Operating Instructions
DUSTHUNTER SB30

Scattered Light Dust Measuring Device

Endress+Hauser
People for Process Automation

Described product
Product name: DUSTHUNTER SB30

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

Legal information

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

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Contents

1 About this document

1.1 Function of this document

These Operating Instructions describe:

- Device components
- Mounting and electrical installation
- Commissioning
- Operation
- Maintenance work required for reliable operation
- Troubleshooting
- Decommissioning

1.2 Scope of application

These Operating Instructions are only applicable for the measuring device described in the product identification.

The Operating Instructions are not applicable for other Endress+Hauser measuring devices.

The standards mentioned in the Operating Instructions must be observed in their currently valid version.

1.3 Target groups

This Manual is intended for persons installing, commissioning, operating and maintaining the device.

1.4 Further information

Observe the enclosed data medium for the product, as well as other supplied documents.

1.5 Symbols and document conventions

1.5.1 Warning symbols

Table 1: Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard by hot surfaces and process gases
	Hazard by voltage
	Hazard by laser radiation
	Hazard for the environment/nature/organic life

1.5.2 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.

Note

Hints.

1.5.3 Information symbols

Table 2: Information symbols

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

1.6 Data integrity

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

Endress+Hauser always assumes that the customer is responsible for the integrity and confidentiality of data and rights involved in connection with using the products.

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

2 For your safety

2.1 Basic safety information

- ▶ Read and observe these Operating Instructions.
- ▶ Observe all safety instructions.
- ▶ If there is something you do not understand: Contact Endress+Hauser Service.

Retention of documents

- ▶ They must be kept available for reference.
- ▶ They must be passed on to new owners.

Correct project planning

- Basis of this Manual is the delivery of the measuring device according to the preceding project planning (e.g., based on the application questionnaire of Endress+Hauser) and the relevant delivery state of the device (see delivered System Documentation).
  - ▶ Contact Endress+Hauser Service if you are not sure whether the measuring device corresponds to the state defined during project planning or to the delivered System Documentation.

Correct use

- Use the devices 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, inspection, transport and storage.
- No components may be removed, added or changed on and in the device unless described and specified in the official manufacturer information. Otherwise
  - – the device could become dangerous
  - – the manufacturer's warranty becomes void.

Special local conditions

In addition to the information in these Operating Instructions, follow all local laws, technical rules and company-internal operating directives applicable wherever the device is installed.

2.1.1 Electrical safety

Hazard through electrical shock

There is a risk of electric shock when working on the measuring device with the voltage supply switched on.

- Before starting work on the measuring device, ensure the voltage supply can be disconnected using a power isolating switch or circuit breaker in accordance with the valid standard.
- 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 of the device connection.
- The measuring device must be disconnected from the voltage supply before opening the enclosure.
- After completion of the work or for calibration, the voltage supply may only be activated again by authorized personnel complying with the applicable safety regulations.

Endangerment of electrical safety through power cable with incorrect rating

Electrical accidents can occur when the specifications for installation of a power cable have not been adequately observed.

- Always observe the exact specification in the Operating Instructions when installing a power cable (see “Specifications”, page 89).
- The user must ensure that the power cable is designed in accordance with the applicable standards.

2.1.2 Hazard through hot and/or aggressive gases and high pressure

The device components are attached directly to the gas duct. In plants with a low hazard potential, installation or removal can be carried out during plant operation when the applicable regulations and safety provisions of the plant are observed, and necessary and appropriate protective measures are taken.

Danger from exhaust gas

Harmful sample gases and high process pressures can cause injuries if handled incorrectly.

- In plants with harmful gases or high pressure, work on the duct and device flange should only be carried out when the plant is at a standstill.

Danger from high temperatures

Risk of skin burns through hot measuring gases and hot components

- In plants with high temperatures, work on the duct or hot assemblies should only be carried out when the plant is at a standstill.
- Keep fitted valves and seals closed until cooled down.
- Allow enclosure parts or surfaces involved to cool down before touching.
- When work is necessary on hot assemblies:
- Before opening gas paths or touching surfaces: Take suitable protective measures (e.g. personal protective equipment).
- Use heat-resistant tools.
- Keep disassembled hot components away from electrical components and cables. Allow to cool down at a protected place.

2.1.3 Work on the device

Danger to system safety in the event of unauthorized work on the device

Work on the device not described in the associated documents can lead to unsafe operation of the measuring device and thus endanger plant safety.

- Only carry out the work on the device described in these Operating Instructions and the corresponding documents.

Danger to operational safety in the event of visible damage

Operating the measuring device with visible damage can further damage the measuring device or make it a source of danger.

- Check the components of the measuring device for external damage after each transport.
- If there is visible damage, do not put the measuring device into operation but repair it or send it in for repair (see “Return delivery”, page 88).

Hazard by laser radiation

Laser class 2 device; there is a risk of eye injury when working on the device when switched on.

- Do not look directly into the beam path.
- Do not point the laser beam at persons.
- Avoid laser beam reflections.
- Observe the valid national regulations for laser protection.

2.2 Warning information on device

The following warning symbol is located on the sender/receiver unit.

Table 3: Warning symbol on the sender/receiver unit

Symbol	Significance
	Warning: Laser class 2, do not look into the beam

2.3 Intended use

DUSTHUNTER SB30 is designed for use in industrial plants for continuous measurement of the dust particle concentration in gas streams.

2.4 Improper use

DUSTHUNTER SB30 is **not** approved for operation in potentially explosive atmospheres (in accordance with DIN EN 60079).

2.5 Requirements on the personnel's qualification

Table 4: Qualification requirements

Tasks	User groups	Qualification
Mounting	• Qualified personnel	• Authorized mechanic, welding skills if necessary • Device expertise; basics of optical operating principle (customer training at Endress+Hauser if necessary)
Electrical installation	• Qualified personnel	• Authorized electrician (qualified electrician or comparable training) • Device expertise (customer training at Endress+Hauser if necessary)
Initial commissioning and parameterization	• Qualified personnel	• Knowledge of electrical/communication technology • Device expertise (customer training at Endress+Hauser if necessary)
Calibration (mg/m³)	• Specialized institutes • Qualified personnel	• Specialist equipment and expertise for carrying out gravimetric comparison measurements
Recommissioning	• Authorized operator	• General knowledge of measurement technology • Device expertise (customer training at Endress+Hauser if necessary)
Decommissioning	• Authorized operator • System integrator	• Plant knowledge • Device expertise (customer training at Endress+Hauser if necessary)
Operation	• Operator	• General knowledge of measurement technology • Basic device knowledge (customer training at Endress+Hauser if necessary)
Troubleshooting	• Operator • Authorized operator	• General knowledge of measurement technology • Basic device knowledge (customer training at Endress+Hauser if necessary)
Maintenance	• Operator • Authorized operator • System integrator	• General knowledge of measurement technology • Basic device knowledge (customer training at Endress+Hauser if necessary)

2.6 Application notes

2.6.1 Purge air supply

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

The user must ensure that:

- ▶ The purge air supply runs reliably and continuously
- ▶ A correct connection between the lines and connections is ensured and regularly checked.
- ▶ Failure of the purge air supply is immediately detected (e.g., by using pressure monitors).
- ▶ The sender/receiver unit is removed from the duct as quickly as possible (depending on the local conditions) and the duct opening is covered (e.g. with a blind flange), see “Flange with tube”, page 93).

2.6.2 Safety information and protective measures

Protection devices

According to the respective hazard potential:

- ▶ Suitable protective devices must be available.
- ▶ Personal safety equipment must be available in sufficient quantities.
- ▶ Personal safety equipment must used by the personnel.

Preventive measures for operating safety

The user must ensure that:

- ▶ Neither failure nor erroneous measurements can lead to damaging or unsafe operating conditions.
- ▶ The specified maintenance and inspection tasks are carried out regularly by qualified, experienced personnel.

Avoiding damage

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 available at all times and as quickly as possible to analyze faults and take appropriate measures to avert danger.
- ▶ The maintenance personnel are adequately qualified to react correctly to malfunctions of the measuring device and any resulting operational interruptions (e.g., when used for measurement and control purposes).
- ▶ The malfunctioning equipment can be switched off immediately in case of doubt and that switching off does not cause collateral malfunctions.

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

Procedure for unsafe operating conditions

If the device is or could be in an unsafe state:

- ▶ Disconnect the device from the power voltage and signal voltage.
- ▶ Dismantle the device from the measuring point, seal open flanges.
- ▶ Secure the device against unallowed or unintentional start-up.

3 Product description

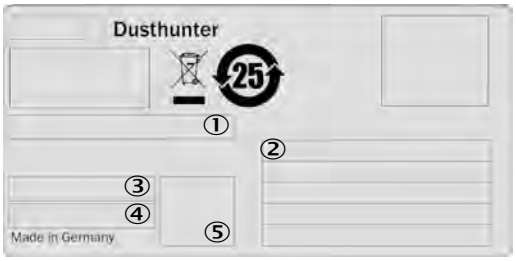
3.1 Product identification

A sender/receiver unit can be used as a stand-alone measuring device, optionally a control unit can be used.

Table 5: Product identification

Measuring device	**DUSTHUNTER SB30**
Manufacturer	Endress+Hauser SICK GmbH+Co. KG Bergener Ring 27 · D-01458 Ottendorf-Okrilla · Germany
Component: **Sender/receiver unit**	**DUSTHUNTER SB30**
Device version	Stand-alone, continuous dust emission measuring device
Type plate	Sender/receiver unit: On the right side
Components: **Control unit**	**MCU**
Device version	Control unit (optional)
Type plates	Control unit: On the left side and inside cover

Type plate



No.	Variable
1	Type code
2	Technical data
3	Part number
4	Serial number
5	Data matrix code

Fig. 1: Type plate (example)

3.2 Product characteristics

- The sender/receiver unit is an in-situ measuring device which means continuous measurement is done directly in the gas carrying duct.
- Measured variable: Dust concentration, scattered light intensity, dust concentration (after gravimetric comparison measurement)
- Measuring principle: Scattered light measurement (backwards)

3.3 Device variants

The DUSTHUNTER SB30 measuring device is available in three versions.

The device components required depend on the area of application and the desired range of functions.

Table 6: Device variants

Variant	Components
Device without control unit	• Sender/receiver unit DHSB30 • Flange with tube
Device **with** control unit **without** integrated purge air supply	• Sender/receiver unit DHSB30 • Flange with tube • MCU-N control unit (without integrated purge air supply) • External purge air unit SLV, for internal duct pressure -50 ... +30 hPa
Device **with** control unit **including** integrated purge air supply	• Sender/receiver unit DHSB30 • Flange with tube • MCU-P control unit (with integrated purge air supply), for internal duct pressure -50...+2 hPa

3.3.1 Optional components

- Non-return valve
- Light trap
- Weather hood for sender/receiver unit
- Weather hood for purge air unit

3.4 Product layout

3.4.1 Device overview

Variant 1: Device without control unit

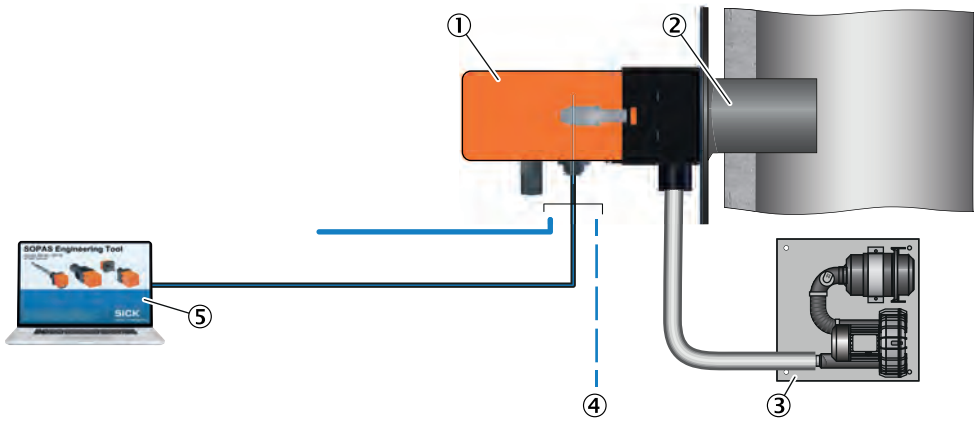


Fig. 2: Variant 1: Device without control unit

① Sender/receiver unit
② Flange with tube
③ Purge air unit
④ Connection provided by customer
⑤ Operation via PC

Variant 2: Device with control unit without integrated purge air supply

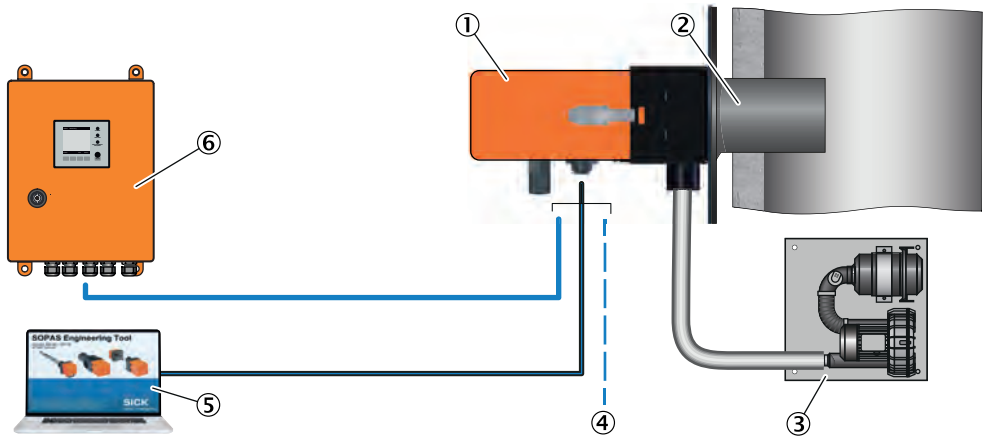


Fig. 3: Variant 2: Device **with** control unit **without** integrated purge air supply

① Sender/receiver unit
② Flange with tube
③ Purge air unit
④ Connection provided by customer
⑤ Operation via PC
⑥ MCU-N control unit

Variant 3: Device with control unit including integrated purge air supply

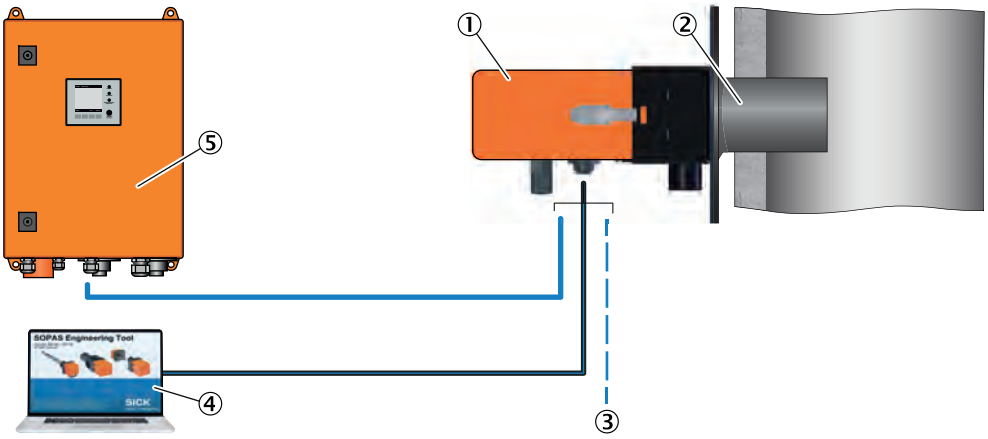


Fig. 4: Variant 3: Device **with** control unit **including** integrated purge air supply

① Sender/receiver unit
② Flange with tube
③ Connection provided by customer
④ Operation via PC
⑤ MCU-P control unit

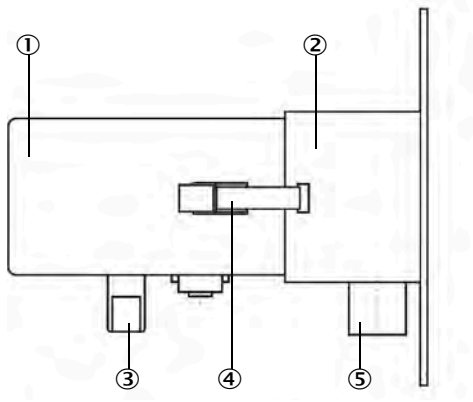
3.4.2 Flange with tube

The flange with tube is attached directly to the gas duct of the measuring point and is used to mount the sender/receiver unit and an optional weather hood.

The flange with tube is available in different steel grades and dimensions (see “Selecting the flange with tube”, page 25).

3.4.3 Sender/receiver unit

The sender/receiver unit contains the optical and electronic assemblies to send and receive the light beam as well as to process and evaluate the signals. An RS485 interface is available for service purposes.



① Enclosure with electronics
② Mounting attachment (flange and purge air connection)
③ Handle
④ Hinge (and tension lock)
⑤ Purge air connection DN40

Fig. 5: Sender/receiver unit DUSTHUNTER SB30

Sender/receiver unit type code

Sender/receiver unit DHSB - T30 x x x

DUSTHUNTER
Scattered light backward
Sender/receiver SB30
Fieldbus
- M: Modbus

Immersion depth
- 0: Short (400 mm)
- 1: Long (800 mm)

Version
- S: Standard
- X: Special device

3.4.4 Weather hood for sender/receiver unit (option)

Weather hoods are available when using the sender/receiver unit outdoors (see “Weather hoods”, page 96).

NOTE:
A weather hood is strongly recommended for outdoor use. This prevents rainwater entering.

3.4.5 MCU control unit (option)

The control unit serves as user interface for the DUSTHUNTER SB30 sender/receiver unit, prepares and outputs the measured values and also performs control and monitoring functions. The device parameters can be set via the RS485 service interface using a computer and an operating program. The MCU-P version also has an integrated purge air supply.

In detail, the control unit takes over the following tasks, for example:

- Sender/receiver unit voltage supply.
- Output of measured values, computed data and operating states
- Communication with the peripheral equipment
- Output of error messages and other status signals.
- Control of automatic test functions and access during service (diagnosis)

MCU type code

MCU control unit: MCU - N W O D N 0 0 0 0 0 N N N E

Purge air supply
- N: Not present
- P: Integrated purge air supply

Voltage supply
- W: 90...250 V AC

Enclosure variant
- O: Wall enclosure, compact, orange, stainless steel

Display module
- D: Present

Other options
- N: Not present

Analog input module(0/4...20 mA; 2 inputs per module)
- 0: Not present

Analog output module (0/4...20 mA; 2 outputs per module)
- 0: Not present

Digital input module (4 inputs per module)
- 0: Not present

Digital output module W(48 V DC 5 A; 2 changeover contacts per module)
- 0: Not present

Digital output module W (48 V DC 0.5 A; 4 N/O contacts per module)
- 0: Not present

Interface module
- N: Not present
- M: Interface module RS 485 (Modbus ASCII/RTU)
- J: Interface module Ethernet (Modbus TCP)
- E: Interface module Ethernet / CoLa-B for SOPAS ET,

Special features
- N: None

Explosion protection certification
- N: None

Software
- E: Emission

3.4.6 External purge air unit (option)

An external purge air unit must be used for an internal duct pressure of +2 ... +30 hPa.

Please refer to the Operating Instructions for the SLV4 purge air unit on the enclosed product data medium.

A suitable weather hood is available for outdoor use of the external purge air unit (see “Weather hoods”, page 96).

Purge air heater

It is recommended to use an optionally available purge air heater (see “Purge air supply”, page 99) to prevent condensation in the device or flange tube when the measuring device is operated at gas temperatures close to the dew point or very low ambient temperatures

The purge air heater can only be used together with the external purge air unit.

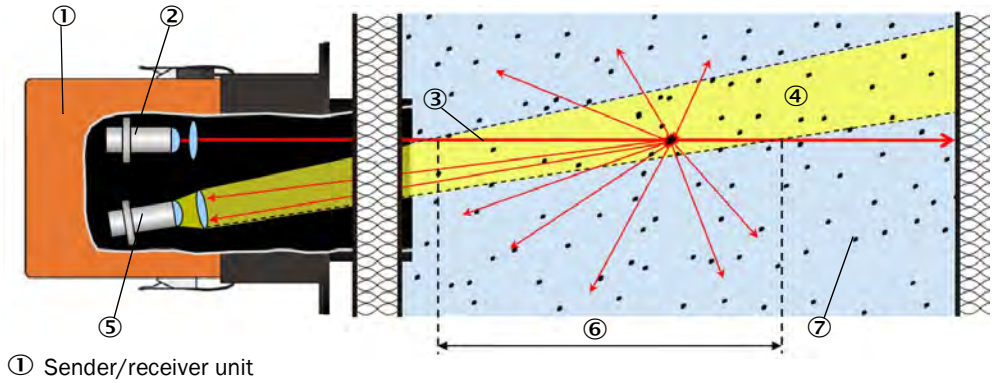
3.5 Product function

3.5.1 Functional principle

The measuring device works according to the scattered light measurement principle (backward dispersion). A laser diode beams the dust particles in the gas flow with modulated light in the visual range (wavelength approx. 650 nm). The scattered light intensity of the illuminated particles is detected by the receiver, whereby the measurement volume is defined by the overlap of the sender beam and the field of view of the receiver optics.

To maintain the measuring function, a permanent gas flow (purge air) keeps the optics free from dust particles as well as condensate.

The measured scattered light intensity is proportional to the dust concentration. However, the scattered light intensity depends not only on the number and size of the particles, but also on their optical properties. Therefore, the sender/receiver unit must be calibrated using a gravimetric comparison measurement for an exact determination of the dust concentration (see “Gravimetric comparison measurement (calibration)”, page 63).



① Sender/receiver unit
② Sender
③ Laser beam
④ Receiver field of view
⑤ Receiver
⑥ Measuring volume depth
⑦ Dust laden exhaust gas

Fig. 6: Measuring principle

3.5.2 Measuring distance

The measuring distance is divided into two areas. The immersion depth is the distance from the measuring device to the point where the sender and receiver beams overlap, the measuring volume is the area in which the sender and receiver beams overlap. The measuring volume must not reach the duct wall.

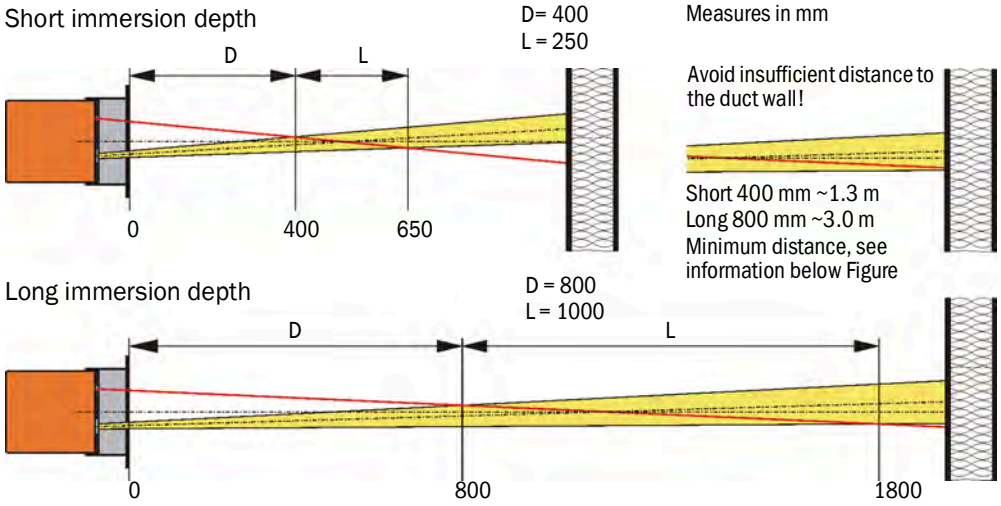


Fig. 7: Relation between scattering angle, immersion depth (D) and measuring volume length (L)

The immersion depth including the measuring volume (D+L) should reach a maximum of half the duct diameter in order to maintain a sufficient distance to the rear wall of the duct. If the laser beam hits the rear wall of the duct within the measuring volume, strong background radiation is to be expected.
It is possible to a limited extent to allow the flange pipe to protrude from the duct in order to influence the distance (see “Selecting the flange with tube”, page 25). A light trap is recommended for smaller internal duct diameters (see “Light trap”, page 25).

3.5.3 Function check

A function check can be triggered at fixed intervals to automatically check the function (check cycle) of the measuring device. The default setting is a time difference of 8 h until the next function check (see “Factory settings”, page 53). The start time for the time difference (interval) up to the next automatic function check begins when the device is switched on.

Any unallowed deviations from normal behavior that may occur during the function check are signaled as warning or error. A function check triggered manually can help localize possible error causes should a device malfunction occur (see “Setting the function check”, page 61).

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 device generates an error signal for deviations greater than ±2%. The error message is cleared again when the next function check runs successfully. The control value is determined with high accuracy due to a high number of intensity changes. The fixed value of 70% is output for very low dust concentrations (< approx. 1 mg/m^3).

Zero point 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 malfunction signal is generated when the “zero value” is outside the specified range.

①: The 70% control value (span value) is mapped on the analog output between Live Zero and 20 mA.

②: The 0% control value (zero point value) is mapped on the analog output between Live Zero and 20 mA (see “Application parameters”, page 55).

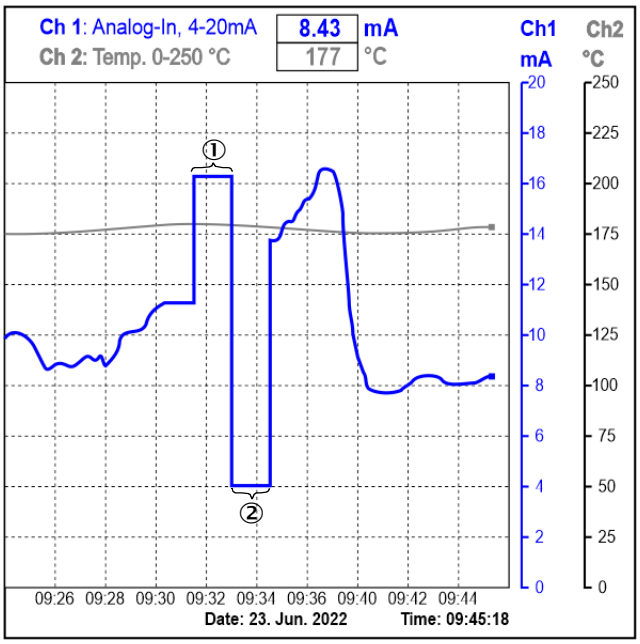


Fig. 8: Output of the function check (example graphic)

- The analog output must be activated to output control values on the analog output (see “Parameterizing analog outputs (control unit option)”, page 68).
- 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.
- A corresponding message is displayed on the control unit display during the function check.
- A function check is not started automatically when the measuring device is in “Maintenance” mode.
- Changes to the interval time are first effective after the next start timepoint.

3.5.4 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 device. Compliance within the allowed tolerance means the measuring device is working correctly. The filter glasses with holder required for the check are deliverable as a check filter set including a carrying case (see “Device check accessories”, page 99).

3.6 Interfaces

3.6.1 Standard interfaces of sender/receiver unit

Analog output	1 output 4...22 mA (electrically isolated; active; resolution 12 bits) to output: Scattered light intensity (corresponds to the uncalibrated dust concentration*), calibrated dust concentration, scaled dust concentration.
Relay outputs	3 N/O contacts (48 V, 1 A) to output status signals: Operation/Malfunction; Limit value; Warning/ Maintenance/Function check (selectable).
Digital inputs	4 inputs to connect potential-free contacts (Selection of Maintenance, Function check, Linearity check, Calibration curve switching, Filter monitoring).
Communication	Service interface RS485 for parameterization with operating program SOPAS ET or connection of an MCU
*	see “Gravimetric comparison measurement (calibration)”, page 63.

3.6.2 Standard interfaces of MCU control unit

Analog output	1 output 0/2/4...22 mA (electrically isolated; active; resolution 12 bits) to output: Scattered light intensity (corresponds to the uncalibrated dust concentration*), calibrated dust concentration*, scaled dust concentration.
Analog inputs	2 inputs 0...20 mA (standard; without electric isolation; resolution 12 bits).
Relay outputs	5 changeover contacts (48 V, 1 A) to output status signals: Operation/Malfunction; Maintenance; Function check; Maintenance request; Limit value.
Digital inputs	4 inputs to connect potential-free contacts (e.g. to connect a maintenance switch, trigger a function check or further actions).
Communication	USB 1.1. RS485 interface for communication between sender/receiver unit and control unit.
*	see “Gravimetric comparison measurement (calibration)”, page 63.

3.6.3 Optional interfaces of MCU control unit

- Various communication modules
- Analog and digital input/output modules
  (see “Selecting the optional control unit”, page 25)

3.6.4 Operating program SOPAS ET

SOPAS ET is a SICK software for easy operation and parameterization of the DUSTHUNTER measuring device. Further functions are also available (e.g., data storage and graphic displays). The software Is supplied on the enclosed data medium.

SOPAS ET can be used on a computer which is connected via an interface with the sender/receiver unit or the optional control unit of the DUSTHUNTER measuring device (see “SOPAS ET”, page 51).

4 Project planning

4.1 Device configuration

The device components required depend on the respective application conditions.

4.1.1 Selecting the sender/receiver unit

Two variants of the sender/receiver unit with preset immersion depth are available. The selection depends on the duct geometry and the light conditions.

Recommendation:

- Variant 400 mm for duct diameters up to 3 m
- Variant 800 mm for duct diameters > 3 m

4.1.2 Project planning of voltage and purge air supply

Options for purge air supply:

- MCU control unit with integrated purge air unit (MCU-P)
- External purge air unit (SLV)
- On-site compressed air supply

Options for voltage supply:

- MCU control unit
- On-site voltage supply 24 V DC

Table 7: Voltage and purge air selection

Internal duct pressure	Connection and supply components	
	Purge air	Voltage
-50 ... 2 hPa	MCU-P with purge air hose DN40	MCU-P
-50 ... 30 hPa	Optional external purge air unit SLV	MCU-N or on-site
-50 ... 100 hPa	On-site compressed air supply (purge air connection DN40)	MCU-N or on-site

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.

Separate components of the purge air and voltage supply (to be ordered separately):

- Purge air hose nominal diameter 40 mm (with purge air supply by MCU-P control unit)
- Connecting cable from the MCU to the sender/receiver unit

Optional non-return valve

When the measuring device 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.

4.1.3 Selecting the flange with tube

Two variants of different nominal lengths, materials and pipe diameters are available.

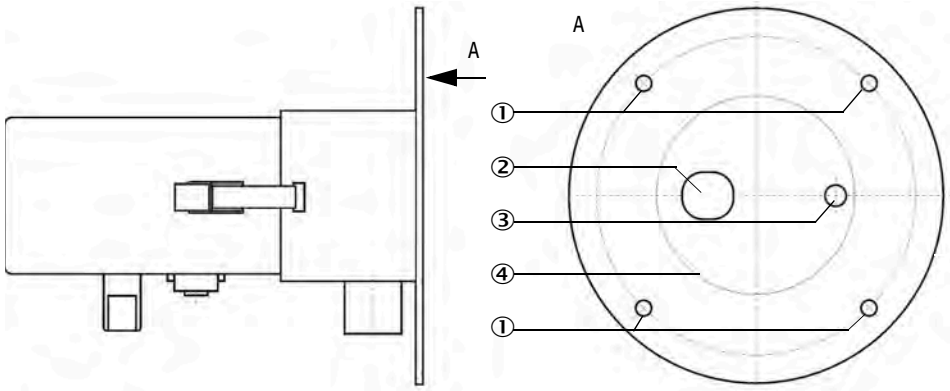
Selection criteria:

- Wall thickness and thermal insulation of the duct wall (nominal length)
- Duct diameter (see “Measuring distance”, page 21)
- Material pairing (for welded connection between flange and duct)

Dimensions and Part numbers: see “Flange with tube”, page 93.

Table 8: Flange with tube, nominal length overview

Material	Duct wall thickness including thermal insulation	
	Up to approx. 280 mm	Approx. 280...630 mm
1.0037 (St37)	350 mm Nominal length	700 mm Nominal length
1.4571 (V4A)		



① Fixing holes pitch circle Ø 225 mm
② Opening for measurement receiver
③ Opening for sender beam
④ Optical diameter used
(min. inner diameter of flange pipe)

Fig. 9: Flange adapter for sender/receiver unit

4.1.4 Light trap

The use of a light trap may be necessary in the following cases:

- Unfavorable background radiation
- Duct diameter < 3 m

4.1.5 Selecting the optional control unit

In addition to operating elements and a 24 V DC voltage supply, the MCU control unit provides an optional integrated purge air supply; alternative or additional interface modules can also be used (see “MCU control unit”, page 94).

4.2 Installation location

4.2.1 Project planning for measuring duct

Electrical connection

Ensure the device can be switched off with a power isolating switch or circuit breaker in accordance with EN 61010-1, this power isolating device must be provided on-site. The equipotential bonding cable of the sender/receiver unit at the measuring point must be flexible enough to allow the cable to remain connected both when the sender/receiver unit is removed and installed.

Determining the measuring point

The operator is responsible for determining the measuring point. Observe the regulations of the local authorities for official measurements. Furthermore, sufficient space must be provided for mounting and subsequent installation and removal of the sender/receiver unit.

Required thermal insulation

If the gas temperatures in the duct are higher than the permissible operating temperature of the measuring device, the following must be observed, among other things:

- Apart from the duct surface, other parts (e.g. device components) that can be subjected to prohibited high temperatures through thermal conduction are to be included in the thermal insulation or the thermal conduction prevented.
- The operator must take into consideration that the device-internal warming can be up to 2 K. It may be necessary to shade the device in climate zones with high temperatures and intensive sunlight.
- The maximum ambient temperature of 60 °C must be observed during operation (see “Specifications”, page 89)

Miscellaneous

- The operator must ensure that the dust measuring device is permanently supplied with purge air.
- The operator is responsible for the tightness of the purge air line between the device, connecting pieces and flange and for monitoring the tightness.

NOTICE:

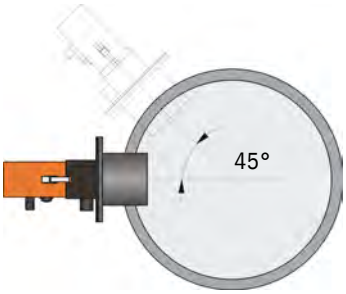
Device damage possible in case of purge air failure

If the device is operated without a purge air supply, there is a risk of components being damaged after a short time. If the measuring device has been operated without a purge air supply, it should be returned to the factory for testing.

4.2.2 Project checklist

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 tick off the completed steps.

Table 9: Project checklist

Task	Requirements		Work step	☑
Determine measuring location and installation locations	Inlet and outlet paths according to DIN EN 13284-1 (inlet ≥ 5x hydraulic diameter d_h, outlet ≥ 3x d_h; distance to stack opening ≥ 5x d_h)	For round and square ducts: d_h = duct diameter For rectangular ducts: d_h = 4x cross-section divided by circumference	Follow specifications for new plants Select best possible location for existing plants. For too short inlet/outlet paths: Inlet path > outlet path	☐
	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	☐
	Fitting position for the sender/ receiver unit (see “Clearance for sender/ receiver unit”, page 31)		Select the best possible measuring point. (Results from local conditions, otherwise select representative measuring point and confirm by gravimetric control measurements if necessary)	☐
	Accessibility, accident prevention	The device components must be easily and safely accessible.	Provide platforms or pedestals as required.	☐
	Mounting with as little vibration as possible	Acceleration < 1 g	Avoid/reduce vibrations through adequate measures.	☐
	Ambient conditions	Limit values according to Technical Data	If necessary: Provide weather hoods/sun protection Enclose or lag device components	☐
Select the purge air supply	Sufficient primary purge air pressure depending on internal duct pressure	Plan a purge air heater for gas temperatures close to the dew point or very low ambient temperatures.	Select supply type. Plan a reliable purge air supply.	☐
	Clean intake air	Whenever possible, low amount of dust, no oil, no moisture, no corrosive gases	Select best possible location for air intake	☐
Select device components	Duct wall thickness with thermal insulation	Flange with tube	Set the immersion depth depending on the internal duct diameter (see “Measuring distance”, page 21). If necessary, plan additional measures to fit the flange with tube (see “Fitting the flange with tube”, page 30).	☐
	Internal duct pressure	Type of purge air supply		
	Fitting locations	Line and purge air hose lengths		
	Space requirement	Clearance for the sender/receiver unit	see Figure 11	☐
		Clearance for control unit	see “Fitting the optional MCU control unit”, page 31	☐
Plan calibration openings	Accessibility	Easy and safe	Provide platforms or pedestals as required.	☐
	Distances to measuring level	No mutual interference between calibration probe and measuring device	Ensure sufficient distance between the measurement and calibration level (approx. 500 mm)	☐
Plan the voltage supply	Operating voltage, power requirements	According to Technical data (see “Specifications”, page 89)	Plan adequate cable cross-sections and fuse protection, observe lightning protection and external interference.	☐

5 Transport and storage

5.1 Transport

Observe the following points when transporting the device components:

- Protect the device openings of the sender/receiver unit from weather and dust.
- Pack all components for transport so that shocks cannot damage the components.
- Close open electrical connections dust-tight.
- The environmental conditions in the Technical data must also be observed during transport (see “Specifications”, page 89).

5.2 Storage

Observe the following points when storing the device components:

- Clean the device, remove dust and other residues (residues of process media can be hazardous to health).
- Close open electrical connections dust-tight.
- Pack all components for storage and store at room temperature in a ventilated, dry and clean room.
- The environmental conditions in the Technical data must also be observed during storage (see “Specifications”, page 89).

6 Mounting

Carry out all assembly work on-site:

- ▶ Fit the flange with tube
- ▶ If required: Install optional light trap
- ▶ If required: Install optional control unit
- ▶ If required: Install optional weather hood for sender/receiver unit
- ▶ If required: Install optional external purge air unit and weather hood
- ▶ Lay hoses or pipes for purge air routing

6.1 Safety

WARNING:
Danger during mounting
Improper mounting can lead to injuries.
- ▶ Observe the relevant safety regulations as well as safety notices during all mounting work.
- ▶ Only carry out mounting work on plants with hazard potential (hot or aggressive gases, higher internal duct pressure) when the plant is at a standstill.
- ▶ Take protective measures against local or plant-specific hazards.

WARNING:
Risk of injury through inadequate fastening of the device
Inadequate fastening can cause the device or device components to become detached from the installation location and injure people if they fall down.
- ▶ Consider the device weight specifications when planning the fitting supports.
- ▶ Take possible vibration loads into account when choosing the fixtures.
- ▶ Before starting installation, check the condition and load-bearing capacity at the installation location.

6.2 Preparing the measuring point

The operator is responsible for preparing the measuring point. Basis for determining the measuring point:

- Preceding project planning
- Regulations of the local authorities

Responsibility of the operator:

- Determining the measuring point, carrying out any necessary structural changes
- Determining the suitable purge gas (e.g. compressed air, ambient air, inert gas)
- Ensuring uninterrupted purge air supply

6.3 Scope of delivery

Check the scope of delivery according to the order confirmation.

6.4 Mounting sequence

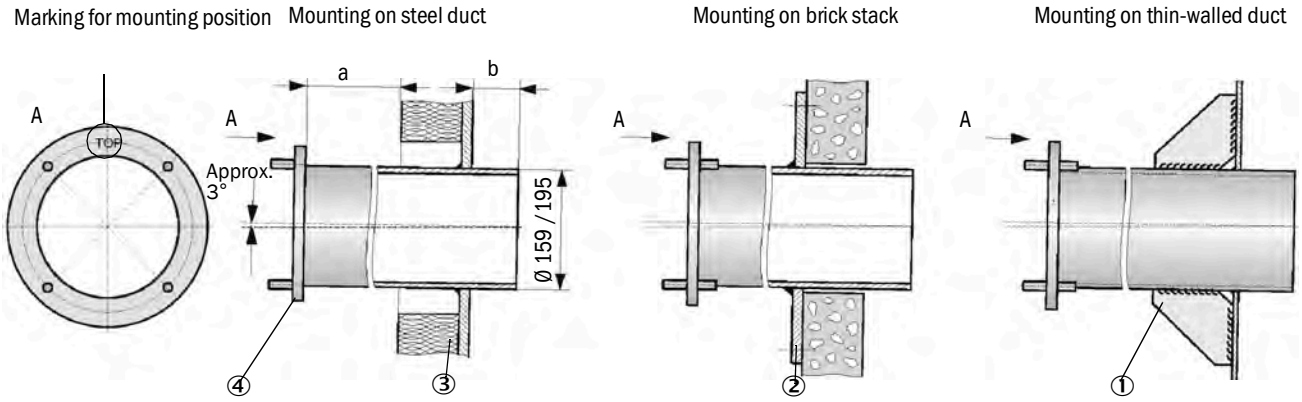
Installation is carried out according to the sequence in this Section, the sender/receiver unit is not installed until commissioning.

6.4.1 Mounting the optional light trap

The light trap must capture the emitted light beam of the sender/receiver unit on the opposite side of the duct as precisely as possible. Installation instructions with information on determining the mounting point are included with the light trap.

It is easier to mount the light trap first and then the flange with tube in order to adjust the laser to the light trap by adjusting the flange.

6.4.2 Fitting the flange with tube



① Junction plate
② Anchor plate
a Distance between flange and outer duct wall
③ Duct wall
④ Flange with tube
b Distance between flange and inner duct wall

Fig. 10: Fitting the flange with tube

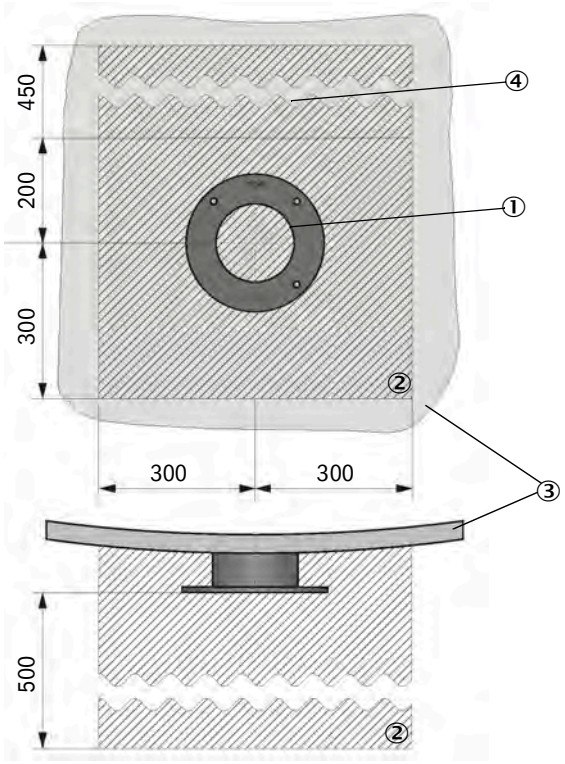
NOTE:
Maximum wall and isolation thickness are derived from the flange tube length (350 mm or 700 mm) less the distance between flange and stack outer wall, and stack immersion depth (dimension b (≥ 30 mm)).
For installation of the weather hood, a spacing must be provided between the flange and the outer duct wall (dimension a(≥ 40 mm)).

Work to be performed

1 Measure the fitting location and mark the installation location.
Observe the clearance for mounting the sender/receiver unit (see Figure 11).
2 Remove thermal insulation (when fitted).
3 Cut out suitable openings in the duct wall; drill suitably sized holes in brick and concrete ducts. Pipe diameter flange tube (see “Flange with tube”, page 93).

NOTICE:
▶ Do not let separated pieces fall into the duct.

4 Insert the flange with tube in the opening slanting slightly downwards (at least 2 to 3 °) so that the “Top” marking points upwards and any condensate that may collect in the duct can drain off.
5 Weld the flange with tube on using an anchor plate for brick or concrete stacks, insert junction plates for thin-walled ducts (see Figure 10).
6 Close off the flange opening after fitting to prevent gas escaping.



① Flange with tube
② Clearance
③ Duct wall
④ Optional: Weather hood (Clearance for placement and removal)
All dimensions in mm

Fig. 11: Clearance for sender/receiver unit

6.4.3 Laying purge air hoses

Lay the purge air hoses as short as possible and free of bends, shorten as required. Maintain sufficient distance from hot duct walls.

6.4.4 Fitting the optional MCU control unit

Fit the MCU control unit in a protected location that is easily accessible.

The following must be taken into account:

- Maintain the ambient temperature according to the Technical Data; take possible radiant heat into consideration (shield when necessary).
- Protect against direct sunlight.
- The control unit must be firmly mounted on a suitable wall or rack, with the cable bushings pointing downwards.
- Whenever possible, choose an installation location with minimum vibrations; dampen any vibrations when necessary.
- Provide sufficient clearance for lines and opening the door.
- For outdoor installation, it is recommended for the customer to provide a weather protection hood.

For further information on maximum cable lengths and minimum voltage, see “Information on electrical connection cables”, page 34.

Steps

1 Drill the holes according to the installation drawing (Ø 7.2 mm for M8).
2 Screw the control unit tight to the four mounting brackets.

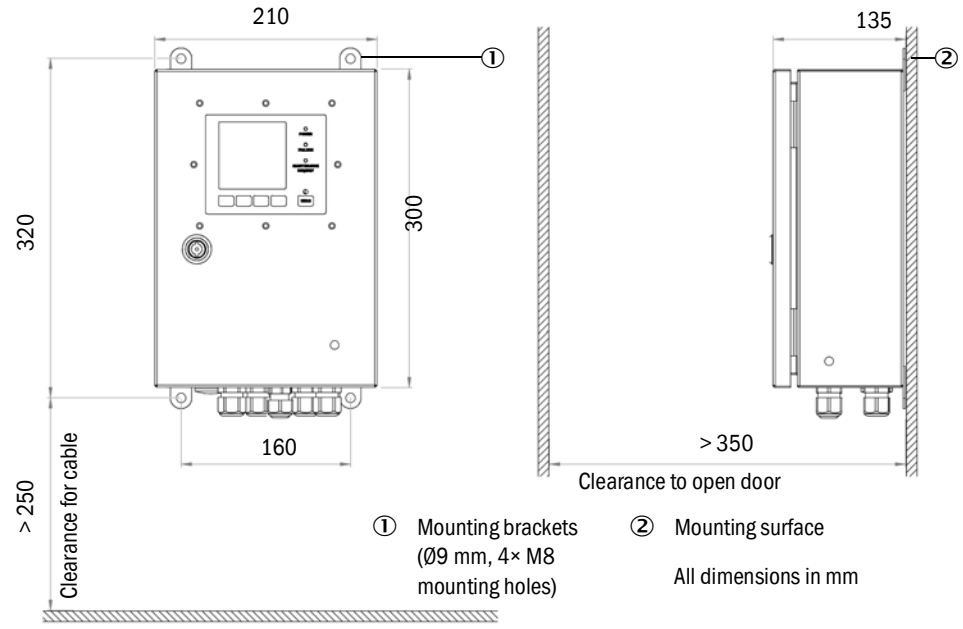


Fig. 12: Clearance for MCU-N control unit

Additional requirements when using the MCU-P control unit

- Install the control unit at a location with dry, preferably clean intake air. The temperature of the intake air must correspond to specifications in the Technical data (see "Specifications", page 89). If necessary, lay an air intake hose at a location where conditions are more favorable.
- The purge air hose to the sender/receiver unit should be as short as possible (max. 10 m including the length of the air intake hose if necessary).

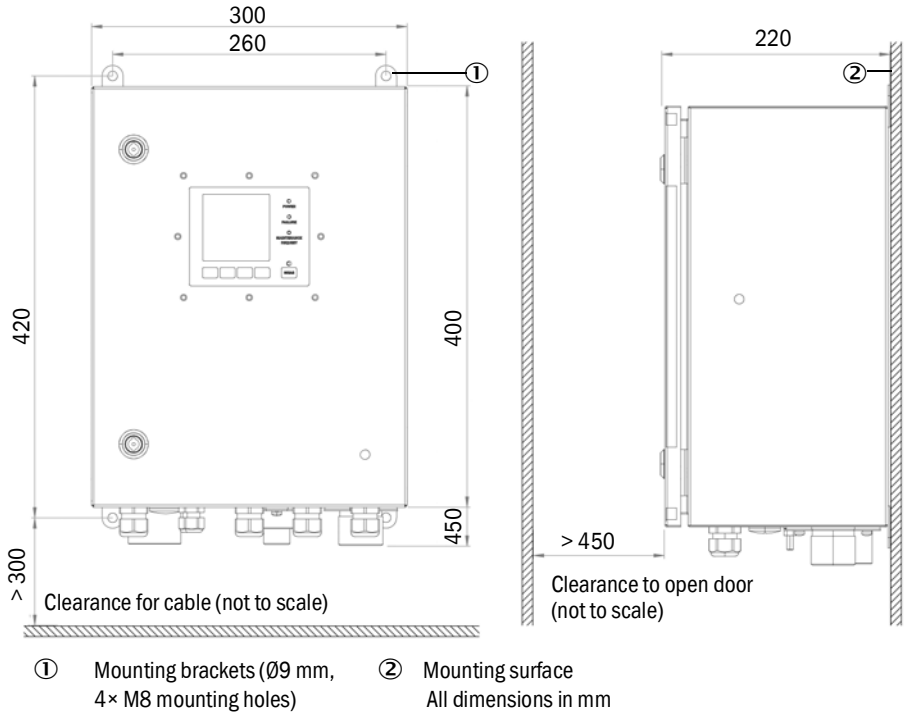


Fig. 13: Clearance for MCU-P control unit (with integrated purge air unit)

6.4.5 Fitting the optional weather hood for sender/receiver unit

Installation work

- ▶ Push base plate ⑤ onto the flange with tube ②, slot onto threaded bolts ③ of the duct-side surface of the flange plate and screw on.
- ▶ The hood can now be placed on the base plate by the catches and locked with the locking lever.

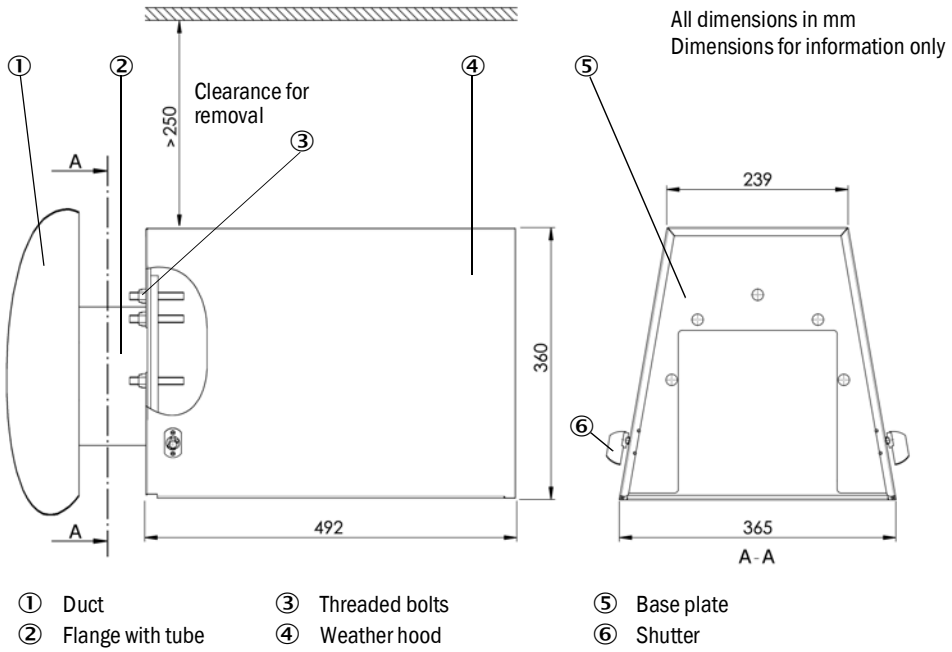


Fig. 14: Mounting dimensions of weather hood

6.4.6 Fitting the optional external purge air unit.

NOTE:
For information on the purge air unit, see the Operating Instructions of the purge air unit (SLV4) on the enclosed product data medium.

7 Electrical installation

All the installation work described above must have been carried out before starting installation.

NOTICE:

Check device suitability before installation.

▶ Before installation, check that the type code and type plate match the intended application.

Carry out all installation work on-site.

▶ Laying all voltage supply and signal cables
▶ Installing switches and power fuses
▶ Connecting the voltage supply and signal cables
▶ Connecting the purge air supply

- Plan adequate line cross-sections (see “Information on electrical connection cables”, page 34).
- Cable ends with plugs to connect the sender/receiver unit must have sufficient free length.

7.1 Safety

The electric installation may only be carried out by a trained electrician.

7.1.1 Information on electrical connection cables

For the signal cables with low voltage limits, only shielded cables with twisted pairs should be used (e.g., UNITRONIC LiYCY (TP) Li2YCY 2 x 2 x 0.5 mm^2 from Lappkabel; 1 pair of wires for RS 485, 1 pair of wires for voltage supply; not suitable for underground laying). Cables with other designations but equivalent construction and comparable or higher electrical properties are permissible.

The maximum cable length depends, among other things, on the internal resistance of the cable. When using suitable connection cables, the maximum distance for signal transmission (RS485 interface) is 1000 m.

For the voltage supply (separate, on-site or by the control unit), the minimum operating voltage of at least 20 V (at maximum current consumption, see “Sender/receiver unit DUSTHUNTER SB30”, page 90) must be observed.

- Protect cables especially endangered by thermal, mechanical or chemical stress, e.g. by laying in protective tubes.
- The cross-section of each individual wire should not be smaller than 0.5 mm^2.
- Unused wires should be connected with a ground cable (ground potential) or secured so that a short circuit with other conductive parts is excluded.
- Torque for tightening the cable glands
  - with sealing plugs: 5 Nm,
  - with inserted cable: 10 Nm (M20) or 12 Nm (M25).

7.2 Connection overview

7.2.1 Connections on the device

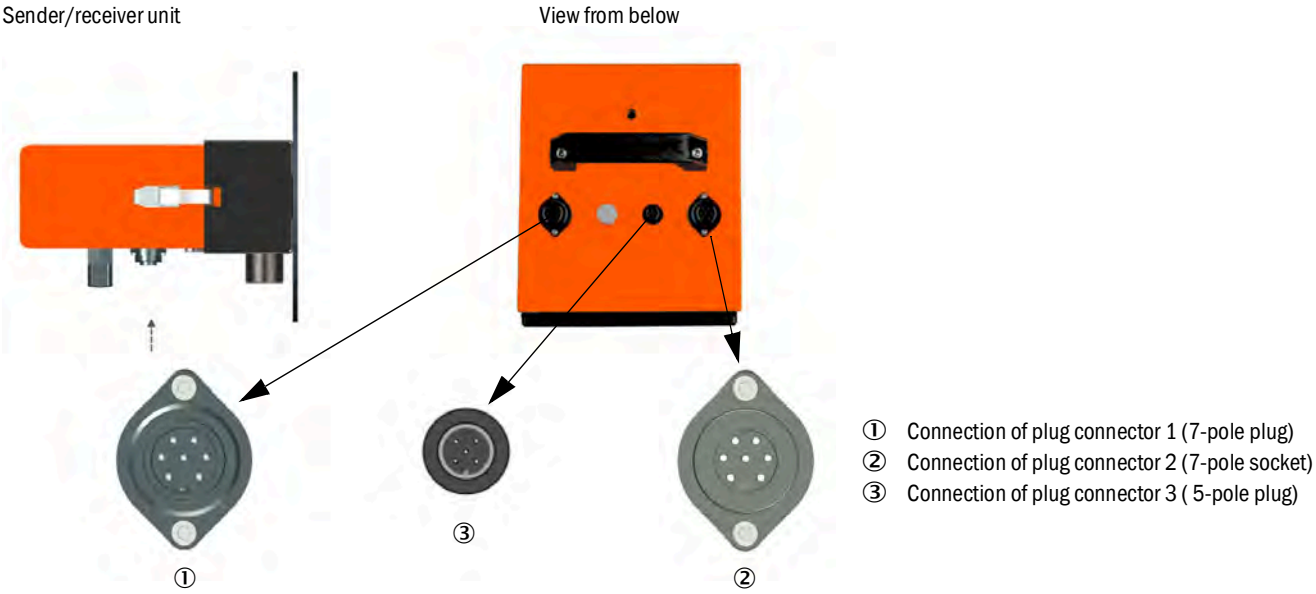


Fig. 15: Connection overview

Table 10: Intended use of the interfaces

Device variant	Interface
SB30 without MCU	**Plug connector ①:** – Voltage supply to device. – Analog output (0...20 mA) for measured value – Data communication via Modbus/RS485
	Plug connector ②: Enables the use of output relays and digital inputs 3 and 4 when connected on-site: – Calibration curve switching, filter monitoring. – Operation/malfunction, limit value, warning/maintenance/function check (selectable with SOPAS ET). Necessary if the output relays and calibration curve switching functions are not used via Modbus or for the synchronization signal for filter monitoring.
	Plug connector ③: Parameterization: – With PC and SOPAS ET – USB service adapter required
SB30 with MCU	**Plug connector ①:** – Voltage supply to device. – Signal processing by MCU, RS485/Cola B (switchover on the circuit board) – Parameterization
	Plug connector ②: Enables the use of output relays and digital inputs 3 and 4 when connected on-site: – Calibration curve switching, filter monitoring – Operation/malfunction, limit value, warning/maintenance/function check (selectable with SOPAS ET). Necessary if the output relays and calibration curve switching functions are not used via SOPAS ET or for the synchronization signal for filter monitoring.
	Plug connector ③: Alternative parameterization directly on the device: – With PC and SOPAS ET – USB service adapter required

7.2.2 Pin assignments of plug connector

NOTE:
The information on the wire colors refers only to the cables offered by Endress+Hauser (see “Accessories”, page 98).
The colors can differ when using cables from other manufacturers.

Table 11: Plug connector 1

Pin	Wire color	Assignment
1	White	+24 V DC
2	Grey	(-) Analog output (0 ... 20 mA)
3	Yellow	RS485 (B) Modbus Slave or MCU
4	Green	RS485 (A) Modbus Slave or MCU
5	Pink	(+) Analog output (0 ... 20 mA)
6	Brown	0 V (Gnd)
7	Black	Gnd and shield

Table 12: Plug connector 2

Pin	Wire color	Assignment
1	White	DI3 (calibration curve switching)
2	Grey	DI4 (filter sync.)
3	Yellow	Relay 1 N/O contact
4	Green	Relay 2 N/O contact
5	Pink	Relay 3 N/O contact
6	Brown	COM relay
7	Black	Gnd and shield

Table 13: Plug connector 3

Pin	Assignment
1	DI1 Maintenance
2	DI2 Function check/ linearity measurement
3	RS485 B (Service, MCU)
4	RS485 A (Service, MCU)
5	Gnd

7.2.3 Connecting cables of plug connectors

The following overview shows the plugs and sockets of the connecting cables for the DUSTHUNTER SB30. Please note the “Information on electrical connection cables”, page 34, for Part numbers, see “Connections for sender/receiver unit”, page 98.

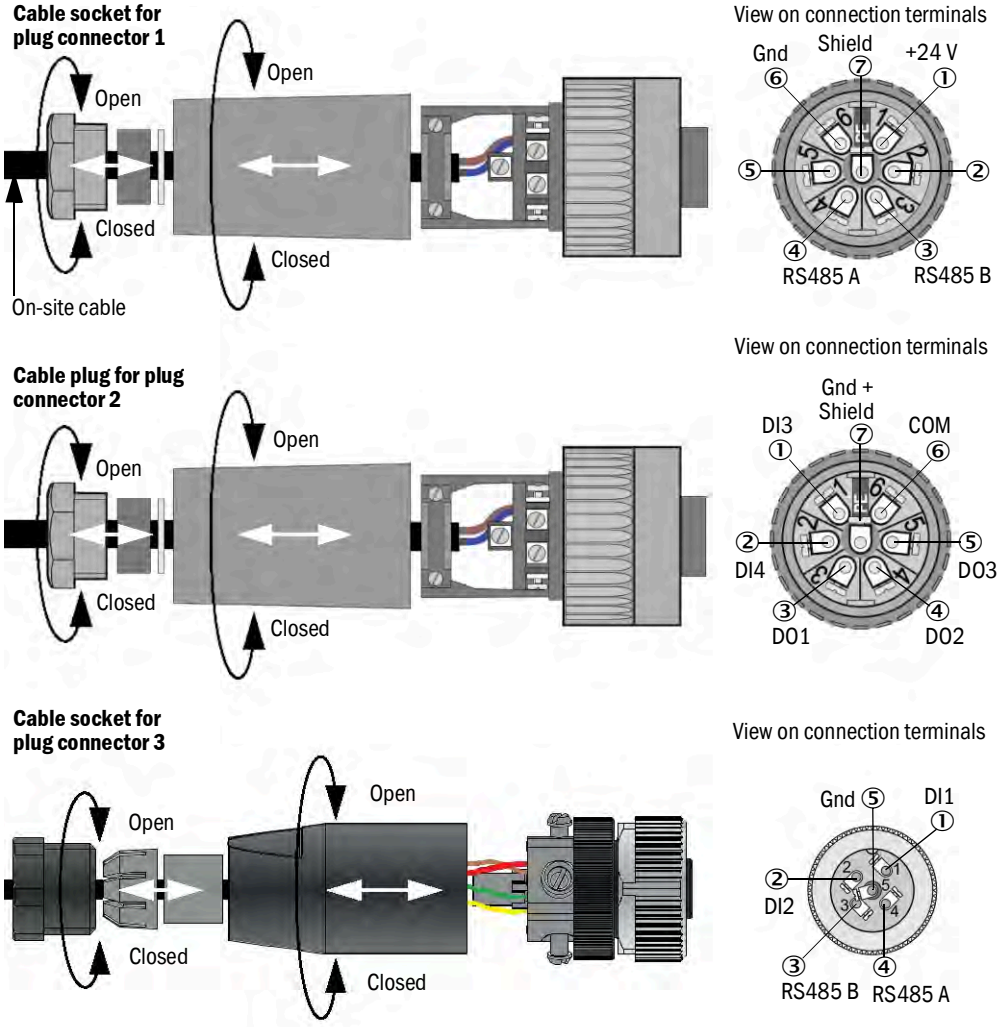


Fig. 16: Connection of plug connector

- To open the cable socket for plug connector 1 and the cable plug for plug connector 2, plug them into the sender/receiver unit.
- To open the cable socket for connector 3, hold the dark knurled screw when unscrewing.

NOTE:

Use suitable cables

▶ Only use shielded lines with twisted pairs (see “Information on electrical connection cables”, page 34).

7.3 Overview of electrical connection steps for device without MCU

Table 14: Connection steps without control unit

Step	Procedure	Reference
1	Connecting the cables	see “Connecting the cables”, page 38
2	Connecting the purge air unit electrically	see Operating Instructions SLV4
3	Optional: Installing the non-return valve	see “Installing the non-return valve option”, page 39
4	Putting the purge air unit into operation	see “Putting the purge air unit into operation”, page 39

7.3.1 Connecting the cables

Requirements

- The factory setting on the processor board has not been changed:
  - Modbus termination jumper is plugged in
  - DIL switch 4-3 = OFF
- Data communication via Modbus

Steps

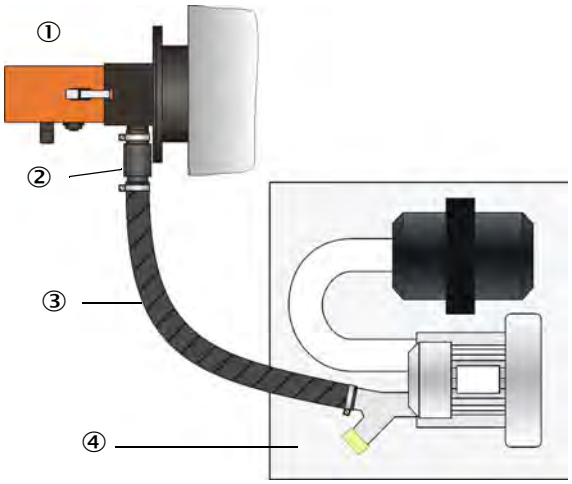
1 Establish connection for parameterization via PC with SOPAS ET:
▶ Connect the connecting cable with the plug to plug connector **3.**
2 Optional: If the output relays and calibration curve switching functions are **not** used via Modbus or for the synchronization signal for filter monitoring:
▶ Connect the connecting cable with the plug to plug connector **2.**

NOTICE:
Device damage due to lack of purge air supply
If the device is connected to the voltage supply, the device is in operation and can be damaged without a purge air supply.
▶ The voltage supply may only be connected during commissioning.

7.3.2 Connecting the purge air unit electrically

NOTE:
For information on the purge air unit, see the Operating Instructions of the purge air unit (SLV4) on the enclosed product data medium.

7.3.3 Installing the non-return valve option



① Sender/receiver unit
② Non-return valve
③ Purge air hose
④ Optional external purge air unit

Fig. 17: Installing the non-return valve option

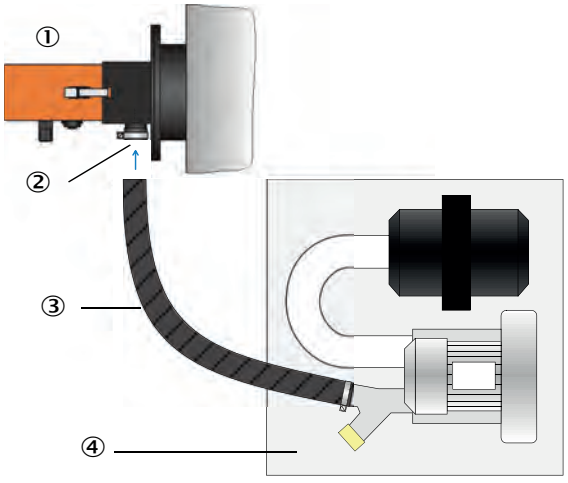
Steps

1 Place the non-return valve on the purge air connection on the sender/receiver unit and secure with the hose clamp.
2 Attach the purge air hose to the non-return valve and secure with the hose clamp.

7.3.4 Putting the purge air unit into operation

Preparation

Switch the power supply for each of the purge air units on for a short time to check the function and to remove any dust that may have penetrated the purge air hose.



① Sender/receiver unit
② Purge air connection
③ Purge air hose
④ Optional external purge air unit

Fig. 18: Fitting the purge air unit to the sender/receiver unit

Steps

1 Connect each of the purge air hoses (from the purge air unit) to the purge air connection with a hose clamp.
2 Switch on the purge air supply.

7.4 Overview of electrical connection steps for device with MCU

Table 15: Connection steps

Step	Procedure	Reference
1	Establishing equipotential bonding	
2	Connecting the connecting cable from the sender/receiver unit to the MCU.	see “Connecting the sender/receiver unit to the MCU control unit”, page 41
3	Changing the transmission protocol of the RS485 interface on DIL switch S4-3	see “Changing the transmission protocol for the MCU control unit”, page 43
4	MCU connection with plug connector 1	see “Connections on the device”, page 35
5	Connecting the purge air unit electrically	see Operating Instructions SLV4
6	Putting the purge air unit into operation	see “Putting the purge air unit into operation”, page 39

7.4.1 Overview of the MCU control unit modules

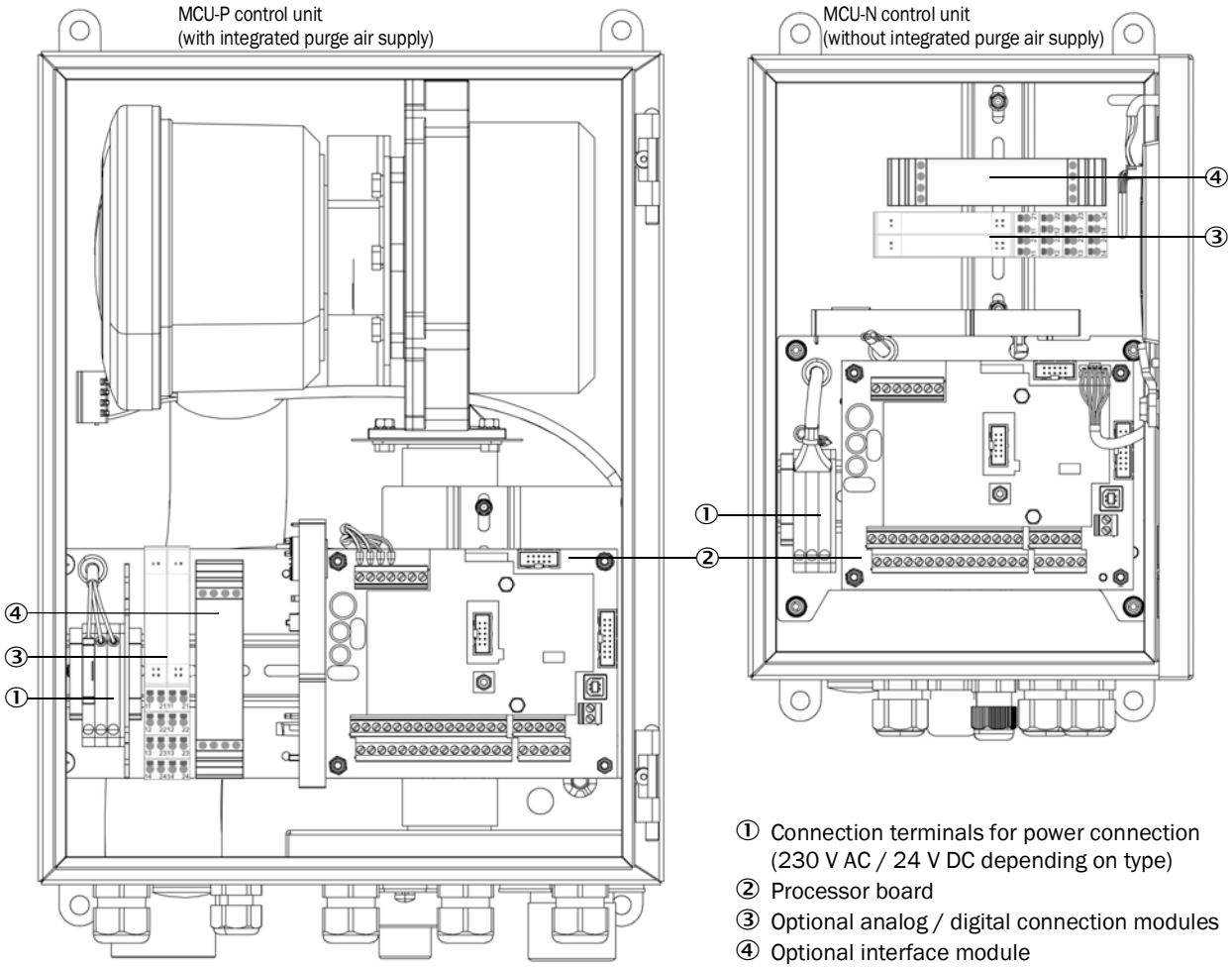


Fig. 19: MCU component layout

7.4.2 Connecting the sender/receiver unit to the MCU control unit

NOTICE:

Faulty wiring can damage the measuring device

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

Steps

- Connect the connecting cable to the sender/receiver unit to the MCU processor board: see “Connection diagram sender/receiver unit – MCU control unit”, page 42.
- If necessary, connect cable for:
  - Status signals (operation/malfunction; maintenance; function check; maintenance request; limit value).
  - Analog output
  - Analog and digital inputs
- Connect the power cable of the control unit to the MCU processor board (see “MCU processor board connections”, page 43).
  - 230 V AC: L1, N or
  - 24 V DC: +24 V, GND, PA
- Close off unused cable glands with blind caps.

7.4.3 Connection diagram sender/receiver unit – MCU control unit

Switching position of the relay contacts in currentless condition

Relay	Connection terminal
1	1, 2, 3
2	4, 5,6
3	7, 8, 9
4	10, 11, 12
5	13, 14, 15

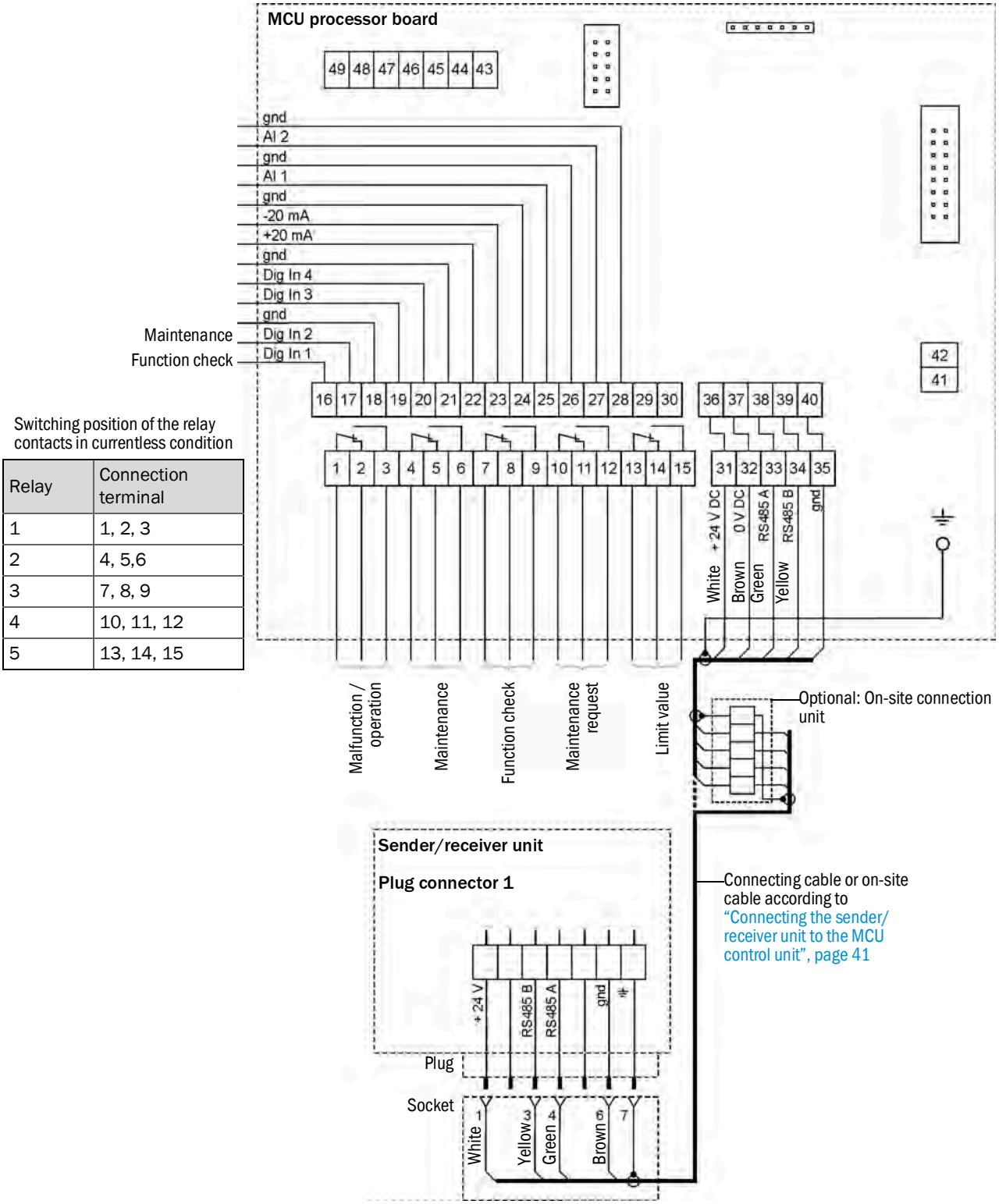
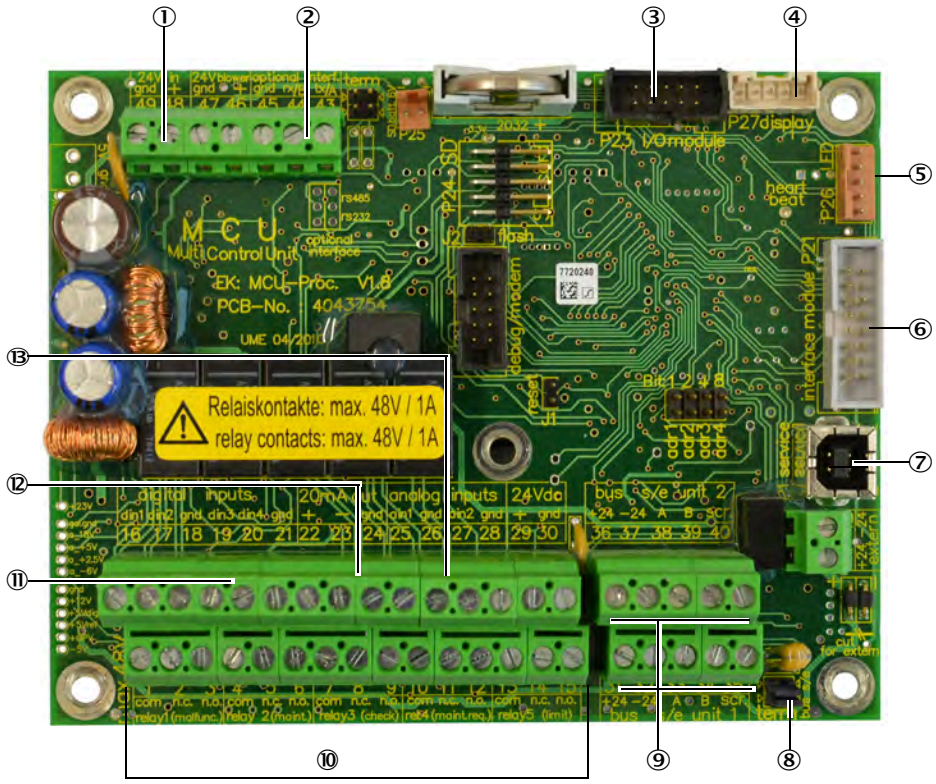


Fig. 20: Connection diagram sender/receiver unit – MCU control unit

7.4.4 MCU processor board connections



① Supply voltage 24 V DC
② Not used
③ Connection for optional I/O module
④ Connection for Display module
⑤ Connection for LED
⑥ Connection for option Interface module
⑦ USB plug connector
⑧ Jumper for termination of the bus system
⑨ Connections for sender/ receiver units
⑩ Connections for relays 1 to 5
⑪ Connections for digital inputs 1 to 4
⑫ Connection for analog output
⑬ Connections for analog inputs 1 and 2

Fig. 21: MCU processor board connections

7.4.5 Changing the transmission protocol for the MCU control unit

Steps

1 Remove the sender/receiver unit (see “Opening the sender/receiver unit”, page 45).
2 On the processor board: Set DIL switch S4-3 to the right to “ON” (see “Making manual settings on the processor board”, page 48).

7.4.6 Connecting the purge air unit electrically

NOTE:
For information on the purge air unit, see the Operating Instructions of the purge air unit (SLV4) on the enclosed product data medium.

8 Commissioning

8.1 Safety

The manufacturer recommends having the initial commissioning carried out by Endress+Hauser Service.

8.2 Requirements

- All specifications are met in accordance with the project planning.
- All the work in the Mounting Section has been completed and checked.
- Electrical installation is completed and checked.
- Measuring point has been checked for free access without problems or hazards.

8.3 Commissioning the sender/receiver unit

8.3.1 Commissioning steps overview

Table 16: Commissioning steps

Step	Procedure	Reference
1	Immersion depth of the sender/receiver unit (only if corrections are required after commissioning or trial operation on the duct)	see “Changing the immersion depth of the sender/receiver unit”, page 44
2	If necessary: Manual settings when using the MCU control unit or unchangeable measuring range output and limit values.	see “Making manual settings on the processor board”, page 48
3	Mounting the sender/receiver unit on the duct, if necessary with the purge air supply switched on	see “Fitting and connecting the sender/ receiver unit”, page 47
4	Connection of voltage supply on the sender/receiver unit	
5	Connection of more plug connectors on the sender/receiver unit	see “Connections on the device”, page 35
6	Parameterization of the measuring device	see “Parameter settings”, page 48

8.3.2 Changing the immersion depth of the sender/receiver unit

The immersion depth set is displayed in the window for the measurement receiver.

For duct diameters greater than approx. 3 m, the sender/receiver unit must generally be set to the long immersion depth (800 mm). If this leads to a low zero point stability due to the background light, the short immersion depth (400 mm) should be set.

8.3.2.1 *Opening the sender/receiver unit*

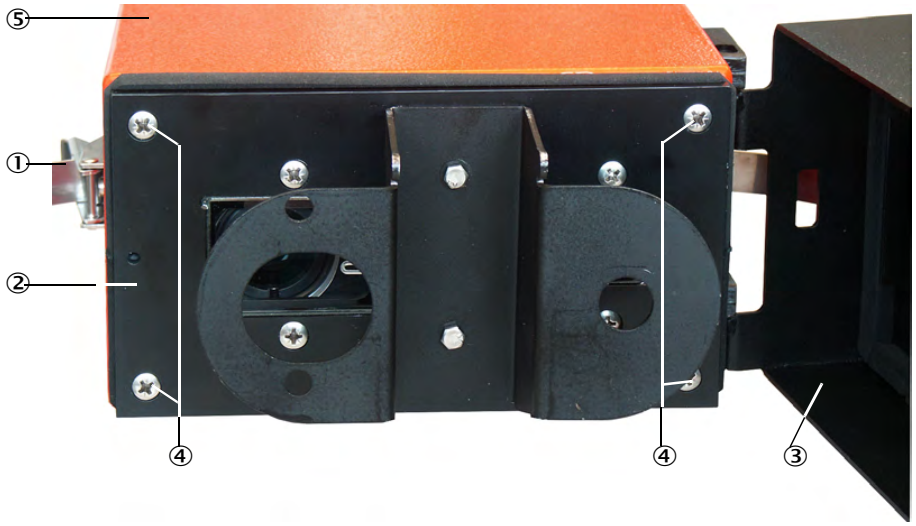


Fig. 22: Opening the sender/receiver unit

① Tension locks
② Front plate
③ Purge air attachment
④ Front panel fastening screws
⑤ Enclosure of sender/receiver unit

Steps

1 Loosen the tension locks ① and swivel the sender/receiver unit to the side.
2 Remove the sender/receiver unit from the purge air attachment ③.
3 Loosen fastening screws ④ for front panel ②.
4 Carefully pull the front panel out of enclosure ⑤.
5 Disconnect plug connector ⑥ for the measuring receiver from processor board ⑦.

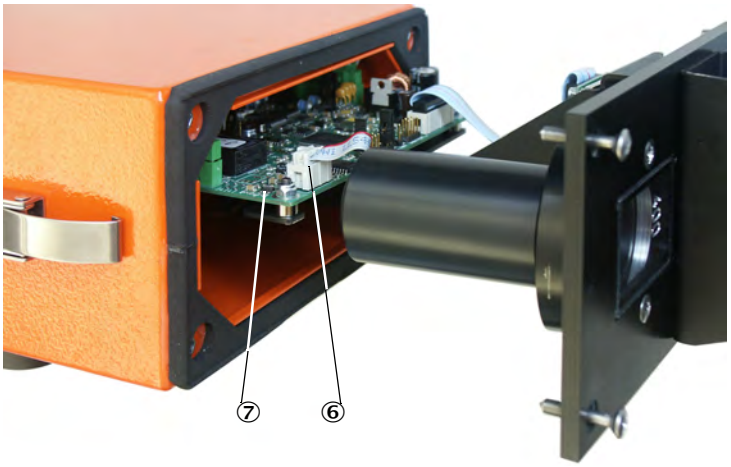


Fig. 23: Sender/receiver unit opened

⑥ Receiver plug connector
⑦ Processor board

8.3.2.2 *Changing the mounting ring on the tube*

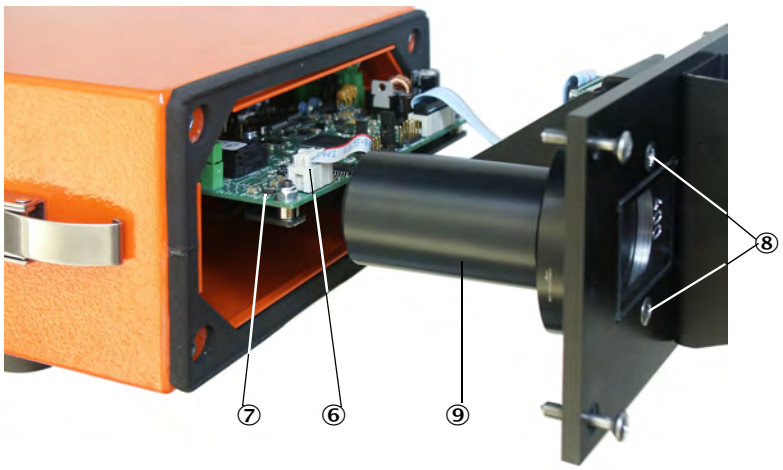


Fig. 24: Removing the tube

⑥ Receiver plug connector
⑦ Processor board
⑧ Fastening screws, tube
⑨ Tube

Steps

1 Loosen fastening screws ⑧ for tube ⑨ and take the tube off.
2 Unscrew mounting ring ⑩ from the tube, turn it round and screw it back on again.

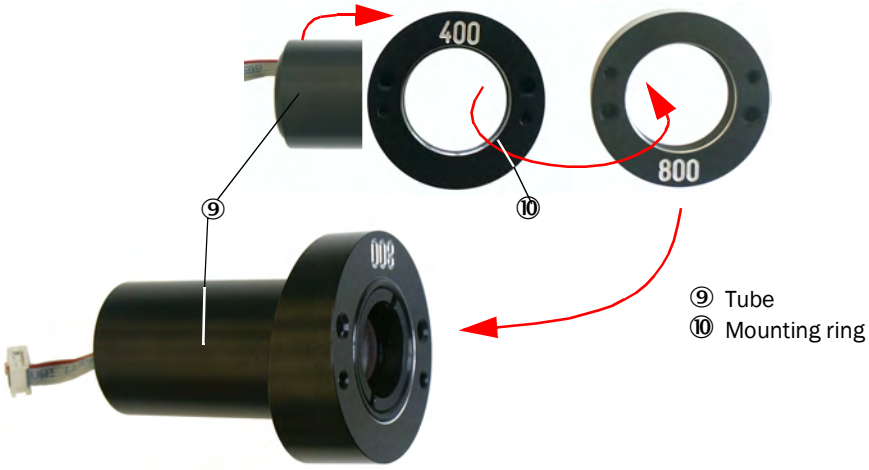


Fig. 25: Tube with mounting ring

3 Make the setting for signaling the immersion depth on DIL switch “S4-4” according to the immersion depth changed on the device (see “Making manual settings on the processor board”, page 48).
4 Plug plug connector ⑥ for the measurement receiver on board ⑦.
5 Reassemble the sender/receiver unit in reverse sequence.

8.3.3 Fitting and connecting the sender/receiver unit

- ▶ Check whether the purge air supply is available (the flow direction must be correct and the purge air hose fits tight on the connection of the purge air unit).
- ▶ If a weather hood has been prepared, loosen the cover at the locks and remove it for installation (see “Fitting the optional weather hood for sender/receiver unit”, page 33).
- ▶ Lay the seal on the flange with tube, position the sender/receiver unit in the flange with tube and fasten with the assembly kit.

> The connections for connecting cable and purge air hose must point towards the bottom (see “Flange with tube”, page 18).

- ▶ Connect the connecting cable with the plug to plug connector **1** and screw tight.

Electrical connection

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

8.4 Recognizing the safe operating state

The measuring device is in proper operation when:

- A system check has been carried out according to the Maintenance plan before commissioning and in running operation.
- The green status indicator on the sender/receiver unit lights up (see “Sender/receiver unit”, page 73).

When using the MCU control unit:

- Status indicator LED “Failure” is off.
- The operating status “Operation” is shown on the display.

9 Parameter settings

9.1 Prerequisites

Prerequisite for the work described in the following is completion of mounting, electrical installation and commissioning as described in Sections 6, 7 and 8.

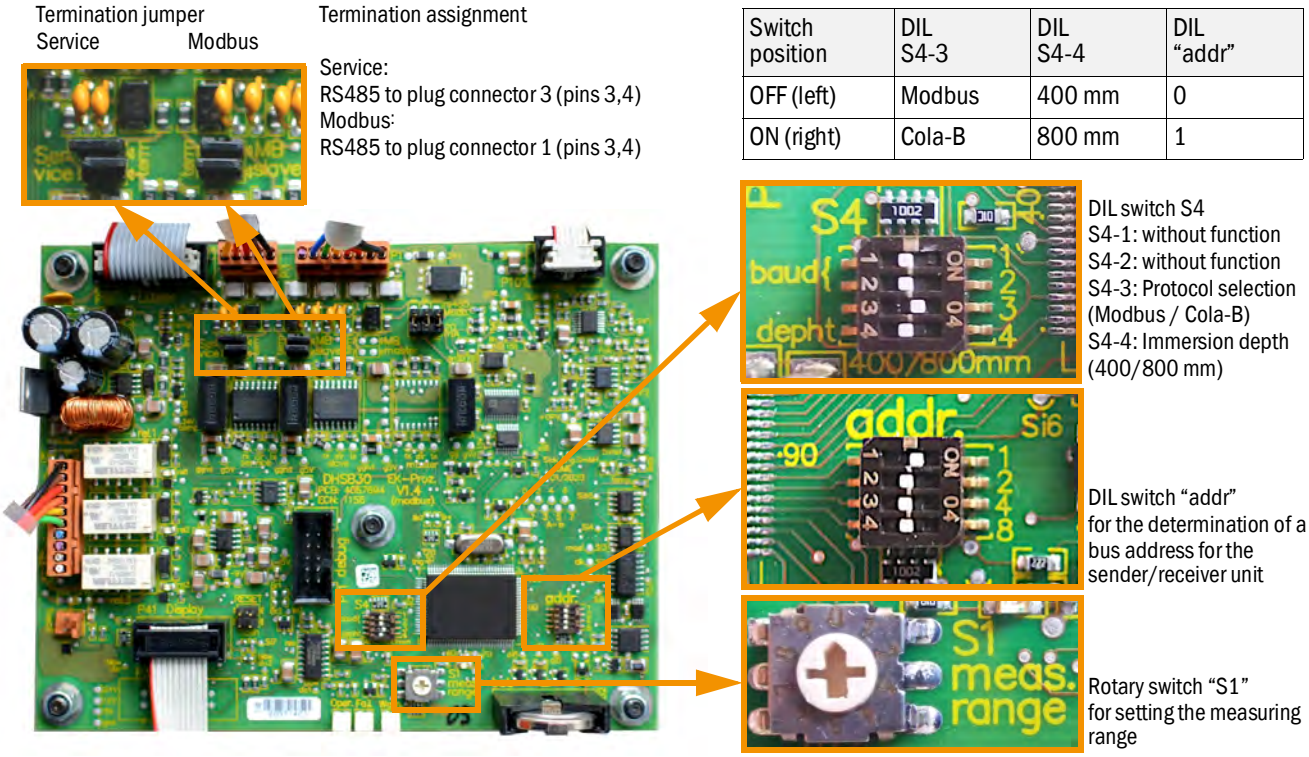
When using an optional MCU control unit, it is recommended that all parameter settings, with the exception of calibration coefficients and measuring range switch-over, are carried out on the control unit in order to avoid contradictory settings.

9.2 Making manual settings on the processor board

The following steps are necessary for manual setting:

- Open the sender/receiver unit (see “Opening the sender/receiver unit”, page 45).
- Loosen the fastening screws on the electronics unit, carefully pull the electronics unit out of the cover.
- After changing the settings, reassemble the sender/receiver unit in reverse sequence.

The following illustration shows the relevant switches on the processor board:



Switch position	DIL S4-3	DIL S4-4	DIL “addr”
OFF (left)	Modbus	400 mm	0
ON (right)	Cola-B	800 mm	1

Fig. 26: Processor board setting options

9.2.1 Termination

The line termination of the RS485 connection can be activated on the processor board (see "Processor board setting options", page 48).

Termination for Modbus

The two termination jumpers activate the terminating resistor in the device for Modbus transmission at plug connector 1 (see "Connections on the device", page 35). These must be plugged for a termination of the RS485 connection.

If several devices are connected via the data bus, the termination jumpers are only set on the last device at the end of the line.

Termination for service interface

The termination jumpers must be plugged in plug connector 3 for termination of the RS485 service interface (see "Making manual settings on the processor board", page 48) (e.g., when connecting the service kit adapter or the MCU control unit).

9.2.2 DIL switch S4

The signaling of the immersion depth of the device can be adjusted on the DIL switch S4 via bottom slider S4-4 (see "Processor board setting options", page 48).

Slider S4-3 above can be used to switch the transmission protocol of the RS485 interface on plug connector 1 (see "Connections on the device", page 35) between Modbus and Cola-B. The upper sliders 1 and 2 have no function.

S4-3 = OFF:

RS485 works with the Modbus protocol as Slave (Modbus Master on customer side)

S4-3 = ON:

RS485 uses the Cola-B protocol for communication with the optional MCU control unit

If the RS485 interface with the Modbus protocol is used, the desired bus address must be parameterized with SOPAS ET (see "Modbus parameterization", page 57).

NOTE:

Communication errors may occur if plug connector 1 is connected to the MCU control unit and at the same time data is being transferred to the SOPAS ET operating program via plug connector 3.

- ▶ When using the optional MCU control unit via plug connectors, only one RS485 connection may be connected at a time (plug connector 1 or 3).

9.2.3 DIL switch addressing

Addressing according to the following Table is only necessary when connecting an optional MCU (plug connector 3), see "Connections on the device", page 35).

The digits to the right of the DIL switch (see "Processor board setting options", page 48) indicate the corresponding binary numerical value of the slider when it is set to "ON". The resulting address is the sum of the numerical values.

Addresses 1...8 are permitted whereby each address in the data bus may only be used by one device.

Table 17: Addressing

addr 4 (value: 8)	addr 3 (value: 4)	addr 2 (value: 2)	addr 1 (value: 1)	Address RS485
0	0	0	1	1 (default)
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8

9.2.4 Rotary switch S1 measuring range

The measuring range parameters can be set directly on the device or via SOPAS ET (see "Installing SOPAS ET", page 51). This function allows setting the values for the 4...20 mA analog output.

Measuring range and limit value

Rotary switch "S1 meas range" (see "Processor board setting options", page 48) can be used to select fixed measuring ranges and the corresponding limit values . In switch position 0, the measuring ranges and limit values can be freely parameterized with the SOPAS ET operating program.

Table 18: Adjustable measuring ranges

Switch position	Measuring range for analog output	Limit value 1	Limit value 2
0	Freely selectable via SOPAS ET		
1	0...7.5 mg/m³	5 mg/m³	7.5 mg/m³
2	0...15 mg/m³	10 mg/m³	15 mg/m³
3	0...45 mg/m³	30 mg/m³	45 mg/m³
4	0...75 mg/m³	50 mg/m³	75 mg/m³
5	0...150 mg/m³	100 mg/m³	150 mg/m³
6	0...225 mg/m³	150 mg/m³	225 mg/m³
7	0...375 mg/m³	250 mg/m³	375 mg/m³
8	0...1000 mg/m³	667 mg/m³	1000 mg/m³
9	0...3000 mg/m³	2000 mg/m³	3000 mg/m³

Freely parameterizable measuring ranges

- In order to be able to freely parameterize measuring ranges in the SOPAS ET operating program, switch S1 must be set to position 0.
- Two variable measuring ranges can be defined in the SOPAS ET menu Configuration/ Application. The limit value for the measuring range switch-over and the two limit values for the limit relay can be entered in the Calibration functions and limit values field (see "Parameterization of measuring range switch-over", page 57).
- The selection between the two different measuring ranges is made by switching the digital input 3 (plug connector 2, see "Connections on the device", page 35). Alternatively, automatic switch-over can be set with SOPAS ET.
- Set the use of relay 3 in the SOPAS ET operating program according to the desired function (see "Application parameters", page 55):
  - DI3 not connected (+5V): Parameter set for measuring range 1 active.
  - DI3 connected to Gnd: Parameter set for measuring range 2 active.

9.3 SOPAS ET

9.3.1 Installing SOPAS ET

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

9.3.2 Password for SOPAS ET

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

Table 19: SOPAS ET user levels

User level		Access to
0	Operator	Displays measured values and system states No password required
1	Authorized operator	Display, query, diagnosis and adaptation of necessary parameters for customer-specific requirements. Preset password: sickoptic

9.3.3 Changing the password for SOPAS ET menus

To change the password for a user level, the operator must be logged in to SOPAS ET at the appropriate level. To do this, start SOPAS ET and add a connected device to the project. Open the device window by double-clicking on the connected device and log in to the corresponding user level. In the command bar, a menu is named after the connected device, click “change password” in this pull-down menu.

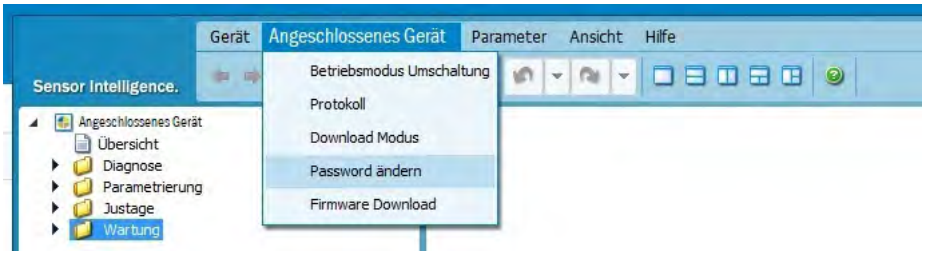


Fig. 27: SOPAS ET menu: Pull-down menu for the connected device

For some parameters in the device window, notes appear when you move the mouse pointer over them; please also note the context help in the bottom left of the device window.

9.3.4 Parameterization with SOPAS ET

To change the adjustable parameters:

- The sender/receiver unit must be connected to SOPAS ET (see “Connecting to the device”, page 52)
- The user must be logged in as an “Authorized Operator” in SOPAS ET (see “Password for SOPAS ET”, page 51)
- The “Maintenance” status (SOPAS ET menu “Maintenance/Maintenance”) must be set. After completing parameterization, the maintenance status must be canceled and the measuring device set to the “Measurement” status.

Fig. 28: SOPAS ET menu: DHSB30/Maintenance/Maintenance

9.4 Connecting to the device

9.4.1 Connection via RS485 Service interface to USB

Recommended procedure:

1 Switch on devices if not already in operation.
2 Connect the USB service kit RS485 (see “Connections for sender/receiver unit”, page 98) to the sender/receiver unit (plug connector 3, 5-pin socket) (see “Connections on the device”, page 35) and laptop/PC.
3 Start SOPAS ET.
4 Select “Search settings”.
5 “Communication interface-oriented search”
6 Make the settings:
  – Deselect Ethernet communication
  – Deselect USB communication:
  – Serial communication: Click
  – Do not specify IP addresses.
7 A list of virtual COM ports is displayed.
  Specify the COM port of the DUSTHUNTER.
  If unclear, see “Finding the DUSTHUNTER interface”, page 72.
8 Make the settings:
  – Baud rate: 57600 / protocol: dialect “binary”; addressing “by index” duplex “half-duplex”; sequence “big endian”
  – Other settings remain unaffected (8 data bits; no parity; 1 stop bit)
9 Assign a name for this search.
10 Click “Finish”.

9.4.2 Connection with optional MCU control unit

The MCU control unit can be connected directly to a computer via the service port (USB type B) on the processor card.

Recommended procedure:

1 Switch on devices if not already in operation.
2 Connect the USB cable (included with the MCU control unit) to the service port on the processor card of the MCU control unit (see “MCU processor board connections”, page 43) and a computer.
3 Start SOPAS ET.
4 Select “Search settings”.
5 “Communication interface-oriented search”
6 Make the settings:
  – Deselect Ethernet communication
  – Click USB communication
  – Deselect serial communication
  – Do not specify IP addresses.
7 A list of virtual COM ports is displayed.
  Specify the COM port of the DUSTHUNTER.
  If unclear, see “Finding the DUSTHUNTER interface”, page 72.
8 Make the settings:
  – Baud rate: 57600 / protocol: dialect “binary”; addressing “by index” duplex “half-duplex”; sequence “big endian”
9 Other settings remain unaffected (8 data bits; no parity; 1 stop bit)
10 Assign a name for this search.
11 Click “Finish”.

9.5 System configuration

9.5.1 Device settings

All preset parameters are stored in the device and can also be reset in the event of incorrect parameterization (see “Resetting parameters”, page 54).

After repairs or device modifications at the factory, the parameterization must be performed again with customer data or the corresponding SOPAS parameter file must be imported (see “Data backup in SOPAS ET”, page 61).

Dust concentration mg/m³ is first valid as a measured value in mg/m³ after calibration (see “Gravimetric comparison measurement (calibration)”, page 63).

Factory settings

The following table shows the factory default settings for some important parameters.

Table 20: Factory settings

Entry field	Parameter	Factory settings
Analog output parameter		
Measuring range 1 AO	4...20 mA	0 ... 75 mg/m³ (active when D!3 open, standard)
Measuring range 2 AO	4...20 mA	0 ... 750 mg/m³ (can be activated via N/O contact on DI3)
Calibration coefficients set 1	cc2/cc1/cc0	0 / 1 / 0 (active when DI3 opened, standard)
Calibration coefficients set 2	cc2/cc1/cc0	0 / 1 / 0 (can be activated via N/O contact on DI3)
	Live zero	4 mA
	Error current output on AO	Yes: 21 mA
Function check	Control value output on AO	Yes - Note: The value measured last is output during control value determination.
	Interval	8 h
	Output duration	90 s per control value
Damping time measured value	T90	60 s
Relay usage	Relay 1 (N/O contact)	Operation (closed) / failure (open)
	Relay 2 (N/O contact)	Limit value 1 (overrun)
	Relay 3 (N/O contact)	Maintenance
Modbus RTU	Address	1
	Baud rate	19200 baud; 8 data bits; even parity; 1 stop bit (19200,8,e,1)
	Byte order	ABCD => ABCD
RS485 SOPAS / MCU	Baud rate	57600 baud; 8 data bits; no parity; 1 stop bit (57600,8,e,1)
	Address (DIL switch “addr”)	1 (ON/off/off/off)

9.5.2 Resetting parameters

The device can be reset to factory settings again after parameter changes. A parameter change in the meantime can also be restored by an automatic backup file, which the device creates after each device restart.

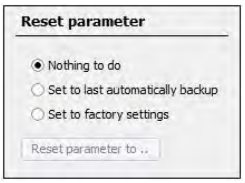


Fig. 29: SOPAS ET menu: Configuration/Reset parameter

Table 21: Resetting parameters

Entry field	Parameter	Explanation
Set to last automatically backup	Parameters are reset to the status after the last restart	Modbus Remote Terminal Unit (binary) / Modbus ASCII When switching from RTU <--> ASCII, the selection of data, parity and stop bit must be reset!
Set to factory settings	Set to factory settings	Reset all parameters to factory settings, see “Device settings”, page 53.
Reset parameter to	Execution of the selected option	After pressing, the device is reset, the device restarts and SOPAS should be reconnected to the device or all parameters must be read in again.

9.5.3 Application parameters

The steps required to change these parameters see “Parameterization with SOPAS ET”, page 51.

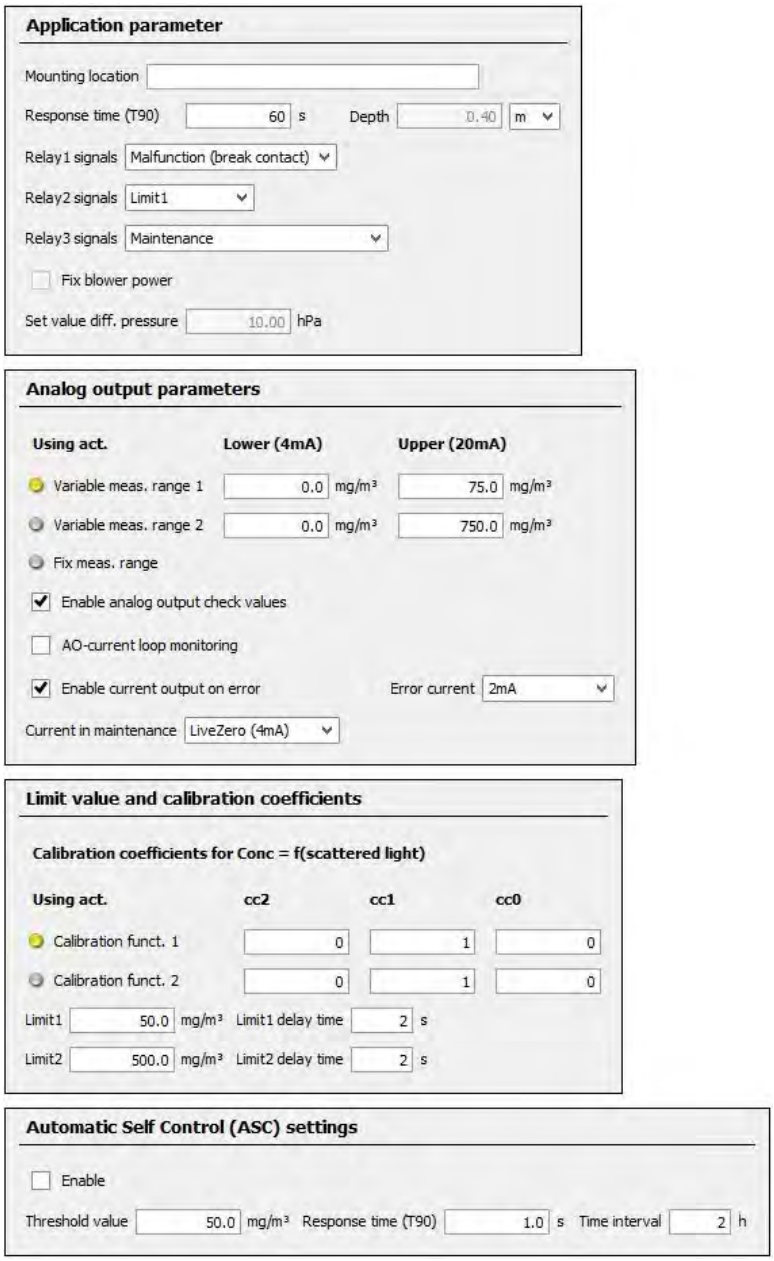


Fig. 30: SOPAS ET menu: Configuration/Application parameter

Application settings

The following table explains the setting options in the SOPAS ET menu Configuraton/ Application parameter.

Table 22: Application settings

Entry field	Parameter	Remark
Mounting location	Name of the measuring location	Sender/receiver unit assignment to the respective measuring location
Response time (T90)	Value in s	Damping time of the measured variable (setting range 1 ... 600 s) A longer damping time reduces the fluctuations in the output signal.
Relay 1 signals	Malfunction	The relay switches on for “Malfunction” mode.
Further functions	Maintenance, warning, function check (see use of relay 3)	
Relay 2 signals	Limit value 1	The relay switches when measured value > limit value 1
Further functions	Maintenance, warning, function check (see use of relay 3)	
Relay 3 signals	Maintenance	The relay switches on when “Maintenance” mode is set.
	Limit value 2	The relay switches when measured value > limit value 2
	Function check	The relay switches on during a function check procedure.
	Warning	The relay switches on for “Maintenance” mode.
	Autom. switch-over	Allows you to enter the limit value for the measuring range switch-over.
Variable meas. range 1	Value at 4 mA Value at 20 mA	Set the lower and upper measuring range limit at the analog output. (Requires the rotary switch “S1” to be set to position 0)
Variable meas. range 2	Value at 4 mA Value at 20 mA	Set the lower and upper measuring range limit at the analog output. (see “Rotary switch S1 measuring range”, page 50)
Output of check values	Inactive	Check values (see “Function check”, page 21) are not output on the analog output.
	Activated	Check values are output on the analog output.
cc2	Quadratic	Entry of the regression factors determined using gravimetric comparison measurement during a calibration (see “Gravimetric comparison measurement (calibration)”, page 63)
cc1	Linear	
cc0	Absolute	
Limit value 1	Value in mg/m³	Limit value for first signaling when exceeded
Limit value 2	Value in mg/m³	Limit value for further signaling when exceeded
Limit value for measuring range switch-over	Value in mg/m³	If the entered value is exceeded or not reached, the limit relay switches (see Use of relay 3 → Automatic switch-over).
Automatic Self Control (ASC) settings (for expected measured value peaks)	Threshold value	Value that must be exceeded during the defined time interval
	Response time (T90)	Duration of the necessary measured value exceedance (default: 1 s)
	Period	Defined time interval

Selecting automatic switch-over (using relay 3) activates automatic measuring range switch-over:
The system automatically switches between the calibration function and measuring ranges 1 and 2 as soon as the limit value for the measuring range switch-over is reached.

9.5.4 Parameterization of measuring range switch-over

The limit value of the automatic measuring range switch-over can be entered in the SOPAS ET menu (see “SOPAS ET menu: Configuration/Application parameter”, page 55). The calibration curves for measuring ranges 1 and 2 can also be adjusted in the menu. The settings of the limit value for measuring range switch-over can only be made after automatic measuring range switch-over has been activated via relay 3.

Once these settings are saved, the measuring range will automatically switch to the other variable measuring range when the set limit value is reached. If the value falls below the limit value, an additional hysteresis of 5% must be taken into account. The currently active measuring range is signaled via relay 3.

If the “Automatic function/measuring range switch-over” function is activated for relay 3, the measuring range switch-over via digital input 3 (rotary switch S1 in position 0) cannot be used!

Configuration of the relay functions

The use of relays 1...3 can be configured via the SOPAS ET menu (see “SOPAS ET menu: Configuration/Application parameter”, page 55).

9.5.5 Modbus parameterization

▶ Switch to project directory Configuration => to “Parameter Modbus” and set the desired parameters.

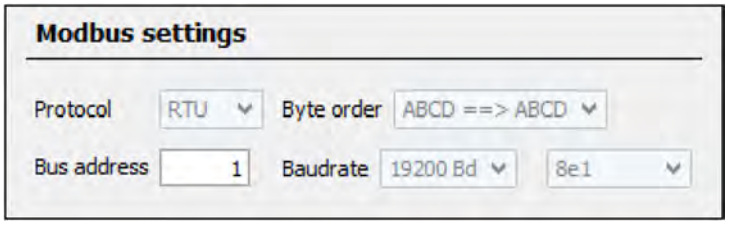


Fig. 31: SOPAS ET menu: Parameter Modbus

To use the Modbus data protocol for transmission, the slider on DIL switch S4-3 must be set to OFF (see “DIL switch S4”, page 49).

Table 23: Application settings

Entry field	Parameter	Explanation
Protocol	RTU ASCII	Modbus Remote Terminal Unit (binary) Modbus ASCII
When switching from RTU <--> ASCII, data, parity and stop bit must be reset!		
Byte order	ABCD -> ABCD; ABCD -> CDBA (ABCD -> BADC; ABCD -> DABC)	Assignment “little-endian / big-endian”
Bus address	1 ... 247	Address range
Baudrate	9600; 19200; 38400; 57600	Data transmission speed
Byte	7e1; 7o1; 7n2; 8n1	Interface setting for: Data bits/parity/stop bits

The exact specifications for using Modbus in DHSB30 are described in document: “Modbus Protocol Implementation”. This document can be found on the Product CD.

9.5.6 Filter watch

The measuring device can be used in cyclically cleaned filter systems with several individual filters (filter bags) to detect defective filter bags.

Continuous evaluation and internal counting of the cleaning peaks of all filter bags in a cleaning cycle serve to determine filter bags causing limit value violations.

A maximum of 100 cleaning pulses can be monitored within one cycle; a cycle begins with the synchronization signal.

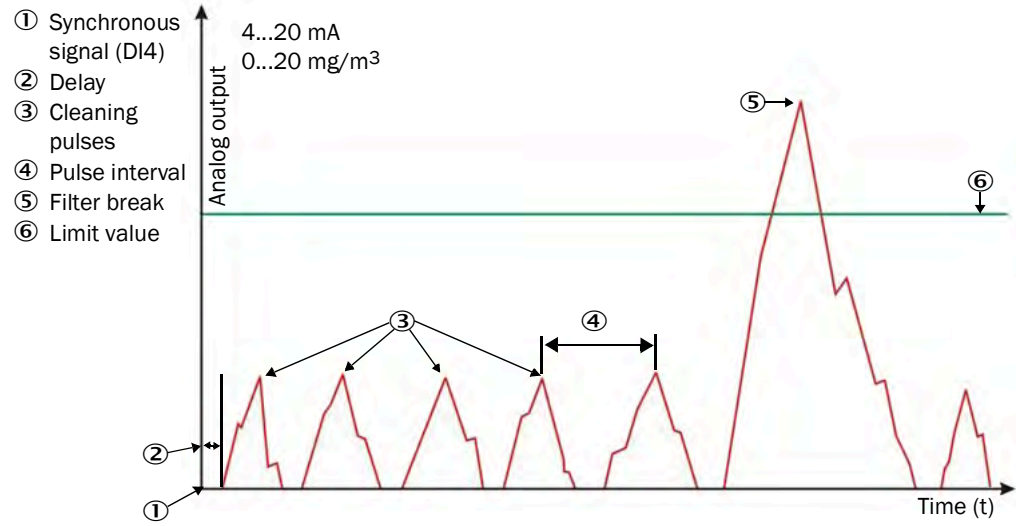


Fig. 32: Filter watch

The following prerequisites must be present for use:

- Debounced synchronizing signal with a duration of 100 ... 900 ms for triggering a measuring cycle.
  Provide this synchronizing signal on the plant on digital input 4 (DI4, plug connector 2)
- The period between dedusting two consecutive filter bags must be higher than the double T90 time (trigger concentration) of the SB30, but at least 0.5 s.

▶ Switch to “Filter watch” in the project directory Configuration and set the desired parameters. see “Parameterization with SOPAS ET”, page 51

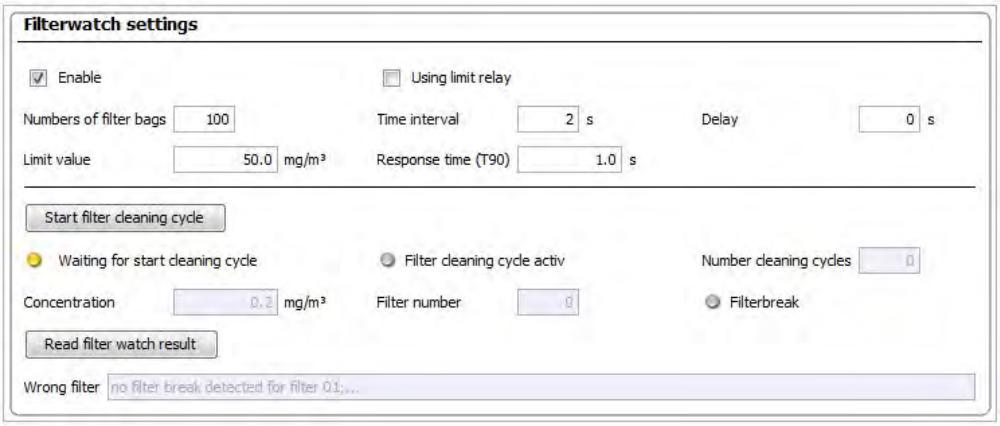


Fig. 33: SOPAS ET menu: SB30/Configuration/Filterwatch settings

Table 24: Filter watching

Entry field	Parameter	Explanation
Enable	Active / inactive	Activates filter watch
Use of limit value relay	Active / inactive	Relay 2 can be used to signal a filter break.
Numbers of filter bags		Number of filter groups to be cleaned within a cycle. Required for recognizing the end of a cleaning cycle.
Time interval		Period of time between dedusting two consecutive filter bags within a cycle.
Delay		Period of time between the synchronizing signal and the arrival of the dust cloud at the measuring location.
Limit value		Limit value where a filter break is signaled.
Response time (T90)	T90 time for filter concentration	Separately adjustable T90 time, only used for filter watch to damp the concentration. The concentration value in “Sensor values” is not affected by this.
Waiting for start cleaning cycle	Synchronizing signal on DI4 (plug connector 2)	Waiting for a start signal for filter watch.
Filter cleaning cycle active	Filter watch running	
Number cleaning cycles	Total number of cleaning cycles measured to this point	Set to 0 for every device restart.
Concentration	Concentration for filter watch	Separate concentration measured value damped by the “Response time”.
Filter number	Current filter number	Shows which filter number is currently measured
Filterbreak	Display for filter break	Indicates a defective filter
Read filter watch result	Button to show currently defective filters	Lists defective filters in the “Wrong filter” line
Wrong filter	Display for defective filter numbers	Defective filters are displayed as number, divided by a semicolon, e.g.: 3; 9; 15.... A start signal on the DI4 resets the measurement result.

9.5.7 Regional settings

There are national and regional directives and specifications that place specific requirements on the operation of dust monitors. In order to operate the DUSTHUNTER SB30 in these regions in accordance with the applicable specifications, a region can be selected directly via SOPAS ET (see “Parameterization with SOPAS ET”, page 51) in the “Configuration/Regional settings“ menu in the region selector to set the required settings. The regional option settings can also be activated individually using the “Manual selection” setting.

For a measurement in accordance with the conformities and approvals specified in these Operating Instructions (see “Appendix”, page 100), the “Standard World” setting must be selected; this is also the factory setting when the device is delivered.

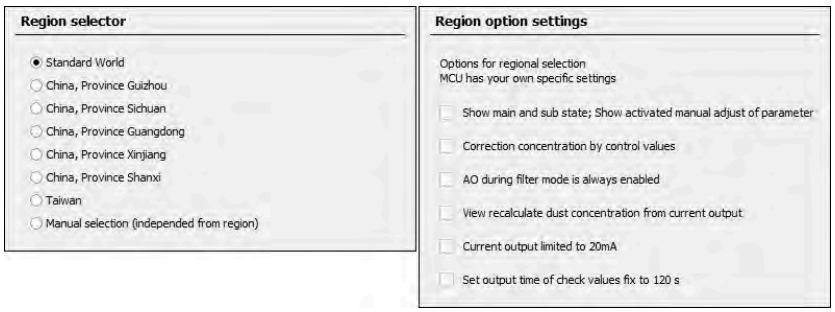


Fig. 34: SOPAS ET menu “Configuration/Regional settings“

9.5.8 Event log

The parameterization of the event log in the SOPAS ET menu “Diagnostics/Event log“ allows you to enter the limit values above which a warning or malfunction is issued. To change the settings, the user must be logged in as an “Authorized operator” and maintenance mode must be set (see “Parameterization with SOPAS ET”, page 51).

When the maximum number of datasets (9,352) is reached, no further entries are created, in which case the log must be deleted completely. If both monitoring messages are deactivated, the oldest dataset is always overwritten when the log is full. Further information about the datasets can be found in the “Dataset Informations” window.

Each event is assigned to a category. In the “Allowed events“ window, the saved datasets can be filtered according to these categories. When selecting one or more categories, only messages from these categories are displayed in the “Dataset Informations” window during step-by-step search (search backwards/forwards).

All events are always saved regardless of the checkboxes set; the selection only relates to reading the datasets.

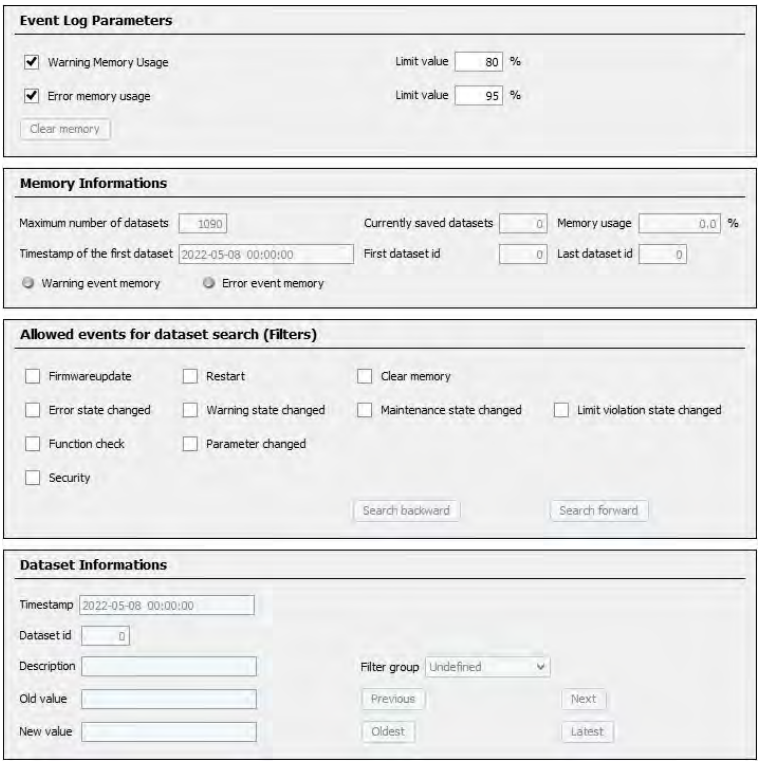


Fig. 35: SOPAS ET menu “Diagnosis/Event log”

The event log is a diagnostic tool without redundancy or fail-safe mechanisms, so this function should not be used as the sole basis for safety-critical or mandatory evaluations.

9.5.9 Setting 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” directory (see “Parameterization with SOPAS ET”, page 51).

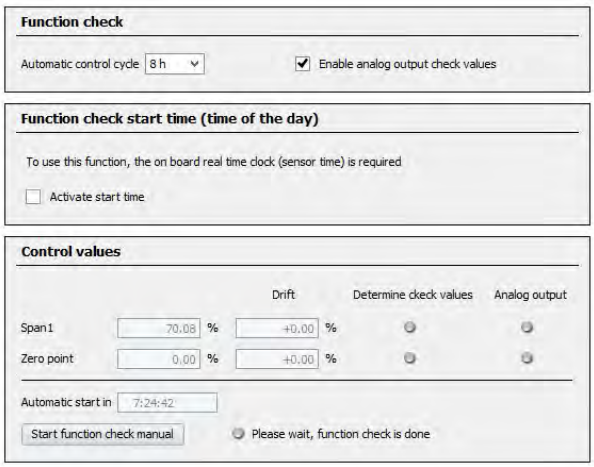


Fig. 36: SOPAS ET menu: SB30/Adjustment/Function check

Standard values: see “Device settings”, page 53
The function check can also be triggered via digital input 2; in this case, do not activate the automatic function check here.
When using the MCU control unit option, the function check should only be set in the MCU (see “Setting the function check (control unit option)”, page 67) and not additionally in the sender/receiver unit.

Table 25: Function check setting options

Entry field	Parameter	Remark
Enable analog output check values	Activation of the check value output to the analog output	
Automatic control cycle	Time between two check cycles	see “Function check”, page 21
Function check start time	Hour	Definition of a start timepoint in hours and minutes.
	Minute	

The last value measured is output during check value determination (see “Function check”, page 21).

9.5.10 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.

For a description, see the SOPAS ET Help menu and the DUSTHUNTER Service Manual.
Before saving, the sender/receiver unit or control unit should be set to maintenance mode.

- 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.

Example for Parameter protocol

Dusthunter - Parameter and Diagnosis protocol

Type of device: DH SB30
Mounting location:
Sensor 1

Device information

Device version	
Firmware version	
Serial number	00008700
Identity number	00000
Hardware version	1.0
Firmware bootloader	V00.99.15

Installation parameter

Adress RS485	1
Adress CAN (hex)	10
Baudrate CAN	125 kBit

Parameter of the selected parameter configuration

Parameter configuration	Config 0 (free)
Depth of immersion	0.40m
Relay 3 signals	Maintenance
Limit value	0.0mg/m³
Response time sensor	60.0s
Function check interval	8 h
Analog output settings	
Live Zero	0 mA
Range low	0.0mg/m³
Range high	0.0mg/m³
Output control values	enabled
Calibration coefficients for calculation of concentration	
cc2	0.0000
cc1	0.0000
cc0	0.0000

Device parameter

Factory settings	
Correction factor depth of immersion	0.9
Response time diagnosis values	10.0s
Burst frequency	10000Hz
Triggerpoint	39µs

Factory settings

Scattered light (SL)	
cc2	0.0000
cc1	1.0000
cc0	0.0000
Laser current	
cc2	0.0000
cc1	30.3000
cc0	0.0000
Device temperature	
cc2	0.0000
cc1	100.0000
cc0	-275.1500
Power supply	
cc2	0.0000
cc1	11.0000
cc0	0.0000
Analog output	
cc2	0.0000
cc1	179.9600
cc0	0.0000

System state

Operation	inactive
Error	inactive
Maintenance request	inactive
Maintenance	inactive
Function check	inactive
Limit value	inactiv

Error

EEPROM	inactive
CRC sum parameter	inactive
Version Parameter	inactive
CRC sum factory settings	inactive
Version factory settings	inactive
Span test	inactive
Overflow mesured value	inactive
Overflow constant light	inactive
Monitor signal	inactive
Laser current to high (>100mA)	inactive
Power supply (24V) < 18V	inactive
Power supply (24V) > 30V	inactive

Warnings

Default factory parameter	inactive
Test mode	inactive
Power supply (24V) < 19V	inactive
Power supply (24V) > 29V	inactive
Laser current to high (>60mA)	inactive

Measured value

Concentration	0.0mg/m³
Scattered light	0.000

Diagnosis value

Monitor	0.000V
Laser current	0.0mA
Constant light	0.0V
Device temperature	0.0°C
Power supply (24V)	0.0V
Laserbyte	0
Monitor factor	1.000
Peak value device temp.	0°C

Check values

Span 70	70.00%
Span 70 drift	+0.00%
Zero point	0.00%
Zero point drift	+0.00%
Filter check	
Nominal value Filter 1	0.00%
Measured value Filter 1	0.00%
Nominal value Filter 2	0.00%
Measured value Filter 2	0.00%
Nominal value Filter 3	0.00%
Measured value Filter 3	0.00%
Nominal value Filter 4	0.00%
Measured value Filter 4	0.00%
Nominal value Filter 5	0.00%
Measured value Filter 5	0.00%

Fig. 37: DUSTHUNTER SB30 Parameter protocol (example)

9.5.11 Gravimetric comparison measurement (calibration)

DUSTHUNTER SB30 uses the optical principle of scattered light measurement. The primary measurand is the scattered light intensity (SI or SL). It is proportional to the dust concentration, but is not only dependent on the number and size of the particles, but also on their optical properties.

To be able to output the dust concentration in mg/m³, the measuring device must be calibrated by gravimetric comparison measurements. During calibration, a calibration curve is determined that establishes the relationship between scattered light intensity and dust concentration. The calibration curve is a polynomial function defined by its coefficients cc0, cc1 and cc2.

The procedure for gravimetric comparison measurements and the creation of a calibration curve (determination of the coefficients cc0, cc1 and cc2) is described in detail in DIN EN 13284-1 and DIN EN 13284-2.

NOTE:
Gravimetric comparison measurements and the creation of the calibration function require special equipment and knowledge. In most cases, this work is carried out by accredited measuring institutes.

Entering the calibration coefficients

After the measuring device has been set to the “Maintenance” status (see “Parameterization with SOPAS ET”, page 51), the regression coefficients cc2, cc1 and cc0 determined can be entered via SOPAS ET in the “Configuration/Application parameters” directory as parameters of the stored polynomial function (see “SOPAS ET menu: Configuration/Application parameter”, page 55). When this is done, the dust concentration can be output in mg/m³ (a.c.).

The conversion of scattered light to dust concentration by means of a calibration curve can also be performed in a downstream emission measurement computer. In this case, the coefficients cc0, cc1 and cc2 in DUSTHUNTER SB30 remain at the standard values 0, 1, 0.

The coefficients calculated for the calibration curve are entered in the emission value calculator in order to now calculate the dust concentrations there.

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

9.5.12 Starting measuring operation

Set the measuring device to “Measurement” mode after entering/modifying parameters (see “Parameterization with SOPAS ET”, page 51).

A restart is also recommended to complete the initial parameterization during commissioning. Standard commissioning is now completed.

9.6 Configuration of optional MCU control unit

When using an optional MCU control unit, all parameter settings, with the exception of calibration coefficients and measuring range switch-over, should be carried out on the control unit in order to avoid double settings.

9.6.1 Setting the optional control unit

The sender/receiver unit must be connected to the control unit.
When using the MCU control unit via plug connector 1 (see “Connections on the device”, page 35), the transmission protocol of the RS485 interface must be changed on the processor board of the sender/receiver unit (see “DIL switch S4”, page 49).

The control unit 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 device is swapped later). The following steps are then necessary:

1 Change the transmission protocol of the RS485 interface on the processor board of the sender/receiver unit (see “DIL switch S4”, page 49).
2 Connect the measuring device to the SOPAS ET program.
3 Login as “Authorized Operator” (see “Password for SOPAS ET”, page 51).
4 Set the measuring device to “Maintenance”: Click “Maintenance sensor”.

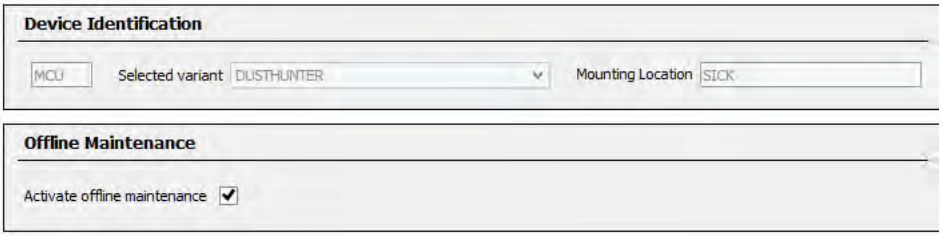


Fig. 38: SOPAS ET menu: MCU/Maintenance/Maintenance

5 Switch to the “Configuration / Application selection” directory.
6 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 control unit.

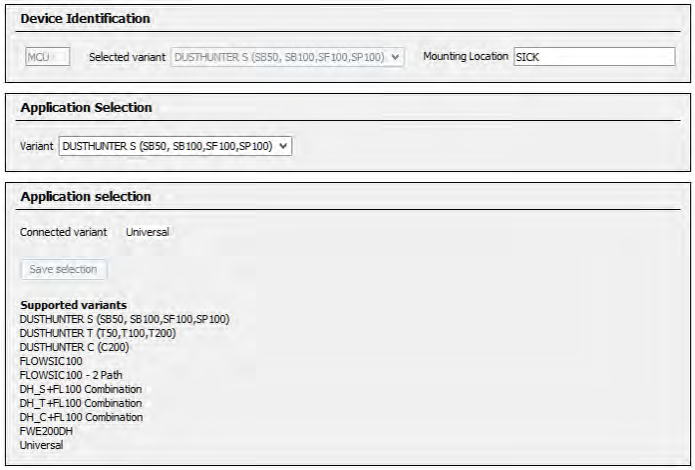


Fig. 39: SOPAS ET menu: MCU/Configuration/Application selection

9.6.2 Connection to the device via Ethernet (MCU option)

> To connect to the measuring device via Ethernet, the Ethernet interface module must be installed on the MCU and the parameters set.

Recommended procedure:

1 Connect the MCU with the network.
2 Connect the laptop/PC to the same network.
3 Switch the MCU on.
4 Start SOPAS ET.
5 “Search settings”
6 “Communication interface-oriented search”
7 Make the settings:
  – Ethernet communication (always clicked)
  – USB communication (always clicked)
  – Serial communication: Do *not* click
8 Enter IP addresses.
  IP address: see “Parameterizing the Ethernet module (control unit option)”, page 66
9 Do not change any other settings.
10 Assign a name for this search and “Finish”.

9.6.3 Parameterizing the Interface module of the MCU control unit

The following steps are required for selecting and parameterizing the optionally available interface module:

1 Select the “MCU” device found in SOPAS ET and transfer it to the project window on the left, select it there to open the device window.
2 Log in as “Authorized operator” and set the measuring device to “Maintenance” status (see “Password for SOPAS ET“and “Parameterization with SOPAS ET”, page 51).
3 Switch to the “Configuration / System Configuration” directory.
4 The field “Interface Module” shows the installed module.

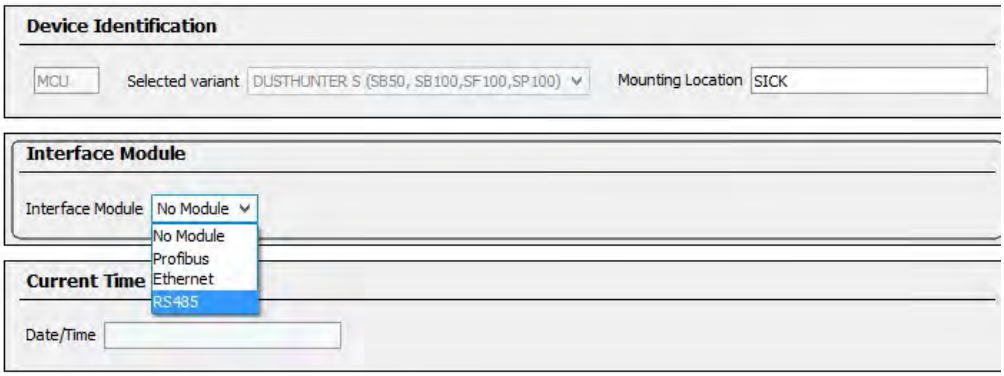


Fig. 40: SOPAS ET menu: MCU/Configuration/System Configuration

> When selecting, please note that “RS485“ must be specified here due to a signal conversion for the modules: “Ethernet V2, Modbus TCP” and “Ethernet V2, Cola-B”. “Ethernet” must only be selected for the “Ethernet V1” modules.

5 Configure the interface module according to the requirements in the menu: “Configuration/IO configuration/Interface module”.

> A gsd file and measured value assignment are available for the PROFIBUS DP Interface module on request. The specification of the MODBUS® module is explained in the specification document, which can be found on the data medium supplied.

9.6.4 Parameterizing the Ethernet module (control unit option)

The following description refers only to the Ethernet interface module for SOPAS ET with Cola-B protocol. For other variants, special software including a description is offered by the manufacturer.

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”.

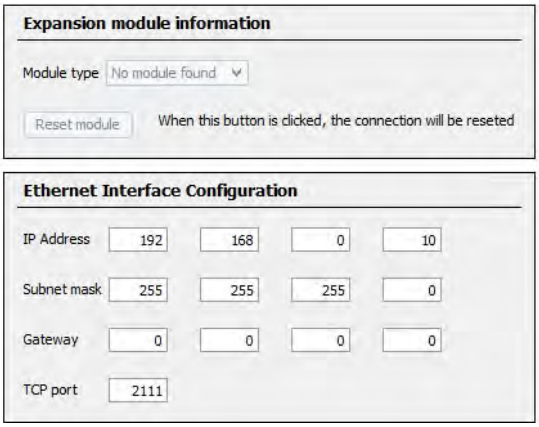


Fig. 41: SOPAS ET menu: MCU/Configuration/IO configuration/Interface Module

9.6.5 Setting the damping time (control unit option)

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

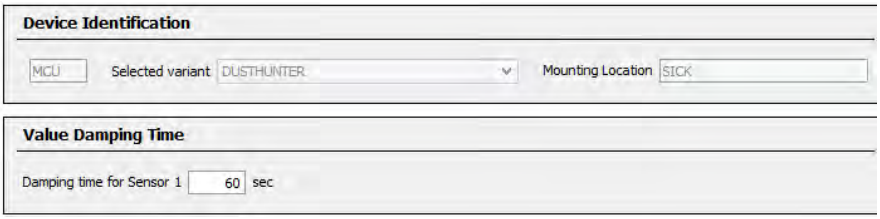


Fig. 42: SOPAS ET menu: MCU/Configuration/Value Damping Time

Erratic increases in measured values can be “calmed” with the damping time, a longer damping time reduces output signal fluctuations.

Table 26: Damping time

Field	Parameter	Remark
Damping time for Sensor 1	Value in s	Damping time for the measured variable Setting range 1 ... 600 s

9.6.6 Setting the function check (control unit option)

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.

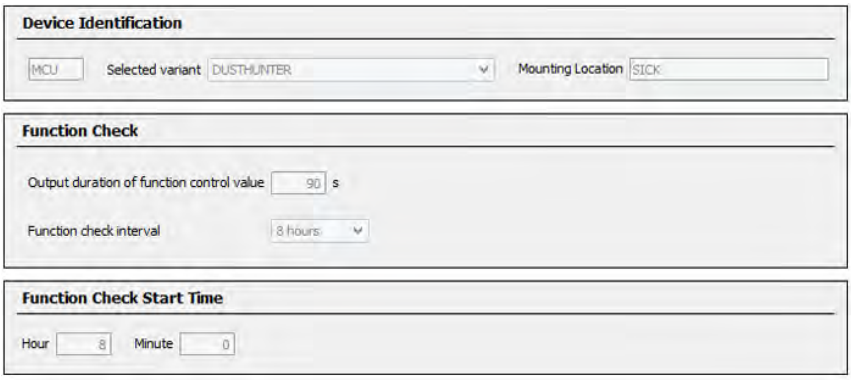


Fig. 43: SOPAS ET menu: MCU/Adjustment/Function Check - Automatic (example)

Standard values: see “Device settings”, page 53
When using the MCU control unit option, it is recommended that the function check is only set in the MCU (see “Setting the function check”, page 61) and not additionally in the sender/receiver unit.

Table 27: Function check setting options

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 21
Function Check Start Time	Hour	Defining a start timepoint in hours and minutes.
	Minute	

The last value measured is output during control value determination (see “Function check”, page 21).

9.6.7 Parameterizing analog outputs (control unit option)

- Standard values, see “Device settings”, page 53
- In order to output the dust concentration under standard conditions (“Conc. s.c.” (Ext)), set the parameters for the analog outputs, see “Parameterizing analog inputs (control unit option)”, page 70.

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

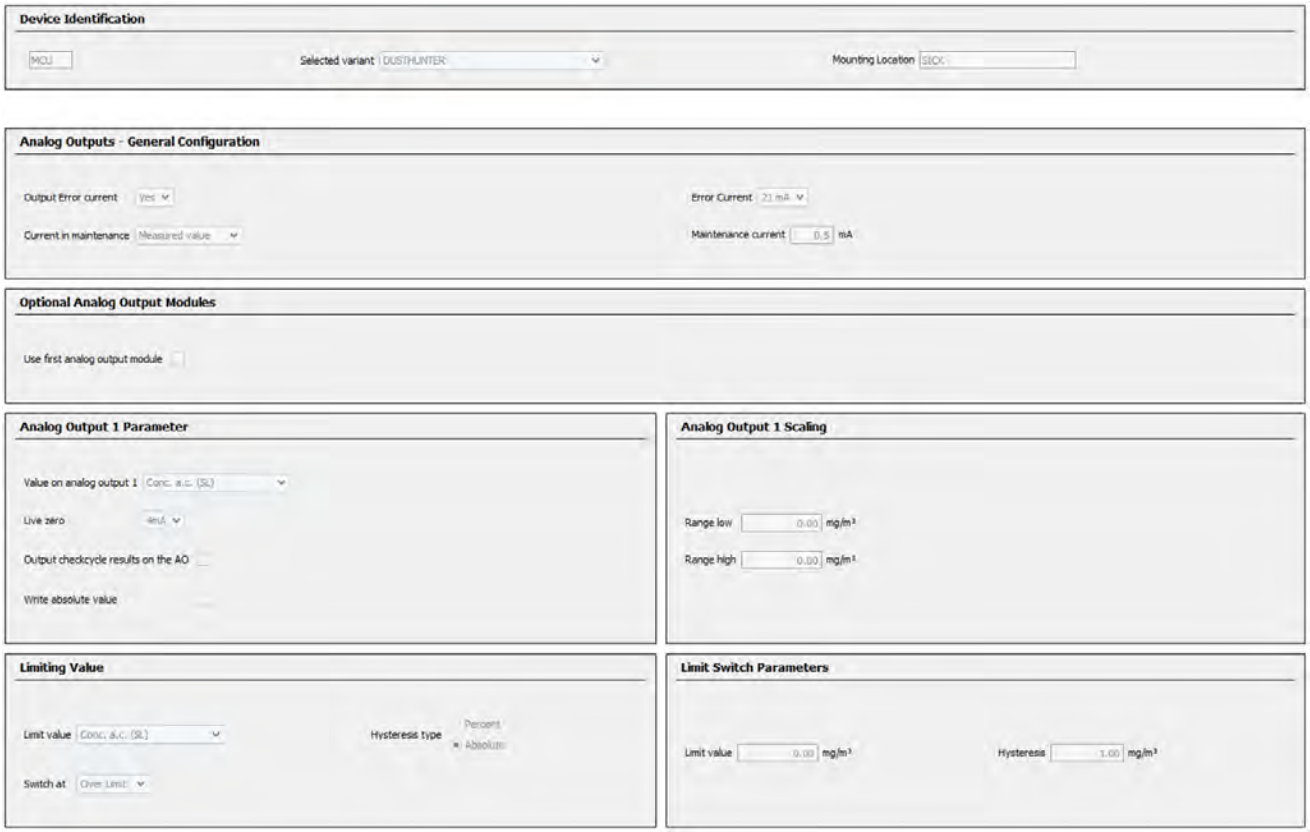


Fig. 44: SOPAS ET menu: MCU/Configuration/IO Configuration/Output Parameters

Table 28: Analog outputs

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).	
	Current in maintenance	User defined value	A value defined by the user is output during “Maintenance”.	
		Last measured value	The value measured last is output during “Maintenance”.	
		Measured value output	The current measured value is output during “Maintenance”.	
	Maintenance current	Whenever possible, value ≠ LZ	mA value to be output in “Maintenance” state.	
Optional Analog Output Modules	Use first analog output module	Inactive	Not used	
		active	Opens the fields to set parameters for AO 2 and AO 3 (if module is present).	
Analog Output 1 Parameter	Value on analog output 1	Conc. a.c. (SI)	Dust concentration in operating state (based on scattered light intensity).	The selected measured variable is output on the analog output.
		Conc. s.c.dry 02 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 check cycle results on the AO	Inactive	Control values (see “Function check”, page 21) 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	Conc. a.c. (SL)	Dust concentration in operating state (based on scattered light intensity).	Select the measured variable for which a limit value is monitored.
		Conc. s.c.dry 02 corr. (SL)	Dust concentration under standard conditions (based on scattered light intensity).	
		SL	Scattered light intensity.	
	Hysteresis type	Percent	Assignment of the value entered in the “Hysteresis value” field as relative or absolute value of defined limit value.	
		Absolute		
	Switch at	Over Limit	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	Defines a tolerance for resetting the limit value relay.	

9.6.8 Parameterizing analog inputs (control unit option)

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

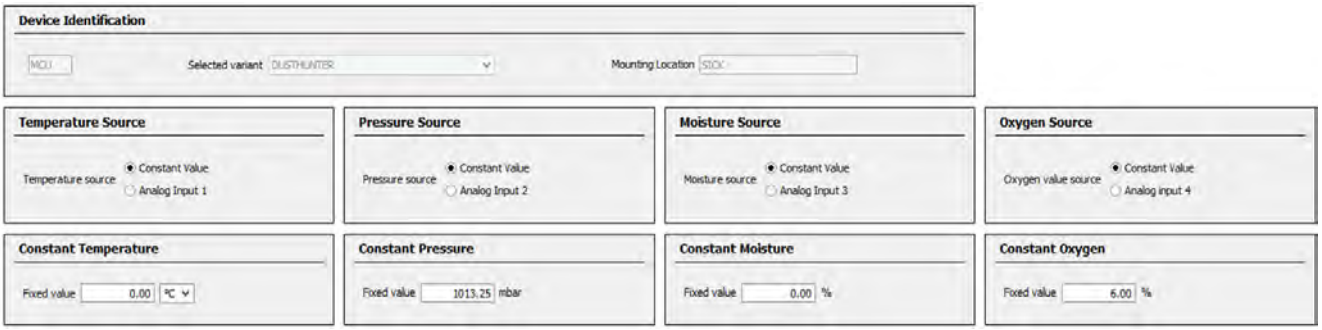


Fig. 45: SOPAS ET menu: MCU/Configuration/IO Configuration/Input Parameters

Table 29: Analog inputs

Field	Parameter	Remark
Temperature Source	Constant Value	A fixed value is used to calculate the scaled value. This parameter opens the “Constant Temperature” field to enter the scaling value in °C (° F for imperial units) or K.
	Analog Input 1	The value from an external sensor connected to analog input 1 (standard scope of delivery) is used to calculate the scaled value. This parameter opens the “Analog input 1 - Temperature” field to set the 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 (mbar equivalent to 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.

9.6.9 Display settings (optional MCU control unit)

To change the factory settings, connect the SOPAS ET to the control unit (see “Connecting the sender/receiver unit to the MCU control unit”, page 41), log in as ”Authorized operator” (see “Setting the optional control unit”, page 64), set the MCU to maintenance and open the “MCU/Configuration/Display settings” directory.

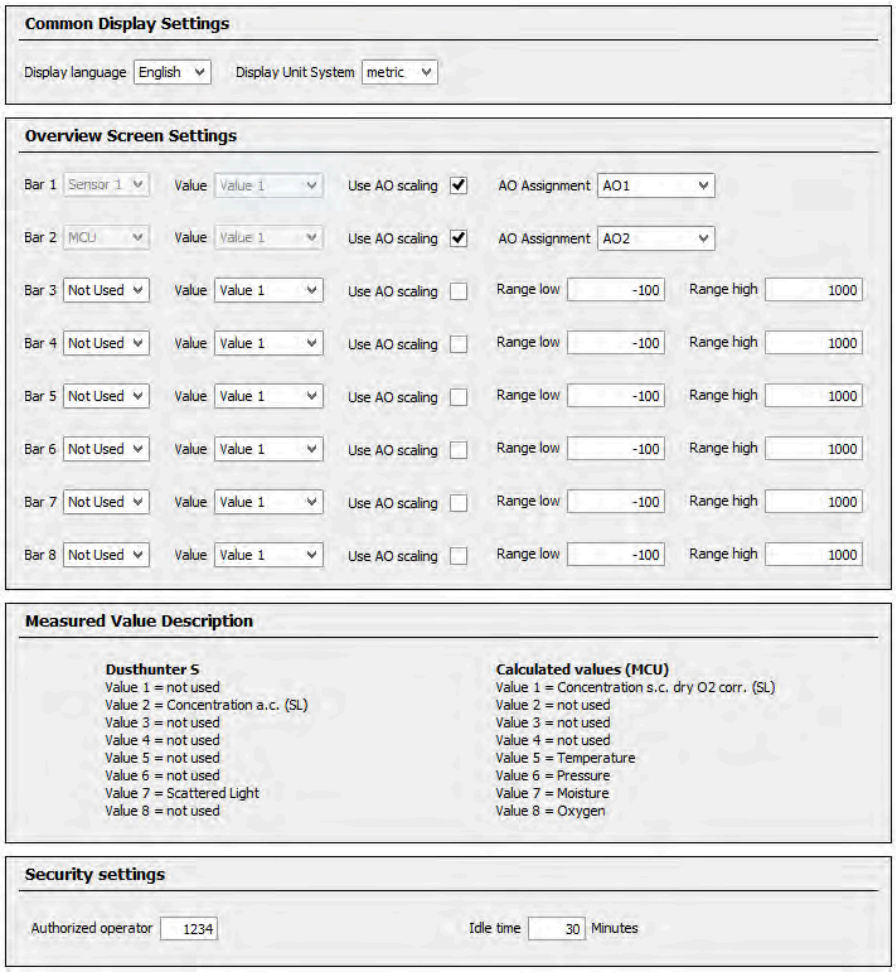


Fig. 46: SOPAS ET menu: MCU/Configuration/Display Settings

Table 30: Display settings

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

Settings overview screen

Table 31: Assignment of the measured values in the control unit

Measured values sender/receiver unit	Assignment
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
Measured values MCU control unit	**Assignment**
Value 1	Concentration s.c. dry O2 corr. (SI)

9.6.10 Starting measurement mode (MCU option)

Set the measuring device to “Measurement” mode after entering/modifying parameters. To do so, stop “Maintenance” mode (see “Setting the optional control unit”, page 64).

A restart is also recommended to complete the initial parameterization during commissioning. Commissioning is now completed.

9.7 Finding the DUSTHUNTER interface

If the interface used cannot be identified, you can find it using the device manager of your Windows® operating system.

1 Disconnect the DUSTHUNTER or MCU from your laptop/PC.
2 Start the device manager.
3 The device manager opens. (See: “Ports (COM & LPT)”)

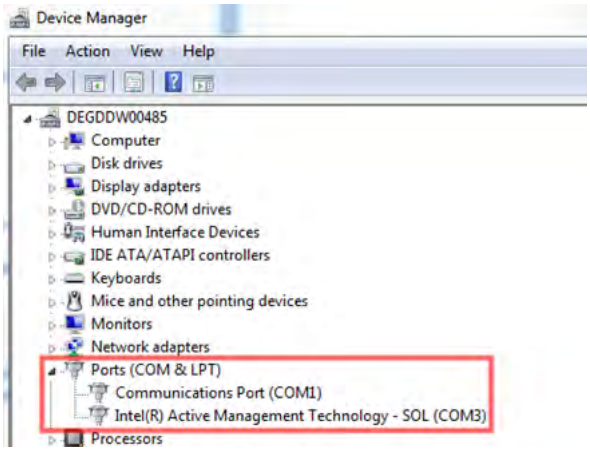


Fig. 47: Device Manager

4 Now connect the device with the laptop/PC.
A new “COM port” is shown.
5 Use this interface for communication.

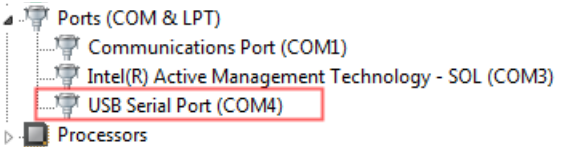
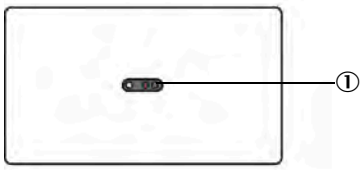


Fig. 48: Interface to be selected

10 Operation

10.1 Sender/receiver unit

The current device state (operation/failure, maintenance/maintenance request) is signaled on the rear side of the enclosure (green = operation, red = failure, yellow = maintenance).



① Signaling of device state

Fig. 49: Rear side of enclosure of DUSTHUNTER SB30 sender/receiver unit

10.2 MCU control unit

The control unit of the measuring device has an LC display, buttons for operation and status LEDs. Alternatively, the control unit can be connected to an external device and operated using the SOPAS ET software (see “SOPAS ET”, page 51).

- Many menus and functions can also be used via the display.
- The menus and functions are called up using the buttons.
- Status LEDs on the display indicate the current operating status.

10.2.1 User groups

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

Table 32: User groups on the control unit

User group		Access to
0	Operator	Displays measured values and system states No password required.
1	Authorized operator	Displays, inquiries as well as parameters required for commissioning or adjustment to customer-specific demands and diagnosis (preset password: 1234).

10.2.2 Changing the password for user groups

The password for the user groups on the control unit can be changed in the display settings in SOPAS ET (see “Display settings (optional MCU control unit)”, page 71).

10.2.3 Displays and operating elements

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

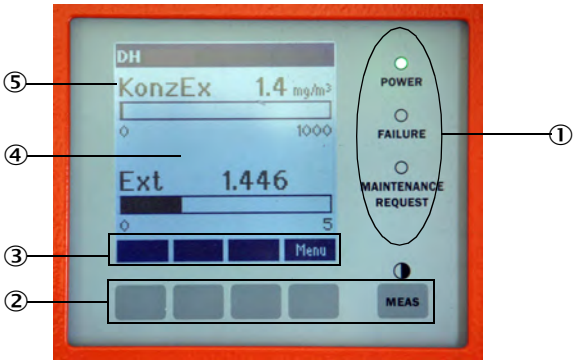


Fig. 50: Functional elements LC display of MCU control unit

11 Menus on the display

11.1 Menu structure of the MCU control unit

The menu structure of the control units is divided into the functions for configuration (“Menu” button) and an overview of the warning and error messages (“Diagnostics” button). The respective functions can be selected directly via the buttons (depending on the version of the control unit) (see “Displays and operating elements”, page 73).

11.1.1 Configuration (Menu)

Menu level	Designation	Explanation
1	I/O (MCU)	Control unit settings
1.1	Operating mode	Setting the maintenance mode or operating mode of the control unit
1.1.1		Set Maintenance / Set Operation
1.2	Adjustment	Start check cycle
1.2.1		Start check cycle
1.3	I/O Diagnosis	AO / AI / Device info
1.3.1	Analog output	Display current signal values n
1.3.2	Analog input	Display current signal values
1.3.3	Device Info	Control unit information text
1.4	I/O Parameter	Analog interfaces, set to sensor type
		(Requires maintenance mode condition)
1.4.1	AO Parameter	Selection of analog output
	The parameterization of the analog interfaces is identical, therefore the submenu for analog input and analog output is only listed once each.	
	The identical number of the submenu and interface is marked with “x”.	
1.4.1.x	AO x	End values, Live Zero, measured value source
1.4.1.x.1	Limit low	Set limit low in mg/m³ (password required)
1.4.1.x.2	Limit high	Set limit high in mg/m³ (password required)
1.4.1.x.3	Live Zero	Set zero point for 0/2/4 mA signal strength
1.4.1.x.4	Measured value	Assign a measured value source to interface AO x :
	ConcA_SL	*Dust concentration in operating condition*
	ConcN	*Dust concentration in standard condition*
	SL	*Scattered light intensity*
1.4.2	AI Parameter	Analog input selection
1.4.2.x	AI x	Assign end values (temperature and pressure)
1.4.2.x.1	Limit low	Set limit low in °C / hPa (password required)
1.4.2.x.2	Limit high	Set limit high in °C / hPa (password required)

1.4.3	Variant	Assigning the sensor type (usually assigned ex works) *This assignment is only necessary when the system has been changed. All compatible sensor types are displayed for selection.*
2	Sensor	Settings on measuring device
2.1	Operating mode	Set the maintenance mode or operating mode of the sensor
2.2	Parameter	Set regression coefficients (see “Damping time”, page 66) (Requires maintenance mode condition)
2.3	Diagnosis	Display diagnosis values
2.4	Device info	Display sensor information

11.1.2 Warning and error messages (Diagnosis)

Menu level	Designation	Explanation
1	I/O (MCU)	Display MCU error and warning messages
1.1	Error	Display MCU error messages
1.2	Warnings	Display MCU warning messages
2	Sensor	Display sensor error and warning messages
2.1	Error	Display sensor error messages
2.2	Warnings	Display sensor warning messages

11.2 Parameterization on the control unit display

Some configuration options can also be set directly on the control unit display. Some important functions are explained here in more detail as examples. The numbers behind the submenus refer to the numbering of the menus in the previous subsections.

11.2.1 Parameterizing analog outputs and inputs of the control unit

1 Set the control unit to “Maintenance” (1.1) and activate submenu “I/O Parameter” (1.4).
2 Select the setting of the “Analog output parameters” (1.4.1) or the “Analog input parameters” (1.4.2) and enter the password (see “User groups”, page 73) using the operating fields.
3 Set the desired value using the operating fields. Press “Save” to save in the device.

11.2.2 Assigning the control unit to the sender/receiver unit

1 Set the control unit to “Maintenance” (1.1) and activate submenu “I/O Parameter” (1.4).
2 Select the setting of the “MCU variant” (1.4.3) and choose the type “DUSTHUNTER S”.
3 Enter the password (see “User groups”, page 73) using the operating fields and save the selected type with “Save”.

12 Maintenance

12.1 General

WARNING: Risk of injury when working on the device
Observe the relevant safety regulations as well as the safety notices (see "Basic safety information", page 10) during all work.

Set the measuring device to "Maintenance" state before starting maintenance work. This can be done using either an external contact on pins 1 and 6 of plug connector 3 (see "Connections on the device", page 35) or with SOPAS ET (see "Parameterization with SOPAS ET", page 51).

Procedure when using the MCU control unit:

- ▶ Connect the MCU to the laptop/PC using the USB cable and start SOPAS ET.
- ▶ Connect with the MCU (see "Connecting to the device", page 52).
- ▶ Login as "Authorized Operator" (see "Password for SOPAS ET", page 51).
- ▶ Set the measuring device to "Maintenance" mode.

Resume measuring operation after completing the work (deactivate the "Maintenance Sensor" checkbox in the "Set on operation mode" window).

- An automatic function check is not carried out during "Maintenance".
- The value set for "Maintenance" is output on the analog output (see "Application parameters", page 55). This is also applicable when a malfunction is present (signaled on relay).
- The "Maintenance" mode is reset when there is a voltage failure. In this case, the measuring device switches to "Measurement" after the operating voltage is switched on again.

Maintenance intervals

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

The plant 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 plant operator. These activities must be carried out by qualified persons, see "Target groups", page 8. If desired, Endress+Hauser Service or authorized Service support centers can carry out all maintenance work. Any repairs will be made by specialists on-site whenever possible.

Auxiliary means required

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

12.2 Maintenance on the sender/receiver unit

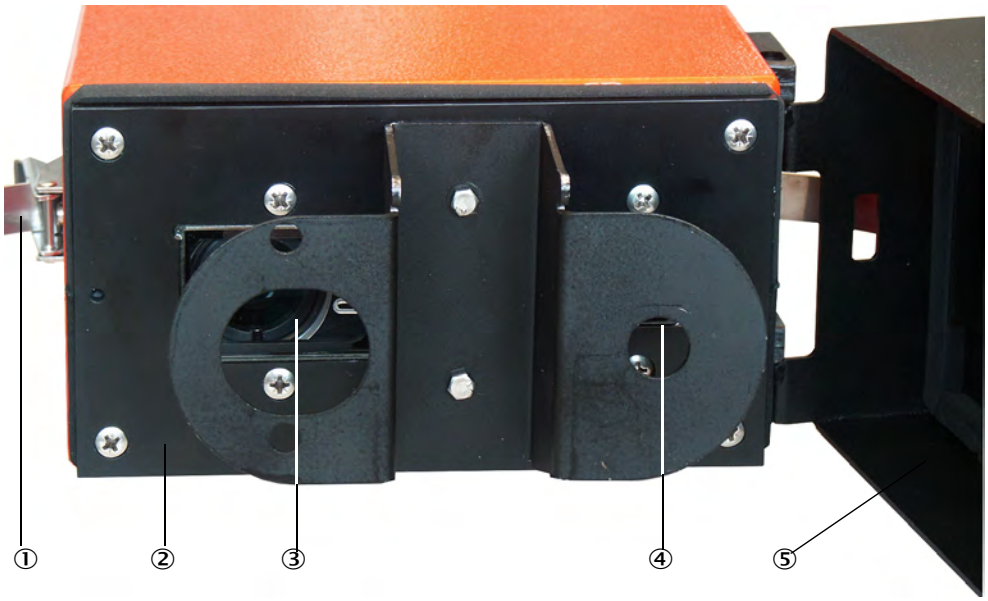
NOTE:
- Do not damage any device parts during maintenance work.
- Do not interrupt the purge air supply.

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

WARNING: Danger from exhaust gas
The sender/receiver unit must be opened for cleaning. It is possible that gas dangerous to health escapes in plants with overpressure in the duct.
- Take suitable protection measures or open the sender/receiver unit only when the plant is at a standstill.

Work to be performed

- Loosen tension locks (①) of the sender/receiver unit and swivel electronics unit (②) to the side.
- Check mounting flange (⑤) and purge air connection (see “Sender/receiver unit”, page 18) for contamination and clean when necessary.
- Carefully clean sender optics (④) and receiver optics (③) with an optics cloth or cotton swabs.
- Reassemble the sender/receiver unit again.
- Resume Measuring mode.



① Tension locks
② Electronics unit
③ Receiver optics
④ Sender optics
⑤ Mounting flange

Fig. 51: Cleaning the optical interfaces

12.3 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 sender/receiver unit is fitted on the duct.
- ▶ Disassemble the connected components before exchanging a damaged purge air hose.

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.

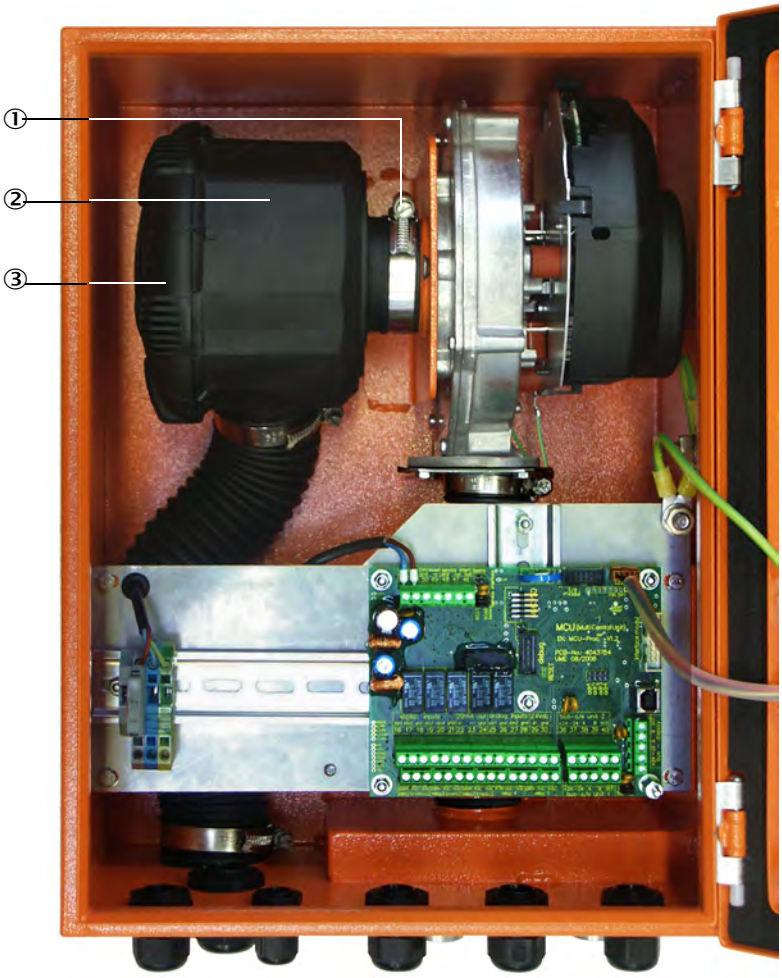
12.3.1 MCU control unit with integrated purge air supply

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 (see “Consumable parts”, page 99)
- Mount 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.



① Strap retainer
② Filter housing
③ Filter housing cover

Fig. 52: Exchanging the filter element of the control unit with purge air supply

12.3.2 Replacing the button cell in the control unit

Exchange criterion: In case of need.

Work steps:

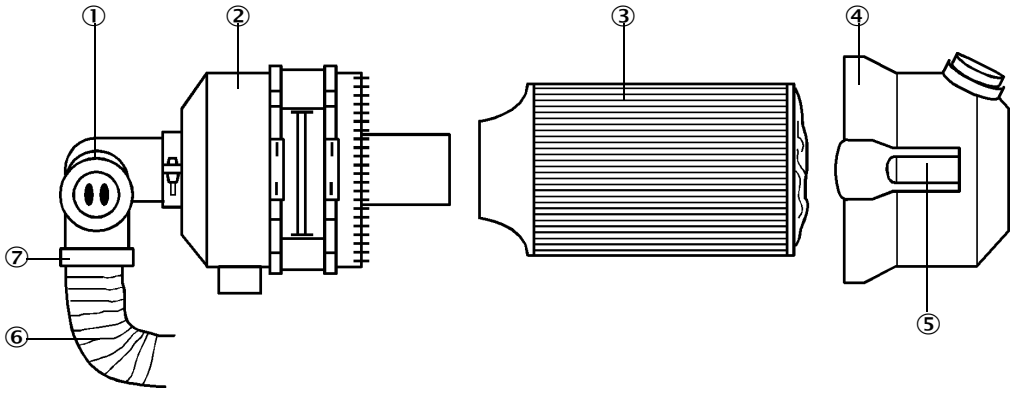
1 The replacement can be carried out under voltage, make sure not to short-circuit the contacts of the cell.
2 Open the MCU with the control cabinet key.
3 Remove the old button cell. Insert new button cell ① into the holder. Observe the installation direction of the button cell. The circuit board is marked accordingly at this point. For a suitable button cell, see “Consumable parts”, page 99.
4 Put the entire device back into operation (switch on voltage and check measured and status values, set time and date).

Fig. 53: Button cell exchange, MCU

12.3.3 Optional external purge air unit

NOTICE:
The purge air unit must be serviced at the latest when the low-pressure monitor (①) at the filter outlet triggers (see Figure 54).

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

Fig. 54: Replacing the filter element

- Switch off the fan.
- Clean outside of filter housing (②).
- Loosen strap retainer (⑦) and clamp purge air hose (⑥) to a clean location.
- 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-Topelement C11 100 (see “Consumable parts”, page 99)
- 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.

13 Troubleshooting

13.1 Monitoring and diagnostic system

The device has an integrated system that continually checks the operating state of the sender/receiver unit and of the optional MCU control unit, when necessary.

Messages for the two device components are categorized into fault messages and warning messages depending on the anticipated effects:

Significance of warning messages

- Measuring results are not (yet) directly influenced by a deviating system state.
- Evaluation and, as necessary, elimination of the causes are required promptly to avoid subsequent faults or device damage.

Significance of malfunction messages

- Measuring operation can no longer be guaranteed.
- The measured values are no longer to be used.

The individual warnings of the sender/receiver unit and the control unit are combined as a collective warning and all faults are combined into a collective fault. The collective warning or collective fault is output via status LED, status relay and status indications in displays.

Detailed information on the current device status is provided by the “Diagnostics / Error messages / Warnings” directories of the sender/receiver unit and the optional MCU control unit. To display, connect the measuring device to SOPAS ET and start the corresponding device file.

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 clearance in the status window (context help at the bottom left) (see “Warning and malfunction messages in SOPAS ET”, page 85).

Warning messages are output, for example, 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 device.

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

13.2 Status display LED and display

Warnings or device malfunctions are output as follows:

- The respective LED lights up on the sender/receiver unit (yellow for Warning, red for Failure) (see “Sender/receiver unit”, page 73).
  When using the optional MCU control unit:
- The respective relay on the control unit triggers (see “Connecting the sender/receiver unit to the MCU control unit”, page 41).
- “Maintenance requ.” or “Failure” is displayed in the status bar of the LC display of the control unit (see “Operation”, page 73). In addition, the respective LED goes on (“WARNING” for warnings, “FAILURE” for malfunctions).
  After pressing the “Diag” button, possible causes are shown as short information in the menu “Diagnosis” after selecting the device (e.g. “MCU control unit” or “DH SB30”).

Status display significance

Next to the display of the control unit, LEDs indicate the operating states of the device.

Table 33: *MCU control unit operating state*

LED	Color	Significance
Power	Green	Device switched on
Failure	Red	Malfunction - operating state: Malfunction
Maintenance request	Yellow	Warning message

13.3 Sender/receiver unit malfunctions

Malfunctions

Table 34: Malfunctions DUSTHUNTER SB30

Malfunction	Possible cause	Action
LEDs of the sender/ receiver are not on	• No supply voltage • Connecting cable not connected correctly or defective • Defective plug connector	▶ Check plug connectors and cables. ▶ Contact Endress+Hauser Service.

Warning and malfunction messages in SOPAS ET

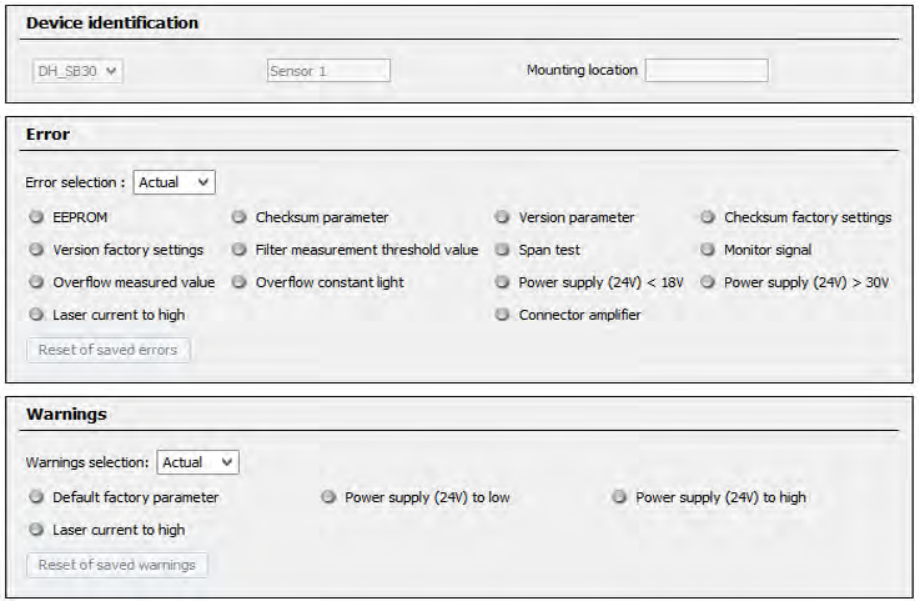


Fig. 55: SOPAS ET menu: DH SB30/Diagnosis/Error messages/Warnings

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 on-site.

Table 35: Sender/receiver unit messages

Message	Significance	Possible cause	Action
Span test	Deviation from nominal value above ±2%	Sudden changes in measuring conditions during determination of control values	▸ Repeat the function check. ▸ Contact Endress+Hauser Service.
Overflow constant light	Constant light signal > 3.5 V; measured values invalid	Extraneous light share too high	▸ Reduce incidence of extraneous light (select different fitting location, sun protection, ...).
Connector amplifier	Measurement not possible	Measurement receiver not connected	▸ Check connection to processor board and connect plug connector, if necessary (see “Connections on the device”, page 35).

13.4 Malfunctions of optional control unit

13.4.1 Malfunctions

Table 36: Optional control unit malfunctions

Malfunction	Possible cause	Action
No display on LC display	• No supply voltage • Connecting cable to display not connected or damaged • Fuse defective	▶ Check voltage supply. ▶ Check the connecting cable ▶ Replace fuse. ▶ Contact Endress+Hauser Service.

13.4.2 Warning and malfunction messages

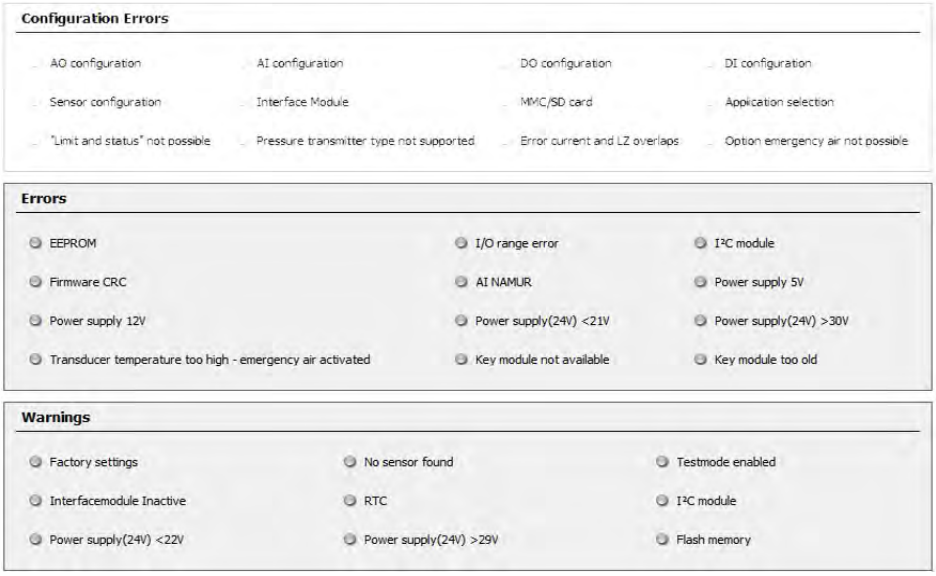


Fig. 56: SOPAS ET menu: MCU/Diagnosis/Error messages/Warnings

Malfunctions listed below can probably be cleared on-site, if not, contact Endress+Hauser Service.

Table 37: Control unit messages

Message	Significance	Possible cause	Action
AO configuration	The number of available and parameterized analog outputs is not identical.	• AO not parameterized • Connection error • Module failure	▶ Check parameterization (see “Parameterizing analog outputs (control unit option)”, page 68).
AI configuration	Number of available and parameterized analog inputs not identical.	• AI not parameterized • Connection error • Module failure	▶ Check parameterization (see “Parameterizing analog inputs (control unit option)”, page 70).
Interface module	No communication via the Interface module.	• Module not parameterized • Connection error • Module failure	▶ Check parameterization (see “Parameterizing the Interface module of the MCU control unit”, page 65).
No sensor found	Sender/receiver unit not recognized	• Communication problems on RS485 cable • Supply voltage problems	▶ Check system settings. ▶ Check the connecting cable ▶ Check voltage supply. ▶ Contact Endress+Hauser Service.
Application selection	MCU setting does not match the connected sensor.	• Sensor type has been changed	▶ Correct application settings (see “Setting the optional control unit”, page 64).
Test mode enabled	MCU(DH Ex) in Test mode.	• Test mode	▶ Deactivate “System Test” mode (“Maintenance” directory)

14 Decommissioning

14.1 Switch-off states

The measuring device must be shut down:

- Immediately if the purge air supply fails (only the sender/receiver unit)
- If the equipment is shut down for more than one week (including the MCU control unit)

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

14.2 Shutdown and disassembly

WARNING: Risk of injury when working on the device
Observe the relevant safety regulations as well as the safety notices (see “Basic safety information”, page 10) during all work.

Work to be performed:

- ▶ Loosen the connecting cable to the MCU.
- ▶ Dismantle the sender/receiver unit from the duct.
- ▶ Close the flange opening with a blind plug (see “Flange with tube”, page 93).
- ▶ 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.

14.3 Return delivery

Before shipping:

- ▶ Contact your local Endress+Hauser representative. The addresses are on the back cover of these Operating Instructions.
- ▶ The Endress+Hauser representative can advise you whether the defective device can be repaired locally or whether it would more advantageous for you to return the device for repair.
- ▶ Observe the following when returning the device to Endress+Hauser:
  - Repair flat rates.
  - Specifications for packaging and transport (see “Transport”, page 28).
  - Replacement devices or putting the device back into operation by Endress+Hauser Service.

Preparatory work

- ▶ Clean all device components and remove any potentially harmful residues.
- ▶ Complete the Return Form.
- ▶ Observe the local transport instructions.

14.4 Disposal

The metal parts of the devices can be disposed of as industrial scrap.

NOTICE:
Disposal
- ▶ Observe relevant local conditions for disposal of industrial waste.

WARNING:
Disposal of assemblies containing residual substances which are harmful to the environment
The following assemblies could contain substances that have to be disposed of separately:
- Electronics: Condensers, circuit boards, batteries.
- Display: Liquid contained in the LC display.
- All parts in contact with the sample gas can be contaminated with harmful substances.

- ▶ Observe the applicable local regulations for disposal.

15 Technical data

15.1 Specifications

Measuring device DUSTHUNTER SB30

Table 38: Technical data, measuring device

Measuring parameters		
Measured variable	Scattered light intensity (SI) Dust concentration output in mg/m³ after gravimetric comparison measurement	
Measuring principle	Scattered light measurement (backward dispersion)	
Measuring ranges 1)	Measuring range 1: 0...7.5 mg/m³	Measuring range 6: 0...225 mg/m³
	Measuring range 2: 0...15 mg/m³	Measuring range 7: 0...375 mg/m³
	Measuring range 3: 0...45 mg/m³	Measuring range 8: 0...1.000 mg/m³
	Measuring range 4: 0...75 mg/m³	Measuring range 9: 0...3.000 mg/m³
	Measuring range 5: 0...150 mg/m³	2 further measuring ranges, freely adjustable 2)
Measurement uncertainty 3)	±2% (of upper measuring range value)	Repeat accuracy at zero point 0.1%
Response time	60 s; preset	0.1...600 s, freely selectable via SOPAS ET
Altitude	0 ... 2000 m	
Measuring conditions		
Process gas temperature	-40...600 °C	
Process gas pressure rel. (environment to gas duct)	-50 hPa ... +2 hPa -50 hPa... +30 hPa	Purge air supply with optional MCU-P control unit (or others) Purge air supply with optional external purge air unit (or others)
Humidity of process gas	<95%, non-condensing	
Internal duct diameter	> 500 mm (a light trap is recommended for < 2,000 mm)	
Ambient temperature	-40...+60 °C -40...+45 °C	Sender/receiver unit, optional MCU-N control unit Optional MCU-P control unit, intake temperature for purge air
Specifications		
Electrical safety	CE	
Control functions	Automatic self-test (linearity, drift, aging) Manual linearity test with test fixture	
1):	see “Measuring range and limit value”, page 50	
2):	see “Freely parameterizable measuring ranges”, page 50	
3):	In temperature range - - 20 °C ... +50 °C	

Sender/receiver unit DUSTHUNTER SB30

Table 39: Technical data, sender/receiver unit

Specifications		
Power supply	Voltage supply: Power consumption:	24 V from external voltage supply or optional MCU max. 4 W maximum power consumption during operation
Weight	7 kg	
Laser	Laser protection class 2; capacity < 1 mW; wavelength between 640 nm and 660 nm	
Protection class (EN 61140)	Protection class III	
Enclosure rating	IP66	
Output signals		
Analog output	4 ... 20 mA, max. load 750 Ω; resolution 12 bits; electrically isolated	
Relay output	3 potential-free outputs (N/O contact) for status signal; load 48 V, 1 A	
Input signals		
Digital input	4 inputs to connect potential-free contacts (e.g. for external maintenance switch, triggering function check or linearity measurement, calibration curve switching or filter monitoring)	
Communication interfaces		
Serial (RS-485)	SOPAS ET operation via SOPAS service kit RS485 or connection of the MCU option	
Modbus	Modbus® RTU for measured value transmission	

MCU control unit

Table 40: Technical data, MCU control unit

Specifications		
Power supply Version with power supply unit Version without power supply unit	Wide-range power pack (MCU-xW): External supply (MCU-x2):	90...250 V AC, 47...63 Hz; opt. 24 V DC ± 2 V 24 V (DC)
Power consumption Version with power supply unit Version without power supply unit Version with purge air supply	Wide-range power pack (MCU-xW): External supply (MCU-x2): Integrated blower (MCU-P):	Max. 40 W, typically 8...15 W Max. 35 W, typically 6...12 W Max. 70 W, typically approx. 50 W (standard version)
Protection class Version with power supply unit Version without power supply unit	Wide-range power pack (MCU-xW): External supply (MCU-x2):	Protection class I Protection class III
Weight	13.5 kg 3.7 kg	Optional MCU-P control unit Optional MCU-N control unit
Display	LC display / 3 status LEDs	
Operation	Via LCD directly on the device or the SOPAS ET operating program	
Protection class (EN 61140)	Protection class III	
Enclosure rating	IP65	
Purge air feed volume	Max. 20 m^3/h	Optional MCU-P control unit
Output signals (standard version, see “Selecting the optional control unit”, page 25)		
Analog output	0/2/4 ... 20 mA, max. load 750 Ω; resolution 12 bits; electrically isolated	
Relay output	3 potential-free outputs (N/O contact) for status signal; load 48 V, 1 A	
Input signals (standard version, see “Selecting the optional control unit”, page 25)		
Digital input	4 inputs to connect potential-free contacts (e.g., for external maintenance switch, triggering function check);	
Communication interfaces (standard version, see “Selecting the optional control unit”, page 25)		
Serial (RS-485)	SOPAS ET operation via SOPAS service kit RS485 or connection of the MCU option	

Purge air supply (SLV)

Table 41: Technical data, purge air supply

Specifications		
Optional external purge air unit (with blower 2BH13)	Voltage supply (3 -phase): Rated current: Motor rating:	200…240 V/345…415 V at 50 Hz 220…275 V/380…480 V at 60 Hz 2.6 A/Y 1.5 A 0.37 kW at 50 Hz; 0.45 kW at 60 Hz
Weight	14 kg	
Enclosure rating	IP 54	
Purge air feed volume	Max. 63 m^3/h	Optional external purge air unit

Accessories

Table 42: Technical data, accessories

Specifications		
Connecting cable length	5 m, 10 m	Other lengths on request
Purge air hose length	5 m, 10 m	Other lengths on request
Live connection cables (e.g. plug-in connector 1)	Shielded cables with twisted pairs (e.g. UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm^2 from LAPPKabel; not suitable for underground installation)	
Signal line (e.g. plug-in connector 3)	Shielded cables with twisted pairs (e.g. UNITRONIC LiYCY (TP) 4 x 2 x 0.25 mm^2 from LAPPKabel; not suitable for underground installation)	

15.2 Dimensions, Part Nos.

All measures are specified in mm.

15.2.1 Sender/receiver unit

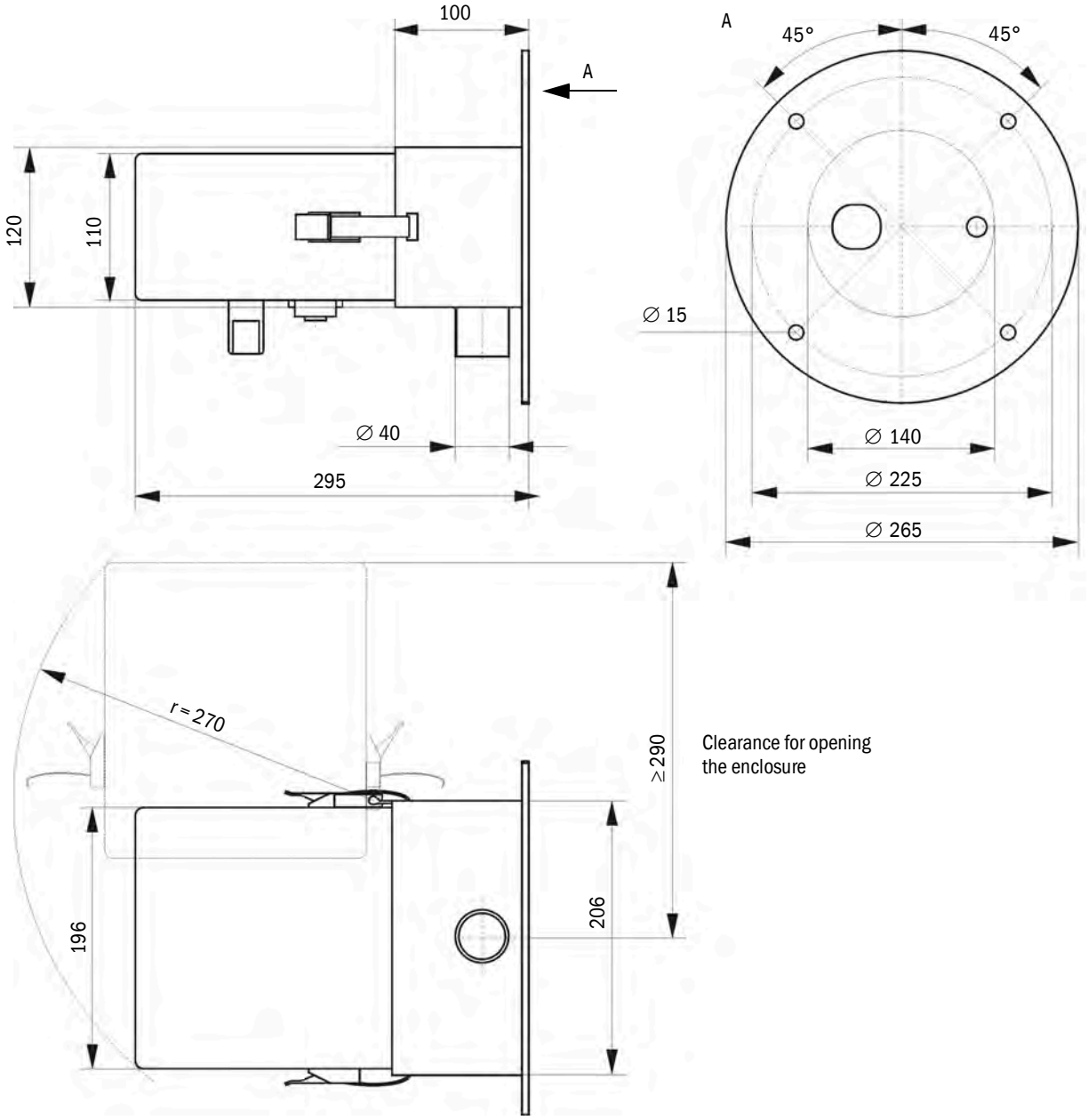


Fig. 57: Sender/receiver unit

Table 43: Part numbers, sender/receiver unit

Designation	Part number
Sender/receiver unit DHSB-T30 400 mm ET	1116606
Sender/receiver unit DHSB-T30 800 mm ET	1116607

15.2.2 Flange with tube

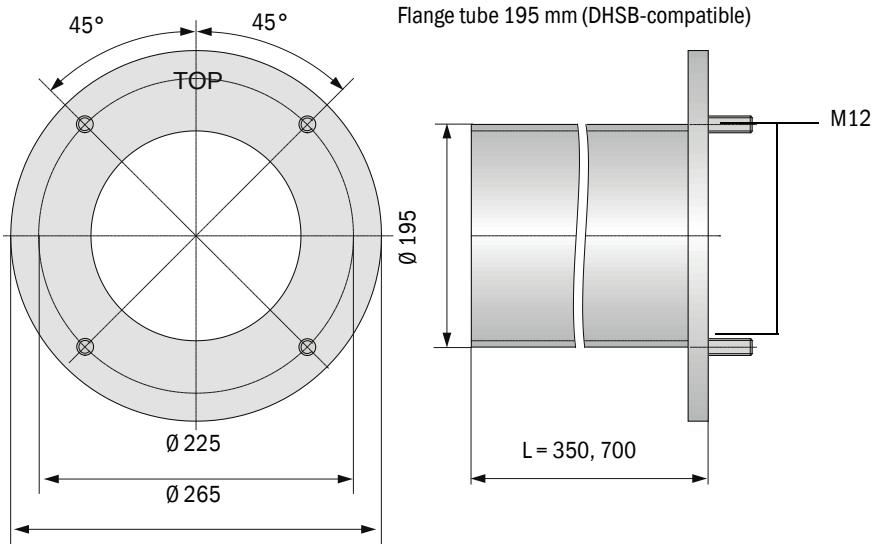


Fig. 58: Flange with tube DHSB

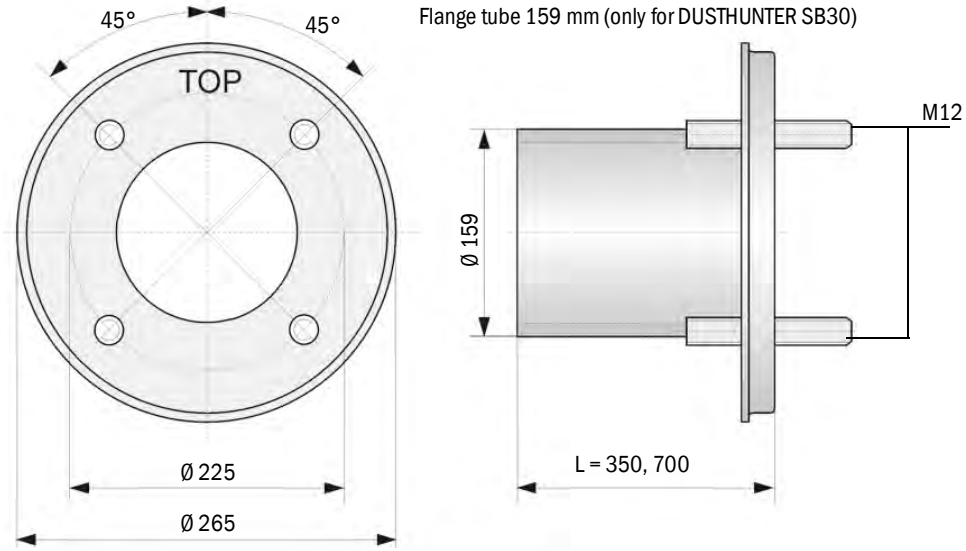


Fig. 59: Flange with tube DHSB30

Table 44: Part numbers, flange with tube DHSB

Designation	Part number
Flange with tube, DN195, length 350 mm, St37 (large tube diameter)	2046526
Flange with tube, DN195, length 700 mm, St37	2046492
Flange with tube, DN195, length 350 mm, 1.4571	2047288
Flange with tube, DN195, length 700 mm, 1.4571	2047287
Flange with tube, DN159, length 350 mm, St37 (small tube diameter)	2142348
Flange with tube, DN159, length 700 mm, St37	2142347
Flange with tube, DN159, length 350 mm, 1.4571	2142350
Flange with tube, DN159, length 700 mm, 1.4571	2142349
Blind flange Ø265 mm, K225 mm (without seal)	4067231

15.2.3 MCU control unit

The optional MCU control unit has a modular design and can be individually equipped and retrofitted with additional interfaces. You will find a selection of possible variants listed below.

Standard interfaces of the MCU control unit, see “Standard interfaces of MCU control unit”, page 23.

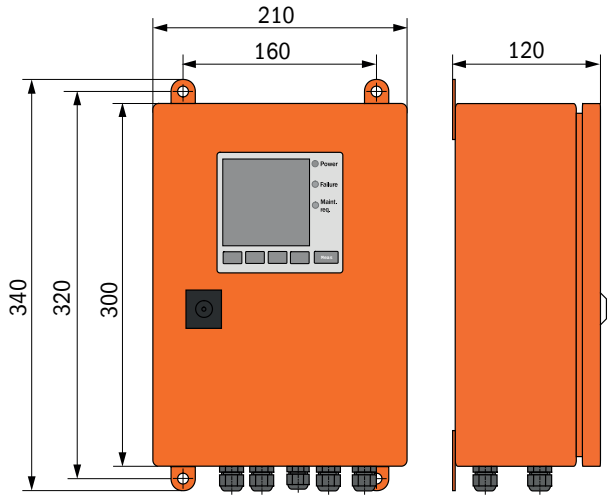


Fig. 60: MCU-N control unit

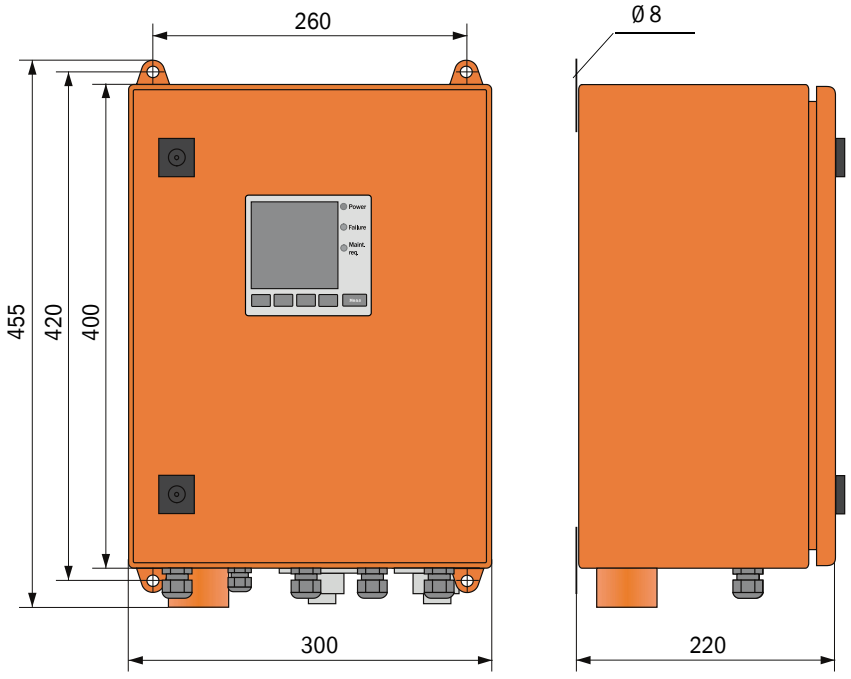


Fig. 61: MCU-P control unit

Table 45: Part numbers, MCU-N control unit

Designation	Part number
MCU-NWODN00000NNNE control unit Supply voltage 90 ... 250 V AC, LC-display	1080506
MCU-NWODN01000NNNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 relay outputs - with 4 digital and 2 analog inputs	1045001
MCU-NWODN00000BNNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 Ethernet Interface module, COLA-B	1080507
MCU-NWODN00000MNNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 Interface module PROFIBUS, RS485	1081996
MCU-NWODN01000JNNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 interface module Modbus TCP/IP	1064639
MCU-NWODN01000ENNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 Ethernet interface module, COLA-B	1047195
MCU-NWODW01000DNNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 interfce module Modbus ASCII/RTU - 1 Ethernet, CoLa-B, Service Interface module	1082232
MCU-NWODW00000FNNE control unit Supply voltage 90 ... 250 V AC, LC-display - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 Interface module PROFIBUS, RS485 - 1 Ethernet, CoLa-B, Service Interface module	1084573
Further variants available on request	

Table 46: Part number, MCU-P control unit

Designation	Part number
Control unit MCU-PWONN00000NNNE Supply voltage 90 ... 250 V AC, without display	1040668
Control unit MCU-P2ODN00000NNNE Supply voltage 24 V DC, with display	1040678
Control unit MCU-PWODN01000NNNE Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 relay outputs - with 4 digital and 2 analog inputs	1045002
Control unit MCU-PWODN01000BNNE Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 relay outputs - with 4 digital and 2 analog inputs - 1 Ethernet interface module, COLA-B	1068712
Control unit MCU-PWODN01002BNNE Supply voltage 90 ... 250 V AC, LC-display - with 1 +2 analog and 5 +8 relay outputs - with 4 digital and 2 analog inputs - 1 Ethernet interface module, COLA-B	1088960
Further variants available on request	

15.2.4 External purge air unit

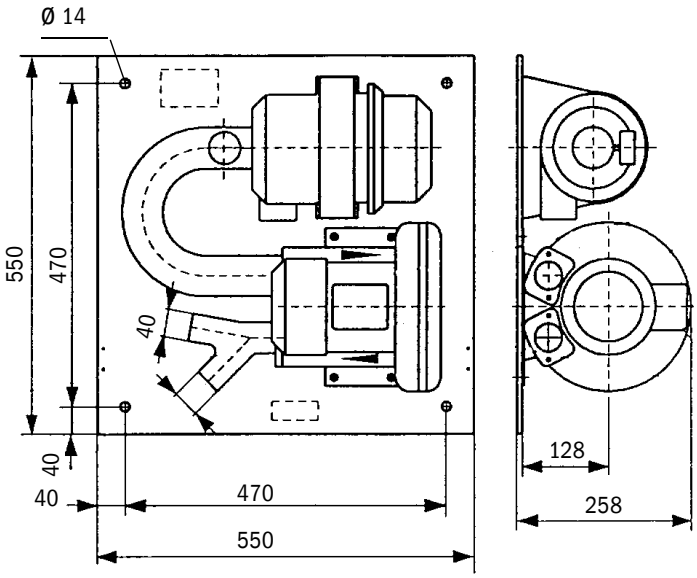


Fig. 62: External purge air unit

Table 47: Part numbers purge air unit

Designation	Part number
Purge air unit with blower 2BH13 and purge air hose, length 10 m	1012409

15.2.5 Weather hoods

Weather hood for external purge air unit

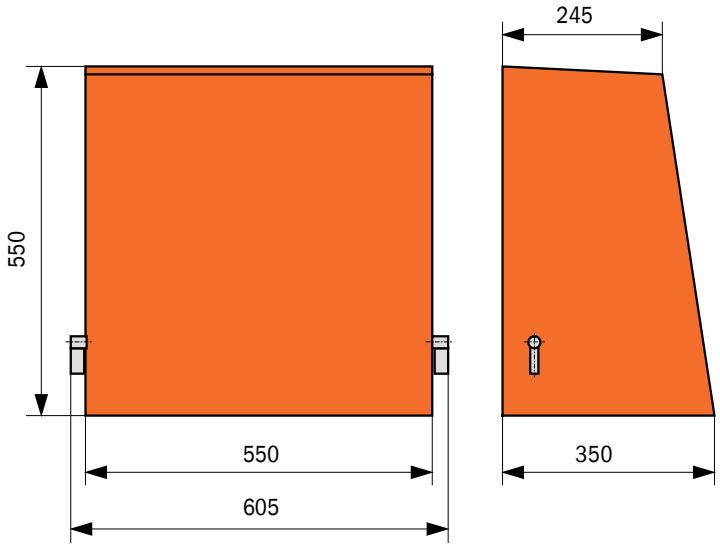


Fig. 63: Weather hood for external purge air unit

Table 48: Part number weather hood

Designation	Part number
Weather hood for purge air unit	2084180

Weather hood for sender/receiver unit

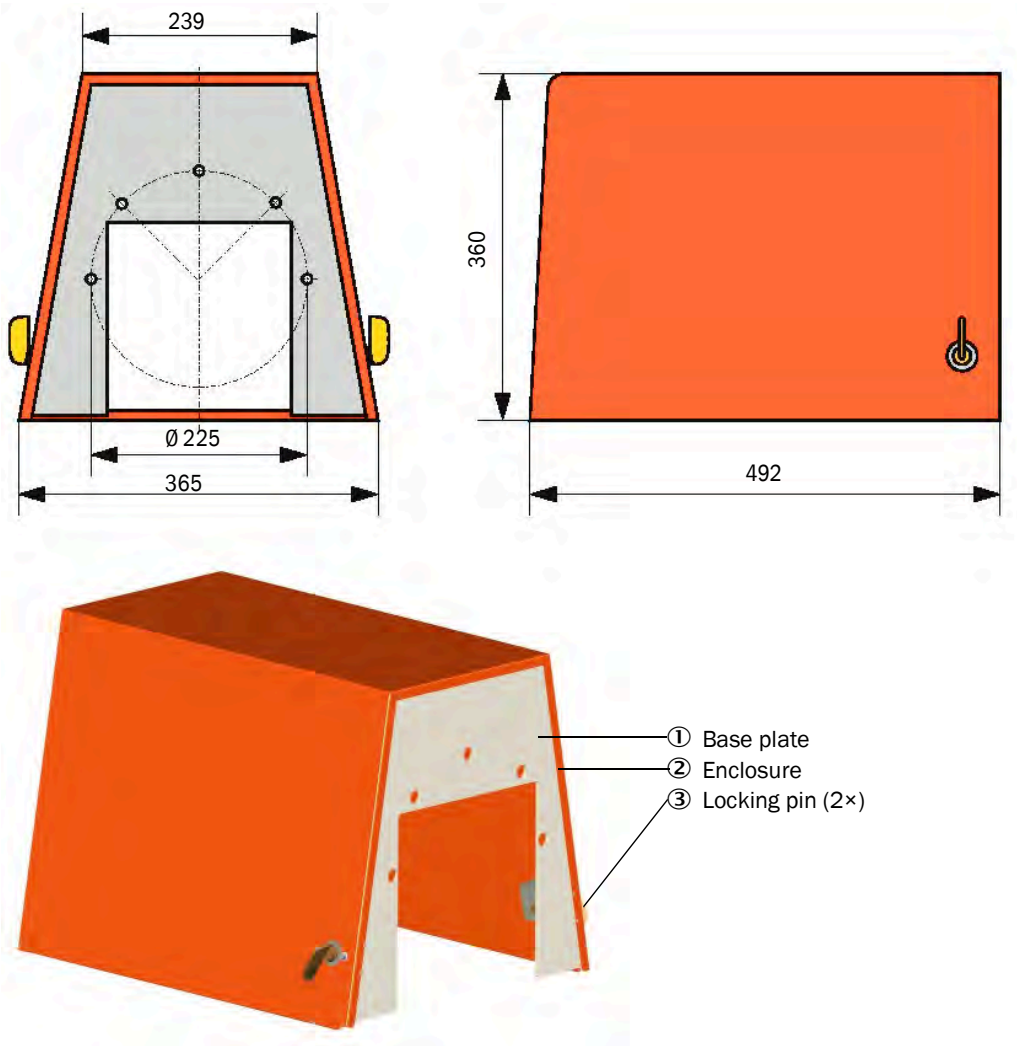


Fig. 64: Weather hood for sender/receiver unit

Table 49: Part number weather hood

Designation	Part number
Weather hood SB30 flange k225	2118825

15.2.6 Light trap

Length	120 mm
Bolt circle diameter	100 mm
Pipe diameter	76.2 mm

Assembly instructions enclosed with the product

Fig. 65: Light trap with weld-on flange

Table 50: Part numbers light trap

Designation	Part number
Light trap DHSB	2110041
A weld-on flange is required for the light trap	
Flange with tube, length 130 mm, St37	2017845
Flange with tube, length 130 mm, 1.4571	2017846

15.3 Accessories

15.3.1 Connections for sender/receiver unit

Table 51: Part numbers connections

Designation	Part number
7-pole socket for connection of voltage supply (plug connector 1)	6049886
7-pole plug for connection of AO and status signals (plug connector 2)	6049036
5-pole socket for connection of DI and Service (plug connector 3)	6009719
Cable with plug/socket	Part number
SOPAS service kit RS485 5 m (plug connector 3) (socket 5-pin/USB)	2097408
Signal cable length 5 m with 7-pin plug (plug connector 2)	2096285
Signal cable length 10 m with 7-pin plug (plug connector 2)	2096286

15.3.2 Cable, sender/receiver unit - MCU

Table 52: Part numbers cables

Designation	Part number
Connecting cable length 5 m (24 V, AO) incl. 7-pin socket (plug connector 1)	7042017
Connecting cable, length 10 m (24 V, AO) incl. 7-pin socket (plug connector 1)	7042018
Connecting cable length 5 m (24 V, AO, ModBus) incl. 7-pin socket (plug connector 1)	2117481
Connecting cable, length 10 m (24 V, AO, ModBus) incl. 7-pin socket (plug connector 1)	2117482

15.3.3 Purge air supply

Table 53: Part numbers purge air supply

Designation	Part number
Non-return valve DN40	2035098
Purge air hose DN 40, sold by the meter	5304683
Hose clamp D32-52	5300809
Purge air heater with enclosure for fitting outdoors 230 V AC, 50/60 Hz, 3000 W, 1 ph	2021514
Purge air heater with enclosure for fitting outdoors 120 V AC, 50/60 Hz, 2200 W, 1 ph	2021513

15.3.4 Assembly parts

Table 54: Part numbers, assembly parts

Designation	Part number
Assembly kit sender/receiver unit	2048677

15.3.5 Device check accessories

Table 55: Part numbers accessory

Designation	Part number
USB-RS485 adapter (MCU option only)	2040718
Check filter set linearity test	2042339
Adjusting stand	2042907

15.4 Consumable parts

Table 56: Part numbers consumables

Designation	Quantity*	Part number
Filter element C11 100 (for optional external purge air unit)	4	5306091
Filter element C11 40 (for optional MCU-P control unit)	4	7047560
Optics cloth	4	4003353
Button cell BR 2032 (for optional MCU control unit)	1	2085319
Optics cleaning set with accessories (1×30 ml spray bottle, optics cloth, bellows, brush, cleaning cloths)		5343133
Optics cleaning set (2×60 ml spray bottle, optics cloth)		5340076
*The number is a recommendation for two years of operation with average use		

16 Appendix

16.1 Conformities

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

- EU Directive: 2011/65/EU (RoHS)
- EU Directive: 2014/35/EU (Low Voltage Directive)
- EU Directive : 2014/30/EU (Electromagnetic Compatibility)

Applied EN standards:

- EN 50581, Guideline for the implementation of RoHS
- 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

16.2 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.

16.3 Approvals

The DUSTHUNTER SB30 measuring device is a TÜV-approved type in accordance with the “TUV Approved” directive (EN 15267-3).

The measuring device DUSTHUNTER SB30 is DNV-certified for maritime applications according to DNV CG-0339

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