

DUSTHUNTER SP100

Dust Concentration Monitor

Installation, Operation, Maintenance

SICK
Sensor Intelligence.



Described Product

Product name: DUSTHUNTER SP100

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Original document

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1 Important Information

1.1 Main hazards

1.1.1 Hazard through hot and/or aggressive gases and 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 component fitted on the duct may only be installed/removed when the equipment is at a standstill.

1.1.2 Hazards through electrical equipment



WARNING: Danger through power voltage

The DUSTHUNTER SP100 measuring system is classified as electrical.

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

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 Symbols and document conventions

1.2.1 Warning Symbols

Symbol	Significance
	Hazard (general)
	Hazard by voltage

1.2.2 Warning levels and signal words

DANGER

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

WARNING

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



CAUTION

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

NOTICE

Hazard which *could* result in property damage.

1.2.3 Information symbols

Symbol	Significance
	Important technical information for this product
	Important information on electric or electronic functions

1.3 Intended use

Purpose of the device

The DUSTHUNTER SP100 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 SP100 measuring system is not approved for use in potentially explosive atmospheres.

1.4 Responsibility of user

1.4.1 General information

Designated users

The measuring system DUSTHUNTER SP100 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.

1.4.2 Safety information and protective measures

Protection devices



NOTE:

Depending on the particular hazard potential, an adequate number of suitable protection devices and personal safety equipment must be available and 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.



NOTE:

When no fail-safe shutters are fitted:
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



NOTE:

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
- Significant drifts in measured results
- Increased power consumption
- Higher temperatures of system components
- Monitoring devices triggering
- Smells or smoke emission
- Heavy contamination.

Avoiding damage



NOTE:

In order to avoid malfunctions that can cause direct or indirect personal injury or property damage, the operator must ensure:

- ▶ 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.
-

Electrical connection

Ensure the device can be switched off with a power isolating switch/circuit breaker in accordance with EN 61010-1.

2 Product Description

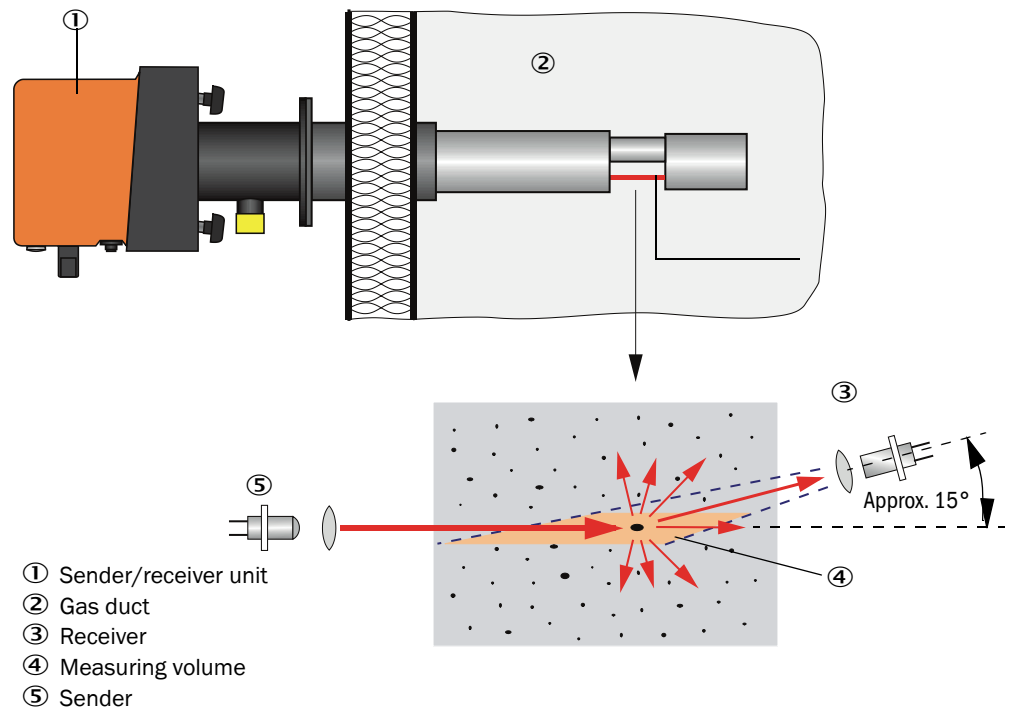
2.1 Measuring principle, measured variables

2.1.1 Functional principle

The measuring system works according to the scattered light measurement principle (forward dispersion). A laser diode beams the dust particles in the gas flow with modulated light in the visual range (wavelength approx. 650 nm). A highly sensitive detector 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.

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

Fig. 1: Measuring principle



Determining the dust concentration

Measured scattered light intensity (SI) 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

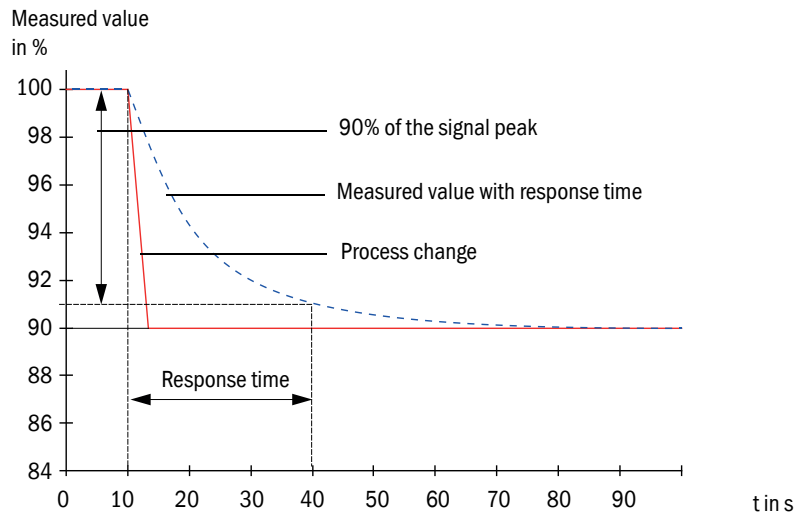
$$c = cc2 \cdot SI^2 + cc1 \cdot SI + cc0$$

(Entry see “Calibration for dust concentration measurement”, page 69; 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.

Fig. 2: Response time



2.1.3 Function check

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 (see “Determining the function check”, page 64). 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.

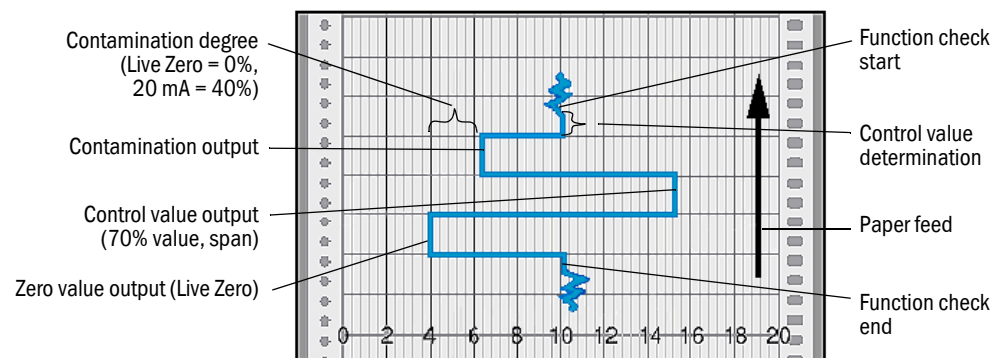


Further information → Service Manual

The function check comprises:

- Approx. 45 s measurement of zero value, control value and contamination of the optical interfaces
The measuring time depends on the increase in contamination value (change > 0.5% → measurement is repeated up to 2 times).
- Every 90 s (standard value), output of values determined (duration parameter can be modified, see “Determining the function check”, page 64).

Fig. 3: Function check output on a plotter



- The analog output must be activated to output control values on the analog output (see “Setting the analog outputs parameters”, page 65).
- 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, relay 3 is activated (see “MCU processor board connections”, page 48) and the green LED in the control window of the sender/receiver unit flashes (see “Sender/receiver unit”, page 16).
- A function check is not started automatically when the measuring system is in “Maintenance” mode.
- “Function control” is displayed on the LC-Display of the MCU control unit during the function check.
- If the start timepoint or cycle interval are changed, a check cycle 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). A warning 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 error 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.

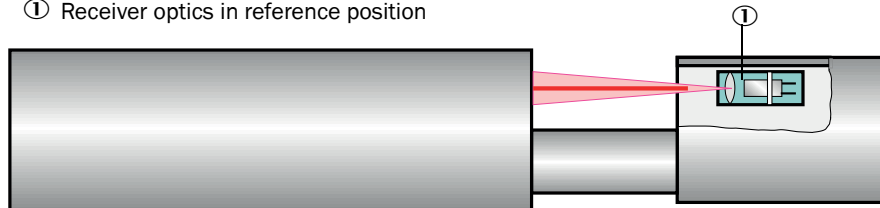
Contamination measurement

For contamination measurement the receiver optics is slewed into a reference position and the scattered light intensity is measured. The measured value determined and the value defined as factory setting are used to calculate a correction factor. This fully compensates any contamination that occurs.

A value between live zero and 20 mA is output on the analog output for contamination values $< 40\%$; when this value is exceeded, the “Malfunction” status is output (on the analog output the set error current; see “Factory settings”, page 63, see “Setting the analog outputs parameters”, page 65).

Fig. 4: Contamination and control value measurement

① Receiver optics in reference position

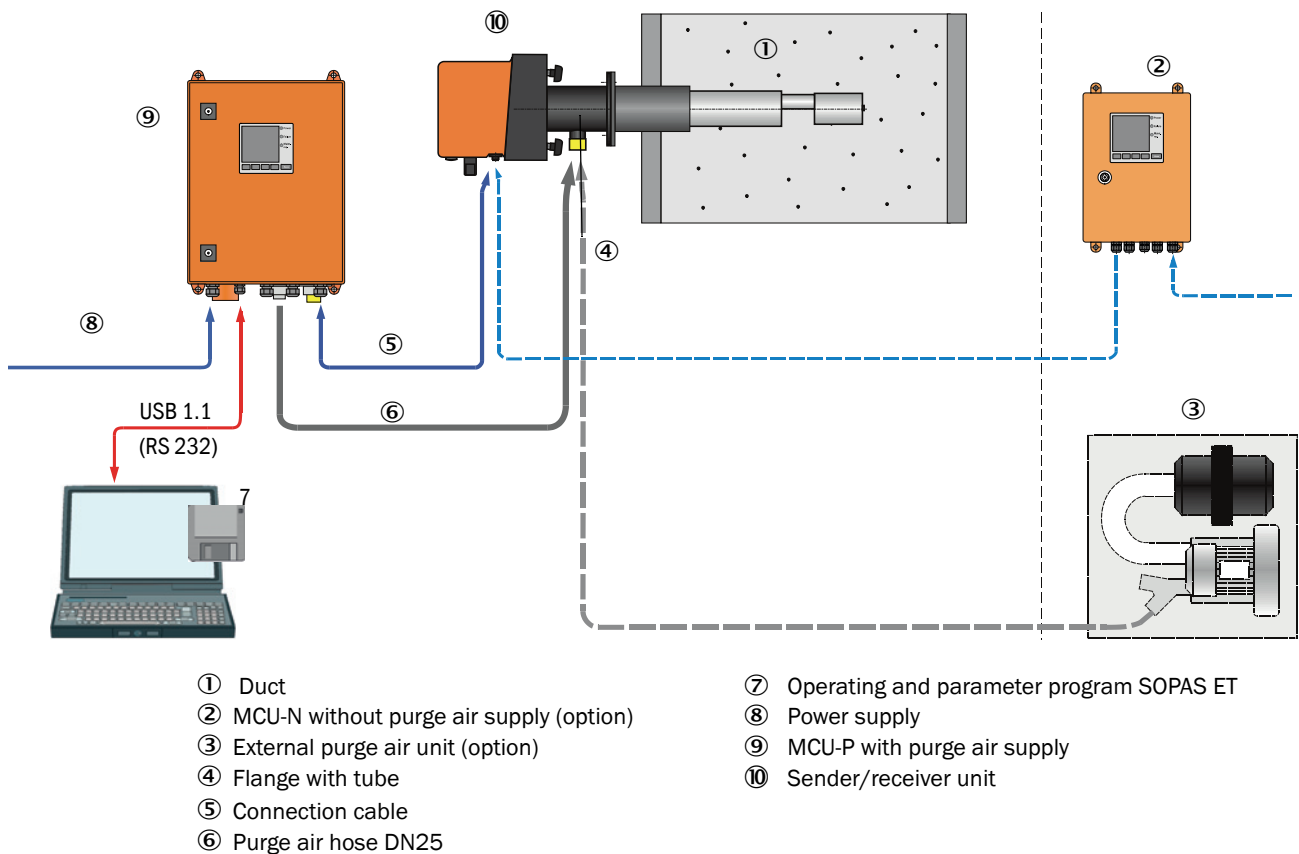


2.2 Device components

Measuring system DUSTHUNTER SP100 comprises the components:

- Sender/receiver unit DHSP-T
- Connection line to connect the sender/receiver unit to the MCU control unit (lengths 5 m, 10 m)
- Flange with tube
- MCU control unit
 - to control, evaluate and output the data of the sender/receiver unit connected via the RS485 interface
 - With integrated purge air supply, for internal duct pressure -50 ... +10 hPa
 - Without purge air supply, therefore additionally required:
- Optional external purge air unit, for internal duct pressure -50 ... +30 hPa

Fig. 5: DUSTHUNTER SP100 device components (standard version is shown)



Communication between sender/receiver unit and MCU

As standard, each sender/receiver unit is connected to an MCU control unit via the connection line.

2.2.1 Sender/receiver unit

The sender/receiver unit comprises two main subassemblies:

- Electronics unit

It contains the optical and electronics subassemblies to send and receive the light beam as well as to process and evaluate the signals.

In the version for use with high internal duct pressure, the electronics unit is in a pressure-proof enclosure.

- Measuring probe

The measuring probe is available in different versions and nominal lengths as well as for various gas temperature ranges and defines the device variant (see [“Device configuration”, page 30](#)).

Data transfer to and power supply (24 V DC) from the MCU control unit run via a shielded line with 4 wires and plug connector. An RS485 interface is available for service purposes. Clean air to cool the probe 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 (see [“Device components”, page 15](#)).

Type code

A type code identifies the special version of the sender/receiver unit:

Sender/receiver unit:

DHSP-T XXXX NNXX

Maximum permissible gas temperature: _____

- 2: 220 °C
- 4: 400 °C (250 °C in version for internal duct pressure up to +200 kPa)

Probe material _____

- V: Stainless steel
- H: Hastelloy
- M: Hastelloy probe + stainless steel protective tube
- S: SS/HS probe + SS Da88 protective tube
- C: Stainless steel probe + protective tube, plastic-coated
- X: Special version

Measuring probe nominal length (NL) _____

- 1: 435 mm
- 2: 735 mm
- 3: 1035 mm
- 4: 1335 mm
- 5: 1635 mm
- 6: 1835 mm
- 7: 2085 mm
- X: Special version

Flange version _____

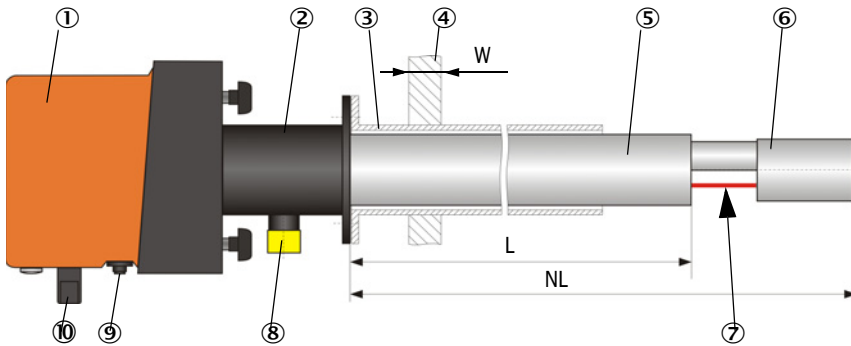
- 1: Reference circle k100
- 2: Reference circle k150
- 3: Reference circle k191
- X: Special version

Ex certification _____

- NNXX: Without

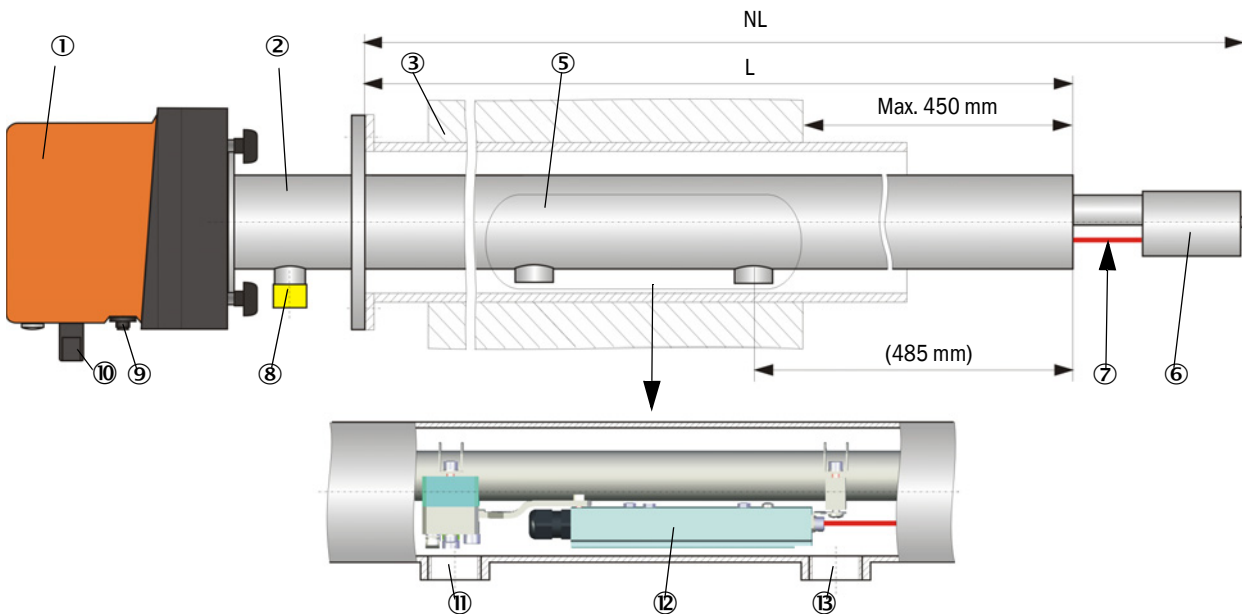
Fig. 6: Sender/receiver unit standard version for internal duct pressure up to +10 kPa

Sender/receiver unit
DHSP-Txx1xNNXX and DHSP-Txx2xNNXX



- ① Electronics unit
- ② Measuring probe
- ③ Flange with tube
- ④ Duct wall with isolation
- ⑤ Protective tube
- ⑥ Probe head with receiver optics
- ⑦ Measuring opening
- ⑧ Purge air connection
- ⑨ Connection for connection cable to MCU
- ⑩ Handle
- ⑪ Adjustment opening
- ⑫ Laser module
- ⑬ Cleaning opening for sender optics

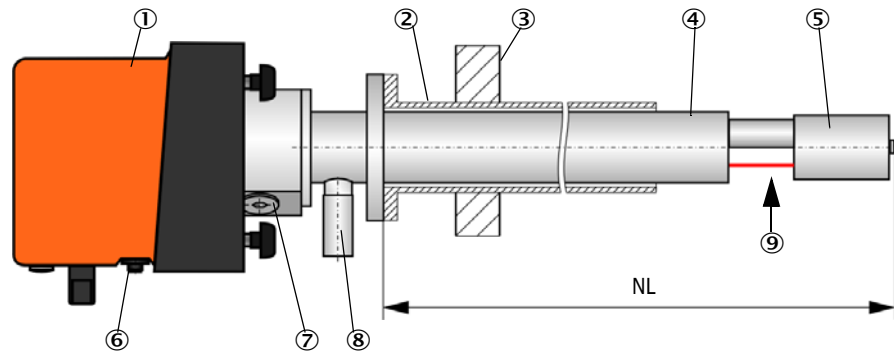
Sender/receiver unit
DHSP-Txx3xNNXX to SP-Txx7xNNXX



NOTE:

- Sender/receiver units with nominal lengths greater than 735 mm are only to be fitted in thick or double-walled ducts.
- The maximum distance between internal duct wall and measuring opening is 450 mm.

Fig. 7: Sender/receiver unit DHSP-T2V11NNXX for internal duct pressure up to +200 kPa



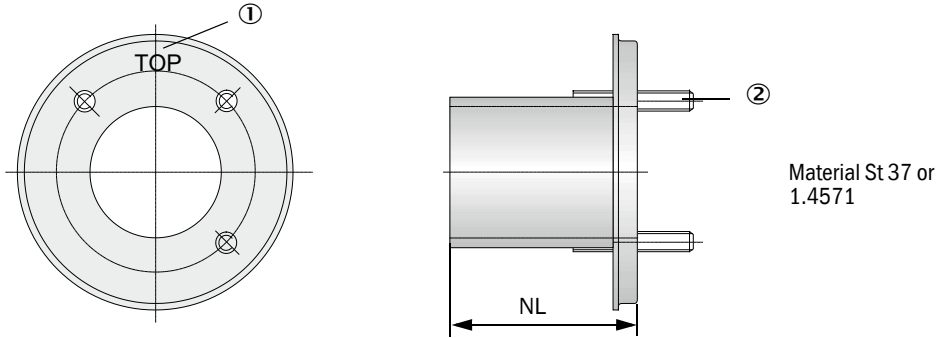
- | | | |
|--------------------|-----------------------------------|--------------------------------------|
| ① Electronics unit | ④ Protective tube | ⑦ Cleaning opening for sender optics |
| ② Flange with tube | ⑤ Probe head with receiver optics | ⑧ Non-return valve |
| ③ Duct wall | ⑥ Connection for connection cable | ⑨ Measuring opening |

2.2.2 Flange with tube

The flange with tube is available in different steel grades and dimensions (see “Flange with tube”, page 102). Selection depends on the wall and isolation thickness of the duct wall (→ nominal length) and the duct material.

Fig. 8: Flange with tube

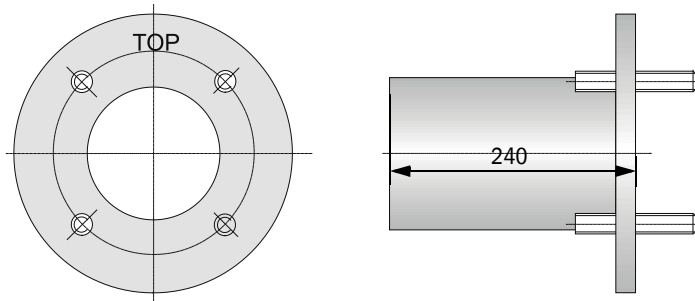
Standard version



- ① Marking for assembly position
- ② Securing bolt

Gas temperature	Sender/receiver unit nominal length (in mm)				NL (in mm)
	435	735	1035	1335	
< 150 °C	130, 240	130, 240, 500	800	1100	
> 150 °C	240	500			

for internal duct pressure > +50 hPa



2.2.3 MCU control unit

Control unit MCU has the following functions:

- Control of the data traffic and processing of the sender/receiver 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.

Control unit MCU has a sheet steel enclosure as standard.

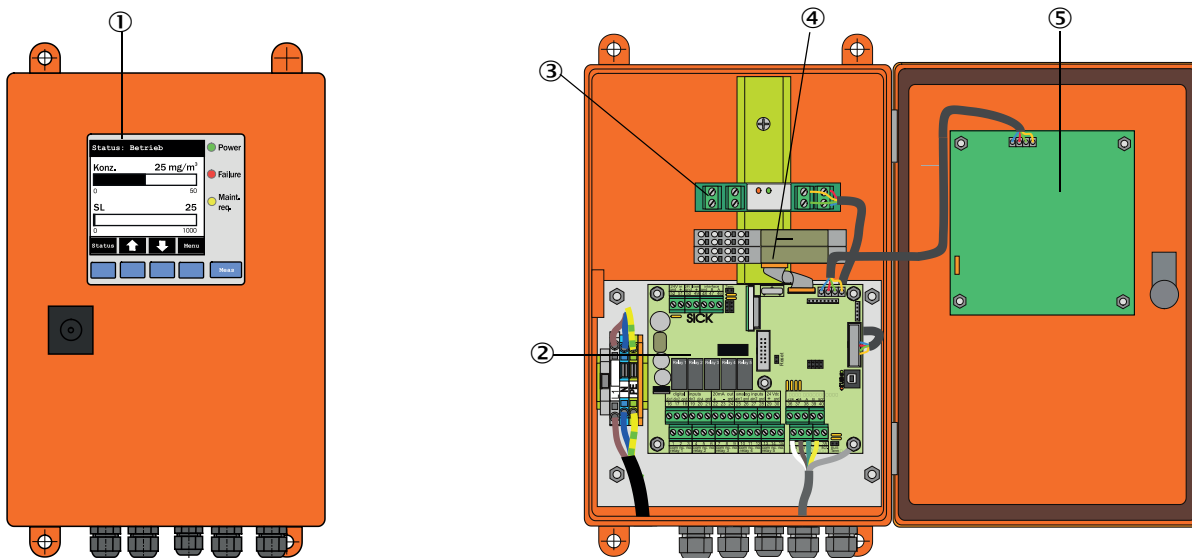
2.2.3.1 Standard interfaces

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
3 outputs 0/2/4...22 mA (electrically isolated, active) to output: <ul style="list-style-type: none"> • Scattered light intensity (corresponds to the uncalibrated dust concentration), • Dust concentration, calibrated • Dust concentration, scaled Resolution 10 bits	2 inputs 0...20 mA (standard; without electric isolation); resolution 10 bits	5 changeover contacts (48 V, 1 A) to output status signals: <ul style="list-style-type: none"> • Operation/failure • Maintenance • Function check • Maintenance request • Limit value 	4 inputs to connect potential-free contacts (e.g. to connect a maintenance switch, trigger a function check or more error messages)	<ul style="list-style-type: none"> • USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and software updates. • RS485 for sensor connection

2.2.3.2 Versions

- Control unit MCU-N without purge air supply

Fig. 9: Control unit MCU-N with options

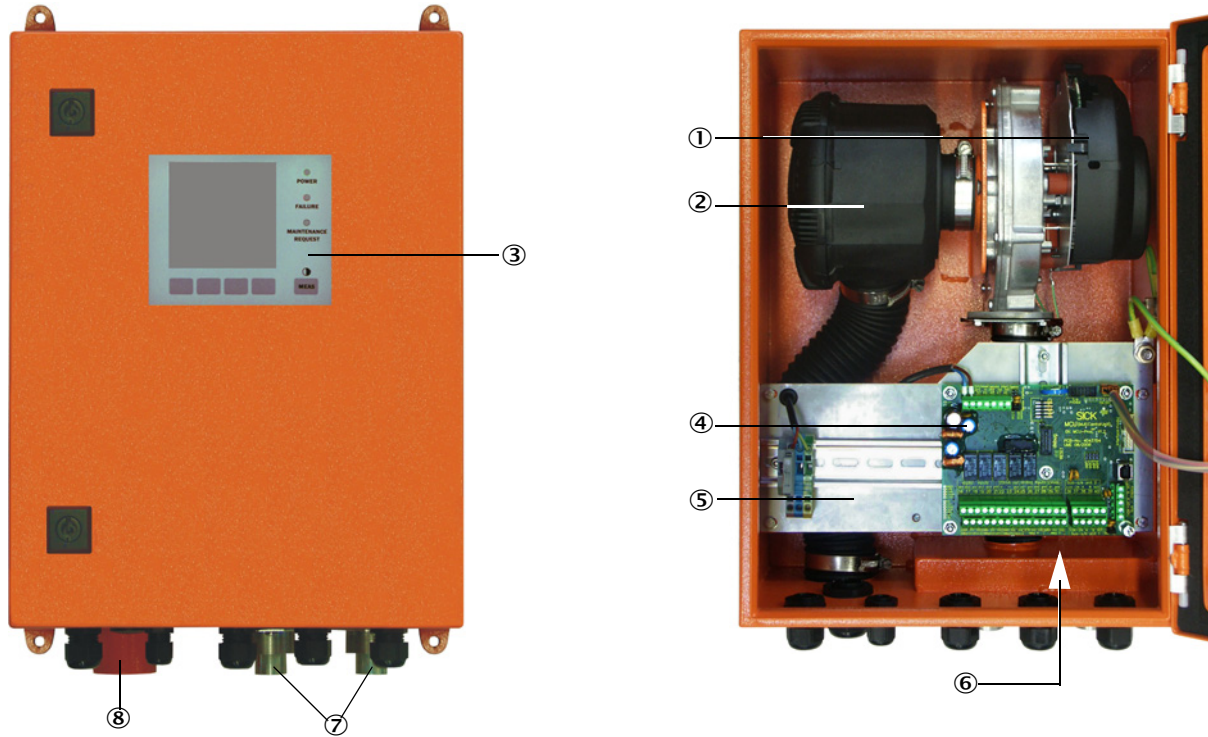


- ① Display module (option)
- ② Processor board
- ③ Interface module (option)

- ④ I/O module (option)
- ⑤ Display module (option)

- MCU-P control unit 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.

Fig. 10: Control unit MCU-P with integrated purge air supply

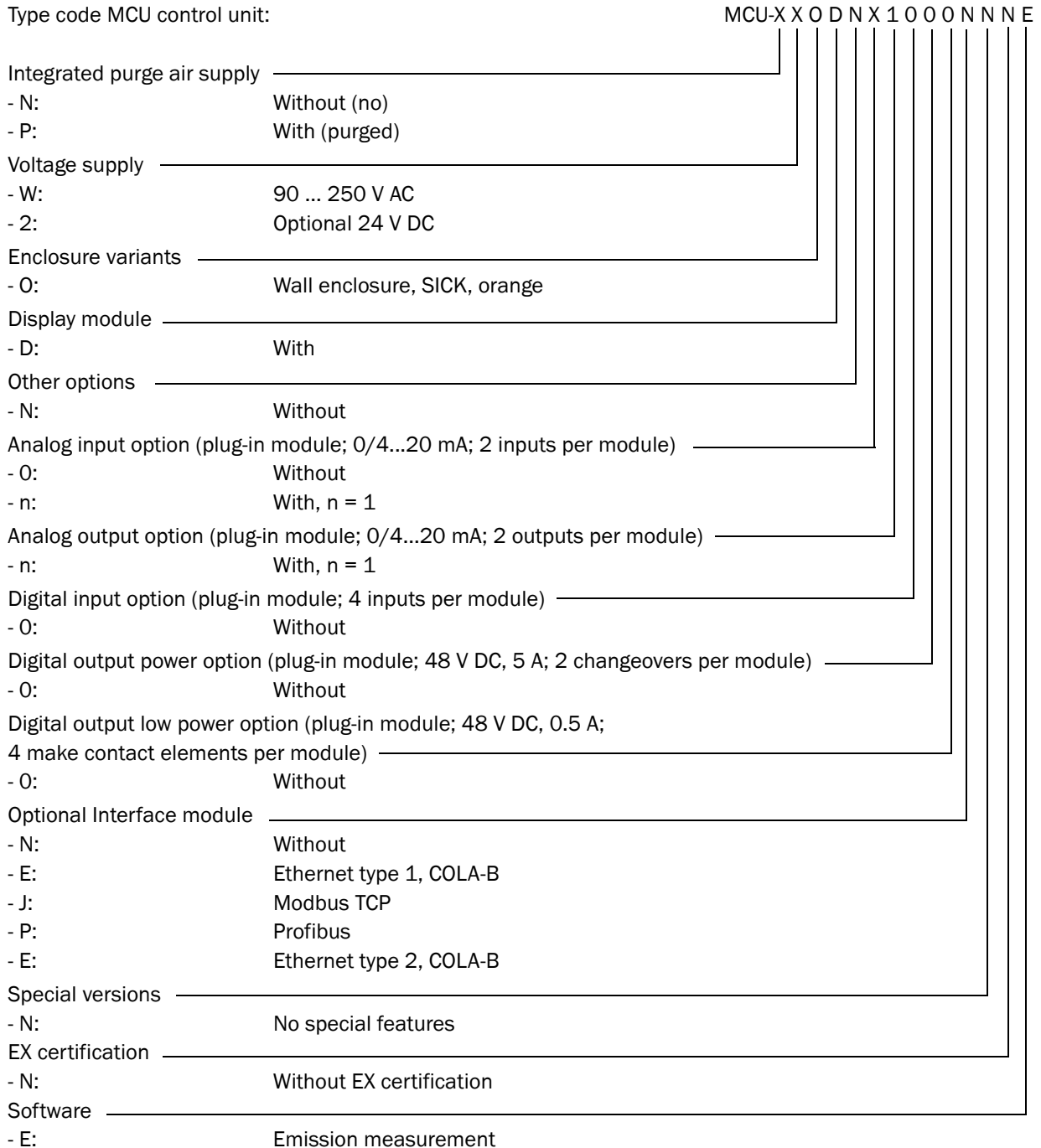


- | | |
|---------------------------|---|
| ① Purge air blower | ⑤ Installation plate |
| ② Air filter | ⑥ Power supply unit (on back of installation plate) |
| ③ Optional Display module | ⑦ Purge air connection |
| ④ Processor board | ⑧ Purge air inlet |

The purge air hose (standard lengths 5 and 10 m (see “Purge air supply”, page 107)) is a separate part of the measuring system and must be ordered separately.

2.2.3.3 Type code

The following type code defines the various configuration options in the same manner as for the sender/receiver unit:



2.2.3.4 Modules

1 Display module

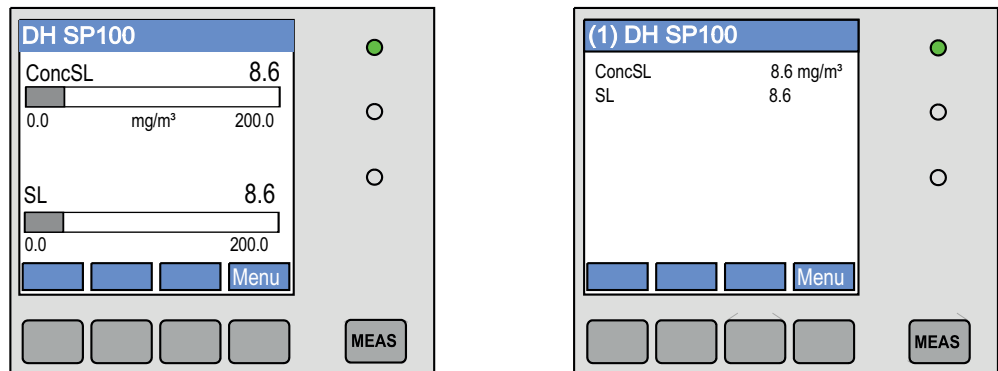
Module to display measured values and status information and for configuration during start-up, selection via operating buttons.

a) Displays

Type		Display
LED	Power (green)	Voltage supply OK
	Failure (red)	Function fault
	Maintenance request (yellow)	Maintenance request
LC-Display	Graphic display (main screen)	- Dust concentration - Scattered light intensity
	Text display	Two measured values (see graphic display) and 8 diagnosis values (see "LC-Display menu structure", page 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).

Fig. 11: LC-LC-Display with graphic (left) and text (right) display



b) Control buttons

Button	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 of main menu and selection of submenus

2 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 line.

Options

1 1x analog input module with two inputs 0/4 ... 22 mA (see “Options for MCU control unit”, page 108) 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, Modbus TCP or Ethernet (type 1 or type 2), to plug onto a hat rail (see “Options for MCU control unit”, page 108). A corresponding line serves to connect the module to the processor board.



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

3 MCU remote control unit

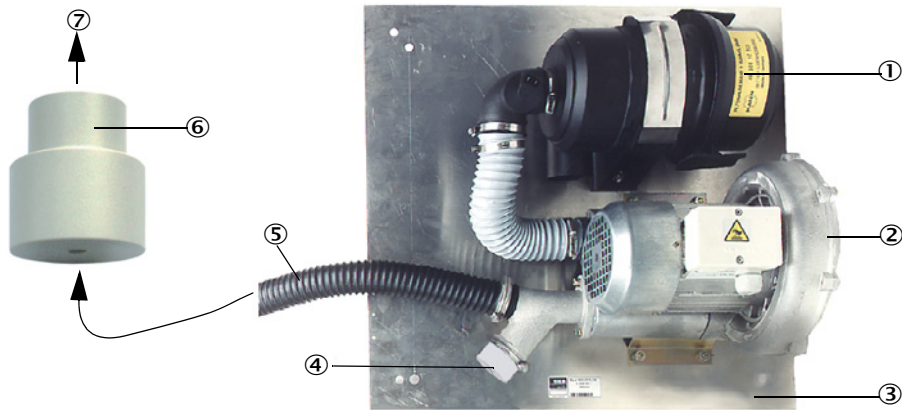
The MCU remote control unit has identical functions to the MCU display near the device, however, it can be installed further away.

- Operating function the same as the MCU display
- Distance to the device:
 - MCU remote control unit without separate power supply unit: Max. 100 m
 - MCU remote control unit with own power supply unit: Max. 1000 m
- The MCU and the MCU remote control unit are interlocked (it is not possible to operate both MCUs at the same time).

2.2.4 Optional external purge air unit

The MCU control unit with integrated purge air supply cannot be used when the internal duct pressure is greater than +10 hPa. Use the optional external purge air unit in this case (see [“Optional external purge air unit”, page 105](#)). 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).

Fig. 12: Optional external purge air unit with purge air reduction



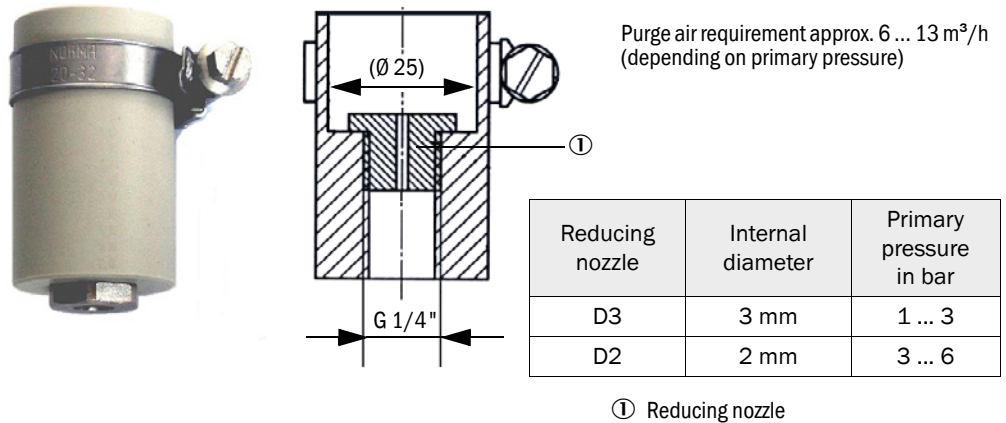
- ① Air filter
- ② Blower (standard type 2BH13)
- ③ Base plate
- ④ Cover cap with opening (part of the purge air reduction)
- ⑤ Purge air hose
- ⑥ Purge air reduction
- ⑦ To purge air connection of sender/receiver unit

A weatherproof cover is available for use outdoors (see [“Weatherproof covers”, page 106](#)).

2.2.5 Adapter for instrument air supply

The sender/receiver unit can also be operated with instrument air instead of purge air supplied via the MCU-P control unit or external purge air unit. An adapter with G 1/4" thread and internal reducing nozzle is available to connect the instrument air (fixing on purge air connection of the sender/receiver unit).

Fig. 13: Adapter for instrument air supply



2.2.6 Installation accessories

Separate parts of the measuring system (order separately) are:

- Purge air hose with 25 mm nominal diameter for purge air supply to the sender/receiver unit from the MCU-P control unit,
- Purge air reduction (see “Optional external purge air unit with purge air reduction”, page 27) to connect the DN40 mm purge air hose when using the optional external purge air unit
- Connection line from the MCU to the sender/receiver unit.

Weatherproof cover

A weatherproof cover is available when using the sender/receiver unit outdoors (see “Weatherproof covers”, page 106).



Observe the nominal length of the sender/receiver unit when selecting a weatherproof cover.

2.2.7 Non-return valve

When the measuring system is used in applications with overpressure in the duct, it is possible to protect the sender/receiver unit, external purge air unit and the environment against the consequences of purge air supply failure by installing a non-return valve on the purge air connection of the sender/receiver unit (see [“Installation of non-return valve”](#), page 46).



On the sender/receiver unit for internal duct pressure up to +200 kPa, the non-return valve is part of this unit.

2.2.8 Test equipment for linearity test

A linearity test can serve to check the correct measurement function (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 measuring system. 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.

2.3.1 Sender/receiver unit

Wall and isolation thickness [mm]	Nominal length NL [mm]	Protective tube length [mm]	Exhaust gas, exhaust air		Sender/receiver unit type
			Max. temperature in °C	Composition	
Max. 150	435	300	220	Non-corrosive/low corrosion	DHSP-T2V1xNNXX
				Corrosive	DHSP-T2H1xNNXX
			400	Non-corrosive/low corrosion	DHSP-T4V1xNNXX
				Corrosive	DHSP-T4H1xNNXX
Max. 400	735	600	220	Non-corrosive/low corrosion	DHSP-T2V2xNNXX
				Corrosive	DHSP-T2H2xNNXX
			400	Non-corrosive/low corrosion	DHSP-T4V2xNNXX
				Corrosive	DHSP-T4H2xNNXX
400 ... 720	1035	900	220	Non-corrosive/low corrosion	DHSP-T2V3xNNXX
				Corrosive	DHSP-T2H3xNNXX
			400	Non-corrosive/low corrosion	DHSP-T4V3xNNXX
				Corrosive	DHSP-T4H3xNNXX
700 ... 1020	1335	1200	220	Non-corrosive/low corrosion	DHSP-T2V4xNNXX
				Corrosive	DHSP-T2H4xNNXX
			400	Non-corrosive/low corrosion	DHSP-T4V4xNNXX
				Corrosive	DHSP-T4H4xNNXX
1000 ... 1320	1635	1500	220	Non-corrosive/low corrosion	DHSP-T2V5xNNXX
			400	Corrosive	DHSP-T4H5xNNXX
1200 ... 1520	1835	1700	220	Non-corrosive/low corrosion	DHSP-T2V6xNNXX
			400	Non-corrosive/low corrosion	DHSP-T4V6xNNXX
				Corrosive	DHSP-T4H6xNNXX
1450 ... 1770	2085	1950	220	Corrosive	DHSP-T2H7xNNXX
1800 ... 2120	2435	2300	220	Non-corrosive/low corrosion	DHSP-T2V2xNNXX



- Select the nominal length of the sender/receiver unit so that the measuring opening is an adequate distance away from the internal duct wall (> 100 mm). The measuring opening (see “Sender/receiver unit standard version for internal duct pressure up to +10 kPa”, page 18) does not have to be in the center of the duct.
- Limit values for corrosive gas composition (reference values, lower values should be used for mixtures of several components):
 - HCl: 10 mg/Nm³
 - SO₂: 800 mg/Nm³
 - SO₃: 300 mg/Nm³
 - NO_x: 1000 mg/Nm³
 - HF: 10 mg/Nm³.

2.3.2 Voltage and purge air supply

Internal duct pressure [hPa]	Connection and supply components	
	Purge air	Voltage
-50 ... +10	MCU-P + purge air hose DN25	
-50... +30	Optional external purge air unit + purge air reduction	MCU-N
-50 ... +100	Adapter for instrument air ^[1]	
-800 ... +2000	Non-return valve ^[2] for instrument air connection ¹⁾	

[1] Instrument air onsite (free of dust, oil, moisture, non-corrosive)
 [2] Part of sender/receiver unit for internal duct pressure up to +200 kPa



NOTE:

For temperatures above 220 °C:

- ▶ Always use the optional external purge air supply and sender/receiver unit DHSP-T4xxxNNXX type up to 400 °C.



We recommend using the optional external purge air unit when the sender/receiver unit is more than 10 m away from the MCU control unit.

2.4 SOPAS ET (PC program)

SOPAS ET is a SICK Software for easy operation and configuration of the DUSTHUNTER.

SOPAS ET runs on a laptop/PC connected to the DUSTHUNTER via a USB line or Ethernet interface (option).

The menu structure simplifies changing settings. Further functions are also available (e.g., data storage, graphic displays).

SOPAS ET is delivered on the product CD. Alternatively, you can download SOPAS ET free of charge from the SICK homepage (“Downloads”).

3 Assembly and 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 checked="" type="checkbox"/>	
Determine the measuring and installation locations for the device components	Inlet and outlet paths according to DIN EN 13284-1 (inlet at least 5x hydraulic diameter d_h , outlet at least 3x d_h ; distance to stack opening at least 5x d_h)	For round and square ducts: d_h = duct diameter For rectangular ducts: d_h = 4x cross-section divided by circumference	<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"/>
	Homogeneous 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"/>
	Fitting position for the sender/receiver unit	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"/>
	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"/>
Select the purge air supply	Sufficient primary purge air pressure depending on internal duct pressure	Up to +10 hPa, MCU control unit with integrated purge air supply Above +10 hPa to +30 hPa, optional external purge air unit Above +30 hPa to +200 kPa with instrument air	Select supply type	<input type="checkbox"/>
	Clean intake air	Whenever possible, low amount of dust, no oil, moisture or corrosive gases	<ul style="list-style-type: none"> Select best possible location for air intake Determine required purge air hose length 	<input type="checkbox"/>
Select device components	Internal duct diameter, duct wall thickness with isolation	Nominal length sender/receiver unit, flange with tube	Select components according to the Configuration Tables (see "Device configuration", page 30); nominal length of the sender/receiver only as long as necessary (measurement in duct center not required). If necessary, plan additional measures to fit the flange with tube (see "Fitting the flange with tube", page 35)	<input type="checkbox"/>
	Internal duct pressure	Type of purge air supply		
	Gas temperature	Sender/receiver unit type (up to 220°C or up to 400°C)		
	Gas composition	For corrosive gases, probe made of Hastelloy		
	Fitting locations	Line and purge air hose lengths		
Plan calibration openings	Access	Easy and safe	Provide platforms or pedestals as required	<input type="checkbox"/>
	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"/>

3 ASSEMBLY AND INSTALLATION

Task	Requirements		Work step	<input checked="" type="checkbox"/>
Plan the voltage supply	Operating voltage, power requirements	According to Technical Data (see "Technical Data", page 98)	Plan adequate line cross-sections and fuses	<input type="checkbox"/>

3.2 Assembly

Carry out all assembly work onsite. This includes:

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



WARNING:

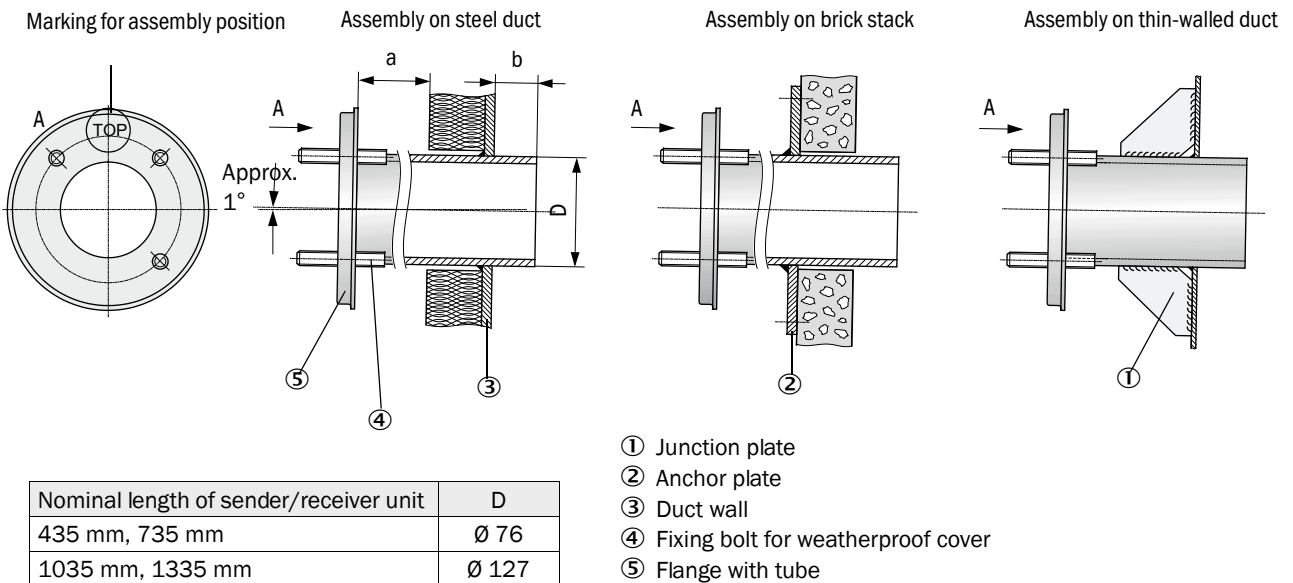
- ▶ Observe the relevant safety regulations as well as the safety notices during all work: [see “Important Information”, page 7](#)
- ▶ Consider the equipment weight specifications when planning the mounting brackets.
- ▶ Only carry out assembly work on equipment with hazard potential (hot or aggressive 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

Fig. 14: Fitting the flange with tube (standard version is shown)



NOTE:

The tube length must suit the planned sender/receiver unit depending on the relation between gas temperature and nominal length ([see “Flange with tube”, page 20](#)).

- ▶ Do not shorten tubes.

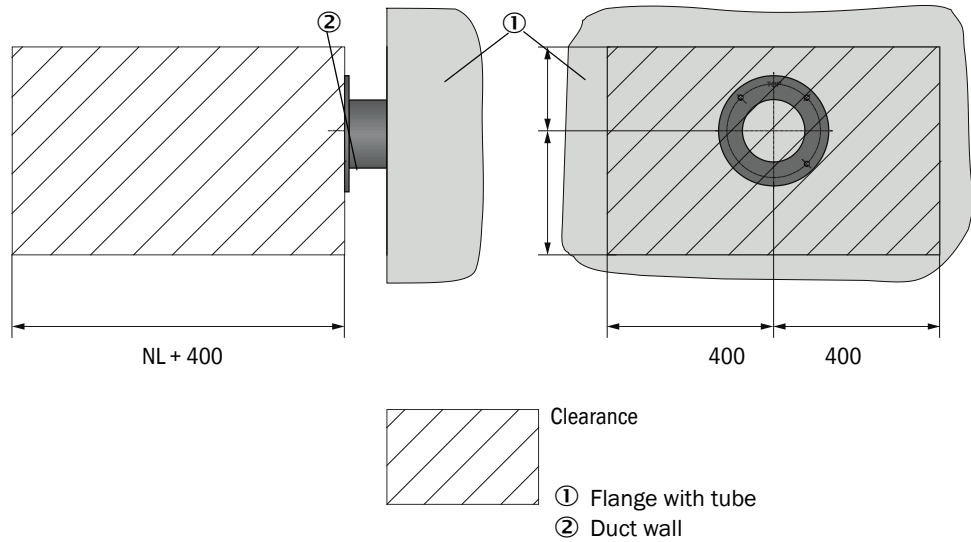


- Dimension a must be large enough so that a weatherproof cover can be fitted easily when necessary (approx. 40 mm).
- Dimension b must be as large as possible under consideration of dimension a.

Work to be performed

- ▶ Measure the fitting location and mark the assembly location and provide sufficient clearance to fit and remove the sender/receiver unit.

Fig. 15: Clearance for the sender/receiver unit



- ▶ Remove insulation (when fitted)
- ▶ Cut suitable openings in the duct wall; bore large enough holes in brick or concrete stacks (flange tube diameter).



NOTE:

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

- ▶ Insert the flange with tube in the opening slanting slightly downwards (1 to 3°) so that the "Top" marking points upwards and any condensate that may collect in the duct can drain off.
- ▶ Weld the flange with tube on using an anchor plate for brick or concrete stacks, insert junction plates for thin-walled ducts.
- ▶ Close off the flange opening after fitting to prevent gas escaping.

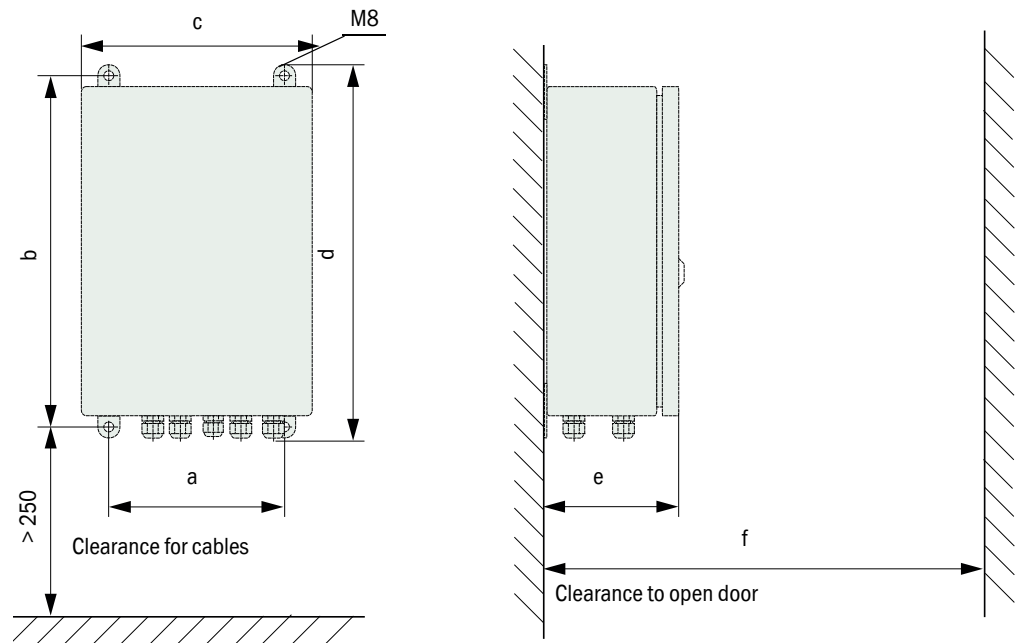
3.2.2 Fitting the MCU control unit

Fit the MCU control unit in a protected location that is easily accessible (see “MCU assembly dimensions”, page 37). 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.
- Provide sufficient clearance for lines and opening the door.

Assembly dimensions

Fig. 16: 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
(see “MCU control unit”, page 21)

Using a suitable line (see “General information, prerequisites”, page 43), 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.

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 (see “Technical Data”, page 98). In unfavorable conditions, lay an air intake hose to a location with better conditions.
- The purge air hose to the sender/receiver unit should be as short as possible.
- When possible, lay the purge air hose so that no water can collect.
- We recommend using the optional external purge air unit when the sender/receiver unit is more than 10 m away from the MCU control unit.

3.2.3 Fitting the optional external purge air unit

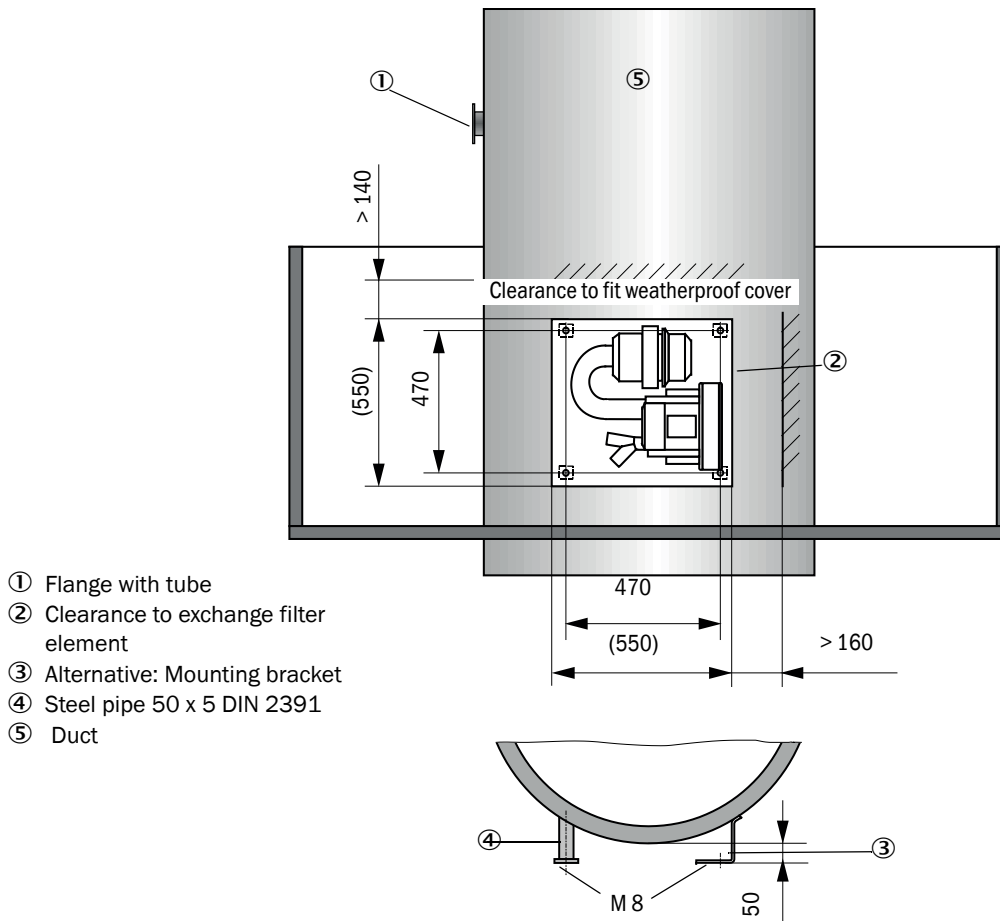
Consider the following points when selecting the assembly location:

- ▶ 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 (see [“Technical Data”, page 98](#)). 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 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 see [“Purge air unit layout and assembly dimensions \(dimensions in mm\)”, page 40](#)).

3.2.4 Assembly work

- ▶ Prepare holder (see “Purge air unit layout and assembly dimensions (dimensions in mm)”, page 40).
- ▶ Fasten purge air unit with 4 M8 screws.
- ▶ Check whether the filter element is fitted in the filter housing otherwise fit when necessary.

Fig. 17: Purge air unit layout and assembly dimensions (dimensions in mm)



3.2.5 Fitting the weatherproof cover

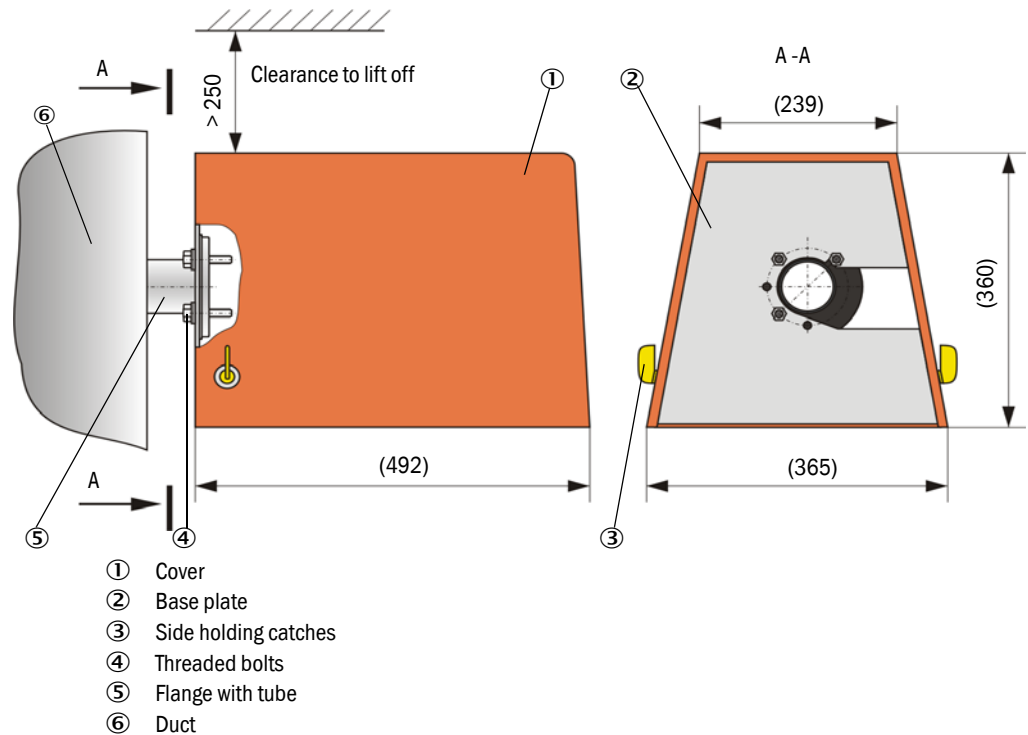
Weatherproof cover for analyzer

This weatherproof cover protects the sender/receiver unit (compare see “Weatherproof cover for sender/receiver unit”, page 106). It comprises a base plate and a cover.

Assembly:

- ▶ Push the base plate (2) sideways on the flange with tube (5), slot onto the threaded bolts (4) of the duct-side surface of the flange plate and screw tight (see “Fitting the weatherproof cover for analyzer (dimensions in mm)”, page 41).
- ▶ Put the cover (1) on from above.
- ▶ Insert the side holding catches (3) into the counterpieces, twist and lock in.

Fig. 18: Fitting the weatherproof cover for analyzer (dimensions in mm)



Weatherproof cover for external purge air unit

The weatherproof cover (see “Weatherproof covers”, page 106) comprises a cover and locking set.

Assembly:

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

3.3 Electrical installation

3.3.1 Electrical safety



WARNING:

- ▶ Observe the relevant safety regulations as well as the safety notices in [see "Important Information", page 7](#) during all installation work.
 - ▶ Take suitable protection measures against possible local hazards or hazards arising from the equipment.
-

3.3.1.1 Properly installed power isolating switches



WARNING:

- Endangerment of electrical safety during installation and maintenance work when the power supply is not switched off.
An electrical accident can occur during installation and maintenance work when the power supply to the device or lines is not switched off using a power isolating switch/circuit breaker.
- ▶ Before starting work on the device, ensure the power supply can be switched off using a power isolating switch/circuit breaker in accordance with DIN EN 61010.
 - ▶ Make sure the power isolating switch is easily accessible.
 - ▶ An additional disconnecting device is mandatory when the power isolating switch cannot be accessed or only with difficulty after installation.
 - ▶ The power supply may only be activated again after the work or for test purposes by personnel carrying out the work under consideration of valid safety regulations.
-

3.3.1.2 Lines with correct rating



WARNING:

- Endangerment of electrical safety through power line with incorrect rating. Electrical accidents can occur when the specifications for replacement of a removable power line have not been adequately observed.
- ▶ Always observe the exact specifications in the Operating Instructions (Technical Data Section) when replacing a removable power line.
-

3.3.1.3 Grounding the devices



CAUTION:

- Device damage through incorrect or missing grounding.
- ▶ During installation and maintenance work, it must be ensured that the protective grounding to the devices and/or lines involved is effective in accordance with EN 61010-1.
-

3.3.1.4 Responsibility for system safety



WARNING:

- Responsibility for the safety of a system.
- ▶ The person setting the system up is responsible for the safety of the system in which the device is integrated.
-

3.3.2 General information, prerequisites

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

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



- Plan adequate line cross-sections (see “Technical Data”, page 98).
- Line ends with plugs to connect the sender/receiver unit must have sufficient free length.

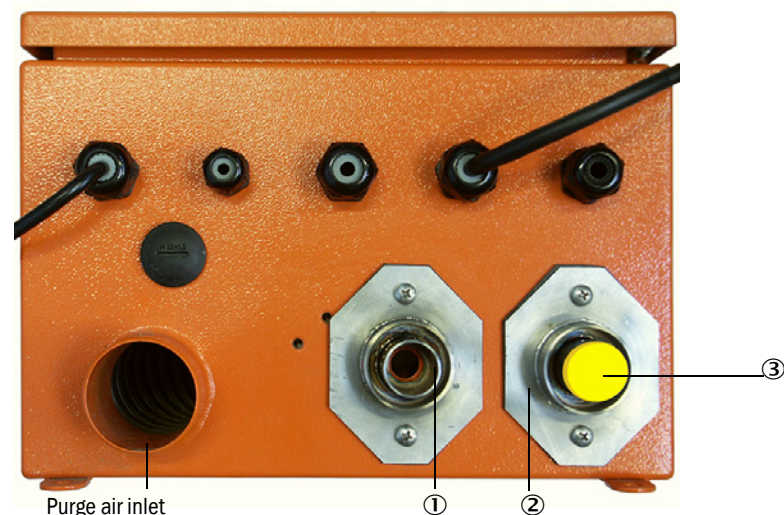
3.3.3 Installing the purge air supply

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

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

Connect the purge air hose DN25 to the purge air outlet DN25 (1) on the underside of the MCU-P and secure with a strap retainer. Set the purge air outlet as shown (correct when necessary). Close the second purge air outlet (2) with a cap (3) (scope of supply).

Fig. 19: Underside of MCU-P

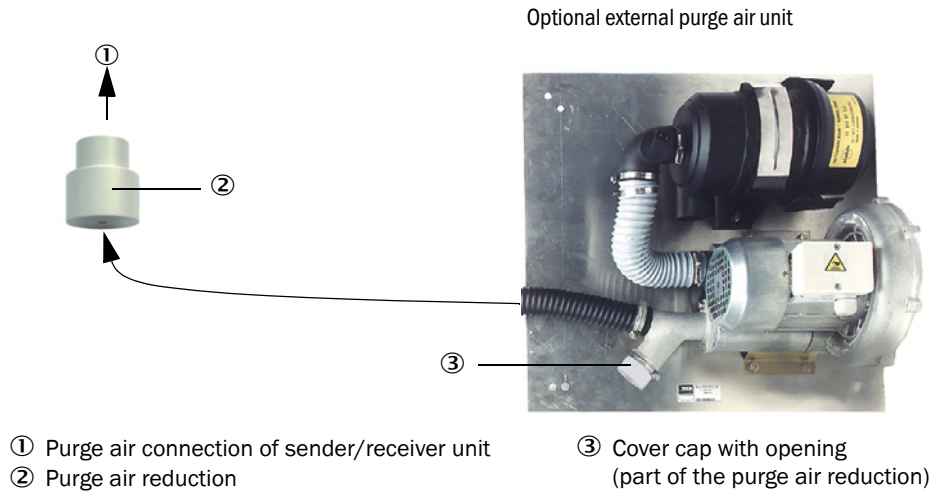


3.3.3.2 Optional external purge air unit

Connect the purge air hose

- ▶ Connect the DN 40 purge air hose to the Y-distributor of the purge air unit and on the purge air reduction and secure with D32-52 hose clamps.
- ▶ Close off the second outlet opening on the Y-distributor with the cover cap.

Fig. 20: Connecting the optional external purge air unit



+i Use the purge air reduction fitted on the sender/receiver unit when using the DHSP-T4XX sender/receiver unit up to 400 °C.

Electrical connection

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

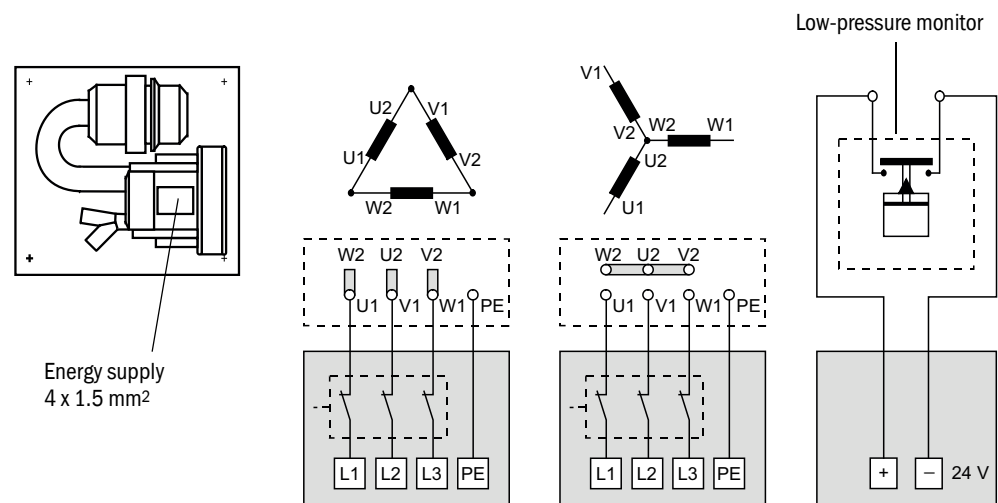


CAUTION:

- ▶ Only connect when these match!

- ▶ Connect the power supply line 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).

Fig. 21: Electrical connection of the external purge air unit



- ▶ Connect protective conductor to terminal.

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



NOTE:

In case of doubt or when using a special motor version, the operating instructions supplied with the motor have priority over any other information.

- ▶ 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 power connections L1 and L2.
- ▶ Connect the pressure controller (option) to monitor purge air feed.



NOTE:

- ▶ Use a fail-safe power supply (standby unit, rails with redundant supply)
- ▶ Fuse the purge air unit separate from the other system components. The fuse type must match the rated current (see technical details of purge air unit). Fuse each phase separately. Use circuit breakers to prevent phase failures on one side.

3.3.3.3 Purging with instrument air



NOTE:

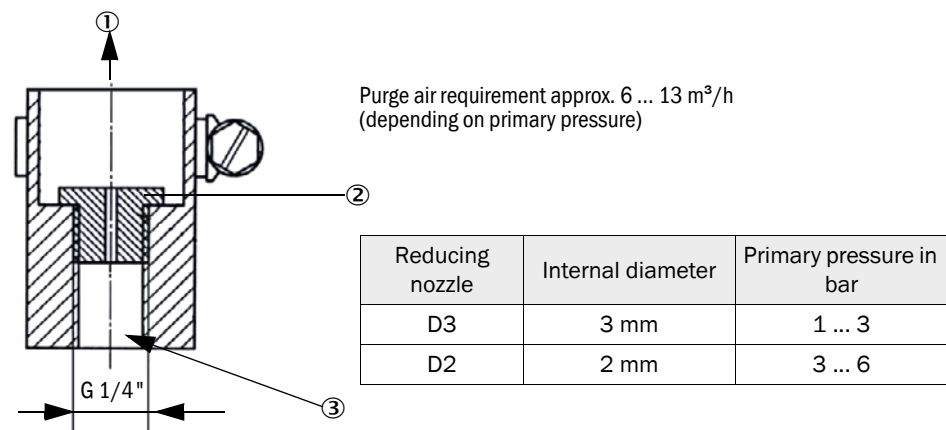
The purge air available onsite must be free from dust, oil and condensate.

- ▶ Select the reducing nozzle (scope of delivery) matching the primary pressure and screw it into the adapter for instrument air supply.
- ▶ Connect the instrument air hose to the adapter thread.



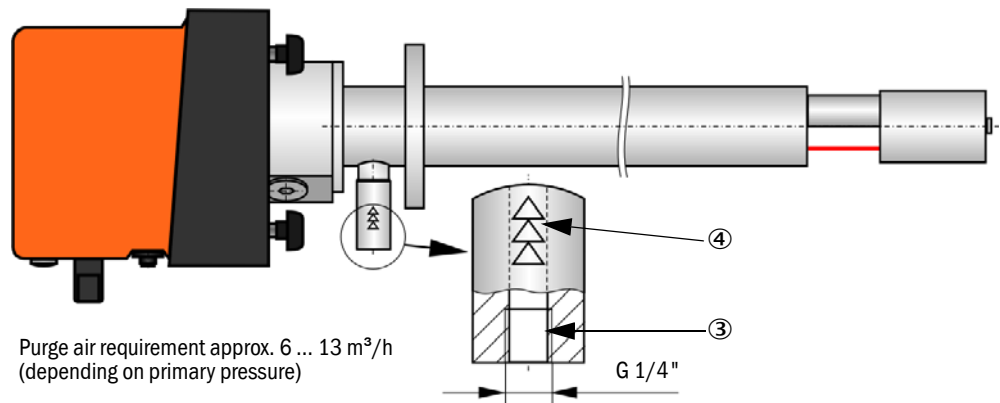
The adapter for instrument air supply can be supplied with a reducing nipple for other adapter threads on request.

Fig. 22: Adapter connection for instrument air supply



- ① Purge air connection of sender/receiver unit
- ② Reducing nozzle

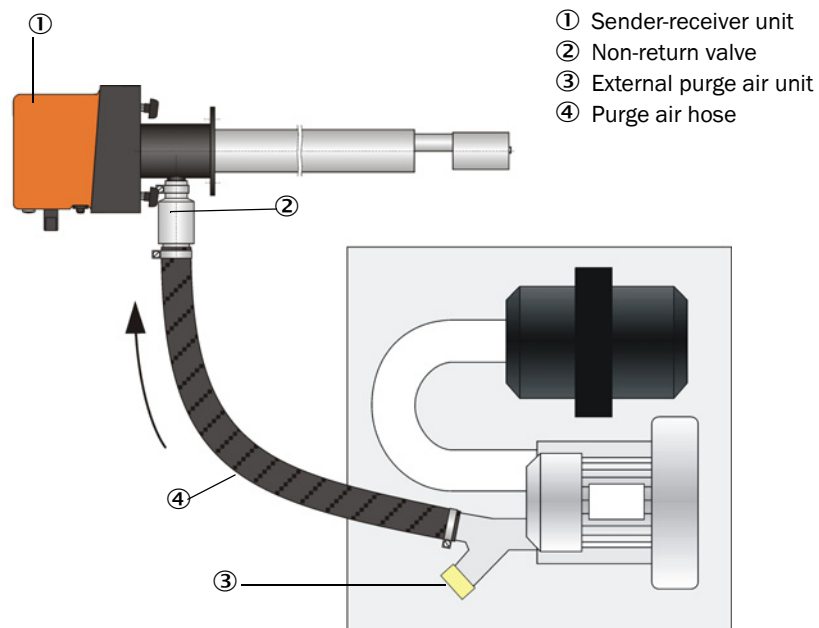
Fig. 23: Instrument air connection of sender/receiver unit for internal duct pressure up to +200 kPa



- ③ Instrument air connection
- ④ Marking for flow direction

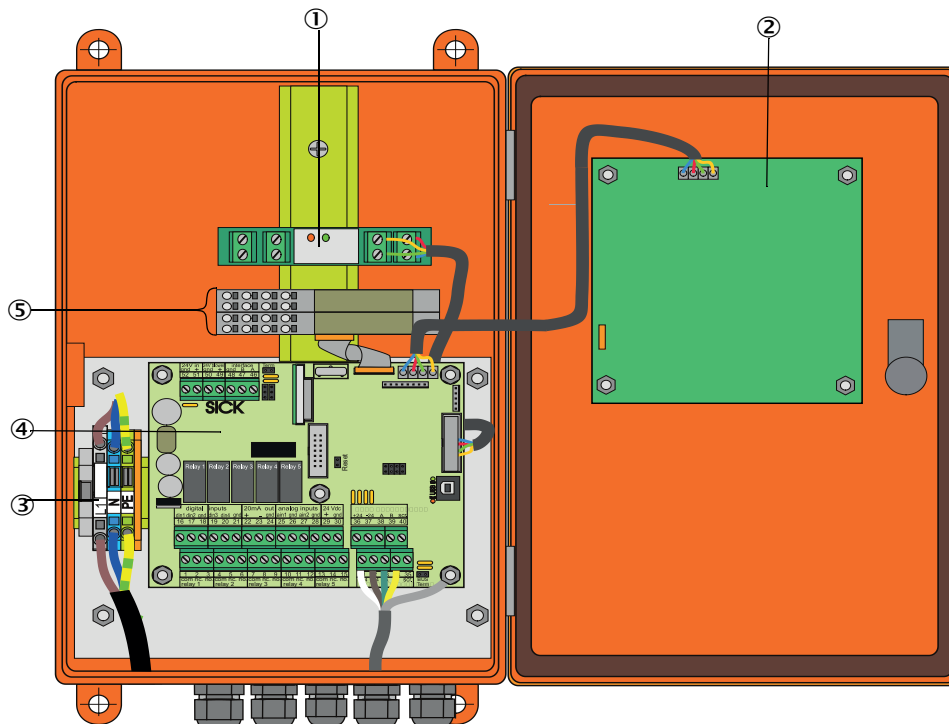
3.3.3.4 Installing the non-return valve option

Fig. 24: Installation of non-return valve



3.3.4 Connecting the MCU control unit

Fig. 25: Component layout in the MCU (without purge air supply, with options)



- | | |
|----------------------------------|------------------------|
| ① Optional Interface module | ④ Processor board |
| ② Optional Display module | ⑤ Optional I/O modules |
| ③ Terminals for power connection | |

3.3.4.1 Work to be done

- ▶ Connect the connection line: see “Standard connection”, page 50.



If an onsite line is to be used, it must be connected to a suitable 7-pole socket (see “Plug connector connection to onsite line”, page 49; SICK Part No.: 7045569).

- ▶ Connect lines for status signals (operation/failure, maintenance, function check, maintenance request, limit value), analog output, analog and digital inputs according to requirements (see “Standard connection”, page 50, p. 53, Fig. 30 and Fig. “Terminal assignment of analog input module”; only use shielded lines with twisted pairs).



NOTICE:

- ▶ Only use shielded lines with twisted pairs (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 line to terminals L1, N, PE of the MCU (see “Component layout in the MCU (without purge air supply, with options)”, page 47).
- ▶ Close off unused line openings with dummy plugs.



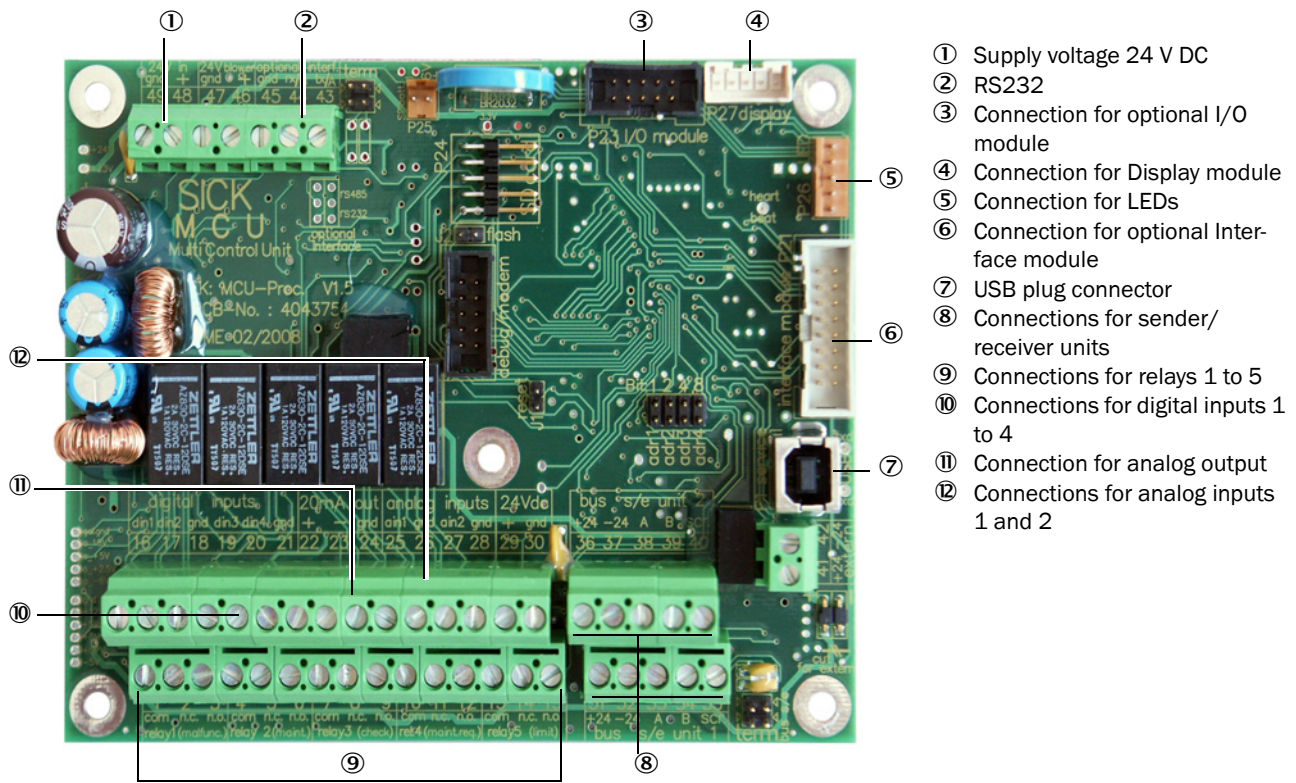
WARNING:

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

3 ASSEMBLY AND INSTALLATION

3.3.4.2 MCU processor board connections

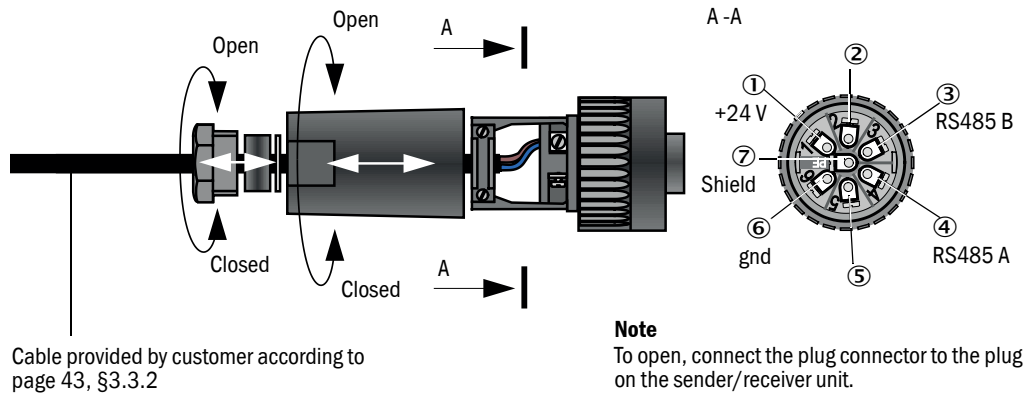
Fig. 26: MCU processor board connections



- ① Supply voltage 24 V DC
- ② RS232
- ③ Connection for optional I/O module
- ④ Connection for Display module
- ⑤ Connection for LEDs
- ⑥ Connection for optional Interface module
- ⑦ USB plug connector
- ⑧ Connections for sender/receiver units
- ⑨ Connections for relays 1 to 5
- ⑩ Connections for digital inputs 1 to 4
- ⑪ Connection for analog output
- ⑫ Connections for analog inputs 1 and 2

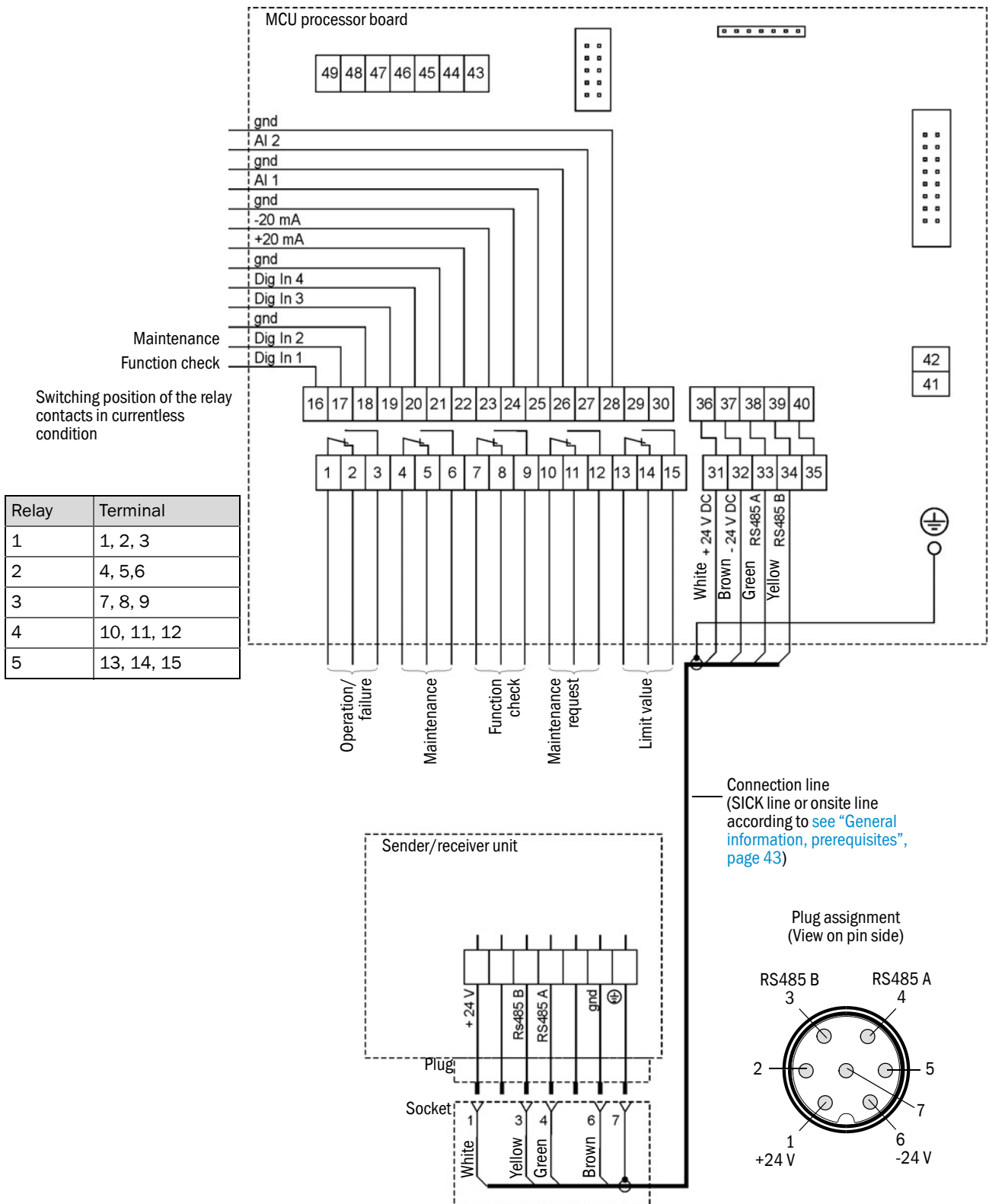
3.3.4.3 Connection of connection line to MCU

Fig. 27: Plug connector connection to onsite line



3.3.4.4 Standard connection

Fig. 28: Standard connection



3.3.5 Connecting the MCU remote control unit

3.3.5.1 Connection to the MCU control unit

Electrical connection see “Standard connection”, page 50

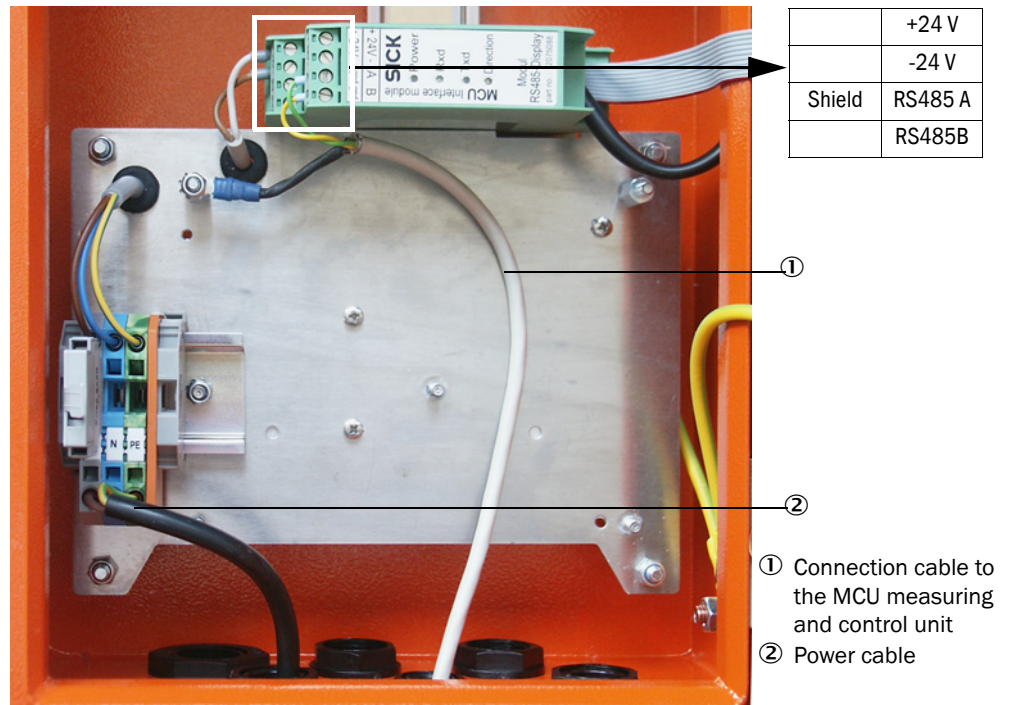
- Electrical connection of the MCU remote control unit without an own power supply unit:
 - 24V supply: Terminals 36 and 37 (or equivalent)
 - Signals: Terminals 38 and 39 (or equivalent)
- Electrical connection of the MCU remote control unit with an own power supply unit:
 - Signals: Terminals 38 and 39 (or equivalent)

3.3.5.2 Connection to the MCU remote control unit

Version without power supply unit

- Connect the connection cable to the measuring and control unit (4-wire, twisted pair, with shield) to the connections in the control unit and the module of the remote unit.

Fig. 29: Connections in the remote control unit (version with integrated wide-range power pack)



Version with integrated wide-range power pack:

- Connect the 2-wire cable (twisted pair, with shield) to the connections for RS485 A/B and shield in the control and remote control unit.
- Connect the 3-wire power cable with sufficient cross-section to the onsite power supply and the corresponding terminals in the remote unit.



NOTICE:

- ▶ During installation, it must be possible to switch the power supply off using a power isolating switch/circuit breaker in accordance with EN 61010-1.
- ▶ After completion of the work or for test purposes, the power supply may only be activated again by the personnel who carried out the work and complying with the valid safety regulations.

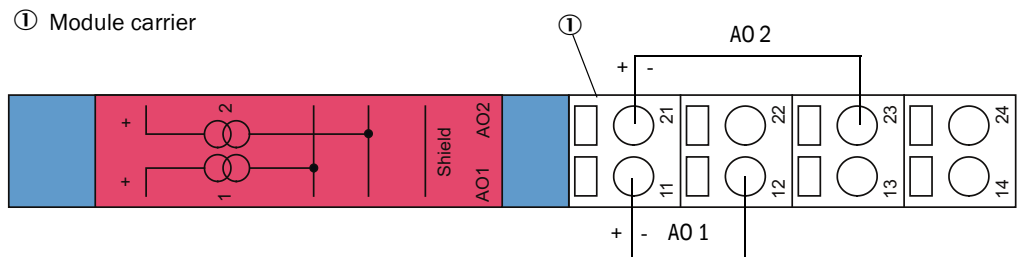
3.3.6 Fitting the interface and I/O module (option)

Plug Interface modules and module carriers for I/O modules onto the hat rail in the MCU (see “Component layout in the MCU (without purge air supply, with options)”, page 47) and connect to the associated connection on the processor board with the line with plug connector (see “MCU processor board connections”, page 48). Then plug the I/O modules on the module carriers.

Connect the Interface modules using the customer provided network line to the local network. Use the terminals on the module carrier to connect I/O modules.

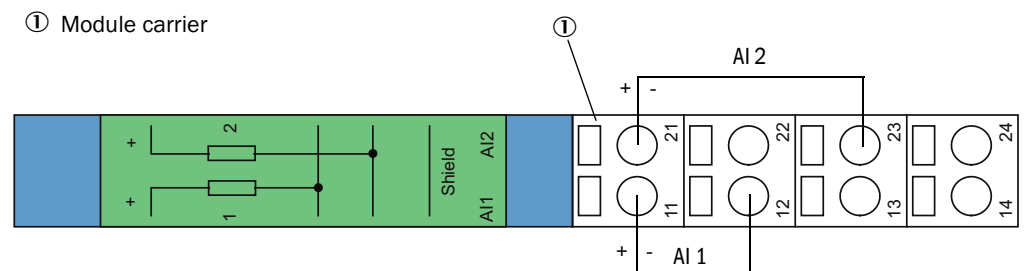
Terminal assignment of AO module

Fig. 30: Terminal assignment of analog output module



Terminal assignment of AI module

Fig. 31: Terminal assignment of analog input module



4 Start-up and Parameter Settings

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:

- Fitting and connecting the sender/receiver unit,
- Customizing parameter settings according to the respective requirements.

To achieve exact measurement, the measuring system must first be calibrated using a gravimetric comparison measurement (see [“Calibration for dust concentration measurement”](#), page 69) before being used for continuous measurement of dust content.

4.1.2 Installing SOPAS ET

- Install SOPAS ET on a laptop/PC.
- Start SOPAS ET.
- Following the installation instructions of SOPAS ET.

4.1.2.1 Password for SOPAS ET menus

Certain device functions are first accessible after a password has been entered.

User level	Access to
0 Operator	Displays measured values and system states No password required
1 Authorized operator	Displays, inquiries as well as start-up or adjustment to customer-specific demands and diagnosis of necessary parameters. Preset password: sickoptic

4.1.3 Connection to the device via USB line

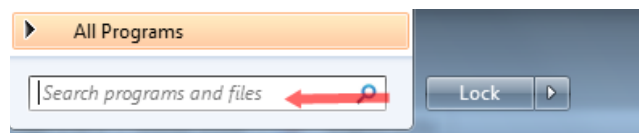
Recommended procedure:

- 1 Connect the USB line to the MCU control unit (see “MCU processor board connections”, page 48) and the laptop/PC.
- 2 Switch the device on.
- 3 Start SOPAS ET.
- 4 “Search settings”
- 5 “Device family oriented search”
- 6 Click the desired MCU.
- 7 Make the settings:
 - Ethernet communication (always clicked)
 - USB communication (always clicked)
 - Serial communication: Click
- 8 Do not specify IP addresses.
- 9 A list of COM ports is shown.
Specify the COM port of the DUSTHUNTER.
If you do not know the COM port: see “Finding the DUSTHUNTER COM port”, page 55
- 10 Assign a name for this search.
- 11 “Finish”

4.1.3.1 Finding the DUSTHUNTER COM port

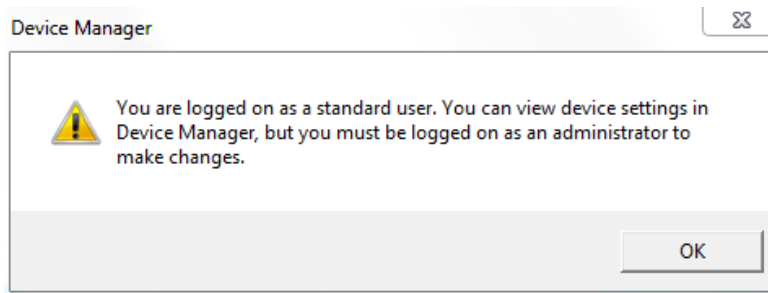
If you do not know your COM port: You can find the COM port with the Windows Device Manager (Administrator rights are not required).

- 1 Disconnect the DUSTHUNTER from your laptop/PC.
- 2 Input: `devmgmt.msc`



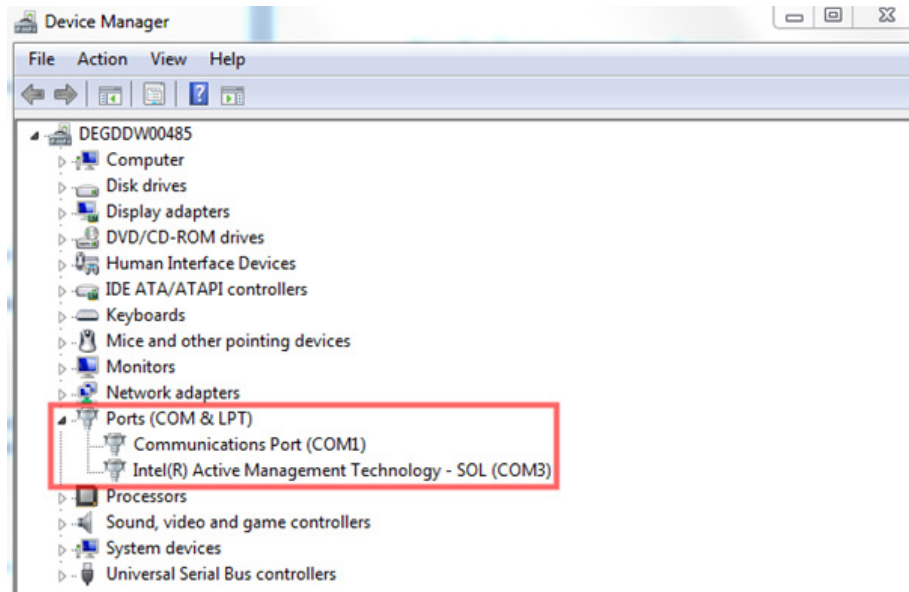
4 START-UP AND PARAMETER SETTINGS

3 This message is shown:

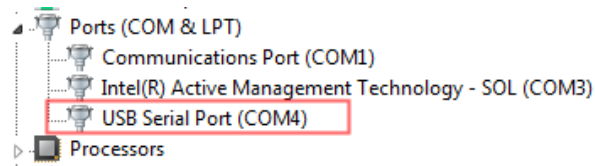


4 "OK"

5 The Device Manager opens.
See: "Ports (COM & LPT)"



6 Now connect the MCU with the laptop/PC.
A new COM port is shown.



Use this COM port for communication.

4.1.4 Connection to the device via Ethernet (option)



The Ethernet interface module (see “Options for MCU control unit”, page 108) must be installed in the MCU (see “Fitting the interface and I/O module (option)”, page 53) and configured (see “Setting the Ethernet module parameters”, page 74) to connect to the measuring system via Ethernet.

Recommended procedure:

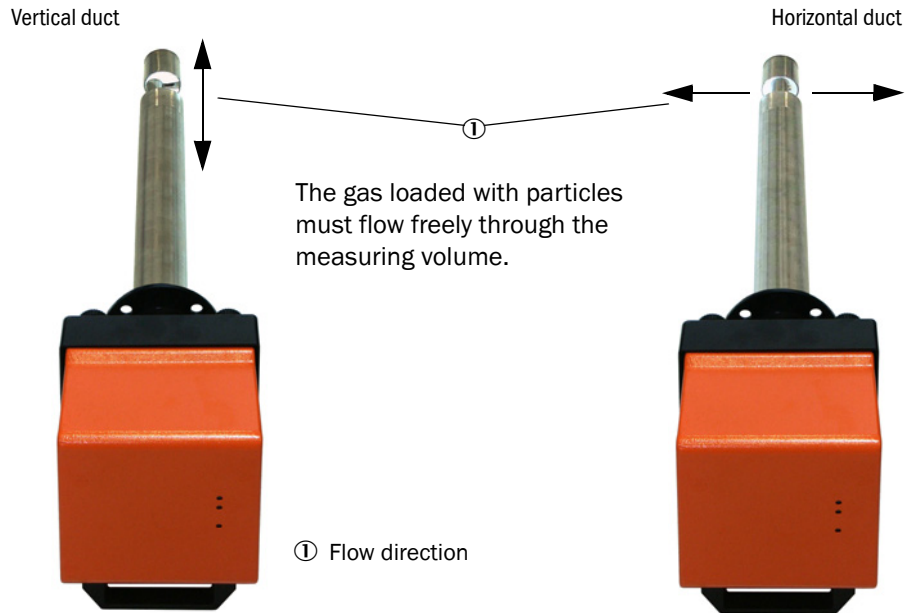
- 1 The MCU must be switched off.
- 2 Connect the MCU with the network.
- 3 Connect the PC to the same network.
- 4 Switch the MCU on.
- 5 Start SOPAS ET.
- 6 “Search settings”
- 7 “Device family oriented search”
- 8 Click the desired MCU
- 9 Make the settings:
 - Ethernet communication (always clicked)
 - USB communication (always clicked)
 - Serial communication: Do *not* click
- 10 Specify the IP addresses
 - IP address: see “Setting the Ethernet module parameters”, page 74
- 11 Do not click a COM port
- 12 Assign a name for this search
- 13 “Finish”

4.2 Fitting the sender/receiver unit

4.2.1 Adapting the sender/receiver unit to the flow direction

Versions for internal duct pressure up to +10 kPa

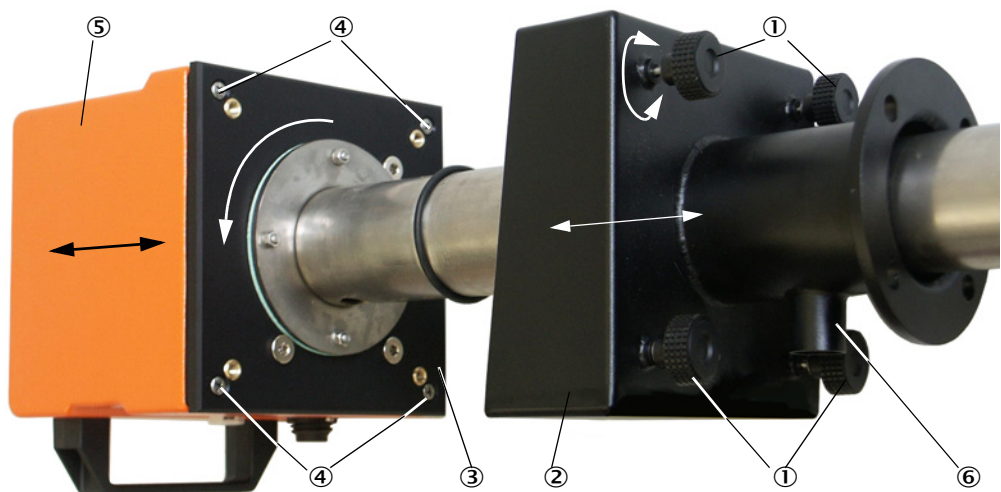
Fig. 32: Probe alignment



The sender/receiver unit is delivered for vertical fitting as standard when the duct direction (horizontal or vertical) is not specified in the order. In this case, the following steps are required for horizontal fitting:

- ▶ Loosen knurled screws (1) and pull probe flange (2) off electronics unit (3).
- ▶ Loosen fastening screws (4), pull the probe with electronics unit carefully out of enclosure (5), turn it 90° and fasten it again.
- ▶ Fit the probe flange so that purge air connection (6) is underneath when fitted.


Fig. 33: Adapting the sender/receiver unit to the flow direction



Sender/receiver unit for internal duct pressure up to +200 kPa

In this version, measuring probe and electronics unit in the pressure-proof enclosure cannot be rotated towards each other by 90 °. The sender/receiver unit must be installed as shown in [see “Probe alignment”, page 58](#) depending on the flow direction.


4.2.2 Fitting and connecting the sender/receiver unit

 **WARNING: Danger from exhaust gas**


- ▶ Install the sender/receiver unit on the duct of equipment with hazard potential (e.g., toxic, aggressive, explosive gases/dusts, danger to health, high pressure, high temperatures) only when the equipment is at a standstill.

- ▶ Connect the sender/receiver unit to the purge air supply and check whether the flow direction is correct and the purge air hose is fitted tight on the connection.

Type of purge air supply	Activity
MCU-P control unit	Push the DN 25 purge air hose onto the connection of the sender/receiver unit and secure with a strap retainer.
External purge air unit	Push the DN 40 purge air hose with purge air reduction onto the connection of the sender/receiver unit (see “Connecting the optional external purge air unit”, page 44) and secure with a strap retainer. Note Use the purge air reduction fitted on the sender/receiver unit when using the DHSP-T4xx sender/receiver unit up to 400 °C.
Instrument air	Connect the instrument air hose to the thread of the adapter for instrument air supply (see “Adapter connection for instrument air supply”, page 45), then push this onto the connection on the sender/receiver unit and secure with a strap retainer

 For gas flow rates < 5 m/s we recommend to reduce the purge air flow by installation of an onsite pressure reducer to a value which approximately equals the gas flow rate.

- ▶ Push the sender/receiver unit with the correct alignment ([see “Probe alignment”, page 58](#)) into the flange with tube (do not forget the seal) and fasten with the assembly kit. Make sure the probe head is not damaged during fitting.

 We recommend closing off the opening no longer required with the delivered cover for sender/receiver units for an internal duct pressure up to +10 kPa. This helps to prevent incorrect alignment to the flow direction when the device has to be fitted again (e.g., during maintenance).

- ▶ Connect the connection line to the MCU on the plug connector and screw tight.

4.2.3 Assigning the sender/receiver unit to the measuring location (in SOPAS ET)

The sender/receiver unit can be assigned explicitly to the respective measuring location. The following steps are then necessary:

- ▶ Start the SOPAS ET program and connect to the measuring system (see “Connection to the device via USB line”, page 55).
- ▶ Select device file “DH SP100” and move it to the “Project Tree” window.

+i The respective device type connected is displayed automatically

- ▶ Enter password level 1.
- ▶ Set the sender/receiver unit to “Maintenance”: Click “Maintenance sensor”.

Fig. 34: SOPAS ET menu: DH SP100/Maintenance/Maintenance

Device identification

DH T 100 Mounting location

Set on operational mode

Maintenance Maintenance sensor

- ▶ Select the “Configuration / Application Parameters” directory and enter the desired data in the “Mounting location” entry field under “Device Identification”.

Fig. 35: SOPAS ET menu: DH SP100/Configuration/Application parameter

Device identification

DH SP100 Mounting location

Calibration coefficients for calculation of concentration with scattered light

Satz 0 ▾

	cc2	cc1	cc0
<input checked="" type="radio"/> Set 0	<input type="text" value="0"/>	<input type="text" value="1"/>	<input type="text" value="0"/>
<input type="radio"/> Set 1	<input type="text" value="0"/>	<input type="text" value="0.5"/>	<input type="text" value="0"/>
<input type="radio"/> Set 2	<input type="text" value="0"/>	<input type="text" value="2"/>	<input type="text" value="0"/>
<input type="radio"/> Set 3	<input type="text" value="0"/>	<input type="text" value="3"/>	<input type="text" value="0"/>

Defining regression coefficients

The “Calibration coefficients for calculation of concentration with scattered light” field serves to select a coefficients set freely (set 0) or a fixed default setting (sets 1 to 3).

Set	Regression coefficients setting	Typical application	Regression coefficients		
			Quadratic	Linear	Absolute
Set 0	Freely selectable	Any	0	1	0
Set 1	Fixed: For small particle sizes (on average 2 µm)	Usage after cloth filter plants	0	0.5	0
Set 2	Fixed: For medium particle sizes (on average 5 µm)	Usage after electrofilter	0	2	0
Set 3	Fixed; for large particle sizes (on average 10 µm)	Usage after coarse filter (cyclone filter)	0	3	0



The regression coefficients in sets 1 to 3 refer to dusts with an average density of 2.5 g/cm³, almost spherical particle structure and even dust distribution across the duct cross-section.

Select set 0 when the measuring system must be calibrated (see “[Calibration for dust concentration measurement](#)”, page 69).

Sets 1 to 3 can be used when the highest precision is not decisive.

4.3 Setting standard parameters

4.3.1 Assigning the MCU to the sender/receiver unit

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

- ▶ Connect the measuring system to the SOPAS ET program.
- ▶ Enter the Level 1 password (see “[Password and operating levels](#)”, page 75).
- ▶ Set the sender/receiver unit to “Maintenance”: Click “Maintenance sensor”.

Fig. 36: SOPAS ET menu: MCU/Maintenance/Maintenance

The screenshot shows two sections of the SOPAS ET menu. The top section, titled "Device Identification", contains a "MCU" dropdown menu, a "Selected variant" dropdown menu with "DUSTHUNTER" selected, and a "Mounting Location" text input field with "SICK" entered. The bottom section, titled "Offline Maintenance", contains a checkbox labeled "Activate offline maintenance" which is checked.

- ▶ Change to the “Configuration / Application selection” directory (see “[SOPAS ET menu: MCU/Configuration/Application selection](#)”, page 62).
- ▶ The basic type of the sender/receiver unit connected is displayed in the “Connected variant” window (field “Application selection”). Click “Save selection” to assign to the MCU.



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

Fig. 37: SOPAS ET menu: MCU/Configuration/Application selection

The screenshot shows two sections of the SOPAS ET menu. The top section, titled "Device Identification", contains a "MCU" dropdown menu, a "Selected variant" dropdown menu with "DUSTHUNTER T (T50,T100,T200)" selected, and a "Mounting Location" text input field with "SICK" entered. The bottom section, titled "Application selection", contains a "Connected variant" text field with "DUSTHUNTER T (T50,T100,T200)" displayed, a "Save selection" button, and a list of "Supported variants" including: DUSTHUNTER S (SB50, SB100, SF100, SP100), DUSTHUNTER T (T50, T100, T200), DUSTHUNTER C (C200), FLOWVIC 100, FLOWVIC 100 - 2 Path, DH_S+FL100 Combination, DH_T+FL100 Combination, DH_C+FL100 Combination, FWE200DH, and Universal.

4.3.2 Factory settings

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

The steps required to modify these settings are described in the following Sections. For this purpose, the devices must be connected in SOPAS ET (see [“Connection to the device via USB line”](#), page 55), the Level 1 password set and the “Maintenance” mode set.

4.3.3 Determining the function check

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

+i Default values see “Factory settings”, page 63

Fig. 38: SOPAS ET menu: MCU/Adjustment/Function Check - Automatic (example)

Device Identification		
MCU	Selected variant: DUSTHUNTER	Mounting Location: SICK
Function Check		
Output duration of function control value	90 s	
Function check interval	8 hours	
Function Check Start Time		
Hour	8	Minute: 0

Entry field	Parameter	Remark
Output duration of function control value	Value in seconds	Output duration of control values.
Function check interval	Time between two check cycles	see “Function check”, page 13
Function Check Start Time	Hour	Defining a start timepoint in hours and minutes.
	Minute	

+i The value measured last is output during control value determination (see “Function check output on a plotter”, page 13).

4.3.4 Setting the analog outputs parameters

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



- Default values see “Factory settings”, page 63
- In order to output the dust concentration under standard conditions (“Conc. s.c.” (Ext)), set the parameters for the analog outputs according to see “Setting the analog inputs parameters”, page 67.

Fig. 39: SOPAS ET menu: MCU/Configuration/IO configuration/Output Parameters

Device Identification	
MCU	Selected variant: DUSTHUNTER
Mounting Location: SICK	
Analog Outputs - General Configuration	
Output Error current: yes	Error Current: 21 mA
Current in maintenance: Measured value	Maintenance current: 0.5 mA
Optional Analog Output Modules	
Use first analog output module: <input type="checkbox"/>	
Analog Output 1 Parameter	Analog Output 1 Scaling
Value on analog output 1: Conc. a.c. (SL)	Range low: 0.00 mg/m ³
Live zero: 4mA	Range high: 0.00 mg/m ³
Output checkcycle results on the AO: <input type="checkbox"/>	
Write absolute value: <input type="checkbox"/>	
Limiting Value	Limit Switch Parameters
Limit value: Conc. a.c. (SL)	Limit value: 0.00 mg/m ³
Hysteresis type: <input type="radio"/> Percent <input checked="" type="radio"/> Absolute	Hysteresis: 1.00 mg/m ³
Switch at: Over Limit	

4 START-UP AND PARAMETER SETTINGS

Field		Parameter	Remark	
Analog Outputs - General Configuration	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).	
		User defined value	A value to be defined is output during "Maintenance"	
			Value measured last	The value measured last is output during "Maintenance"
	Maintenance current	Measured value output	The current measured value is output during "Maintenance".	
Whenever possible, value ≠ LZ		mA value to be output in "Maintenance" state		
Optional Analog Output Modules	Use first analog output module	Inactive	Not permitted for DUSTHUNTER SP100 (results in error, because AO 2 and AO 3 are available by default).	
		Active	Opens the fields to set parameters for AO 2 and AO 3 (standard on DUSTHUNTER SP100)	
Analog Output 1 Parameter	Value on analog output 1	Concentration a.c. (SI)	Dust concentration under standard conditions (based on scattered light intensity)	The selected measured variables are output on the analog output.
		Conc.s.c.dry O2 corr. (SI)	Dust concentration under standard conditions (based on scattered light intensity)	
		SI	Scattered light intensity	
	Live zero	Zero point (0, 2 or 4 mA)	Select 2 or 4 mA to ensure being able to differentiate between measured value and switched off device or interrupted current loop.	
	Output checkcycle results on the AO	Inactive	Control values (see "Function check", page 13) are not output on the analog output.	
		Active	Control values are output on the analog output .	
	Write absolute value	Inactive	Positive and negative measured values are differentiated.	
Active		The amount of the measured value is output.		
Analog Output 1 Scaling	Range low	Lower measuring range limit	Physical value at live zero	
	Range high	Upper measuring range limit	Physical value at 20 mA	
Limiting Value	Limit value	Concentration a.c. (SI)	Dust concentration under standard conditions (based on scattered light intensity)	Select the measured variable for which a limit value is to be monitored.
		Conc.s.c.dry O2 corr. (SI)	Dust concentration under standard conditions (based on scattered light intensity)	
		SI	Scattered light intensity	
	Hysteresis type	Percent	Assignment of the value entered in the "Hysteresis value" field as relative or absolute value of defined limit value	
		Absolute		
	Switch at	Value exceeded	Define the switching direction	
Underflow				
Limit Switch Parameters	Limit value	Value	The limit value relay switches when the entered value is overflown or underflown.	
	Hysteresis	Value	Define 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".

4.3.5 Setting the analog inputs parameters

Select the “Configuration / I/O Configuration / Input Parameters DUSTHUNTER” directory to set the analog inputs.

Fig. 40: SOPAS ET menu: MCU/Configuration/IO configuration/Input Parameters

Field	Parameter	Remark
Temperature Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the “Temperature Constant” 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 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 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 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 4 (optional module required) is used to calculate the scaled value. This parameter opens the “Analog input 4 - Oxygen” field to set the lower and upper range limit values and the Live Zero value.

4.3.6 Setting the response time

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

Fig. 41: SOPAS ET menu: MCU/Configuration/Value Damping

Device Identification		
MCU	Selected variant	DUSTHUNTER
	Mounting Location	SICK
Value Damping Time		
Damping time for Sensor 1		60 sec

Field	Parameter	Remark
Damping time for Sensor 1	Value in s	Response time for the selected measured variable (see “Response time”, page 12) Setting range 1 ... 600 s

4.3.7 Calibration for dust concentration measurement

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



NOTE:

Carrying out a gravimetric comparison measurement demands special knowledge that cannot be described in detail here.

Steps to be carried out

- ▶ Select device file “MCU”, set the measuring system to “Maintenance” mode
- ▶ Enter the Level 1 password (see “Password and operating levels”, page 75).
- ▶ Select the “Configuration / IO Configuration / Output Parameters” directory (see “SOPAS ET menu: MCU/Configuration/IO configuration/Output Parameters”, page 65) and assign the “Scattered light intensity” measured variable to one of the three analog outputs available.
- ▶ Estimate the measuring range required for the dust concentration in operational state and enter this in the “Analog Output 1 (2/3) Scaling” field assigned to the selected analog output assigned to the scattered light intensity.
- ▶ Deactivate “Maintenance” mode.
- ▶ Carry out the gravimetric comparison measurement according to DIN EN 13284-1.
- ▶ Determine regression coefficients from the mA values of the analog output for “Scattered light intensity” and the actual dust concentrations measured gravimetrically.

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

c: Dust concentration in mg/m³
 K2, K1, K0: Regression coefficients of the function $c = f(I_{\text{out}})$
 I_{out}: Current output value in mA

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

SI: Measured scattered light intensity
 LZ: Live Zero
 MBE: Defined upper range limit value
 (value entered for 20 mA;
 normally 2.5 x fixed limit value)

► Enter the regression coefficients

There are two options:

- Direct input of K2, K1, K0 in a measured value computer.



NOTE:

In this case, the regression coefficients set in the sender/receiver unit and the measuring range set in the MCU may not be changed anymore. On the optional LC Display (when used), the dust concentration is displayed as uncalibrated value in mg/m³.

- Use the regression function of the measuring system (use without measured value computer). In this case, the correlation to the scattered light intensity has to be determined. To do this, calculate the regression coefficients cc2, cc1, cc0 to be entered in the measuring system from K2, K1, K0.

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

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

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

Using (3), the result is as follows:

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

Now enter the regression coefficients cc2, cc1 and cc0 determined in directory “Configuration/Application parameters” (see [“Assigning the sender/receiver unit to the measuring location \(in SOPAS ET\)”](#), page 60) (set sender/receiver unit to “Maintenance” state and enter the Level 1 password).

Reset the sender/receiver unit back to “Measurement” state afterwards).




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

4.3.8 Data backup in SOPAS ET

All parameters relevant for recording, processing and input/output of measured values as well as current measured values can be saved in SOPAS ET and printed. This allows easy reentering of set device parameters as needed or registering device data and states for diagnostic purposes.

The following options are available:

- Saving as a project
Not only device parameters but also data logs can be saved.
- Saving as a device file
Saved parameters can be processed without a device connected and transferred to the device again later.

 Description, see SOPAS ET Help menu and DUSTHUNTER Service Manual.

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

Parameter protocol example

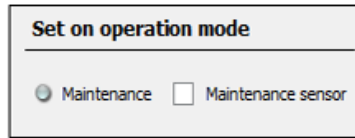
Fig. 42: DUSTHUNTER SP100 Parameter protocol (example)

Dusthunter - Parameter protocol	
Type of device: DH SP100	
<i>Mounting location:</i>	
<hr/>	
Device information	Factory calibration settings
<i>Device version</i>	Gains
<i>Firmware version</i>	<i>ANO-AN1</i> 10.2000
<i>Serial number</i> 00008700	<i>Relais 1</i> 5.7000
<i>Identity number</i> 00000	<i>Relais 2</i> 31.0000
<i>Hardware version</i> 1.0	<i>Relais 3</i> 700.0000
<i>Firmware bootloader</i> V00.99.15	Offsets
	<i>ANO</i> 0.000450
Installation parameter	<i>Relais 1</i> 0.000250
<i>Bus adress</i> 1	<i>Relais 2</i> 0.000050
<i>Measurement laser temperature</i> inactiv	<i>Relais 3</i> 0.000010
Calibration coefficient for calculation of concentration	Scattered light
<i>Coefficient set</i> Polynomial	<i>cc2</i> 0.0000
Set 0	<i>cc1</i> 1.0000
<i>cc2</i> 0.0000	<i>cc0</i> 0.0000
<i>cc1</i> 1.0000	Current laser
<i>cc0</i> 0.0000	<i>cc2</i> 0.0000
Set 1 (fix)	<i>cc1</i> 30.3000
<i>cc2</i> 0.0000	<i>cc0</i> 0.0000
<i>cc1</i> 0.5000	Device temperature
<i>cc0</i> 0.0000	<i>cc2</i> 0.0000
Set 2 (fix)	<i>cc1</i> 100.0000
<i>cc2</i> 0.0000	<i>cc0</i> -275.1500
<i>cc1</i> 2.0000	Current motor
<i>cc0</i> 0.0000	<i>cc2</i> 0.0000
Set 3 (fix)	<i>cc1</i> 2000.0000
<i>cc2</i> 0.0000	<i>cc0</i> -19.5000
<i>cc1</i> 3.0000	Power supply
<i>cc0</i> 0.0000	<i>cc2</i> 0.0000
Device parameter	<i>cc1</i> 10.8000
Factory settings	<i>cc0</i> 0.0000
<i>Response time Sensor</i> 1.0 s	
<i>Response time diagnosis values</i> 10.0 s	

4.3.9 Starting measurement mode

Set the measuring system to “Measurement” mode after entering/modifying parameters. To do so, cancel “Maintenance”: Deselect “Maintenance sensor”.

Fig. 43: SOPAS ET menu: MCU/Maintenance/Maintenance



Standard start-up is now completed.

4.4 Setting the Interface module parameters

4.4.1 General information

The following steps are necessary to select and set the optionally available Interface modules Profibus DP, Modbus TCP and Ethernet type 1:1

- ▶ Select device file “MCU”, set the measuring system to “Maintenance” mode
- ▶ Enter the Level 1 password (see “Password and operating levels”, page 75).
- ▶ Switch to the “Configuration / System Configuration” directory.
The installed interface module is displayed in the field “Interface Module”.
- ▶ Configure the Interface module according to requirements.

Fig. 44: SOPAS ET menu: MCU/Configuration/System Configuration

Device Identification		
MCU	Selected variant: DUSTHUNTER S (SB50, SB100,SF100,SP100) ▼	Mounting Location: SICK
Interface Module		
Interface Module	No Module ▼ No Module Profibus Ethernet RS 485	
Current Time		
Date/Time: <input type="text"/>		
Adjust Date/Time		
Day	Month	Year
<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="2007"/>
Hour	Minute	Second
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<input type="button" value="Set date / time"/> <input checked="" type="radio"/> Date / Time set <input type="radio"/> Invalid value		
System Time Synchronization		
Date / Time: Thursday, October 1, 2015 9:58:24 AM CEST		<input type="button" value="Synchronize"/>
Settings for service interface		
Protocol selection	Modbus Address	Serial service port baudrate
CoLa-B ▼	<input type="text" value="1"/>	<input type="text" value="57600"/>
Use RTS/CTS lines <input type="checkbox"/>		



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

4.4.2 Setting the Ethernet module parameters



NOTICE:

The risk of undesired access to the measuring system is inherent when communicating via Ethernet.

- ▶ Operate the measuring system only behind suitable protection (e.g., Firewall).



The configuration of interface module Ethernet type 2 (see “Options for MCU control unit”, page 108) is not possible with program SOPAS ET. A special software with description is supplied with the program.

Standard setting: 192.168.0.10

A predefined IP address is set on request.

To change the settings:

- ▶ Select directory “Configuration / I/O Configuration / Interface Module”.
- ▶ Set the desired network configuration in the “Expansion module information” field and click “Reset module”.

Fig. 45: SOPAS ET menu: MCU/Configuration/I/O configuration/Interface Module

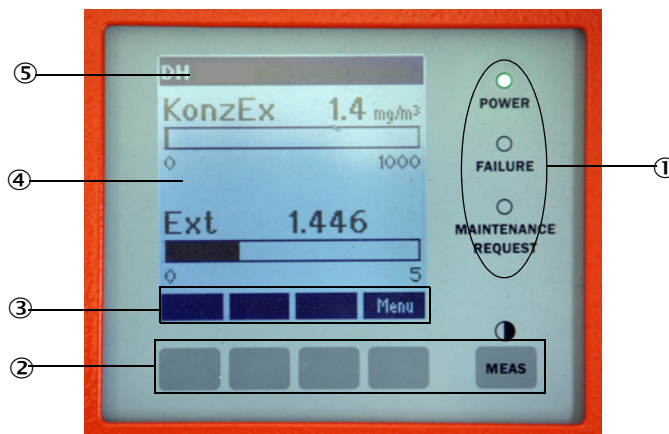
The screenshot shows two configuration panels. The top panel, titled "Expansion module information", contains a "Module type" dropdown menu currently set to "No module found" and a "Reset module" button. Below the button is a note: "When this button is clicked, the connection will be reset". The bottom panel, titled "Ethernet Interface Configuration", contains several input fields: "IP Address" (192, 168, 0, 10), "Subnet mask" (255, 255, 255, 0), "Gateway" (0, 0, 0, 0), and "TCP port" (2111).

4.5 Operating/setting parameters via the optional LC-Display

4.5.1 General information on use

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

Fig. 46: LC-Display functional elements



- ① Status LED
- ② Control buttons
- ③ Current button function
- ④ Display field
- ⑤ Status bar

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)
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	Switch from main measured values to measured sensor values Display the contrast setting (after 2.5 s)

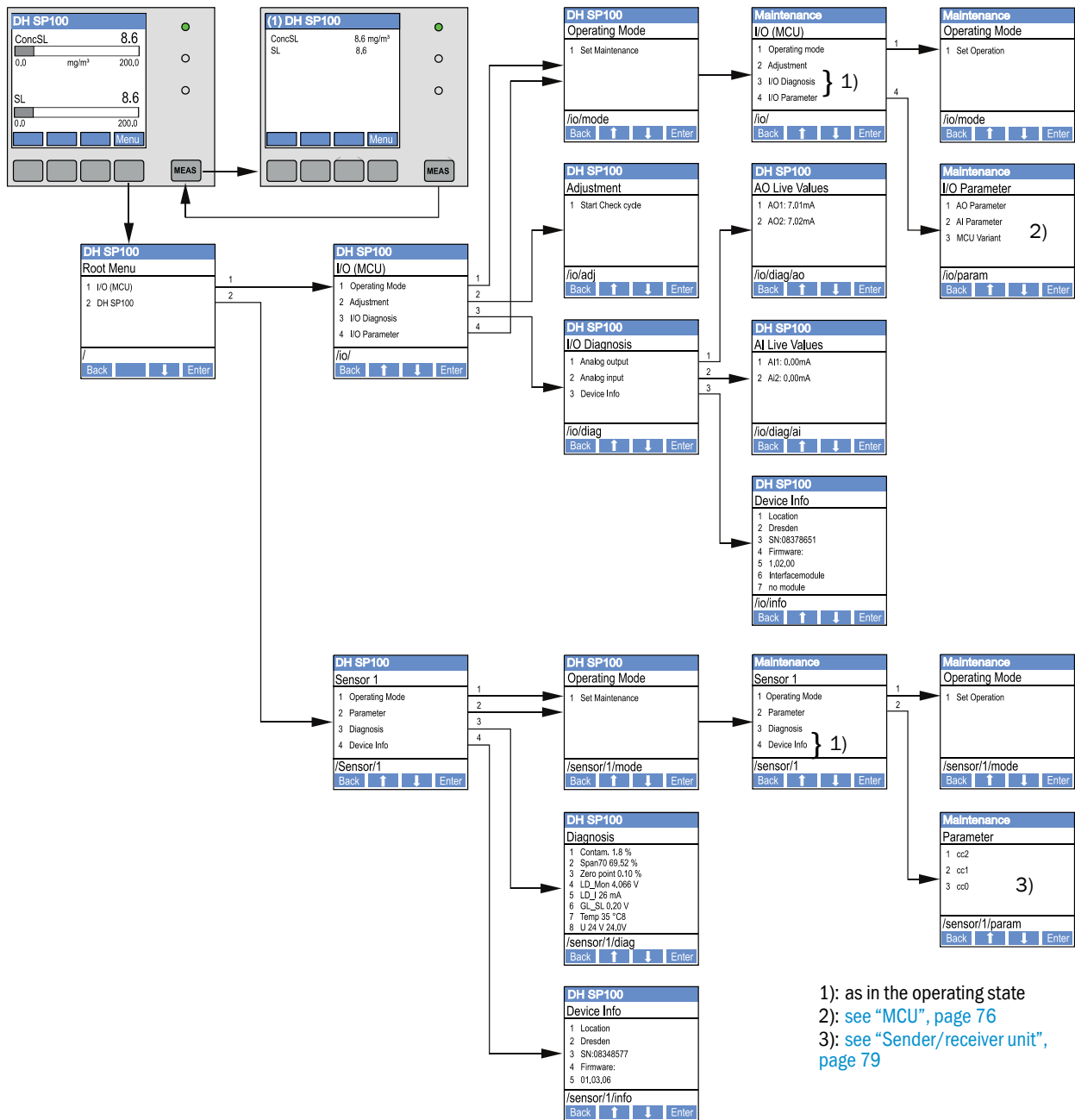
4.5.2 Password and operating levels

Certain device functions are first accessible after a password has been entered.

User level	Access to
0 Operator	Displays measured values and system states No password required
1 Authorized operator	Displays, inquiries as well as start-up or adjustment to customer-specific demands and diagnosis of necessary parameters Preset password: 1234

4.5.3 Menu structure

Fig. 47: LC-Display menu structure



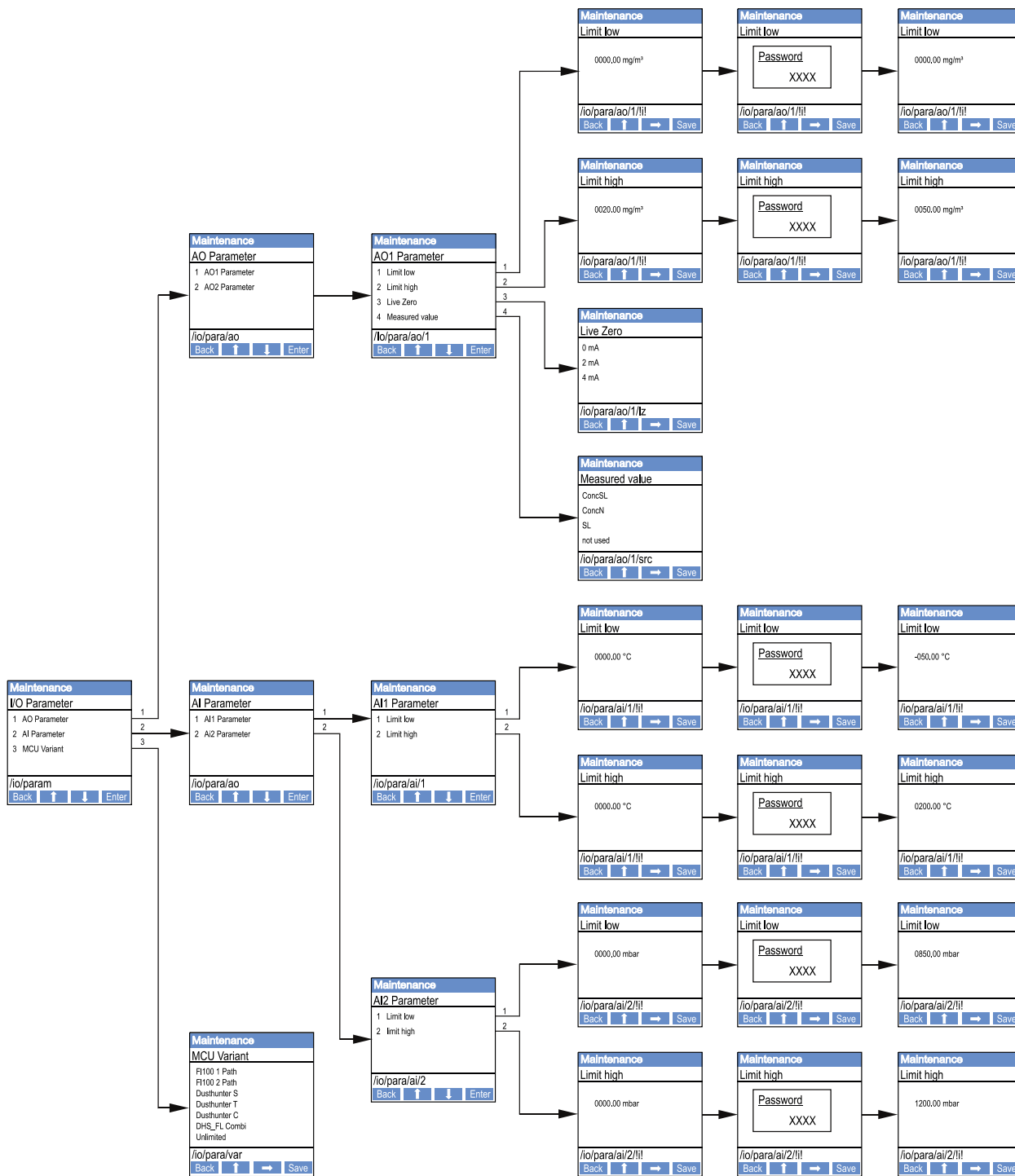
4.5.4 Configuration

4.5.4.1 MCU

Analog outputs / inputs

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

Fig. 48: Menu structure for configuring analog outputs/inputs and setting the MCU variant



Setting the MCU variant

The following steps are required to set the MCU for the DUSTHUNTER SP100 sender/receiver unit to be connected (see [“Assigning the MCU to the sender/receiver unit”, page 62](#)):

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

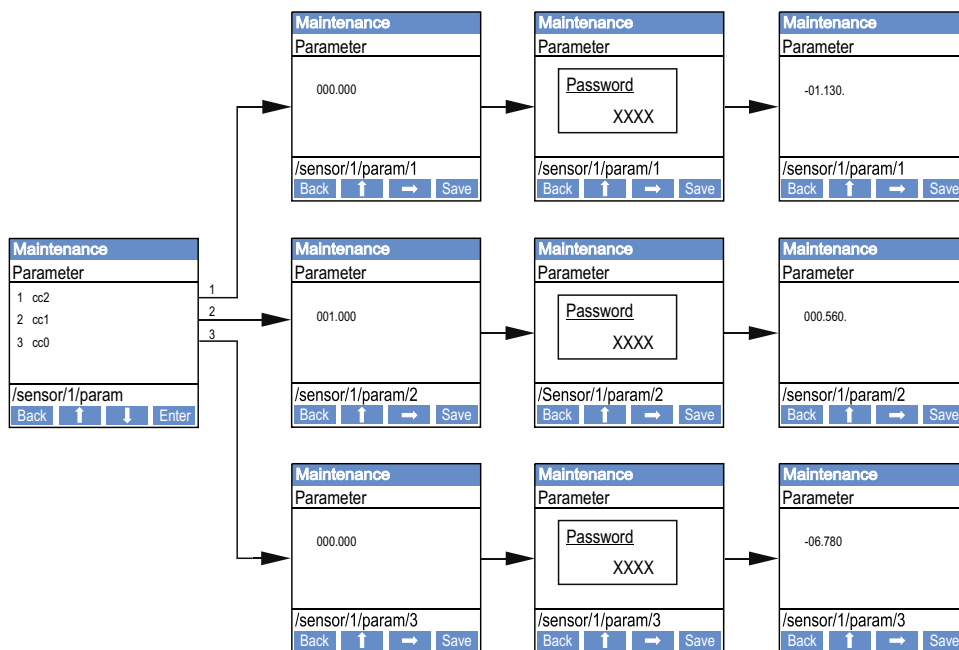
The other selection options have no significance here.

4.5.4.2 Sender/receiver unit

The following steps are required to enter the regression coefficients:

- ▶ Set the sender/receiver unit to “Maintenance” and select the “Parameter” submenu.
- ▶ Select the desired parameter and enter the password (see “Password and operating levels”, page 75).
- ▶ Set the calculated coefficients (see “Calibration for dust concentration measurement”, page 69) using the “^” and/or “→” buttons and write to the device with “Save” (confirm twice).

Fig. 49: Entering the regression coefficients



4.5.5 Using SOPAS ET to modify display settings

To modify the factory settings, connect SOPAS ET with the “MCU” (see “[Connection to the device via USB line](#)”, page 55), enter the Level 1 password and select the “Configuration / Display Settings” directory.

Fig. 50: SOPAS ET menu: MCU/Configuration/Display Settings

Device Identification

MCU Selected variant DUSTHUNTER Mounting Location SICK

Common Display Settings

Display language English Display Unit System metric

Overview Screen Settings

Bar 1	Sensor 1	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 2	MCU	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 3	Not Used	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 4	Not Used	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 5	Not Used	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 6	Not Used	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 7	Not Used	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000
Bar 8	Not Used	Value Value 1	Use AO scaling <input type="checkbox"/>	Range low -100	Range high 1000

Measured Value Description

<p>Dusthunter S</p> <ul style="list-style-type: none"> Value 1 = not used Value 2 = Concentration a.c. (SL) Value 3 = not used Value 4 = not used Value 5 = not used Value 6 = not used Value 7 = Scattered Light Value 8 = not used 	<p>Calculated values (MCU)</p> <ul style="list-style-type: none"> Value 1 = Concentration s.c. dry O2 corr. (SL) Value 2 = not used Value 3 = not used Value 4 = not used Value 5 = Temperature Value 6 = Pressure Value 7 = Moisture Value 8 = Oxygen
---	---

Security settings

Authorized operator 1234 Idle time 30 Minutes

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	Bars 1 to 8	Number of measured value 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
	Range low	Values for separate scaling of the measured value bar independent of the analog output
	Range high	
Security settings	Authorized operator	Password input for the Display menu operating level "Authorized Operator" Default: 1234
	Idle time	Time until user level "Authorized Operator" is automatically switched off again.

Measured value assignment

MCU measured value	Sender/receiver unit measured value
Value 1	Not used
Value 2	Concentration a.c. (SI)
Value 3	Not used
Value 4	Not used
Value 5	Not used
Value 6	Not used
Value 7	Scattered light
Value 8	Not used
MCU Value 1	Conc.s.c.dry O2 corr. (SI)

5 Maintenance

5.1 General

The maintenance work to be carried out is limited to cleaning work and securing the purge air supply function.

Take the following steps to set the measuring system to “Maintenance” mode before starting maintenance work.

- ▶ Connect the MCU to the laptop/PC using the USB line and start program SOPAS ET.
- ▶ Connect with the MCU (see [“Connection to the device via USB line”, page 55](#)).
- ▶ Enter the Level 1 password (see [“Password and operating levels”, page 75](#)).
- ▶ Set the sender/receiver unit to “Maintenance”: Click “Maintenance sensor”)

Fig. 51: SOPAS ET menu: MCU/Maintenance/Maintenance

The screenshot shows a software window with two main sections. The top section is titled 'Device Identification' and contains a text box with 'MCU', a dropdown menu for 'Selected variant' set to 'DUSTHUNTER', and another dropdown menu for 'Mounting Location' set to 'SICK'. The bottom section is titled 'Offline Maintenance' and contains a checkbox labeled 'Activate offline maintenance' which is checked.



WARNING:

Observe the relevant safety regulations as well as the safety notices (see [“Responsibility of user”, page 9](#)) during all work.

Resuming measuring operation

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



- “Maintenance” mode can also be set using the buttons on the display on the MCU (see [“Menu structure”, page 76](#)) when the LC-Display option is present or by connecting an external maintenance switch to the terminals for Dig In2 (17, 18) in the MCU (see [“Connecting the MCU control unit”, page 47](#)).
- An automatic function check is not carried out during “Maintenance”.
- The value set for “Maintenance” is output on the analog output (see [“Setting the analog outputs parameters”, page 65](#)). This is also applicable when a malfunction is present (signaled on relay output).
- The “Maintenance” mode 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.

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 requested, all maintenance activities can also be performed by SICK Service or an authorized Service partner. 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



NOTE:

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

Clean the outside of the sender/receiver unit 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 failure).



If contamination on the glass surfaces cannot be removed with the optics cloth, clean the glass surfaces with soap suds and then dry.



WARNING: Hazard through gas and hot parts

Dismantle the sender/receiver unit from the duct for cleaning and then fit it back on again.

- ▶ Observe the relevant safety regulations as well as the safety notices (see [“Responsibility of user”, page 9](#)) during all work.
- ▶ Only carry out assembly work on equipment with hazard potential (higher internal duct pressure, hot or aggressive gases) when the equipment is at a standstill.
- ▶ Take suitable protection measures against possible local hazards or hazards arising from the equipment.

5.2.1 Cleaning the optics of the sender/receiver unit

Sender/receiver unit with NL up to 735 mm

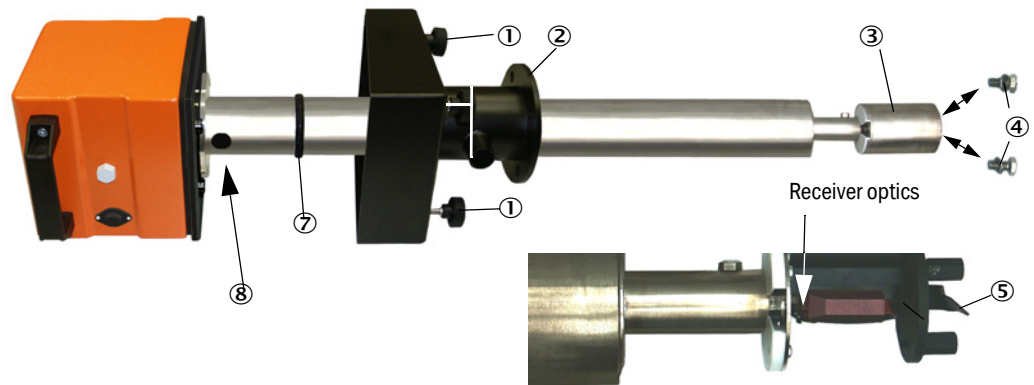
- ▶ Loosen knurled screws (1) and pull the electronics unit with probe carefully out of probe flange (2 see [“Cleaning the optical interfaces”, page 85](#)).
- ▶ Close the probe flange with a cover (see [“Accessories”, page 107](#)).
- ▶ Loosen fastening screws (3) for cover (4) and take off cover.
- ▶ Clean the optics carefully with cotton swabs and, if necessary, light trap (5) as well.

Sender/receiver unit with NL > 735 mm or for internal duct pressure up to +200 kPa

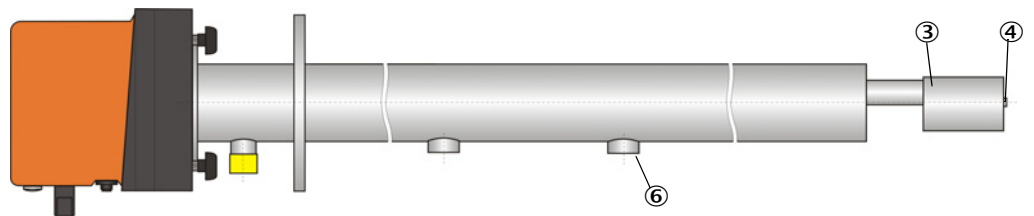
- ▶ Remove the sender/receiver unit from the duct.
- ▶ Close off the flange with tube with a blind flange.
- ▶ Unscrew cover screw (6) from the cleaning opening for sender optics (see [“Cleaning the optical interfaces”, page 85](#)).
- ▶ Loosen fastening screws (3) for cover (4) and take off cover.
- ▶ Clean the optics carefully with cotton swabs and, if necessary, light trap (5) as well.

Fig. 52: Cleaning the optical interfaces

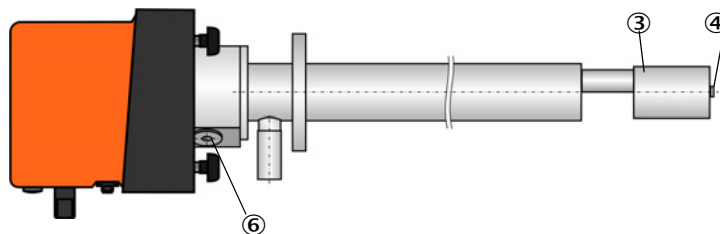
Sender/receiver unit with NL up to 735 mm



Sender/receiver unit with NL > 735 mm



Sender/receiver unit for internal duct pressure up to + 200 kPa



- | | |
|--------------------|-----------------|
| ① Knurled screws | ⑤ Light trap |
| ② Probe flange | ⑥ Cover screw |
| ③ Cover | ⑦ O-ring |
| ④ Fastening screws | ⑧ Sender optics |



We recommend checking the O-ring (7) for wear and to replace it as required (see "Device check accessories", page 107).

5.2.2 Checking the contamination value

- ▶ Start the function check by moving device file “MCU” to the “Project tree” window”, select the “Adjustment / Function Check Manual” directory and click the “Start Manual Function Check” button.

Figure 53 SOPAS ET menu: MCU/Adjustment/Function Check - Manual

+i The function check can also be started via the LC-Display on the MCU (see “Menu structure”, page 76).

- ▶ Select the “DH SP100” device file in the “Project Tree” window, select the “Diagnosis / Check values” directory and check the contamination value.

Figure 54 SOPAS ET menu: DH SP100/Diagnosis/Check values

- ▶ If the measured values for contamination, zero point and span are within the allowed ranges, save them to the device by clicking the “Refresh” button (“Check values” field); if not, repeat cleaning and check the contamination value again by triggering a renewed function check.

+i

- The contamination value can also be displayed on the LC display of the MCU (initiate a function check and select the “SP100/Diagnosis” menu, see “Menu structure”, page 76).
- If the contamination value does not sink below the value for warning (30%) in spite of several cleaning processes, the device is probably defective → contact SICK Service.

- ▶ Reassemble the sender/receiver unit, remove the cover from the probe flange (cover) or flange with tube (blind flange) and install the sender/receiver unit on the duct.



NOTICE: An incorrect position of the O-ring (7) can result in inadequate purge air supply and therefore damage the optical subassemblies.

- ▶ When installing the sender/receiver unit, ensure the O-ring is correctly positioned in the groove and remains in this position.

- ▶ Resume measuring operation (see “Resuming measuring operation”, page 82).

5.2.3 Checking and cleaning the non-return valve

- ▶ Loosen the strap retainer and pull the purge air hose off the non-return valve.
- ▶ Loosen the strap retainer ① and the securing screw ② on the non-return valve and remove them from the purge air connection of the sender/receiver unit.
- ▶ Unscrew the non-return valve ①.
- ▶ Check tappet ④ for free movement.
- ▶ Check seal ⑤ and other parts for damage, check metal parts for corrosion. If parts are damaged, exchange the complete non-return valve for a new one.
- ▶ Check sealing surfaces ⑥ and through-holes ⑦ for contamination, clean as required.
- ▶ Reassemble non-return valve ②, mount on the purge air connection and connect purge air hose.

Fig. 55: Non-return valve, dismantled



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 inspecting the purge air supply at short intervals (approx. 2 weeks) and then optimizing maintenance intervals over a longer period of operation.



NOTE:

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 the purge air supply when the optical component sender/receiver unit is fitted on the duct.
 - ▶ Disassemble the connected components before exchanging damaged purge air hoses (see “Shutdown”, page 91).
-

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 MCU with integrated purge air supply

Cleaning or replacing the filter element

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

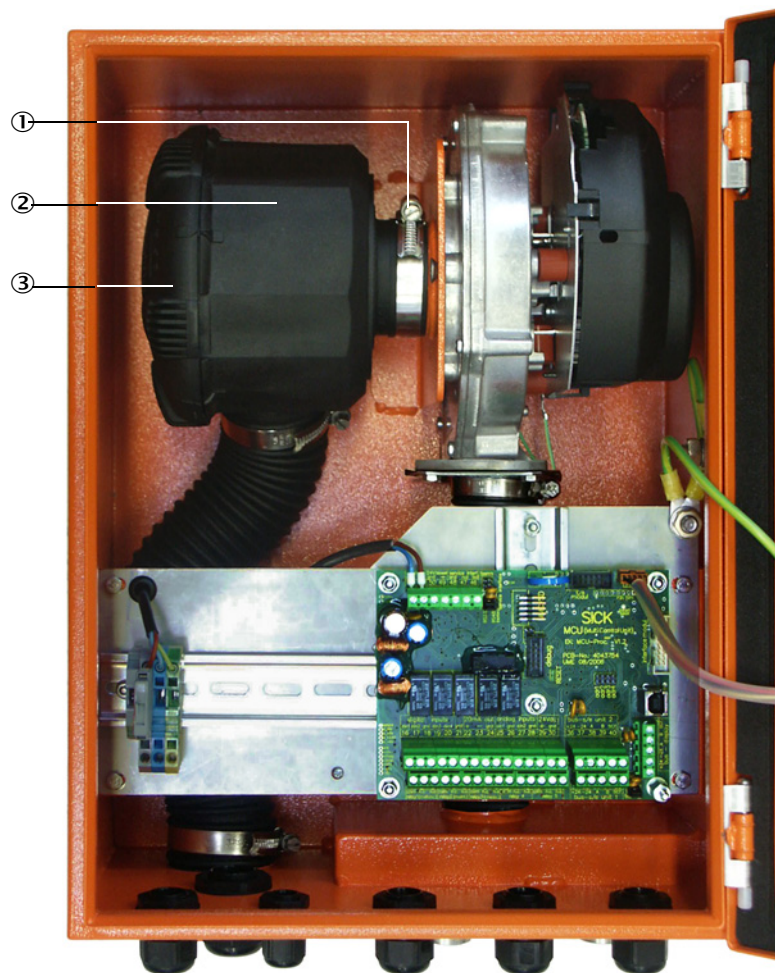


NOTICE:

- ▶ For wet cleaning, use only a water-soaked cloth and then dry the parts well.

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

Fig. 56: Exchanging the filter element for the control unit with purge air supply



- ① Strap retainer
- ② Filter housing
- ③ Filter housing cover

5.3.2 Optional external purge air unit

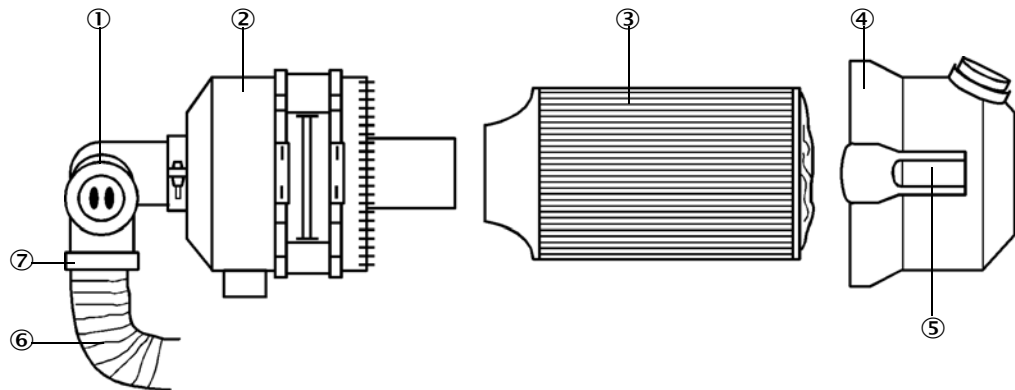


NOTICE:

The purge air unit must be serviced at the latest when the low-pressure monitor (7) at the filter outlet triggers (see “Replacing the filter element”, page 90).

Replacing the filter element

Fig. 57: Replacing the filter element



- ① Low-pressure monitor
- ② Filter housing
- ③ Filter element
- ④ Filter housing cover
- ⑤ Snap lock
- ⑥ Purge air hose
- ⑦ Strap retainer

- ▶ Switch the fan off for a short time.
- ▶ Clean outside of filter housing (2).
- ▶ Loosen strap retainer (7) and clamp purge air hose (6) to 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, the purge air entering the purge air connection pieces is unfiltered.

- ▶ Press snap locks (5) together and take off filter housing cover (4).
- ▶ Remove filter element (3) with twisting-pulling movements.
- ▶ 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 new filter element with twisting-pressing movements.
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 snap locks into place.
- ▶ Reconnect the purge air hose to the filter outlet using the hose clamp.
- ▶ Switch the fan on again.

5.4 Shutdown

The measuring system must be shut down:

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

**NOTE:**

Never switch off or interrupt the purge air supply when the sender/receiver unit is fitted on the duct.

Work to be performed

- ▶ Loosen the connection line to the MCU.
- ▶ Dismantle the sender/receiver unit from the duct.

**WARNING: Hazard through gas and hot parts**

- ▶ Observe the relevant safety regulations as well as the safety notices in Section 1 during all disassembly work.
 - ▶ Only remove the sender/receiver unit on equipment with hazard potential (higher internal duct pressure, hot or aggressive gases) 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 plug.
 - ▶ 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 MCU control unit from the supply voltage.

Storage

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

6 Troubleshooting

6.1 General

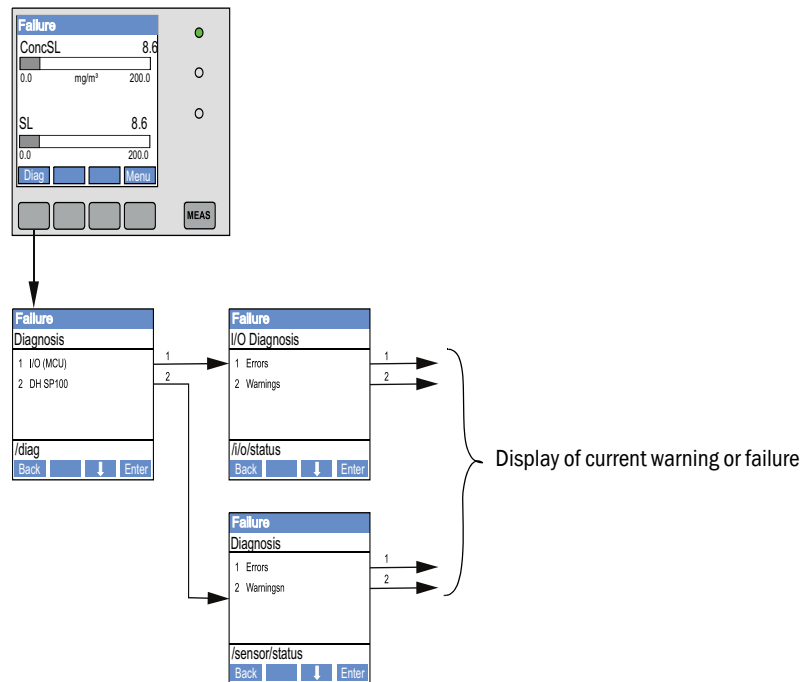
Warning or error messages are output as follows:

- On the MCU, the respective relay is switched on (see “Standard connection”, page 50).
- Maintenance requ.” or “Failure” is displayed in the status bar of the LC-Display (see “General information”, page 73). In addition, the respective LED goes on (“MAINTENANCE REQUEST” for warnings, “FAILURE” for errors).

After pressing the button “Diag”, possible causes are shown as short information in the menu “Diagnosis” after selecting the device (“MCU” or “DH SP100”).

Figure 58

Display on the LC-Display



“Diagnosis / Error messages/warnings” provides detailed information on the current device state. To display, connect the measuring system to SOPAS ET and start the device file “DH SP100” or “MCU”.

Move the mouse to the respective message to display more details on the significance of individual messages in a separate window. Clicking on the display shows a short description of possible causes and corrections under “Help” (see “Warning and error messages in SOPAS ET”, page 93).

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



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



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

6.2 Sender/receiver unit

Malfunctions

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

Warning and error messages in SOPAS ET

Fig. 59: SOPAS ET menu: DH SP100/Diagnosis/Error messages/Warnings

Device identification

DH SP100 Mounting location

Errors

Error selection : Actual

EEPROM CRC sum parameter Version Parameter CRC sum factory settings
 Version Factory settings Threshold value Span test Monitor signal
 Contamination Overflow measured value Motor current
 Zero point Laser current to high
 Power supply (24V) < 18V Power supply (24V) > 30V

Warnings

Selection Warnings : Actual

Reference value Contamination Contamination invalid Default factory parameter
 Laser current to high
 Power supply (24V) to low Power supply (24V) to high

Current warning or error messages, or earlier messages stored in the error memory, can be shown by selecting “actual” or “memory” in the “Error selection” or “Warnings selection” window.

- Display of error or warning: With LED symbol
- Description of error or warning: In the description field of SOPAS ET

Malfunctions listed below can probably be cleared onsite.

Message	Significance	Possible cause	Action
Contamination	Current reception intensity is lower than the allowable limit value (see “Technical Data”, page 98)	<ul style="list-style-type: none"> Deposits on the optical interfaces Unclean purge air 	<ul style="list-style-type: none"> Clean the optical surfaces (see “Maintenance on the sender/receiver unit”, page 84). Check purge air filter (see “Maintenance on the purge air supply”, page 88) Contact SICK Customer Service.
Span test, Zero point	Deviation from setpoint value $> \pm 2\%$.	Sudden changes in measuring conditions during determination of control values	<ul style="list-style-type: none"> Repeat the function check. Contact SICK Customer Service.

6.3 MCU control unit

6.3.1 Malfunctions

Symptom	Possible cause	Action
No display on the LCD	<ul style="list-style-type: none"> No supply voltage Connection line to LC-Display not connected or damaged Defective fuse 	<ul style="list-style-type: none"> ▶ Check voltage supply. ▶ Check the connection line ▶ Exchange fuse. ▶ Contact SICK Customer Service.

6.3.2 Warning and error messages in the SOPAS ET program

Fig. 60: SOPAS ET menu: MCU/Diagnosis/Error messages/Warnings

Device Identification

MCU Selected variant: DUSTHUNTER S (SB50, SB100,SF100,SP100) Mounting Location: SICK

System Status MCU

Operation
 Malfunction
 Maintenance Request
 Maintenance
 Function Check

Configuration Errors

AO configuration AI configuration DO configuration DI configuration
 Sensor configuration Interface Module MMC/SD card Application selection
 "Limit and status" not possible Pressure transmitter type not supported Error current and LZ overlaps Option emergency air not possible

Errors

EEPROM I/O range error I²C module
 Firmware CRC AI NAMUR Power supply 5V
 Power supply 12V Power supply(24V) <21V Power supply(24V) >30V
 Transducer temperature too high - emergency air activated Key module not available Key module too old

Warnings

Factory settings No sensor found Testmode enabled
 Interfacemodule Inactive RTC I²C module
 Power supply(24V) <22V Power supply(24V) >29V Flash memory

- Display of error or warning: With LED symbol
- Description of error or warning: In the description field of SOPAS ET

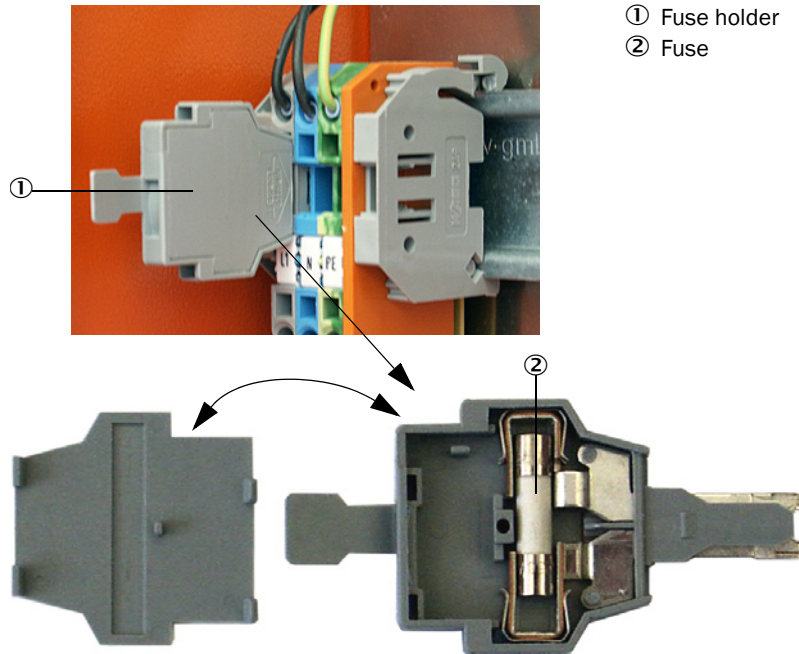
Malfunctions listed below can probably be cleared onsite.

Message	Significance	Possible cause	Action
AO configuration	The number of available and configured analog outputs is not identical.	<ul style="list-style-type: none"> • No parameters set for AO • Connection error • Module failure 	<ul style="list-style-type: none"> ▶ Check configuration (see “Setting the analog outputs parameters”, page 65). ▶ Contact SICK Customer Service.
AI configuration	Number of available and configured analog inputs not identical.	<ul style="list-style-type: none"> • No parameters set for AI • Connection error • Module failure 	<ul style="list-style-type: none"> ▶ Check configuration (see “Setting the analog inputs parameters”, page 67). ▶ Contact SICK Customer 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 configuration (see “Setting the Ethernet module parameters”, page 74). ▶ Contact SICK Customer 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 system settings. ▶ Check the connection line ▶ Check voltage supply. ▶ Contact SICK Customer Service.
Variant configuration error	MCU setting does not match the connected sensor	Sensor type has been changed	<ul style="list-style-type: none"> ▶ Correct application settings (see “Assigning the MCU to the sender/receiver unit”, page 62).
Testmode enabled	MCU in “Test” mode.		<ul style="list-style-type: none"> ▶ Deactivate “System Test” mode (“Maintenance” directory)

6.3.3 Replacing the fuse

- ▶ Control unit MCU must be disconnected from the power supply and potential-free.
- ▶ Open the door of the MCU, remove and open fuse holder (1).
- ▶ Replace the defective fuse (2) (see “Miscellaneous”, page 108).
- ▶ Close and attach the fuse holder.
- ▶ Close the door and connect power voltage.

Fig. 61: Replacing the fuse



7 Specifications

7.1 Compliances

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

- EU Directive: LVD (Low Voltage Directive)
- EU Directive: EMC (Electromagnetic Compatibility)

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
- EN 14181, Stationary source emissions - Quality assurance of automated measuring systems

Electrical protection

- Insulation: Protection class 1 according to EN 61010-1.
- Insulation coordination: Measuring category II according to EN 61010-1.
- Contamination: The device operates safely in an environment up to degree of contamination 2 according to EN 61010-1 (usual, not conductive contamination and temporary conductivity by occasional moisture condensation).
- Electrical energy: The wiring system to the power supply voltage of the system must be installed and fused according to the relevant regulations.

Approvals

DUSTHUNTER SP100 is performance-tested according to EN 15267 and may be used for continuous emission monitoring in plants requiring approval and plants according to EU Directives.

7.2 Technical Data

Measuring Parameters			
Measured variable	Scattered light intensity Dust concentration output in mg/m ³ after gravimetric comparison measurement		
Measuring range (freely adjustable)	Smallest range: Largest range:	0 ... 5 mg/m ³ 200 mg/m ³	Higher on request
Limit values for corrosive gas composition .	HCl: SO ₂ : SO ₃ : NOx: HF:	10 mg/Nm ³ 800 mg/Nm ³ 300 mg/Nm ³ 1000 mg/Nm ³ 10 mg/Nm ³	
Measurement uncertainty ¹⁾	±2% of upper measuring range value		
Response time	1 ... 600 s; freely selectable		
Measuring Conditions			
Gas temperature (above dew point)	Standard version DHSP-T2xxxNNXX: Version for internal duct pressure up to +200 kPa High-temperature version DHSP-T4xxxNXX:		-40 ... 220 °C -40 ... 250 °C -40 ... 400 °C
Internal duct pressure	Sender/receiver unit DHSP-T2xxxNNXX and DHSP-T4xxxNNXX	MCU-P control unit	-50 hPa ... +10 hPa
		Optional external purge air unit	-50 hPa ... +30 hPa
	DHSP-T4V11NNXX 2 bar	With onsite instrument air	-50 hPa ... +10 kPa -80 kPa ... +200 kPa
Internal duct diameter	> 250 mm		
Ambient temperature	-40 ... +60 °C -40 ... +45 °C	Sender/receiver unit, 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% failure		
Manual linearity check	Using a reference filter		
Output Signals			
Analog Outputs	3 outputs 0/2/4 ... 22 mA, max. load 750 ; resolution 10 bits; electrically isolated		
Relay outputs	5 potential-free outputs (changeover contacts) for status signal; load 48 V, 1 A		
Input signals			
Analog inputs	2 inputs 0...20 mA (standard; without electric isolation); resolution 10 bits 2 further analog inputs when using an Analog Input module (option, see "MCU control unit", page 21)		
Digital input	4 inputs to connect potential-free contacts (e.g., for external maintenance switch, triggering function check);		
Communication Interfaces			
USB 1.1, RS 232 (on terminals)	For measured value inquiries and software updates per PC/laptop using the operating program		
RS485	For connection of sender/receiver unit		
Optional Interface module	To communicate with the Host PC, optional for Profibus, Ethernet		
Power supply			
MCU control unit	Voltage supply: Power consumption:	90...250 V AC, 47...63 Hz; opt. 24 V DC ± 2 V Max. 15 W without purge air supply Max. 70 W with purge air supply	
Sender/receiver unit	Voltage supply: Power consumption:	24 V from MCU control unit Max. 4 W	
Optional external purge air unit (with blower 2BH13)	Voltage supply (3 ph): 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	
MCU connection line	Shielded lines with twisted pairs (e.g., UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm ² from LAPPKabel; 1 pair of wires for RS 485, 1 pair of wires for power supply; not suitable for underground laying).		
	1): In temperature range - 20 °C ... +50 °C		

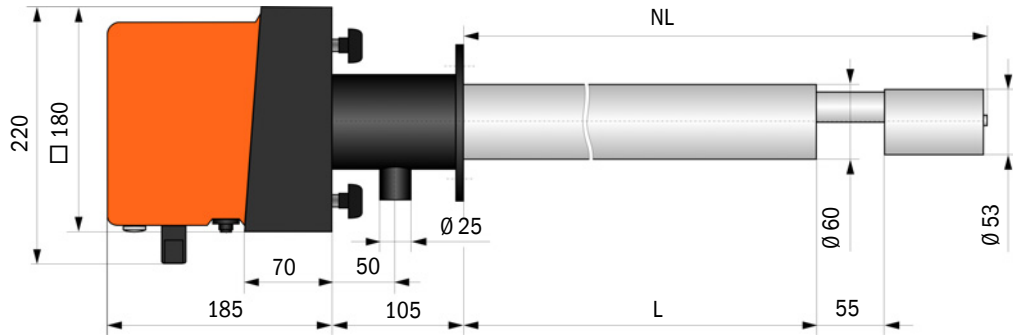
Weight		
Sender/receiver unit	DHSP-Txx1xNNXX	6.5 kg
	DHSP-Txx2xNNXX	7.8 kg
	DHSP-Txx3xNNXX	9.5 kg
	DHSP-Txx4xNNXX	11.0 kg
	DHSP-Txx5xNNXX	13.0 kg
	DHSP-Txx6xNNXX	16.0 kg
	DHSP-Txx7xNNXX	18.0 kg
	DHSP-T4V11NNXX 2 bar	7.5 kg
MCU control unit	MCU-P	13.5 kg
	MCU-N	3.7 kg
Optional external purge air unit	14 kg	
Miscellaneous		
Protection class	Sender/receiver unit, MCU control unit	IP 66
	Optional external purge air unit	IP 54
Connection line length	5 m, 10 m	Other lengths on request
Purge air hose length (DN25)	5 m, 10 m	Other lengths on request
Laser	Degree of protection 2; capacity < 1 mW; wavelength between 640 nm and 660 nm	
Purge air feed volume	Max. 20 m ³ /h	MCU-P control unit
	Max. 63 m ³ /h	Optional external purge air unit (type 2BH1300)

7.3 Dimensions, part Nos.

All measures are specified in mm.

7.3.1 Sender/receiver unit

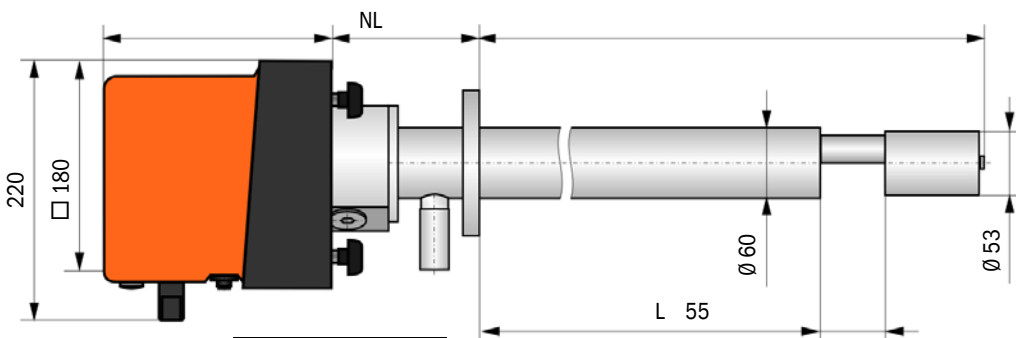
Fig. 62: Sender/receiver unit with NL up to 735 mm



NL	L
435	300
735	600

Designation	Part No.
Sender/receiver unit DHSP-T2V11NNXX	1043883
Sender/receiver unit DHSP-T2V21NNXX	1043884
Sender/receiver unit DHSP-T4V11NNXX	1043885
Sender/receiver unit DHSP-T4V21NNXX	1043886
Sender/receiver unit DHSP-T2H11NNXX	1043891
Sender/receiver unit DHSP-T2H21NNXX	1043892
Sender/receiver unit DHSP-T4H11NNXX	1043893
Sender/receiver unit DHSP-T4H21NNXX	1043894
Sender/receiver unit DHSP-T2C11NNXX	1063885
Sender/receiver unit DHSP-T2C21NNXX	1063886

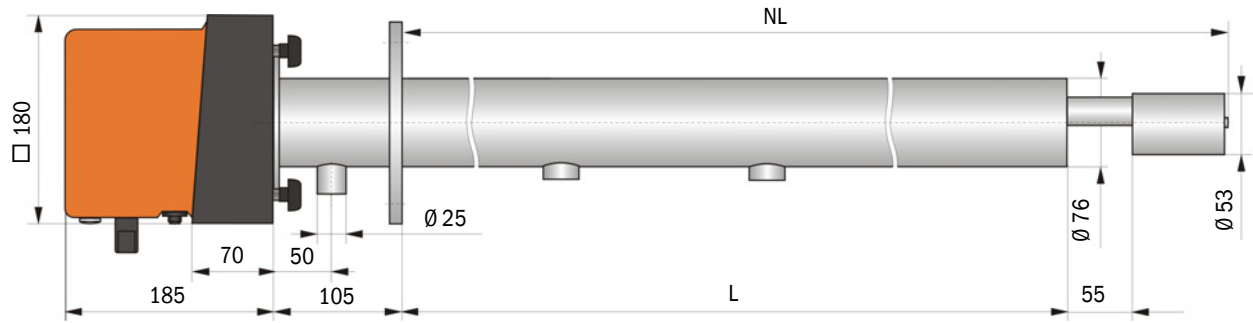
Fig. 63: Sender/receiver unit for internal duct pressure up to +200 kPa



NL	L
435	300
735	600

Designation	Part No.
Sender/receiver unit DHSP-T4V11NNXX 2 bar	1057191
Sender/receiver unit DHSP-T4H21NNXX 2 bar	1067618

Figure 64 Sender/receiver unit mit NL > 735 mm

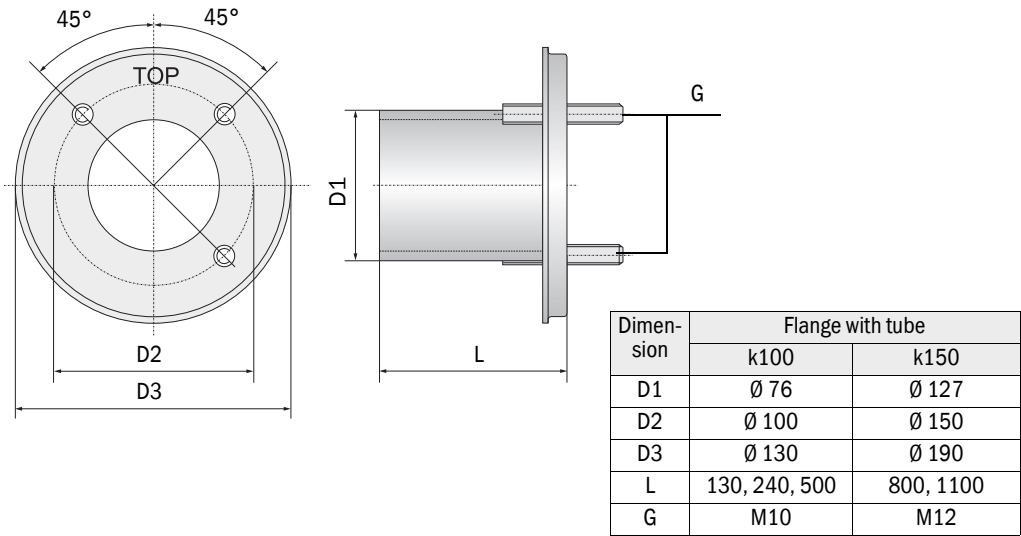


NL	L
1035	900
1335	1200
1635	1500
1835	1700
2085	1950

Designation	Part No.
Sender/receiver unit DHSP-T2V32NNXX	1043887
Sender/receiver unit DHSP-T2V42NNXX	1043888
Sender/receiver unit DHSP-T2V52NNXX	1050567
Sender/receiver unit DHSP-T2V62NNXX	1053274
Sender/receiver unit DHSP-T2VX2NNXX	1061685
Sender/receiver unit DHSP-T4V32NNXX	1043889
Sender/receiver unit DHSP-T4V42NNXX	1043890
Sender/receiver unit DHSP-T4V62NNXX	1051652
Sender/receiver unit DHSP-T2H32NNXX	1043895
Sender/receiver unit DHSP-T2H42NNXX	1043896
Sender/receiver unit DHSP-T4H32NNXX	1043897
Sender/receiver unit DHSP-T4H42NNXX	1043898
Sender/receiver unit DHSP-T4H52NNXX	1050524
Sender/receiver unit DHSP-T4H62NNXX	1051565
Sender/receiver unit DHSP-T2S73NNXX	1051862

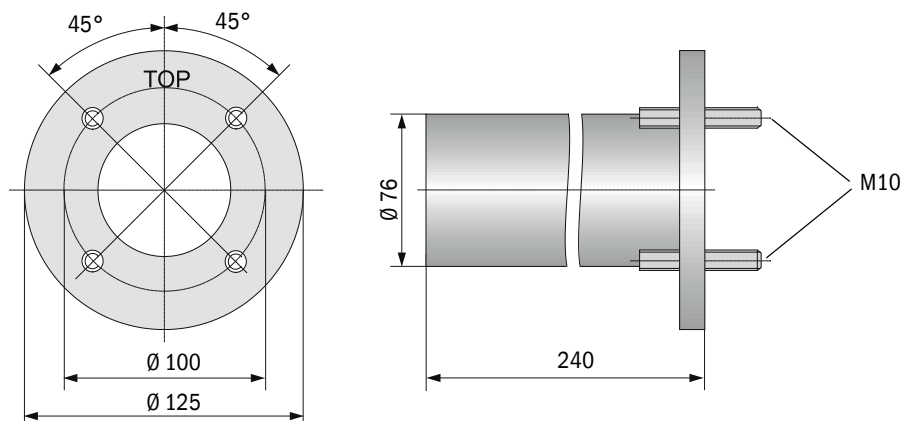
7.3.2 Flange with tube

Fig. 65: Flange with tube (standard version)



Designation	Part No.	Usage on
Flange type k100		
Flange with tube, Di = 70.2 Length 130 mm, St37	2017845	DHSP-Txx1, DHSP-Txx2
Flange with tube, Di = 70.2 Length 240 mm, St37	2017847	
Flange with tube, Di = 70.2 Length 500 mm, St37	2017849	DHSP-Txx2
Flange with tube, Di = 70.2 Length 130 mm, 1.4571	2017846	DHSP-Txx1, DHSP-Txx2
Flange with tube, Di = 70.2 Length 240 mm, 1.4571	2017848	
Flange with tube, Di = 70.2 Length 500 mm, 1.4571	2017850	DHSP-Txx2
Flange type k150		
Flange with tube, DN125, NL 800 mm, St37	7047580	DHSP-Txx3, DHSPxx4
Flange with tube, DN125, NL 1100 mm, St37	7047581	DHSPxx4

Fig. 66: Flange with tube for internal duct pressure > +50 hPa

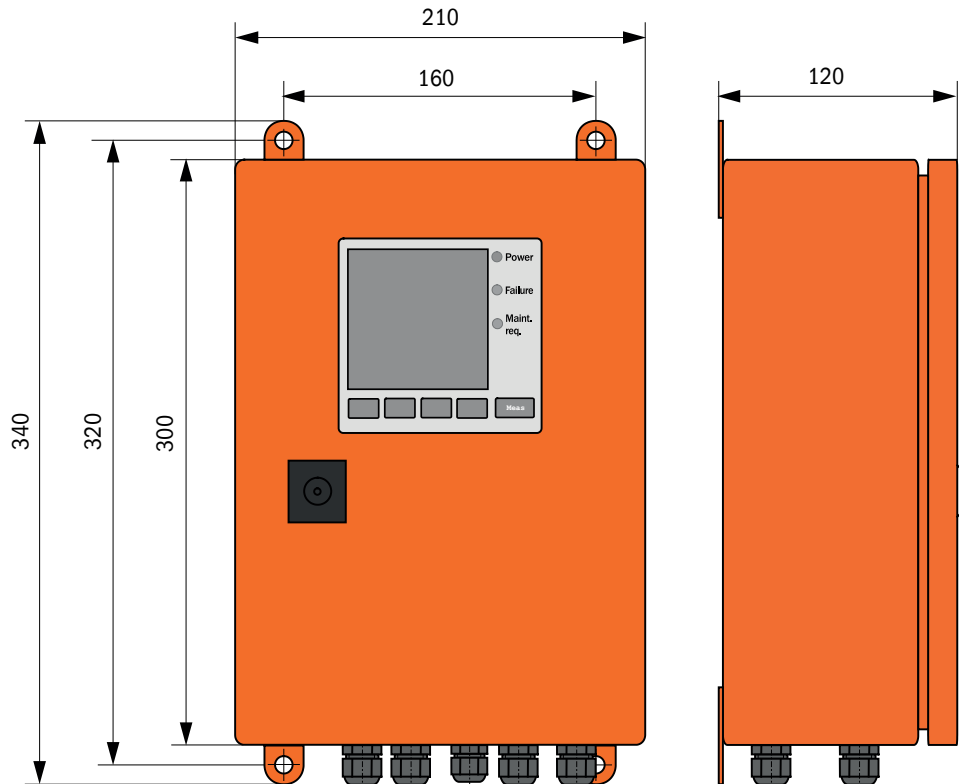


Designation	Part No.
Flange with tube, Di = 70,2, length 240 mm, VA	2063087

7.3.3 MCU control unit

MCU-N control unit and MCU remote control unit without integrated purge air supply

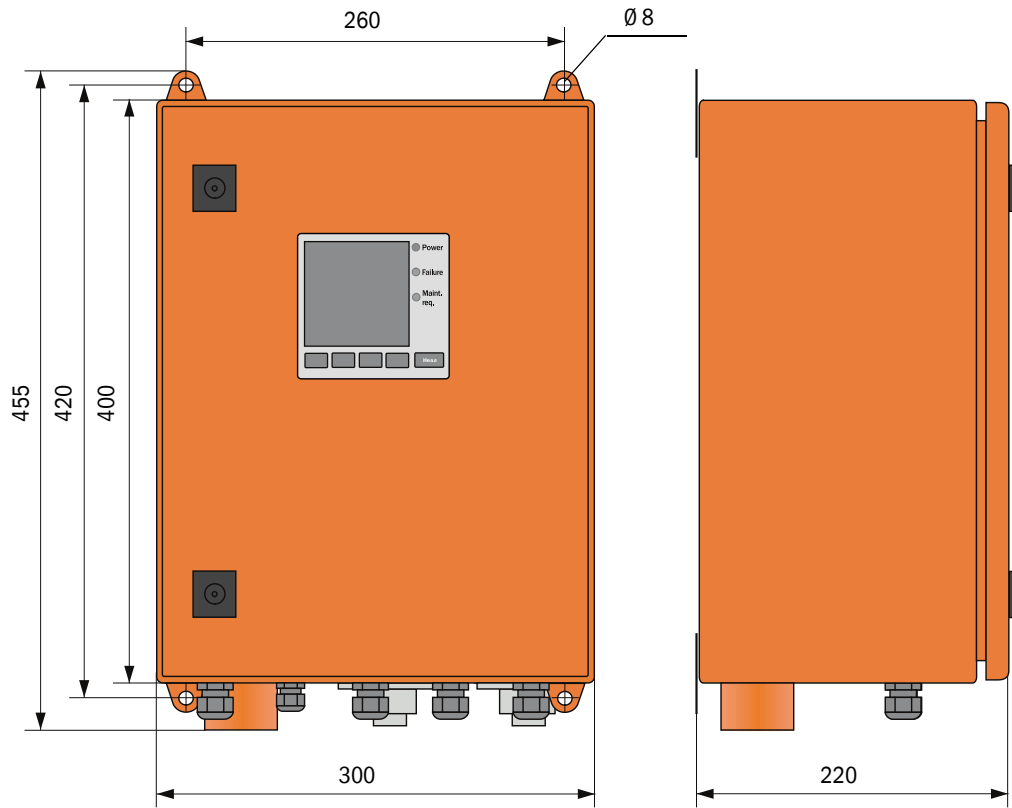
Fig. 67: MCU-N control unit



Designation	Part No.
Control unit MCU-NWODN01000NNNE in wall-mounted enclosure (orange), Supply voltage 90 ... 250 V AC, without purge air unit, with display	1045001
Control unit MCU-N2ODN01000NNNE in wall-mounted enclosure (orange), Supply voltage 24 V DC, without purge air unit, with display	1045003
MCU remote control unit without power supply unit	2075567
MCU remote control unit with power supply unit	2075568

MCU-P control unit with integrated purge air supply

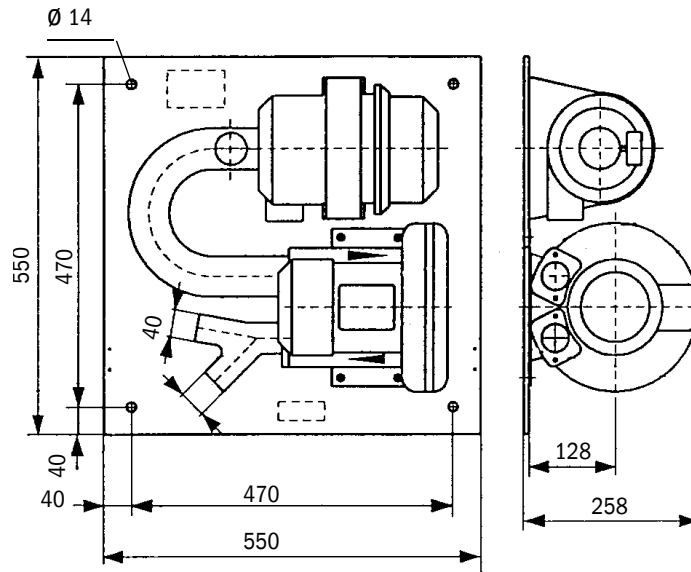
Fig. 68: MCU-P control unit



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

7.3.4 Optional external purge air unit

Fig. 69: Optional external purge air unit

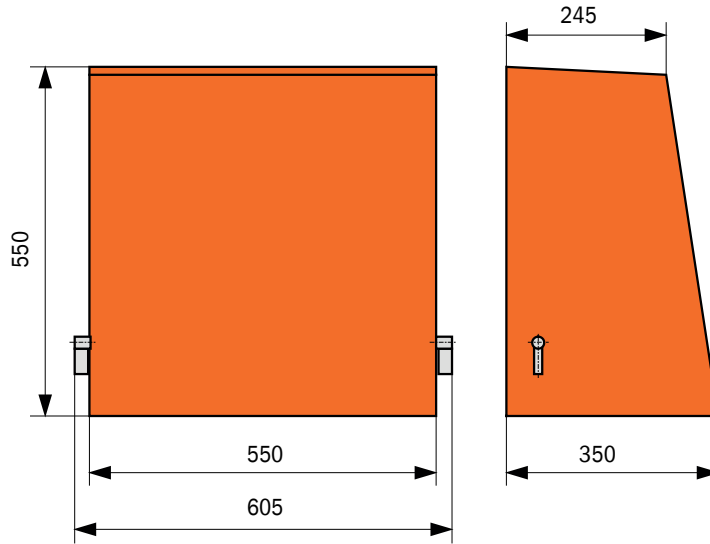


Designation	Part No.
Purge air unit with blower 2BH13 and purge air hose, length 5 m	1012424
Purge air unit with blower 2BH13 and purge air hose, length 10 m	1012409

7.3.5 Weatherproof covers

Weatherproof cover for external purge air unit

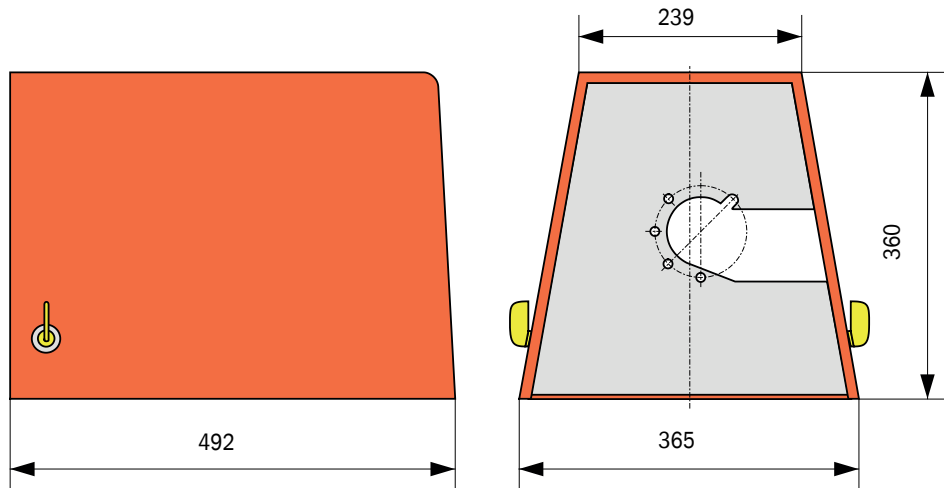
Fig. 70: Weatherproof cover for external purge air unit



Designation	Part No.
Weatherproof cover for purge air unit	5306108

Weatherproof cover for sender/receiver unit

Fig. 71: Weatherproof cover for sender/receiver unit



Designation	Part No.
Weatherproof cover for sender/receiver unit with NL up to 735 mm	2702407
Weatherproof cover for sender/receiver unit with NL > 735 mm	7047582

7.4 Accessories

7.4.1 Line sender/receiver unit - MCU

Designation	Part No.
Connection line, length 5 m	7042017
Connection line, length 10 m	7042018

7.4.2 Purge air supply

Designation	Part No.
Purge air hose DN 25, length 5 m	2046091
Purge air hose DN 25, length 10 m	7047536
Purge air reduction	7047538
Purge air adapter for instrument air	7047539
Non-return valve DN25	2042278
Non-return valve g G1/4" 0.1 bar (for sender/receiver unit DHSP-T4V11NNXX 2 bar)	5320060
Hose clamp D20-32	7045039
Hose clamp D32-52	5300809

7.4.3 Assembly parts

Designation	Part No.
Assembly kit flange (for sender/receiver unit with NL 435 mm and 735 mm)	2018184
Assembly kit (for sender/receiver unit with NL > 735 mm)	2048677

7.4.4 Device check accessories

Designation	Part No.
Control filter set DHSP	2049045

7.4.5 Options for MCU control unit

Designation	Part No.
Analog input module, 2 channels, 100 W, 0/4...22 mA, electrically isolated	2034656
Module carrier	6033578
Interface, Profibus module DP V0	2048920
Interface module Ethernet type 1	2055719
Interface module Ethernet type 2	2069666
Modbus TCP module	2059546

7.4.6 Miscellaneous

Designation	Part No.
Cover	2052377
Fuse set T 2 A (for MCU with power voltage supply)	2054541
Fuse set T 4 A (for MCU with 24 V supply)	2056334

7.5 Consumable parts for 2-years operation

7.5.1 Sender/receiver unit

Designation	Number	Part No.
Flange seal k100	2	7047036
Flange seal k150	2	7047937
O-ring 57x5	1	5321973
O-ring 57x4,5 (for sender/receiver units DHSP-T2C11NNXX and DHSP-T2C21NNXX)	1	5328042
Optics cloth	4	4003353

7.5.2 MCU with integrated purge air supply

Designation	Number	Part No.
Filter element C1140	4	7047560

7.5.3 Optional external purge air unit

Designation	Number	Part No.
Filter element Micro-Topement C11 100	4	5306091

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