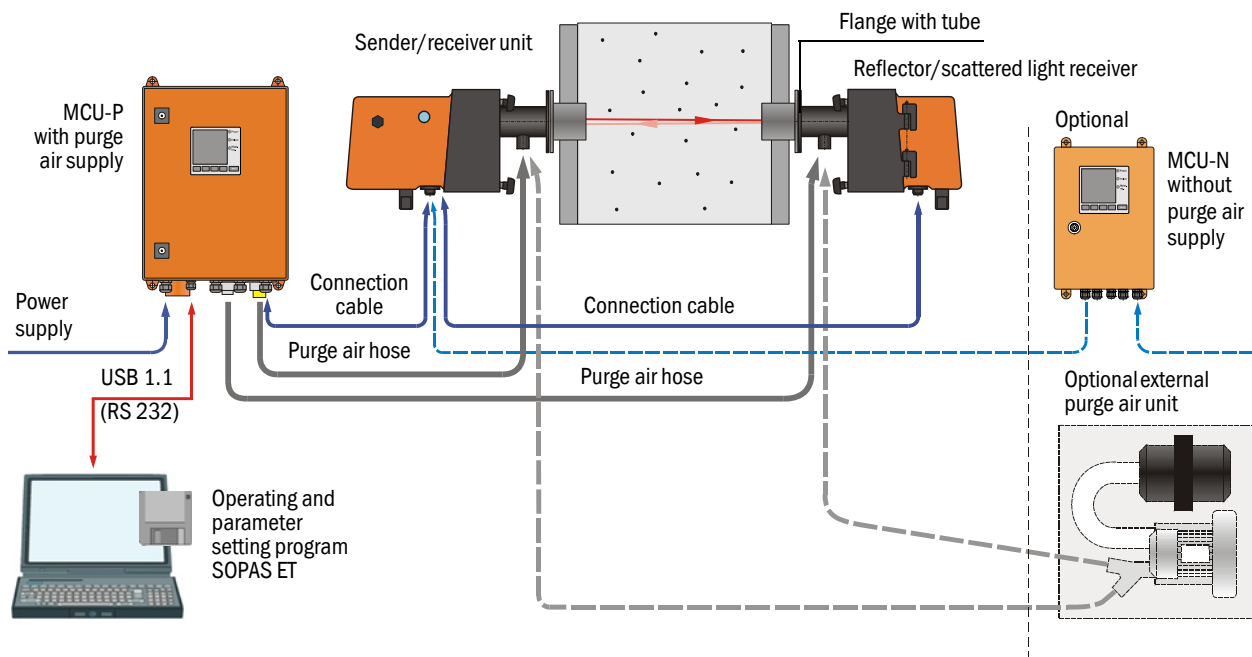
Device components

Measuring system DUSTHUNTER C200 comprises the components (→ Fig. 6):

- Sender/receiver unit DHC-T
- Connection cable to connect the sender/receiver unit to the control unit (lengths 5 m, 10 m)
- Reflector/scattered light receiver DHC-R
- Connection cable to connect the reflector/scattered light receiver to the sender/receiver unit (lengths 5 m, 10 m, 20 m)
- Flange with tube
- Control unit MCU to control, evaluate and output the data of the sender/receiver 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 C200 device components

**Communication between sender/receiver unit and MCU**

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

2.2.1

Sender/receiver unit

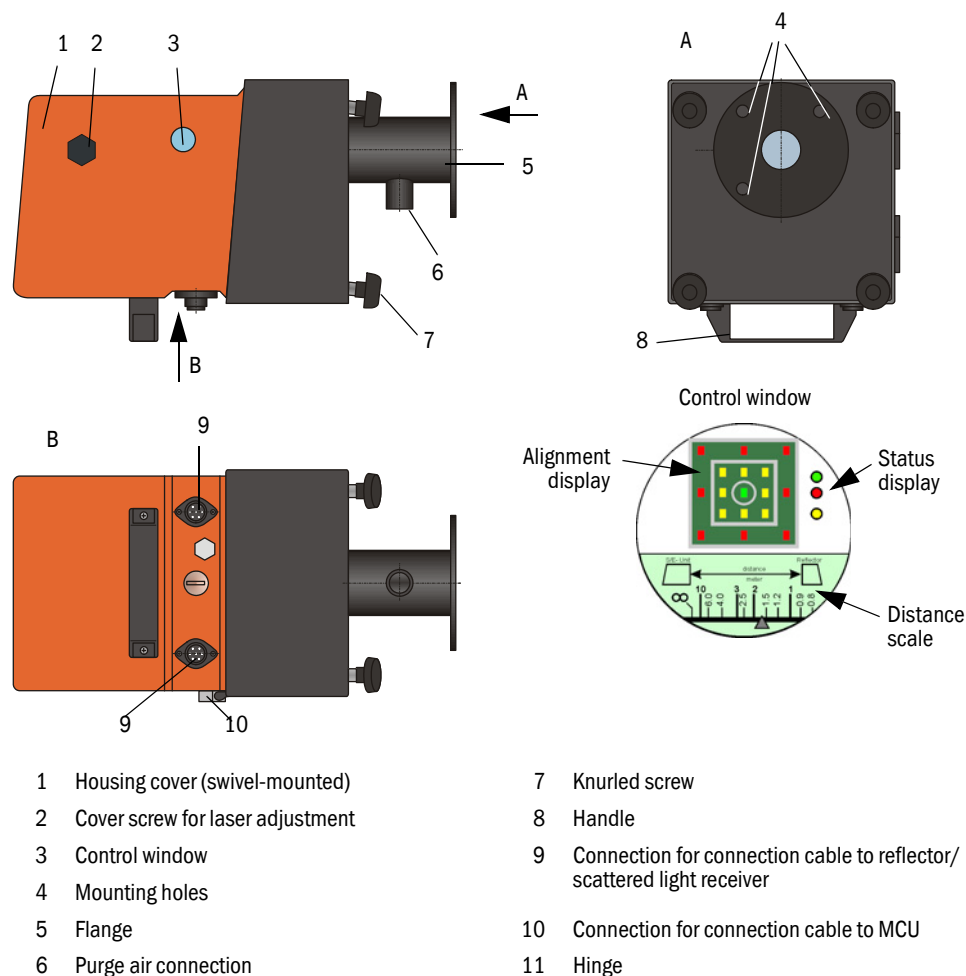
The sender/receiver unit contains the optical and electronic subassemblies to send and receive the reflected light beam of the transmission measurement as well as to process and evaluate the signals. Swivel mechanisms are also fitted for contamination measurement and self-alignment (→ p. 18, Fig. 5 and → p. 21, Fig. 8).

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. Clean air to cool the device and keep the optical surfaces clean is fed via a purge air connection.

The sender/receiver unit is fastened to the duct with a flange with tube (→ p. 19, Fig. 6).

Figure 7

Sender/receiver unit DHC-T for transmission and scattered light measurement



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

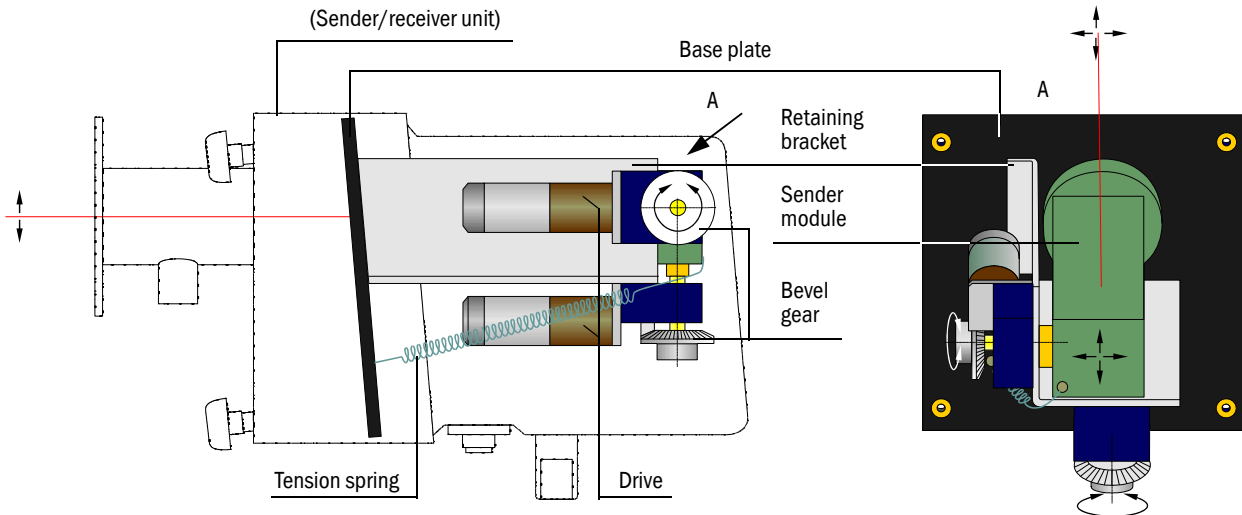
The housing with fitted sender/receiver unit can be swiveled to the side after the knurled screws have been loosened. Optics, electronics and mechanical components can then be easily accessed for maintenance work.

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.

How self-alignment works

The sender module can be moved horizontally and vertically using motors and bevel gears so that the sender light beam can be adjusted by approximately 2° in all directions. Tracking is performed using the measurement signal on the 4 quadrant elements of the measurement receiver. This allows automatic compensation of optical axis misalignment caused by, for example, distortion of duct walls due to temperature fluctuations.

Figure 8 Self-alignment principle design



2.2.2 Reflector/scattered light receiver

This component contains a reflector to reflect the sender light beam back to the receiver in the sender/receiver unit and a scattered light receiver with a light trap. Two versions are available to adapt to different internal duct diameters. A type code identifies the versions:

Reflector/scattered light receiver: _____ DHC-Rx
 Measuring path: _____
 - 0: Short (0.5 ... 3 m)
 - 1: Long (2.5 ... 8 m)

Figure 9 Reflector/scattered light receiver for short measuring paths

Housing with electronics (swivel-mounted)

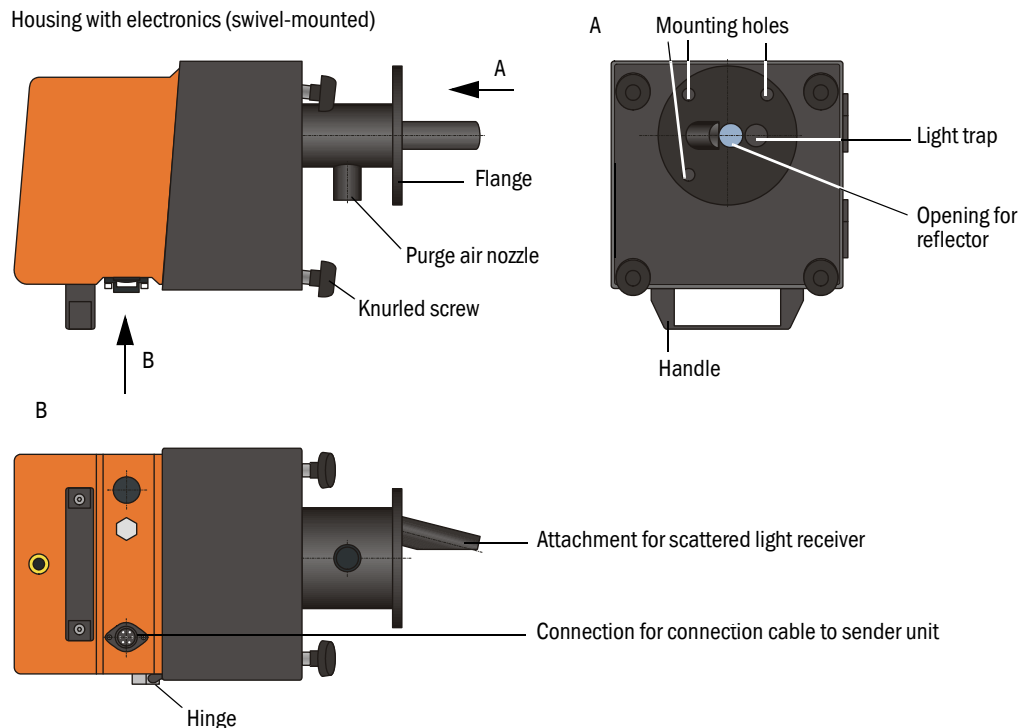
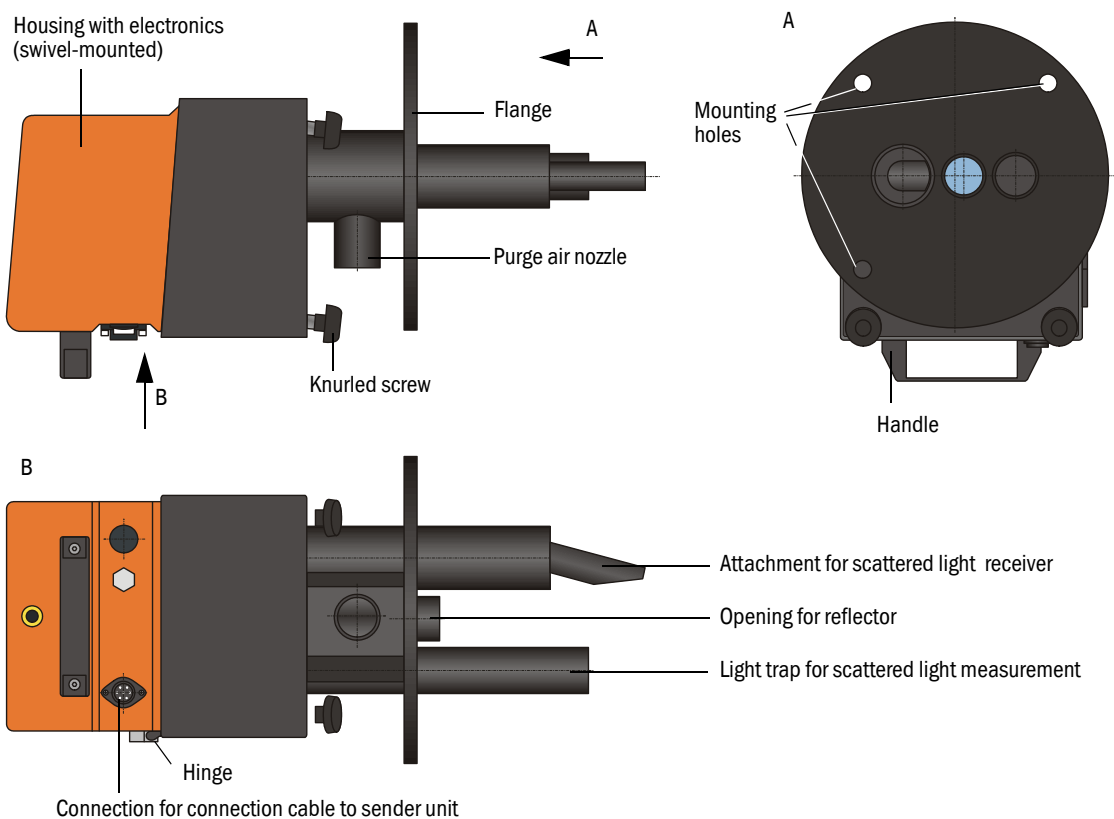


Figure 10 Reflector/scattered light receiver for long measuring paths



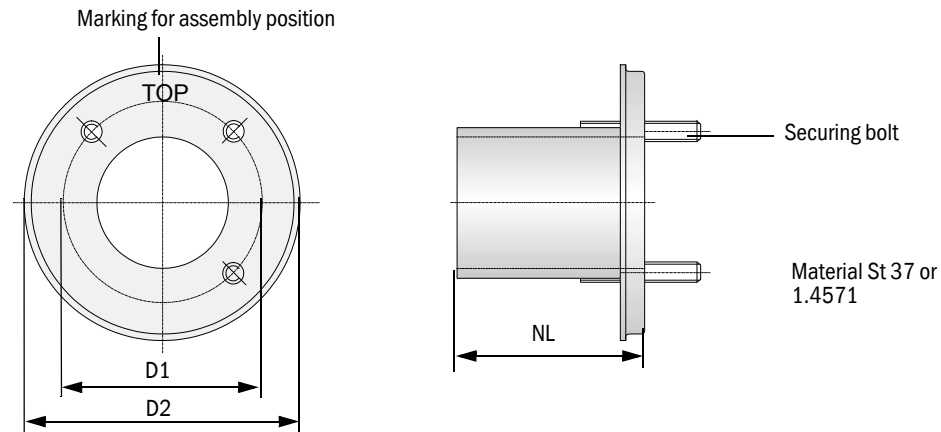
2.2.3

Flange with tube

The flanges with tube serve to fit the sender/receiver unit and reflector/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. 11).

Figure 11

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

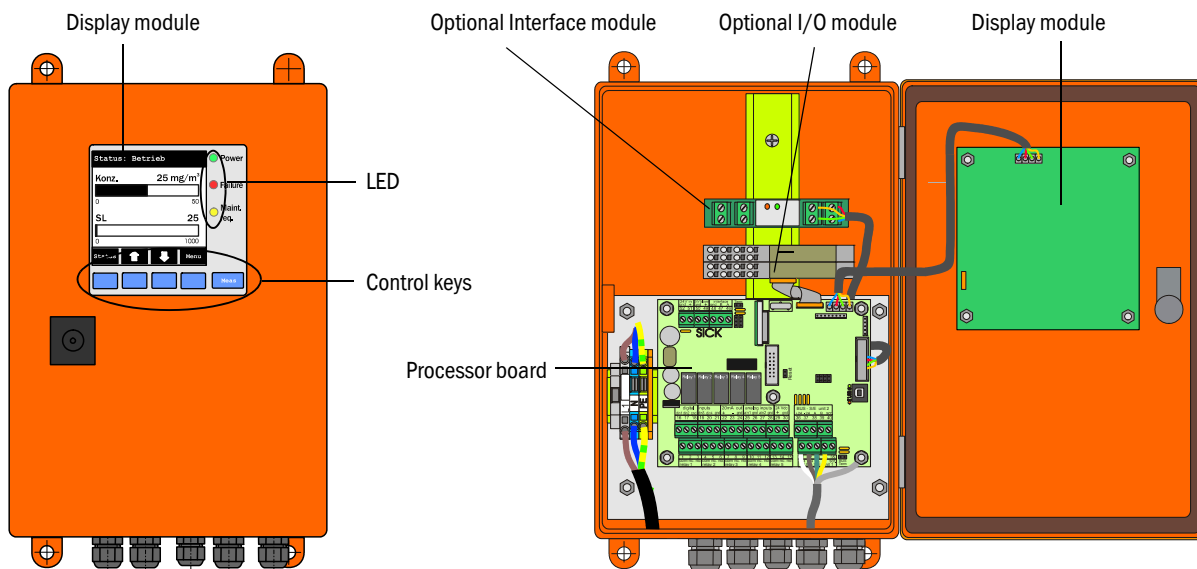
Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
3 outputs 0/2/4...22 mA (electrically isolated, active) to output: ● Dust concentration Ext a.c. ● Dust concentration Ext s.c. ● Dust concentration SL a.c. ● Dust concentration SL s.c. ● Scattered light intensity ● Opacity ● Extinction ● Transmission ● relative opacity Resolution 10 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 soft- ware updates. ● RS485 for sensor connection

Versions

- Control unit MCU-N without purge air supply

Figure 12

Control unit MCU-N with options

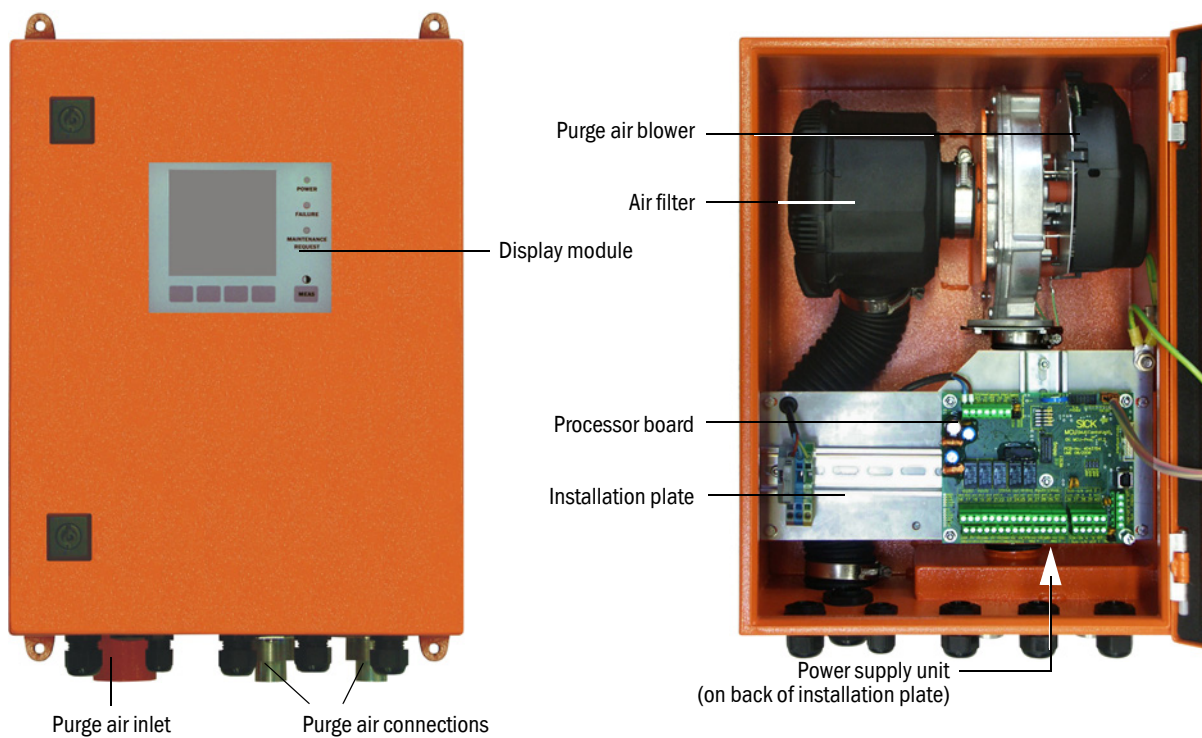


- Control unit MCU-P with integrated purge air supply

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/receiver unit.

Figure 13

Control unit MCU-P with integrated purge air supply



The purge air hose (standard lengths 5 and 10 m; → p. 126, §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/receiver unit, selection via control keys.

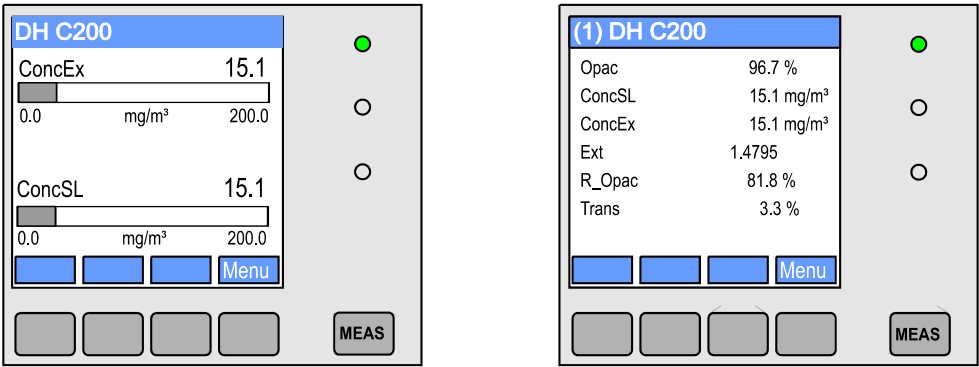
• Displays

Type		Display
LED	Power (green)	Voltage supply OK
	Failure (red)	Function fault
	Maintenance request (yellow)	Maintenance requirement
LC-Display	Graphic display (main screen)	<ul style="list-style-type: none">- Dust concentration- Transmission- Opacity- Extinction- Scattered light intensity
	Text display	2 measured values (see graphic display) and 8 diagnosis values (→ p. 89, Fig. 76)

The graphic display shows two main measured values of a connected sender/receiver 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/receiver unit can be displayed (toggle with "Meas" button).

Figure 14

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



• Control keys

Key	Function
Meas	<ul style="list-style-type: none">• 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 SP100 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, O₂) 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/receiver units and reflector/scattered light receivers:

Type code control unit:	MCU-X	X	O	D	N	X	1	0	0	N	N	N	E
Integrated purge air supply _____													
- N: Without (no)													
- P: With (purged)													
Voltage supply _____													
- W: 90 ... 250 V AC													
- 2: Optional 24 V DC													
Housing variants _____													
- O: Wall housing, SICK, orange													
Display module _____													
- D: With													
Other options _____													
- N: Without													
Analog input option (plug-in module; 0/4...20 mA; 2 inputs per module) _____													
- O: Without													
- n: With, n = 1													
Analog output option (plug-in module; 0/4...20 mA; 2 outputs per module) _____													
- n: With, n = 1													
Digital input option (plug-in module; 4 inputs per module) _____													
- O: Without													
Digital output power option (plug-in mod.; 48 V DC, 5 A; 2 changeovers per mod.) _____													
- O: Without													
Digital output low power option (plug-in module; 48 V DC, 0.5 A; 4 make contact elements per module) _____													
- O: Without													
Optional Interface module _____													
- N: Without													
- E: Ethernet													
- P: Profibus													
Special versions _____													
- N: No special features													
EX certification _____													
- N: without EX certification													
Software _____													
- E: Emission measurement													

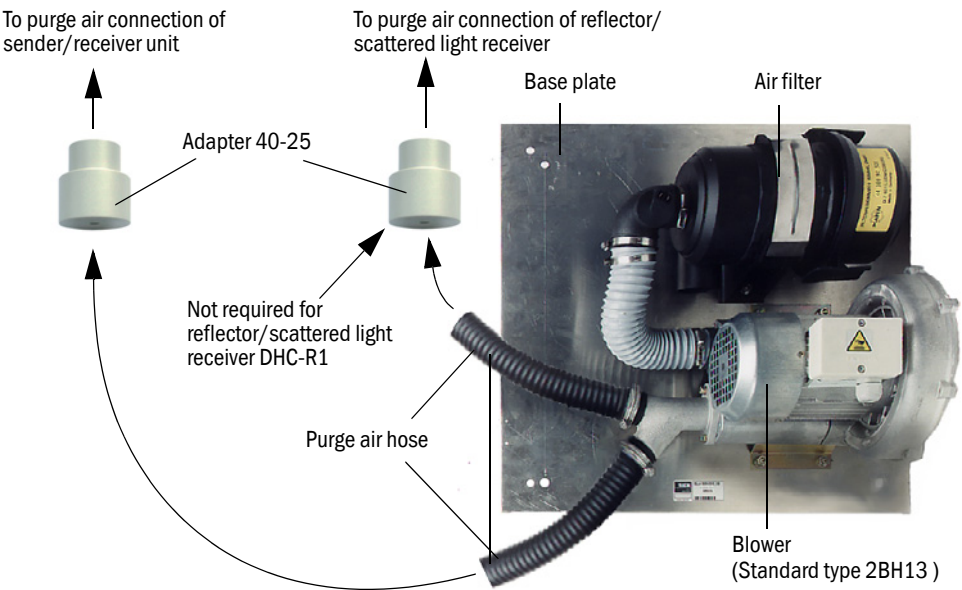
2.2.5

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 DHC-R1 reflector/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 15

Optional external purge air unit with adapter



A weatherproof cover is available for use outdoors (→ p. 125, 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 reflector/ scattered light receiver		for sender/ receiver unit	for reflector/ scattered light receiver	
		DHC-R0	DHC-R1		DHC-R0	DHC-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/receiver unit to the MCU and the reflector/scattered light receiver to the sender/receiver unit. The respective lengths are 5 or 10 m (for connecting the reflector/scattered light receiver to the sender/receiver unit also 20 m).

Weatherproof covers

Weatherproof covers are available for sender/receiver units and reflector/scattered light receivers used outdoors (→ p. 125, Fig. 102).

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 C200. 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/receiver unit, reflector/scattered light receiver, flange with tube**NOTICE:**

The reflector/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/receiver unit	Reflector/Scattered light receiver	Flange with tube		Cable for reflector/scattered light receiver
				Sender/receiver unit	Reflector/Scattered light receiver	
0,5 ... 3 m	40 mm	DHC-T	DHC-R0	Flange with tube k100 NL 130/240/500 mm	Flange with tube k100 NL 110 mm	x
2,5 ... 6 m	270 mm		DHC-R1		Flange with tube k225 NL 350 mm	

Voltage and purge air supply

Internal duct pressure	Distance MCU - sender/receiver unit or reflector/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 /receiver unit and reflector/scattered light receiver DHC-R0) or purge air hose DN 40 (to reflector/scattered light receiver DHC-R1)	
> +2 hPa		Optional external purge air unit + adapter 40-25 (for sender/receiver unit)	MCU-N

DUSTHUNTER C200

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.

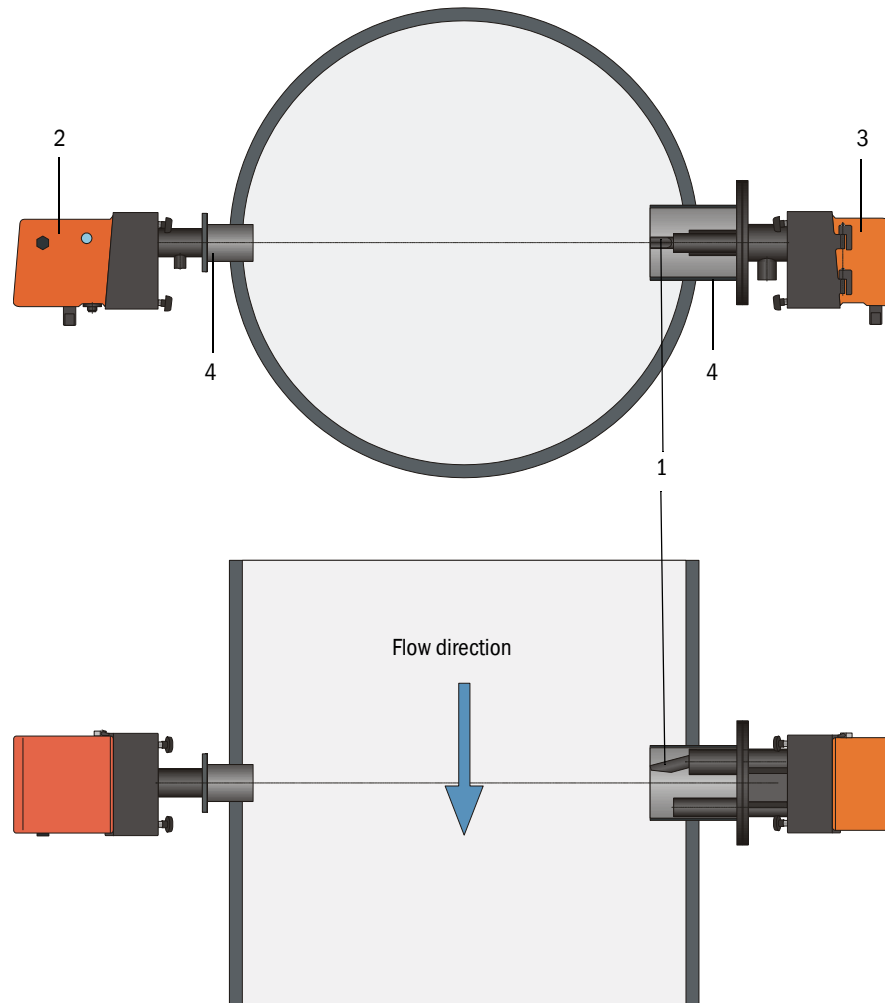
Task	Requirements		Work step	<input type="checkbox"/>
Determine the measuring and installation location for the device components	Inlet and outlet paths according to DIN EN 13284-1 (inlet at least 5x hydraulic diameter d_h , outlet at least 3x d_h ; distance to stack opening at least 5x d_h)	For round and square ducts: d_h = duct diameter	<ul style="list-style-type: none"> Follow specifications for new equipment Select best possible location for existing equipment; For too short inlet/outlet paths: Inlet path > outlet path 	<input type="checkbox"/>
		For rectangular ducts: d_h = 4x cross-section divided by circumference		
	<ul style="list-style-type: none"> 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	<input type="checkbox"/>
	Assembly position for sender/receiver unit and reflector/scattered light receiver	Do not fit vertically on horizontal or slanted ducts; max. measuring axis angle to horizontal 45°	Select best possible location	<input type="checkbox"/>
	Accessibility, accident prevention	The device components must be easily and safely accessible	Provide platforms or pedestals as required	<input type="checkbox"/>
	Installation free of vibrations	Acceleration < 1 g	Eliminate/reduce vibrations through suitable measures	<input type="checkbox"/>
Select the purge air supply	Ambient conditions	Limit values according to Technical Data	If necessary: <ul style="list-style-type: none"> Provide weatherproof covers/sun protection Enclose or lag device components 	<input type="checkbox"/>
	Sufficient primary purge air pressure depending on internal duct pressure	<ul style="list-style-type: none"> 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	<input type="checkbox"/>
Select device components	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	<input type="checkbox"/>
	Measuring path, duct wall thickness with insulation	Sender/receiver unit, reflector/scattered light receiver, flange with tube	<ul style="list-style-type: none"> Select components according to Configuration Table (→ p. 29, §2.3); if necessary, plan additional measures to fit the flange with tube (→ p. 34, §3.2.1) 	<input type="checkbox"/>
	Internal duct pressure	Type of purge air supply		
Plan calibration openings	Fitting locations	Cable and purge air hose lengths		
	Access	Easy and safe	Provide platforms or pedestals as required	<input type="checkbox"/>
Plan power supply	Distances to measuring level	No mutual interference between calibration probe and measuring system	Plan sufficient distance between measuring and calibration level (approx. 500 mm)	<input type="checkbox"/>
	Operating voltage, power requirements	According to Technical Data (→ p. 114, §7.1)	Plan adequate cable cross-sections and fuses	<input type="checkbox"/>

Installation of sender/receiver unit and reflector/scattered light receiver at horizontal pipes

Sender/receiver unit and reflector/scattered light receiver must be installed according to Fig. 16 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 16

Installation of sender/receiver unit and reflector/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.



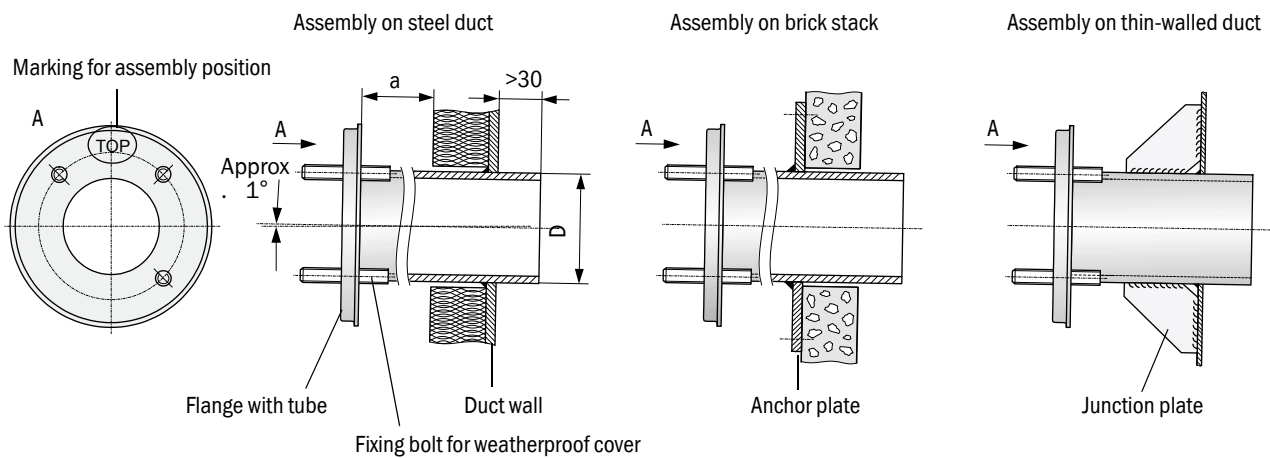
All dimensions specified in this Section are shown in mm.

3.2.1

Fitting the flange with tube

Figure 17

Fitting the flange with tube



Component	D
DHC-T sender/receiver unit	Ø 76
DHC-R0 reflector/scattered light receiver	
DHC-R1 reflector/scattered light receiver	Ø 159

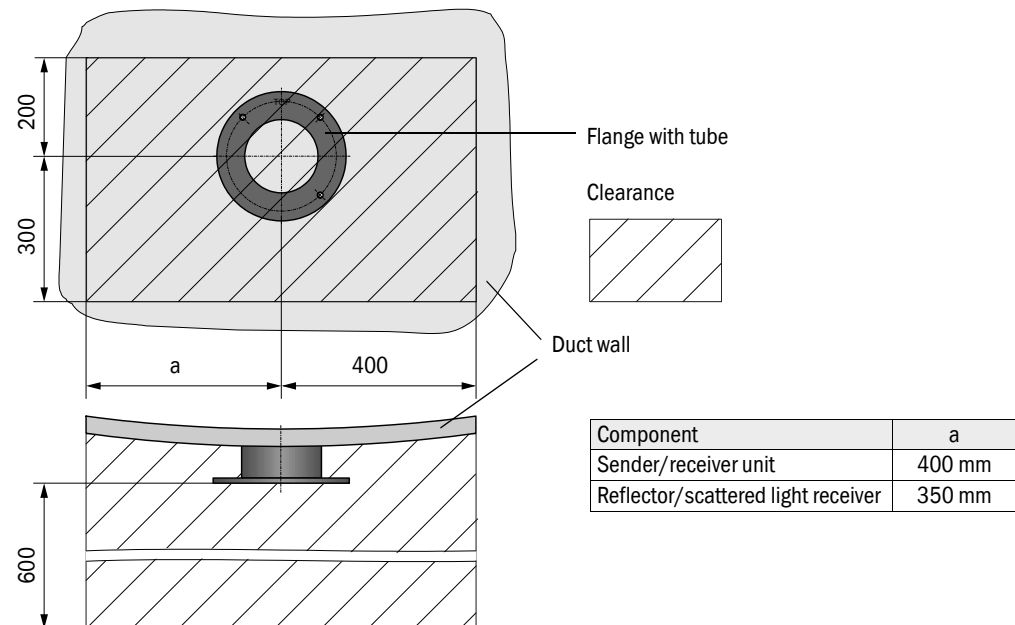
Dimension a must be large enough so that a weatherproof cover can be fitted easily when necessary (approx. 40 mm).

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/receiver unit and reflector/scattered light receiver (→ Fig. 18).

Figure 18

Clearance for sender/receiver unit and reflector/scattered light receiver (dimensions in 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. 121, Fig. 97))



NOTICE:

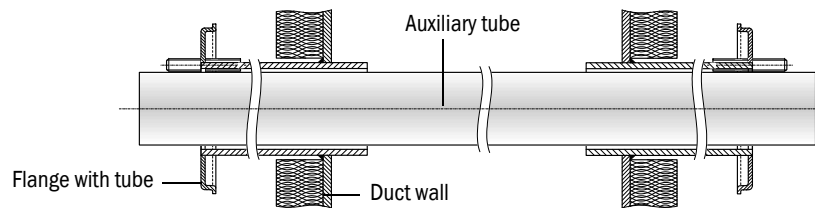
- ⊗ Do not let separated pieces fall into the duct.

- Insert the flange with tube in the opening so that the "Top" marking points upwards (→ p. 34, Fig. 17).
- 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. 34, Fig. 17).
- 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. 36, Fig. 19); axes deviation to each other max. $\pm 1^\circ$.

Figure 19

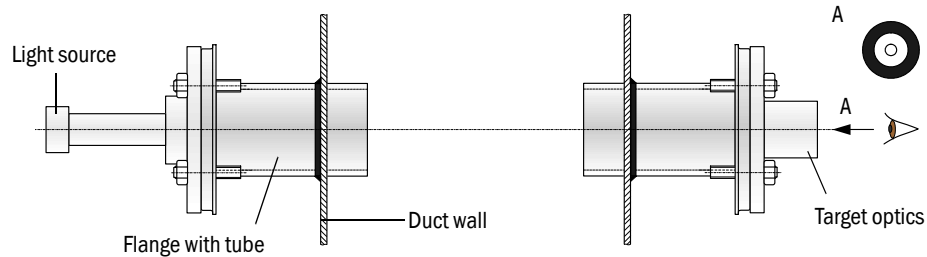
Aligning the flange with tube

Aligning with auxiliary tube



Aligning with adjusting device

(→ p. 126, §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. 20). 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.

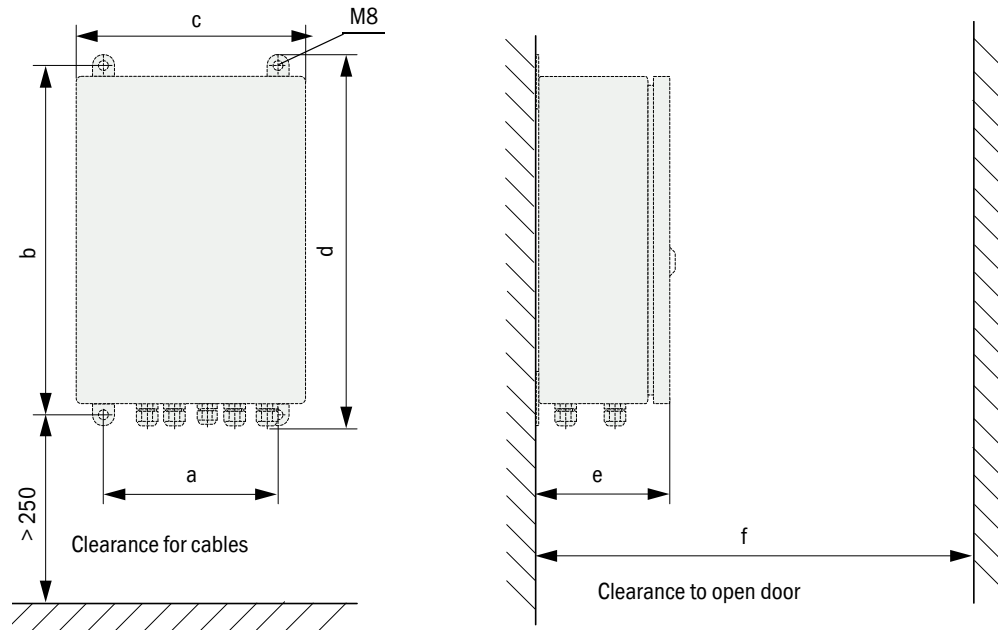
Using a suitable cable (→ p. 40, §3.3.1), the MCU-N control unit (without integrated purge air supply) can be located up to 1000 m away from the sender/receiver unit. We therefore recommend fitting the MCU in a control room (measuring station or similar) to ensure free access to the MCU. This considerably 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 20

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. 23, §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. 114, §7.1). In unfavorable conditions, lay an air intake hose to a location with better conditions.
- The purge air hoses to the sender/receiver unit and reflector/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/receiver unit and reflector/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:

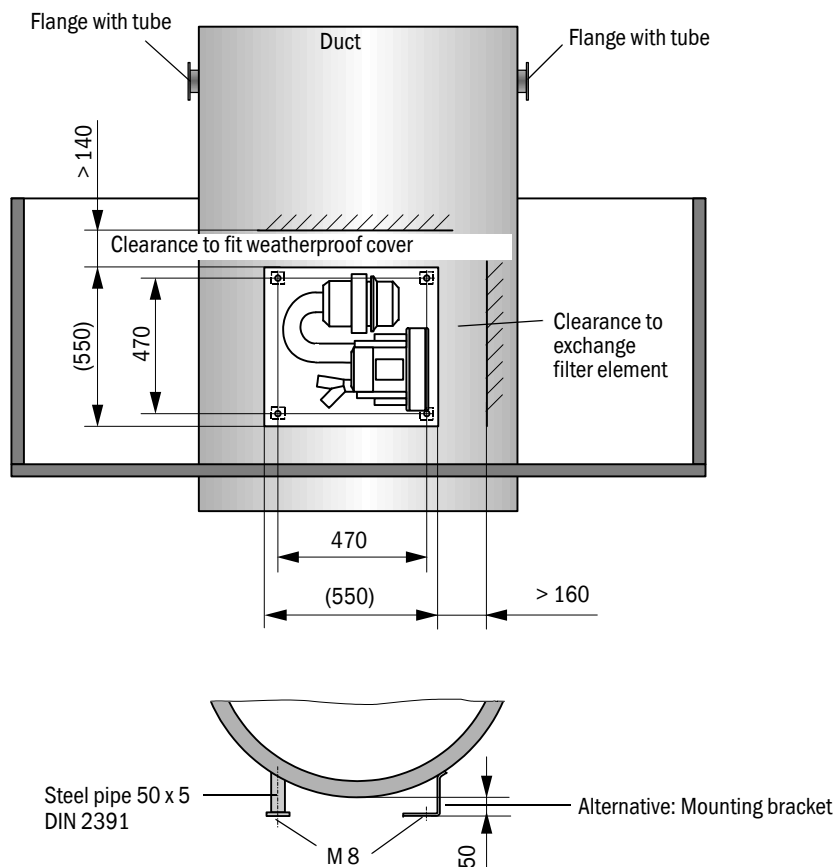
- Install the purge air unit at a location with clean air whenever possible. The air intake temperature must correspond to specifications in the Technical data (→ p. 29, §). In unfavorable conditions, lay an air intake hose or pipe to a location with better conditions.
- The fitting location must be 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/receiver unit and reflector/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. 21).

Assembly work

- Prepare holder (→ Fig. 21).
- Fasten purge air unit with 4 M8 screws.
- Check whether the filter element is fitted in the filter housing otherwise fit when necessary.

Figure 21

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



3.2.4 Fitting the weatherproof cover

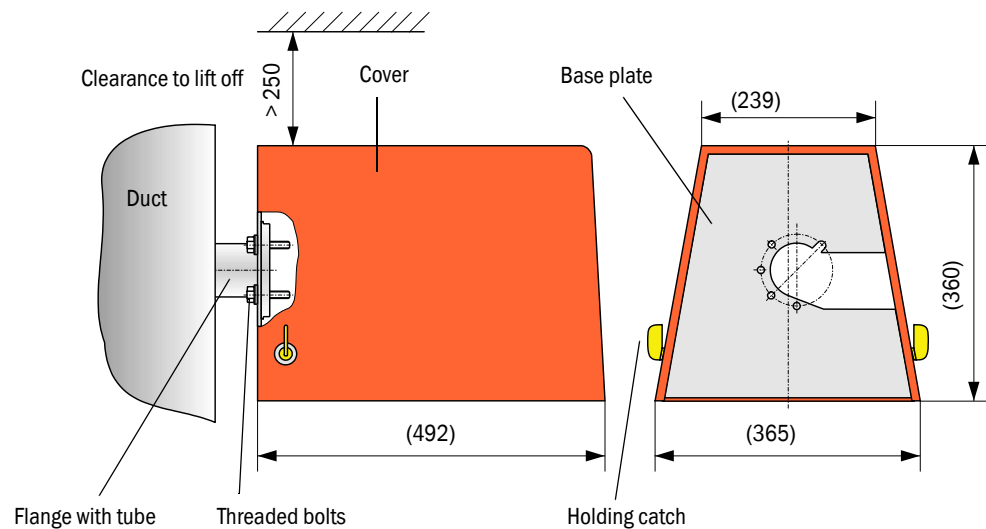
Weatherproof cover for analyzer

This weatherproof cover serves to protect the sender/receiver unit and reflector/scattered light receiver (see → p. 125, Fig. 102). 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. 22).
- Put the cover on from above.
- Insert the side holding catches into the counterpieces, twist and lock in.

Figure 22 Fitting the weatherproof cover for analyzer (dimensions in mm)



Weatherproof cover for external purge air unit

The weatherproof cover (→ p. 125, Fig. 7.2.6) 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.

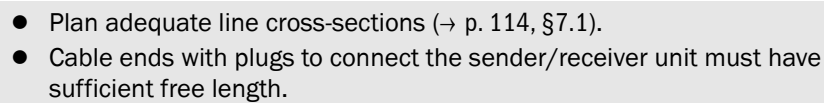
Installation



- ▶ 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.

General information, prerequisites

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.



Connecting/starting the optional external purge air unit

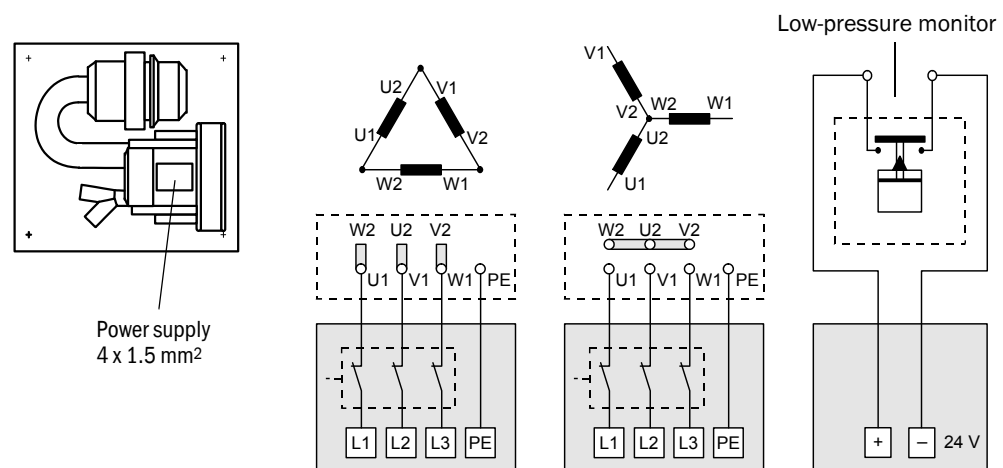
- ▶ Compare mains voltage and frequency with the specifications on the type plate on the purge air motor.



- 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. 23).

Electrical connection of the external purge air unit



- Subject to change without notice

- 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.

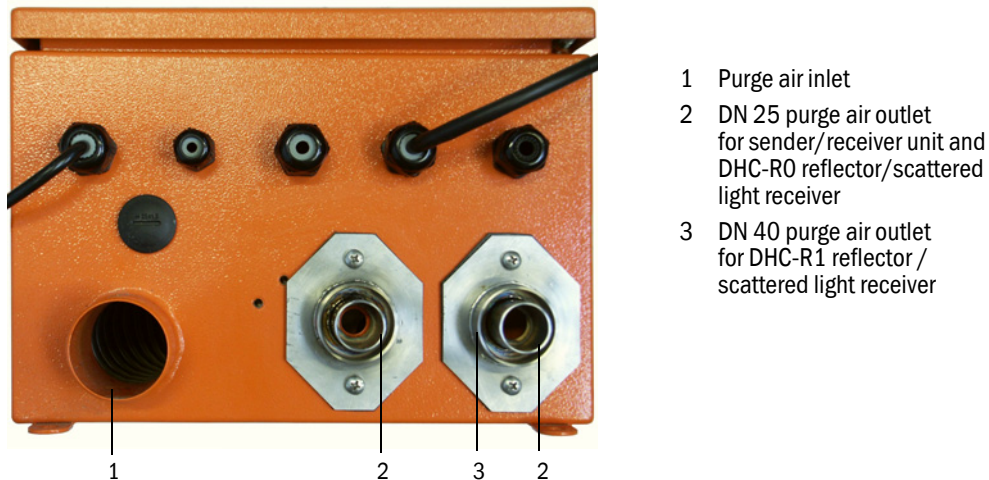
3.3.3 Installing the purge air supply

- 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. 24) and secure with a strap retainer. Set the purge air outlets as shown (correct when necessary).

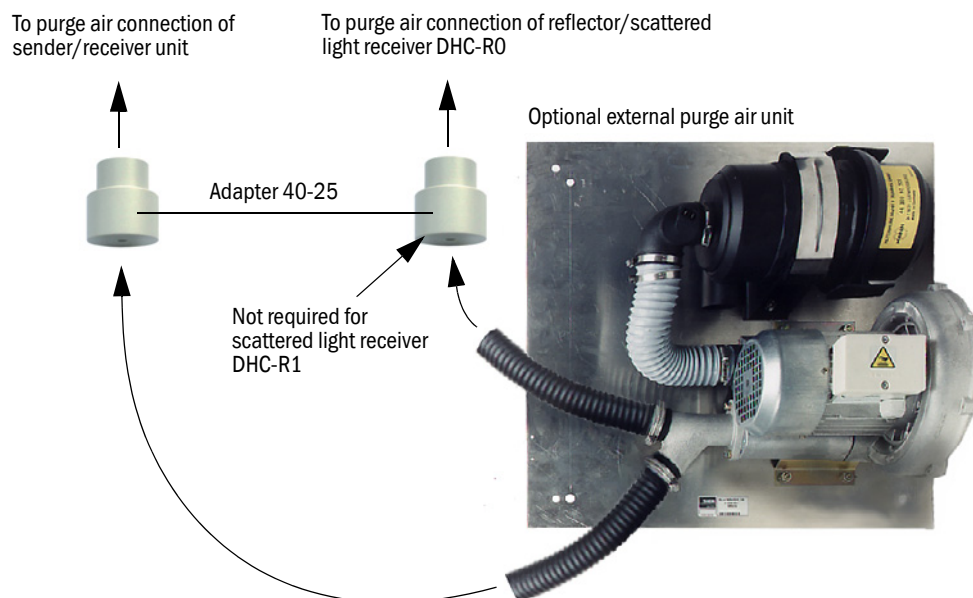
Figure 24 Control unit underside with integrated purge air supply



Optional external purge air unit

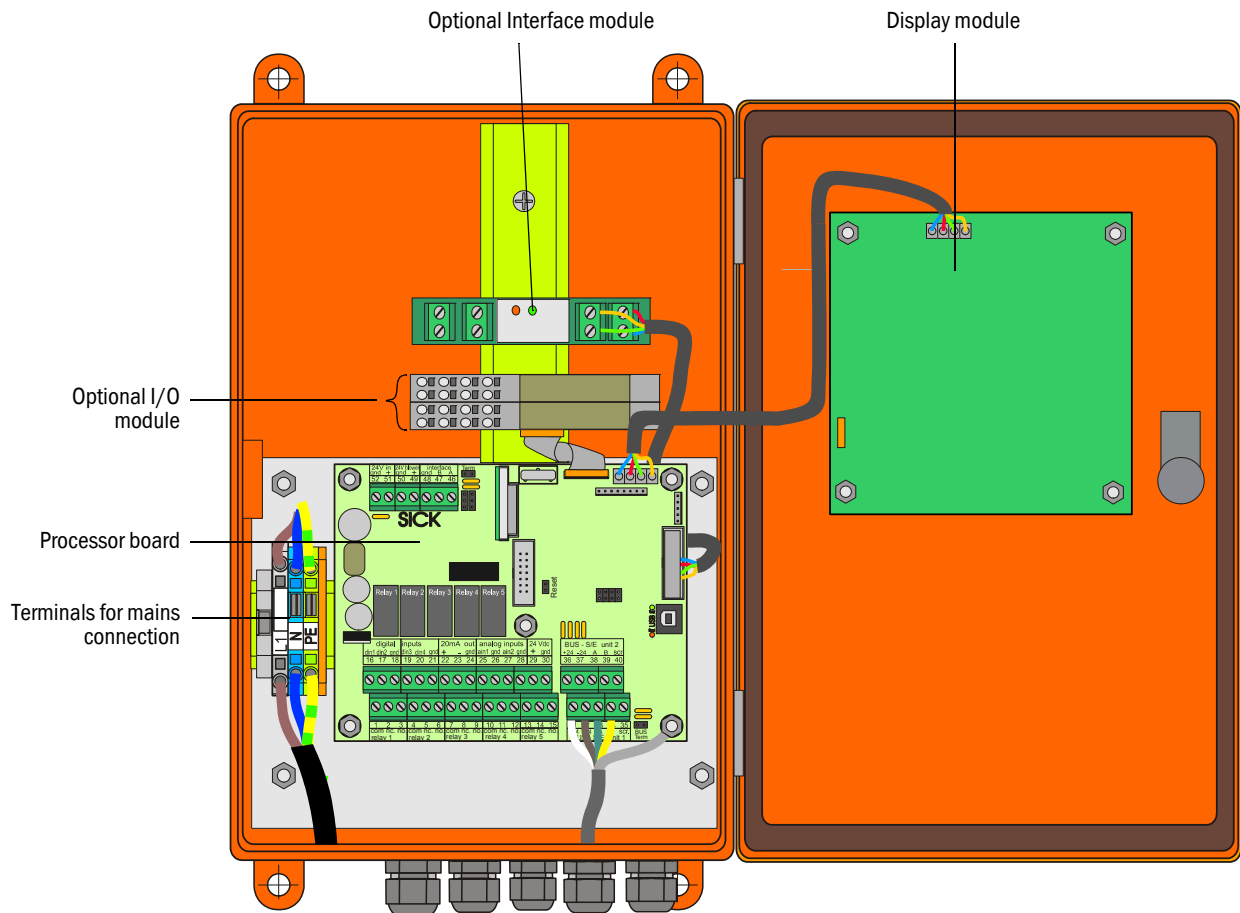
Connect the DN 40 purge air hose to the Y-distributor of the purge air unit and to the adapter, and secure with D32-52 hose clamps.

Figure 25 Connecting the optional external purge air unit



3.3.4 Connecting the MCU control unit

Figure 26 Component layout in the MCU (without purge air supply, with options)



Work to be done

- ▶ Connect connection cable according to → p. 45, Fig. 29.



If an onsite cable is to be used, it must be connected to a suitable 7-pole socket → p. 44, Fig. 28; 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. 45, Fig. 29, Fig. 30 and Fig. 31).



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. 43, Fig. 26).
- ▶ Lock not used cable bushings with blind stoppers.

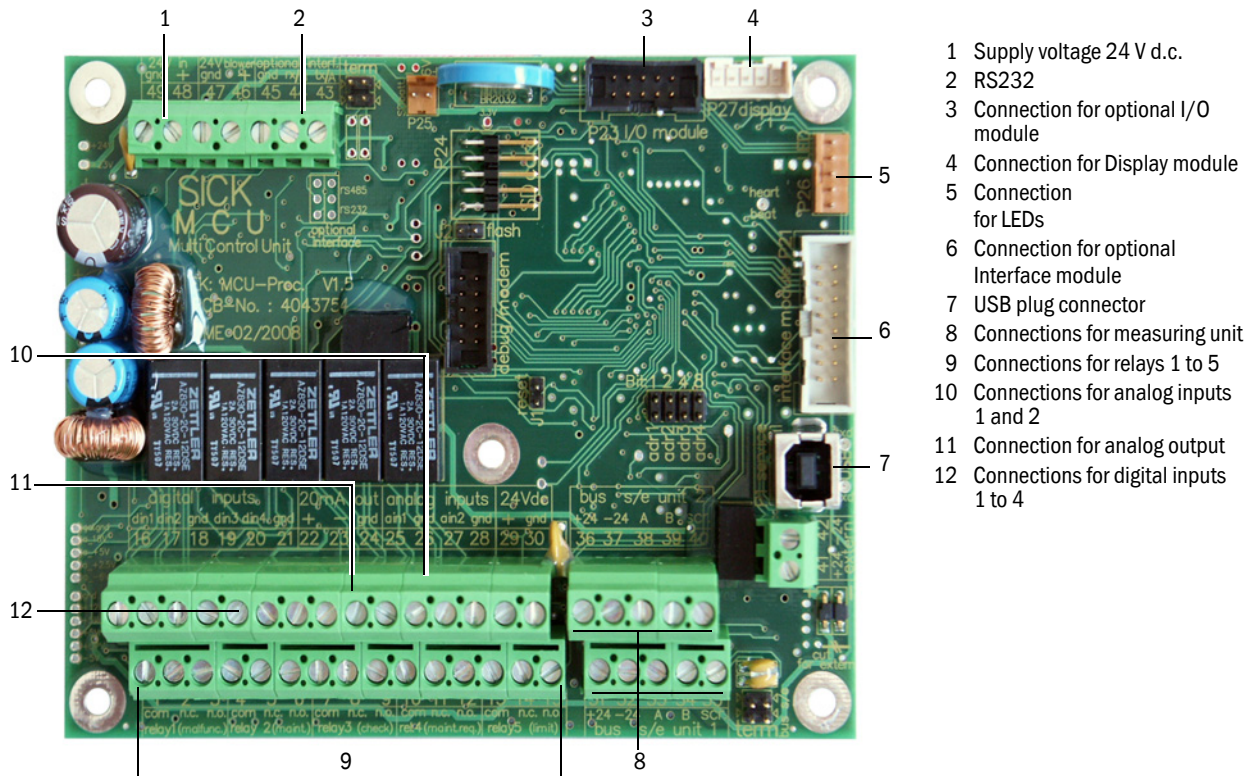


WARNING:

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

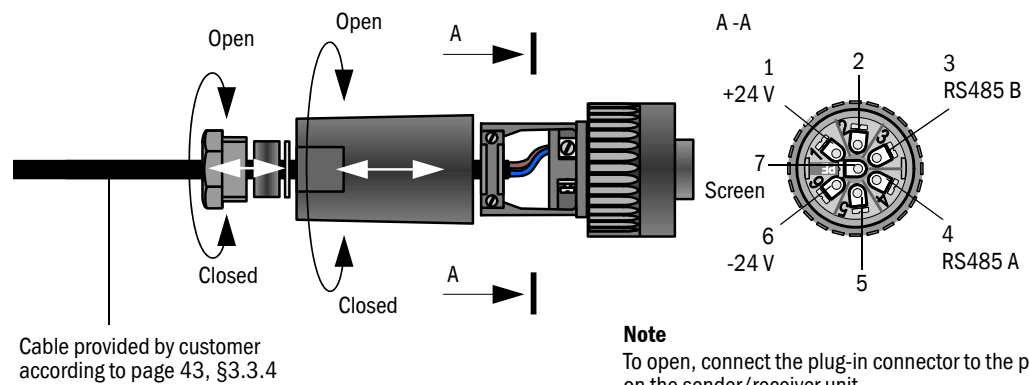
MCU processor board connections

Figure 27 MCU processor board connections



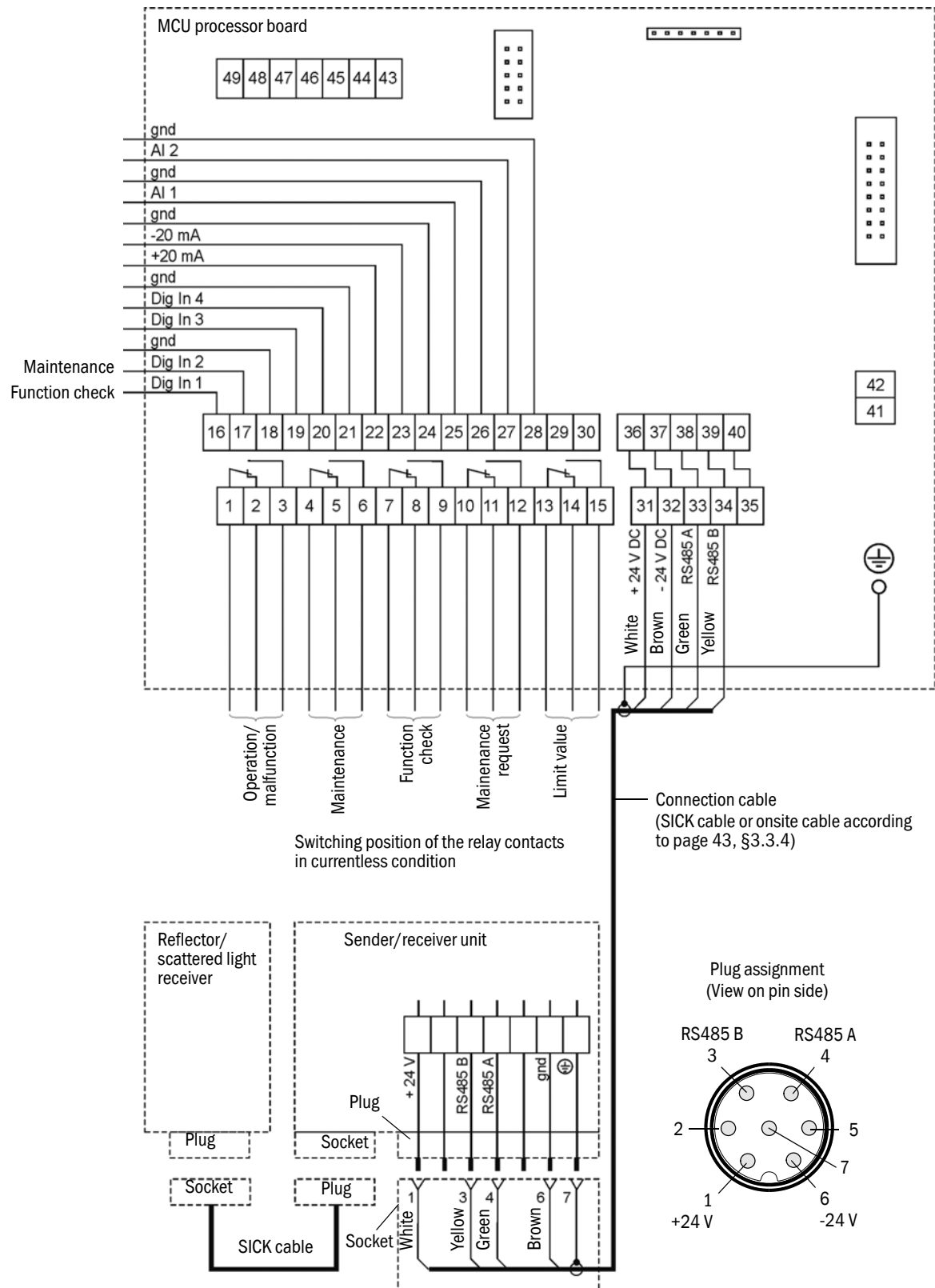
Onsite connection cable connection to MCU

Figure 28 Plug-in connector connection on onsite cable



Standard connection

Figure 29 Standard connection



3.3.5 Connecting the reflector/scattered light receiver

Connect the cable belonging to this component (→ p. 126, §7.3.2) to the sender/receiver unit and reflector/scattered light receiver and screw tight.

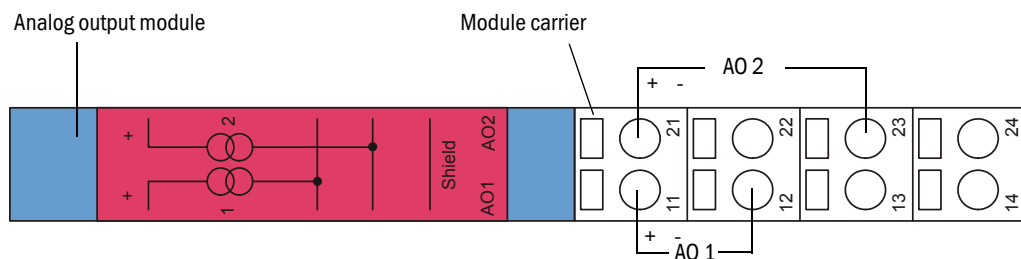
3.3.6 Fitting and connecting optional Interface and I/O modules

Plug interface modules and module carriers for I/O modules onto the hat rail in the MCU (→ p. 43, Fig. 26) and connect to the associated connection on the processor board with the cable with plug-in connector (→ p. 44, Fig. 27). Then plug the I/O module on the module carrier.

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

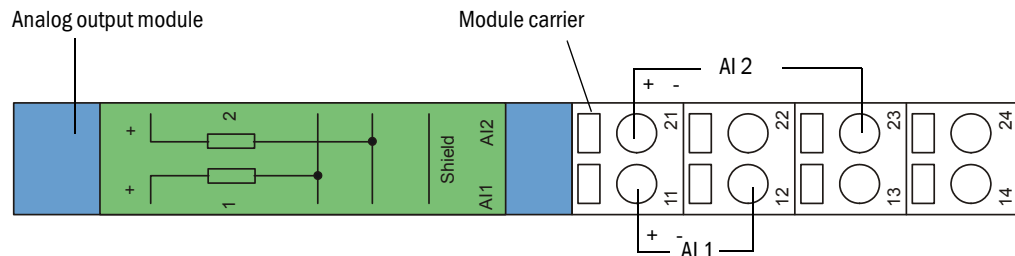
Terminal assignment AO module

Figure 30 Terminal assignment analog output module



Terminal assignment AI module

Figure 31 Terminal assignment analog input module



DUSTHUNTER C200

4 Start-up and Parameter Settings

Basics

Application specific settings

Installing the sender/receiver unit and reflector/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/receiver unit and reflector/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. 77, §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

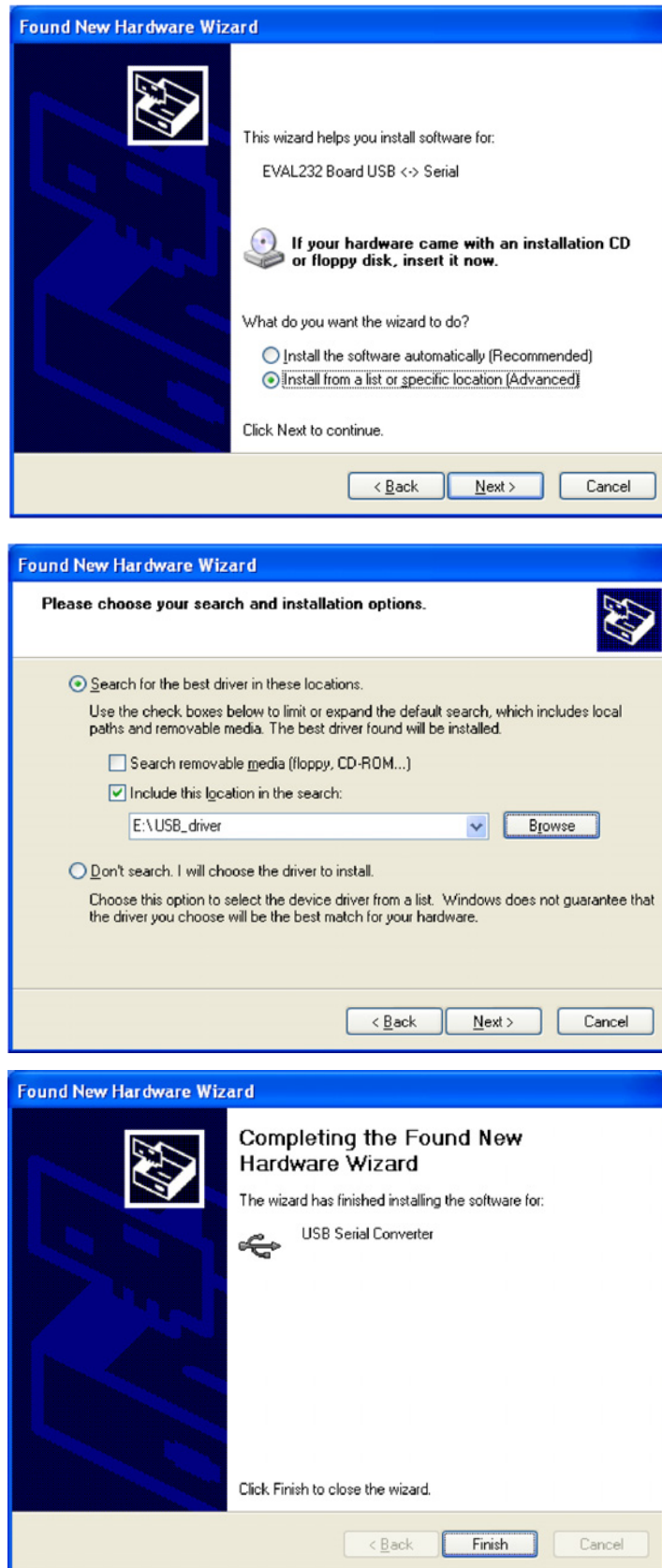
A special software driver is required for communication between the operating and parameter program SOPAS ET and the measuring system via the USB interface. Connect the MCU to the supply voltage and to the PC via USB cable to install the driver. A message appears on the display that new hardware has been detected. Then insert the delivered CD in the PC drive and follow the installation instructions (→ p. 49, Fig. 32).

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. 51, §4.1.3.2).

Figure 32 Installing the USB driver

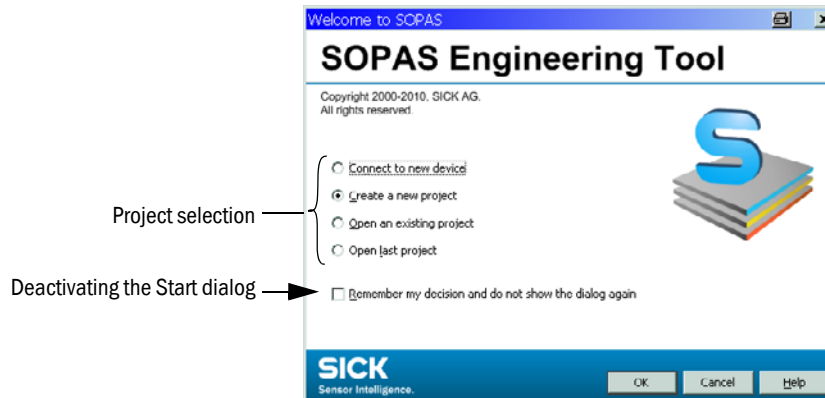


4.1.3 Connecting to the device

4.1.3.1 Basic settings

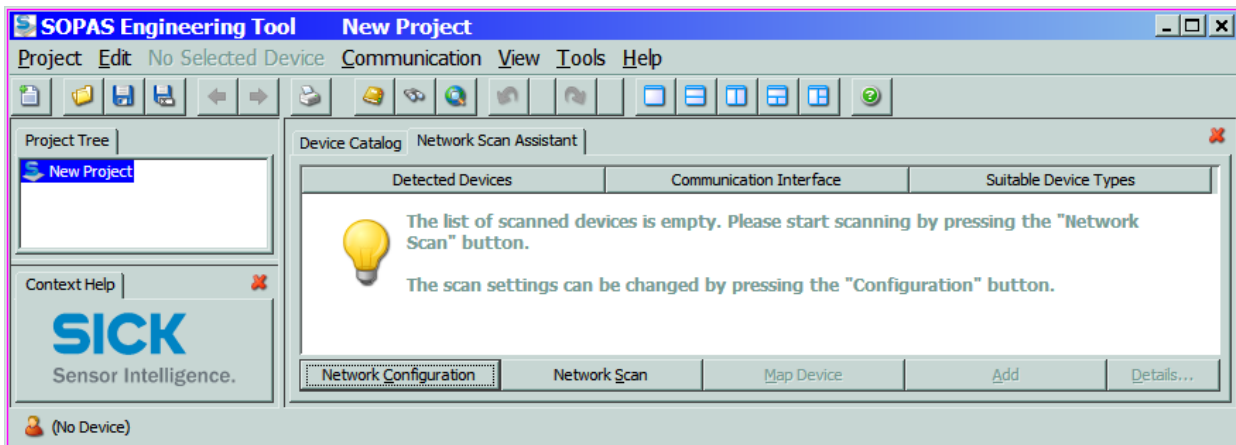
- ▶ Connect the USB cable to the MCU control unit (→ p. 44, Fig. 27) and the Laptop/PC.
- ▶ Start the program in the "SICK\SOPAS" start menu.
- ▶ The Start dialog appears on the screen (can be suppressed for further program usage).

Figure 33 Start dialog



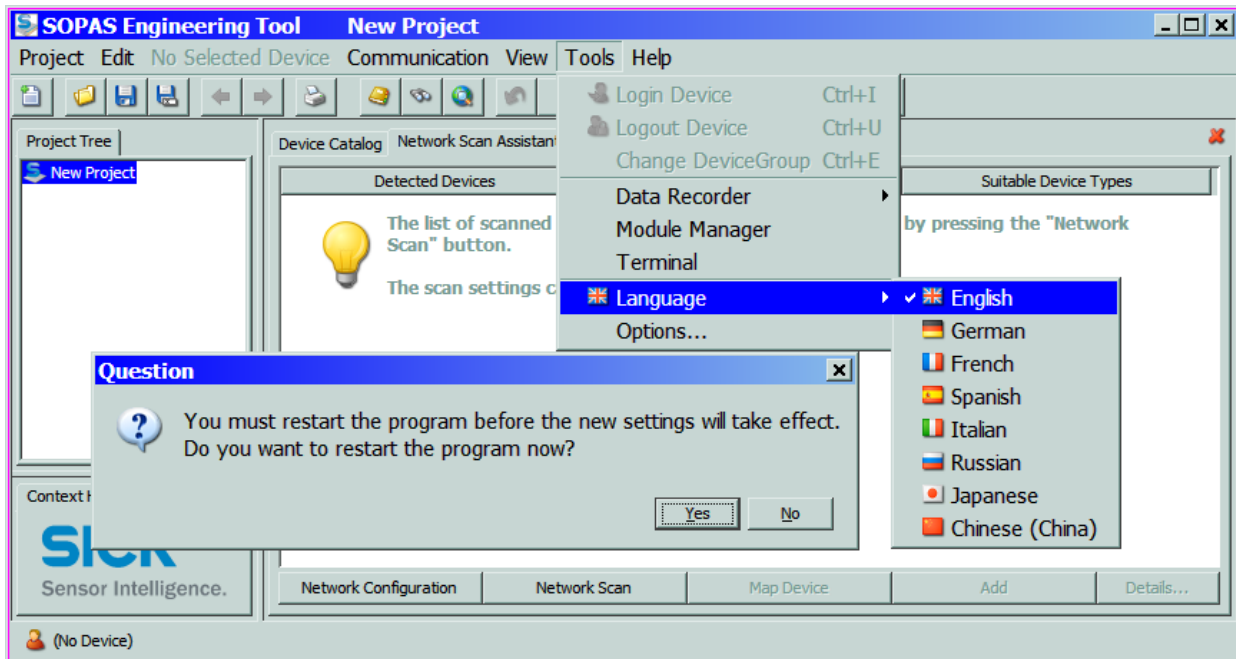
The following Start menu appears after confirmation with "OK".

Figure 34 Start menu



- ▶ If required, select the desired language in the "Tools / Language" menu (→ p. 51, Fig. 35), confirm with "OK", and restart the program .

Figure 35 Change of language settings

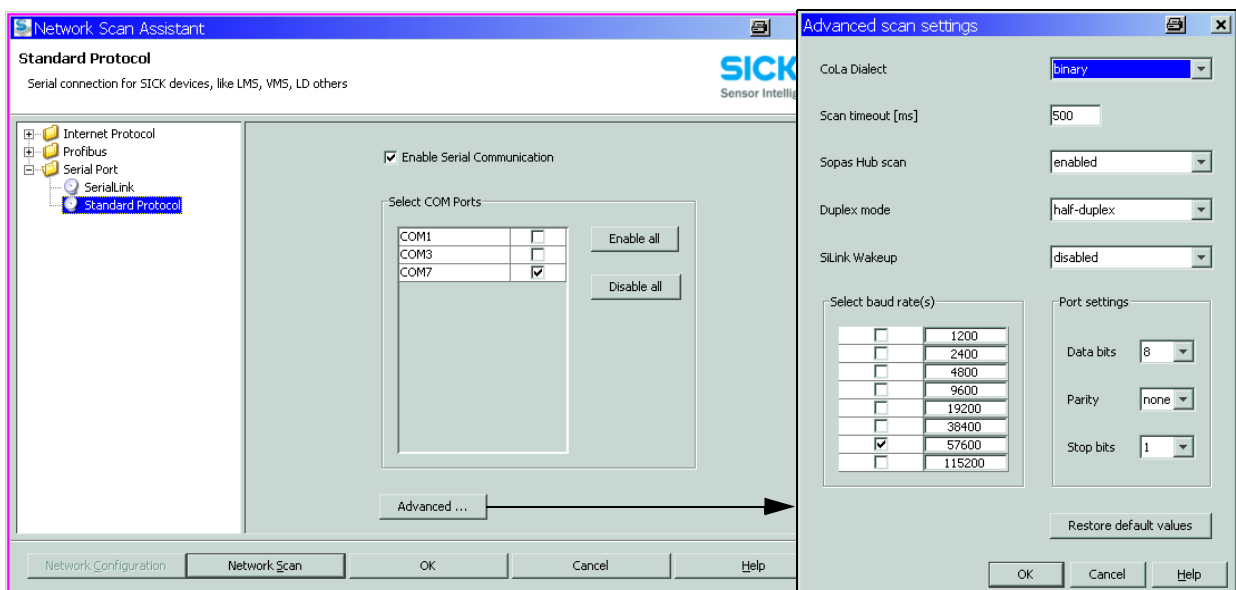


4.1.3.2 Configuring the interface

COM Port

- Click the "Network Configuration" button in the start menu (→ p. 50, Fig. 34) 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. 36 (settings only required during the first connection to the measuring system).

Figure 36 COM port selection and configuration



Ethernet

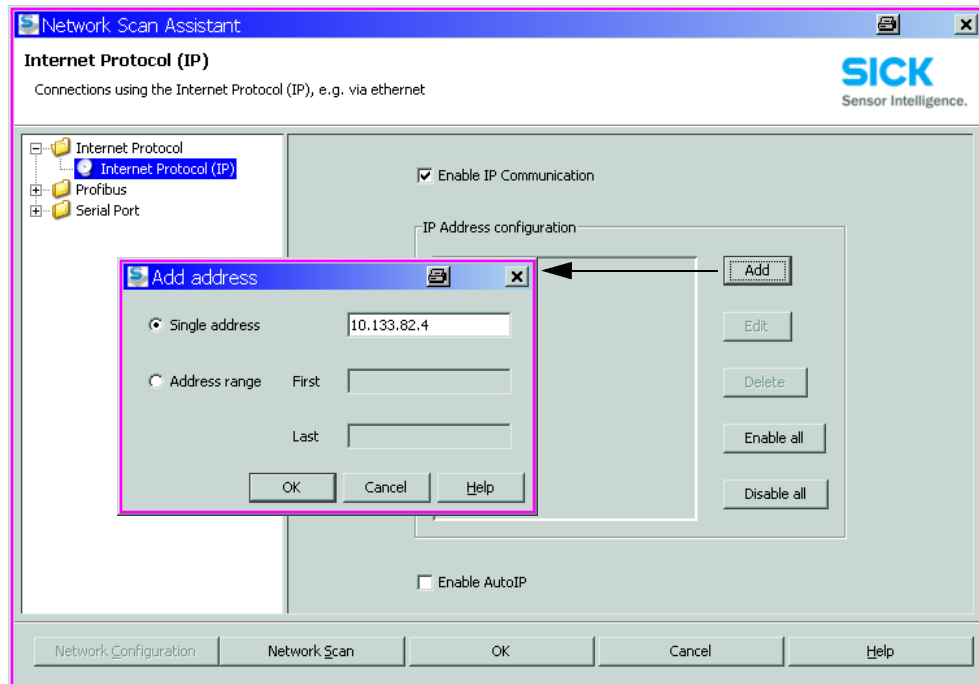


The Ethernet interface module (→ p. 126, §7.3.6) must be installed in the MCU (→ p. 46, §3.3.6) and configured (→ p. 85, §4.5.2) to get a connection to the measuring system via Ethernet.

- Click the "Network Configuration" button in the start menu (→ p. 50, Fig. 34) and select "Internet Protocol (IP)".
- Click the "Add" button, enter the IP address and confirm with "OK".

Figure 37

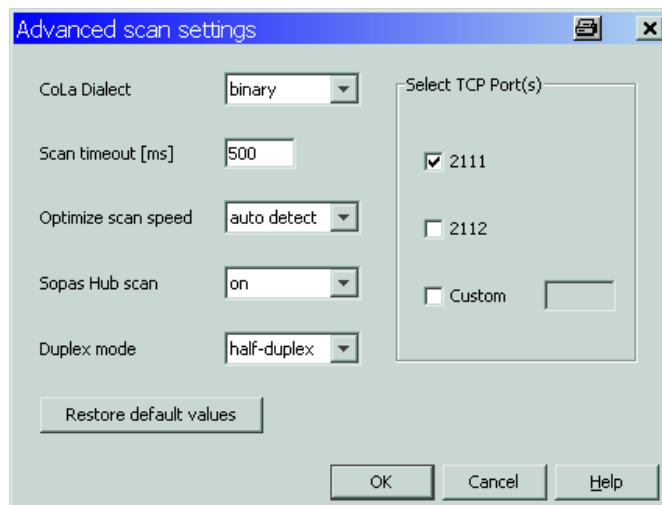
Ethernet interface selection (example settings)



- Click the "Advanced..." button and configure the interface according to Fig. 38.

Figure 38

Configuring the Ethernet interface



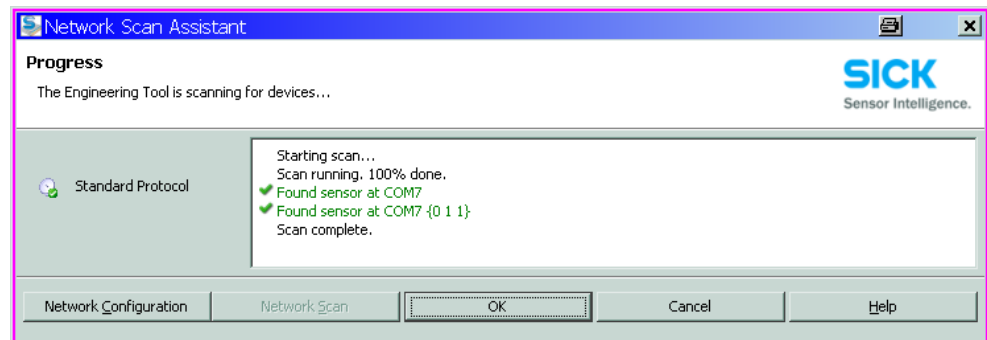
4.1.3.3 Establish connection via "Network Scan Assistant" directory

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

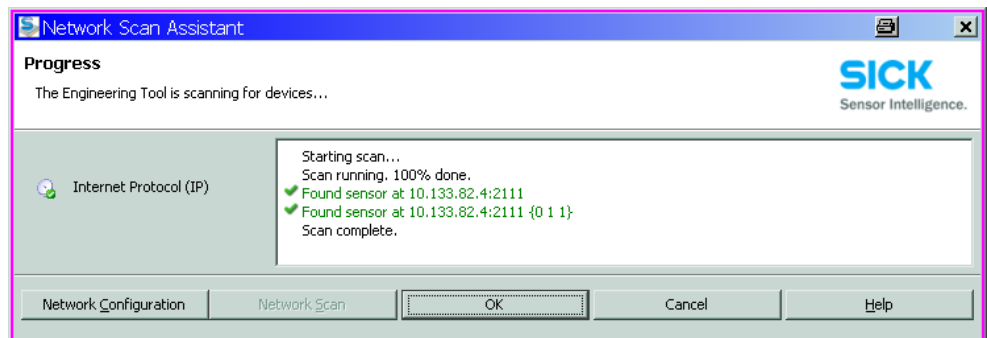
Bild 39

Search for connected devices

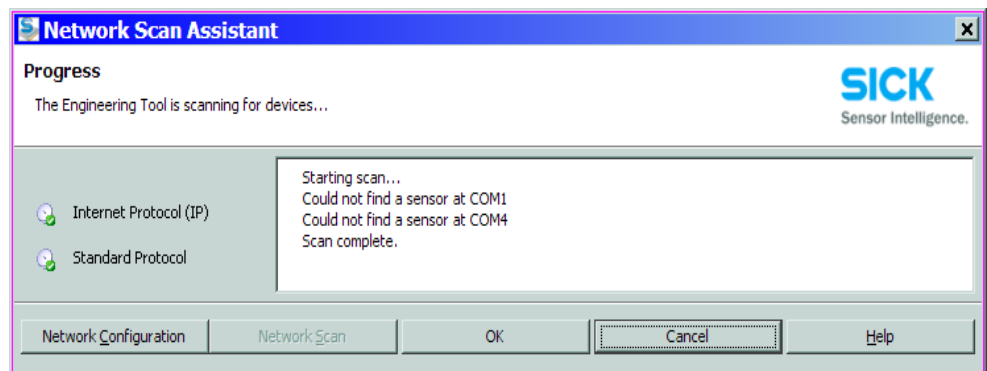
Connection via COM port



Connection via Ethernet



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



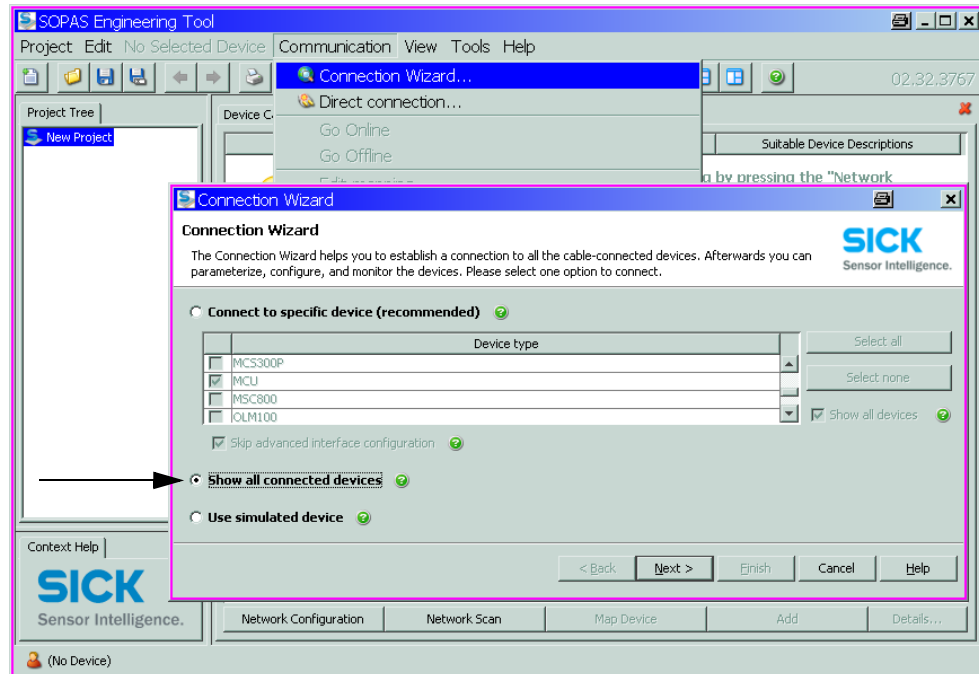
Problems with Ethernet connection can be caused by incorrect addressing
→ contact system administrator.

- Confirm search for connected devices with "OK".

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

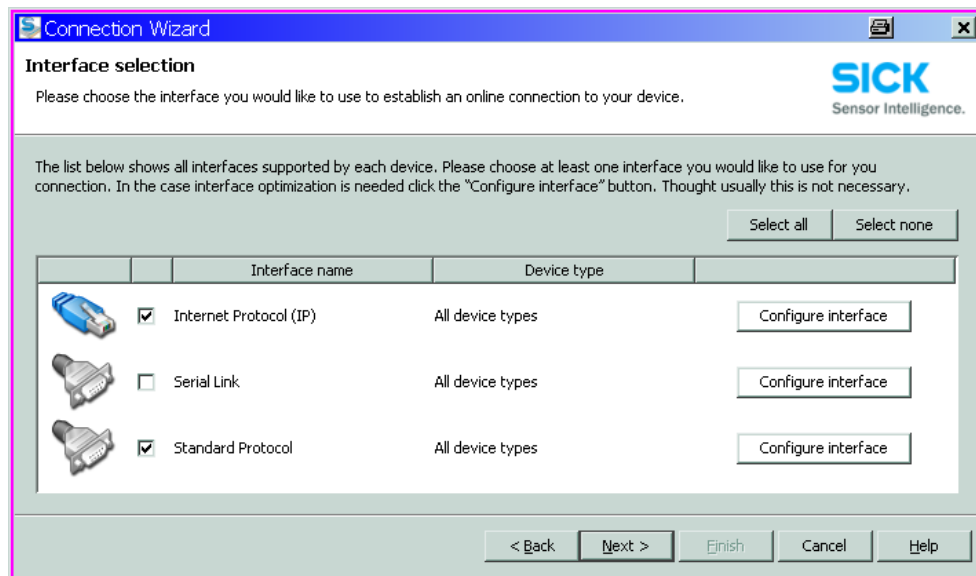
- Select "Communication / Connection Wizard" menu and activate "Show all connected devices".

Figure 40 "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 41 Interface selection

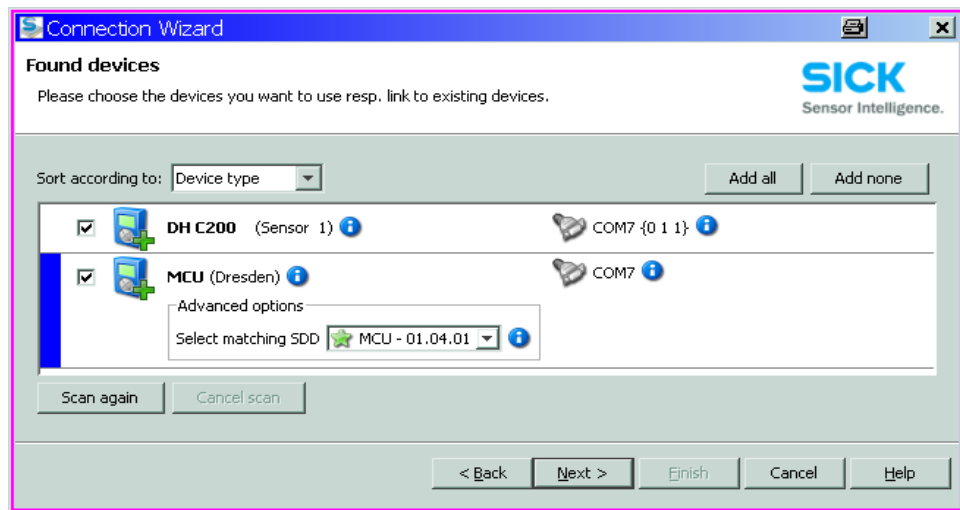


- Check interface configuration for setting according to S. 51, §4.1.3.2 and change accordingly if necessary.
- Click "Next >" button.

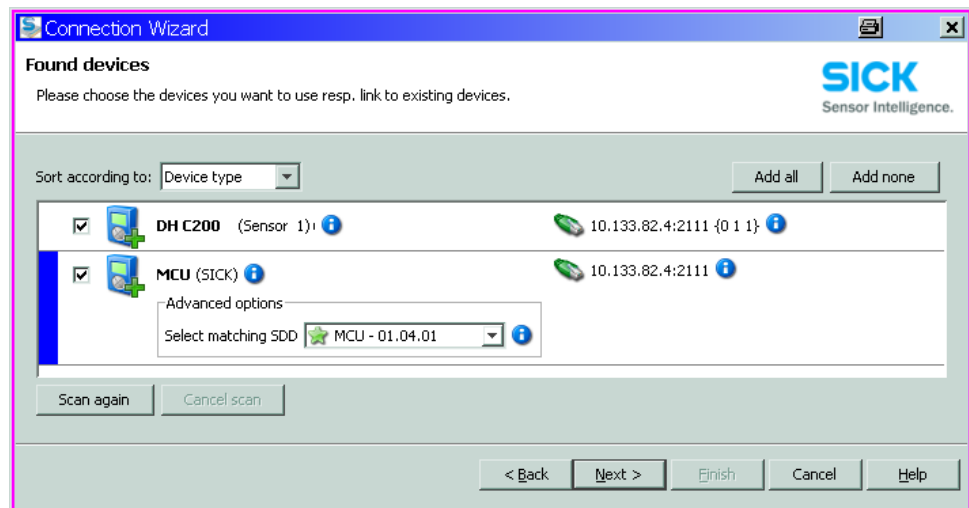
Figure 42

Search for connected devices

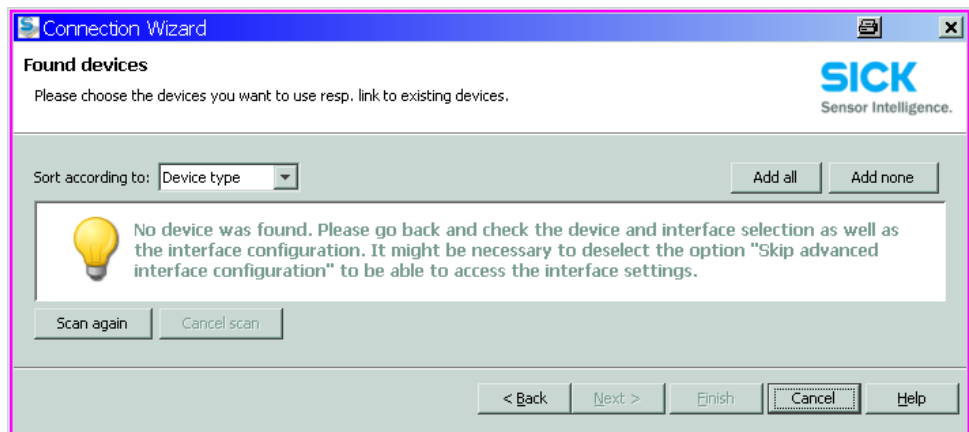
Connection via COM port



Connection via Ethernet



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

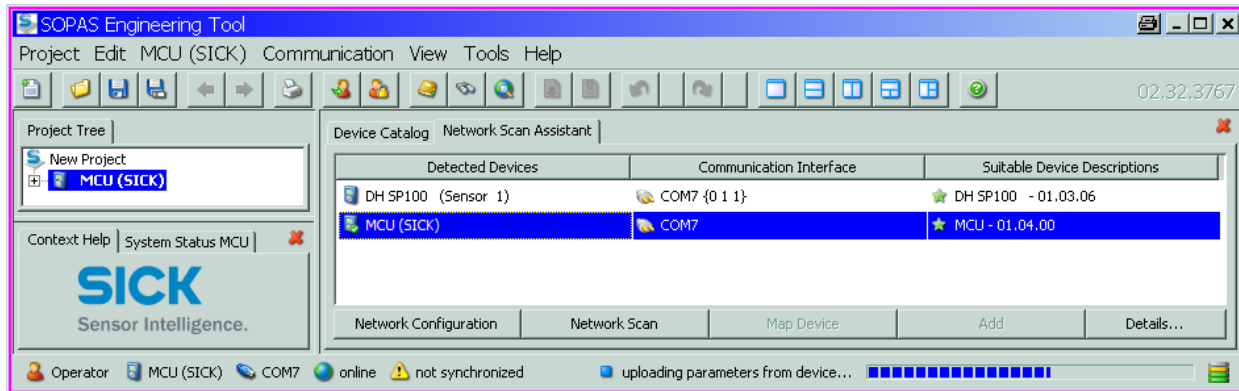


4.1.3.5 Selecting the device

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).

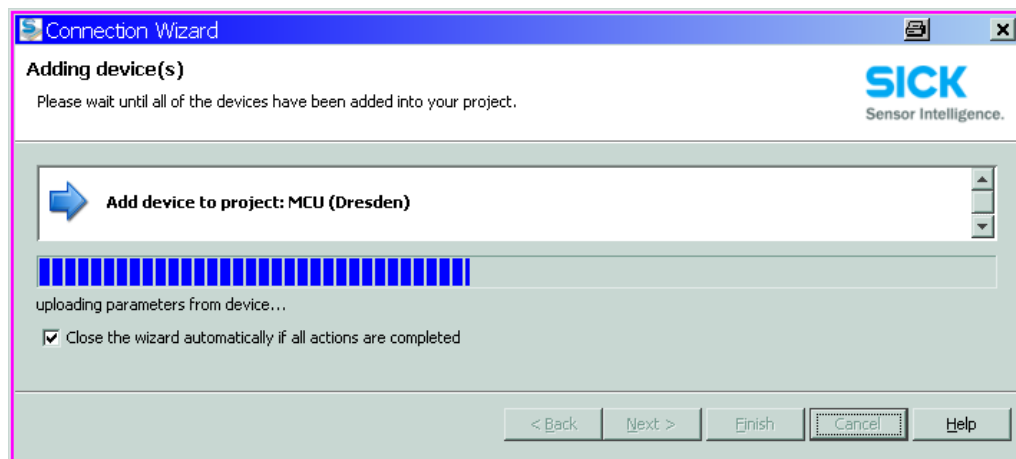
Figure 43 Selecting the device file



Connection via "Connection Wizard" menu

Activate the checkbox of the required device file in the "Connection Wizard / Found devices" (→ p. 55, Fig. 42) and Click "Next >" button. This transfers the device file to the "Project Tree" window.

Figure 44 Transferring the device file



4.1.4 Information on using the program

Password

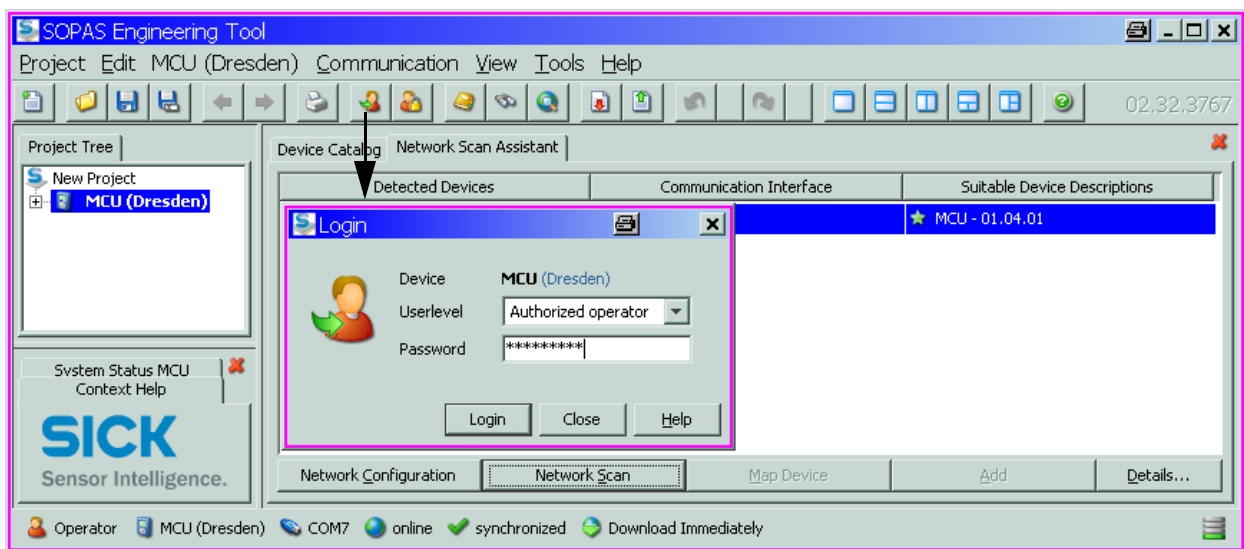
Certain device functions are first accessible after a password has been entered (→ p. 57, Fig. 45). Access rights are assigned in 3 levels:

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.

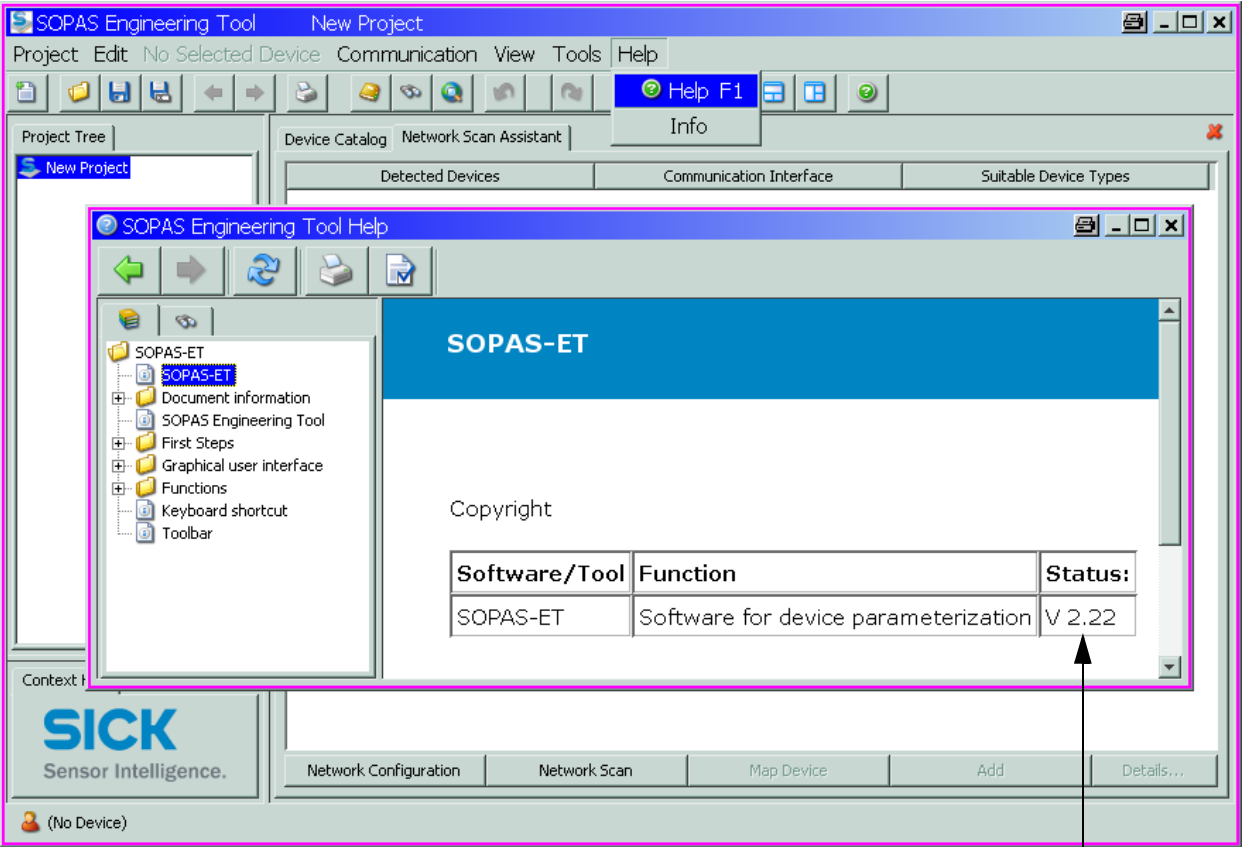
Figure 45 Password entry



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 46 Online help



The installed version is displayed

4.2

Application specific settings

The measuring system must first be set to the respective internal duct diameter to ensure correct measurement of transmission and scattered light intensity. The following steps are required:

Measuring principle	Work step	Aim
Transmission measurement	Focussing the sender light beam	The light spot on the reflector must lie within the optical active reflection surface under consideration of the active measuring path and the swivel angle allowed.
	Scaling the measuring system to a path free of particles	Influences on measuring results specific to the device and dependent on the distance must be eliminated. The path free from particles must be identical to the active measuring path (distances between the optical interfaces of the sender/receiver unit and reflector/scattered light receiver must be the same).
Scattered light measurement	Adjusting the laser beam	The laser beam must always be aligned to the light trap on the scattered light receiver.

4.2.1

Preparatory work

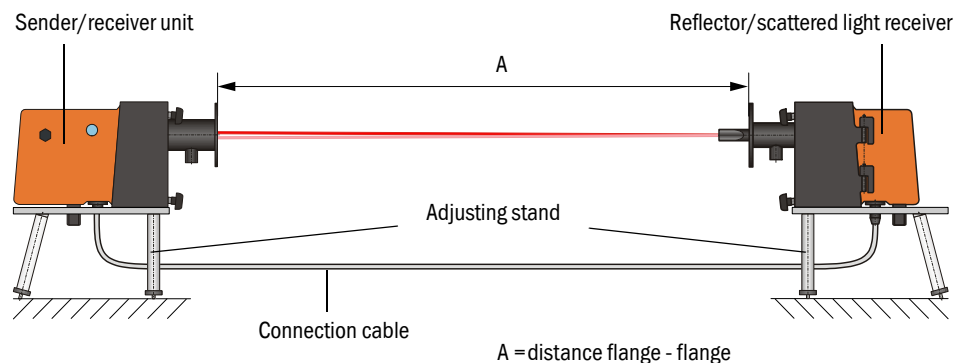
- Assemble the measuring system away from the installation location at a place as dust-free as possible with available power supply:

There are two options here:

- Using the optional adjusting stand

Figure 47

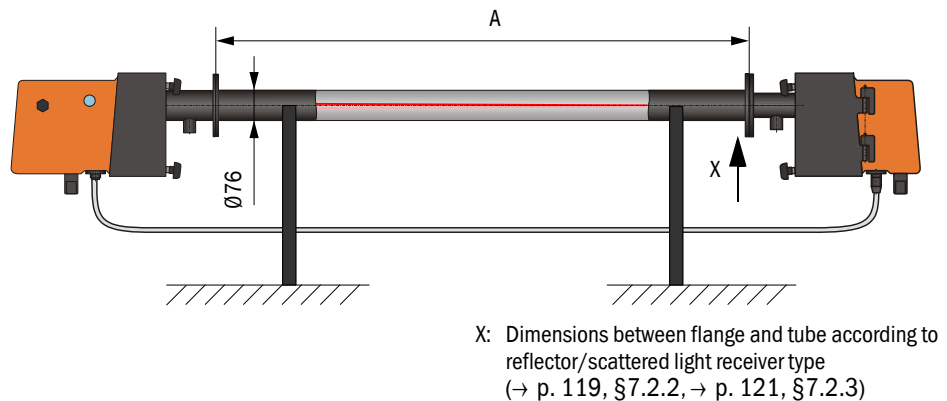
Creating a smoke-free path with adjusting stands



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

Figure 48

Creating a smoke-free path with a zero tube



- ▶ Connect the sender/receiver unit to the MCU and the reflector/scattered light receiver to the sender/receiver unit using the accompanying cables.
- ▶ Connect the MCU to the supply voltage.
- ▶ Start the SOPAS ET program and connect to the measuring system (→ p. 50, §4.1.3).
- ▶ Select the "DH C200" device file and move it to the "Project Tree" window (→ p. 56, §4.1.3.5).

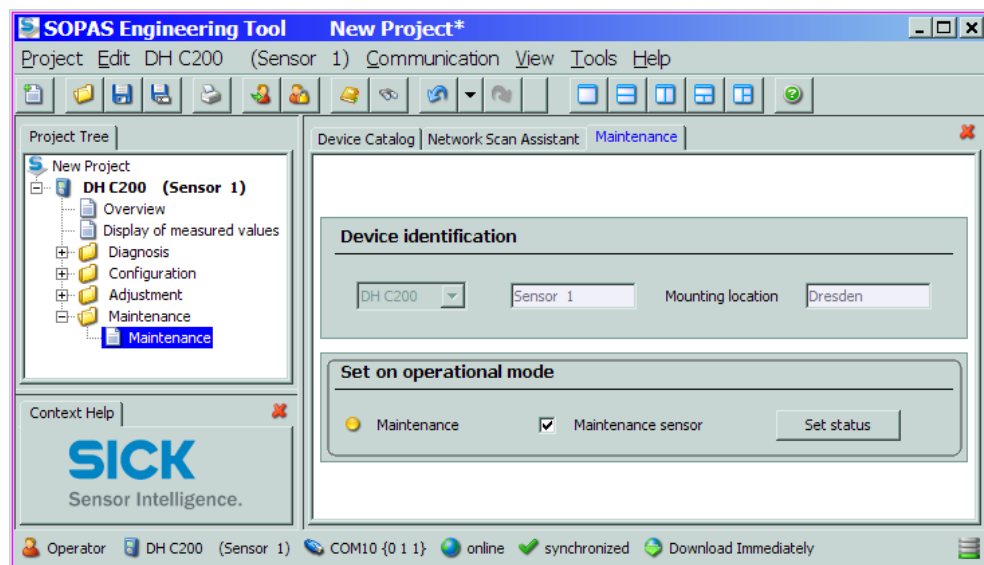


The respective device type connected is displayed automatically

- ▶ Enter the Level 1 password (→ p. 54, §4.1.3.4), activate the "Maintenance Sensor" check-box in the "Maintenance / Maintenance" directory and click "Set State".

Figure 49

Setting "Maintenance" mode



- ▶ Clean the optical boundary surfaces on sender /receiver unit and reflector/scattered light receiver (→ p. 98, §5.2.1 and → p. 101, §5.2.2).
- ▶ Wait approx. 30 min before starting the following work (measuring system must be in operation conditions).

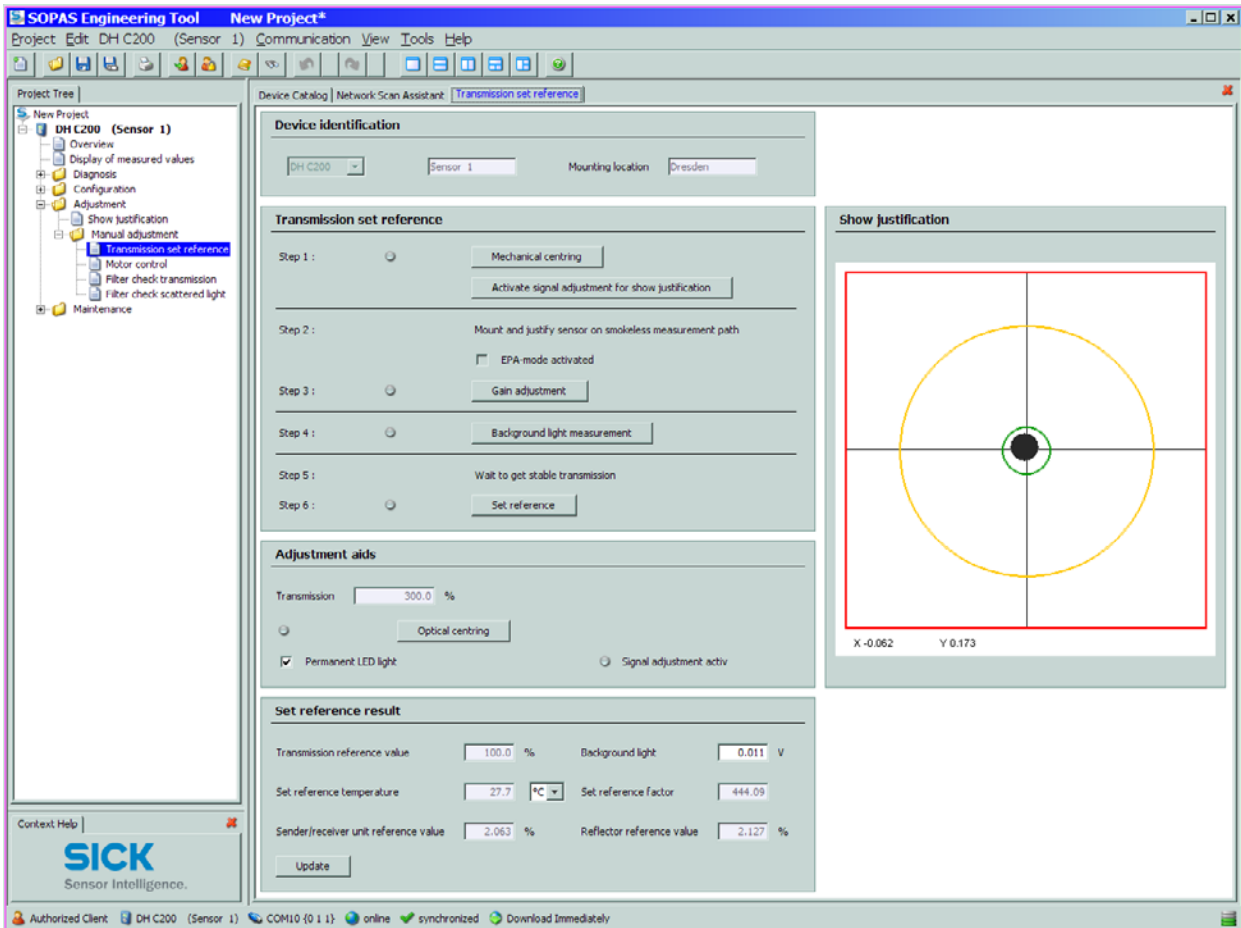
4.2.2

Focussing the sender light beam for transmission measurement

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

Figure 50

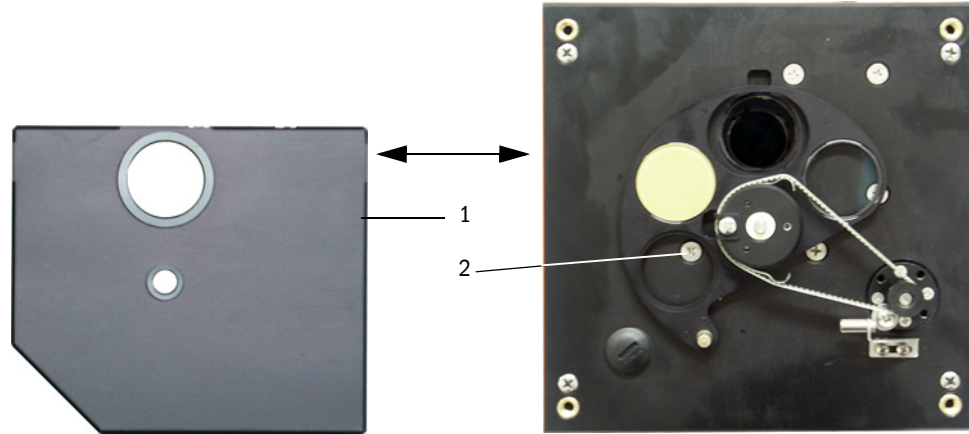
"Adjustment / Manual Adjustment / Transmission set reference" directory



- ▶ Loosen the knurled screws (→ p. 20, Fig. 7), swivel the electronic unit to the side and remove the swivel plate cover (1).
- ▶ Screw the cover screw (2) out of the focussing opening using a screwdriver.

Figure 51

Cover screw for focussing opening



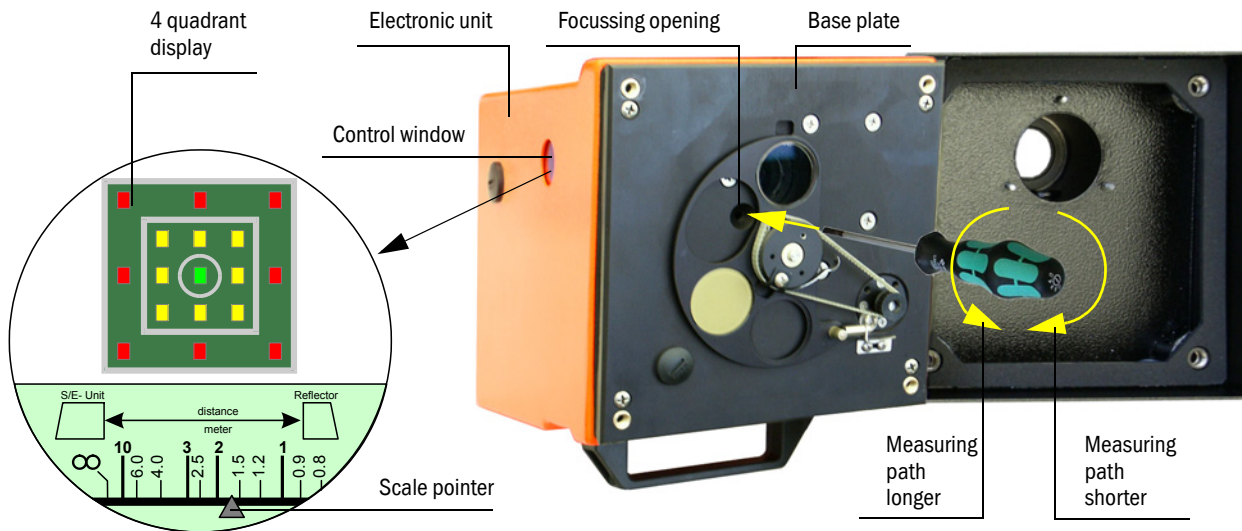
- ▶ Insert the screwdriver in the focussing opening and set the adjustment screw so that the scale pointer in the control window points to the distance between the optical surfaces of sender/receiver unit and reflector/scattered light receiver (= distance of the base plates).

Measuring distance 0.5 ... 3 m: Distance = measure A in Fig. 47 + 343 mm

Measuring distance 2.5 ... 8 m: Distance = measure A in Fig. 47 + 348 mm

Figure 52

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 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. 61, Fig. 50).

- Align the optical axes of the sender/receiver unit and reflector/scattered light receiver to each other.

Align the sender/receiver unit so that the sender spot lies on the middle of the opening for the reflector (→ p. 22, Fig. 9). Align the reflector/scattered light receiver so that the sender spot (1) can be seen in the central marking in the middle of the control window (2) on the back of the housing (3).

Figure 53

Sender spot on reflector/scattered light receiver side



- Deactivate the "Permanent LED light" checkbox.
- 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. 62, Fig. 52),
- in the "Adjustment / Manual Adjustment / Transmission set reference" directory (→ p. 61, Fig. 50), the sender spot (black circular area in the "Show justification" window) is inside the green circle.

A non-exact alignment is signaled by shining of LED in the 4 quadrant display in the control window in the following manner:

LED shining	Misalignment of the light spot on the reflector
green and yellow	Deviation max. approx. 0.1° in the shown direction; measured values are valid
yellow	Deviation max. approx. 0.1° to 0.3° in the shown direction; measured values are valid
yellow and red	Deviation max. approx. 0.3° to 0.4° in the shown direction; measured values are valid, possibly larger swivel error as listed in the technical data
red	Deviation $> \text{approx. } 0.4^\circ$ in the shown direction; measured values are valid, possibly larger swivel error as listed in the technical data
red LED shine in a circle	Deviation $> \text{approx. } 0.5^\circ$ or transmission $< \text{approx. } 10\%$; dust concentration too high or measurement system wrong scaled; self-alignment not possible



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.

The measuring system must then be scaled after focussing has completed.



NOTICE:

The measuring system must be scaled again after every focus change.

4.2.3

Scaling the measuring system for transmission measurement**NOTICE:**

The optical surfaces must be clean (clean if necessary before performing the following steps; → p. 98, §5.2).

- Carry out the steps listed in the "Transmission reference value" group in the "Adjustment / Manual Adjustment / Transmission set reference" directory (→ p. 61, Fig. 50) after each other. The corresponding indication changes to yellow when step 1 to 6 is in process.
- Check whether the transmission is shown as 100% in the "Transmission reference value" window after this process completes (→ p. 61, Fig. 50). Click "Set reference" at smaller deviations (< approx. 1%), repeat the normalization at greater deviations.



The values shown in the field "Set reference result" window "Sender/receiver unit reference value" and "Reflector reference value" shall not exceed 8% (otherwise a device defect exists under circumstances → contact SICK Service).

4.2.4

Adjusting the laser beam for scattered light measurement

- Take off the sender/receiver 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 reflector/scattered light receiver.

**NOTICE:**

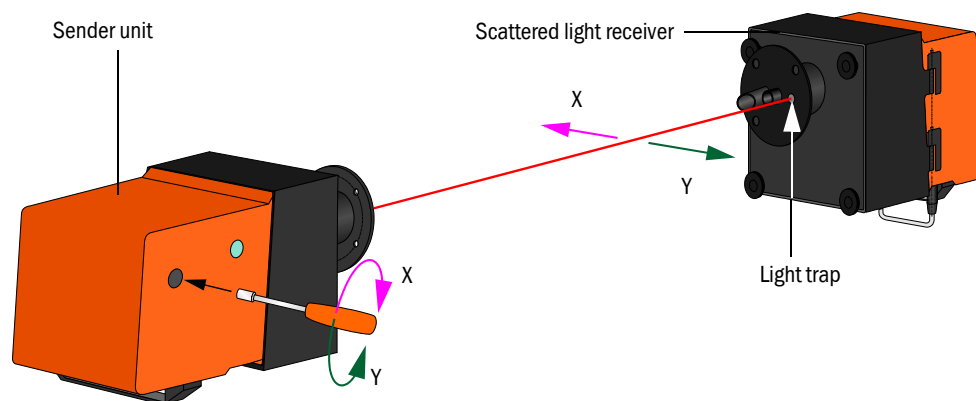
Don't change the alignment of sender/receiver unit and reflector/scattered light receiver.



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

Figure 54

Aligning the laser beam to the light trap



- Put the cover back on.

4.2.5 Entering application specific parameters

Figure 55 "Configuration / Application parameters" directory (example)

The screenshot displays the SOPAS Engineering Tool interface. The left pane shows the 'Project Tree' with the following structure:

- New Project
 - DH C200 (Sensor 1)
 - Overview
 - Display of measured values
 - Display of measured values graphical
 - Diagnosis
 - Configuration
 - Application parameters (selected)
 - Adjustment
 - Maintenance

The main window is titled 'Application parameters' and contains the following sections:

- Device identification**
 - Mounting location: Dresden, DH C200, Sensor 1
 - Flange-flange: 2.00 m
 - Opt. measuring distance: 1.00 m
 - Chimney opening: 1.00 m
 - Correction factor: 1.000
- Concentration calibration coefficients = f(extinction)**
 - cc2: 0, cc1: 1, cc0: 0
- Concentration calibration coefficients = f(Scattered light)**
 - cc2: 0, cc1: 1, cc0: 0
- Primary measuring principle**
 - Primary measuring principle: Transmission
- Span 2 transmission**
 - Span 2 transmission: ☐ Reference value: 50 %
- Limit contamination and average**
 - Limit contamination: 4%, Limit warning: 3.0 %
 - ☒ Average activ
 - Average Interval: 6 min (dropdown menu open showing 1 min, 2 min, 3 min, 4 min, 5 min, 6 min)
 - Selection Measure Value: Opacity
- EPA Conformity**
 - ☒ EPA-mode activ

The bottom status bar shows: Authorized Operator, DH C200 (Sensor 1), COM7 {0 1}, online, synchronized, and Download Immediately.

Group	Window	Parameter	Remark
Device identification	Mounting location	Name of the measuring place	Assignment of the measuring system to the respective measuring location
	Flange - Flange	Flange distance measured at the stack	for registration purposes (e.g. for repetition scalings on a dustfree path)
	Opt. measuring distance	active measuring path length	Input required for the calculation of the relative opacity
	Chimney opening	Duct diameter at the top	
	Correction faktor	Value	
Concentration calibration coefficients = f (extinction)	cc2	quadratic coefficient	Entering the regression coefficients determined on basis extinction to measure the dust concentration in mg/m ³ (→ p. 77, §4.4.7.1) .
	cc1	linear coefficient	
	cc0	absolute coefficient	
Concentration calibration coefficients = f (Scattered light)	cc2	quadratic coefficient	Entering the regression coefficients determined on basis scattered light to measure the dust concentration in mg/m ³ (→ p. 78, §4.4.7.2) .
	cc1	linear coefficient	
	cc0	absolute coefficient	
Primary measuring principle	Primary measuring principle	Transmission	Assigning the light source (LED at 'transmission', laser at 'scattered light') for determination of control values ??in function control
		Scattered light	
Span2 transmission	Span2 Transmission	activated	During function check the second control value is compared with the reference value.
		deactivated	The second control value is not used.
	Reference value	Transmission value in %	Entering a second control value for function check (→ p. 16, §2.1.3)
Limit contamination and average	Limit contamination	Value in %	Determination of a contamination limit value, selectable 40 % (default value), 20%, 10%, 6%, 4% The limit value 4% is firmly assigned if the "EPA conformity" check box is activated.
	Limit warning	75 % of limit contamination	Automatic assignment depending on the set limit value
	Average active	activated	An average value is calculated from the values measured in the set interval if the check box is activated.
		deactivated	
	Average interval	Intervallzeit 1/2/3/4/5/6min	Selection of the interval time (6 min for use according to EPA standards)
EPA Conformity	EPA-mode activated	activated	required for use according to EPA standard
		deactivated	no use according to EPA standard



After deactivation of "EPA conformity" the values for "Limit contamination" and "Limit warning" are reset to default values (40% and 30%).

4.3 Installing the sender/receiver unit and reflector/scattered light receiver

Remove sender/receiver unit and reflector/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/receiver unit and reflector/scattered light receiver to the purge air supply

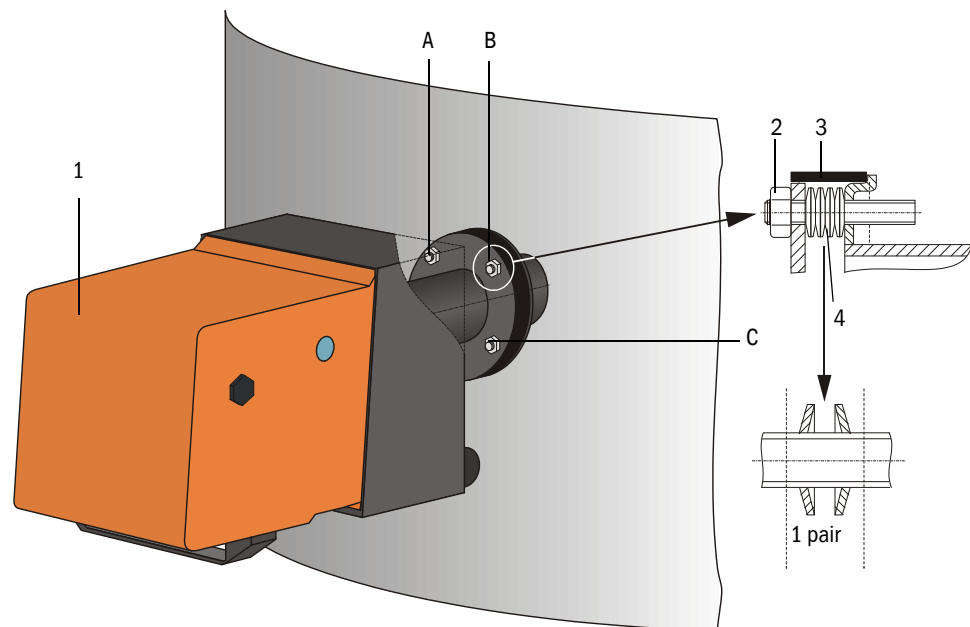
- Check whether the purge air supply is available (the flow direction must be correct and the purge air hoses fitted tight on the connections).
- For purge air supply by the MCU-P control unit, push the DN 25 purge air hose onto the connections of the sender/receiver unit and reflector/scattered light 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/receiver unit and reflector/scattered light receiver on the duct

- Attach the sender/receiver unit and reflector/scattered light receiver to the flange with tube and fasten with the accompanying assembly kit (→ p. 126, §7.3.4). Screw the self-locking nuts as tight as possible.

Figure 56

Fitting the sender/receiver unit / reflector/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/receiver unit and the cable sender/receiver unit - reflector/scattered light receiver at the respective connectors (→ p. 20, Fig. 7, → p. 21, Fig. 8 and → p. 22, Fig. 9) and screw tight.
- ▶ Start the SOPAS ET program and connect to the measuring system, select the "DH C200" device file and move it to the "Project Tree" window.
- ▶ Enter the Level 1 password and set the sender/receiver unit to "Maintenance" mode.
- ▶ Click "Mechanical centring" („Step 1“) in the "Adjustment / Manual Adjustment / Transmission set reference" directory (→ p. 61, Fig. 50).
- ▶ Align the optical axes of the sender/receiver unit and reflector/scattered light receiver according to p. 67, Fig. 56 so that the sender spot is in the middle of the control window on the back of the housing of the reflector/scattered light receiver.
- ▶ Check that the laser beam disappears into the light trap on the reflector/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.

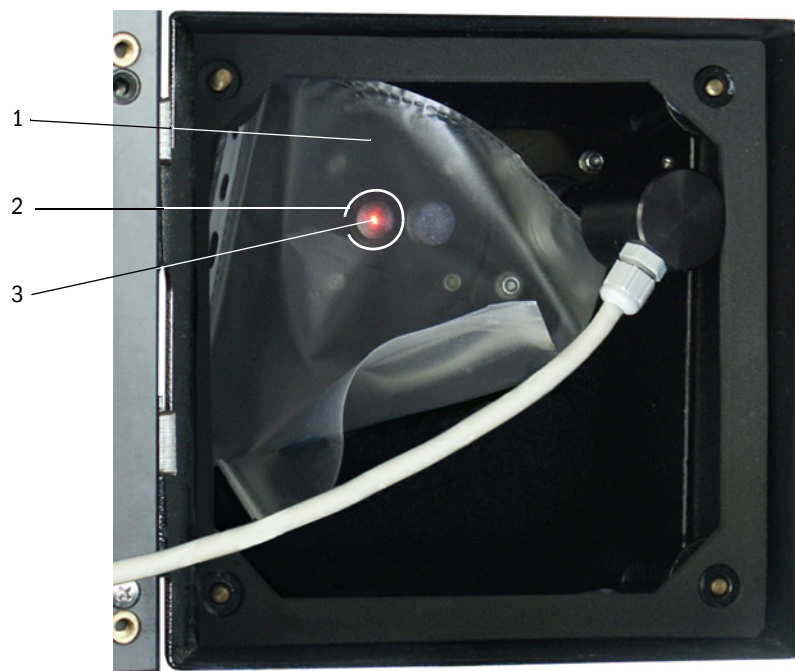


WARNING: Hazards when looking at the laser beam

- ▶ Never look directly into the laser beam.

Figure 57

Laser beam in light trap opening



- ▶ Readjust the laser beam according to p. 64, Fig. 54 when this is not the case.

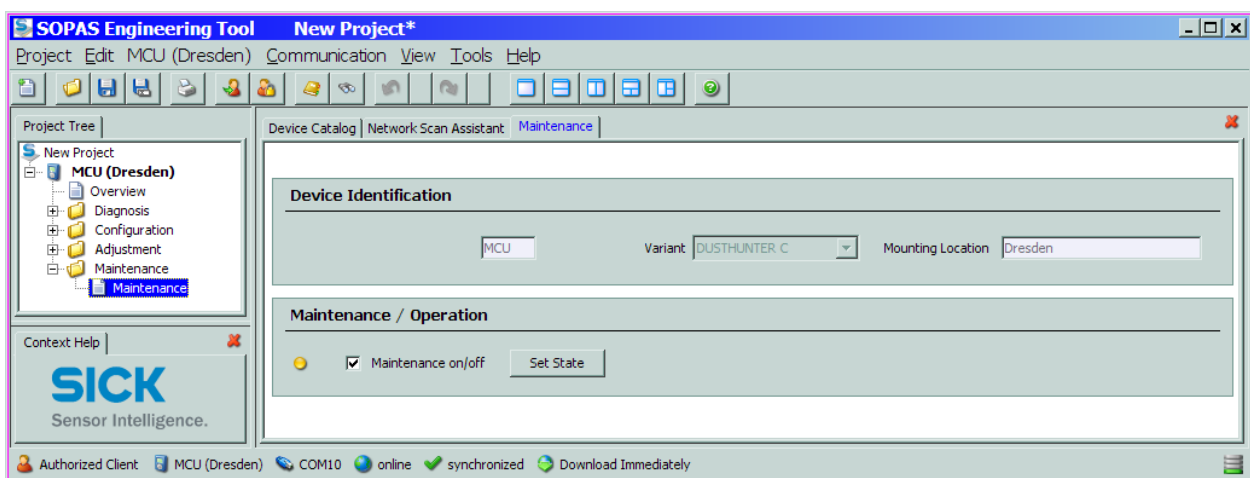
4.4 Setting standard parameters

4.4.1 Assigning the sensor

The MCU must be assigned to the connected sender unit. A malfunction is signalled 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. 56, §4.1.3.5).
- ▶ Enter the Level 1 password (→ p. 57, §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 58 Setting "Maintenance" mode

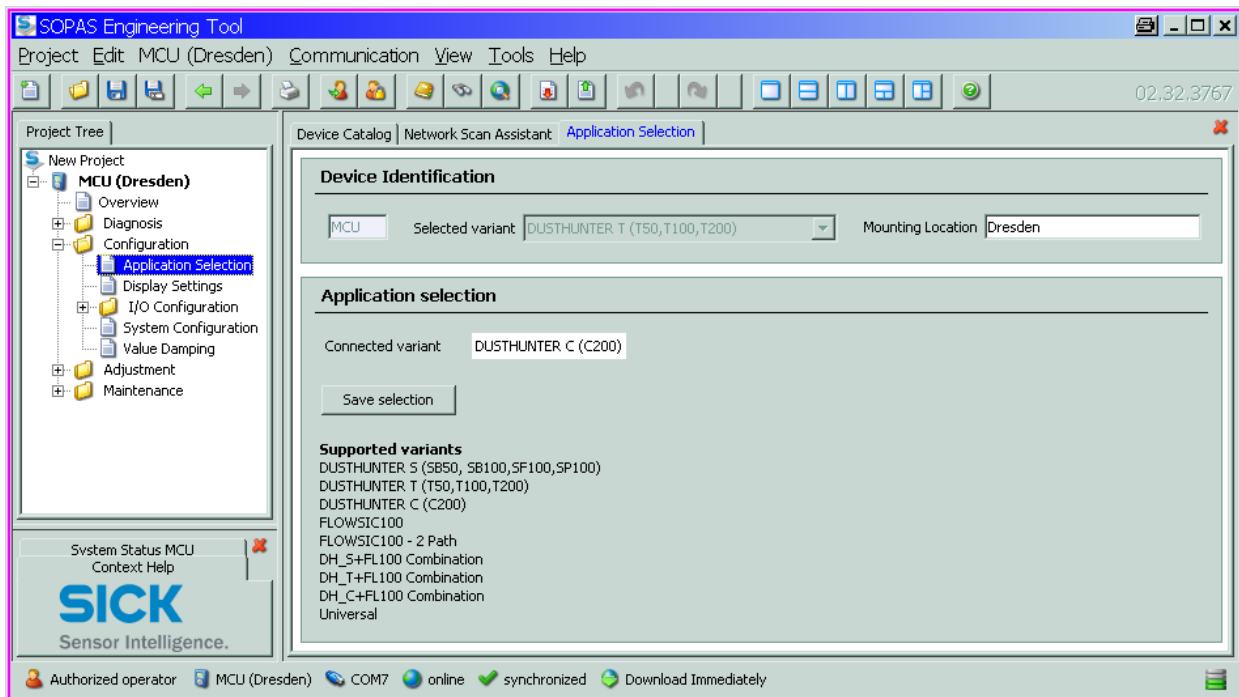


- ▶ Switch to the "Configuration / Application selection" directory (→ p. 70, Fig. 59).
- ▶ The basis type of the connected sender/receiver unit is shown in the window "Connected variant" (group "Application selection"). Click "Safe selection" to assign the MCU.



The sender/receiver unit must be connected to the MCU.

Figure 59 Assigning the sensor



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
Opacity [%]	1	0	100
Dust concentration act. Ext [mg/m³]	2	0	200
Dust concentration act. Ext [mg/m³]	3	0	200
Regression coefficients (for dust concentration Ext)		0.00 / 1.00 / 0.00	
Regression coefficients (for dust concentration SL)		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.

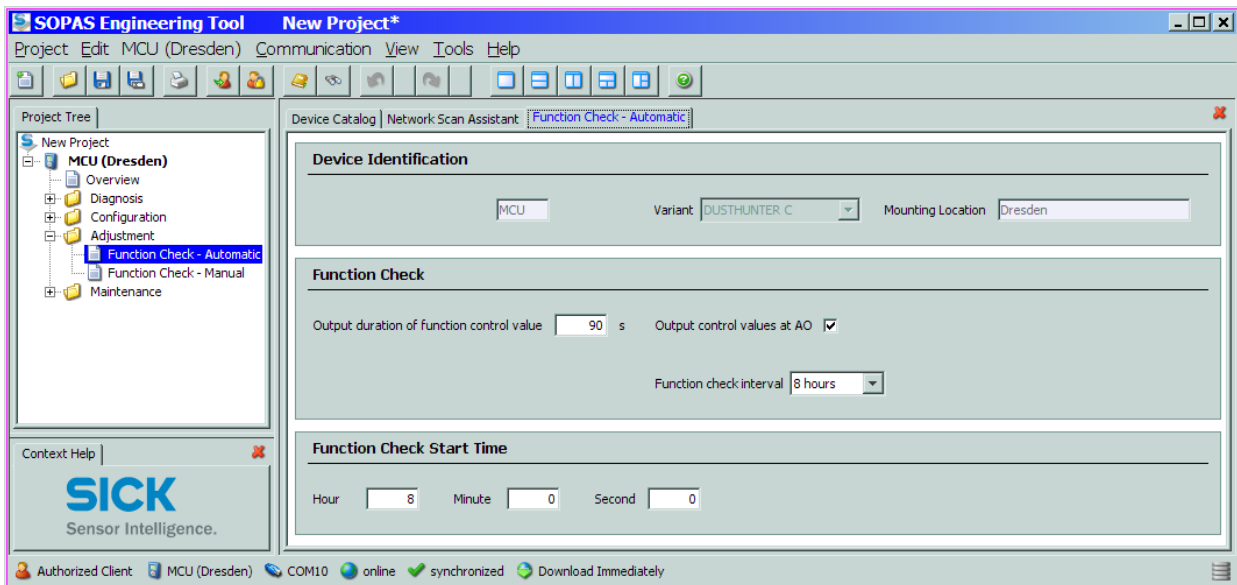
4.4.3 Determining the function check

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. 70, §4.4.2

Figure 60 "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. 16, §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. 17, Fig. 3).

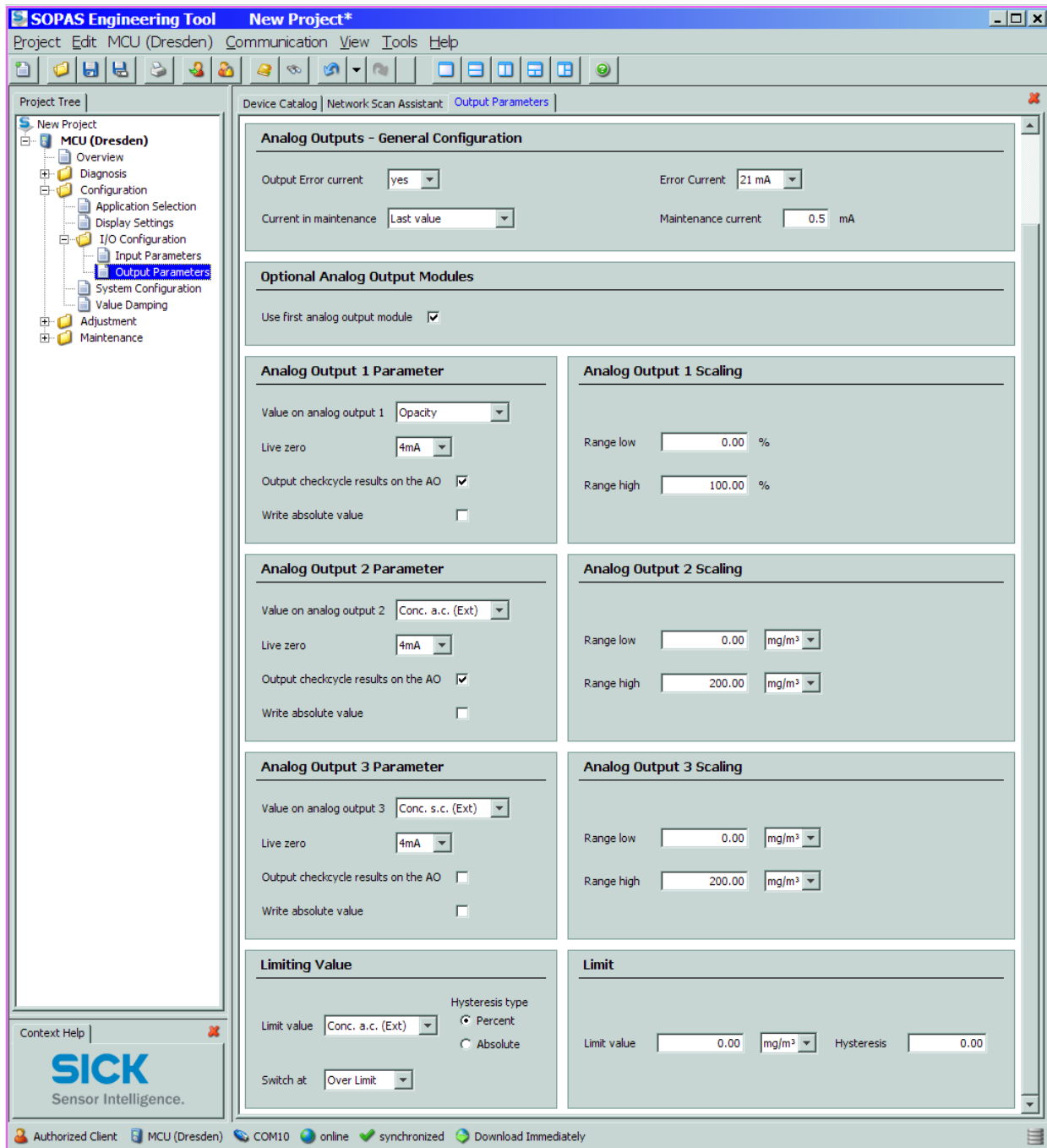
4.4.4 Setting the analog outputs parameters

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



- Default values → p. 70, §4.4.2
- To output the dust concentration under standard conditions ("Concentration s.c. (Ext)" or "Concentration s.c. (SL)), set the parameters for the analog inputs according to §4.4.5.

Figure 61 "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 \neq LZ	mA value to be output in "Maintenance" state	
Optional Analog Output Modules	Use first analog output module	Inactive	Not permitted for DUSTHUNTER C200 (AO 2 and AO 3 available per default).	
		Active	Opens the fields to set parameters for AO 2 and AO 3 (standard on DUSTHUNTER C200)	
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)	
		Opacity		
		Extinction		
		Transmission		
		SL	Scattered light intensity	
		Rel. opacity	Relative opacity	
		Conc. a.c. (Ext)	Dust concentration under operating (actual) conditions (based on Extinction)	
	Conc. s.c. (Ext)	Dust concentration under standard conditions (based on Extinction)		
	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. 16, §2.1.3) are not output on the analog output .	
		Active	Control values are output on the analog output (the "Output control values at AO" checkbox in the "Adjustment / Function Check - Automatic" directory must be activated).	
	Write absolute value	Inactive	It's distinguished between positive and negative measured values.	
		Active	The amount of the measured value is output (not relevant for DUSTHUNTER C200).	
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	

Field		Parameter	Remark	
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)	
		Opacity		
		Extinction		
		Transmission		
		SL	Scattered light intensity	
		Rel. opacity	Relative opacity	
		Conc. a.c. (Ext)	Dust concentration under operating (actual) conditions (based on Extinction)	
		Conc. s.c. (Ext)	Dust concentration under standard conditions (based on Extinction)	
	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	

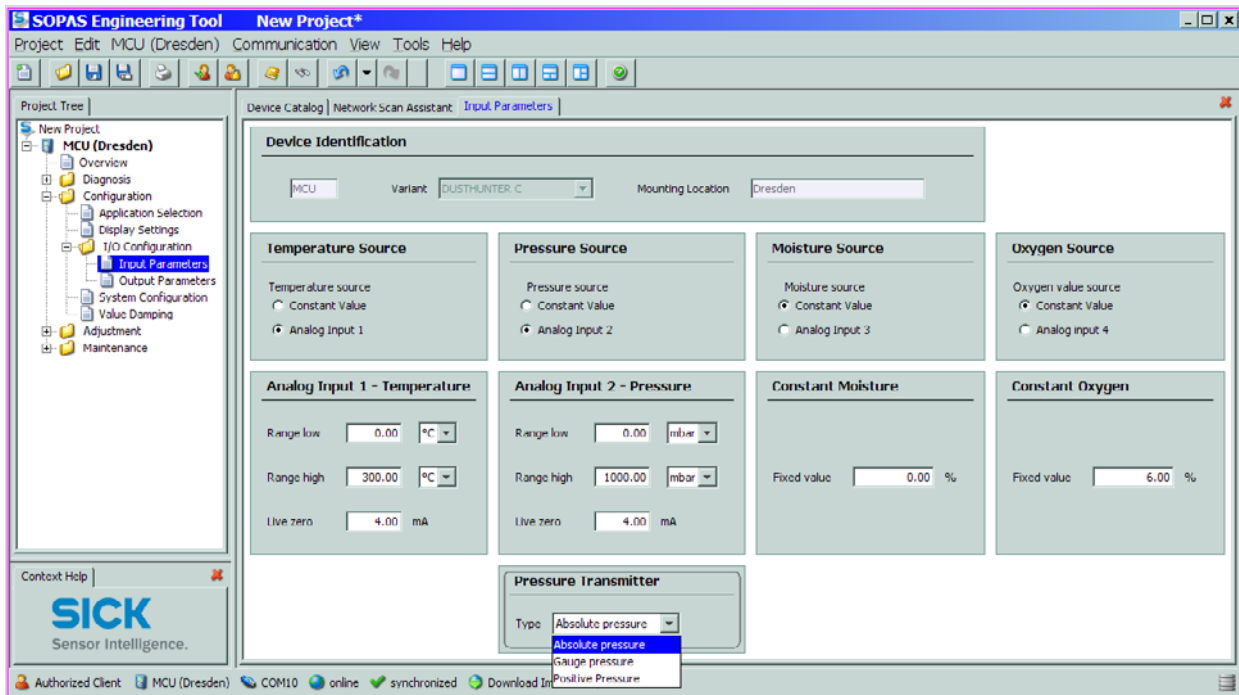


Set the parameters for "Analog Output 2(3) Parameter" and "Analog Output 2(3) Scaling" in the same manner as for "Analog Output 1 Parameter" and "Analog Output 1 Scaling" .

4.4.5 Setting the analog inputs parameters

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

Figure 62 "Configuration / IO Configuration / Input Parameters" directory

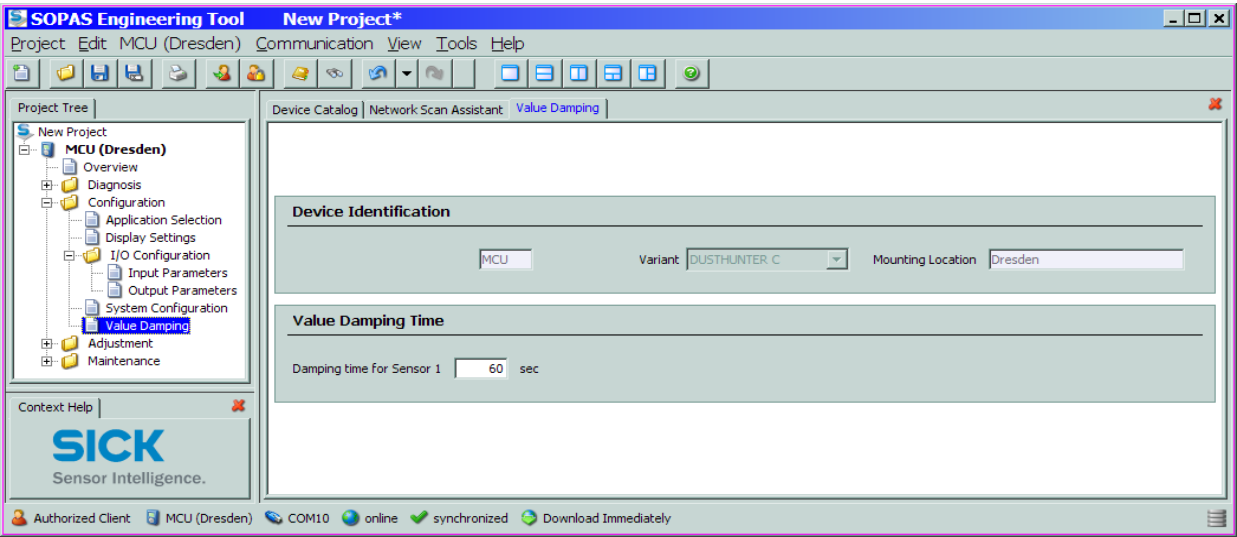


Field	Parameter	Remark
Temperature Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the "Constant Temperature" field to enter the scaling value in °C (°F for imperial units) or K.
	Analog Input 1	The value from an external sensor connected to analog input 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.
Oxygen Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the "Constant Oxygen" 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 63 "Configuration / Value Damping" directory



Field	Parameter	Remark
Responsetime Sensor 1	Value in s	Response time for the selected measured variable (→ p. 16, §2.1.2)

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 is not described in detail here.

For exact dust concentration measurement, the relation between the primary measured variable transmission (→ Extinction) or 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 DIN EN 13284-1 or comparable regulations and set in relation to the values measured at the same time by the measuring system.

4.4.7.1

Calibrating dust concentration measurement based on extinction

- ▶ Select device "MCU", set the measuring system to "Maintenance" mode and enter the Level 1 password (→ p. 54, §4.1.3.4).
- ▶ Select the "Configuration / IO Configuration / Output Parameter" directory (→ p. 72, Fig. 61) and assign the "Extinction" measured variable to an analog output.
- ▶ 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 extinction value.
- ▶ Select device "DH C200", set the sender/receiver unit to "Maintenance" mode and enter the Level 1 password (→ p. 54, §4.1.3.4).
- ▶ Switch "Maintenance" off.
- ▶ Carry out the gravimetric comparison measurement according to DIN EN 13284-1 or comparable regulations.
- ▶ Determine regression coefficients from the mA values of the analog output for "Extinction" and the dust concentrations act. measured gravimetrically.

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

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

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

Ext: measured extinction value
 LZ: Live Zero
 MBE: defined upper range limit (entered value for 20 mA; normally 2.5 x fixed limit value)

- ▶ Enter the calibration coefficients
 There are two possibilities:
 - Direct input of K2, K1, K0 into a measurement computer.

**NOTICE:**

The coefficient set entered in the sender/receiver 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).
a) In this case the correlation to the extinction 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.

$$c = cc2 \cdot Ext^2 + cc1 \cdot Ext + cc0 \quad (3)$$

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

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

Using (3), the result is as follows:

$$\begin{aligned} cc0 &= K2 \cdot LZ^2 + K1 \cdot LZ + K0 \\ cc1 &= (2 \cdot K2 \cdot LZ + K1) \cdot \left(\frac{20mA - LZ}{MBE} \right) \\ cc2 &= K2 \cdot \left(\frac{20mA - LZ}{MBE} \right)^2 \end{aligned}$$

a) Enter then the determined regression coefficients cc2, cc1 and cc0 in the "Configuration / Application parameters" directory (→ p. 65, Fig. 55) (Set the sender/receiver 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.

4.4.7.2

Calibrating dust concentration measurement based on scattered light intensity

- ▶ Select device "MCU", set the measuring system to "Maintenance" mode and enter the Level 1 password.
- ▶ Select the "Configuration / IO Configuration / Output Parameter" directory and assign the "Scattered light intensity" measured variable to an analog output.
- ▶ 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.
- ▶ Select device "DH C200", set the sender/receiver unit to "Maintenance" mode and enter the Level 1 password.
- ▶ Switch "Maintenance" off.
- ▶ Carry out the gravimetric comparison measurement according to DIN 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.

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

c: dust concentration in mg/m³

K2, K1, K0: regression coefficients of the function $c = f(I_{out})$

I_{out}: current output value in mA

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

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 calibration coefficients

There are two possibilities:

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



NOTICE:

The coefficient set entered in the sender/receiver 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).
a) 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.

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

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

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

Using (3), the result is as follows:

$$\begin{aligned} cc0 &= K2 \cdot LZ^2 + K1 \cdot LZ + K0 \\ cc1 &= (2 \cdot K2 \cdot LZ + K1) \cdot \left(\frac{20\text{mA} - LZ}{MBE} \right) \\ cc2 &= K2 \cdot \left(\frac{20\text{mA} - LZ}{MBE} \right)^2 \end{aligned}$$

a) Enter then the determined regression coefficients cc2, cc1 and cc0 in the "Configuration / Application parameters" directory (→ p. 65, Fig. 55) (Set the sender/receiver 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**
Saving the data as a project allows saving not only device parameters but also data logs.
- **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.



See the Service Manual for a description

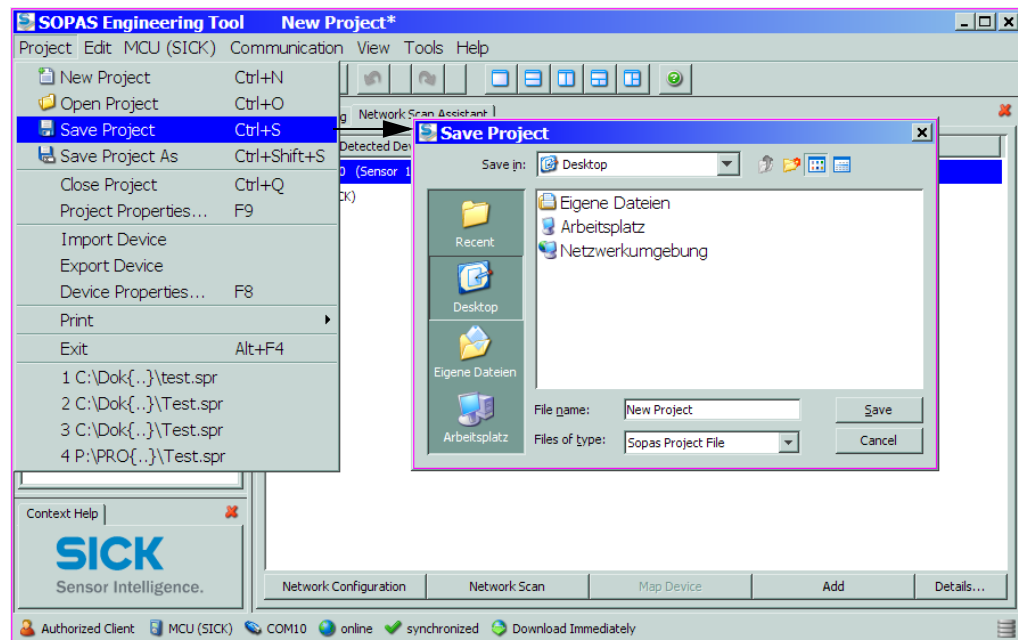
- **Saving as a protocol**
Device data and parameters are recorded in the Parameter protocol.
A Diagnosis protocol can be created for analysis of the device function and recognition of possible malfunctions.

Saving as a project

- ▶ Select device, select the "Project / Export Device" directory 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 64

"Project / Save Project" menu

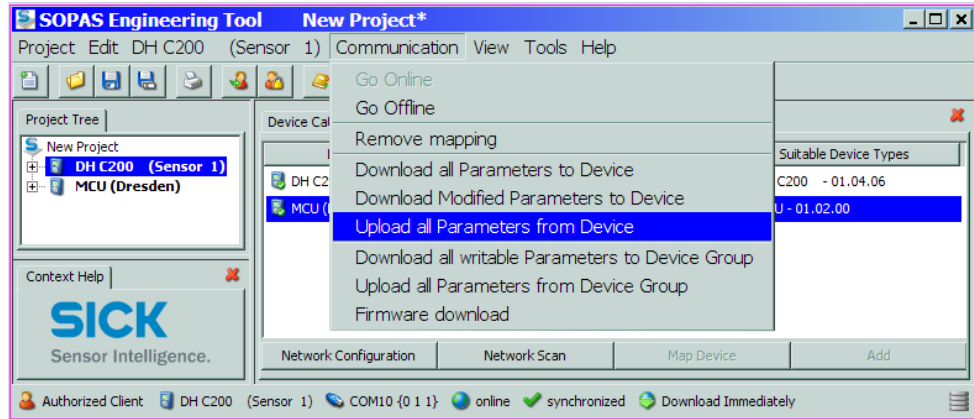


Saving as a protocol

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

Figure 65

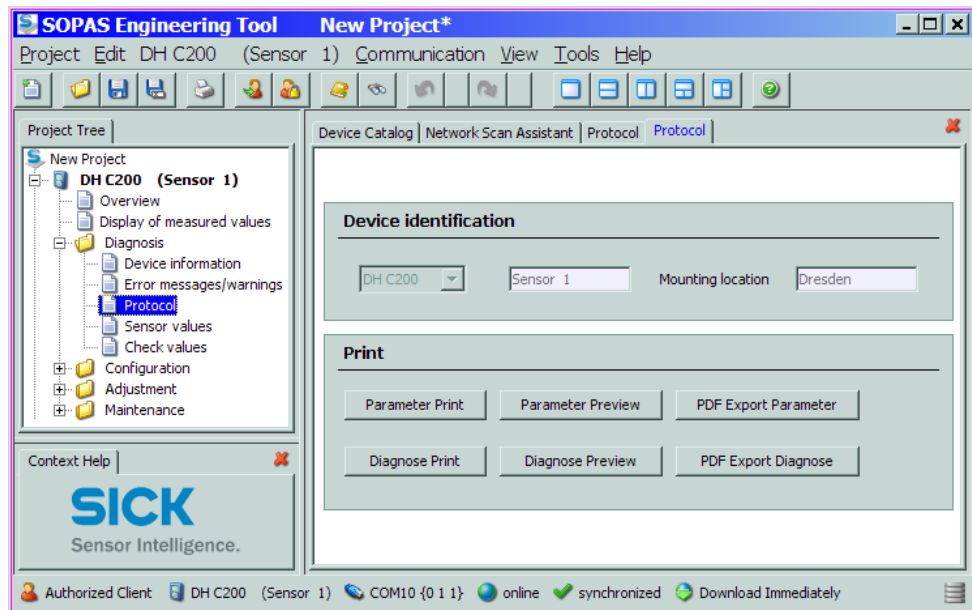
Actualising the device parameters



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

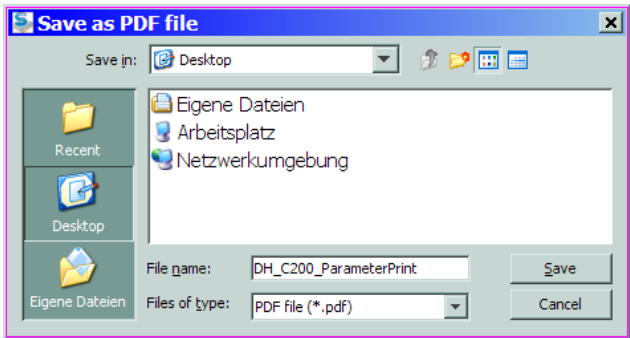
Figure 66

"Diagnosis / Protocols" directory



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

Figure 67 Specifying file name and storage location



Parameter protocol example

Figure 68 DUSTHUNTER C200 Parameter protocol (example)

Print preview...

File

Page 1 of 1

Zoom: 150%

Dusthunter - Parameter protocol

Type of device: DH C200
Mounting location: Dresden
Sensor 1

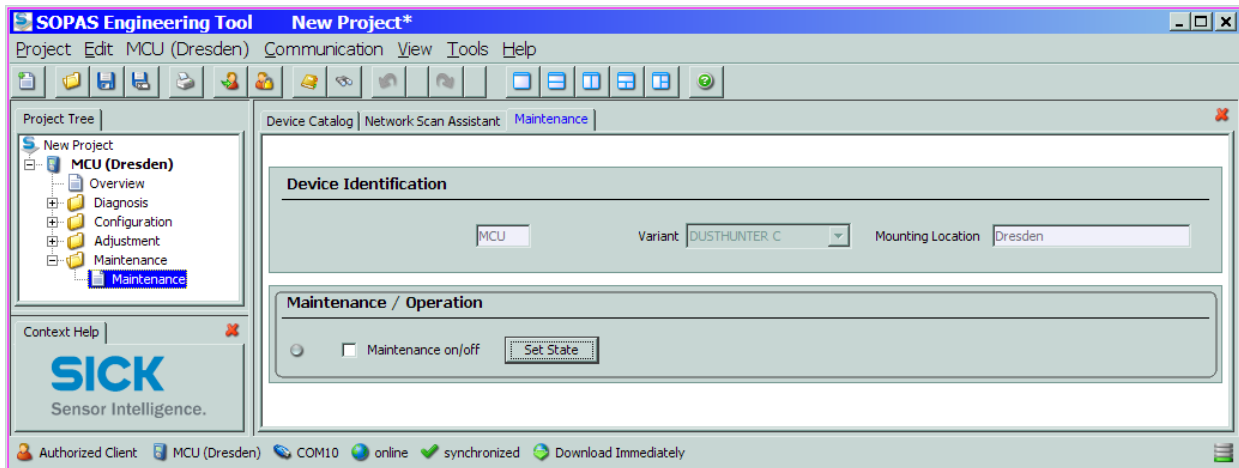
Device information		Device parameter	
Device version S/R-unit		Factory settings	
Firmware version S/R-unit	01.08.00	Automatic self adjustment	activ
Serial number S/R-unit	09078564	Automatic self adjustment interval	30 min
Identity number S/R-unit	00029	Automatic self adjustment limit	0.1
Hardware version S/R-unit	1.3	Response time sensor	1.0s
Firmware bootloader S/R-unit	01.00.00	Response time diagnosis values	10.0s
Firmware version reflector	00000000	Delay ADC-trigger LED	32µs
Serial number reflector	00000000	Delay ADC-trigger Laser	35µs
Identity number reflector	00000	Response time contamination	5
Hardware version reflector	1.1	Pivoted shutter at S/R-unit in contamination measurement position	51
Firmware bootloader reflector	V00.99.15	Pivoted shutter at S/R-unit in check point measurement position	102
Installation parameter		Pivoted shutter at reflector in contamination measurement position	51
Bus address	1	Pivoted shutter at S/R-unit in back light measurement position	102
Flange-flange	2.00m	Refl. Gain AN0-AN1	10.0
Opt. measuring distance	1.00m	Refl. Gain Relais 1	5.7
Chimney opening	1.00m	Refl. Gain Relais 2	27.0
Correction factor	1.000	Factory calibration settings	
Primary measuring principle	Transmission	Scattered light (MUF)	
Concentration calibration coefficients = f(Scattered light)		cc2	0.0000
cc2	0.0000	cc1	0.3000
cc1	1.0000	cc0	0.2000
cc0	0.0000	Current laser	
Concentration calibration coefficients = f(Extinction)		cc2	0.0000
cc2	0.0000	cc1	30.3000
cc1	1.0000	cc0	0.0000
cc0	0.0000	Device temperature	
Limit contamination warning	3.0%	cc2	0.0000
Limit contamination fault	4.0%	cc1	100.0000
Average	aktiv	cc0	-275.1500
Average Interval	6 min	Power supply	
Selection Measure Value	Opacity	cc2	0.0000
EPA-mode	aktiv	cc1	11.0000
		cc0	0.0000
		Temp. correction transmission	
		cc2	0.0000
		cc1	-0.0128
		cc0	0.0000

Subject to change without notice

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 in the "Set Operating State" window and click "Set State" (→ Fig. 69). Standard start-up is now completed.

Figure 69 Setting the operational state



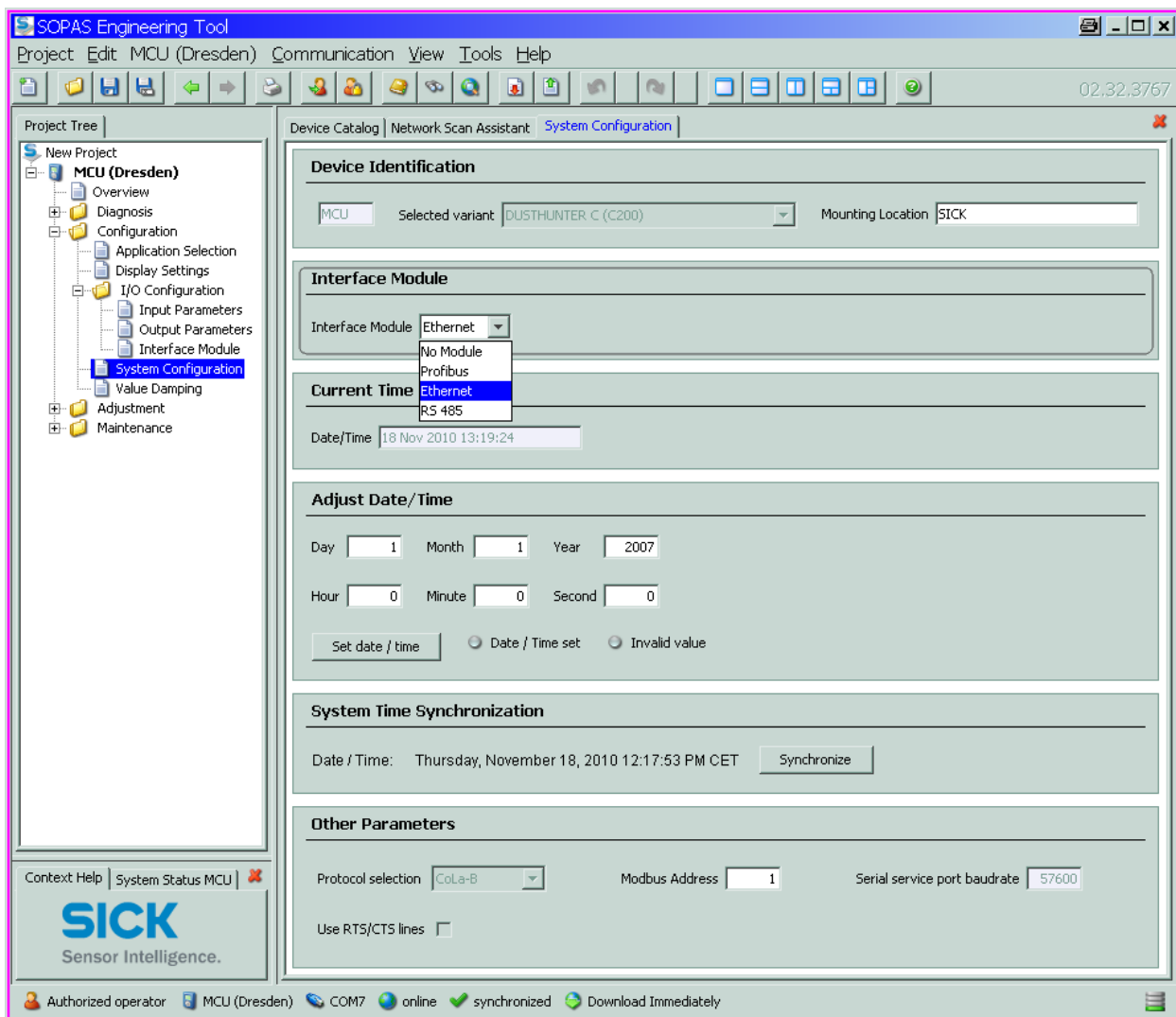
4.5 Setting the Interface module parameters

4.5.1 General information

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

- ▶ Select device "MCU", set the measuring system to "Maintenance" mode and enter the Level 1 password (→ p. 57, §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 70 "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.

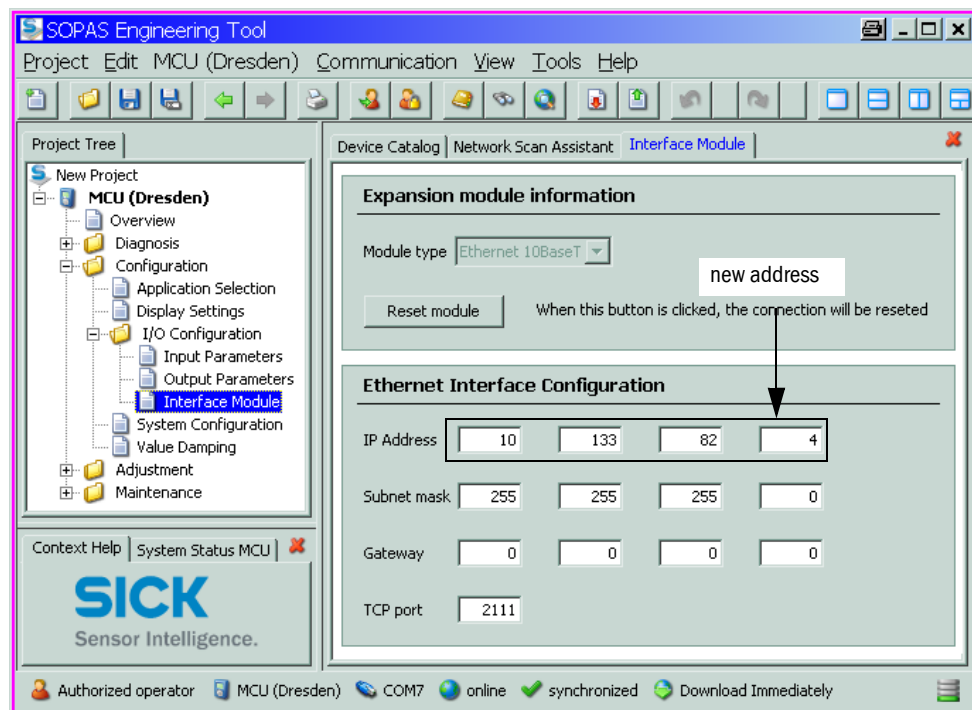
- ▶ Operate the measurement system only behind a suitable protective equipment (eg. Firewall).

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 71 Assigning the Ethernet module a new IP address

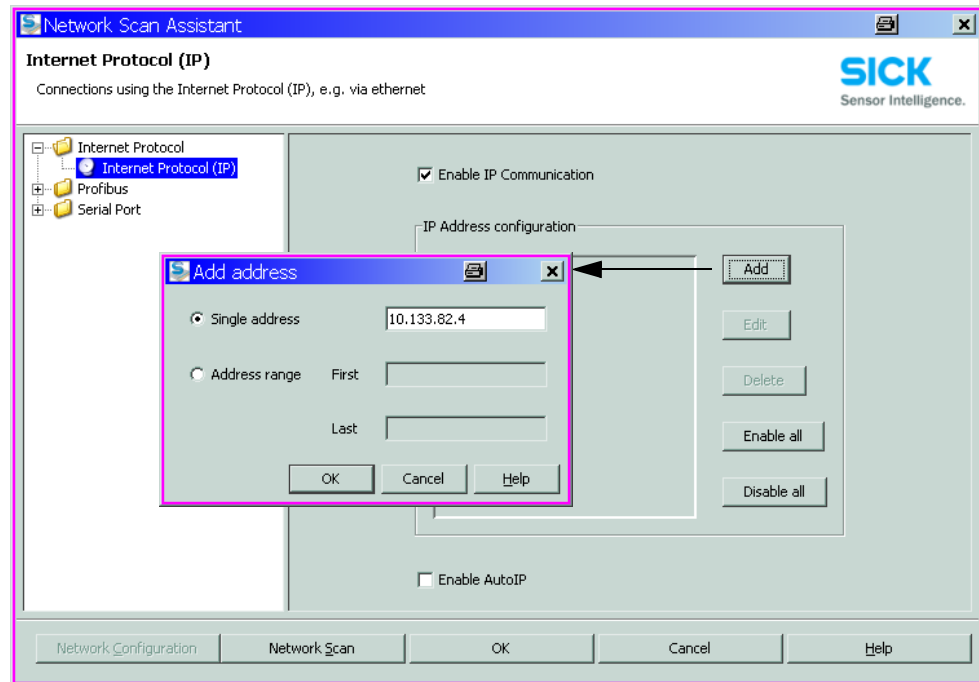


Assigning the new IP address to the SOPAS ET program

- ▶ 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 72

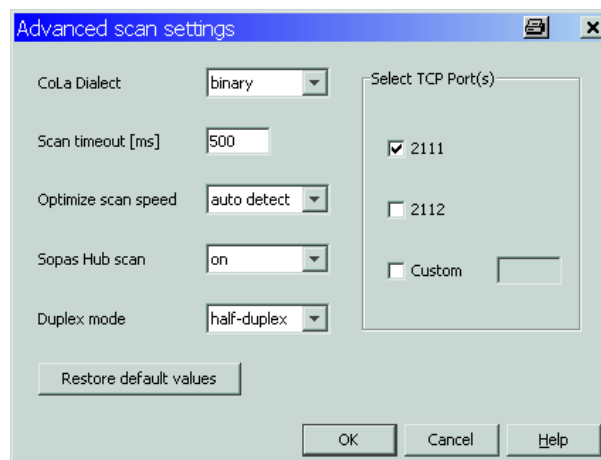
Entering the IP address (example)



- ▶ Click "Advanced..." in the "Internet Protocol (IP)" window.
- ▶ Select port address "2111" and confirm with "OK" (all other settings and values according to Fig. 73).

Figure 73

Specifying the TCP port



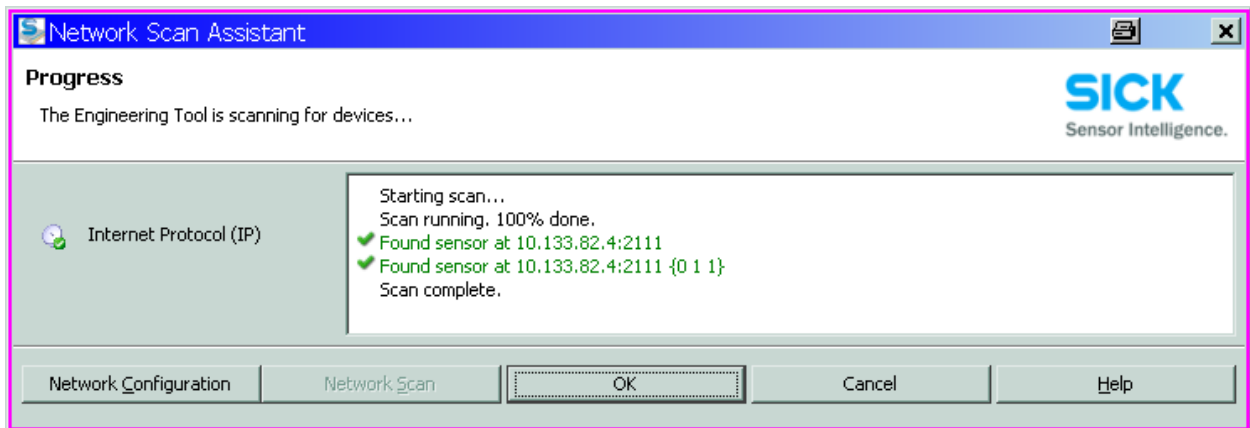


- ▶ Activate only the required TCP-Port.
- ▶ Activate the checkbox "Custom" and enter the port number in the window besides this if a TCP port shall be used different from 2111 or 2112.

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

Figure 74

Network scanning



NOTICE:

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

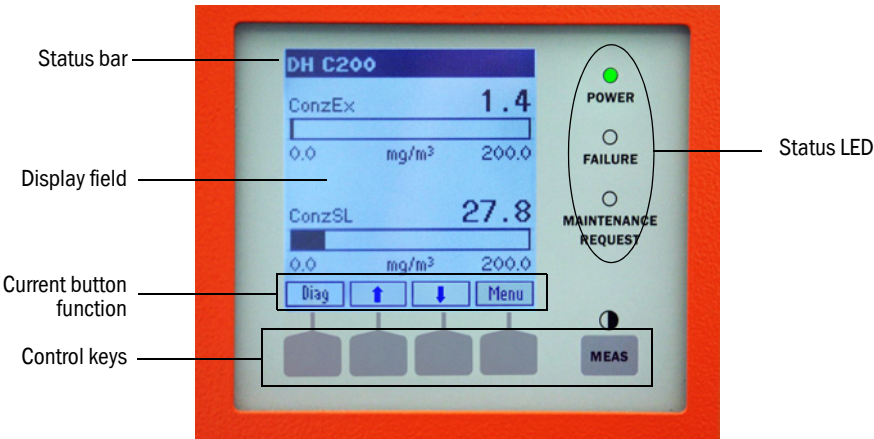
- ▶ If measured values are transferred exclusively via Ethernet and used to control processes, disturbances are possible in the plant operation for which the manufacturer of the DUSTHUNTER C200 is not responsible. Increase the value in field "Scantimeout" from 500 ms to 3000 ms if disturbances appear 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. 75.

Figure 75 LC-Display functional elements



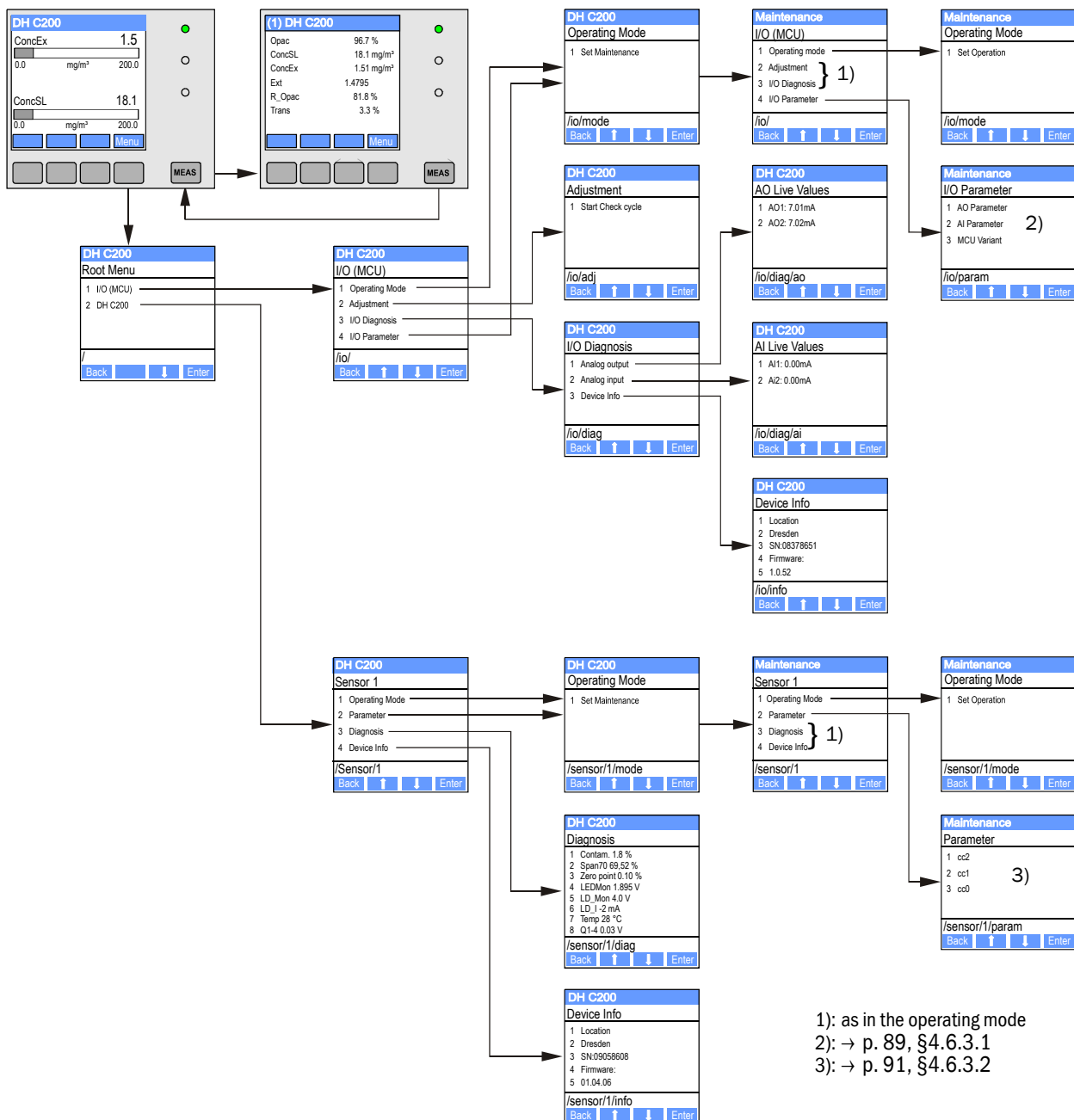
Button functions

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 → p. 89, Fig. 76)
Back	Switch to higher level menu
Arrow ↑	Scroll up
Arrow ↓	Scroll down
Enter	Execution of the action selected with an arrow button (switch to a submenu, confirm parameter selected during parameter setting)
Start	Start an action
Save	Store a changed parameter
Meas	Toggle between test and graphic display Display the contrast setting (after 2.5 s)

4.6.2 Menu structure

Figure 76 LC-Display menu structure



4.6.3 Parameter setting

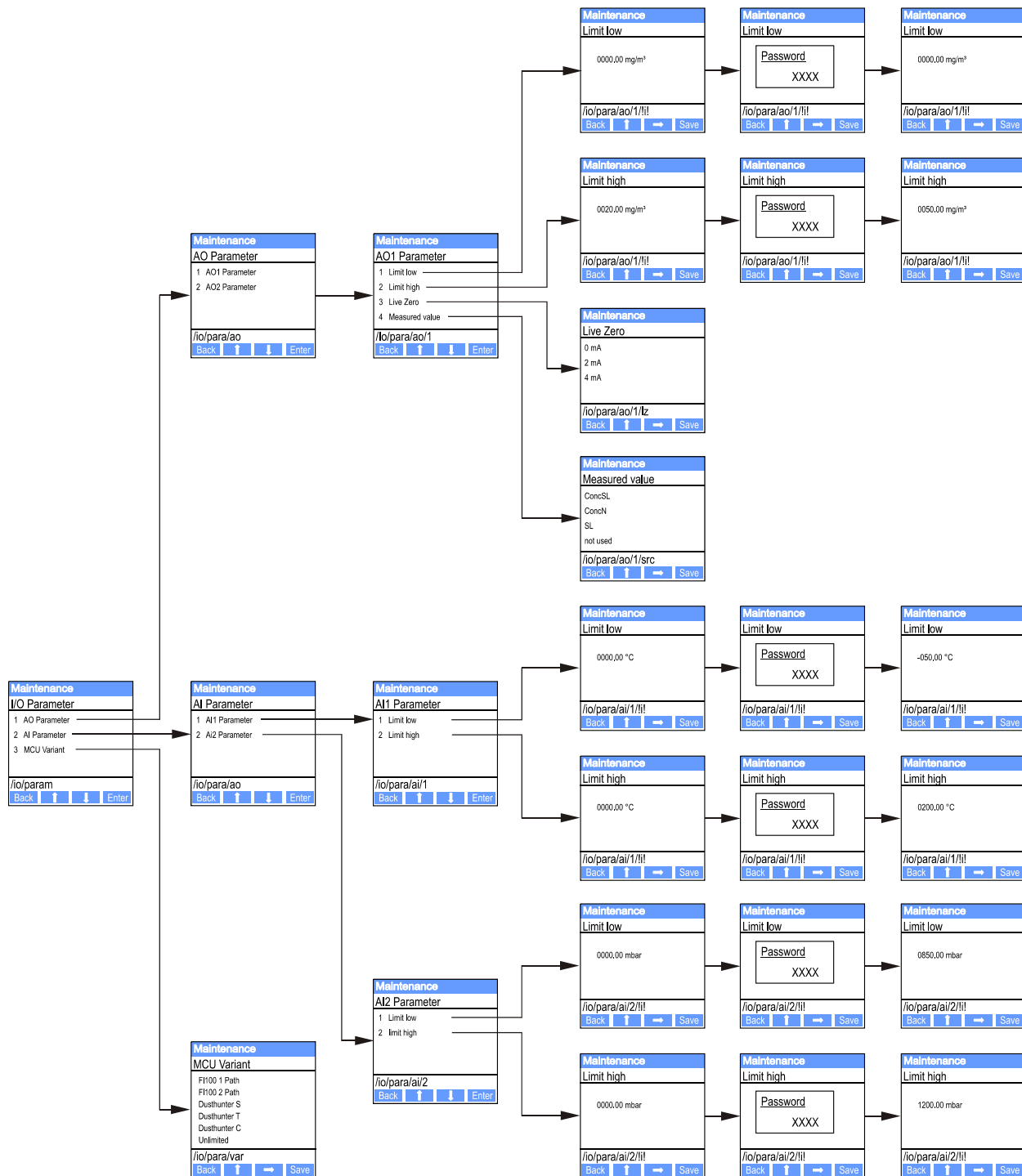
4.6.3.1 MCU

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 77

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/receiver unit of the DUSTHUNTER C200 (→ p. 69, §4.4.1), :

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

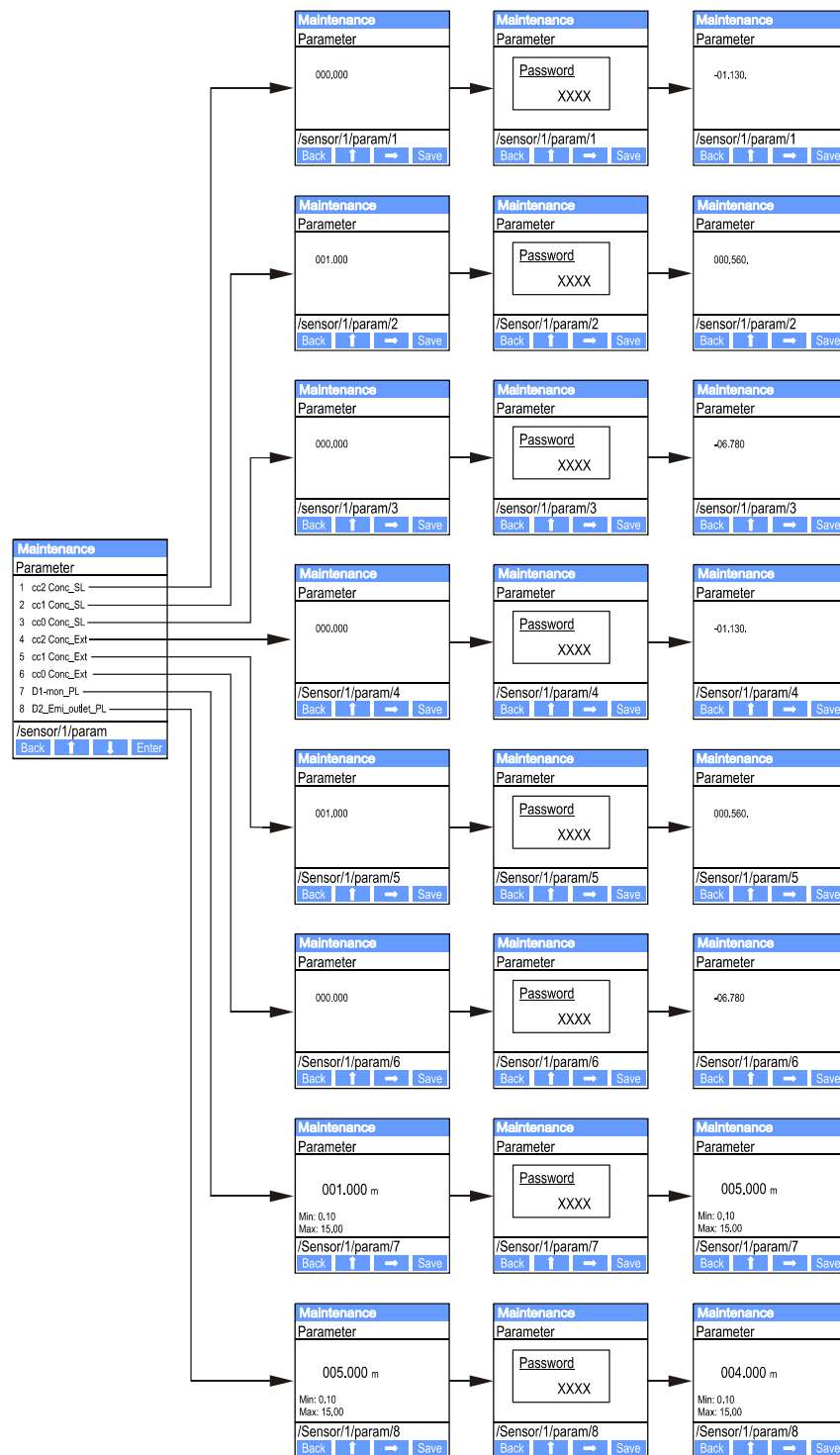
The other assigning possibilities are not practicable here.

4.6.3.2 Sender/receiver unit

The following steps are required to enter the regression coefficients:

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

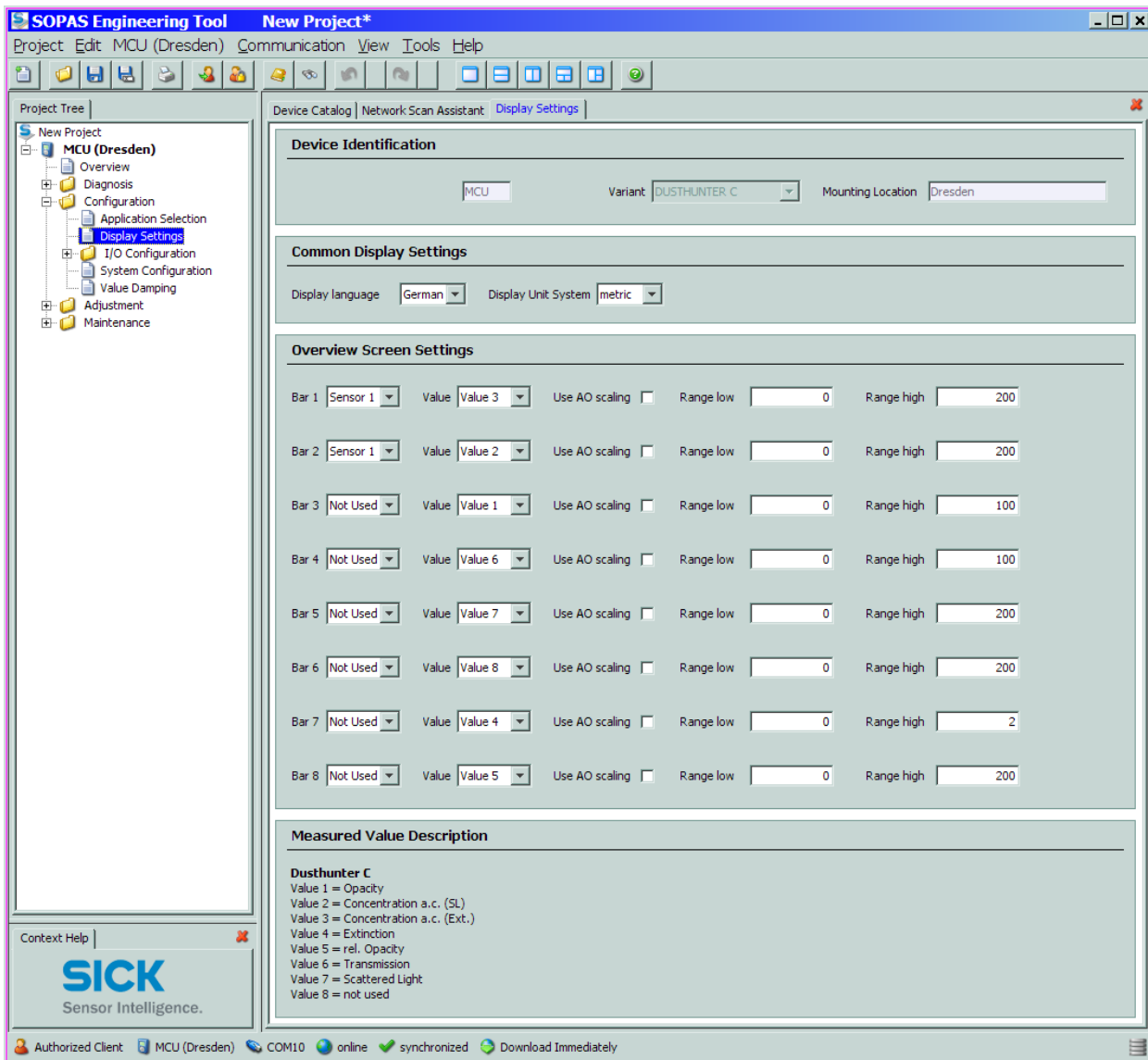
Figure 78 Entering the regressions coefficients



4.6.4 Using SOPAS ET to modify display settings

To modify factory settings, select type "MCU" in the "Project Tree" window, enter the Level 1 password and select the "Configuration / Display Settings" directory.

Figure 79 "Configuration / Display Settings" directory



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

Measured value assignment

MCU measured value	Sender/receiver unit measured value
Measured value 1	Opacity
Measured value 2	Concentration a.c. (SL)
Measured value 3	Concentration a.c. (Ext)
Measured value 4	Extinction
Measured value 5	Rel. opacity
Measured value 6	Transmission
Measured value 7	Scattered light
Measured value 8	Not used
MCU Value 1	Concentration s.c. (SL)
MCU Value 2	Concentration s.c. (Ext)

DUSTHUNTER C200

5 Maintenance

General

Maintenance on the sender/receiver unit and reflector/scattered light receiver

Maintenance on the purge air supply

Shutdown

5.1

General

The maintenance work to be carried out consists of:

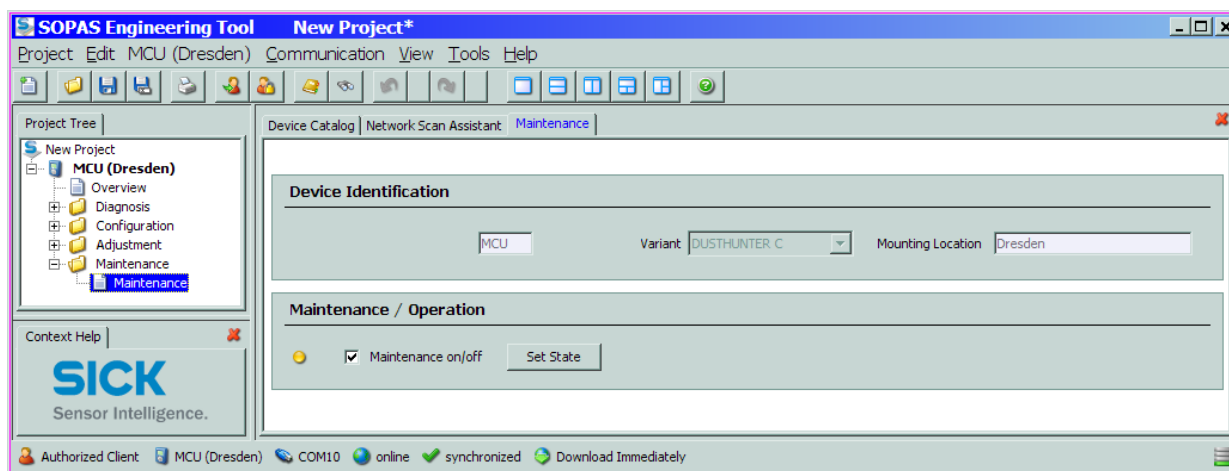
- Cleaning work (→ p. 98, §5.2),
- Securing the purge air supply function (→ p. 103, §5.3),
- Checking/correction the optical alignment of sender/receiver unit and reflector/scattered light receiver (→ p. 61, §4.2.2 and → p. 64, §4.2.4).

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" directory, select "MCU" device file and move it to the "Project Tree" window (→ p. 57, §4.1.4).
- ▶ Switch to the "Maintenance/Maintenance" directory, activate the "Maintenance on/off" checkbox in the "Maintenance / Operation" group and click "Set State" (see → Fig. 80).

Figure 80

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. 89, §4.6.2) or connecting an external maintenance switch to the terminals for Dig In2 (17, 18) in the MCU (→ p. 43, §3.3.4).
- During "Maintenance", an automatic function check is not performed.
- The control window on the back of the reflector/scattered light receiver (→ p. 63, Fig. 53) is illuminated for easier check of the optical alignment.
- The value set for "Maintenance" is output on the analog output (→ p. 72, §4.4.4). This also applies in case of malfunction (signalled 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/receiver unit and reflector/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/receiver unit and reflector/scattered light receiver in regular intervals. Remove deposits with water or mechanically using suitable auxiliary means.

Clean the optical interfaces when deposits can be seen or before contamination reaches the 30% warning limit value (40% for malfunction).

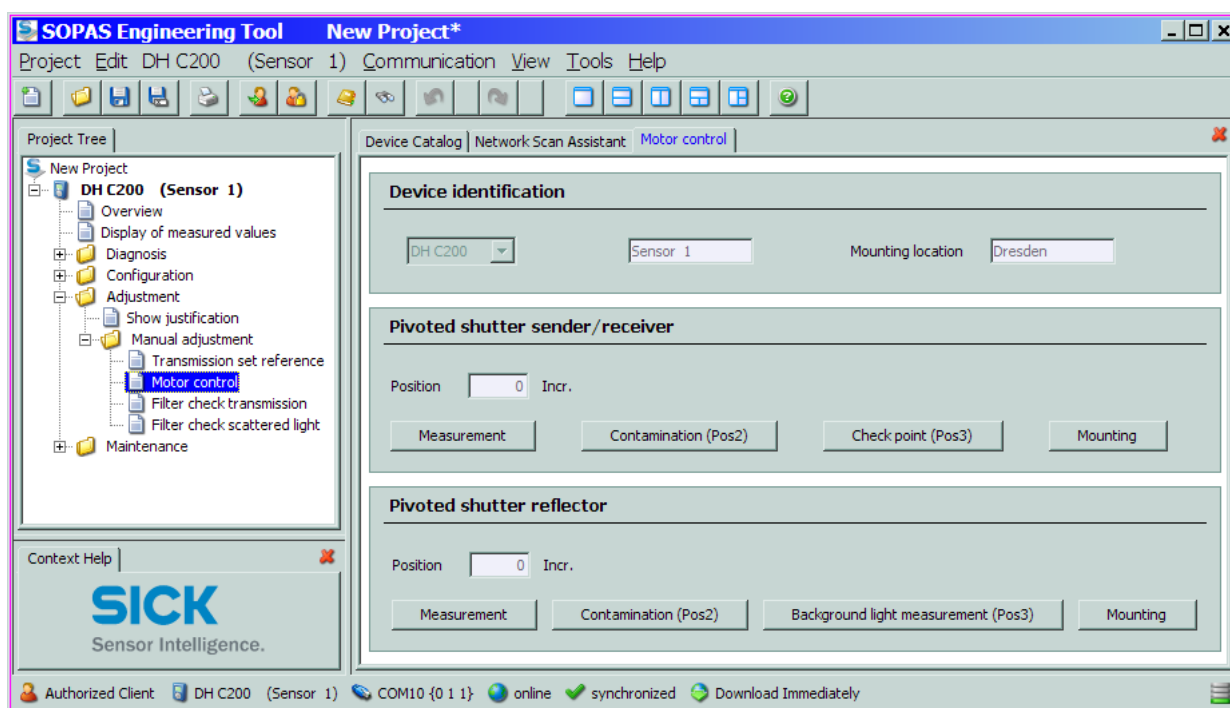
5.2.1 Maintenance on the sender/receiver unit

- ▶ Switch the sender/receiver unit to maintenance mode (→ p. 60, Fig. 49) 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. 126, §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 81

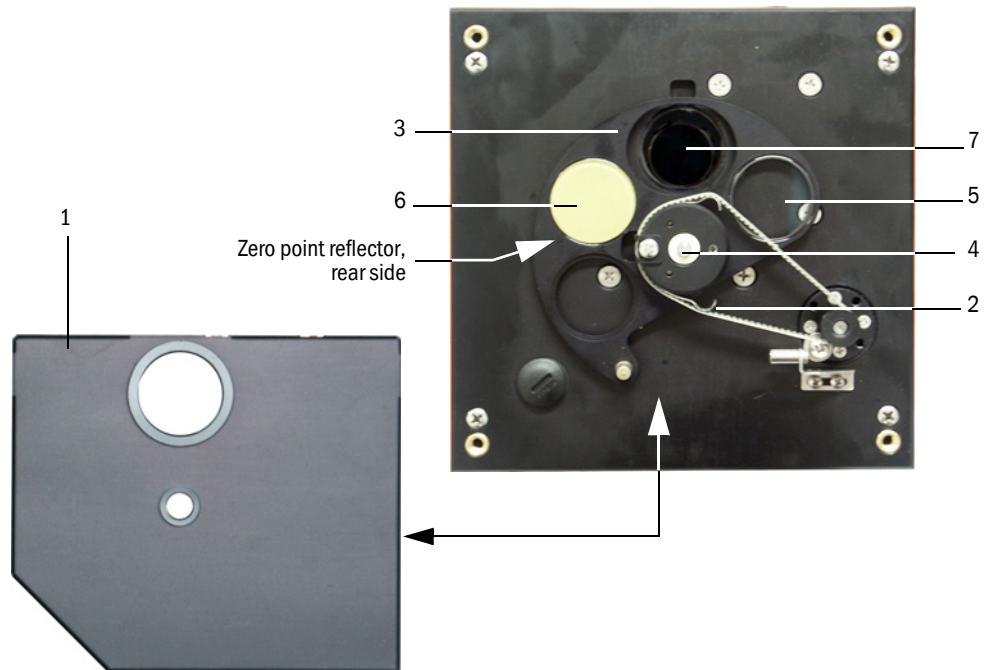
"Adjustment / Manual Adjustment / Motor control" directory



- ▶ 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 82

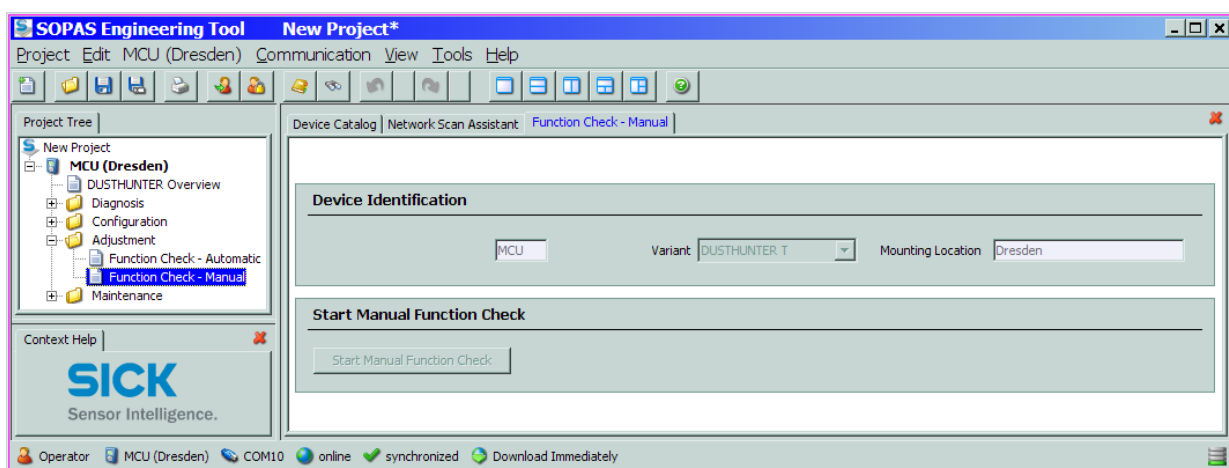
Cleaning the optical interfaces on the sender/receiver unit



- ▶ Lay the toothed belt on the drive axis, press the the tension spring and push the swivel plate back onto the axis.
- ▶ Initiate a function check (move the "MCU" device file from the "Network Scan Assistant" tab to the "Project Tree" window, open the "Adjustment / Function Check -Manual" directory and click "Start Manual Function Check").

Figure 83

"Adjustment / Function Check -Manual" directory

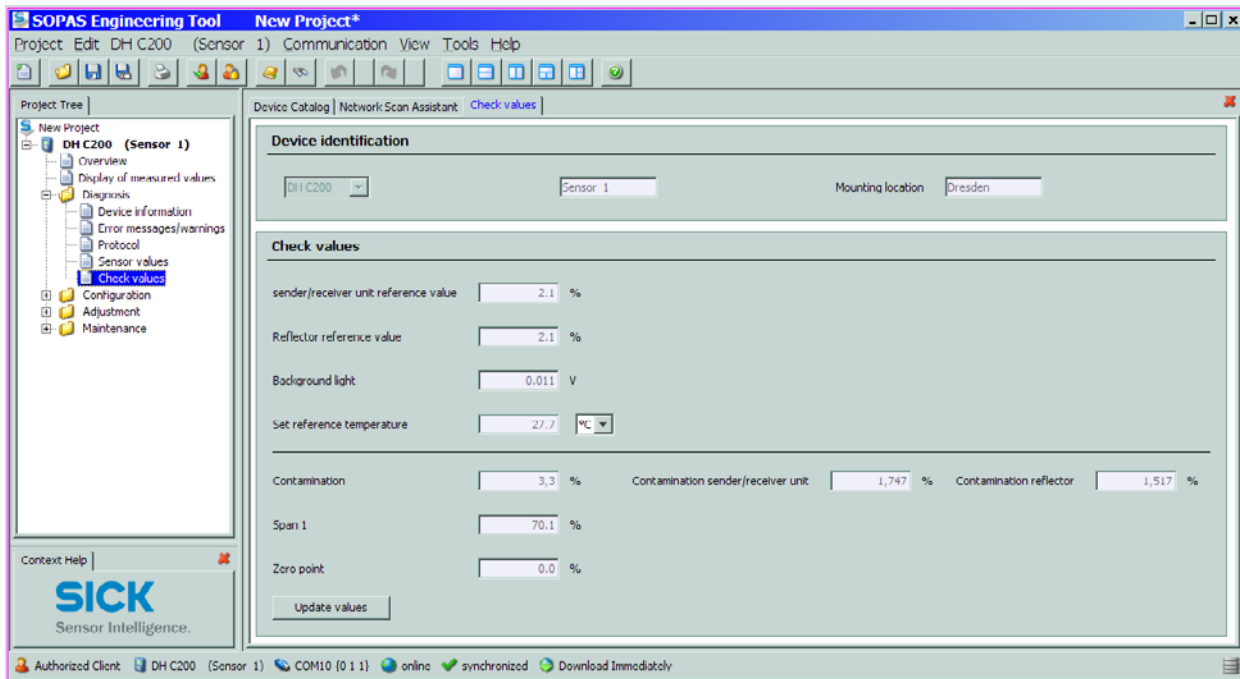


The function check can also be triggered by using the keys on the LC display of the MCU (→ p. 89, §4.6.2).

- ▶ Select the "DH C200" device file in the "Project Tree" window, open the "Diagnosis / Check values" subdirectory and check the contamination value.

Figure 84

"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 "C200/Diagnosis" menu; → p. 89, §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.
- If the contamination value is negative after cleaning (e.g. due to scaling with contaminated optics), the measuring system must be scaled again (→ p. 64, §4.2.3).

- ▶ 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. 98, Fig. 81).
- ▶ Resume measuring operation.

5.2.2

Performing maintenance on the reflector/scattered light receiver

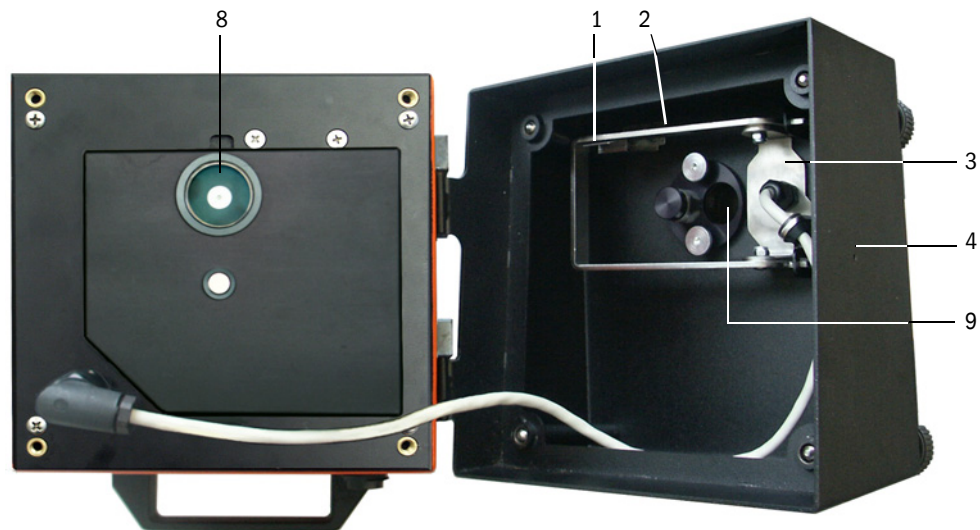
- Switch the measuring system to maintenance mode (→ p. 96, §5.1), loosen the knurled screws and swivel the housing to the side.

Maintaining the scattered light receiver

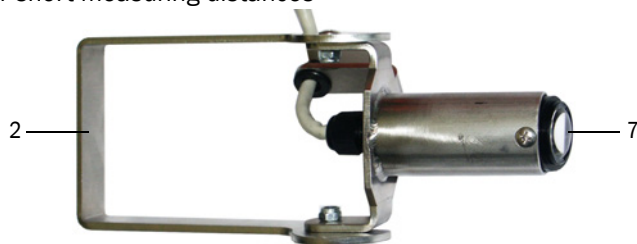
- Press the spring (1) to the side, pull the clamp (2) to the front and pull the scattered light receiver optic (3) carefully out of the tube.
- Lock the assembly flange with cover (→ p. 126, §7.3.7).
- Open the grips (5) at the scattered light receiver optic for large measuring distances and remove the attachment (6).
- Carefully clean the lens of the scattered light receiver (6) and reflector optics (7) with an optics cloth.
- Check purge air tube (8), light trap (9) and O ring (10) for deposits, and clean if necessary.

Figure 85

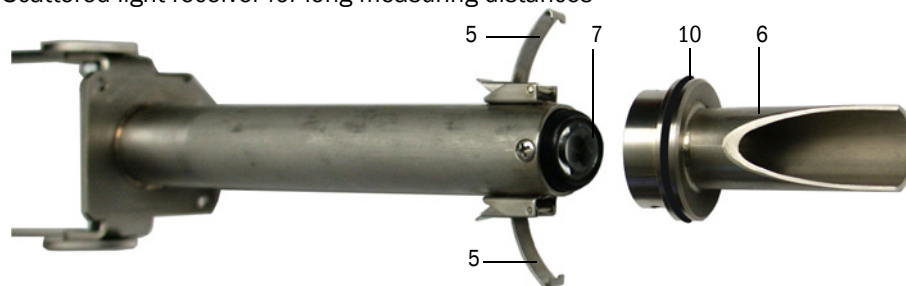
Cleaning the optical interfaces on the scattered light receiver



Scattered light receiver for short measuring distances



Scattered light receiver for long measuring distances



Maintaining the reflector

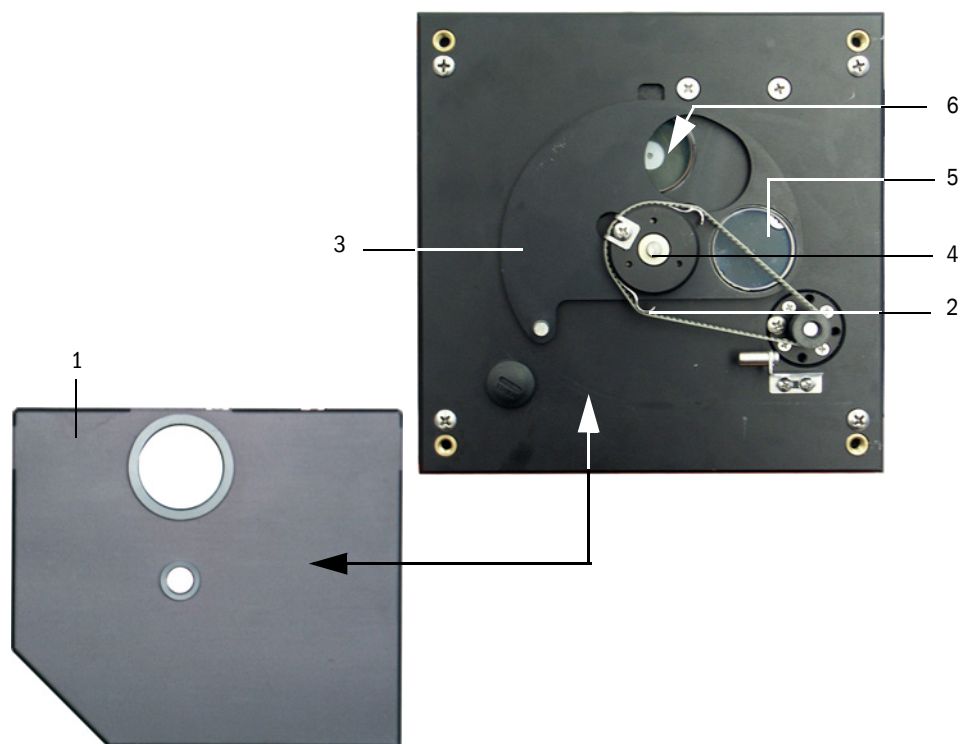
- Select "DH C200" device file in the "Project tree" window, switch to the "Adjustment / Manual adjustment / Motor control" directory and click "Mounting" at "Pivoted shutter reflector" (→ p. 98, Fig. 81).

The swivel plate moves then to the cleaning position.

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

Figure 86

Cleaning the optical interfaces on the reflector/scattered light receiver



- Lay the toothed belt on the drive axis, press the the tension spring and push the swivel plate back onto the axis.
- Initiate a function check (select the "Adjustment / Function Check -Manual" directory in the "MCU" device file and click "Start Manual Function Check"; → p. 99, Fig. 83).
- Check the contamination value (→ p. 98, §5.2.1, → p. 100, Fig. 84).
- 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.
- Put the swivel plate cover back on, remove the cover from the assembly flange, put the scattered light receiver optic back in and fasten it
- 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" at "Pivoted shutter reflector" in the "Adjustment / Manual Adjustment / Motor control" directory (→ p. 98, Fig. 81).
- Resume measuring operation.

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/receiver unit.

- ▶ Always ensure purge air supply when the optical components sender/receiver unit and reflector/scattered light receiver are fitted on the duct.
- ▶ Disassemble the connected components before exchanging damaged purge air hoses (→ p. 106, §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 MCU with the appropriate key.
- ▶ Open the strap retainer (1) on filter outlet and pull the filter housing (2) off connection piece.
- ▶ Remove the filter housing.
- ▶ Rotate the filter housing cover 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.

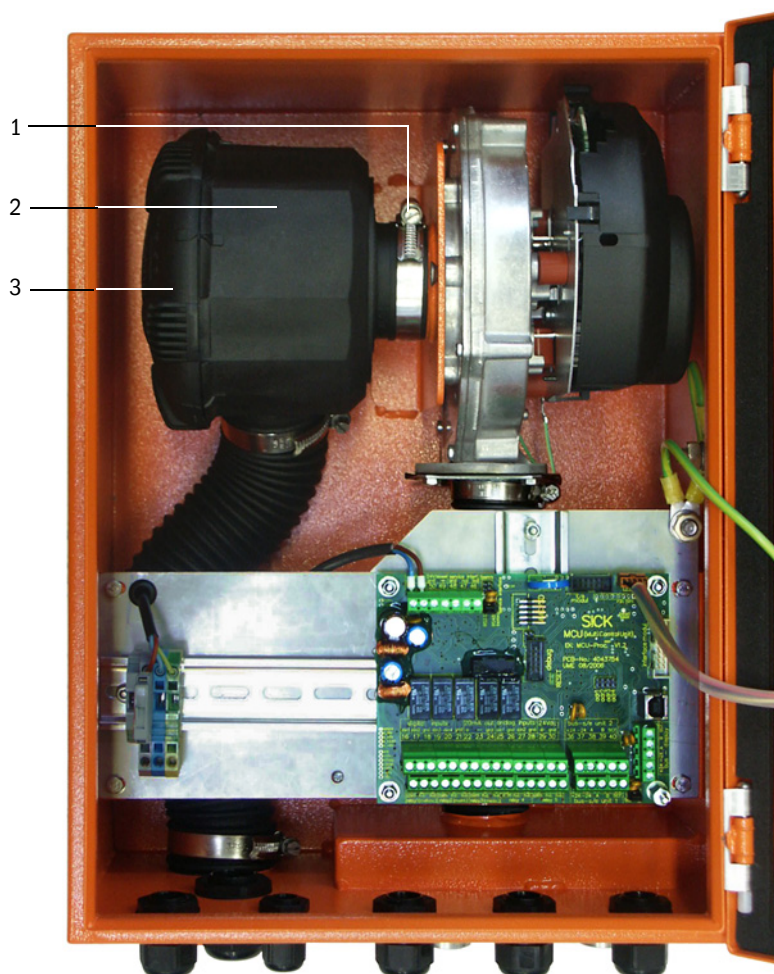
**NOTICE:**

- ▶ 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 87

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



5.3.2 Optional external purge air unit

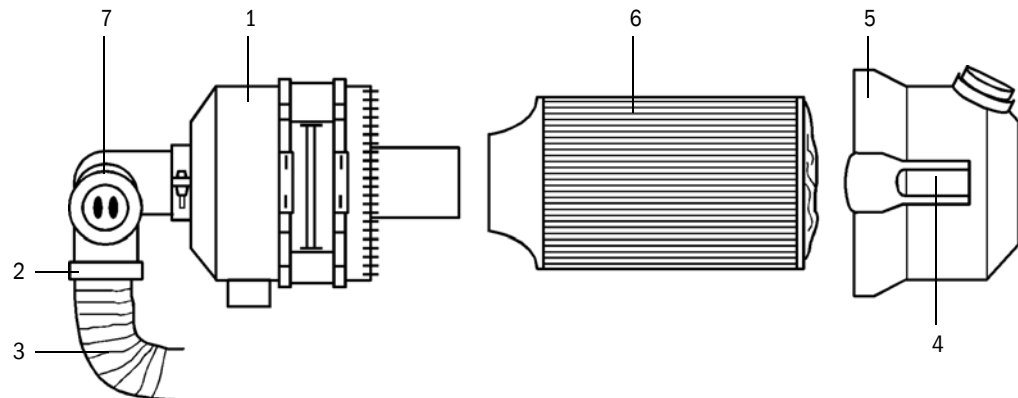
**NOTICE:**

The purge air unit must be serviced at the latest when the low-pressure monitor at the filter outlet triggers (→ Fig. 88).

Replacing the filter element

Figure 88

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/receiver unit and reflector/scattered light receiver are fitted on the duct.

Work to be performed

- ▶ Loosen the connection cable to the MCU
- ▶ Dismantle the sender/receiver unit and reflector/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 C200

6 Malfunctions

General
Sender/receiver unit
Control unit

6.1

General

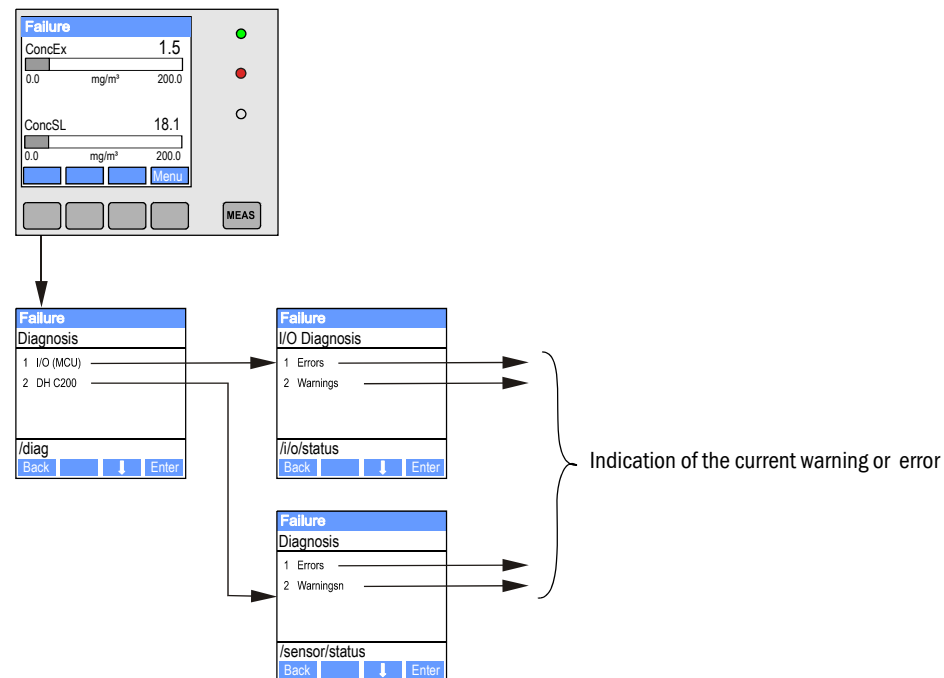
Warning or error messages are output in the following manner:

- On the MCU, the respective relay is switched on (→ p. 45, Fig. 29).
- "Maintenance requ." or "Failure" is displayed in the status bar of the LCD (→ p. 88, §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 C200").

Figure 89

Display at the LCD



Detailed status information about the current device status is provided by the "Diagnosis / Errors/Warnings" directory. Connect the measuring system to the SOPAS ET program and start the "DH C200" or "MCU" device file (→ p. 56, §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. 109, Fig. 90, → p. 111, Fig. 91).

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



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



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

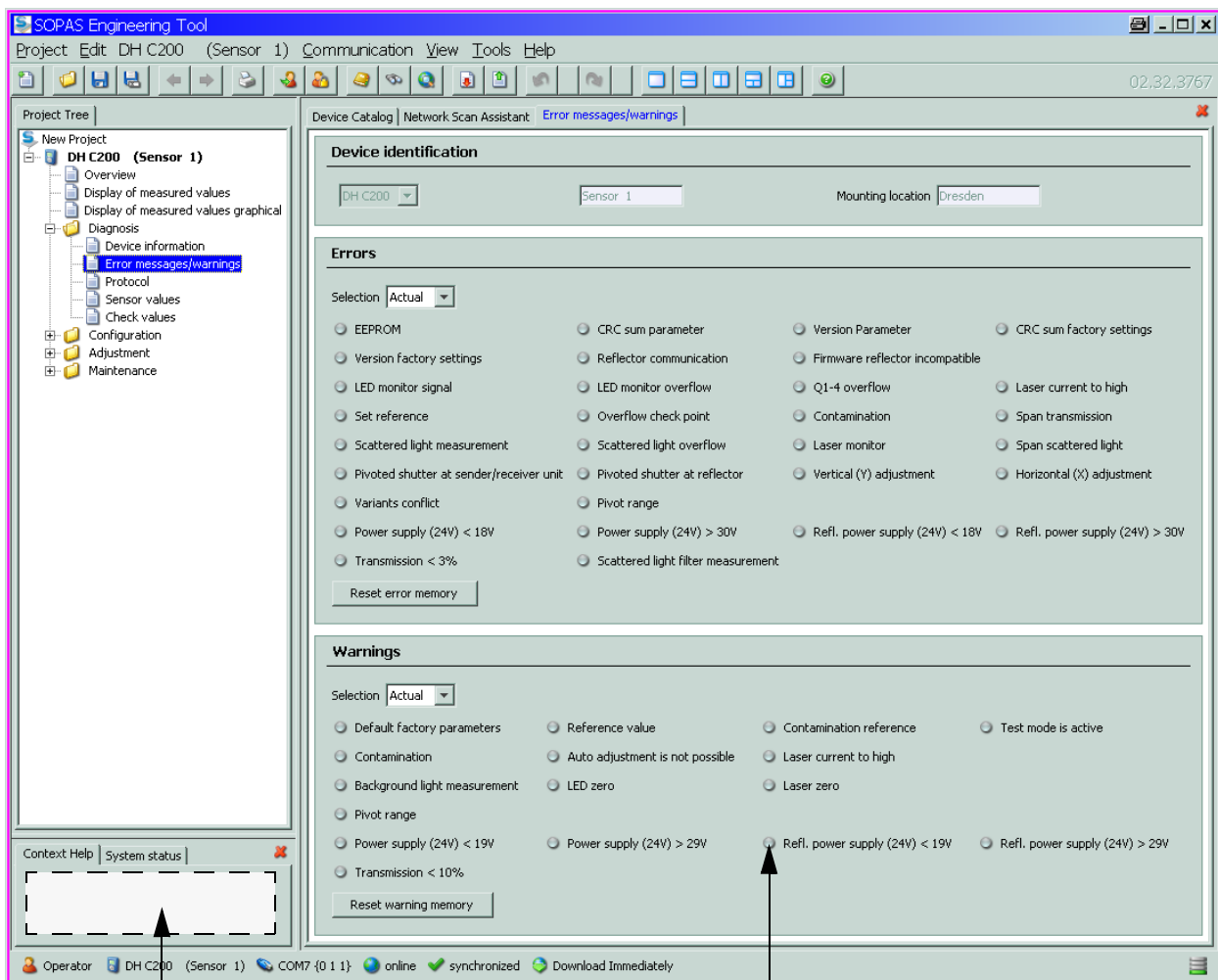
6.2

Sender/receiver unit**Malfunctions**

Symptom	Possible cause	Action
<ul style="list-style-type: none"> LEDs of the sender/receiver unit are not on No laser beam 	<ul style="list-style-type: none"> No supply voltage Connection cable not connected correctly or defective Defective plug connector 	<ul style="list-style-type: none"> Check plug connectors and cable. Contact SICK service.

Warning and error messages in the SOPAS ET program

Figure 90 "Diagnosis / Errors/Warnings" directory



Description

Indicator

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/receiver unit and reflector/scattered light receiver	<ul style="list-style-type: none"> ● Connection cable not connected or not connected correctly ● Defective connection cable ● Defective reflector ● RS485 interface of the sender/receiver unit defective 	<ul style="list-style-type: none"> ▶ Check connection cable. ▶ Contact SICK service.
LED monitor overflow	Overdriving of the monitor channel when scaling	Incorrect alignment of the optical axes of sender/receiver unit and reflector	<ul style="list-style-type: none"> ▶ Check/correct alignment. ▶ Repeat scaling.
Q1-4 overflow	Group signal of quadrant measurement too high	<ul style="list-style-type: none"> ● Measuring system not yet scaled ● Changed alignment of optical axes ● Reduced active measuring path 	<ul style="list-style-type: none"> ▶ Scale measuring system. ▶ Check/correct alignment. ▶ Contact SICK service.
Set reference	Scaling not possible	Measurement or monitor signal too low (contamination, incorrect alignment)	<ul style="list-style-type: none"> ▶ Check/correct alignment. ▶ Clean the optical surfaces (→ p. 98, §5.2).
Contamination	Current contamination value is higher than the permitted limit value (→ p. 114, §7.1)	<ul style="list-style-type: none"> ● Deposits on the optical surfaces ● Unclean purge air 	<ul style="list-style-type: none"> ▶ Clean the optical surfaces (→ p. 98, §5.2). ▶ Check purge air filter and replace, if required (→ p. 103, §5.3). ▶ Contact SICK service.
Power supply (24 V) < 18 V	Supply voltage too low	<ul style="list-style-type: none"> ● Cable provided by customer doesn't match the specification (→ p. 43, §3.3.4) ● Voltage loss on the connection cable (core cross-section too low in relation to the cable length) 	<ul style="list-style-type: none"> ▶ Check the connection cable. ▶ Contact SICK Service.
Power supply (24 V) < 19 V			

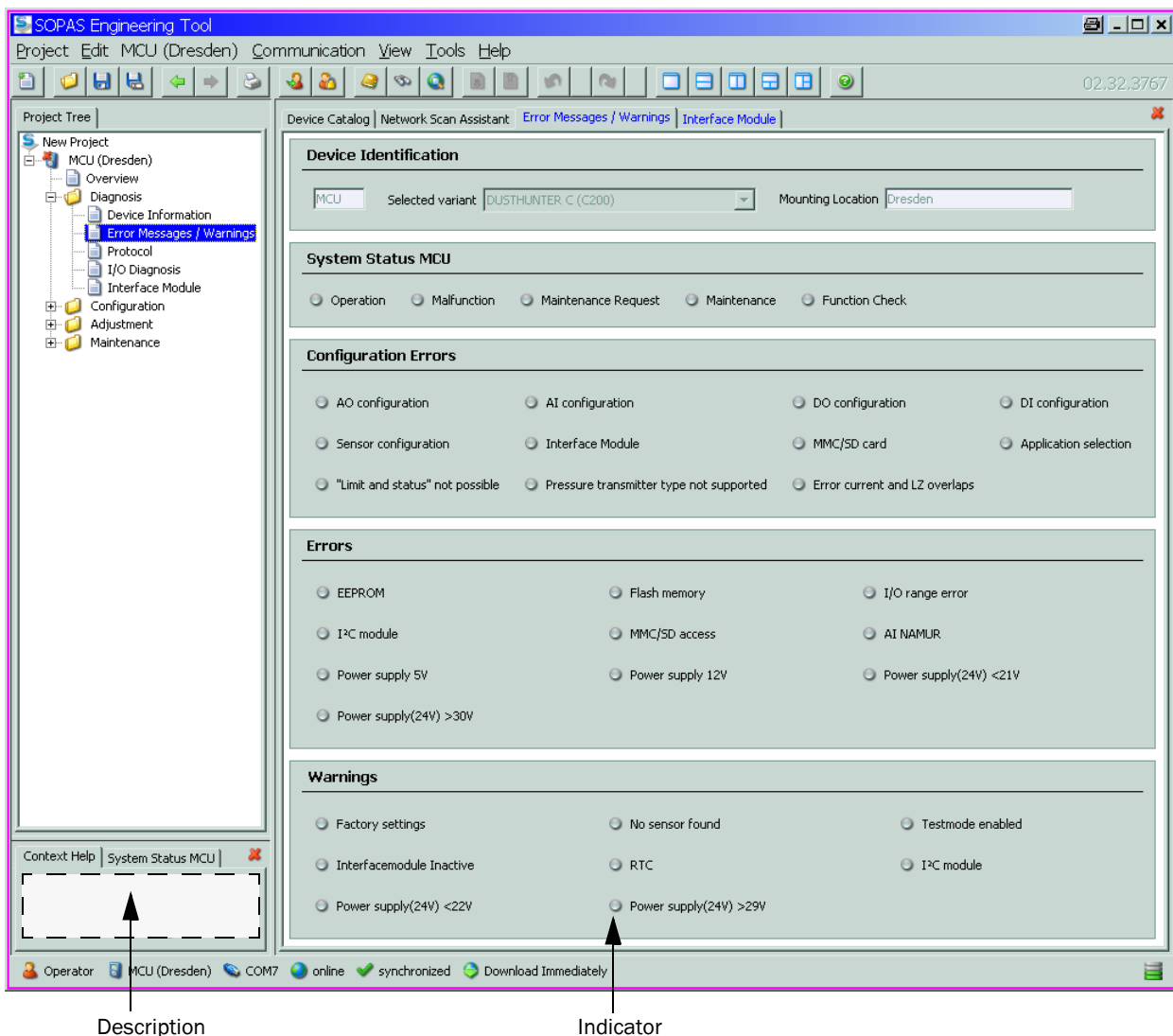
6.3

Control unit**Malfunctions**

Symptom	Possible cause	Action
No display on the LCD	<ul style="list-style-type: none"> ● No supply voltage ● Cable to the LCD not connected or damaged ● Defective fuse 	<ul style="list-style-type: none"> ▶ Check the power supply. ▶ Check the connection cable. ▶ Exchange the fuse (T 2 A). ▶ Contact SICK service.

Warning and error messages in the SOPAS ET program

Figure 91 "Diagnosis / Errors/Warnings" directory



The following malfunctions can be removed under circumstances at site.

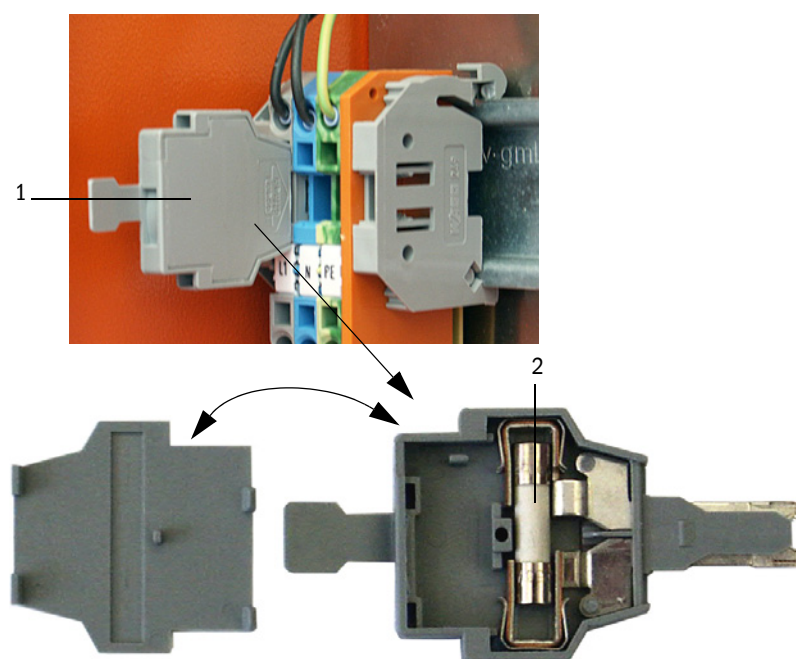
Message	Significance	Possible cause	Action
AO configuration	The number of configured analog outputs does not match the number of connected outputs.	<ul style="list-style-type: none"> ● No parameters set for AO ● Connection error ● Module failure 	<ul style="list-style-type: none"> ▶ Check the parameter settings (→ p. 72, §4.4.4). ▶ Contact SICK service.
AI configuration	The number of configured analog inputs does not match the number of connected outputs.	<ul style="list-style-type: none"> ● No parameters set for AI ● Connection error ● Module failure 	<ul style="list-style-type: none"> ▶ Check the parameter settings (→ p. 75, §4.4.5). ▶ Contact SICK service.
Interface Module	No communication via interface module	<ul style="list-style-type: none"> ● No parameters set for module ● Connection error ● Module failure 	<ul style="list-style-type: none"> ▶ Check the parameter settings (→ p. 89, §4.6.2). ▶ Contact SICK service.
No sensor found	sender/receiver unit was not recognized	<ul style="list-style-type: none"> ● Communication problems on RS485 line ● Supply voltage problems 	<ul style="list-style-type: none"> ▶ Check the system settings. ▶ Check the connection cable. ▶ Check the power supply. ▶ Check the termination. ▶ Contact SICK service.
Variant configuration error	MCU setting doesn't match attached sensor	<ul style="list-style-type: none"> ● Sensor type was changed 	<ul style="list-style-type: none"> ▶ Correct application settings (→ p. 69, §4.4.1).
Testmode enabled	MCU is in test mode.		<ul style="list-style-type: none"> ▶ 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. 126, §7.3.7).
- ▶ Close the fuse bracket and install.
- ▶ Close the door and connect the power supply.

Figure 92

Replacing the fuse



DUSTHUNTER C200

7 Specifications

Technical Data

Dimensions, Part Nos.

Accessories

Consumable parts for 2-years operation

Password

7.1

Technical Data

Measurement parameter		
Measured variable	Transmission, Opacity, relative Opacity, Extinction, Scattered light intensity, Dust concentration	
Measuring range (freely adjustable)	Min.	Max.
● Transmission	100 ... 90 %	100 ... 0 %
● Opacity	0 ... 10 %	0 ... 100 %
● Relative Opacity	0 ... 10 %	0 ... 100 %
● Extinction	0 ... 0.045	0 ... 2
● Dust concentration	Scattered light intensity	
	0 ... 5 mg/m³	0 ... 200 mg/m³
	Transmission (dependent on measuring path and particle characteristics; see special graphic)	
	0 ... 200 mg/m³	0 ... 10,000 mg/m³
Uncertainty ¹⁾	± 2%	
Response time	1 ... 600 s; freely selectable	
Measurement conditions		
Distance flange - flange ²⁾	With reflector/scattered light receiver DHC-R0: With reflector/scattered light receiver DHC-R1:	0.5...3 m 2.5...8 m
Effective measuring distance (Scattered light measurement) ³⁾	With reflector/scattered light receiver DHC-R0: With reflector/scattered light receiver DHC-R1:	approx. 0.1 m approx. 0.3 m
Swivel error ⁴⁾	0.2% Transmission	
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/receiver unit, reflector/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 30% warning: From 40% malfunction	
Manual linearity check	Using a reference filter	
Output Signals		
Analog output	3 outputs 0/2/4 ... 22 mA, max. load 500 Ω (standard output max. 750 Ω); resolution 10 bits; electrically isolated 2 further analog outputs by using an analog output module (option, → p. 23, §2.2.4)	
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 an analog input module (option, → p. 23, §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/receiver unit(s)	
Optional Interface module	To communicate with the Host PC, optional for Profibus, Ethernet	

1): In temperature range - 20 °C ... +50 °C

2): Upper limit only with distortion-free fitting

3): → p. 14, Fig. 1

4): With swivel angle ± 0.3°; total swivel range ±1°

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/receiver 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
Weight		
Sender/receiver unit	9,5 kg	
Reflector/scattered light receiver	8,0 kg 12,0kg	DHC-R0 DHC-R1
Control unit	13,5 kg 4,5 kg	MCU-P MCU-N
Optional external purge air unit	14 kg	
Misc.		
Protection class	IP 66 IP 54	Sender/receiver unit, reflector/scattered light receiver, control unit Optional external purge air unit
Connection cable length	5 m, 10 m, 20 m ⁵⁾	Other lengths on request
Purge air hose length	5 m, 10 m	Other lengths on request
Sender LED	White light, wavelength between 450 nm and 700 nm	
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

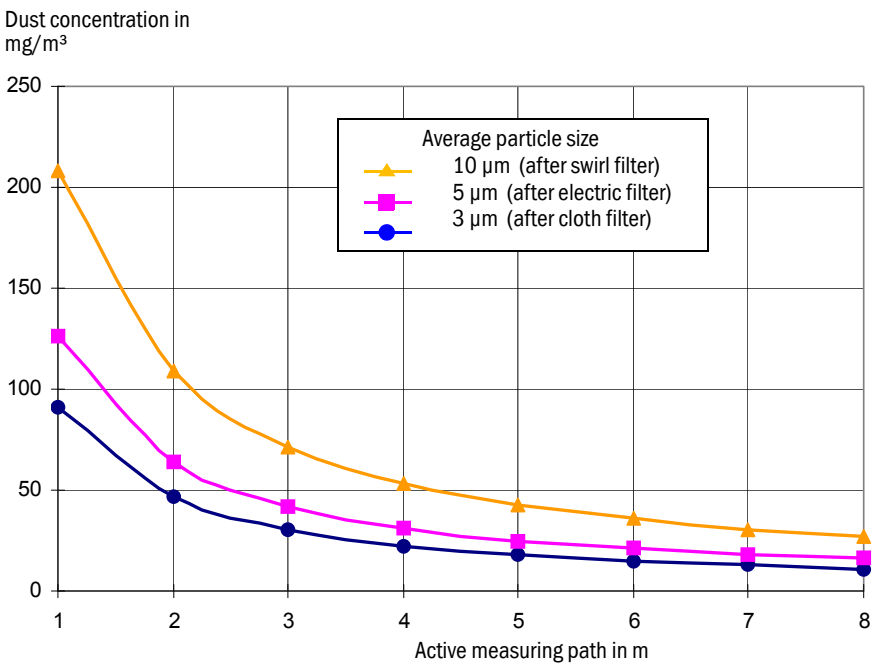
5): for connecting the reflector/scattered light receiver to the sender/receiver unit

Dust concentration measuring range

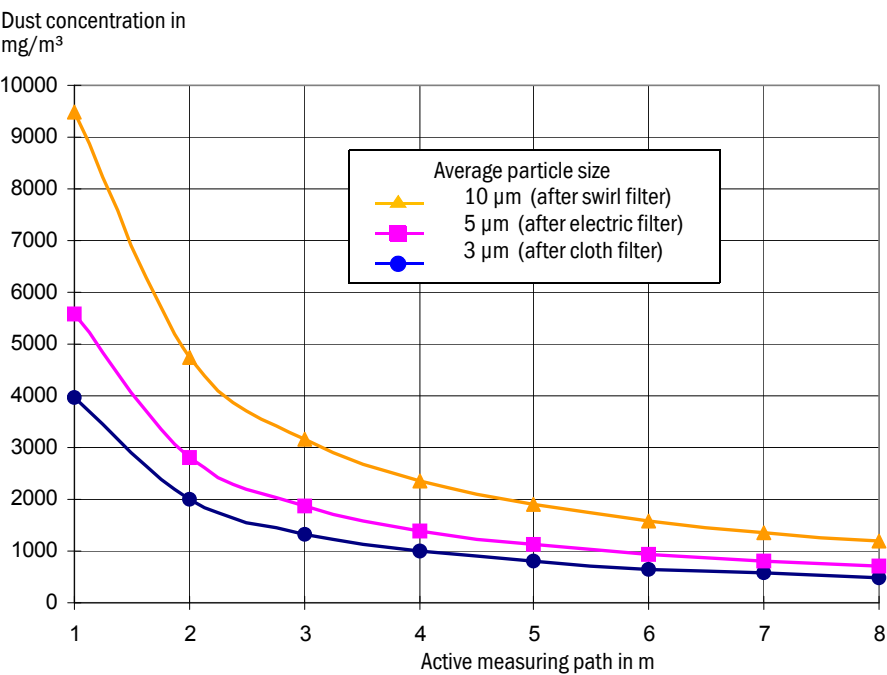
The limits for the smallest/largest measuring range depend on the extinction measuring range, active measuring path and optical particle characteristics. Therefore exact range limits cannot be specified here. The following charts can be used to estimate the ranges used. These have been determined based on SICK's many years of experience and are valid assuming constant particle size and characteristics.

Figure 93 Measuring ranges for dust concentration measurement based on extinction

Smallest measuring range



Largest measuring range



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.

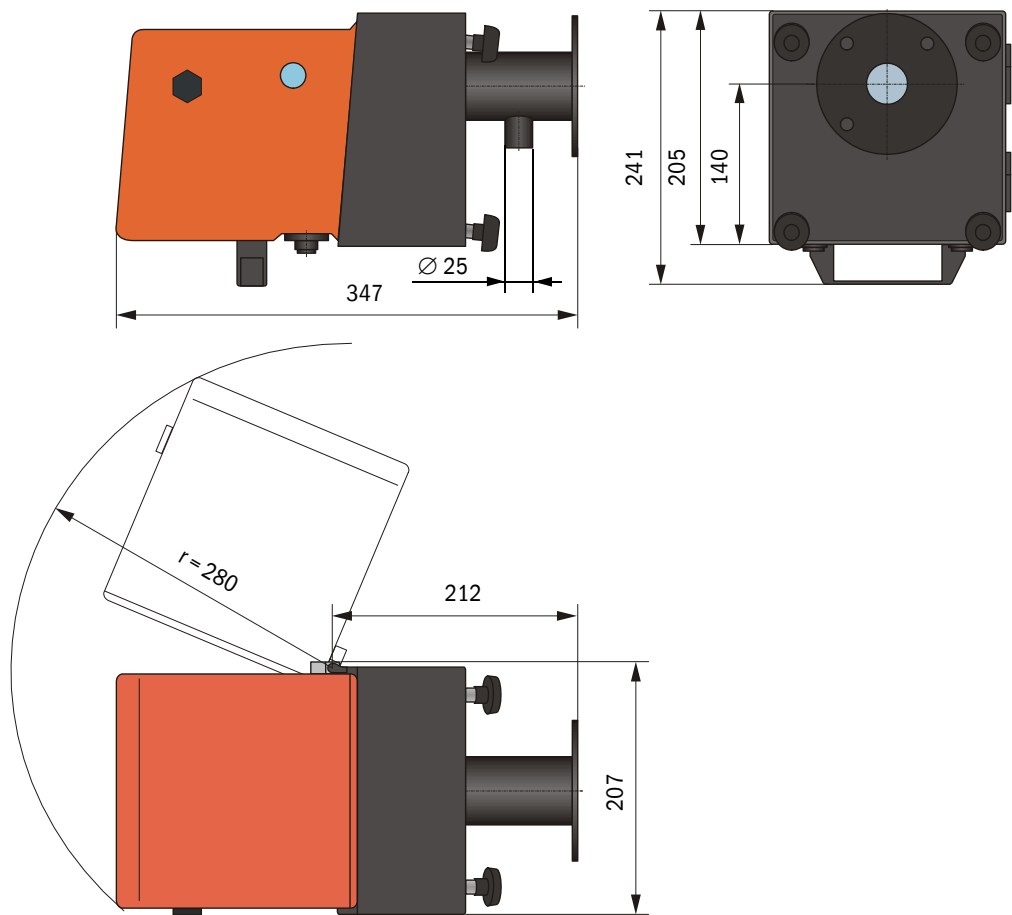
Approvals

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/receiver unit**

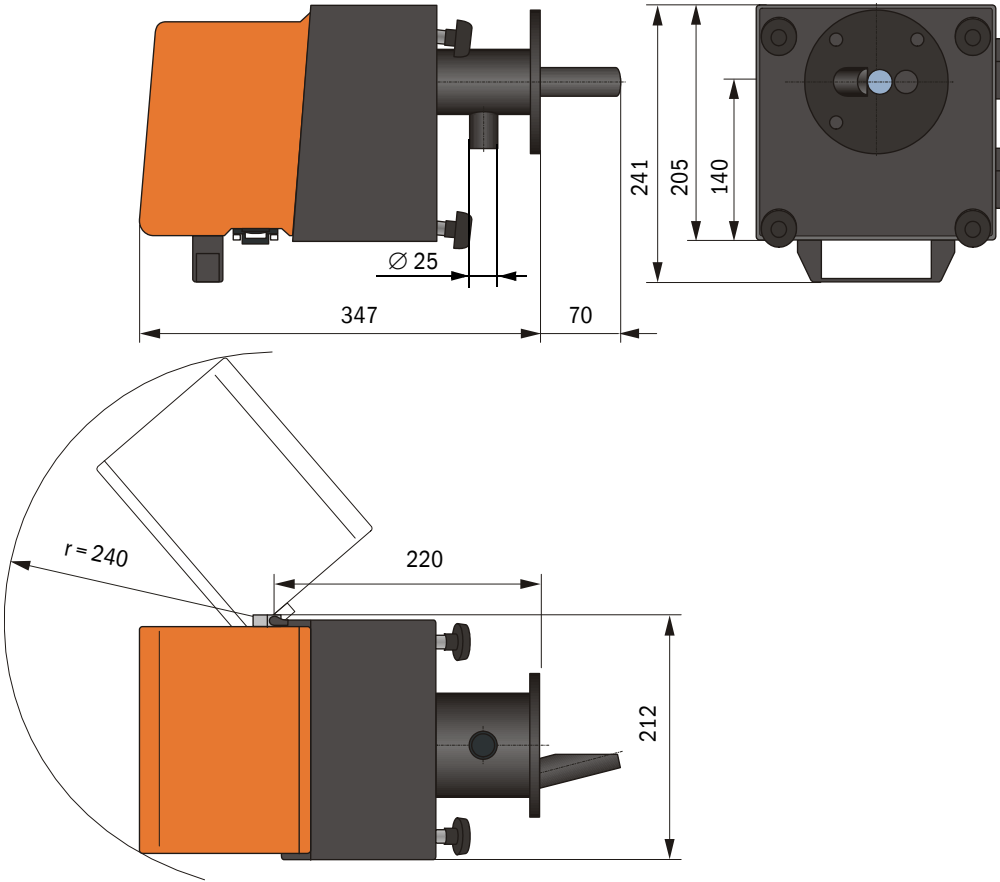
Figure 94 Sender/receiver unit



Name	Part number
Sender/receiver unit DHC-T	1044863

7.2.2 **Reflector/scattered light receiver**
Reflector/scattered light receiver DHC-R0 for short measuring paths

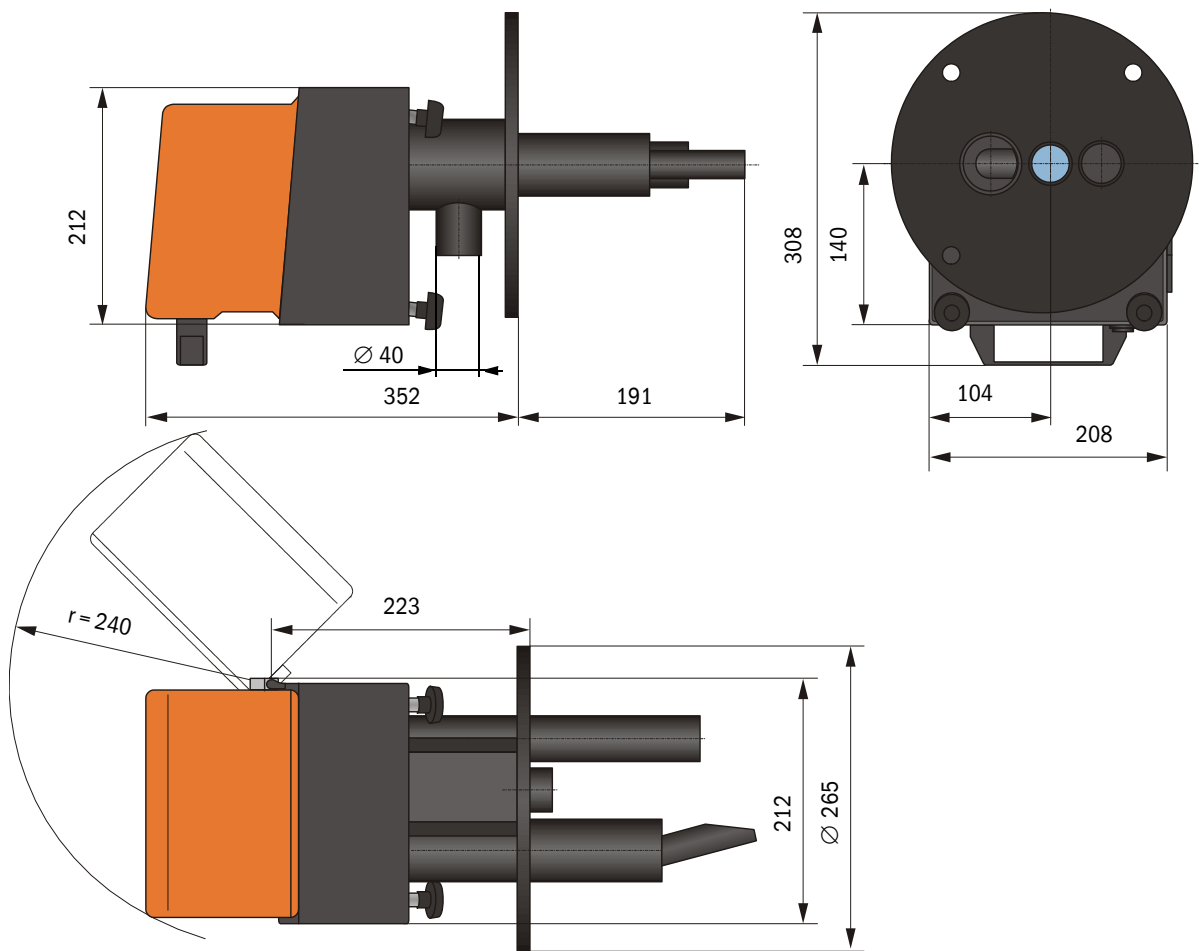
Figure 95 Reflector/scattered light receiver DHC-R0



Name	Part number
Reflector/scattered light receiver DHC-R0	1044864

Reflector/scattered light receiver DHC-R1 for long measuring paths

Figure 96 Reflector/scattered light receiver DHC-R1



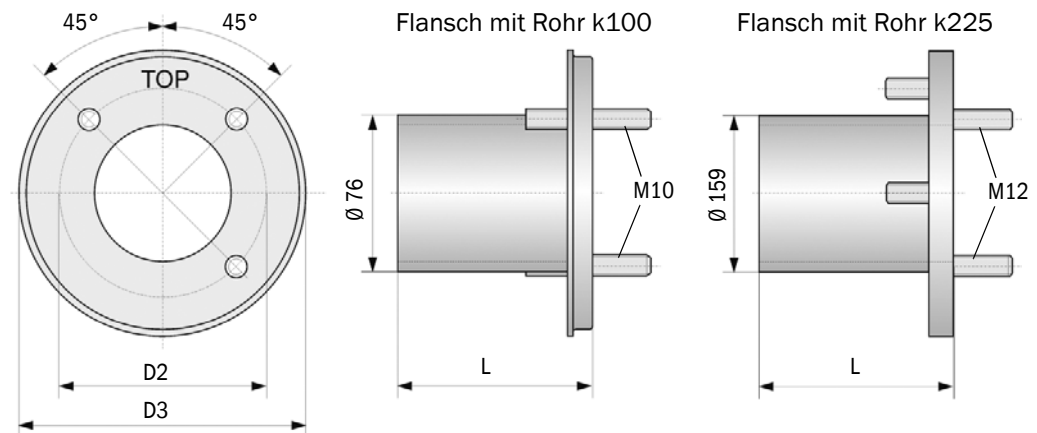
Name	Part number
Reflector/scattered light receiver DHC-R1	1044865

7.2.3

Flange with tube

Figure 97

Flange with tube

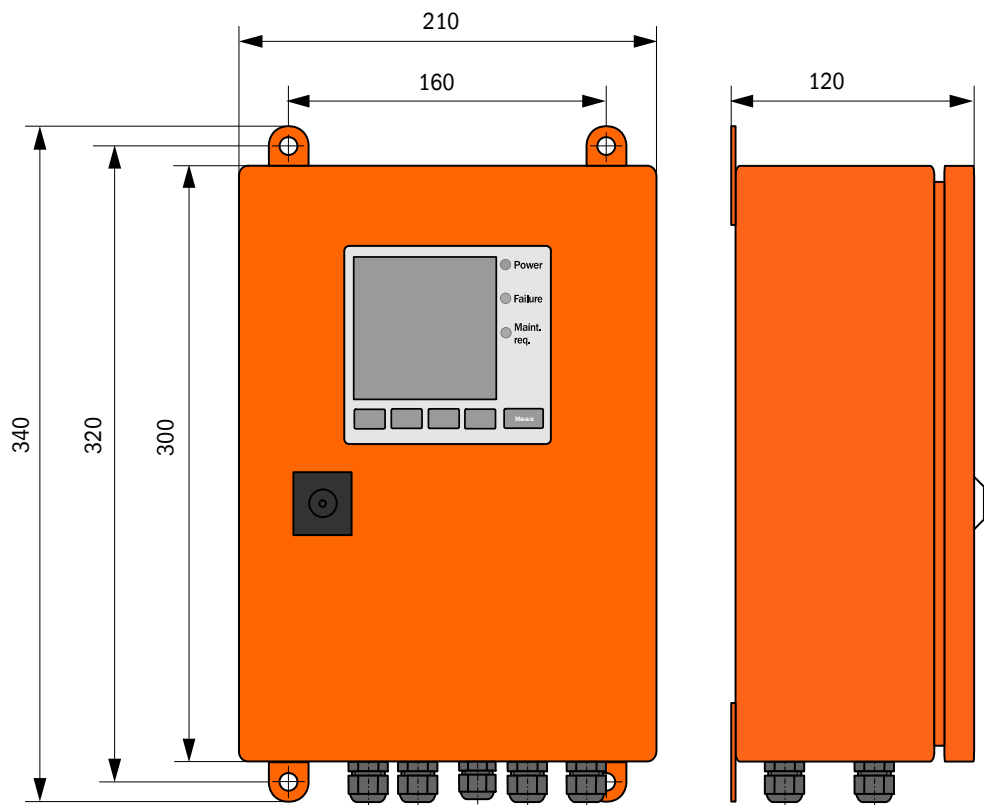


Maß	Flansch mit Rohr	
	k100	k225
D2	Ø 100	Ø 225
D3	Ø 130	Ø 265
L	110, 130, 240, 500	350

Name	Part No.	Usage on
Flange type k100		
Flange with tube, Di = 70.2 Length 130 mm, St37	2017845	DHC-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	DHC-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	DHC-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

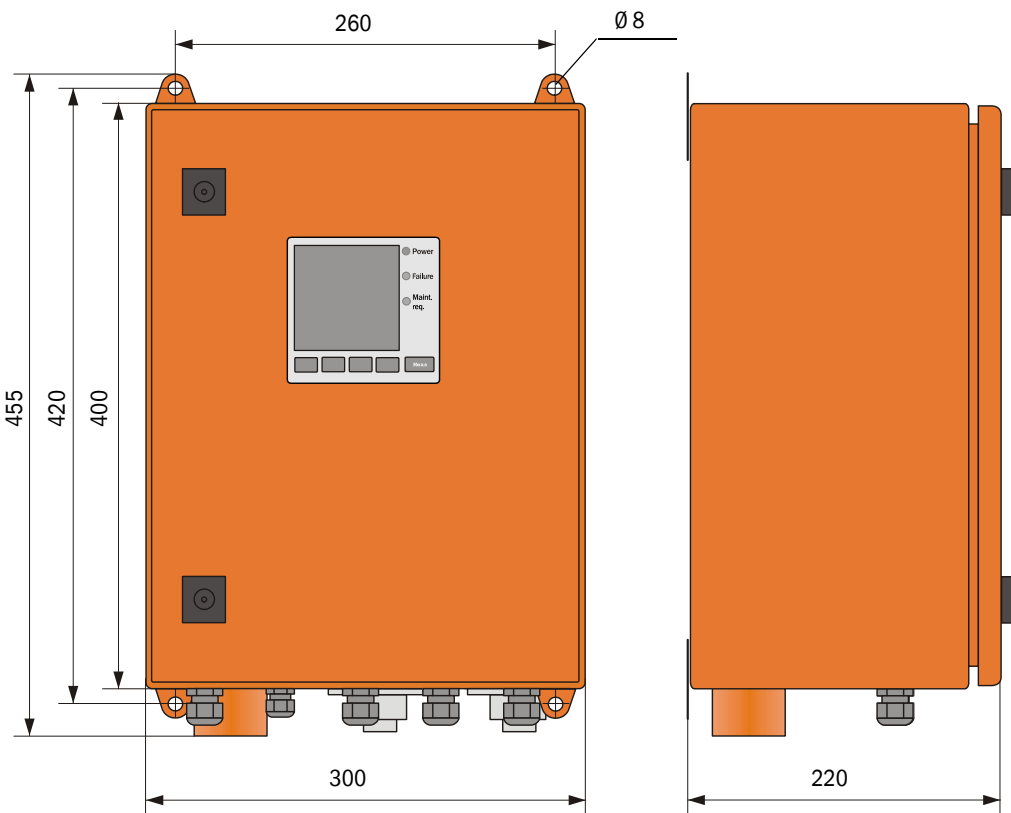
Figure 98 MCU-N control unit



Name	Part number
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

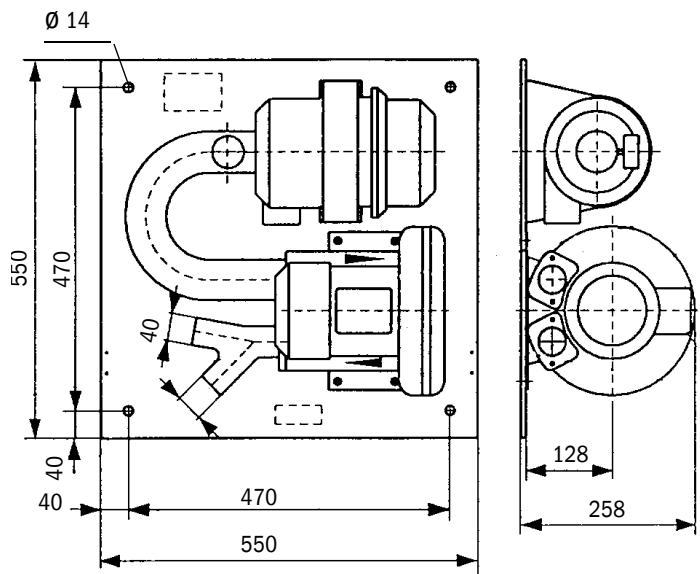
Figure 99 MCU-P control unit



Name	Part number
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

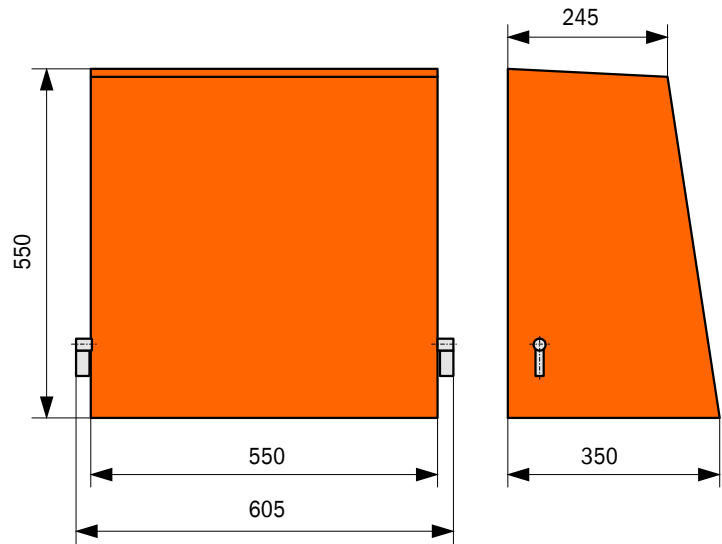
Figure 100 Optional external purge air unit



Name	Part number
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

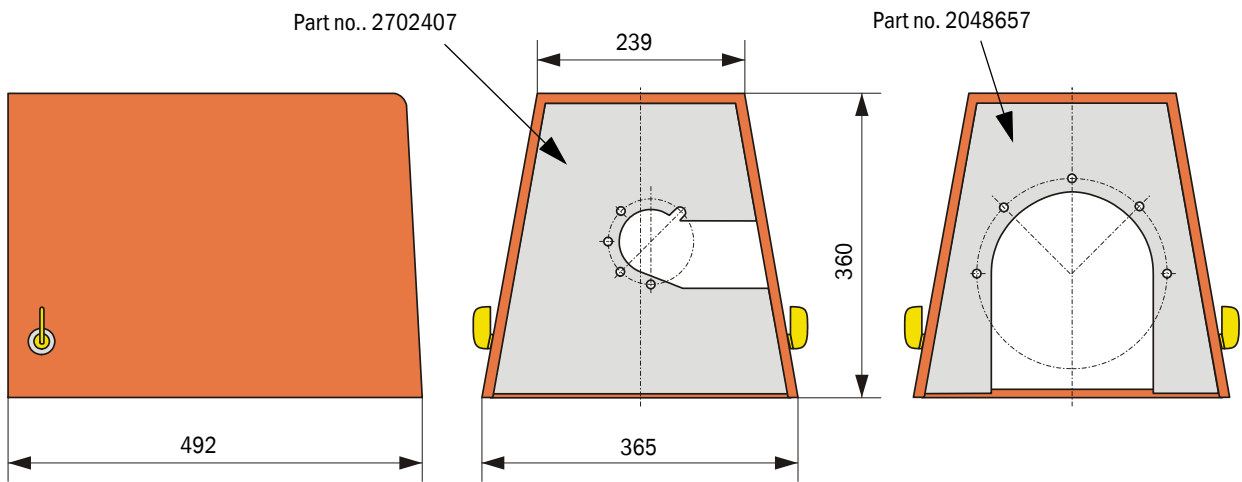
Figure 101 Weatherproof cover for external purge air unit



Name	Part number
Weatherproof cover for purge air unit	5306108

Weatherproof cover for sender/receiver unit and reflector/scattered light receiver

Figure 102 Weatherproof cover for analyzer



Name	Part number	Part number
Weatherproof cover for analyzer	2702407	DHC-T, DHC-R0
Weatherproof cover flange k225	2048567	DHC-R1

Subject to change without notice

7.3 Accessories

7.3.1 Connection cable, sender/receiver unit - MCU

Name	Part number
Connection cable, length 5 m	7042017
Connection cable, length 10 m	7042018

7.3.2 Connection cable, sender/receiver unit - reflector/scattered light receiver

Name	Part number
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 number
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 number
Assembly kit, flange - analyzer (for sender/receiver unit and reflector/scattered light receiver DHC-R0)	2018183
Assembly kit receiver (for scattered light receiver DHC-R1)	2060477

7.3.5 Device check accessories

Name	Part number
Check filter set	2048676
Adjusting stand	2042907

7.3.6 Options for MCU control unit

Name	Part number
Analog input module, 2 channels, 100 Ω , 0/4...22 mA, electrically isolated	2034656
Module carrier for AI module	6028668
Connection cable for AI module	2040977
Interface, Profibus module DP V0	2040961
Interface module Profibus DP V0	2040961
Interface module Ethernet	2040965

7.3.7 Misc.

Name	Part number
Optical adjusting device for flange assembly	1700462
Cover	2052377
Set of fuses T 2 A	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/receiver unit and reflector/scattered light receiver

Name	Number	Part number
Sealing tape	4	4704676
Sealing tape 235x50x2 (for DHC-R1)	2	4058792

7.4.2 Control unit MCU with integrated purge air supply

Name	Number	Part number
Filter element C1140	4	7047560
Optics cloth	4	4003353

7.4.3 Optional external purge air unit

Name	Number	Part number
Filter element Micro-Topelement C11 100	4	5306091
Optics cloth	4	4003353

Password



Password „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 Funktionsumfangs wird das

Password

sickoptic

benötigt.

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

Password "Authorized 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.

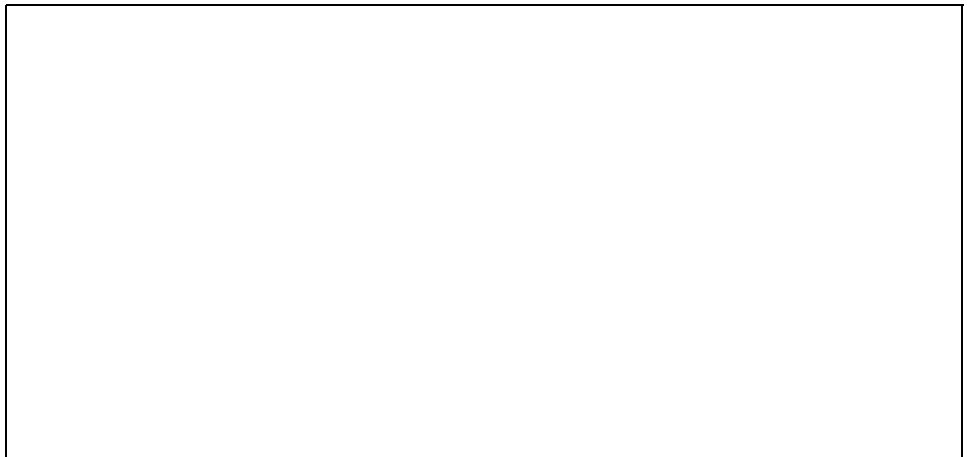
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