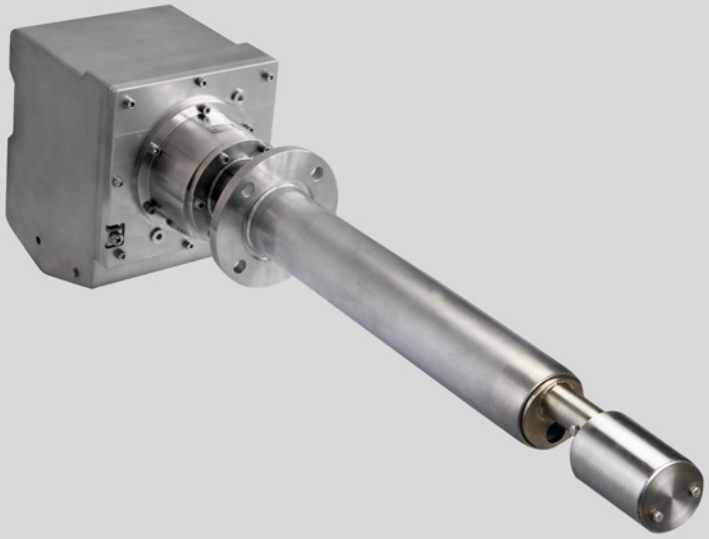
OPERATING INSTRUCTIONS

DUSTHUNTER SP100 Ex-3K

Scattered Light Dust Measuring Device

SICK
Sensor Intelligence.



Described product

DUSTHUNTER SP100 Ex-3K

Version for potentially explosive atmospheres zone 2/22

Manufacturer

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Legal information

Original document

This document is an original document of SICK Engineering GmbH.

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1 About this document

1.1 Function of this document

These Operating Instructions describe:

- Device components
- Installation
- Operation
- Maintenance tasks necessary for safe operation

1.2 Scope of application

These Operating Instructions apply exclusively to the measuring system described in the product identification (see “Product identification”, page 21).

The Operating Instructions do not apply to other measuring devices from SICK.

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 who install, operate and maintain the device.

Operation

The device may only be operated by authorized persons who, based on their device-specific training as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Installation and maintenance

Installation and maintenance may only be carried out by trained specialists familiar with the installation conditions.

Observe the information at the beginning of the respective Sections.

1.4 Further information

Observe the delivered Product CD as well as other delivered documents.

Further information on the internet under: sick.com

1.5 Symbols and document conventions

1.5.1 Warning symbols

Table 1: Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard by voltage
	Hazard by laser radiation
	Hazard in potentially explosive atmospheres
	Hazard for environment and organisms

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
	Information on product condition with regard to protection against explosions (general)
	Information on product condition with regard to Explosion Protection Directive ATEX 2014/34/EU
	Additional information and explanations

1.6 Data integrity

SICK Engineering GmbH uses standardized data interfaces, such as standard IP technology, in its products. The focus here is on product availability and features.

SICK Engineering GmbH always assumes that the customer ensures the integrity and confidentiality of data and rights affected in connection with the use of 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

Work on the device

NOTICE:

Risk for system safety through work on the device not described in these Operating Instructions

Work on the device not described in the Operating Instructions or associated documents can lead to unsafe operation of the measuring system and thus endanger equipment safety.

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

WARNING:

Injury risk through incorrect lifting and carrying of device components

Due to the weight of individual device components, carelessness and mishandling during transport can lead to injuries.

- Consider the device component's weight before lifting.
- Observe the regulations for protective clothing (e.g., safety shoes, non-slip gloves).
- To carry the device components safely, use handles or reach under the component.
- Do not use protruding parts on device components for carrying.
- Call in further persons as assistants as required.
- Use a hoist or transport equipment as an option.
- Pay attention to the transport safety.
- Clear obstacles that could cause falls and collisions out of the way.

Hazards through hot or aggressive gases and high pressure

The DUSTHUNTER SP100 Ex-3K sender/receiver unit is fitted directly on the gas-carrying duct. On systems with a low hazard potential, installation or removal can be carried out during system operation when the applicable regulations and safety provisions of the system are observed, and necessary and appropriate protective measures are taken.

WARNING:

Health hazard due to sample gas and sample gas residues

When working on the sender/receiver unit, leaking gas can cause hazardous sample gas to escape from the duct and contaminate the enclosure.

- In systems with gases detrimental to health, high pressure, high operating temperatures or risk of explosions, the sender/receiver unit fitted on the duct may only be installed or removed when the system is at a standstill.
- When removing the sender/receiver unit from the duct, the sample gas supply must be interrupted and the opening in the duct closed with a blind flange. The purge gas supply remains.
- Before opening the gas paths: Take suitable safety measures (e.g., stop sample gas feed, purge gas paths with inert gas, protective clothing).
- Skin or eye contact with contaminated parts:
  - Observe the instructions of the respective Safety Data Sheet.
  - Consult a doctor.
- Remove sample gas residues: Purge all parts carrying sample gas with inert gas for a sufficiently long time.
- Remove solid and liquid residues.

WARNING:

Health hazard due to hot sample gases and components

Risk of skin burns through contact with hot sample gases and hot components

- In systems with high temperatures, work on the duct or hot assemblies should only be carried out when the system is shut down.
- 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 lines. Allow to cool down at a protected place.

WARNING:

Hazard through escaping gas or bursting components due to overpressure in the system

High process pressure can damage components and lead to personal injury through bursting components or escaping health-endangering gas.

- Only use components designed for the process pressure in the application (see “Technical data”, page 124).
- Only carry out installation and maintenance of the device when the system is switched off.

NOTICE:

Danger to operational safety at high temperatures

The device can be damaged by high temperatures. The operator must take suitable measures to ensure the enclosure temperature does not exceed 70 °C.

- Avoid direct sunlight. If necessary, take measures to protect against the weather.
- If necessary, insulate the stack to prevent high temperatures.

NOTICE:

Danger to operational safety in the event of visible damage

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

- Check the components of the measuring system for external damage after each transport.
- If there is visible damage, do not put the measuring system into operation but send it in for repair (see “Return delivery”, page 123).

Hazards through electrical equipment

WARNING:
Danger through power voltage

There is a risk of electric shock when working on the system components.

- ▶ Ensure the power supply can be switched off at an easily accessible and marked power isolating switch and/or circuit breaker.
- ▶ When working on the device:
  - Only have the work carried out by skilled electricians familiar with potential risks.
  - Take suitable protective measures against local hazards and plant-specific hazards (e.g., free room for movement, cable ducts, automatic switch on).
  - Disconnect power supply connections or power lines before working on the device.
  - Only allow personnel carrying out the work to activate the power supply under consideration of valid safety regulations.
- ▶ Refit any contact protection removed before switching the power voltage back on again.
- ▶ When replacing a removable power line: Observe the specifications (see “Information on connection lines”, page 56).
- ▶ When device damage is visible: Switch the power supply off at the external point.
- ▶ Only use electrical fuses corresponding to the stated ratings (design, breaking current, trigger characteristic).

Hazards through laser beam

WARNING:
Hazard by laser radiation

Laser class 2 device, health hazard in case of irradiation of eye or skin.

- ▶ Never look directly into the beam path.
- ▶ Do not point the laser beam at persons.
- ▶ Avoid laser beam reflections.

Hazards through explosive or combustible gases and dust

WARNING:
Risk of explosion when using unsuitable tools within the Ex-area

Unsuitable tools can be an ignition source when used.

- ▶ Only use tools approved for the Ex-area.

WARNING:
Risk of explosion when working on device components within the Ex-area

Sparking and static discharge can be a source of ignition.

- ▶ The device components may only be unpacked, transported, installed, assembled and disassembled outside the Ex-area.
- ▶ Never take the packaging material into the Ex-area under any circumstances.

WARNING:
Risk of explosion from escaping gas

There is a risk of explosion due to escaping hot gases when the sender/receiver unit is pulled out of the duct or the maximum process pressure is exceeded.

- ▶ Only fit or remove device components when the system is shut down.
- ▶ Observe the maximum permissible process pressure (see “Technical data”, page 124), safe operation of the measuring system is not possible when this value is exceeded.

CAUTION:

Risk of explosion through incorrect or missing potential equalization.

Incorrect connection of the potential equalization can generate charges that can lead to explosions in an Ex atmosphere.

- Connect potential equalization to all planned points.
- Ensure the potential equalization is connected during all work on the device described in the Operating Instructions.

DANGER:

Risk of explosion when opening the MCUDH Ex-3K control unit

The MCUDH Ex-3K control unit must not be opened in Ex-atmosphere until 3 minutes after switching off the power supply, so that the residual energy in the capacitors can dissipate.

- Do not open the MCUDH Ex-3K control unit in an Ex atmosphere until after the waiting period.
- Take suitable precautions to prevent dust from entering the control unit enclosure when the enclosure door is open.

DANGER:

Risk of explosion when opening the sender/receiver unit enclosure

Opening the DUSTHUNTER SP100 Ex-3K sender/receiver unit housing cancels the explosion protection, the device can then be an ignition source.

- The DUSTHUNTER SP100 Ex-3K sender/receiver unit enclosure may only be opened by SICK Service.
- If the DUSTHUNTER SP100 Ex-3K sender/receiver unit enclosure has been opened, take the device out of operation immediately and contact SICK Service.

2.2 Warning information on the device

2.2.1 Information on the sender/receiver unit

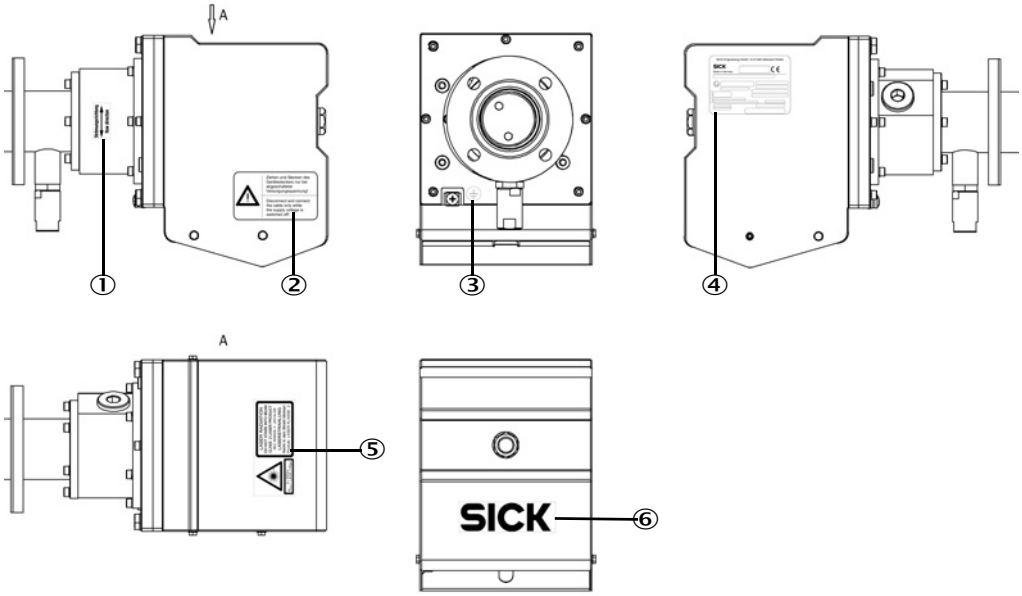


Fig. 1: Information on the sender/receiver unit DUSTHUNTER SP100 Ex-3K

Table 3: Significance of the information on the sender/receiver unit DUSTHUNTER SP100 Ex-3K

No.	Note
1	Information on aligning the device according to the flow direction in the duct (see “Adapting the sender/receiver unit to the duct geometry”, page 66).
2	Warning: Only pull and plug the connector plug when the supply voltage is switched off.
3	Information on the connection point of the potential equalization.
4	Type plate for clear identification of the device.
5	Warning: Laser class 2, do not look into the beam.
6	Manufacturer's identification

2.2.2 Information on the MCUDH Ex-3K control unit

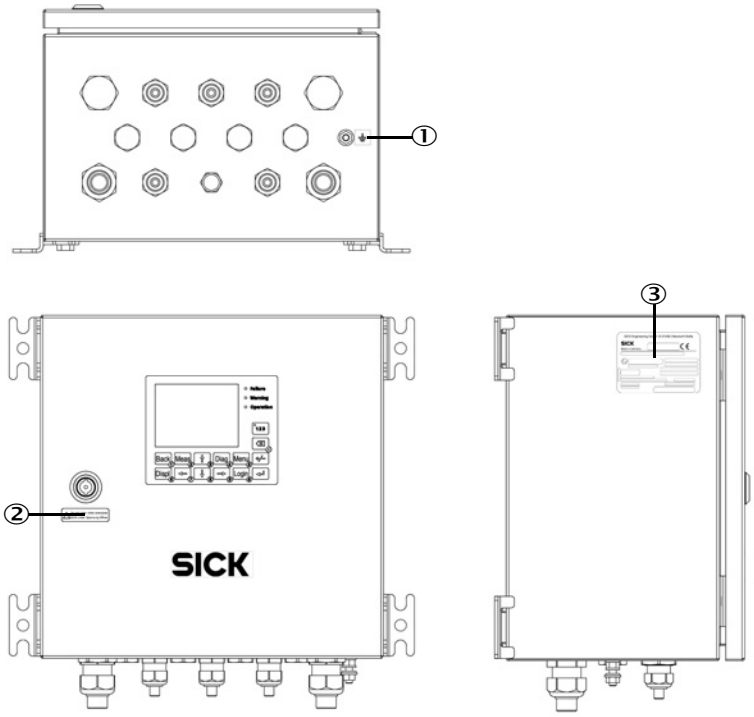


Fig. 2: Information on the MCUDH Ex-3K control unit - external

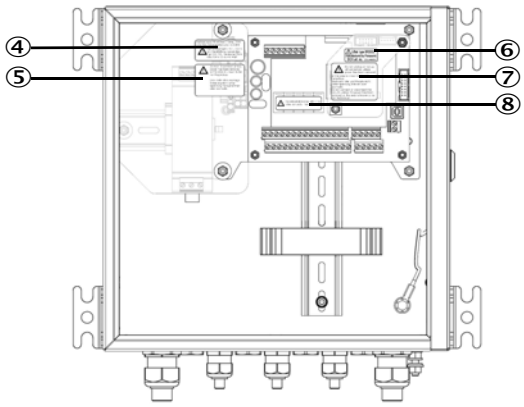


Fig. 3: Information on the MCUDH Ex-3K control unit - internal

Table 4: Significance of the information on the MCUDH Ex-3K control unit

No.	Note
1	Information on the connection point of the potential equalization.
2	Warning: Do not open the door of the MCUDH Ex-3K control unit until 3 minutes after switching off the power supply.
3	Type plate for clear identification of the device.
4	Information on the specifications of the fuses.
5	Warning: Do not remove or replace the fuse while the power is on.
6	Specifications regarding the button cell used.
7	Warning: Do not disconnect or change connectors and modules while they are live.
8	Information on the specifications of the relay contacts.

2.3 Intended use

Purpose of the system

The measuring system (see “Product description”, page 21) is designed as intended for use in industrial technical systems for continuous measurement of the dust load in gas flows. The device is used for both emission and process measurement and is intended for use in explosive gas or dust atmospheres.

Correct use

- The device should only be used as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- Observe all measures necessary for conservation of value, e.g., for maintenance and inspection and/or transport and storage.
- 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
  - any warranty by the manufacturer becomes void.

Sender/receiver unit restrictions of use

The sender/receiver unit complies with ATEX category 3G and 3D and is only to be used in a corresponding area (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36).

The device identification is as follows:

DHSP-TxxxxEX3K (2/22)

Ex II 3G Ex nR op is IIC T6 Gc

Ex II 3D Ex tc op is IIIC T85 °C Dc

Control unit restrictions of use

The control unit complies with ATEX category 3G and 3D and is only to be used in a corresponding area (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36).

The device identification of the version with power supply unit is as follows:

MCUDH-NSxx

Ex II 3G Ex ec nA nC IIC T4 Gc

Ex II 3D Ex tc IIIC T85 °C Dc

The device identification of the version without power supply unit is as follows:

MCUDH-N2xx

Ex II 3G Ex ec IIC T4 Gc

Ex II 3D Ex tc IIIC T85 °C Dc

NOTE:

Observe explosion protection regulations:

- Installation, commissioning, maintenance and testing may only be carried out by experienced personnel who have knowledge of the rules and regulations for hazardous areas, in particular
  - Ignition protection types and applicable standards
  - Installation regulations and zone classification

2.4 Responsibility of user

Avoiding damage

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

- The maintenance personnel responsible can reach the site immediately, and at any time.
- The maintenance personnel are adequately qualified to react correctly to malfunctions of the measuring system and any resulting operational interruptions (e.g., when used for measurement and control purposes).
- The malfunctioning equipment is switched off immediately in case of doubt and that switching off does not cause collateral malfunctions.

Procedure for unsafe operating conditions

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

- Put the device out of operation.
- Disconnect the device from the power voltage and signal voltage.
- Secure the device against unallowed or unintentional start-up.

For further information, see “Recognizing the safe operating state”, page 67.

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.

Purge gas

The purge gas supply serves to protect device-internal optical surfaces and internal parts against hot or aggressive gases. The supply must also be left switched on when the system is at a standstill. Optical subassemblies can be severely damaged in a short time or combustible gases can escape causing a risk of explosion when the purge gas supply fails (see “Non-return valve”, page 31). The user must ensure that:

- The purge gas supply runs reliably and continuously.
- A correct connection between the lines and connections is ensured and regularly checked.
- Suitable line material (preferably metal) is used and plug connections are avoided wherever possible.
- Failure of the purge gas supply is immediately detected (e.g., by using pressure monitors).
- The sender/receiver unit is removed from the duct and the duct opening is covered (e.g. with a blind flange in case of purging gas failure, taking into account explosion protection (see “Fastening technology”, page 135)).

Preventive measures for operating safety

The user must ensure:

- Neither failure of the measuring system 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.

Correct project planning

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

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.

Read the Operating Instructions

- ▶ Read and observe these Operating Instructions.
- ▶ Observe all safety information.
- ▶ If there is something you do not understand: Contact SICK Service.

Retention of documents

These Operating Instructions must be:

- ▶ Available for reference.
- ▶ Passed on to new owners.

3 Product description

3.1 Product identification

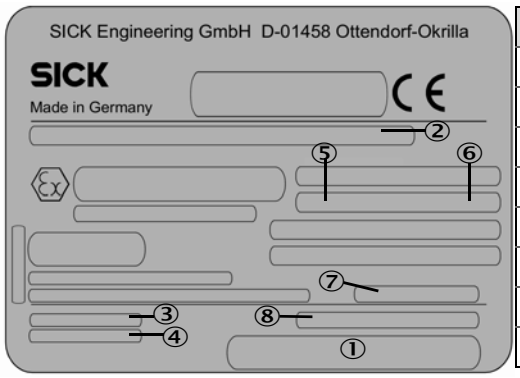
The measuring system comprises the components sender/receiver unit and control unit. The characteristics of the sender/receiver unit mainly determine the practical applicability of the measuring system, therefore the designation of the sender/receiver unit is the same as the designation of the measuring system.

Table 5: Product identification

Measuring system	**DUSTHUNTER SP100 Ex-3K**
Manufacturer	SICK Engineering GmbH Bergener Ring 27 · D-01458 Ottendorf-Okrilla · Germany
Components: Sender/receiver unit	**DUSTHUNTER SP100 Ex-3K**
Device version	Version for potentially explosive atmospheres zone 2/22
Type plate	Sender/receiver unit: On right side
Components: Control unit	**MCUDH Ex-3K**
Device version	Version for potentially explosive atmospheres zone 2/22
Type plate	Control unit: On left side
Components: Control unit	**MCU**
Device version	Conventional version
Type plate	Control unit: On left side

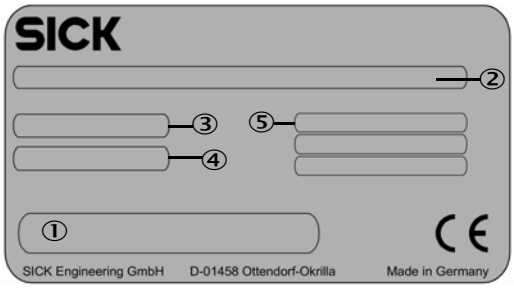
Type plates

The type plate serves correct device identification. If the device is suitable for use in the Ex-area, possible areas of application are also listed there based on the explosion protection types.



No.	Variable
1	Barcode
2	Type code
3	Part No.
4	Serial number
5	Minimum gas temperature
6	Maximum gas temperature
7	Nominal length
8	Year of manufacture

Fig. 4: Type plate, sender/receiver unit and MCUDH Ex control unit (example)



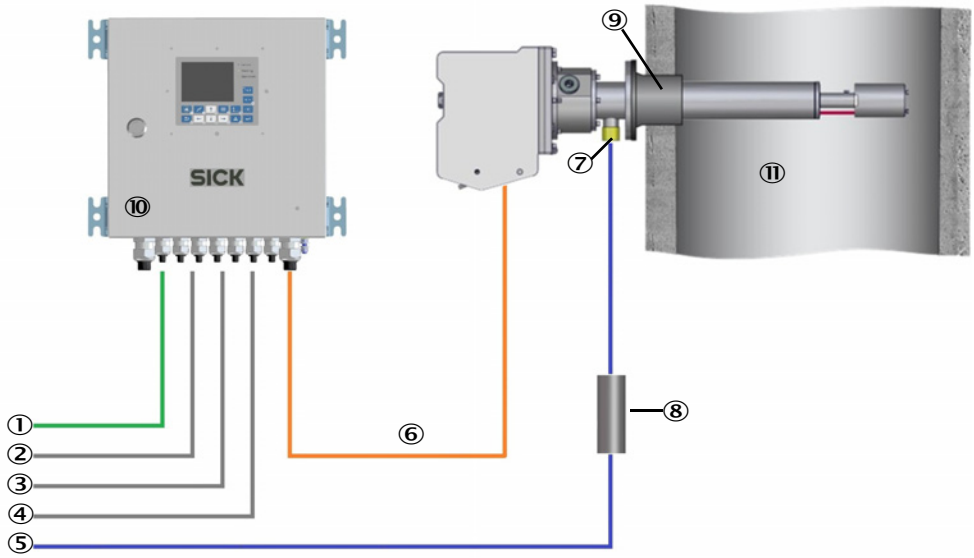
No.	Variable
1	Barcode
2	Type code
3	Part No.
4	Serial number
5	Technical data

Fig. 5: Type plate,MCU control unit (example)

3.2 Product characteristics

- The measuring system serves continuous measurement of dust particle concentrations in exhaust gas and exhaust air plants.
- The sender/receiver unit is an in-situ measuring device which means measuring is done directly in the gas carrying duct.
- The DUSTHUNTER SP100 Ex-3K sender/receiver unit is certified for use in potentially explosive atmospheres in zones 2 and 22.
- The MCUDH Ex-3K control unit is certified for use in zones 2 and 22.
- Measuring principle: Scattered light (forwards)

3.3 Layout and function



① Power supply (onsite)
② Signal line, RS485 Service interface
③ RS485 signal line from Interface module (optional)
④ I/O signal line
⑤ Instrument air (onsite)
⑥ Connection line
⑦ Non-return valve G¼ Inch
⑧ Pressure reducer / flowmeter (Onsite / recommended)
⑨ Flange with tube
⑩ Control unit (zone 2/22) (as example)
⑪ Duct

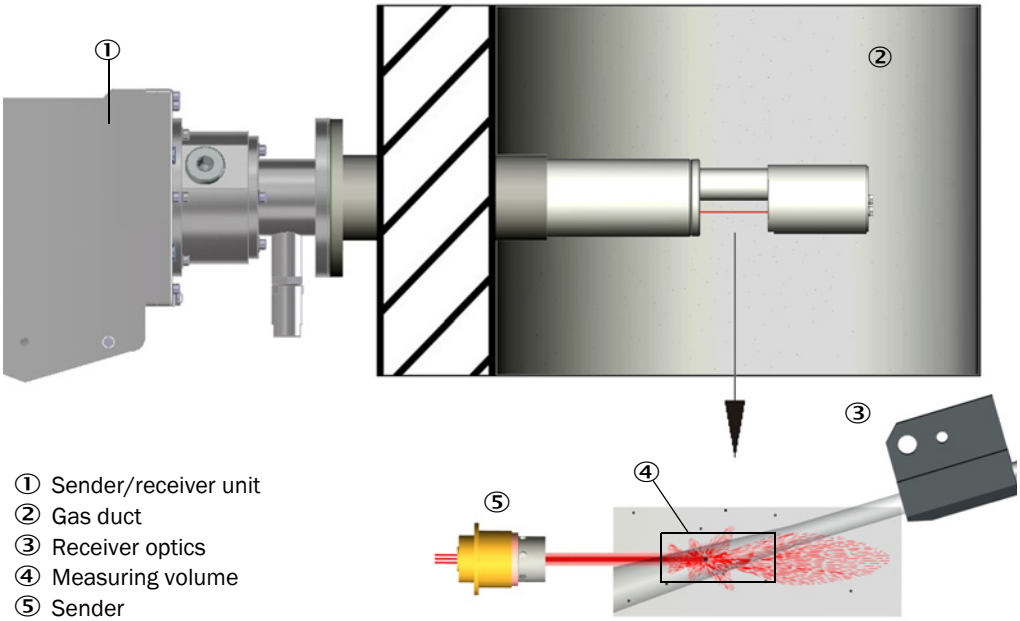
Fig. 6: DUSTHUNTER SP100 Ex-3K layout with explosion-proof MCUDH Ex-3K control unit

- The selection of individual components is the responsibility of the operator of the measuring system (for further information, see “Selecting the control unit”, page 41).

3.3.1 Functional principle

- The measuring system works according to the principle of scattered light measurement (forward scattering), the measuring volume in the gas duct is defined by the intersection of the sender beam and receive aperture.
- To maintain the measuring function, a permanent gas flow (purge gas) keeps the optics free from dust particles as well as condensate.

Determining the dust concentration



① Sender/receiver unit
② Gas duct
③ Receiver optics
④ Measuring volume
⑤ Sender

Fig. 7: Measuring principle

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

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

(Entry see “Calibration for dust concentration measurement”, page 82; standard factory setting: cc2 = 0, cc1 = 1, cc0 = 0).

3.3.2 Protection concept

Sender/receiver unit protection concept

The mechanical construction of the DUSTHUNTER SP100 Ex-3K is intended for use in explosive atmospheres of category 3G and 3D. The enclosure is dust-tight and the surface temperature limited. Thus the device corresponds to ignition protection type “t” (protection by enclosure). In addition, ignition protection type “nR” (steam safety) is used. This ignition protection type prevents explosive gases penetrating into the electronics enclosure. The device uses a laser to perform its measuring task. To avoid ignition of a potentially explosive gas mixture by optical radiation, the laser module meets the criteria of the type of protection inherently safe optical radiation “op is” according to EN60079-28.

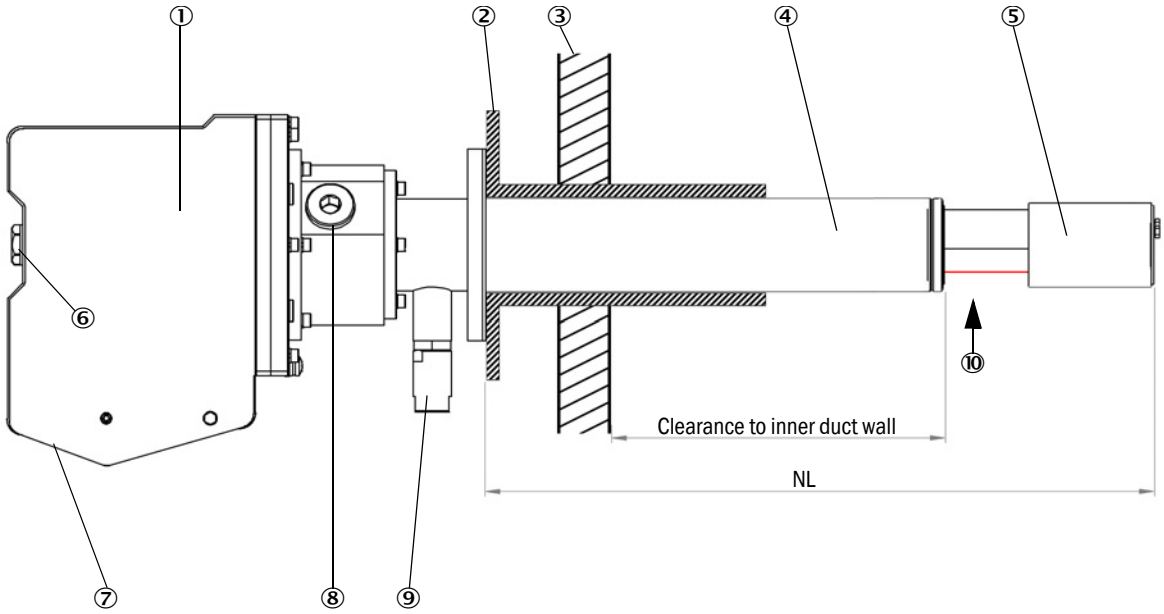
Control unit protection concept

The MCUDH Ex-3K control unit is intended for use in explosive atmospheres of category 3G and 3D. Ignition protection types “ec” (increased safety) and “t” (protection by enclosure) are used. In addition, ignition protection types “nA” and “nC” are used on the versions with integrated power supply unit.

3.3.3 DUSTHUNTER SP100 Ex-3K sender/receiver unit

The sender/receiver unit comprises two main subassemblies:

- Electronics unit
  The assembly contains the optical and electronic subassemblies for sending the laser beam and receiving the scattered light.
- Measuring probe
  The measuring probe is available in different versions and nominal lengths as well as for various gas temperature ranges and defines the device variant (see “Selecting the sender/receiver unit”, page 39).



① Electronic housing
② Flange with tube
③ Duct wall
④ Protective tube
⑤ Probe head with receiver optics
⑥ Sight glass
⑦ Control line connection
⑧ Cleaning opening for sender optics
⑨ Non-return valve G1/4“
⑩ Measuring volume

Fig. 8: DHSP-T2VxxEX-3K sender/receiver unit

NOTE:

Clearance to inner duct wall

The clearance between internal duct wall and sender/receiver unit measuring volume should be at least 100 mm. For the high-temperature version, the clearance should be between 100 mm and 140 mm so that the measuring device does not protrude too far into the duct and is not warmed up unnecessarily by the hot sample gas.

Sender/receiver unit type code

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

Sender/receiver unit type code (extract): DHSP-T 2 V 1 X EX3K T6

Maximum permissible gas temperature
- 2: 220 °C (standard version)
- 4: 400 °C (high-temperature version)

Probe material
- V: Stainless steel
- H: Hastelloy

Measuring probe nominal length (NL)
- 1: 435 mm
- 2: 735 mm

Flange version
- 1: Reference circle k100
- X: Special version

Ex certification
- EX3K: Ex-marking gas and dust zone 2/22

Maximum surface temperature
- T6: 85 °C

3.3.4 MCUDH Ex-3K control unit

The control unit serves as user interface for the DUSTHUNTER SP100 Ex-3K sender/ receiver unit, prepares and outputs the measured values and also performs control and monitoring functions.

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

- Sender/receiver unit power 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)

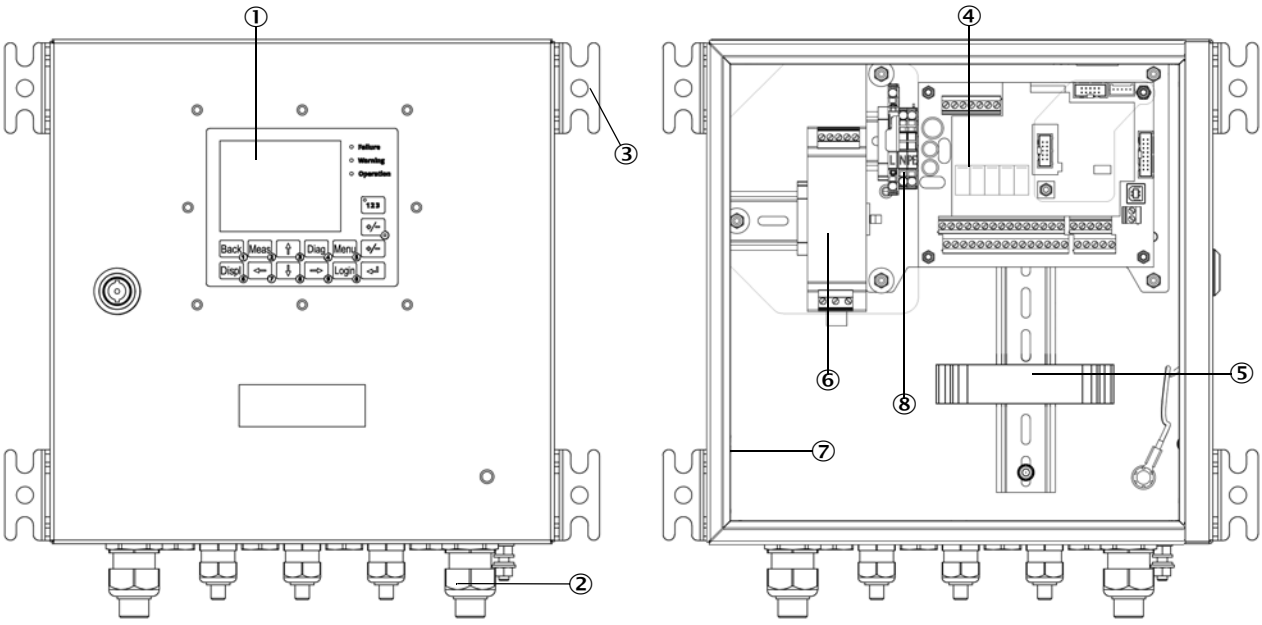
The device parameters can be set via the RS485 Service interface using a computer and an operating program. The parameters are stored reliably even in the case of a power failure.

WARNING:
Risk of explosion when the USB Service interface is used in an Ex-atmosphere.

Operation of the USB connector can cause an explosion.

- ▶ Using the USB Service interface in an Ex-atmosphere is prohibited.
- ▶ If necessary, set up an alternative RS485 Service interface that can be led into the safe area (see “Interfaces”, page 37).

Use the control unit according to the intended area of application (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36).



① Display module
② Line glands (2×M25; 5×M20)
③ Fastening brackets
④ Processor board
⑤ Interface module (option)
⑥ Power supply unit
⑦ Enclosure
⑧ Connection terminal (Input, voltage supply 90...250 V)

Fig. 9: MCUDH Ex-3K control unit

MCUDH Ex-3K type code

A type code identifies the special version of the control unit:

MCUDH Ex-3K (extract) control unit type code: MCUDH -N 2 Y D N 0 0 0 0 0 M N 0 E

Purge gas supply
- N: Not present

Voltage supply
- S: 90...250 V EX
- 2 24 V DC

Enclosure variants
- Y: Wall enclosure, middle, 300×300×220, stainless steel
- Z: Ex-d enclosure, aluminium, coated

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; 2 changeover contacts per module)
- 0 Not present

Interface module
- N: Not present
- M: RS485 Interface module for transmission from Modbus® ASCII/RTU o. CoLa-B

Special features
- N: None
- S: Special solution

EX certification
- O: ATEX zone 2/22:

Software
- E: Emission

3.3.5 Conventional MCU control unit

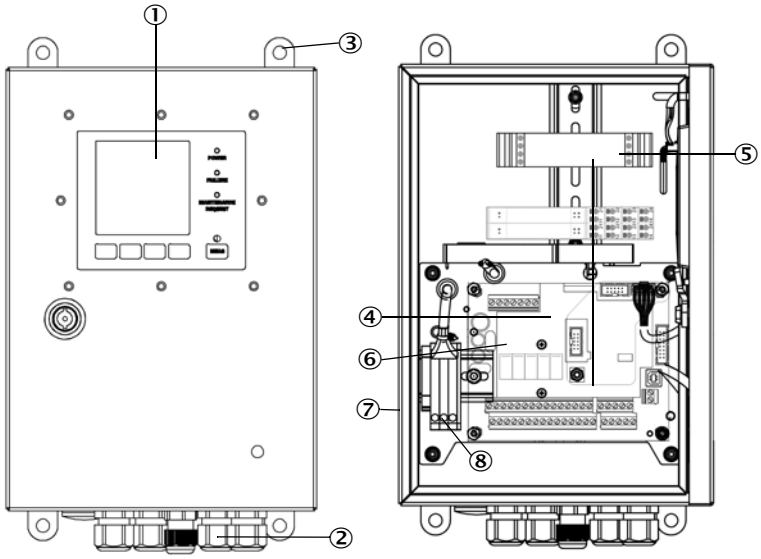
The control unit serves as user interface for the DUSTHUNTER SP100 Ex-3K sender/ receiver unit, prepares and outputs the measured values and also performs control and monitoring functions.

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

- Sender/receiver unit power 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)

Via the RS485 Service interface, the device parameters can be set using a computer and an operating program. The parameters are stored reliably even in the case of a power failure.

Use the control unit according to the intended area of application (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36).

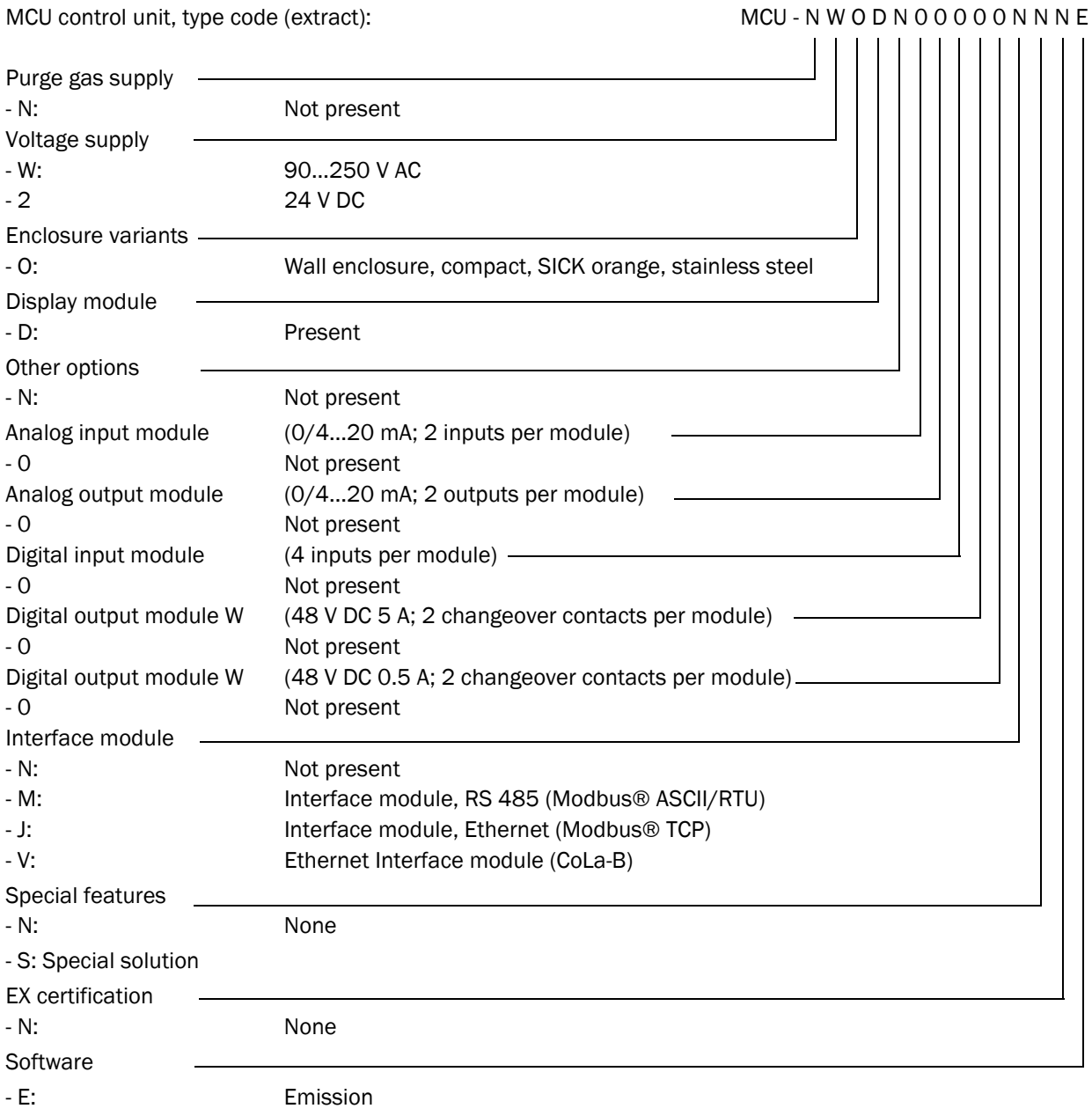


① Display module
② Line glands (1×M16; 4×M20)
③ Fastening brackets
④ Processor board
⑤ Interface module (option)
⑥ Power supply unit (under the processor board)
⑦ Enclosure
⑧ Connection terminal, voltage supply input

Fig. 10: MCU control unit

MCU type code

A type code identifies the special version of the control unit:



3.3.6 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.

3.3.7 Non-return valve

The non-return valve protects the sender/receiver unit against high temperatures and sample gas for a short time (up to 15 minutes) should the purge gas supply fail.

WARNING:
Risk of explosion through purge gas failure
Explosive gases may escape in case of purge gas failure.
- The sender/receiver unit must be disconnected immediately from the power supply when a purge gas failure occurs.
- To avoid damage to the device, the sender/receiver unit must be removed from the duct, but only if this does not create a risk of explosion or danger to employees.

NOTICE:
Device damage possible in case of purge gas failure
During longer operation (up to15 minutes) without purge gas supply, there is a risk that components relevant to ignition protection (seals and adhesives) may lose their sealing function or fatigue strength completely or partially. If the device is connected to the duct without purge gas supply for a longer period of time, the device must be sent to the factory immediately for testing.

Purge gas supply

The sender/receiver unit must be purged with onsite purge gas. Purging protects the opto-electronic components from contamination and excessive gas temperatures. Take into consideration that purge gas consumption is higher in the high-temperature version (see “Purge gas supply”, page 45).

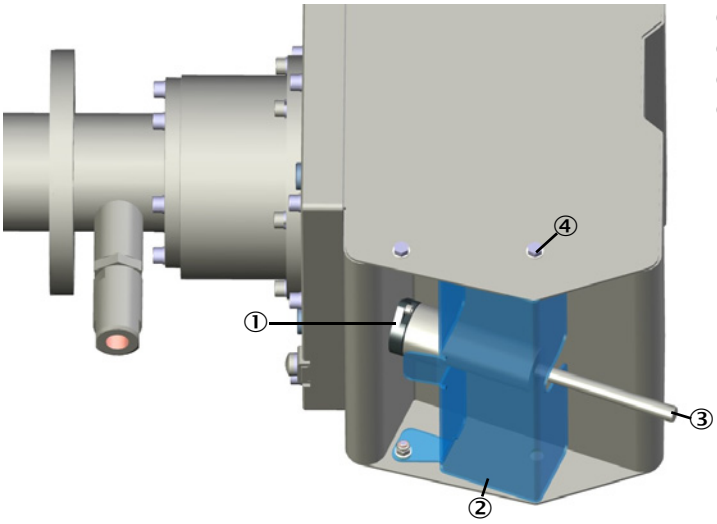
The manufacturer recommends the use of a float-type flowmeter and a pressure reducer (see “DHSP-T2VxxEX-3K sender/receiver unit”, page 25) to adjust and control the purge gas volume, because an undersupply or failure of the purge gas supply can lead to equipment damage. If necessary, an additional nozzle can be used to stabilize the purge gas volume.

Purge gas hose (antistatic)

The purge gas hose is used to supply purge gas to the sender/receiver unit. On the device side, the purge gas hose is connected to the G¼" non-return valve. The operator must ensure a suitable and uninterrupted purge gas supply (see “Purge gas supply”, page 45), including a suitable purge gas hose. Due to the danger of explosion in the event of electro-static discharge, it is imperative that a purge gas hose made of a material that prevents static charging is provided.

3.3.8 Connection line and plug protection guard.

The plug of the connection line between control unit and sender/receiver unit must be secured with a plug protection guard as mechanical protection against pulling off after connection to the DUSTHUNTER SP100 Ex-3K. Swivel the guard open before connecting, for this purpose loosen the safety screw. After connection, swivel the guard back and secure with the safety screw.



① Connection socket
② Plug protection guard
③ Connection line
④ Securing screw

Fig. 11: Connection, connection line with plug protection guard

3.3.9 Weather hood housing

When mounting the sender/receiver unit outdoors, a weather hood housing is strongly recommended as protection against sunlight and weather (see “Weather hood housing”, page 135). The weather hood housing available is suitable for use in the Ex-zone.

Fig. 12: Weather hood housing for the Ex-area

3.3.10 Function check

A function check can be triggered at fixed intervals to automatically check the function (check cycle) of the measuring system. The start time for the 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 errors. A function check triggered manually can help localize possible error causes should a device malfunction occur.

The function check comprises:

- Approx. 45 seconds measurement of zero point, control value and contamination of optical surfaces
  The measuring time depends on the increase in contamination value (change > 0.5% → measurement is repeated up to 2 times).
- Every 90 seconds (standard value) output of values determined (duration parameter can be modified, see “Setting the function check”, page 78).

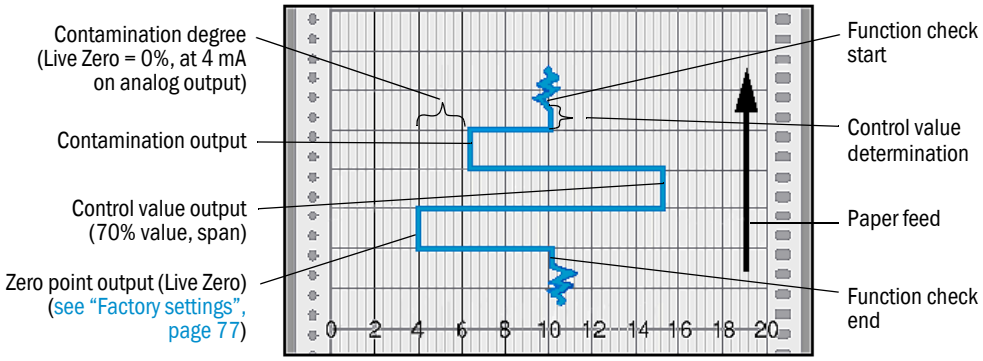


Fig. 13: Function check output on a plotter

- The analog output must be activated to output control values on the analog output (see “Setting the analog outputs parameters”, page 79).
- 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.
- “Function control” is displayed on the control unit display during the function check.
- A function check is not started automatically when the measuring system is in “Maintenance” mode.
- If the cycle interval is changed, a check cycle timed between parameter setting and new start timepoint is still carried out.
- Changes to the interval time are first effective after the next start timepoint.

Zero 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). An error message is generated when the “zero point” is outside the specified range.

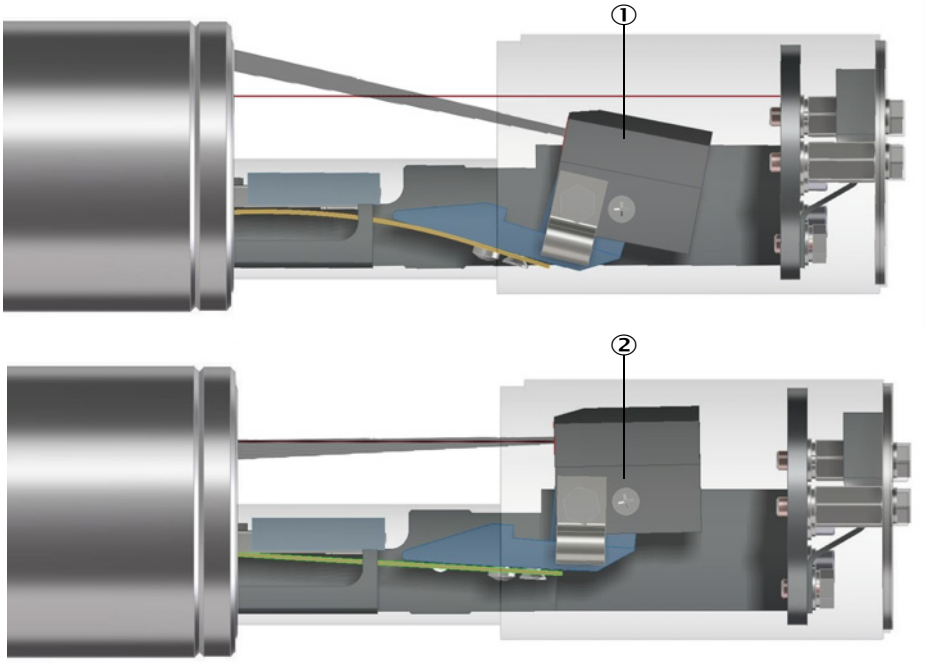
Control value measurement (span test)

Sender beam intensity changes between 70 and 100% during control value determination. The brightness of the light signal in the measuring circuit (“measuring signal”) is compared with the brightness in an independent internal reference channel (“monitor signal”). The measuring system generates an error signal for deviations greater than ±2%. The error message is cleared again when the next functional check runs successfully.

Contamination measurement

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

A value between Live Zero and 20 mA, proportional to the contamination, is output on the analog output for contamination values < 40% ; when this value is exceeded, “Malfunction” status is output and the set error current on the analog output (see “Setting the analog outputs parameters”, page 79).



① Receiver optics in measuring position
② Receiver optics in control position

Fig. 14: Contamination and control value measurement

3.4 Explosion protection in accordance with ATEX

3.4.1 Operation in the Ex-zone

DUSTHUNTER SP100 Ex-3K sender/receiver unit

The marking of the electrical explosion-proof device is:
ATEX II 3G Ex nR op is IIC T6 Gc / ATEX II 3D Ex tc op is IIIC T85 °C Dc

- The marking is on the type plate
- Type Examination Certificate: BVS 16 ATEX E 068 X
  Letter “X” after the certificate number indicates the following special condition for safe use of the device:
  The maximum surface temperature of the electronic housing is 70 °C. The external heat source (duct walls) must be insulated so that 70 °C is not exceeded.

MCUDH Ex-3K control unit

The marking of the electrical explosion-proof device depends on the device selection (see “Technical data”, page 124).

- The marking is on the type plate
- Type Examination Certificate: BVS 20 ATEX E 043 X
  Letter “X” after the certificate number indicates the following special condition for safe use of the device:
- Device is designed for degree of contamination 2.
- It must be ensured that the transient protection is set to a value not exceeding 140% of the measured peak voltage on the supply terminals of the device.

NOTE:

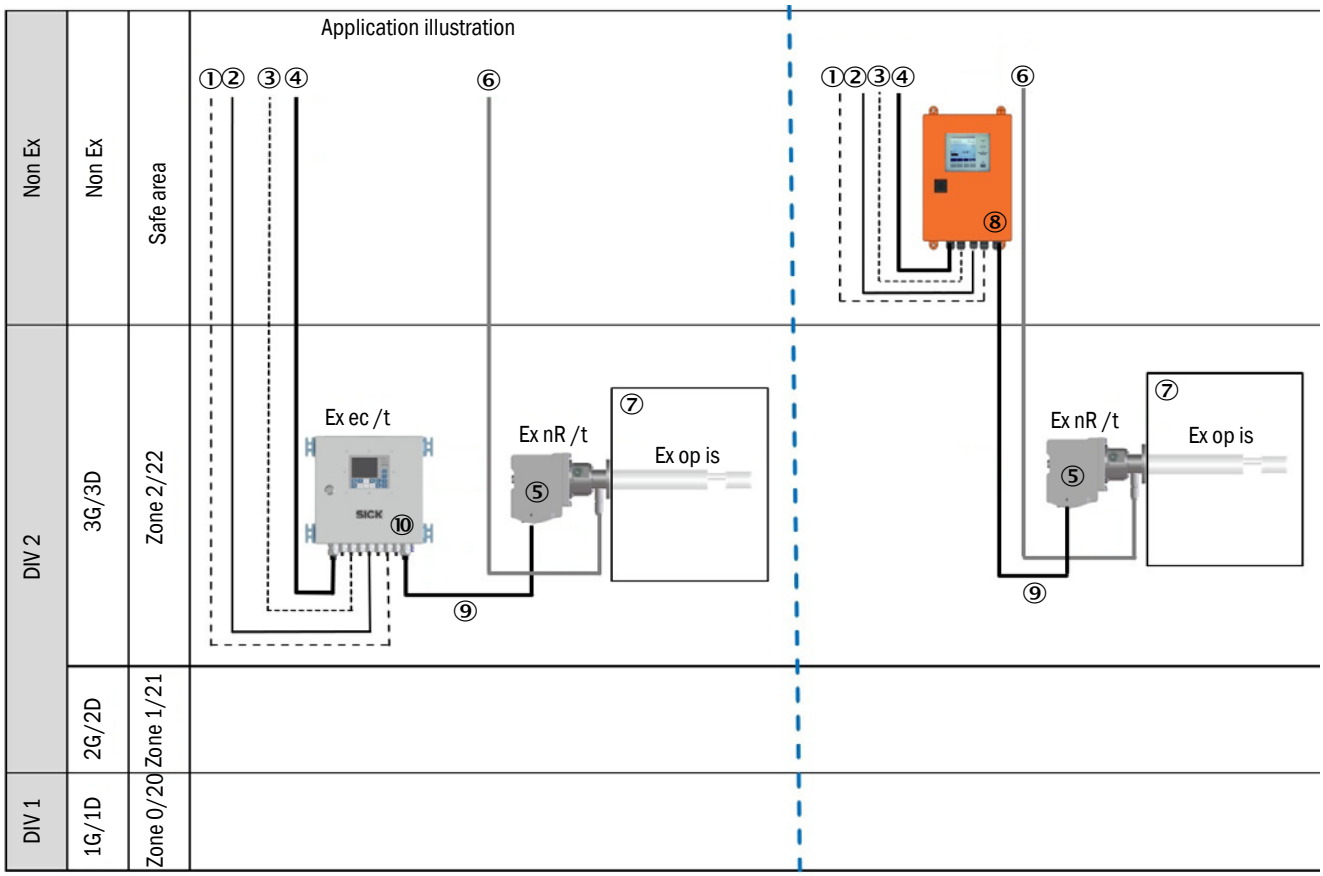
Hazard during operation in the Ex-zone

Risk of explosion when regulations on explosion protection are not observed during operation.

- ▶ Only use the measuring system in the Ex-zone according to the device marking (see “Intended use”, page 18).
- ▶ Only use the measuring system within the temperature limits as specified in these Operating Instructions as well as on the type plate.
  The specified values must not be exceeded even for brief periods.
- ▶ The use of the measuring system with hybrid mixtures (mixture of combustible gases or vapors with dust) must be evaluated according to the situation being considered, e.g. regarding concentration limits or energy and temperature limits.
- ▶ Do not install any components, apart from the electronics unit of the sender/receiver unit, in lines, tanks, or other installation areas where explosive gas and/or dust mixtures may be present.
- ▶ The measuring system must not be operated with dust deposits thicker than 5 mm on the electronics housing.
- ▶ Dust deposits must be removed regularly and properly.

3.5 Application illustration DUSTHUNTER SP100 Ex-3K

The Figure shows, on the left side, the possible constellation for use of the DUSTHUNTER SP100 Ex-3K with the MCUDH Ex-3K control unit, and on the right side, the possible constellation of the DUSTHUNTER SP100 Ex-3K with the conventional MCU control unit, that can only be used in safe areas without explosion hazards.



① RS485 Service interface
② Line for measured value transmission
③ Data interface
(when using optional Interface module)
④ Voltage supply
⑤ DUSTHUNTER SP100 Ex-3K
(sender/receiver unit for zone 2/22)
⑥ Purge gas hose (antistatic)
⑦ Measuring channel
⑧ Conventional MCU control unit
⑨ Connection line from control unit
to sender/receiver unit
⑩ MCUDH Ex-3K (control unit for zone 2/22)

Fig. 15: Usage illustration with application variants DUSTHUNTER SP100 Ex-3K

3.6 Interfaces

Communication between sender/receiver unit and control unit

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

Data transfer to the MCUDH Ex-3K control unit and the power supply (24 V DC) from the MCUDH Ex-3K control unit run via a 4-lead shielded line with plug-in connector.

The MCUDH Ex-3K USB interface may only be used in the Ex-free zone, because opening the control unit while it is live is not permitted in the Ex-area. Alternatively, an RS485 Service interface is connected to terminals 43 and 44 (see “Connection plan”, page 55). A line up to 1000 m long can be routed from the above-mentioned connection terminals into the safe area. Please note that the Service and USB interfaces cannot be operated simultaneously.

3.6.1 Standard interfaces of the MCUDH Ex-3K control unit

Table 6: Standard interfaces of the MCUDH Ex-3K control unit

Analog output	1 output 0/2/4...22 mA (electrically isolated; active; resolution 10 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 10 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 (use only outside the Ex-area). RS485 Service interface (on connection terminals) for measured value inquiry, configuration and software update. Internal RS485 interface for communication between sender/receiver unit and control unit.

Optional interfaces for the MCUDH Ex-3K control unit

Additional options can be integrated to extend the functional scope of the MCUDH Ex-3K control unit (see “Options for MCUDH Ex-3K control unit”, page 136).

- Interface module

The Interface module for the transmission of Modbus ASCII/RTU or CoLa-B (protocol SOPAS ET) serves to forward measured values, system status and service information to higher-level control systems. A ribbon cable serves to connect the module to the processor board. An RS485 signal line up to 1000 m long can be connected to the module, which can then be led out of the Ex-zone. The RS485 signal line can then be converted to Ethernet in the safe area using the following Interface modules: Ethernet Service Type or Modbus® TCP (remote modules with separate 24 V supply).

- Remote-Display 100
  The Remote-Display 100 in connection with the MCUDH Ex-3K control unit offers identical functions for operation in the safe area.
  - Operating functions as on MCUDH Ex-3K display.
  - Installation in the safe area.
  - Clearance to the device: Observe the minimum cable cross section (max. current: 0.15 A, min. voltage: 20 V on the display).

The MCUDH Ex-3K and the Remote-Display 100 are locked against each other, both devices cannot be operated at the same time.

3.6.2 Standard interfaces of the MCU control unit

Table 7: Standard interfaces of the MCU control unit

Analog output	1 output 0/2/4...22 mA (electrically isolated; active; resolution 10 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 10 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 Service interface (on connection terminals) for measured value inquiry, configuration and software update. Internal RS485 interface for communication between sender/receiver unit and control unit.

Optional interfaces of the conventional MCU control unit

Additional options can be integrated to extend the functional scope of the MCU control unit (see “Options for MCU control unit”, page 136).

- Various Interface modules
- Analog and digital input/output modules

3.6.3 SOPAS ET user interface

SOPAS ET is a SICK software for easy operation and configuration of DUSTHUNTER measuring devices. Further functions are also available (e.g., data storage, graphic displays).

SOPAS ET runs on a computer connected via an interface to the control unit of the DUSTHUNTER measuring system (see “SOPAS ET”, page 68).

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

4 Project planning

4.1 Device configuration

The device components required for a measuring system depend on the respective application conditions. The following Section can help you with your selection.

4.1.1 Selecting the sender/receiver unit

Selection of the suitable sender/receiver unit depends on the wall and insulation thickness of the duct and the composition and temperature of the sample gas.

Table 8: Sender/receiver unit selection Table

Wall and insulation thickness [mm]	Nominal length NL [mm]	Protective tube length [mm]	Sample gas		Sender/receiver unit type
			Max. temperature in °C	Corrosiveness	
Max. 100	435	300	220	Non-corrosive/ low corrosion	DHSP-T2V11EX3K
				Corrosive	DHSP-T2H11EX3K
			400	Non-corrosive/ low corrosion	DHSP-T4V11EX3K
Max. 400	735	600	220	Non-corrosive/ low corrosion	DHSP-T2V21EX3K
			400	Non-corrosive/ low corrosion	DHSP-T4V21EX3K
Further variants available on request					

- Select the nominal length of the sender/receiver unit so that the measuring volume has an adequate clearance to the internal duct wall.
  - Standard version clearance: At least 100 mm.
  - High-temperature version clearance: Between 100 mm and 140 mm so that the measuring probe does not protrude too far into the duct and is not warmed up unnecessarily by the hot sample gas.
- The selected nominal length of the sender/receiver unit should only be as long as necessary, the measuring volume (see “DHSP-T2VxxEX-3K sender/receiver unit”, page 25) need not be in the middle of the duct.
- Observe the maximum process pressure (see “Technical data”, page 124). Safe operation of the measuring system is not possible when this exceeds the maximum pressure specified for the sender/receiver unit.
- Limit values for corrosive gas composition (standard values assuming normal pressure and temperature conditions. Use lower values for mixtures of several components):
  - HCl: 10 mg/m³
  - SO_2: 800 mg/m³
  - SO_3: 300 mg/m³
  - NOx: 1000 mg/m³
  - HF: 10 mg/m³

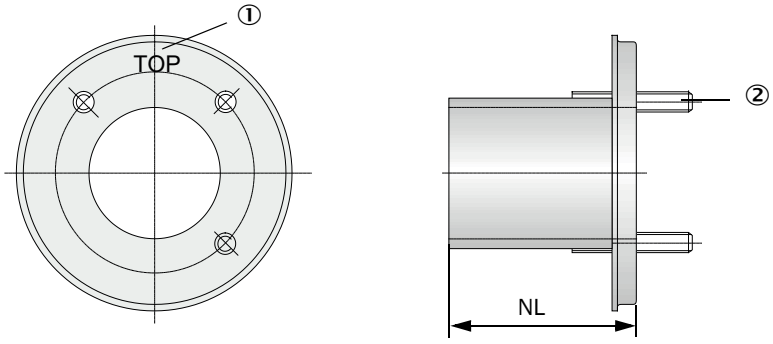
4.1.2 Selecting the flange with tube

The selection of a suitable flange with tube depends on the wall and insulation thickness of the duct wall, the nominal length of the selected sender/receiver unit and the sample gas temperature. Standard flanges with tube are available which are delivered with a 3.1 Material Certificate (see “Flange with tube”, page 129). The material pairing of the duct and the tube should also be taken into account when a welded connection between the flange with tube and duct is planned.

Table 9: Flange with tube, nominal length overview

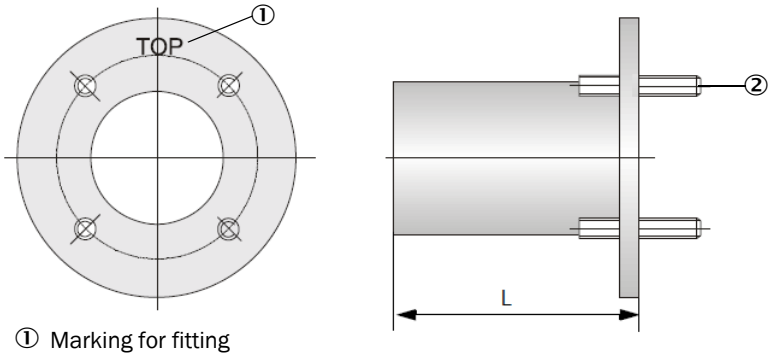
Gas temperature	Nominal length of sender/receiver unit		
	435 mm	735 mm	
< 150 °C	130, 240	130, 240, 500	Nominal length of flange with tube (mm)
> 150 °C	240	500	

Standard version



① Marking for fitting
② Fixing bolts

Fig. 16: Standard flange with tube



① Marking for fitting
② Fixing bolts

Fig. 17: Flange with tube (4 bolts)

4.1.3 Selecting the control unit

When selecting the control unit, it must always be clarified whether an explosion-proof version is necessary or whether the control unit can also be installed in the safe area (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36). Please note that additional precautions for explosion protection must be observed when connecting the control unit in the Ex-area.

Selecting the MCUDH Ex-3K control unit

Selection of the MCUDH Ex-3K control unit depends on the required power supply unit and the optional Interface module (see “Interfaces”, page 37). The control units are suitable for operation in Ex-zones 2/22.

Table 10: Selection Table for MCUDH Ex-3K control unit

Power supply unit	Interface module	Type designation
Without (24 V DC)	No Interface module	MCUDH-N2YDN00000NNOE
Wide range 95...250 V EX		MCUDH-NSYDN00000NNOE
Without (24 V DC)	RS485 / Modbus® ASCII/RTU	MCUDH-N2YDN00000MNOE
Wide range 95...250 V EX		MCUDH-NSYDN00000MNOE

Selecting a conventional MCU control unit

Selection depends on the type of power supply and the optional Interface modules (see “Interfaces”, page 37). The conventional control units are not suitable for operation in Ex-areas.

Table 11: MCU control unit selection Table

Power supply unit	Interface module	Type designation
Without (24 V DC)	No Interface module	MCU-N2ONN00000NNNE (o. LCD) MCU-N2ODN01000NNNE (+2 AO)
Wide range 95...250 V AC		MCU-NWODN00000NNNE MCU-NWODN01000NNNE (+2 AO)
	Ethernet / COLA-B	MCU-NWODN00000BNNE MCU-NWODN01000ENNE (+2 AO)
	RS485 / Modbus® ASCII/RTU	MCU-NWODN00000MNNE
	Ethernet Modbus® TCP	MCU-NWODN01000JNNE (+2 AO)
	CAN bus / RS485	MCU-NWODN01000CNNC (+2 AO)
	RS485 / Modbus® ASCII/RTU Ethernet COLA-B Service	MCU-NWODN01000DSNE (+2 AO)
	PROFIBUS / RS485 Ethernet COLA-B Service	MCU-NWODN01000DSNE (+2 AO)
Further MCU control unit variants available on request		

4.2 Installation location

4.2.1 Project planning for measuring channel

Electrical connection

Ensure the device can be switched off with a power isolating switch or circuit breaker in accordance with EN 61010-1. The potential equalization line of the sender/receiver unit at the measuring point must be flexible enough to allow the line 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, it is important to ensure an uninterrupted supply of purge gas and to maintain sufficient space for installing and subsequent fitting and removing the sender/receiver unit.

Required thermal insulation

The thermal insulation is an explosion protection measure to be subjected to special examination when gas temperatures in the duct are higher than the surface temperature allowed by the selected temperature class. Observe the following during this examination:

- Apart from the duct surface, other parts (e.g. flange tube and flange) that can be subjected to prohibited high temperatures through thermal conduction are to be included in the insulation or the thermal conduction prevented
- The operator must ensure that suitable insulation reduces the heat radiation sufficiently so that the enclosure temperature remains below 70 °C and therefore below the temperature for the temperature protection class. The operator must take into consideration that the device-internal warming can be up to 2K. 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 project planning and operation (see “Technical data”, page 124).

Miscellaneous.

- The operator must ensure that the dust measuring device is permanently supplied with purge gas.
- The operator is responsible for the tightness of the purge gas line between the device, connecting pieces and flange and for monitoring the tightness.
- Ensure sufficient ventilation at the installation site.
- The operator must ensure that no hot process gas can escape from the duct when removing the sender/receiver unit from the duct or that there is no potentially explosive atmosphere.

4.2.2 Space requirements for system components

Sender/receiver unit space requirements

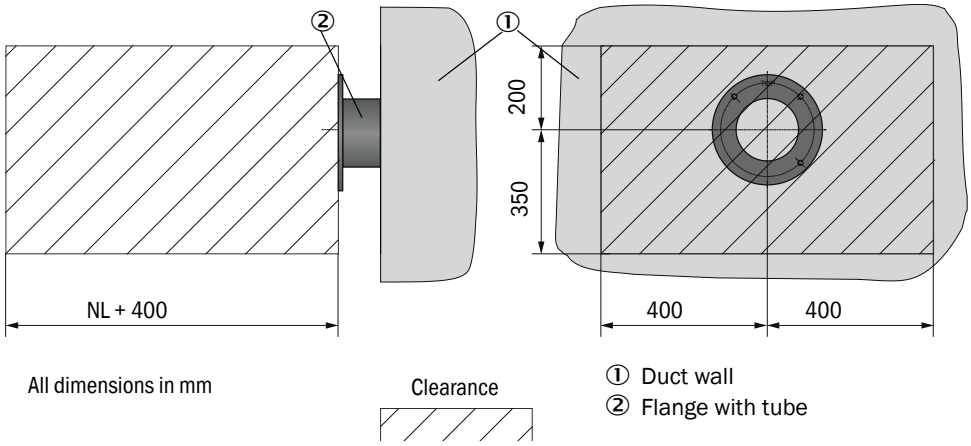


Fig. 18: Sender/receiver unit clearance

When determining the installation location of the sender/receiver unit, make sure the device is aligned with the flow direction in the duct (see “Adapting the sender/receiver unit to the duct geometry”, page 66).

MCUDH Ex-3K control unit space requirements

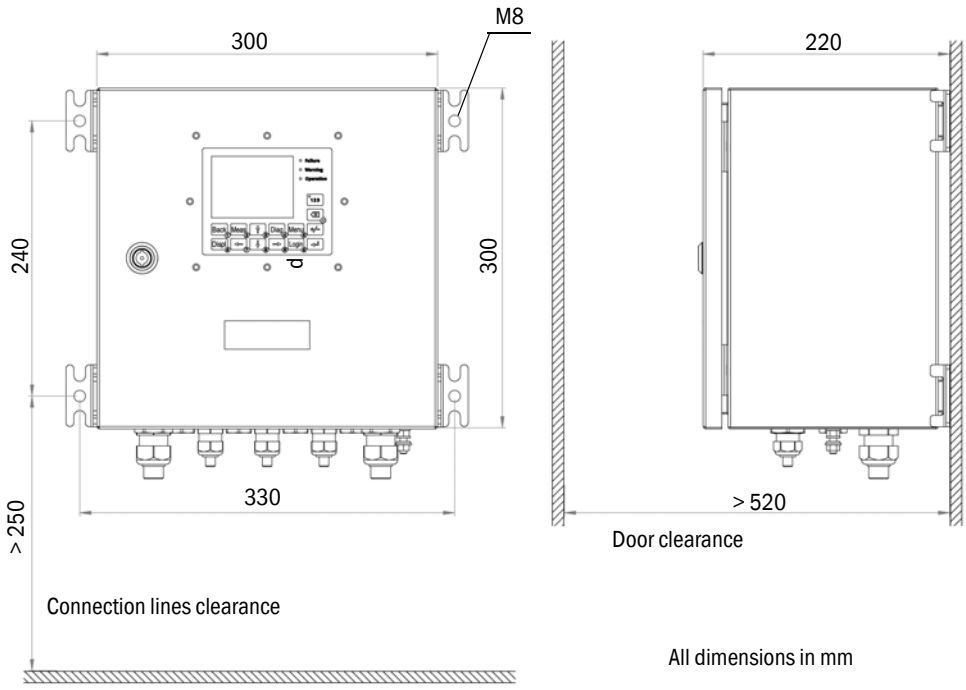


Fig. 19: MCUDH Ex-3K control unit clearance

MCU control unit space requirements

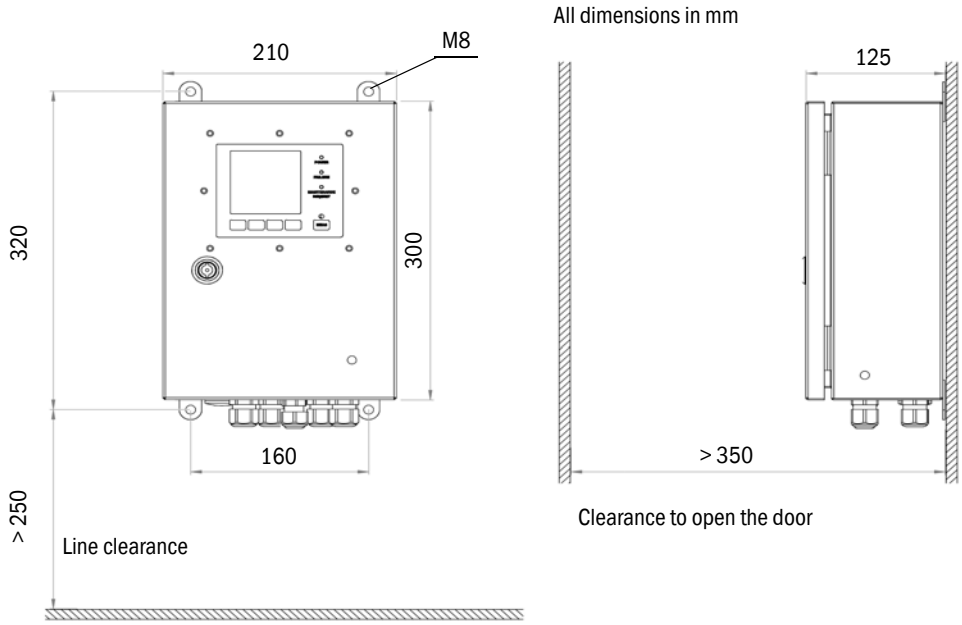


Fig. 20: MCU control unit clearance

4.2.3 Purge gas supply

The sender/receiver unit must be permanently supplied with purge gas during operation in order to keep the optical surfaces clean and to cool the measuring probe (especially at high gas temperatures). The customer must provide the purge gas as compressed air (e.g. air, nitrogen) with a pressure of 2...6 bar_{abs}. The purge gas line is connected to the non-return valve (internal thread G¼"). The purge gas line must be made of antistatic material to avoid electrical discharge.

Purge gas requirement

For DUSTHUNTER SP100 Ex-3K Standard version: 3...5 m³/h

For DUSTHUNTER SP100 Ex-3K High temperature version: 18...20 m³/h

In order to adjust the purge gas volume, it is recommended to install a flow meter ② upstream of the non-return valve ①. A filter regulator ③ (pressure regulator with filter element and possibly pressure gauge) must be provided upstream of this to be able to adjust the purge air volumes.

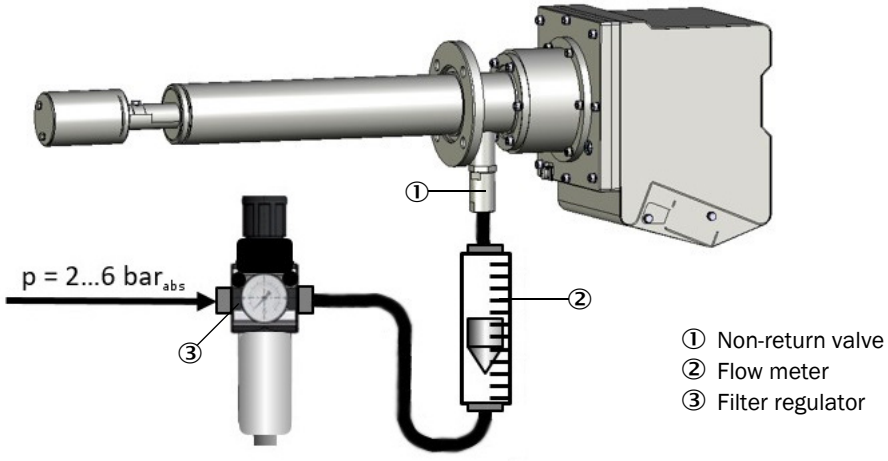


Fig. 21: Purge gas supply DUSTHUNTER SP100 Ex-3K

The following Table shows the compressed air requirement at different pressures of the supplied compressed air. The values are calculated for a compressed air temperature of 20 °C and a duct overpressure of 30 mbar.

Table 12: Compressed air requirement

Compressed air requirement in m³/h for purge air volume	Pressure of the supplied compressed air in bar_{abs}				
	2.0	3.0	4.0	5.0	6.0
3 m³/h purge air	1.6	1.1	0.8	0.6	0.5
5 m³/h purge air	2.7	1.8	1.3	1.1	0.9
18 m³/h purge air	9.6	6.4	4.8	3.8	3.2
20 m³/h purge air	10.7	7.1	5.3	4.3	3.6

Purge gas quality

In addition to cooling the measuring probe, the supplied purging gas is mainly used to keep the optical surfaces clean. The purge gas should be dry and free of dust and oil. The cleaner the purge gas, the less the optical surfaces become dirty. The maintenance cycle can thus be considerably extended.

4.2.4 Project checklist

The following Table provides an overview of 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 13: Project checklist

Task	Requirements	Work step	☑
Determine measuring and installation locations for device components	Inlet and outlet piping in accordance with DIN EN 13284-1 – Inlet at least 5 × d_h (hydraulic diameter) – Outlet at least 3 x d_h – Clearance from stack opening at least 5 × d_h For round and square ducts: d_h = duct diameter For rectangular ducts: d_h = 4 × A (surface) ÷ U (circumference)	Follow specifications for new systems Select best possible location for existing systems. For too short inlet/outlet paths: Inlet path > outlet path	☐
	Laminar flow, 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 in accordance with DIN EN 13284 and select best possible location.	☐
	Sender/receiver unit fitting location and alignment – No vertical mounting on horizontal or inclined ducts, max. angle of the measuring axis to the horizontal 45° – Observe alignment to flow direction (see “Adapting the sender/receiver unit to the duct geometry”, page 66)	Select best possible location Provide information on duct direction.	☐
	Accessibility, accident prevention – Device components must be safely accessible	Provide platforms or pedestals as required.	☐
	Installation free of vibrations – Acceleration < 1 g	Take suitable measures to eliminate/reduce vibrations.	☐
	Ambient conditions – Limit values according to Technical Data (see “Technical data”, page 124)	If necessary, provide weather protection (see “Weather hood housing”, page 32), enclose or lag components.	☐
	Consider lines and hoses at the installation site (see “Fastening technology”, page 135)	Observe line and hose lengths. Select the best possible location, potential equalization line must allow removing the sender/receiver from the duct when connected.	☐
	Observe the application illustration (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36) with regard to the installation locations.		
Purge gas Determine type and quantity	Suitable purge gas in compliance with application-specific requirements for explosion protection. – Dry, dust-free and oil-free, non-corrosive	Provide purge gas supply. Work steps, see “Purge gas supply”, page 45.	☐
Select device components: Measuring device	Nominal length of sender/receiver unit and flange with pipe according to duct diameter, duct wall thickness with insulation	Select components according to configuration (see *“Selecting the sender/receiver unit”, page 39*); If necessary, plan additional measures for mounting flange with tube (see *“Fitting the flange with tube”, page 50*).	☐
	Sender/receiver unit type (up to 220 °C or up to 400 °C) depending on gas temperature in duct		
	Measuring probe material depending on gas composition in the duct – For corrosive gases, measuring probe made of Hastelloy		
Select control unit	Power supply and communication options based on the intended system integration	Select components according to the Configuration Table (see *“Selecting the control unit”, page 41*).	☐
Plan calibration openings	Easy and safe access, no mutual interference of calibration probe and measuring system	Provide platforms or pedestals as required. Plan sufficient clearance between measuring and calibration level (approx. 500 mm)	☐
Plan the voltage supply	Supply voltage and power requirements according to Technical Data (see “Technical data”, page 124)	Plan adequate line cross-sections and fuses	☐

5 Transport and storage

NOTICE:

Sensitive components

The DUSTHUNTER SP100 Ex-3K probe head contains sensitive components and must therefore be handled carefully:

- Protect the probe head from shocks.
- Do not load the probe head.
- Take safety precautions when transporting the device.
- Check the components for visible damage after each transport.

5.1 Transport

Observe the following during device transport:

- Protect the device openings of the sender/receiver unit from weather influences and dust.
- Pack all components for transport in such a way that shocks cannot damage the components.
- Close off open electrical connections dust-tight.
- The ambient conditions specified in the Technical Data must also be observed when transporting the measuring system (see “Technical data”, page 124).

5.2 Storage

Observe the following during device storage:

- Process media residues can be hazardous to health.
- Close off open electrical connections dust-tight.
- Protect the device openings of the sender/receiver unit from weather influences and dust.
- Pack all components for storage.
- Store all components of the measuring device in a ventilated, dry, clean area.
- The ambient conditions specified in the Technical Data must also be observed when storing the measuring system (see “Technical data”, page 124).

6 Assembly

Carry out all assembly work onsite. This includes:

- ▶ Fitting the flange with tube,
- ▶ Fitting the control unit.

6.1 Assembly information

6.1.1 Proper assembly

CAUTION:
Danger during assembly work
Improper installation can lead to injuries.
- ▶ Observe the relevant safety regulations as well as safety notices during all assembly work.
- ▶ Only carry out assembly work on systems with hazard potential (hot or aggressive gases, higher internal duct pressure) when the system is at a standstill.
- ▶ Take suitable protection 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 site 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 assembly, 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 local authorities

Responsibility of the operator

- Determining the measuring point
- Carrying out any necessary structural changes
- Determining the suitable purge gas
- Ensuring uninterrupted purge gas supply

6.3 Scope of delivery

Check the scope of delivery according to the order confirmation.

6.4 Installation sequence

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

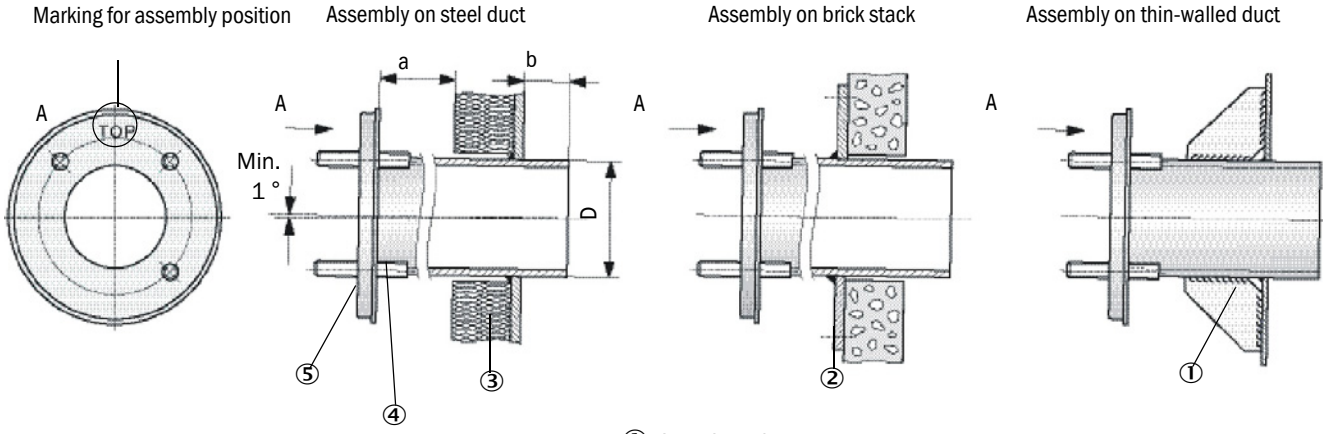
NOTICE:

Device damage due to premature installation of the measuring device on the gas duct

Unsuitable ambient conditions or the atmosphere in the measuring duct can damage the measuring system and make intended use impossible.

- The sender/receiver unit is first positioned in the duct during commissioning (see “Fitting and connecting the sender/receiver unit”, page 66).

6.4.1 Fitting the flange with tube



Nominal length of sender/receiver unit	D
435 mm, 735 mm	Ø 76

Fig. 22: Fitting the flange with tube (shown for standard version)

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

NOTE:

The tube length must suit the planned sender/receiver unit depending on the relation between gas temperature and nominal length (see “Flange with tube”, page 31).

▶ Do not shorten tubes.

Work to be performed

1 Measure the fitting location and mark the assembly location, ensure sufficient clearance to fit and remove the sender/receiver unit (see “Sender/receiver unit space requirements”, page 43).
2 Remove thermal insulation (when fitted).
3 Cut suitable openings in the duct wall; bore large enough holes in brick or concrete stacks (flange tube diameter).

NOTE:

▶ Do not let separated pieces fall into the duct.

4 Insert the flange with tube in the opening slanting slightly downwards (1 to 3°) so that the “Top” marking points upwards and any condensate that may collect in the duct can drain off.
5 Weld the flange with tube on using an anchor plate for brick or concrete stacks, insert junction plates for thin-walled ducts.
6 Close off the flange opening with a blind flange after fitting (see “Fastening technology”, page 135) to prevent gas escaping.

6.4.1.1 *High-temperature version*

High-temperature version
- Fitting on a steel duct, brick stack and on a thin-walled duct is the same as for the standard version.

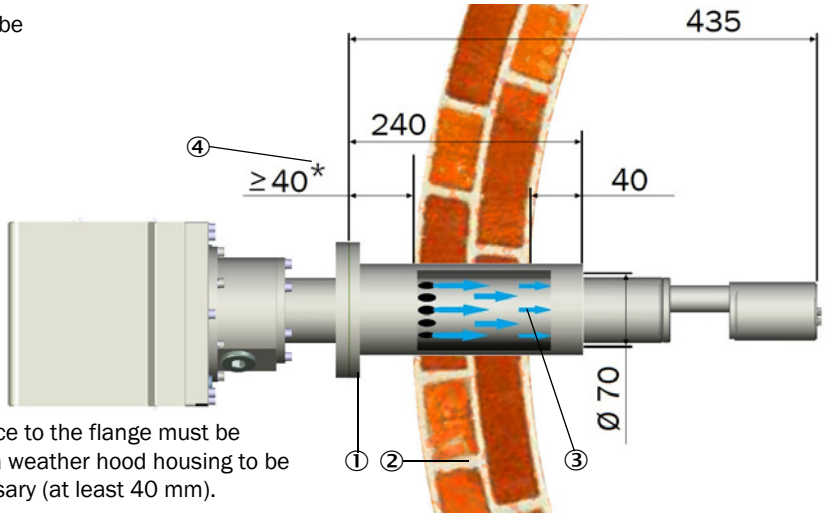
NOTICE:

High-temperature version

Temperature damage can occur on the sender/receiver unit when fitted without a flange with tube.
- ▶ The flange inner diameter must be 70 mm otherwise correct purging is not possible.
- ▶ Only fit the measuring probe in the duct as far as necessary (see above measure 40 mm) to avoid temperature damage.

Fitting the measuring probe NL 435 mm

① Flange with tube
② Duct
③ Purge gas

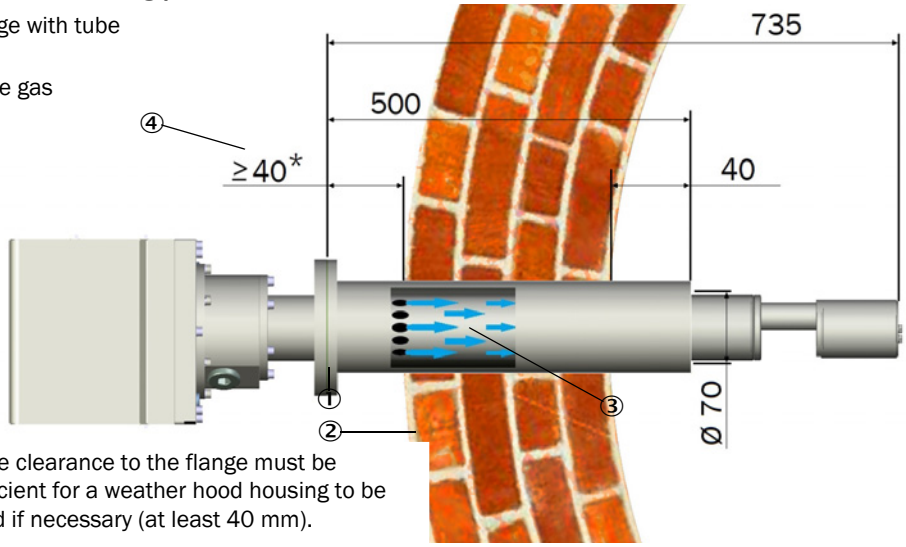


④ * The clearance to the flange must be sufficient for a weather hood housing to be fitted if necessary (at least 40 mm).

Fig. 23: Fitting the flange with tube (all dimensions in mm)
Shown for high-temperature version, nominal length 435 mm

Fitting the measuring probe NL 735 mm

① Flange with tube
② Duct
③ Purge gas



④ * The clearance to the flange must be sufficient for a weather hood housing to be fitted if necessary (at least 40 mm).

Fig. 24: Fitting the flange with tube (all dimensions in mm)
Shown for high-temperature version, nominal length 735 mm

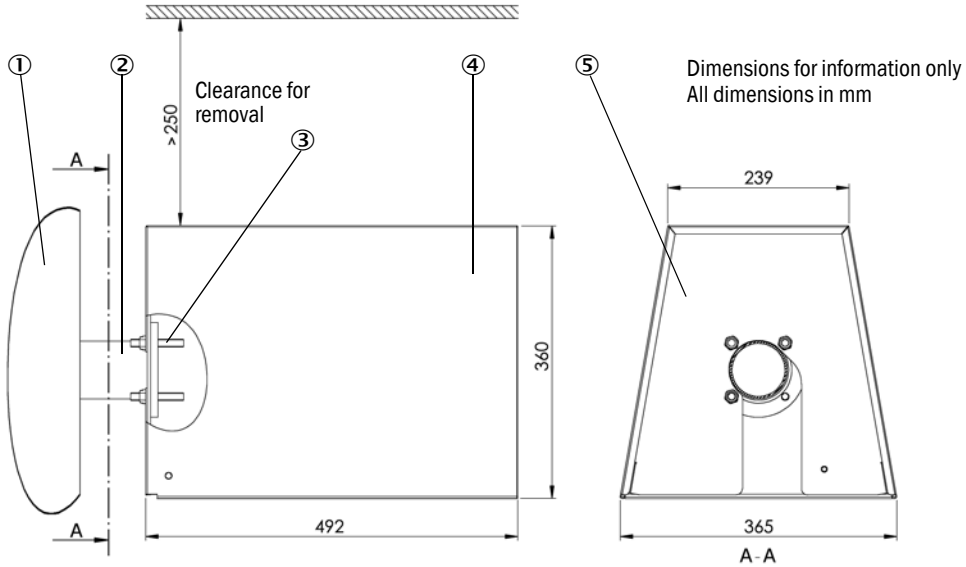
6.4.1.2 *Fitting the weather hood housing*

This weather hood housing serves to protect the sender/receiver unit. It comprises a base plate and a protective hood.

A special weather hood housing is available for the explosion-proof area. Other compatible weather hood housings must not be used in the explosion-proof area (see “Weather hood housing”, page 135).

Assembly:

1 Push base plate (2) on flange with tube (5), slot onto threaded bolts (4) of the duct-side surface of the flange plate and screw on (see “Fitting the weather hood housing for the sender/receiver unit”, page 52).
2 Connect the potential equalization.



① Duct
② Flange with tube
③ Threaded bolts
④ Weather hood housing
⑤ Base plate

Fig. 25: Fitting the weather hood housing for the sender/receiver unit

6.4.2 Fitting the control unit

Fit the MCU or MCUDH Ex-3K control unit in a protected location that is easily accessible (see “MCUDH Ex-3K control unit space requirements”, page 43). Observe the following points during fitting:

- The MCUDH Ex-3K control unit may only be used in the Ex-zone in accordance with the specifications (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36).
- Maintain the ambient temperature range in accordance with the Technical Data under consideration of possible radiant heat (shield when necessary).
- Protect against direct sunlight.
- Whenever possible, choose an assembly location with minimum vibrations; dampen any vibrations when necessary.
- Provide sufficient clearance for lines and opening the door.
- When opening the enclosure door, take suitable precautions to prevent dust from entering.

The control unit can be located up to 1000 m away from the sender/receiver unit when using a separate 24 V power supply provided by the customer and using suitable connection lines (see “Information on connection lines”, page 56).

For outdoor installation, it is necessary for the customer to provide a weather hood.

7 Electrical installation

NOTE:
Check device suitability before installation.
- ▶ Before installation, check that the type code and type plate match the intended application.

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

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

- Plan adequate line cross-sections (see “Information on connection lines”, page 56).
- Line ends with plugs to connect the sender/receiver unit must have sufficient free length.
- The potential equalization line of the sender/receiver unit must be flexible enough to allow the sender/receiver to be removed from the duct with the potential equalization connected.

7.1 Electrical installation safety information

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

WARNING:
Endangerment of electrical safety through power line with incorrect rating
Electrical accidents can occur when the specifications for replacement of power lines have not been adequately observed for the line.
- ▶ Always observe the exact specifications in the Operating Instructions when replacing the power line (see “Technical data”, page 124).

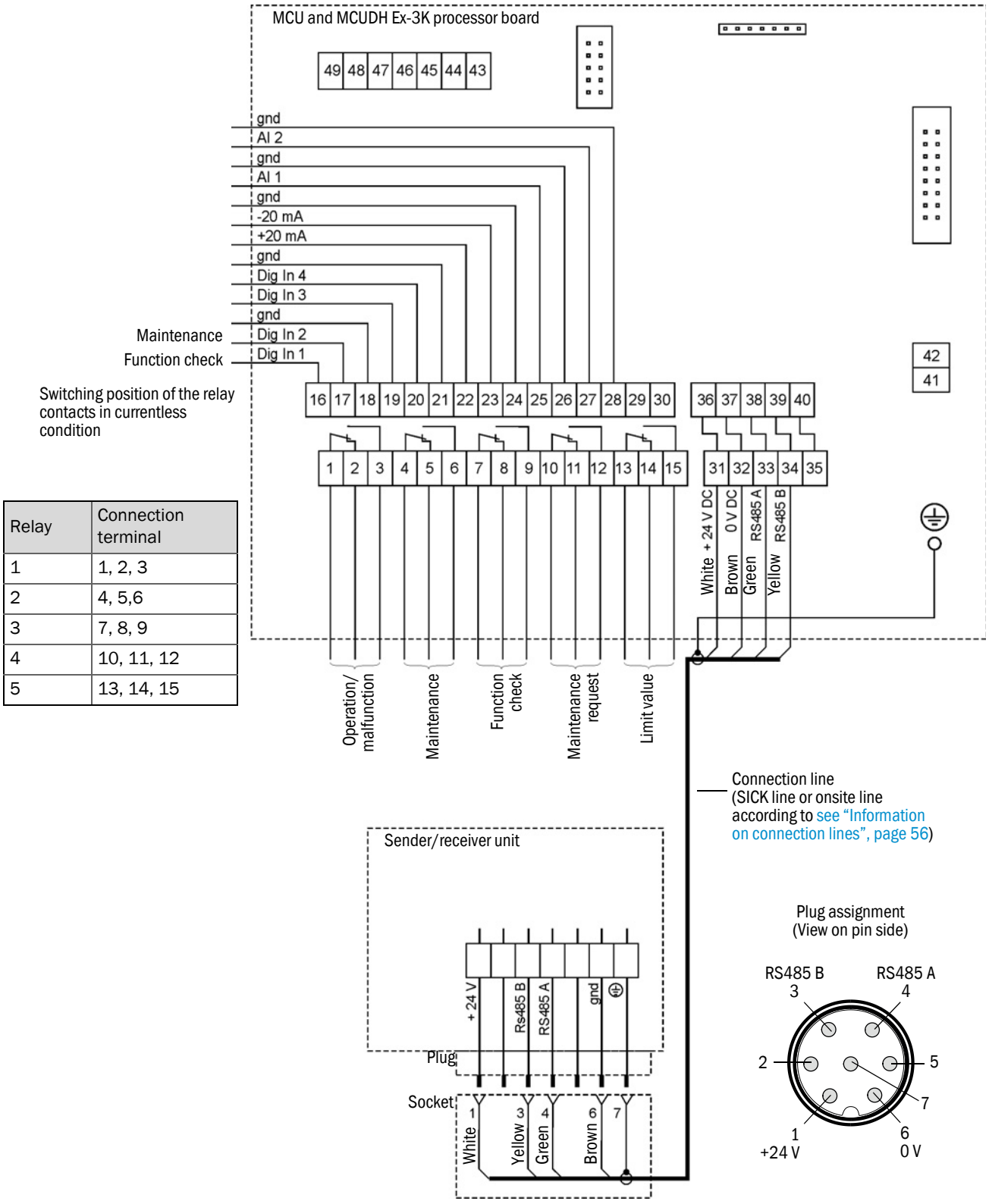
7.2 Connection overview

Pay attention to zone separation when installing and connecting device components (see “Application illustration DUSTHUNTER SP100 Ex-3K”, page 36).

Connecting is done in three main steps:

1 Before connection work, establish potential equalization of devices to be connected.
2 Before commissioning: Make the connections for the device components, other than the sender/receiver unit.
3 During commissioning: Establish the connections still required on the sender/receiver unit at the measuring point.

7.2.1 Connection plan



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

Fig. 26: Connection plan

7.3 Information on connection lines

DANGER:
Risk of explosion through unsuitable screw fittings and electric lines

- ▶ Use only suitable cables (according to valid standard) with matching outside diameter.
- ▶ Protect lines against electrostatic charges.
- ▶ Only open those line glands to be used for the installation. Keep the screw plugs.
- ▶ Refit the original screw plugs when a line gland has to be closed again (see “MCUDH Ex-3K line glands”, page 59).

Requirements for connecting lines in the safe area (no Ex-zone)

For the signal lines with low voltage limits, only use shielded lines with twisted pairs (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 power supply; not suitable for underground laying). Lines with other designations but equivalent construction and comparable or higher electrical properties are permissible.

Requirements for connecting lines in the Ex-zone

- The documentation for zone division according EN 60079-10 must be available.
- The lines to be used must be checked for suitability for the application area.
- After installation, an initial test of the device and the system according to EN 60079-17 must be performed.
- Potential equalization and line connections must fulfill the requirements according to EN 60079-14.
- Lines which are especially endangered by thermal, mechanical or chemical stress, must be protected, e.g., by laying in protective tubes open at both ends.
- For lines not protected against smoldering, the fire behavior must be verified according to IEC 60332-1.
- The cross-section of each individual wire must not be smaller than 0.5 mm^2.
- When selecting the lines, the respective clamping range of the line duct described here must be observed. If you need more than one line duct or line ducts with different diameters, a set can be found in the spare parts (see “Spare parts, control unit”, page 134).
- The inserted lines must be routed to the designated connection terminals by the shortest possible route and fixed inside the enclosure in order to maintain the air and creepage distances of the existing circuits.
- Ex line glands must be suitable for the intended cable type (e.g., lines with or without shield).
- Protect the wire ends with connector sleeves against fraying.
- Replace unused line glands with the enclosed Ex-d sealing plugs.
- Unused wires must be connected with a ground line (ground potential) or secured so that a short circuit with other conductive parts is excluded.
- Torque for tightening the line glands with sealing plugs: 5 Nm, for line glands with inserted line: 10 Nm.

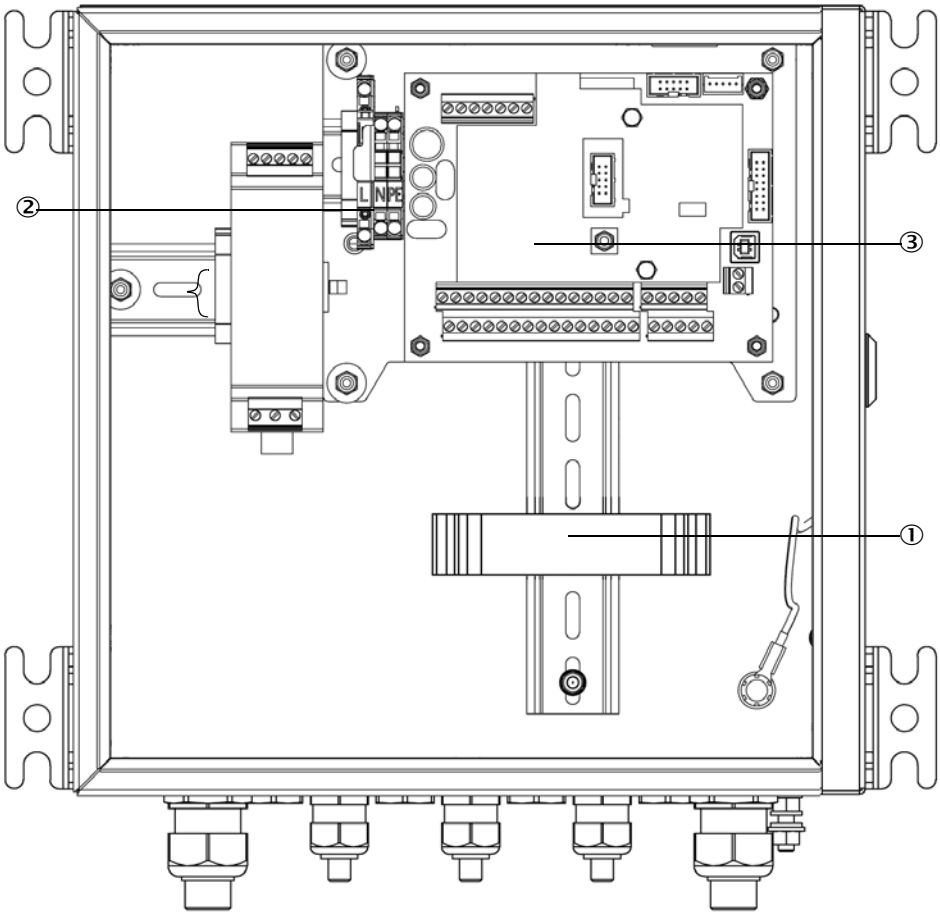
7.4 Connecting the sender/receiver unit

Connecting the sender/receiver unit is covered in the Section on the control unit, the sender/receiver unit is only positioned in the duct during commissioning (see “Fitting and connecting the sender/receiver unit”, page 66).

7.5 Connecting the control unit

WARNING:
Connect potential equalization when working on the measuring system
Static charge can lead to explosions.
- ▶ Connect the potential equalization as first task during assembly and as last task during disassembly.

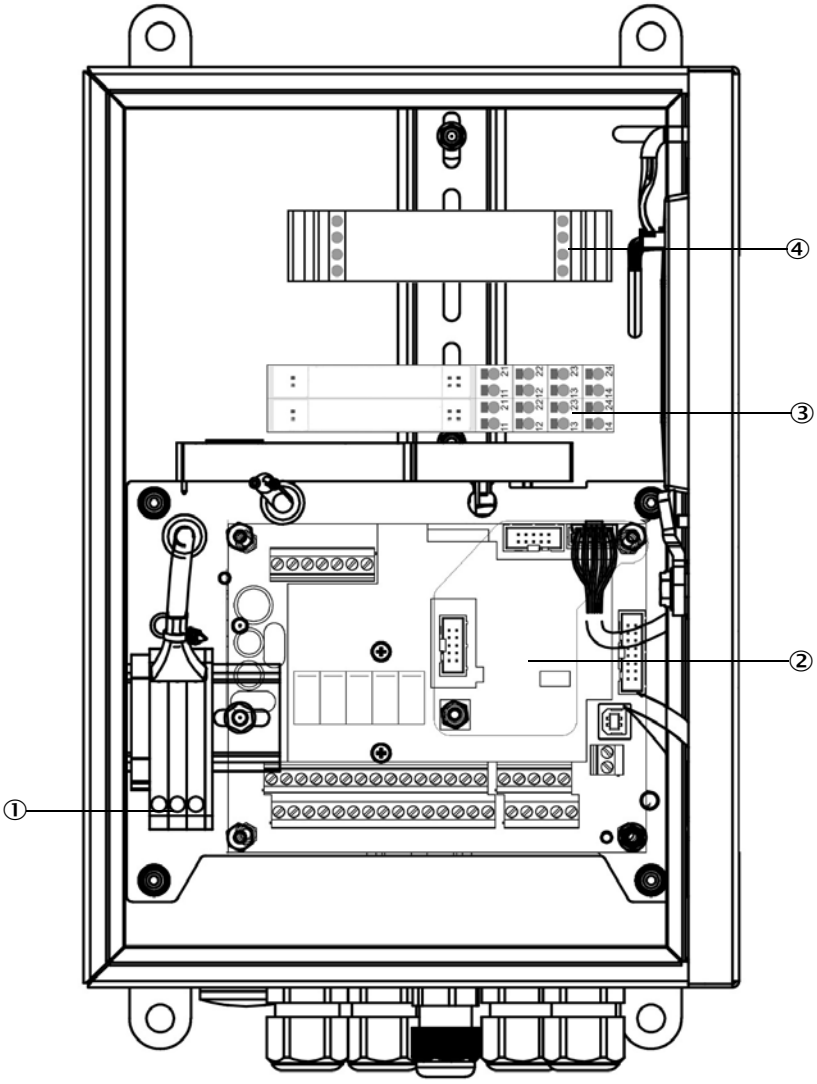
7.5.1 MCUDH Ex-3K control unit component layout



① Option, Interface module RS485 Modbus® ASCII/RTU
② Terminals for power connection
③ Processor board

Fig. 27: MCUDH Ex-3K control unit component layout

7.5.2 MCU control unit component layout



① Terminals for power connection
② Processor board
③ Optional analog / digital connection modules
④ Optional Interface module

Fig. 28: MCU component layout

7.5.3 Work to be done

- Connect the connection line: see “Connection plan”, page 55.
- Connect lines for status signals (operation/malfunction, maintenance, function check, maintenance request, limit value), analog output, analog and digital inputs according to requirements (see “Connection plan”, page 55 and see “Communication options”, page 62).
- Connect power line to terminals L1, N, PE of the control unit (see “Connecting the control unit”, page 57).

Also close off unused line glands.

NOTE:
If more connecting lines are to be used than initially planned, a set with line glands is available for the MCUDH Ex-3K control unit (see “Spare parts, control unit”, page 134).

NOTICE:
Faulty wiring can damage the measuring system
- Be sure to check the potential equalization of the devices and the wiring before switching the supply voltage on.
- Only modify wiring when disconnected from the power supply and potential-free.

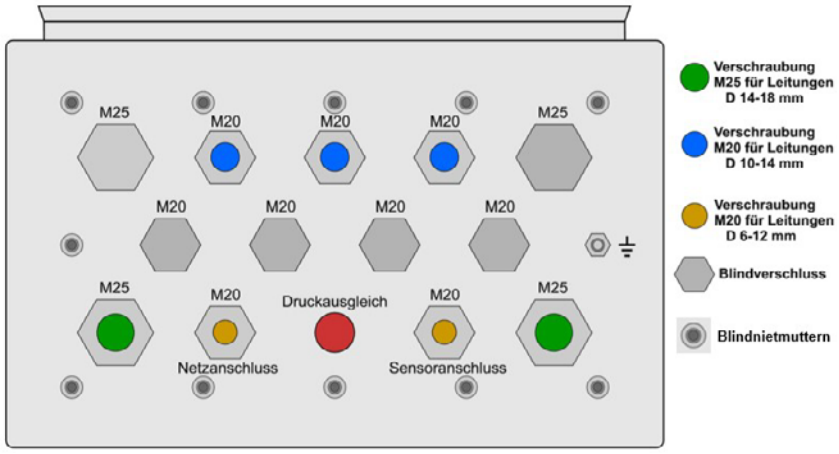
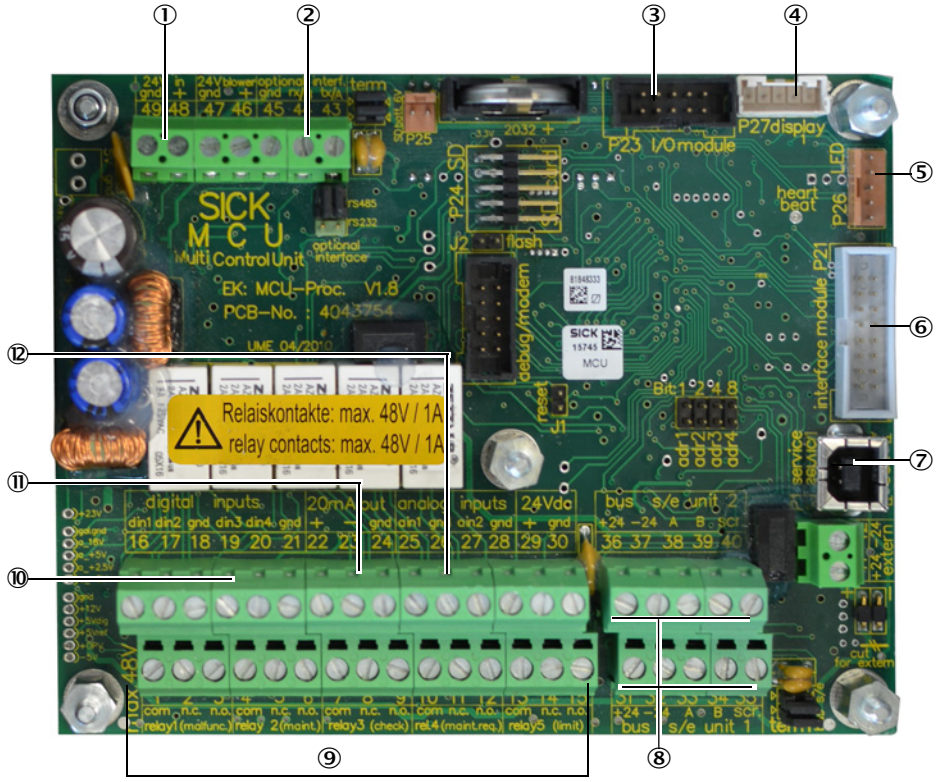


Fig. 29: MCUDH Ex-3K line glands

7.5.4 Processor boards connections of control units

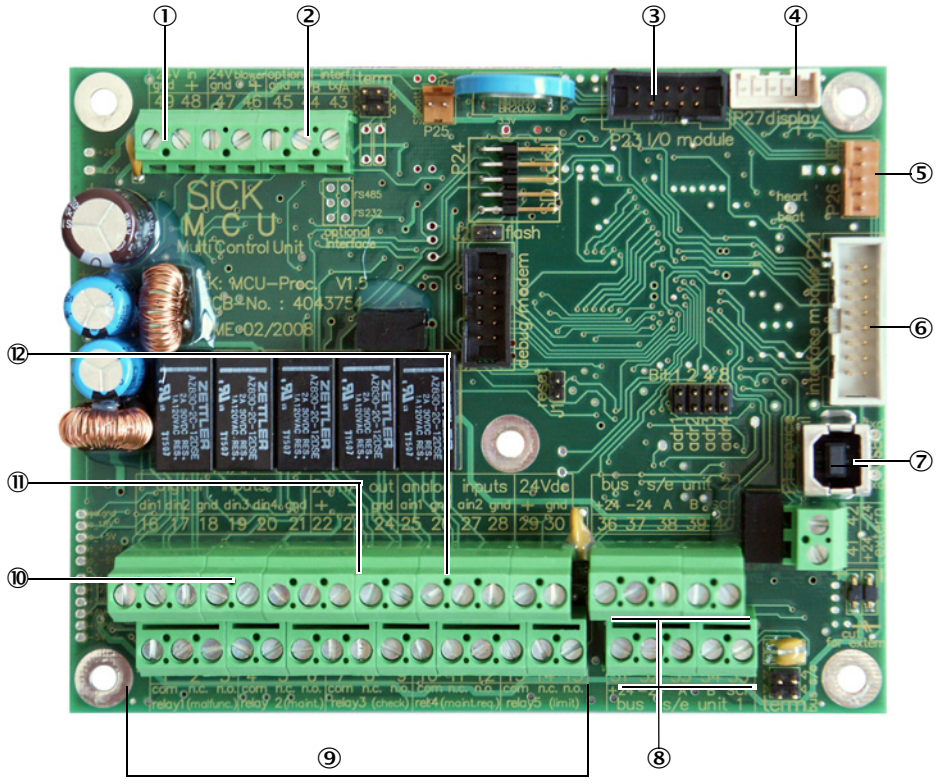
MCUDH Ex-3K processor board connections



① Supply voltage 24 V DC
② Service interface RS485 for SOPAS communication
③ Connection for option I/O module - use not permitted for MCUDH Ex-3K
④ Connection for Display module
⑤ Connection for LEDs - use not permitted for MCUDH Ex-3K
⑥ Connection for option Interface module
⑦ USB plug connector
⑧ Connections for sender/ receiver units
⑨ Connections for relays 1 to 5
⑩ Connections for digital inputs 1 to 4
⑪ Connection for analog output
⑫ Connections for analog inputs 1 and 2

Fig. 30: MCUDH Ex-3K processor board connections

MCU processor board connections



① Supply voltage 24 V DC
② Service interface RS485 for SOPAS communication
③ Connection for option I/O module
④ Connection for Display module
⑤ Connection for LEDs
⑥ Connection for option Interface module
⑦ USB plug connector
⑧ Connections for sender/ receiver units
⑨ Connections for relays 1 to 5
⑩ Connections for digital inputs 1 to 4
⑪ Connection for analog output
⑫ Connections for analog inputs 1 and 2

Fig. 31: MCU processor board connections

7.5.5 Connection line to control unit

The connection line has a 7-pole plug which may only be connected to the DUSTHUNTER SP100 Ex-3K when currentless. The connector plug is inserted into the socket when the plug protection guard is opened and the plug-side safety gland is screwed onto the socket. Then fasten the plug protection guard (see “Connection line and plug protection guard.”, page 32). The following Figure shows the connector plug pin assignment.

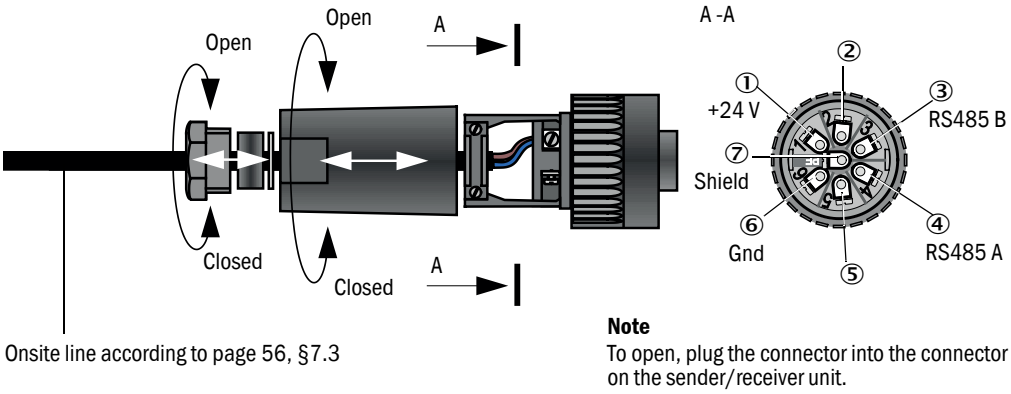


Fig. 32: Connecting the plug connector to the customer's line

7.6 Installing the purge gas supply

WARNING:
Risk of explosion through electrostatic charges
► An antistatic purge gas hose must be used within the Ex-zone.

For the requirements on the purge gas to be provided onsite see “Purge gas supply”, page 45.

7.7 Connecting Remote-Display 100

The Remote-Display 100 is not suitable for use in the Ex-zone. The Remote-Display 100 is only to be used in connection with the MCUDH Ex-3K. The data line and, if necessary, the power supply must be routed to the safe area.

7.7.1 Connection to the MCUDH Ex-3K control unit

Electrical connection see “Connection plan”, page 55

- Electrical connection of the Remote-Display 100 without own power supply unit:
  - 24-V supply: Connection terminals 36 and 37
  - Communication: Connection terminals 38 and 39
- Electrical connection of Remote-Display 100 with own power supply unit:
  - Communication: Connection terminals 38 and 39

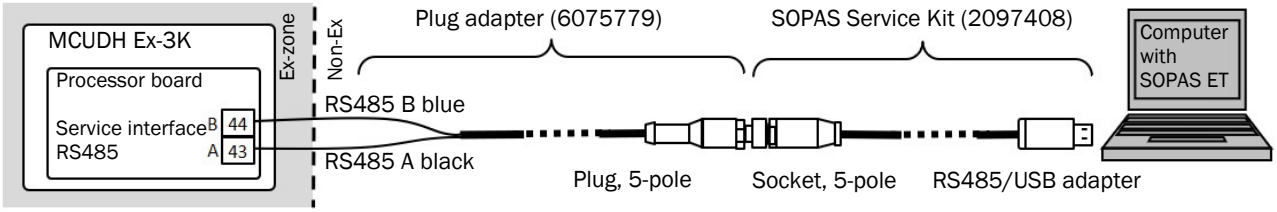
7.8 Communication options

There are two options for communicating with the MCUDH Ex-3K for configuration and data exchange.

Option 1

Communication via the RS485 Service interface available on terminals 43 and 44 of the MCUDH Ex-3K processor board. It is permanently set to the SICK internal (proprietary) Cola-B protocol with a transfer protocol 57,600 baud 8N1 (semi-duplex) and can only be used for communication with SOPAS ET. This can be done in two ways:

Option 1



Option 2

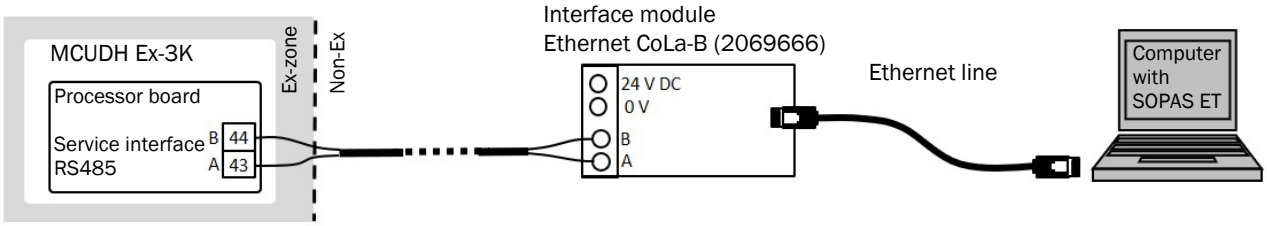


Fig. 33: Communication options 1 and 2

Option 2

Communication via the RS485 / Modbus® ASCII/RTU Interface module plugged onto the top hat rail. This module is connected to the MCUDH Ex-3K processor board with a ribbon cable. The communication mode in which this module is to be used (PROFIBUS DP, Ethernet or RS485) must then be set in SOPAS ET (see “Connecting to the MCUDH Ex-3K control unit via Ethernet”, page 70). The RS485, led to the outside via a two-wire line, can then be used directly or via Interface modules in the following way:

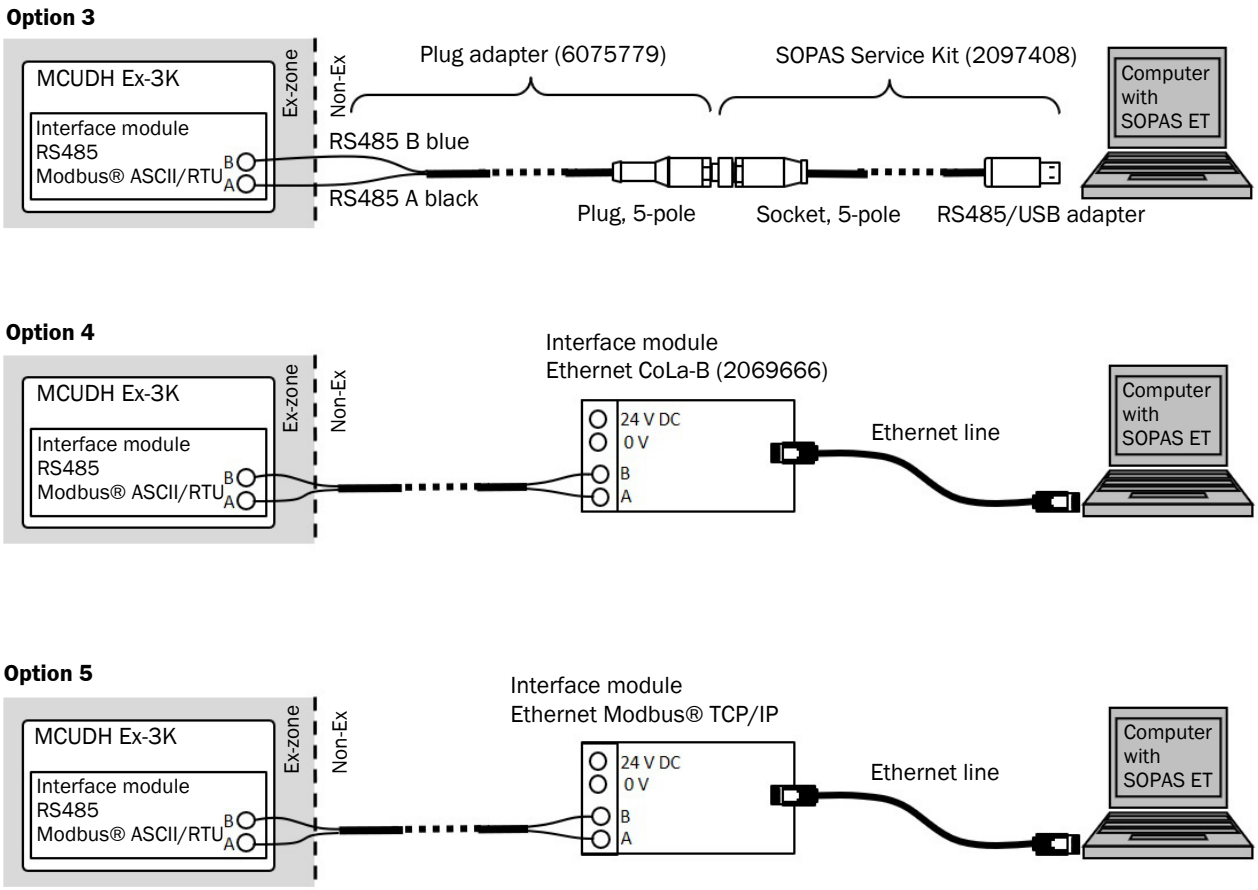


Fig. 34: Communication options 3, 4 and 5

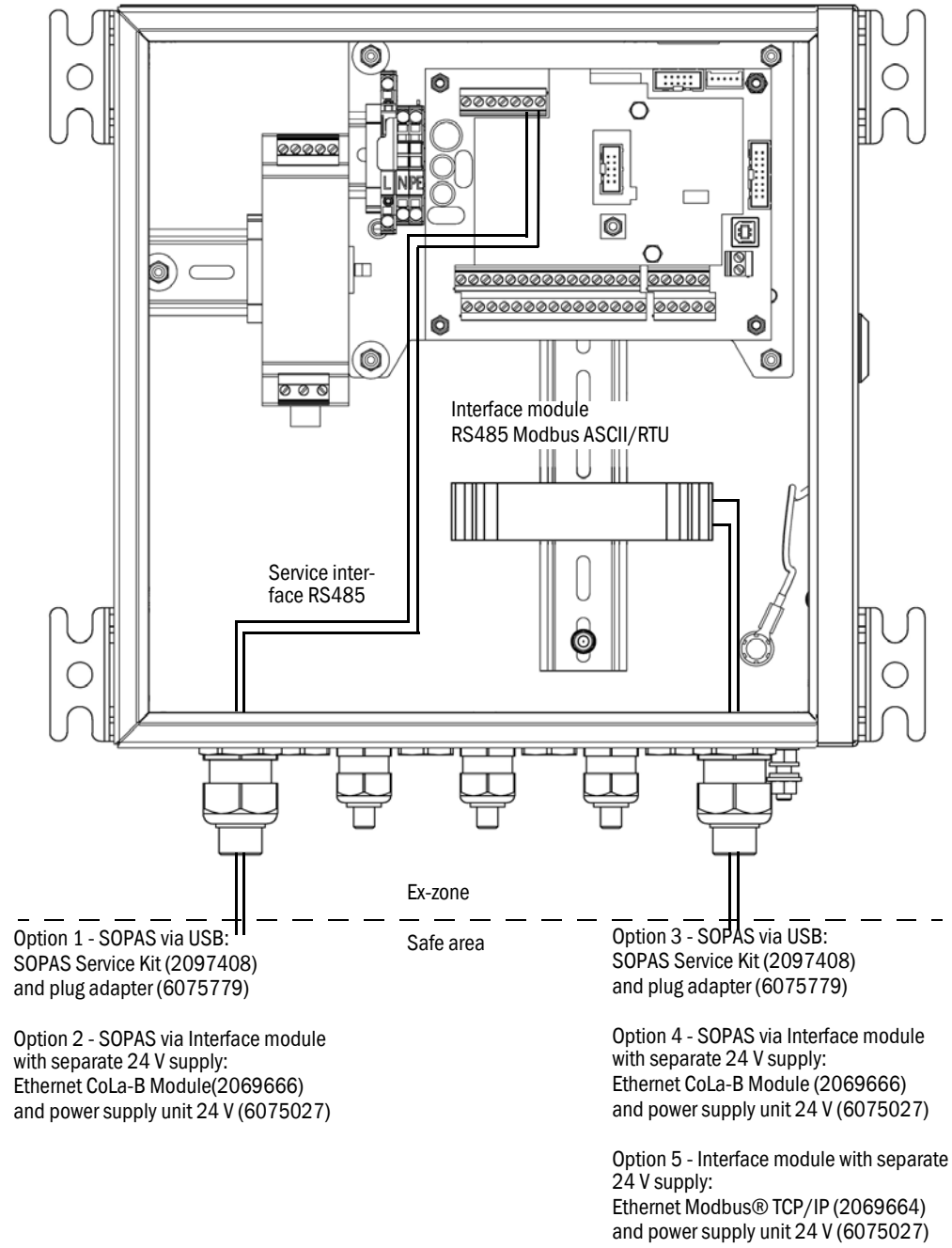


Fig. 35: MCUDH Ex-3K interface options

8 Commissioning

8.1 Safety information on commissioning

NOTICE:

Device damage possible due to an unprofessionally executed electrical installation.

▶ The manufacturer recommends having the initial commissioning carried out by SICK Service.

The explosion protection regulations must be observed during commissioning:

- Do not remove, add or modify any components on and in the sender/receiver unit unless described and specified in the official manufacturer information, otherwise the approval for use in potentially explosive atmospheres becomes void.
- Follow the sequence of the commissioning procedure described in this Section.
- Adhere to the prescribed maintenance intervals (see “Maintenance plan”, page 97).
- Do not insert or remove the power supply plug on the sender/receiver unit when under voltage.
- System components without Ex marking must not be used in the Ex-zone.
- Ex-zone
  - Observe transport regulations, e.g. no transport of packaging materials into the Ex-zone.
  - Do not carry out installation work or commissioning in the Ex-zone. Commissioning, decommissioning and cleaning may only be performed when it is verified that no explosive media are present (verification by gas detector).
  - The sender/receiver unit enclosure may only be opened by SICK Service.
  - Only employ trained personnel in the Ex-zone.
  - Only use suitable tools for the Ex-zone.
  - Observe behavior rules to prevent sparks.
  - Only work that does not affect ignition protection is allowed.

8.2 Requirements for commissioning

The following requirements must be met before starting commissioning:

- All specifications are met in accordance with the project planning.
- All the work in the Assembly 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 Inserting and switching on

8.3.1 Adapting the sender/receiver unit to the duct geometry

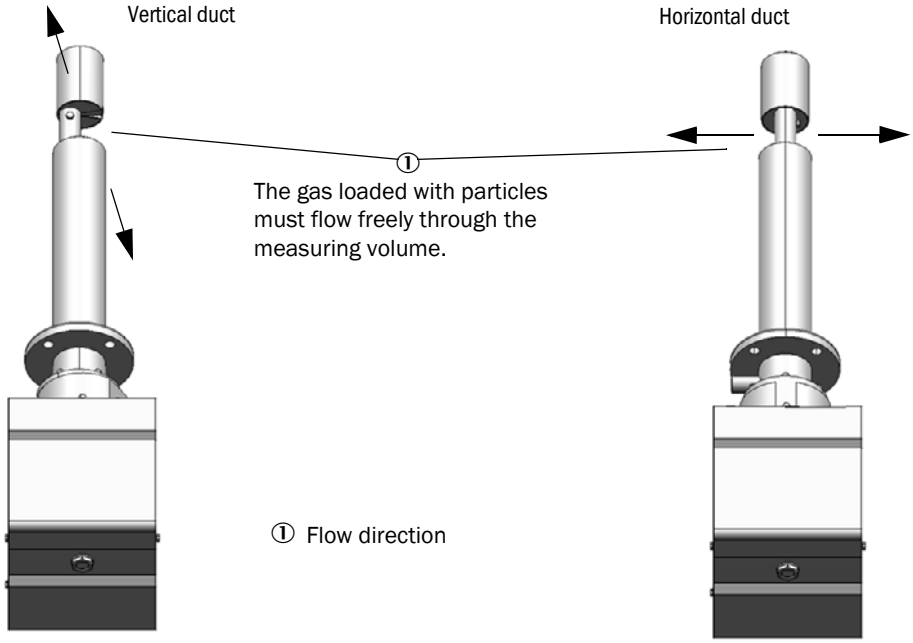


Fig. 36: Measuring probe alignment

The sender/receiver unit is delivered for vertical fitting as standard when the duct direction (horizontal or vertical) is not specified in the order. Rotate the sender/receiver unit 90° when fitting on a horizontal duct. This task may only be carried out by trained personnel, please contact SICK Service for this purpose.

8.3.2 Fitting and connecting the sender/receiver unit

WARNING:
Risk of poisoning by exhaust gases
When the sender/receiver unit is installed in potentially explosion-hazardous areas, toxic or aggressive gases or dusts may escape and cause injury through inhalation or contact.
- ▶ In case of potential danger, only install the sender/receiver unit on the duct when the system is at a standstill.

The sender/receiver unit is already connected to the purge gas supply (see “Installing the purge gas supply”, page 61) and connected to the control unit (see “MCU processor board connections”, page 60) with the connection line, the steps for insertion in the duct now follow:

1 Connect a flexible potential equalization line that allows the sender/receiver unit to be removed from the duct when connected.
2 Activate the purge gas supply.
3 Push the sender/receiver unit with the correct alignment (see “Adapting the sender/receiver unit to the duct geometry”, page 66) into the flange with tube. Do not forget the seal and fasten it with the assembly kit (see “Fastening technology”, page 135). Make sure the probe head is not damaged during fitting.
4 Switch the supply voltage on.

8.4 Recognizing the safe operating state

The system is in proper operation when:

- A system check has been carried out according to the Maintenance plan before commissioning and in running operation.
- Only the green status indicator on the control unit lights up and operating status “Operation or Power” (MCUDH Ex or MCU) shown on the display.

Recognizing malfunctions

At this stage of commissioning, a display of the malfunctions can only be seen on the control unit. Any deviation from normal operation must be regarded as a serious indication of a functional impairment or unsafe operating state. These are, amongst others:

- Indication of malfunctions on the LC display
- The red LED lights up (malfunction)
- Implausible measurement results
- Increased power consumption
- Increased system components temperature
- Triggering of monitoring devices
- Smells or smoke emission

Electrical connection

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

9 Configuring

9.1 Prerequisites

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

9.2 SOPAS ET

9.2.1 Install SOPAS ET

- Install SOPAS ET on a computer (see “SOPAS ET user interface”, page 38).
- Start SOPAS ET.
- Follow the SOPAS ET installation instructions.

9.2.2 Password for SOPAS ET menus

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

Table 14: SOPAS ET user levels

User level		Access rights
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: sickoptic

9.2.3 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 user level for which the password is to be changed. In the command bar, a menu is named after the connected device, click on the “Change password” setting in this pull-down menu.

9.3 Connecting to the MCUDH Ex-3K control unit

9.3.1 Connection via RS485 Service interface

Recommended procedure:

1 Establish electrical connections (see “Communication options”, page 62 Option 1).
2 Switch control unit on.
3 Start SOPAS ET.
4 Select “Search settings”.
5 “Device family oriented search”
6 Click on the MCU (DH) control unit.
7 Make the settings:
  – Ethernet communication (always clicked)
  – USB communication (always clicked)
  – Serial communication: Click
8 Do not specify IP addresses.
9 A list of COM ports appears.
  Specify the COM port of the DUSTHUNTER.
  If you do not know the COM port: see “Finding the DUSTHUNTER COM port”, page 86.
10 Enter a name for this search if you want to save it.
11 Click “Finish”.

9.3.2 Connecting to the MCUDH Ex-3K control unit via Ethernet

Recommended procedure:

1 Establish electrical connections (see “Communication options”, page 62 Option 2, 4 or 5).
2 Configure the Ethernet module using the manufacturer software and note the IP address.
3 Connect the laptop/PC with the Ethernet module.
4 Connect the switched-off control unit to the network cable (LAN).
5 Switch control unit on.
6 Start SOPAS ET.
7 “Search settings”
8 “Search by interface”
9 Make the settings:
  – Ethernet communication (always clicked)
  – USB communication (always clicked)
  – Serial communication: Click
10 Enter the noted IP address.
11 A list of COM ports appears.
  Specify the COM port of the DUSTHUNTER.
  If you do not know the COM port: see “Finding the DUSTHUNTER COM port”, page 86.
12 Enter a name for this search if you want to save it.
13 Click “Finish”.

9.3.3 Configuring the RS485 Modbus ASCII/RTU Interface module

If a control unit model that already contains the optional RS485 / Modbus® ASCII/RTU Interface module right from the factory is selected, this is already preconfigured. Configuring is necessary when the module is subsequently integrated. Configuration must be carried out outside the Ex-zone because the USB Service interface must not be used within the Ex-zone. The following steps are then necessary:

1 Select device file “MCU”, set the measuring system to “Maintenance” mode
2 Enter the Level 1 password (see “Password for SOPAS ET menus”, page 68).
3 Switch to the “Configuration / System Configuration” directory.
The field “Interface Module” shows the installed Interface module. This module must be selected because only an RS485 connection is possible for the explosion-proof MCUDH Ex-3K control unit.
4 Installed Interface module: Select RS485.
5 Configure the Interface module according to requirements.

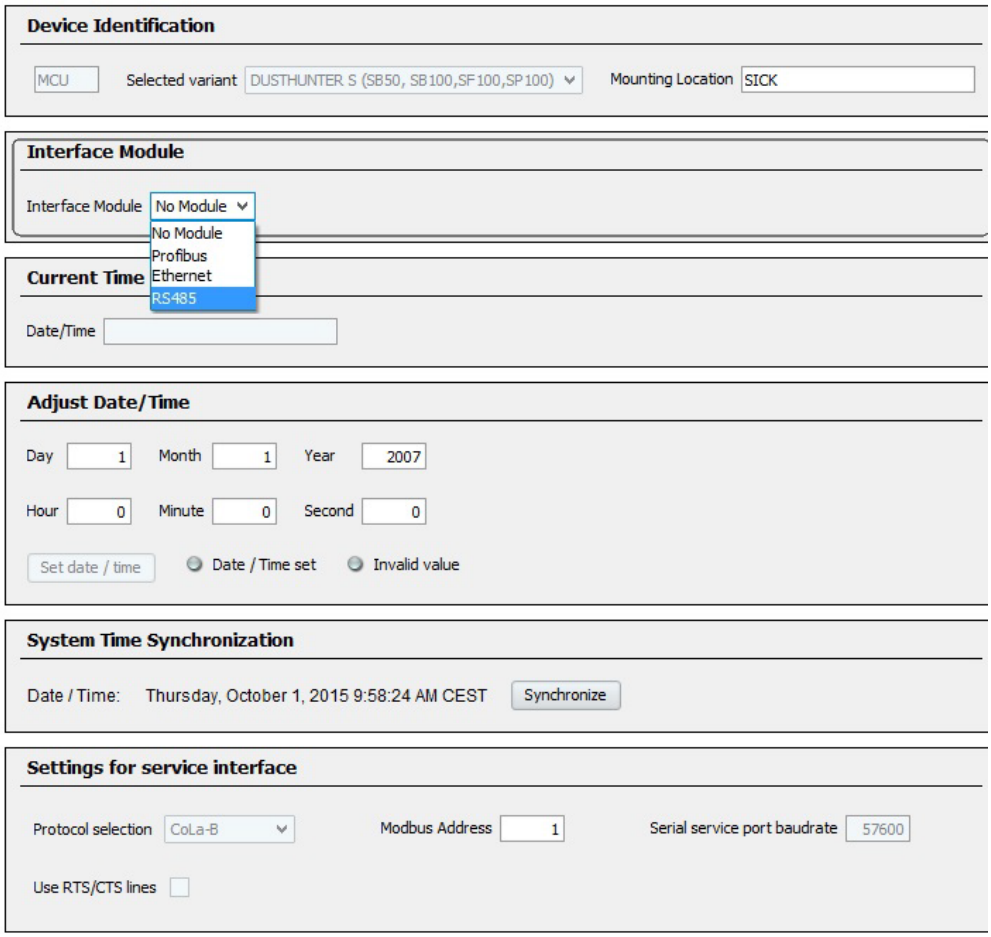


Fig. 37: SOPAS ET menu: MCU/Configuration/System Configuration

9.3.4 Connecting a remote Ethernet Interface module

The optionally integrated Interface module of the MCUDH Ex-3K control unit allows the connection of further optional Ethernet Interface modules via an up to 1000 m long RS485 connection line outside the Ex-zone, based on the RS485 output of the internal Interface module (see “Options for MCUDH Ex-3K control unit”, page 136). For such a connection, the remote Ethernet module must be set to the same IPv4 network address used in the network in which the Ethernet connection is connected. The documentation supplied with the optional Ethernet module contains the necessary information. No software updates are possible via the Ethernet interface, these must be carried out via the Service interface (see “MCUDH Ex-3K interface options”, page 64).

9.4 Connecting to the MCU control unit

9.4.1 Connection to device via Ethernet

Recommended procedure:

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

9.4.2 Configuring the Interface module of the MCU control unit

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

1 Select device file “MCU”, set the measuring system to “Maintenance” mode
2 Enter the Level 1 password (see “Password for SOPAS ET menus”, page 68).
3 Switch to the “Configuration / System Configuration” directory.
4 The field “Installed Interface Module” shows the installed Interface module.
5 Configure the Interface module according to the requirements.

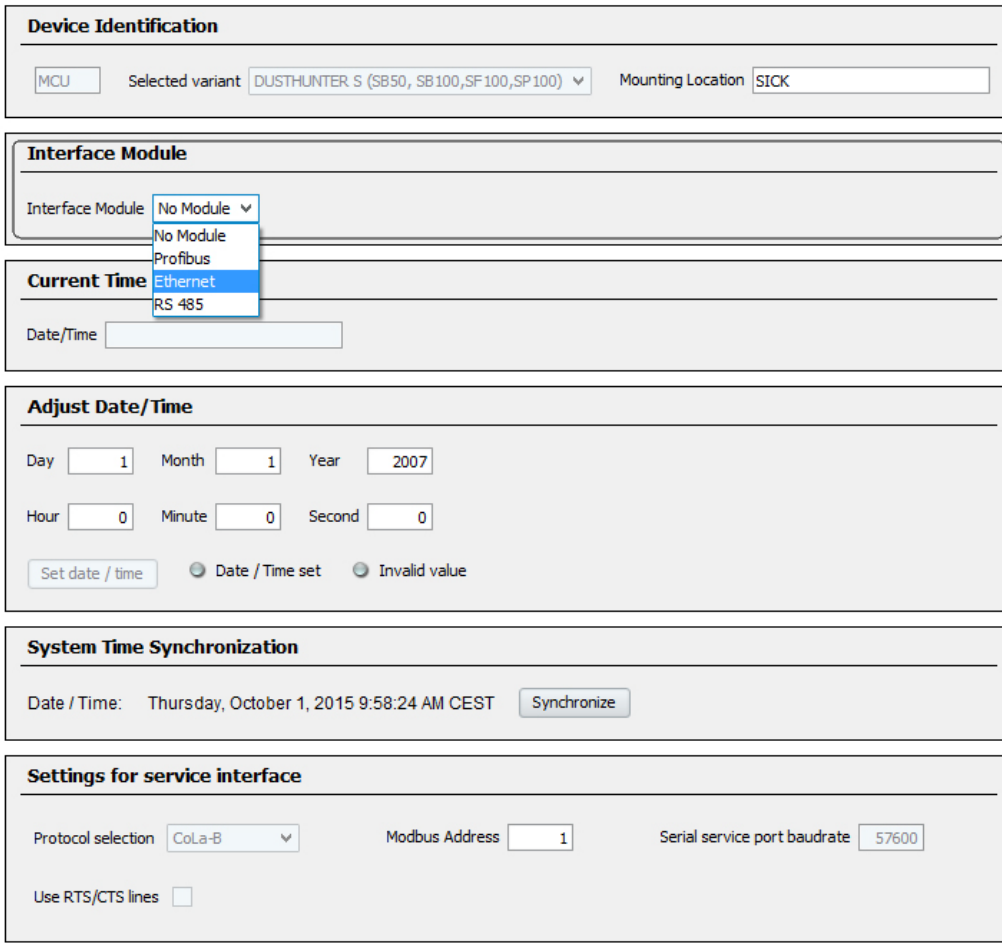


Fig. 38: SOPAS ET menu: MCU/Configuration/System Configuration

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

9.4.3 Configuring the MCU control unit Ethernet module

NOTICE:
There is a risk of unwanted access to the measuring system when communicating via Ethernet.
- ▶ Only operate the measuring system behind a suitable protective barrier (e.g. firewall).

Standard setting: 192.168.0.10

A default IP address is set if desired.

To change the settings:

- ▶ Switch to directory “Parameterization / IO configuration / Interface module”.
- ▶ Set the desired network configuration and press the “Reset module” button in the “Expansion Module Information” field.

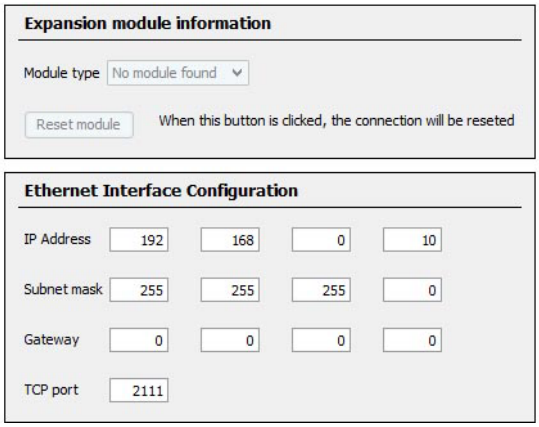


Fig. 39: SOPAS ET menu: MCU/Configuration/System Configuration

9.5 System configuration

9.5.1 Application parameters

Assign the sender/receiver unit to the measuring location

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

1 Start the SOPAS ET program and connect to the measuring system (see “SOPAS ET”, page 68).
2 Select device file “DH SP100” and move it to the “Project Tree” window.

> The respective device version connected is displayed automatically

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

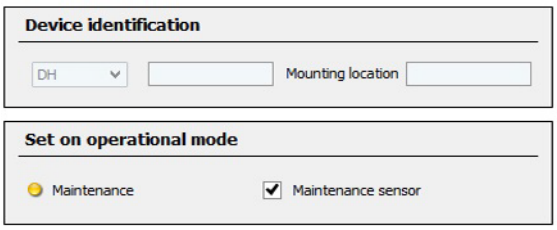


Fig. 40: SOPAS ET menu: DH SP100/Maintenance/Maintenance

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

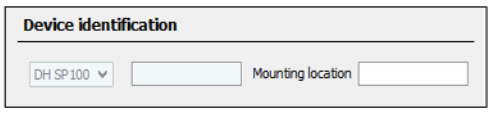


Fig. 41: SOPAS ET menu: DH SP100/Configuration/Application parameters (top window)

Defining regression coefficients

The “Configuration / Application parameters” directory also contains the “Calibration coefficients for calculating concentration from scattered light” window. There a set of coefficients with free choice of coefficients (Set 0) or fixed presetting (Set 1 to 3) can be selected to convert the received measurand scattered light into a dust concentration (see “Calibration for dust concentration measurement”, page 82). Select Set 0 when the application requires calibration of the measuring system or when very accurate measured values are required. Set 1 to 3 can be used when approximately correct dust concentration values are sufficient for the application.

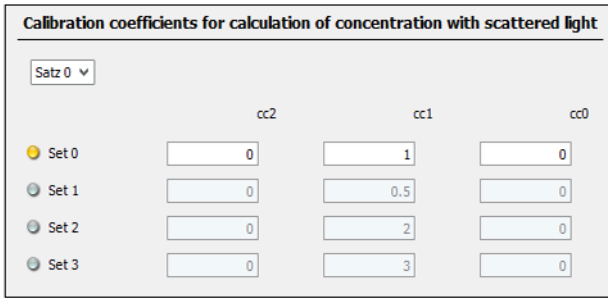


Fig. 42: SOPAS ET menu: DH SP100/Configuration/Application parameters (bottom window)

Table 15: Regression coefficient sets overview

Set	Regression coefficient setting	Typical application	Regression coefficients		
			Quadratic	Linear	Absolute
Set 0	Freely selectable	Any	0	1	0
Set 1	Fixed: For small particle sizes (on average 2 µm)	Usage after cloth filter units	0	0.5	0
Set 2	Fixed: For medium particle sizes (on average 5 µm)	Application after electro-filter	0	2	0
Set 3	Fixed: For large particle sizes (on average 10 µm)	Application after pre-filter (cyclone filter)	0	3	0

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

9.5.2 Assigning the control unit to the sender/receiver unit

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

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 Connect the measuring system to the SOPAS ET program.
2 Enter the Level 1 password (see “Password for SOPAS ET menus”, page 68).
3 Set the sender/receiver unit to “Maintenance”: Click “Maintenance sensor”.

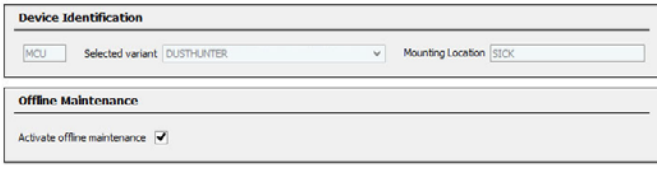


Fig. 43: SOPAS ET menu: MCU/Maintenance/Maintenance

4 Switch to the “Configuration / Application selection” directory.
5 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.

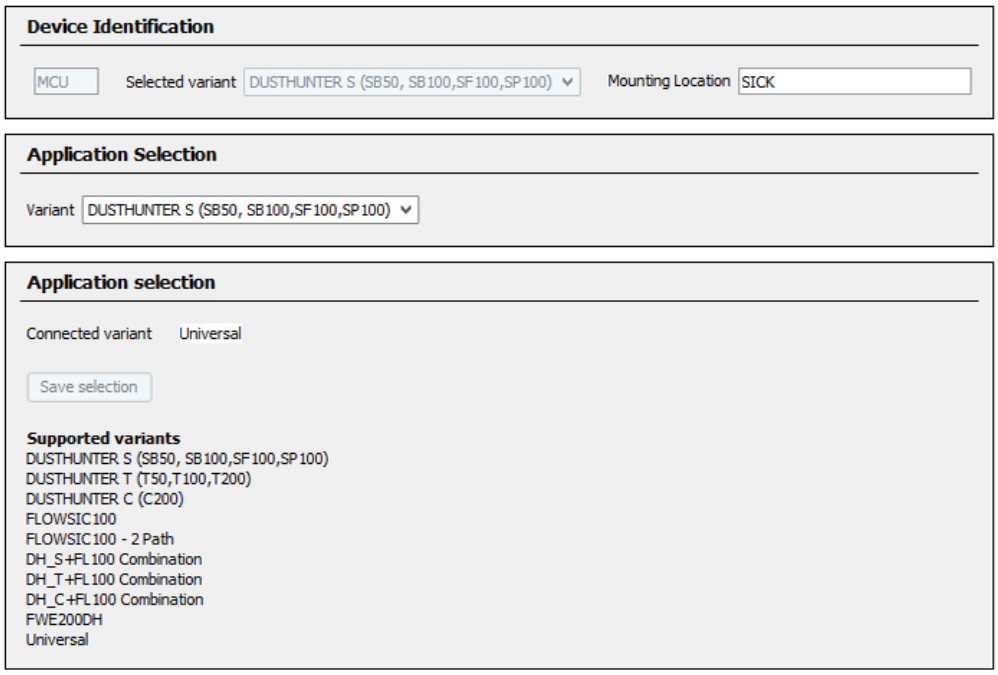


Fig. 44: SOPAS ET menu: MCU/Configuration/Application selection

9.5.3 Factory settings

Table 16: Factory settings

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

The steps required to modify these settings are described in the following Sections. For this purpose, the devices must be connected in SOPAS ET (see “SOPAS ET”, page 68), the Level 1 password set and the “Maintenance” mode set.

9.5.4 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 - Automatic” directory.

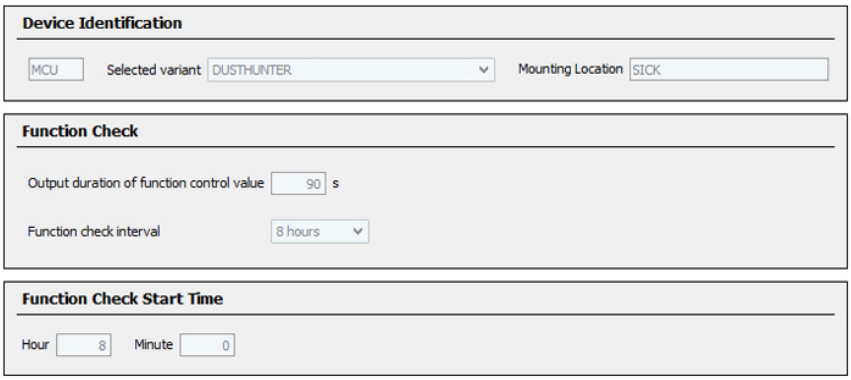


Fig. 45: SOPAS ET menu: MCU/Adjustment/Function Check - Automatic (example)

Standard values: see “Factory settings”, page 77

Table 17: Function check setting options

Entry field	Parameter	Remark
Function control Output duration of	Value in seconds	Output duration of control values.
Function check interval	Time between two check cycles	see “Function check”, page 33
Function control Start Time	Hour	Defining a start timepoint in hours and minutes.
	Minute	

The value measured last is output during control value determination (see “Function check”, page 33).

9.5.5 Setting the analog outputs parameters

- Standard values see “Factory settings”, page 77
- In order to output the dust concentration under standard conditions (“Conc. s.c.” (Ext)), set the parameters for the analog outputs according to see “Setting the analog inputs parameters”, page 81.

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

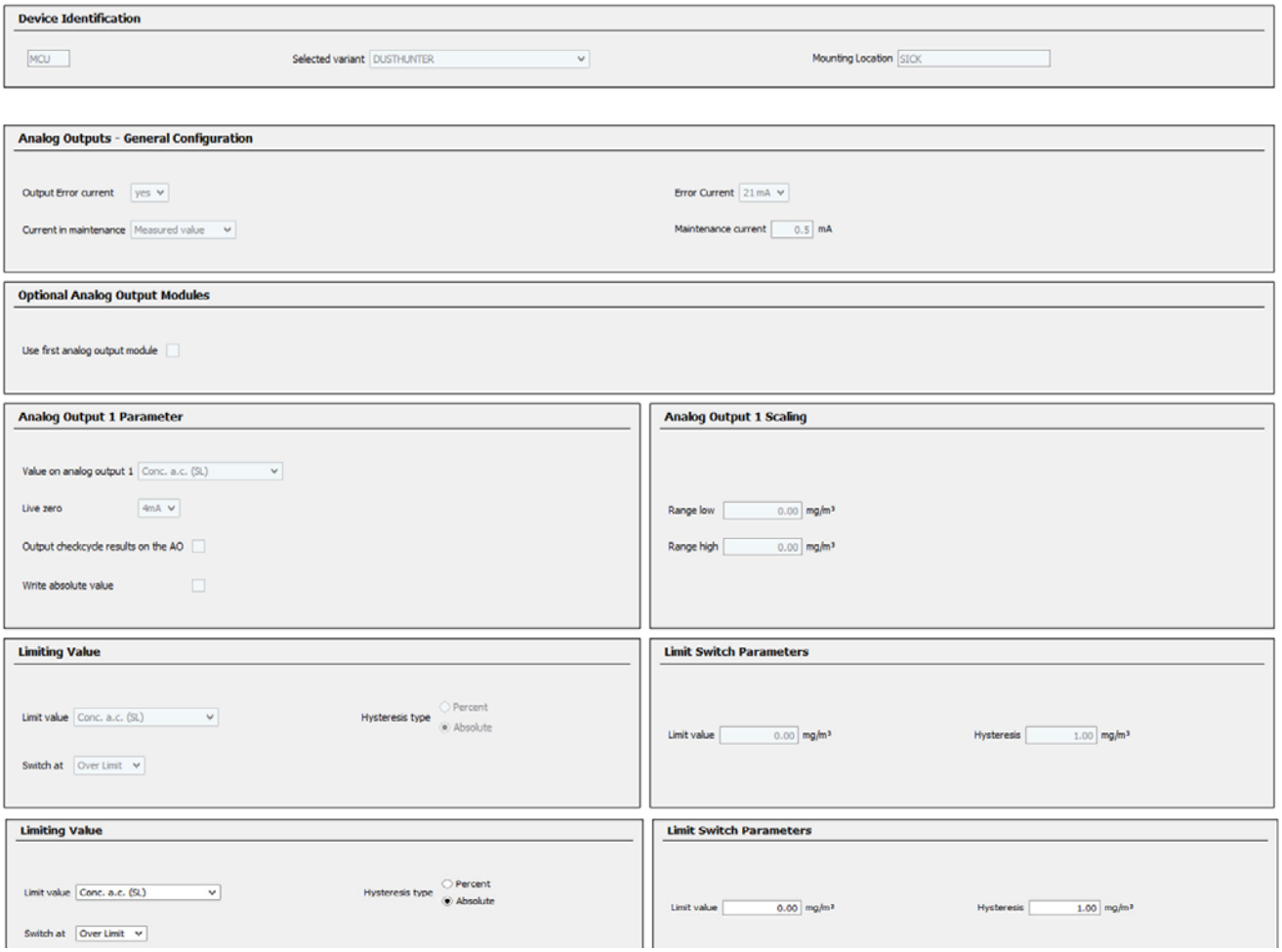


Fig. 46: SOPAS ET menu: MCU/Configuration/IO configuration/Output Parameters

Table 18: 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 to be defined 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 permitted for DUSTHUNTER SP100 Ex-3K (results in error, because AO 2 and AO 3 are available by default).	
		Active	Opens the fields to set parameters for AO 2 and AO 3 (standard for DUSTHUNTER SP100 Ex-3K).	
Analog Output 1 Parameter	Value on analog output 1	Concentration a.c. (SL)	Dust concentration in operating state (based on scattered light intensity).	The selected measured variables are output on the analog output.
		Concentration s.c.dry O2 corr. (SL)	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 33) 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	Measured value	Concentration a.c. (SL)	Dust concentration in operating state (based on scattered light intensity).	Select the measured variable for which a limit value is monitored.
		Concentration s.c.dry O2 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	Value exceeded	Define the switching direction.	
		Underflow		
Limit Switch Parameters	Limit value	Value	The limit value relay switches when the entered value is overflown or underflown.	
	Hysteresis	Value	Defines a tolerance for resetting the limit value relay.	

9.5.6 Setting the analog inputs parameters

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

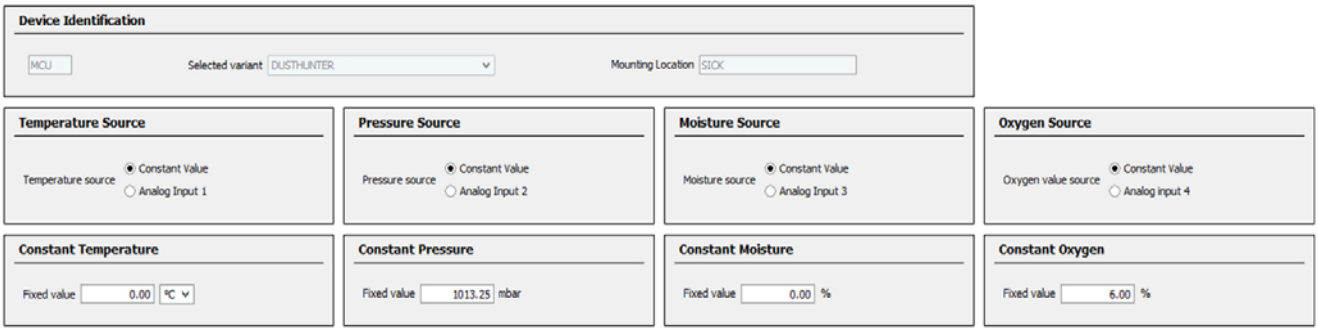


Fig. 47: SOPAS ET menu: MCU/Configuration/IO Configuration/Input Parameters

Table 19: 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 (= 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.

9.5.7 Setting the response time

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

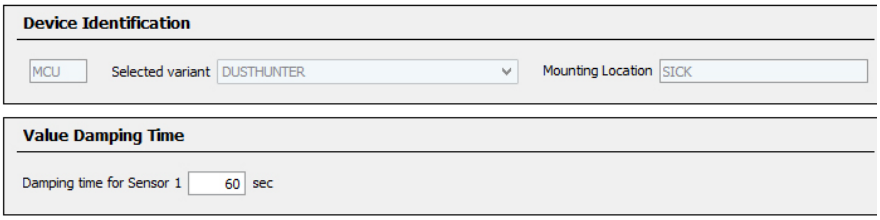


Fig. 48: SOPAS ET menu: MCU/Configuration/Value Damping

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

Table 20: Damping time (response time)

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

9.5.8 Calibration for dust concentration measurement

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

NOTE:
The performance of a comparative gravimetric measurement requires special equipment and knowledge, which are described in more detail in DIN EN 13284 and others.

Steps to be carried out

1 Select device file “MCU”, set the measuring system to “Maintenance” mode
2 Enter the Level 1 password (see “Password for SOPAS ET menus”, page 68).
3 Select the “Configuration / IO Configuration / Output Parameter” directory (see “SOPAS ET menu: MCU/Configuration/IO configuration/Output Parameters”, page 79) and assign the “Scattered light intensity” measured variable to one of the three analog outputs available.
4 Estimate the measuring range required for the dust concentration in operational state and enter this in the “Analog output 1 *(2/3)* Scaling” field assigned to the selected analog output assigned to the scattered light intensity.
5 Deactivate the “Maintenance” status.
6 Carry out the gravimetric comparison measurement according to DIN EN 13284-1.
7 Determine regression coefficients from the mA values of the analog output for “Scattered light intensity” and the actual dust concentrations measured gravimetrically.

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

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

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

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

8 Enter the regression coefficients
There are two options:
– Direct input of K2, K1, K0 in a measured value computer.

NOTE:
In this case, the regression coefficients set in the sender/receiver unit and the measuring range set in the control unit may no longer be changed anymore as this will impair the calculation of the dust concentration from the scattered light values. The dust concentration is displayed in mg/m³ on the LC display of the control unit as an uncalibrated value.

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

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

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

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

Using (3), the result is as follows:

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

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

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

9 Now enter the regression coefficients cc2, cc1 and cc0 determined in directory “Configuration/Application parameters” (see “Defining regression coefficients”, page 76) (set sender/receiver unit to “Maintenance” state and enter the Level 1 password).
10 After entering, set the sender/receiver unit to “Measurement” mode again.

9.5.9 Changing display settings

To change factory settings, connect SOPAS ET to the control unit (see “Connecting the control unit”, page 57), enter the level 1 password and select the “Parameter settings/ Display settings” directory.

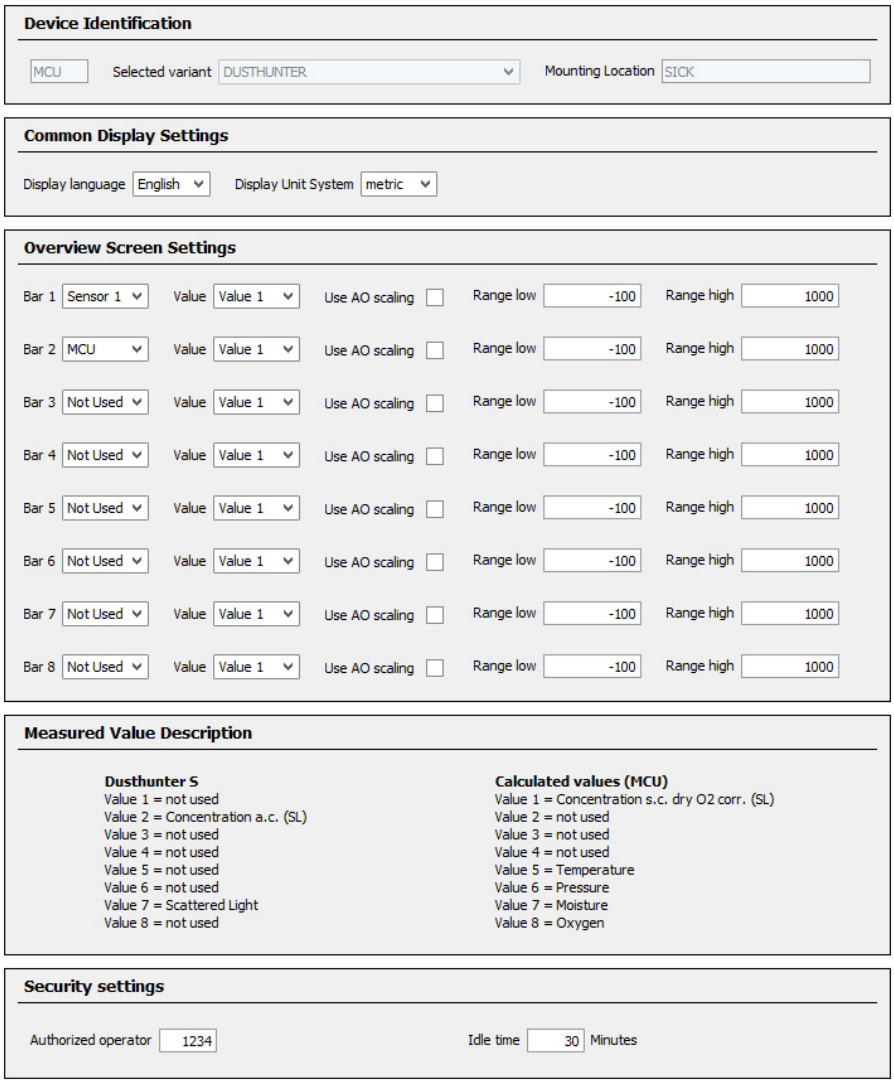


Fig. 49: SOPAS ET menu: MCU/Configuration/Display Settings

Table 21: Display settings

Window	Entry field	Significance
Common Display Settings	Display language	Language version shown on the LC display.
	Display Unit System	Unit of measurement system used in displays.
Overview Screen Settings	Bars 1 to 8	Number of 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	When activated, the measured value bar is scaled to the associated analog output. 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

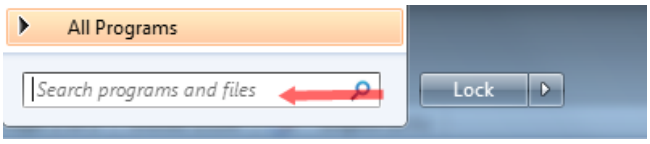
Table 22: Assignment of the measured values in the control unit

Measured value	Assignment
Value 1 - Sensor	Not used
Value 2 - Sensor	Concentration a.c. (SI)
Value 3 - Sensor	Not used
Value 4 - Sensor	Not used
Value 5 - Sensor	Not used
Value 6 - Sensor	Not used
Value 7 - Sensor	Scattered light
Value 8 - Sensor	Not used
Value 1 - Control unit (MCU)	Concentration s.c.dry O2 corr. (SI)

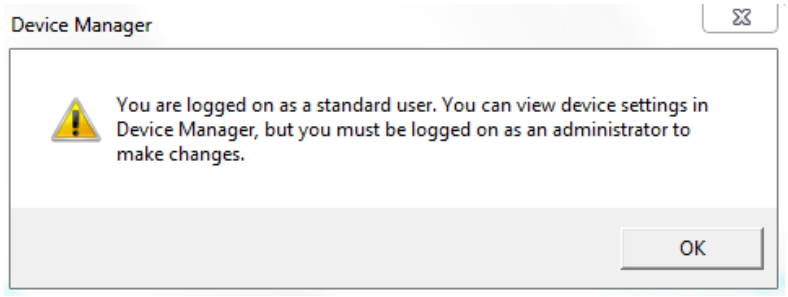
9.6 Finding the DUSTHUNTER COM port

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

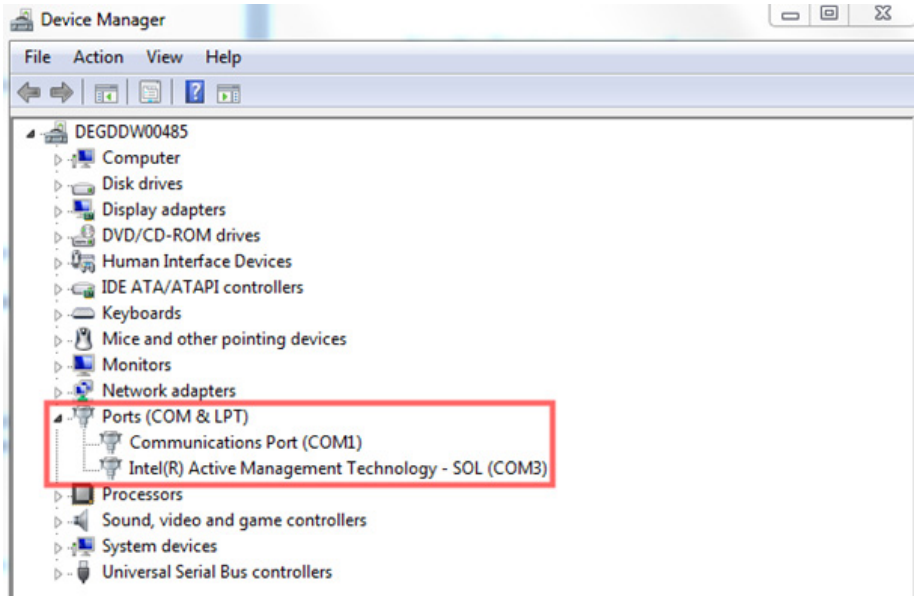
1 Disconnect the connection of the DUSTHUNTER and your PC.
2 Input: *devmgmt.msc*



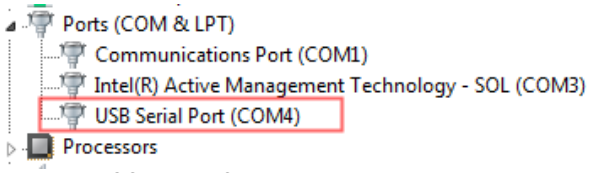
3 this message is shown:



4 “OK”
5 The Device Manager opens.
See: “Ports (COM and LPT)”



6 Connect the control unit with the computer.
A new COM port is shown.



7 Use this COM port for communication.

10 Operation

10.1 Operating concept

The control unit of the measuring system has a display with LCD display, buttons for operation and status LEDs. Alternatively, the control unit can be connected to an external device and operated via the SOPAS ET software (see “SOPAS ET”, page 68).

- 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.

NOTE:
The display can also be operated in the Ex-area.

10.2 User groups

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

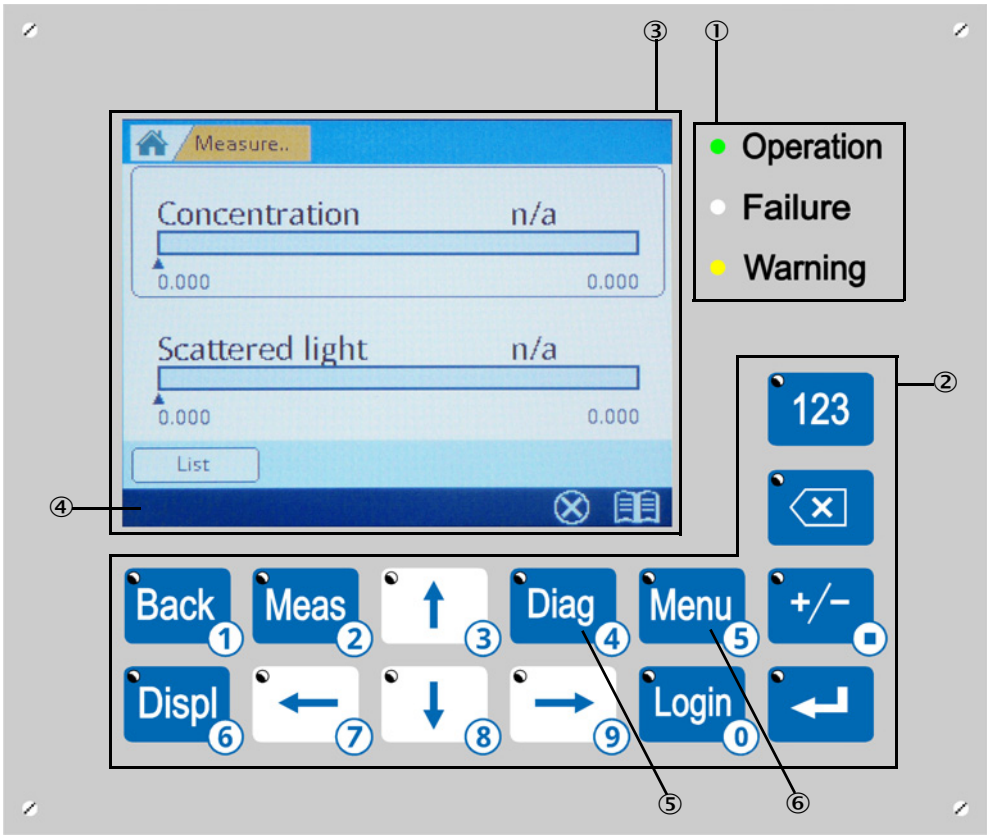
Table 23: User groups on the control unit

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).

10.2.1 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 “Changing display settings”, page 84).

10.3 MCUDH Ex-3K displays and operating elements



① Status LED
② Buttons
③ Display field
④ Status bar
⑤ Button for menu tree “Diagnosis”
⑥ Button for menu tree “Menu”

Fig. 50: Function elements, LC display, MCUDH Ex-3K control unit

10.4 MCUDH Ex-3K control unit buttons

The function shown depends on the menu currently selected. All buttons that can be selected for the respective menu are indicated by an illuminated LED.

Table 24: MCUDH Ex-3K control unit buttons

Button	Name	Function
	Login button	Displays the login.
	Back button	Returns to the previous display.
	Measured value button	Displays current measured values.
	Arrow up button	Navigates through menu items.
	Menu button	Calls up the Diagnosis menu.
	Menu button	Calls up the Settings menu.
	Display button	Calls up the display settings.
	Arrow left button	Navigates through menu items.
	Arrow down button	Navigates through menu items.
	Arrow right button	Navigates through menu items.
	Number button	Activates the numeric function of the buttons.
	Delete button	Deletes entries character by character.
	Plus-minus button	Sets plus or minus.
	Confirmation button	Confirms the entry.

10.5 MCU control unit displays and operating elements

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

Fig. 51: Functional elements LC-Display MCU control unit

11 Menus

11.1 MCU and MCUDH Ex-3K control units menu tree

The menu structure of the control units is divided into configuration functions (menu tree “Menu”) and diagnostic functions (menu tree “Diagnostics”). The respective functions can be selected directly via the buttons (depending on the version of the control unit, see “MCUDH Ex-3K displays and operating elements”, page 88 or see “MCU control unit displays and operating elements”, page 90).

11.1.1 Menu tree “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/m^3 (password required)
1.4.1.x.2	Limit high	Set limit high in mg/m^3 (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 *ConcN* *SL*	*Dust concentration in operating condition* *Dust concentration in standard condition* *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 “Calibration for dust concentration measurement”, page 82) (Requires maintenance mode condition)
2.2.1	Coeff	Set Coefficient set 0-3 (see “Defining regression coefficients”, page 76)
2.2.2	cc2	Set regression coefficients (password required)
2.2.3	cc1	Set regression coefficients (password required)
2.2.4	cc0	Set regression coefficients (password required)
2.3	Diagnosis	Display diagnosis values
2.4	Device info	Display sensor information

11.1.2 Menu tree “Diagnosis”

Menu level	Designation	Explanation
1	I/O (MCU)	Display MCU(DH Ex) error and warning messages
1.1	Error	Display MCU(DH Ex) error messages
1.2	Warnings	Display MCU(DH Ex) 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 Configuring 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 Configuring 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 87) using the control 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 87) using the operating fields and save the selected type with “Saved”.

11.2.3 Entering the regression coefficients

1 Set the sender/receiver unit to “Maintenance” (2.1) and activate submenu “I/O Parameter” (2.2).
2 Select the desired parameter and enter the password (see “User groups”, page 87) with the operating fields.
3 Enter the determined coefficient (see “Calibration for dust concentration measurement”, page 82) with the operating fields and save to the device with “Save”.

12 Maintenance

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

- Connect the control unit with the computer. Start SOPAS ET.
- Connect with the MCU(DH Ex) (see “Connecting the control unit”, page 57).
- Enter the Level 1 password (see “Password for SOPAS ET menus”, page 68).
- Set the sender/receiver unit to “Maintenance”: Click “Maintenance sensor”.

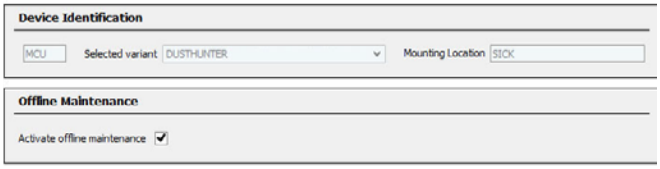


Fig. 52: SOPAS ET menu: MCU/Maintenance/Maintenance

Resuming measuring operation

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

- Maintenance” mode can also be set using the buttons on the optional control unit LC display (see “Menus”, page 91) or by connecting an external maintenance switch to the terminals for Dig In2 (17, 18) in the MCUDH Ex-3K and MCU control units (see “Processor boards connections of control units”, page 60).
- An automatic functional check is not carried out during “Maintenance”.
- The value set for “Maintenance” is output on the analog output (see “Setting the analog outputs parameters”, page 79). This is also applicable when a malfunction is present (signaled on relay output).
- The “Maintenance” mode is reset when there is a voltage failure. In this case, the measuring system switches automatically to “Measurement” after the supply voltage is switched on again. If “Maintenance” mode is set via the external maintenance switch (see top item), the mode is also maintained when there is a voltage failure.

12.1 Safety information

WARNING:
Risk of explosion during maintenance work

There is a risk of explosion during maintenance work in the Ex-zone.

- Maintenance work must only be carried out outside the Ex-zone.
- Only remove the sender/receiver unit from the duct when the surface temperature cannot be an ignition source.
- If necessary, use a gas detector to verify the explosion hazard.

DANGER:
Risk of explosion when using spare or expendable parts not approved for the Ex-area

All spare and wear parts are tested by SICK for use in the Ex-zone. The use of other spare and expendable parts will invalidate the claim against SICK because the ignition protection cannot be guaranteed.

- Use only original spare parts and expendable parts from SICK.

WARNING:
Health hazards through dangerous process residues

The device may be contaminated by dangerous process residues.

- If process gas that is harmful to health is used, purge the unit thoroughly with purge gas, if necessary clean it with water and suitable agents.

12.2 Data backup

12.2.1 Data backup in SOPAS ET

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

The following *options are available:*

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

Description, see SOPAS ET Help menu

- 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 protocol

Type of device: DH SP100
Mounting location:

Device information

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

Installation parameter

Bus adress	*1*
Measurement laser temperature	*inactiv*
Calibration coefficient for calculation of concentration	
Coefficient set	*Polynomial*
Set 0	
cc2	*0.0000*
cc1	*1.0000*
cc0	*0.0000*
Set 1 (fix)	
cc2	*0.0000*
cc1	*0.5000*
cc0	*0.0000*
Set 2 (fix)	
cc2	*0.0000*
cc1	*2.0000*
cc0	*0.0000*
Set 3 (fix)	
cc2	*0.0000*
cc1	*3.0000*
cc0	*0.0000*

Device parameter

Factory settings

Response time Sensor	*1.0*	*s*
Response time diagnosis values	*10.0*	*s*

Factory calibration settings

Gains	
AN0-AN1	*10.2000*
Relais 1	*5.7000*
Relais 2	*31.0000*
Relais 3	*700.0000*
Offsets	
AN0	*0.000450*
Relais 1	*0.000250*
Relais 2	*0.000050*
Relais 3	*0.000010*
Scattered light	
cc2	*0.0000*
cc1	*1.0000*
cc0	*0.0000*
Current laser	
cc2	*0.0000*
cc1	*30.3000*
cc0	*0.0000*
Device temperature	
cc2	*0.0000*
cc1	*100.0000*
cc0	*-275.1500*
Current motor	
cc2	*0.0000*
cc1	*2000.0000*
cc0	*-19.5000*
Power supply	
cc2	*0.0000*
cc1	*10.8000*
cc0	*0.0000*

Fig. 53: DUSTHUNTER SP100 Parameter protocol (example)

12.3 Maintenance plan

Maintenance intervals

The equipment operator must specify the maintenance intervals. The period depends on existing operating parameters such as dust content and state, gas temperature, how the equipment is run and ambient conditions.

The work to be performed by the operator and execution must be documented in a Maintenance Manual.

Maintenance contract

Scheduled maintenance work can be carried out by the equipment operator. Only qualified personnel according to Section 1 should be allowed to do the work. If desired, SICK Service or authorized Service support centers can carry out all maintenance work. Any repairs will be made by specialists on-site, whenever possible.

12.4 Consumables and spare parts

Consumables and spare parts for the measuring system are listed in the Spare parts Section (see “Spare parts”, page 133).

To facilitate device maintenance, SICK offers a set of spare and wear and tear parts. In addition to the required wear and tear parts for 5 years, this set contains a selection of small parts that may only be replaced with original parts if lost (see “Spare parts, DUSTHUNTER SP100 Ex-3K”, page 134).

12.5 Maintenance on the sender/receiver unit

Information on sender/receiver maintenance

- Commissioning and decommissioning, maintenance and cleaning may only be performed after verification that no explosive gases are present (verification by gas detector).
- Check the potential equalization for corrosion, other damage and secure contacts.
- Check lines for damage and strain relief.
- Check that the locking parts of the device are firmly locked (laser adjustment opening, cleaning opening, purge gas connection, hood, plug, sight glass).
- There is a risk of explosion when pulling the sender/receiver unit out from the duct due to the hot surface of the measuring probe and possibly escaping hot gases.
  Ensure the probe is either cold or the temperature is significantly below ignition temperature or no Ex atmosphere is present when removing the sender/receiver unit from the duct.
- Hot, aggressive or ignitable gas can escape when opening gas paths. Exercise particular caution and take the necessary safety precautions.

NOTICE:

Maintenance work

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

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

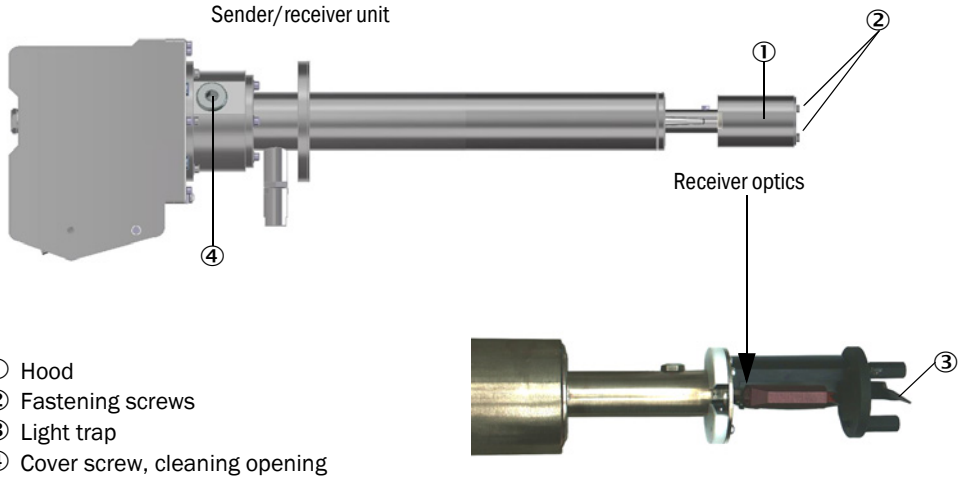
Clean the optical surfaces when deposits can be seen or before contamination reaches the limit value (30% for warning, 40% for malfunction).

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

WARNING:
Hazard through gas and hot parts
When cleaning the sender/receiver unit, toxic gases which can lead to poisoning can escape and hot parts can cause burns.
- Dismantle the sender/receiver unit from the duct for cleaning and then fit it back on again.
- Only carry out assembly work on systems with hazard potential (higher internal duct pressure, hot, aggressive, explosive gases or dusts) when the system is at a standstill.
- Take suitable protection measures against local or plant-specific hazards.

12.5.1 Cleaning the optics of the sender/receiver unit

- Remove the sender/receiver unit from the duct.
- Close off the flange with tube with a blind flange (see “Fastening technology”, page 135).
- Unscrew cover screw ④ from the cleaning opening for the sender optics (see “Replacing the seal in the cleaning opening”, page 103, steps 1 to 3).
- Loosen fastening screws ② for hood ① and remove hood.
- Clean the optics carefully with cotton swabs and, if necessary, light trap ③ as well.



① Hood
② Fastening screws
③ Light trap
④ Cover screw, cleaning opening

Fig. 54: Cleaning the optical surfaces

12.5.2 Checking the contamination value

▶ Start the function check. To do this, select device file “MCU” and move it to window “Project Tree”. Switch to directory “Adjustment / Function Check - Manual”. Click “Start Manual Function Check”.

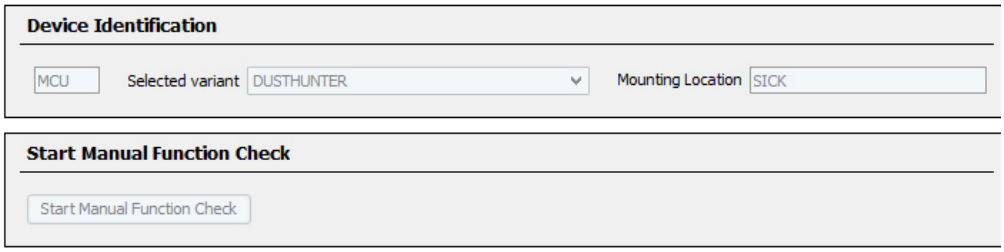


Fig. 55: SOPAS ET menu: MCU/Adjustment/Function Check - Manual

> The function check can also be started via the LC display on the MCU(DH Ex) (see “Menus”, page 91).

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

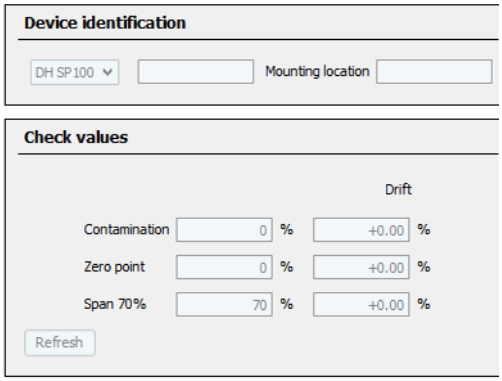


Fig. 56: SOPAS ET menu: DH SP100/Diagnosis/Check values

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

> - The contamination value can also be displayed on the LC display of the MCU(DH Ex) (initiate a function check and switch to the “SP100/Diagnosis” menu, see “Menus”, page 91).
> - The device is probably defective when the contamination value does not sink below the warning value (30%) despite several cleaning processes → contact SICK Service.

▶ Reassemble the sender/receiver unit. Remove the cover from the flange with tube (blind flange). Fit the sender/receiver unit on the duct.

▶ Resume measuring operation (see “Resuming measuring operation”, page 94).

12.5.3 Non-return valve

Make a visual check of the non-return valve at each service interval. Clean with suitable means (e.g. cotton swabs) when necessary. Replace the non-return valve with a spare part when it no longer functions (see “Spare parts, DUSTHUNTER SP100 Ex-3K”, page 134) (see “Replacing the non-return valve”, page 107).

12.5.4 Test equipment for linearity test

Measurement linearity can be checked using a linearity test. In this case, filter glasses with defined transmission values are positioned in the beam path and the values compared against those measured by the measuring system. Compliance within the allowed tolerance means the measuring system is working correctly. The filter glasses with holder required for the check are deliverable as a set including documentation and a carrying case (see “Device check accessories”, page 136). The measuring function is checked by the function check and the linearity test.

12.5.5 Power supply without control unit

Due to the regulations for explosion protection, some maintenance activities must not be carried out in the Ex-area; the sender/receiver unit must be dismantled and transported out of the Ex-area for this purpose. Observe the safety instructions in Section 2 and at the beginning of this Section before carrying out the activities. If a power supply is required for the work, you can establish this according to the following diagram. For the optional accessories see “Options for MCUDH Ex-3K control unit”, page 136.

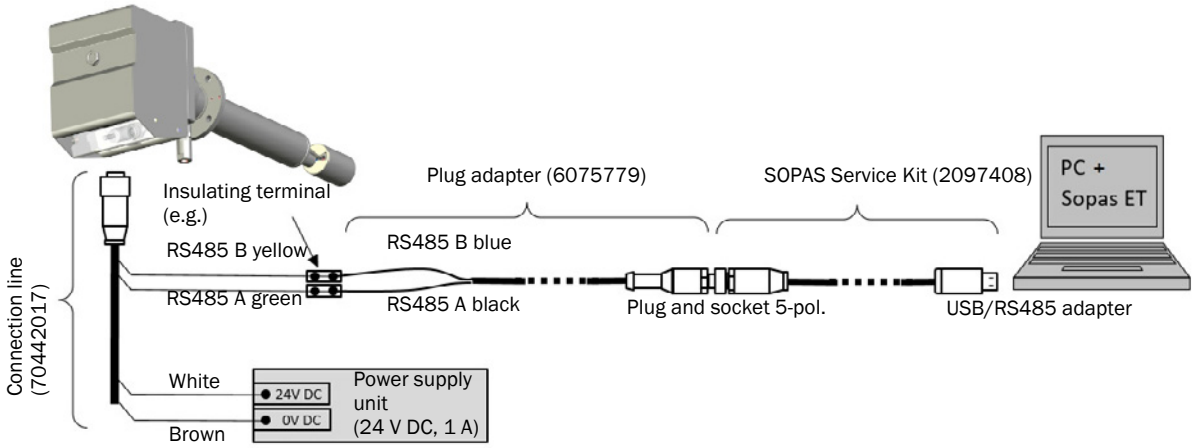
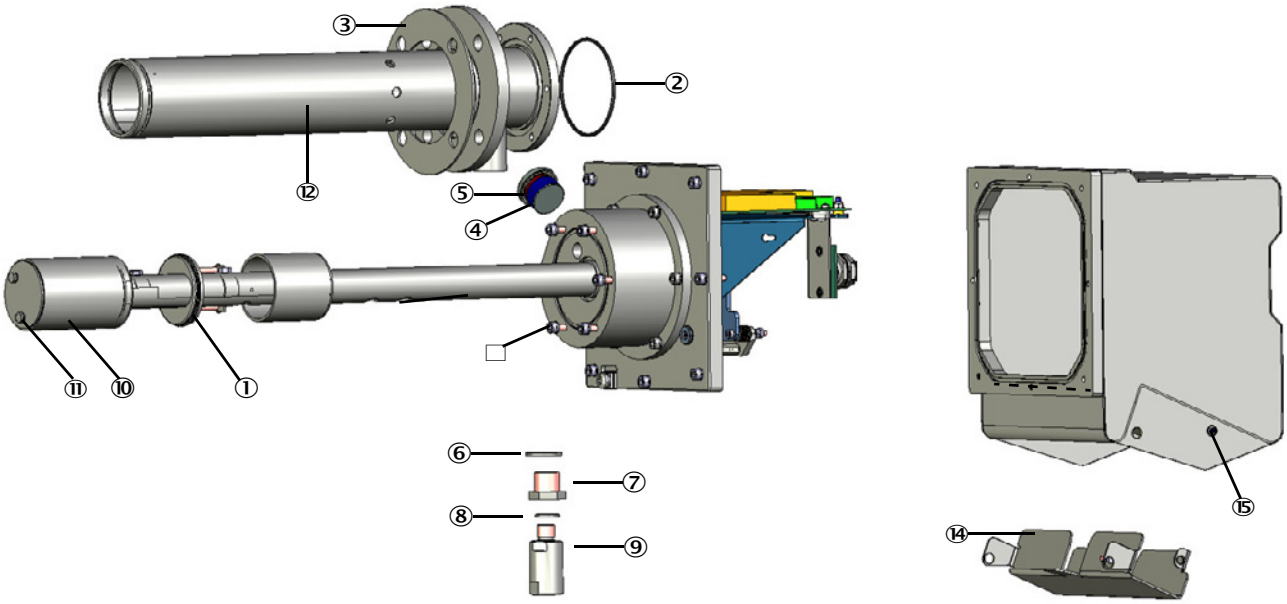


Fig. 57: Voltage supply for sender/receiver unit without the control unit

The optional power supply unit for supplying the remote modules (see “Options for MCUDH Ex-3K control unit”, page 136) can also be used to supply power to the sender/receiver unit without using the control unit.

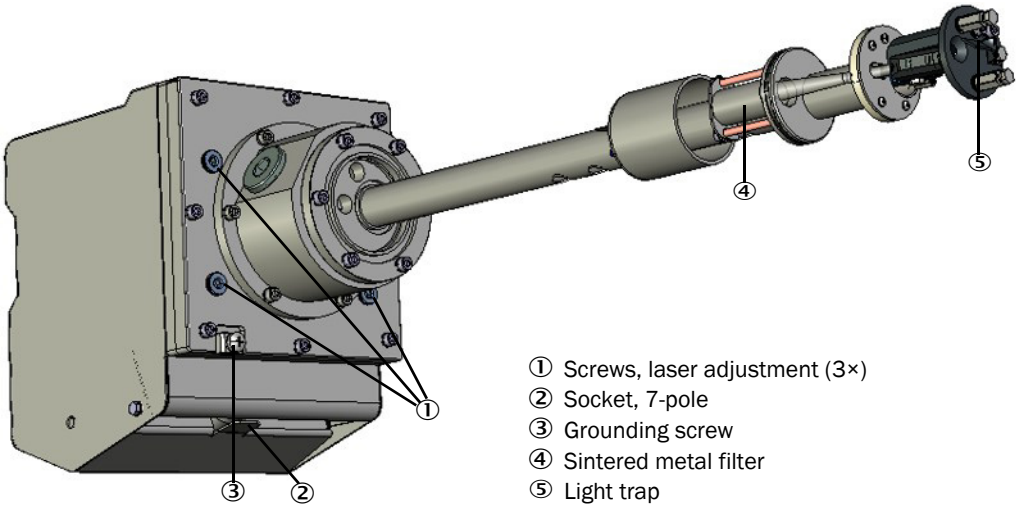
12.6 Maintenance work on the sender/receiver unit

Device views for sender/receiver unit



① O-ring, protection tube, top
② O-ring, protection tube, bottom
③ Flat seal, flange
④ Screw, cleaning opening
⑤ Seal, cleaning opening
⑥ Flat seal, reduction piece
⑦ Reduction piece
⑧ Flat seal, non-return valve
⑨ Non-return valve
⑩ Hood
⑪ Hood screw and spring washer (2×)
⑫ Protective tube
⑬ Hood screw and spring washer (6×)
⑭ Plug protection guard
⑮ Safety screw, plug protection guard

Fig. 58: Device view 1



① Screws, laser adjustment (3×)
② Socket, 7-pole
③ Grounding screw
④ Sintered metal filter
⑤ Light trap

Fig. 59: Device view 2

For an overview of available spare parts, see “Spare parts, DUSTHUNTER SP100 Ex-3K”, page 134.

12.6.1 Checking laser alignment

To be done: As required.

Ex-condition: Check must be performed outside the Ex-area.

24 V DC power supply must be available outside the Ex-area (see “Power supply without control unit”, page 100).

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Loosen the flange screws. Remove the sender/receiver unit from the duct. Allow to cool down, if necessary.
3 Switch off the purge gas supply.
4 Remove the purge gas hose.
5 Disconnect the potential equalization line.
6 Disconnect the connection plug, for this purpose release the plug protection guard (see “Connection line and plug protection guard.”, page 32).
7 Move the sender/receiver unit out of the Ex-zone into a safe area.
8 Place the enclosure rear side of the sender/receiver unit on a flat surface.
9 Loosen both screws (see Fig. 58 ⑪) (SW 7) of the hood (see Fig. 58 ⑩).
10 Remove the hood.
11 Connect and switch the sender/receiver unit power supply on.
12 Check the alignment of the light trap with a suitable object or finger, as shown in the following Figure, the laser must be exactly in the middle.
13 If necessary, adjust the alignment (see “Setting the laser alignment”, page 118).
14 Disconnect the sender/receiver unit from the power supply.
15 Refit the probe protection tube. Fasten with the six protection tube screws (torque 5 Nm).
16 Fit the cover and tighten the screws (2 Nm).
17 Bring the sender/receiver unit to the measuring location.
18 Connect the potential equalization line.
19 Fit the purge gas hose and switch on the purge gas supply.
20 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
21 Insert the connector plug and secure with the plug protection guard (see “Connection line and plug protection guard.”, page 32).
22 Put the complete device back into operation (switch on voltage and check measured and status values).

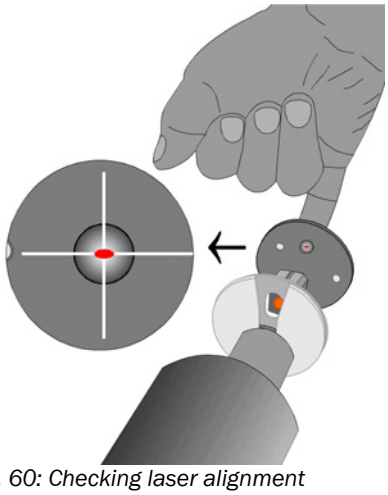


Fig. 60: Checking laser alignment

12.6.2 Replacing the protection tube O-ring

Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws. Remove the sender/receiver unit from the duct. If necessary, allow to cool down.
4 Place the enclosure rear side of the sender/receiver unit on a flat surface.
5 Switch off the purge gas supply.
6 Loosen both screws (see Fig. 58 ⑪) (SW 7) of the hood (see Fig. 58 ⑩). Remove the hood.
7 Loosen the six protection tube screws (see Fig. 58 ⑬). Turn the protection tube lightly and pull it off upwards.
8 Position a suitable tool (e.g. small screwdriver) under the “top” O-ring (see Fig. 58 ①). Remove it from the groove - lightly rub the new O-ring with silicone grease. Put this back in the groove.
9 Position a suitable tool (e.g. small screwdriver) under the “bottom” O-ring (see Fig. 58 ②). Remove it from the groove - lightly rub the new O-ring with silicone grease and lay it in the groove.
10 Refit the probe protection tube. Fasten with the six protection tube screws (torque 5 Nm).
11 Replace the hood and fasten it again with the two screws (torque 2 Nm)
12 Switch on the purge gas supply.
13 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
14 Connect the potential equalization line.
15 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.3 Replacing the seal in the cleaning opening

Replacement criterion: As required (manufacturer recommendation).

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Using an Allen key (SW 12), unscrew screw (see Fig. 58 ④) on the cleaning opening in an anti-clockwise direction (caution: Hot, aggressive and explosive gases may escape; the measuring probe may be hot).
4 Replace old sealing ring (see Fig. 58 ⑤) with a new one.
5 Retighten the screw (torque 30 Nm).
6 Connect the potential equalization line.
7 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.4 Replacing the sinter filter

Replacement criterion: Every 2 years (manufacturer's recommendation).

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Unscrew the flange screws and remove the sender/receiver unit from the duct (caution: hot, aggressive and explosive gases may escape; the measuring probe may be hot) and allow it to cool down if necessary.
4 Place the enclosure rear side of the sender/receiver unit on a flat surface.
5 Switch off purge gas supply, if necessary.
6 Loosen both screws (see Fig. 58 ⑪) (SW 7) of hood (see Fig. 58 ⑩). Remove the hood.
7 Loosen the four protection tube screws (see Fig. 58 ⑬). Turn the protection tube lightly and pull it off upwards.
8 Loosen the two fixing screws and replace sinter filter (see Fig. 59 ④).
9 Slightly tighten the fixing screws again.
10 Visually inspect O-rings (see Fig. 58 ①,②) at this opportunity and replace if there is any visible wear or damage (see “Replacing the protection tube O-ring”, page 103).
11 Refit the probe protection tube. Fasten with the six protection tube screws (torque 5 Nm).
12 Replace the hood and fasten it again with the two screws (torque 2 Nm)
13 Switch on the purge gas supply.
14 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
15 Connect the potential equalization line.
16 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.5 Replacing the flange seal

Replacement criterion: Every 2 years (manufacturer's recommendation).

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws and remove the sender/receiver unit from the duct and allow it to cool down, if necessary.
4 Replace the old flange seal with a new one (see Fig. 58 ④).
5 Fit the sender/receiver unit back on the duct flange (torque 20 Nm).
6 Connect the potential equalization line.
7 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.6 Replacing the potential equalization screw

Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws and remove the sender/receiver unit from the duct and allow it to cool down, if necessary.
4 Loosen potential equalization screw (see Fig. 59 ③) and replace all parts of the set with new ones.
5 Fit the sender/receiver unit back on the duct flange (torque 20 Nm).
6 Connect the potential equalization line.
7 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.7 Replacing the protection tube

Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws. Remove the sender/receiver unit from the duct. Allow to cool down, if necessary.
4 Place the enclosure rear side of the sender/receiver unit on a flat surface.
5 Switch off purge gas supply, if necessary.
6 Loosen both screws (see Fig. 58 ⑪) (SW 7) of the hood (see Fig. 58 ⑩). Remove the hood.
7 Loosen the six protection tube screws (see Fig. 58 ⑬). Turn the protection tube lightly and pull it off upwards.
8 Visually inspect O-rings (see Fig. 58 ①,②) at this opportunity and replace if there is any visible wear or damage (see “Replacing the protection tube O-ring”, page 103).
9 Fit a new probe protection tube. Fasten with the six protection tube screws (torque 5 Nm).
10 Replace the hood and fasten it again with the two screws (torque 2 Nm)
11 Switch on the purge gas supply.
12 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
13 Connect the potential equalization line.
14 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.8 Replacing the hood

Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of a potentially explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws. Remove the sender/receiver unit from the duct. Allow to cool down, if necessary.
4 Place the enclosure rear side of the sender/receiver unit on a flat surface.
5 Switch off purge gas supply, if necessary.
6 Loosen both screws (see Fig. 58 ⑪) (SW 7) of the hood (see Fig. 58 ⑩). Remove the hood.
7 Fit the new hood and fasten it again with the two screws (torque 2 Nm)
8 Switch on the purge gas supply.
9 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
10 Connect the potential equalization line.
11 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.9 Replacing the copper seal of the non-return valve

Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Note: Depending on the design conditions on site, the seals can be replaced without removing the sender/receiver unit from the duct. In this case, work steps 2, 3, 4, 11 and 12 are not necessary.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws and remove the sender/receiver unit from the duct and allow it to cool down, if necessary.
4 Place the enclosure rear side of the sender/receiver unit on a flat surface.
5 Switch off the purge gas supply.
6 Detach the purge air hose from the non-return valve.
7 Unscrew the non-return valve with a wrench (SW 22), then unscrew the reduction piece (SW 24) and separate these components if necessary.
8 Screw reduction piece (see Fig. 58 ⑦) back in with new seal (see Fig. 58 ⑥) and, whilst centering the sealing ring at the same time, tighten with 30 Nm..
9 Screw in the non-return valve (see Fig. 58 ⑨) with new seal (see Fig. 58 ⑧) and tighten with 20 Nm.
10 Fit the purge gas hose and switch on the purge gas supply.
11 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
12 Connect the potential equalization line.
13 Put the complete device back into operation (switch on voltage and check measured and status values).

12.6.10 Replacing the non-return valve

Replacement criterion:	In case of damage.
Ex-condition:	Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.
Note	Depending on the design conditions on site, the seals can be replaced without removing the sender/receiver unit from the duct. In this case, work steps 2, 3, 4, 10 and 11 are not necessary.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Disconnect the potential equalization line, if necessary.
3 Loosen the flange screws and remove the sender/receiver unit from the duct and allow it to cool down, if necessary.
4 Place the enclosure rear side of the sender/receiver unit on a flat surface.
5 Switch off the purge gas supply.
6 Detach the purge air hose from the non-return valve.
7 Unscrew the non-return valve (SW 22) while holding the reduction piece with a wrench (SW 24).
8 Screw in the non-return valve (see Fig. 58 ⑨) with new seal (see Fig. 58 ⑧) and tighten with 20 Nm.
9 Fit the purge gas hose and switch on the purge gas supply.
10 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
11 Connect the potential equalization line.
12 Put the complete device back into operation (switch on voltage and check measured and status values).

12.7 Maintenance activities for MCUDH Ex control unit

12.7.1 Replacing the button cell in the control unit

WARNING:
Risk of explosion when using an unspecified button cell
There is a risk of explosion when a different type of button cell is used.
- ▶ Only use button cell type BR1632A with adapter ring (see “Consumable parts, MCUDH Ex-3K / MCU control unit”, page 133).

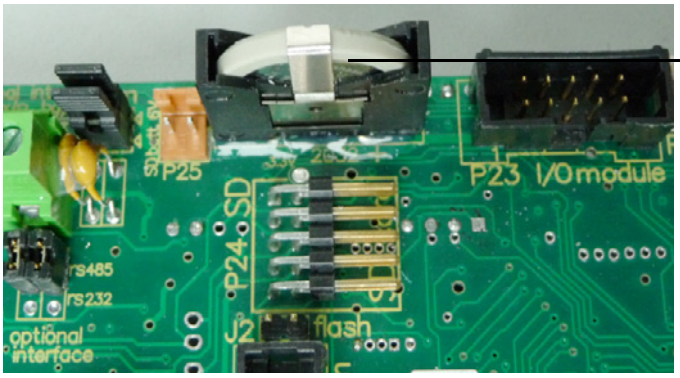
Replacement criterion: As required.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Take suitable measures to prevent dust from entering the control unit enclosure when the door is open.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Make sure that the environment allows the door of the control unit to be opened and open it after the waiting time has elapsed.
3 Remove the old button cell on the circuit board. Insert a new button cell with adapter ring ① into the holder. Observe the installation direction of the button cell. The circuit board is marked accordingly at this point.
4 Close the control unit door again.
5 Put the complete device back into operation (switch on voltage and check measured and status values, set date and time).



① Button cell of the MCUDH Ex-3K control unit

Fig. 61: Replacing the MCUDH Ex-3K button cell

12.7.2 Replacing the Ex power supply unit

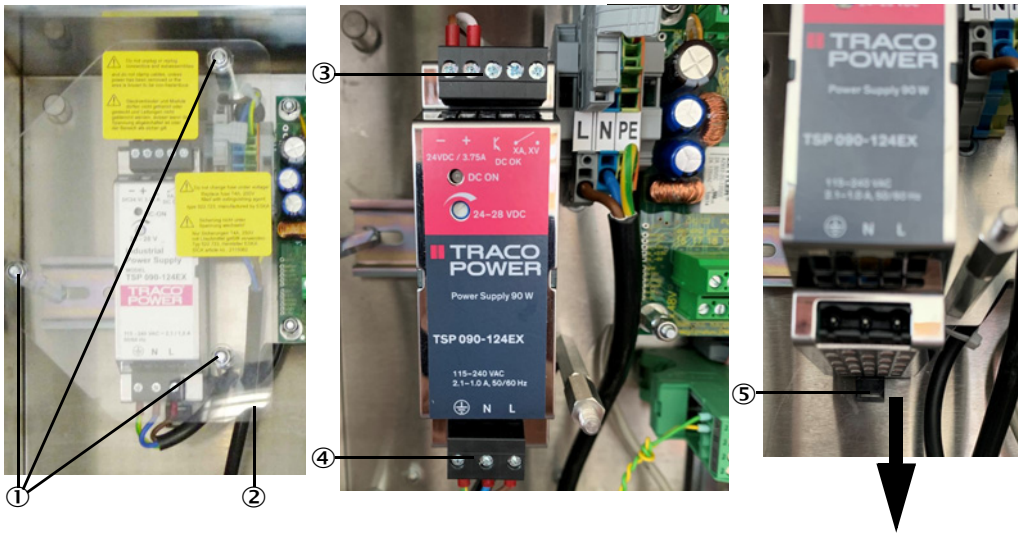
Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Take suitable measures to prevent dust from entering the control unit enclosure when the door is open.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Make sure that the environment allows the door of the control unit to be opened and open it after the waiting time has elapsed.
3 Open the MCUDH with the control cabinet key.
4 Loosen three nuts (①) and remove transparent protective cover (②).
5 Disconnect power plug (③) and DC plug (④) from the power supply unit.
6 Use a screwdriver to unlock hat rail lock ⑤ of the power supply unit (pull the black plastic latch downwards) and remove the power supply unit from the hat rail.
7 Plug the new power supply unit onto the hat rail.
8 Connect power plug (③) and DC plug (④) to the power supply unit.
9 Place protective cover ② on the three stud bolts and fasten it again with nuts ①.
10 Close the MCUDH Ex-3K with the control cabinet key.
11 Put the complete device back into operation (switch on voltage and check measured and status values).



① Nuts, protective cover
② Protective cover (transparent)
③ Power plug
④ DC plug
⑤ Hat rail lock

Fig. 62: Replacing the MCUDH Ex-3K power supply unit

12.7.3 Replacing the RS485 Interface module

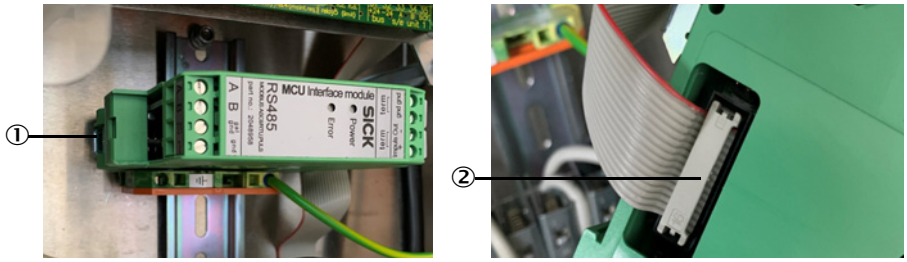
Replacement criterion: In case of damage.

Ex-condition: Replacement can be carried out in the Ex-area when the absence of an explosive atmosphere has been verified with a gas warning device.

Take suitable measures to prevent dust from entering the control unit enclosure when the door is open.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Make sure that the environment allows the door of the control unit to be opened and open it after the waiting time has elapsed.
3 Open the MCUDH Ex-3K with the control cabinet key.
4 Loosen the connecting wires on the Interface module.
5 Use a screwdriver to unlock hat rail lock (①) of the power supply unit and remove the module. Note how the ribbon cable is laid on the module.
6 Disconnect ribbon cable connector (②).
7 Connect ribbon cable connector (②) to the new Interface module.
8 Plug the new power supply unit onto the hat rail.
9 Connect the connecting wires to the new module.
10 Close the MCUDH Ex-3K with the control cabinet key.
11 Put the complete device back into operation (switch on voltage and check measured and status values).



① Hat rail lock
② Ribbon cable connector

Fig. 63: Replacing the MCUDH Ex-3K Interface module

12.8 MCU control unit maintenance work

12.8.1 Replacing the button cell in the control unit

Replacement criterion: As required.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Open the MCU with the control cabinet key.
3 Remove the old button cell ① into the holder. Observe the installation direction of the button cell. The circuit board is marked accordingly at this point.
4 Put the complete device back into operation (switch on voltage and check measured and status values, set date and time).

① Button cell of the MCU control unit

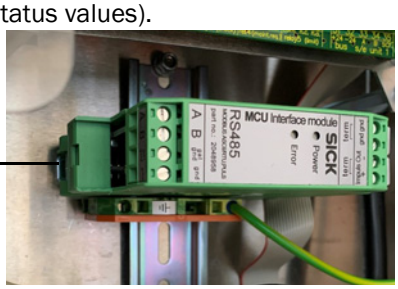
Fig. 64: Replacing the MCU button cell

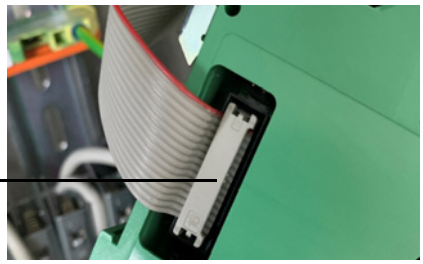
12.8.2 Replacing the Interface module

Replacement criterion: In case of damage.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Open the MCU with the control cabinet key.
3 Loosen the connecting wires on the Interface module.
4 Use a screwdriver to unlock hat rail lock (①) of the power supply unit and remove the module. Note how the ribbon cable is laid on the module.
5 Disconnect ribbon cable connector (②).
6 Connect ribbon cable connector (②) to the new Interface module.
7 Plug the new power supply unit onto the hat rail.
8 Connect the connecting wires to the new module.
9 Lock the MCU with the control cabinet key.
10 Put the complete device back into operation (switch on voltage and check measured and status values).





① Hat rail lock
② Ribbon cable connector

Fig. 65: Replacing the MCU Interface module

13 Troubleshooting

13.1 Safety information

WARNING:
Danger to health from gas and hot parts when working on the unit
When clearing malfunctions on the sender/receiver unit, toxic gases which can lead to poisoning,can escape and hot parts can cause burns.
- For work on the device, remove the sender/receiver unit from the duct and fit it back on after the work is completed.
- Observe the relevant safety regulations as well as the safety notices (see “Responsibility of user”, page 19) during all work.
- Only carry out assembly work on systems with hazard potential (higher internal duct pressure, hot, aggressive, explosive gases or dusts) when the system is at a standstill.

WARNING:
Risk of explosion due to removal of hot parts from the duct
There is a risk of explosion when pulling the sender/receiver unit out from the duct due to the hot surface of the measuring probe and possibly escaping hot gases.
- Take suitable protection measures against local or plant-specific hazards.

WARNING:
There is a risk of explosion when the enclosure is opened in a potentially explosive environment
- The sender/receiver unit enclosure may only be opened by SICK Service.

13.2 Monitoring and diagnostic system

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

Messages for the two system components are categorized into error 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.
- Observance and clearance of the cause(s), e.g., through maintenance measures, are necessary to prevent subsequent errors or device damage

Significance of malfunction messages

- Measuring operation is no longer possible or no longer reliable.

“Diagnosis / Error messages/warnings” provides detailed information on the current device state. To display, connect the measuring system 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 corrections under “Help” (see “Warning and malfunction messages in SOPAS ET”, page 115).

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

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

13.3 Status display LEDs

Warning or error messages are output as follows:

- The respective relay on the control unit triggers (see “Connection overview”, page 54).
- “Maintenance requ.” or “Failure” is displayed in the status bar of the LC display of the control unit (see “Operation”, page 87). 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 SP100 Ex”).

Status display significance

Three LEDs next to the control unit display of the control unit indicate the operating state of the device.

Table 25: *MCUDH Ex control unit operating state*

LED	Color	Significance
Operation	Green	Measuring operation
Warning	Yellow	Warning message
Failure	Red	Function fault

Table 26: *MCU control unit operating state*

LED	Color	Significance
Power	Green	Measuring operation
Failure	Yellow	Warning message
Maintenance	Red	Function fault

13.4 Sender/receiver unit malfunctions

13.4.1 Malfunctions

Table 27: Sender/receiver unit malfunctions

Malfunction	Possible cause	Action
• LEDs of the sender/receiver unit are not on • No laser beam	• No supply voltage • Connection line not connected correctly or defective • Defective plug connector	▶ Check plug connectors and lines. ▶ Contact SICK Service.

13.4.2 Warning and malfunction messages

Malfunctions listed below can probably be cleared onsite.

Table 28: Sender/receiver unit malfunctions that can be cleared

Message	Significance	Possible cause	Action
Contamination	Contamination of optical surfaces too high (see “Technical data”, page 124).	• Deposits on the optical surfaces • Unclean purge gas • Incorrect laser alignment	▶ Clean optical surfaces (see “Maintenance on the sender/receiver unit”, page 97). ▶ Check laser alignment (see “Checking laser alignment”, page 102). ▶ Contact SICK Service.
Span test, Zero point	Deviation from nominal value > ±2%.	• Sudden change of measuring conditions during control value determination	▶ Repeat the functional check. ▶ Contact SICK Service.

Warning and malfunction messages in SOPAS ET

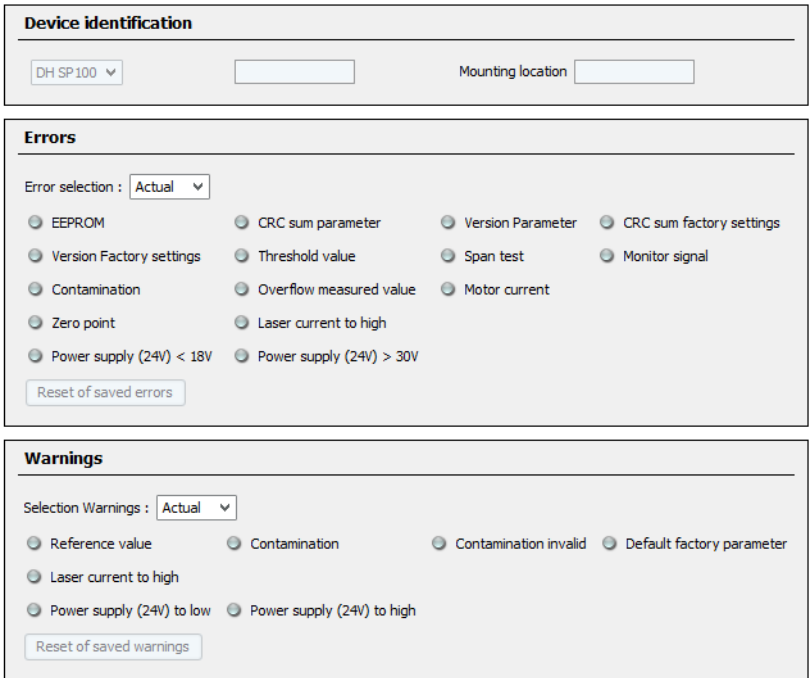


Fig. 66: SOPAS ET menu: DH SP100/Diagnosis/Error messages/Warnings

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

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

13.5 Control unit malfunctions

13.5.1 Malfunctions

Table 29: Control unit malfunctions

Malfunction	Possible cause	Action
No display on the LC display	• No supply voltage • Connection line to display not connected or damaged • Defective fuse	▶ Check voltage supply. ▶ Check connection line. ▶ Replace fuse. ▶ Contact SICK Service.

13.5.2 Warning and malfunction messages

Malfunctions listed below can probably be cleared onsite.

Table 30: Control unit malfunctions that can be cleared

Message	Significance	Possible cause	Action
AO configuration	The number of available and configured analog outputs is not identical.	• No parameters set for AO • Connection error • Module failure	▶ Check configuration (see “Setting the analog outputs parameters”, page 79). ▶ Contact SICK Service.
AI configuration	Number of available and configured analog inputs not identical.	• No parameters set for AI • Connection error • Module failure	▶ Check configuration (see “Setting the analog inputs parameters”, page 81). ▶ Contact SICK Service.
Interface module	No communication via the Interface module.	• No parameters set for module • Connection error • Module failure	▶ Check configuration (see “Connecting to the MCUDH Ex-3K control unit”, page 69) or (see “Connecting to the MCU control unit”, page 72). ▶ Contact SICK Service.
No sensor found	Sender/receiver unit not recognized	• Communication problems on RS485 line • Supply voltage problems	▶ Check system settings. ▶ Check connection line. ▶ Check voltage supply. ▶ Contact SICK Service.
Variant configuration error	MCU setting does not match the connected sensor.	Sensor type has been changed	▶ Correct application settings (see “Assigning the control unit to the sender/receiver unit”, page 76).
Test mode enabled	MCU(DH Ex) in Test mode.		▶ Deactivate “System Test” mode (“Maintenance” directory)

Warning and malfunction messages in SOPAS ET

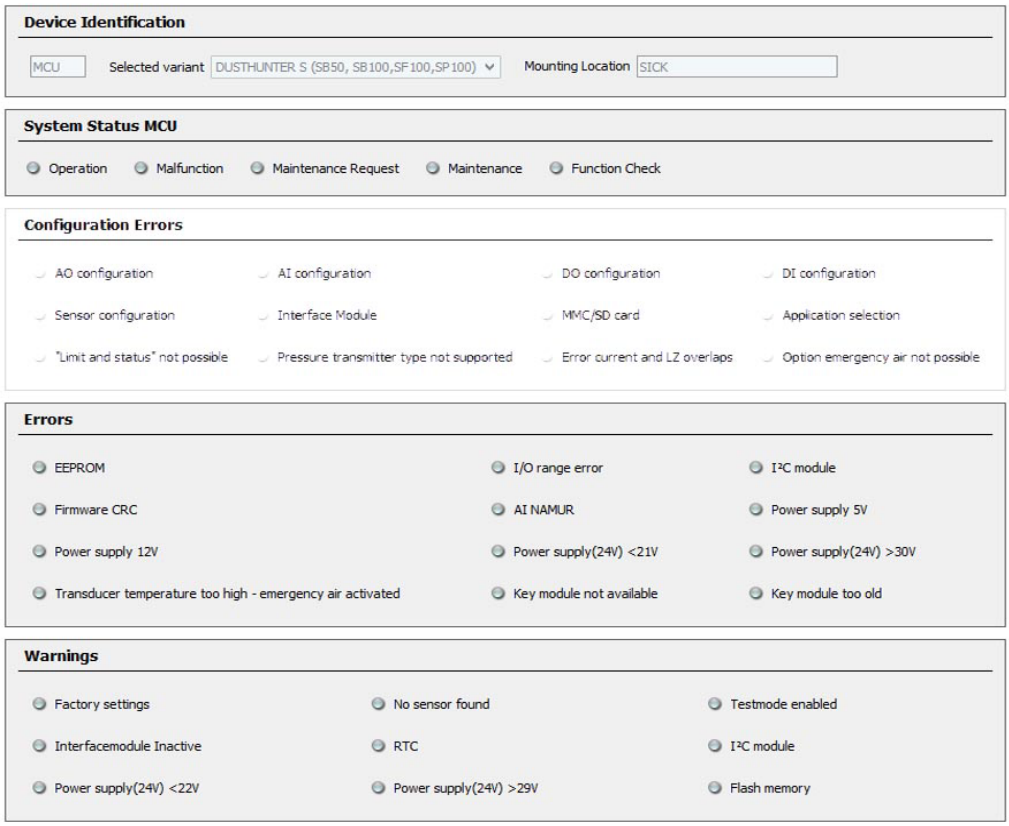


Fig. 67: SOPAS ET menu: MCU/Diagnosis/Error messages/Warnings

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

13.6 Control unit troubleshooting measures

13.6.1 Setting the laser alignment

In case the laser is no longer correctly aligned when checking the laser alignment (see “Checking laser alignment”, page 102), adjust the laser alignment anew.

To be done: As required.

Ex-condition: Check must be performed outside the Ex-area.

24 V DC power supply must be available outside the Ex-area (see “Power supply without control unit”, page 100).

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Loosen the flange screws. Remove the sender/receiver unit from the duct. If necessary, allow to cool down.
3 Switch off the purge gas supply.
4 Remove the purge gas hose.
5 Disconnect the potential equalization line.
6 Disconnect the connection plug, for this purpose release the plug protection guard (see “Connection line and plug protection guard.”, page 32).
7 Move the sender/receiver unit out of the Ex-zone into a safe area.
8 Place the enclosure rear side of the sender/receiver unit on a flat surface.
9 Loosen both screws (see Fig. 58, page 101 ⑪) (SW 7) of the hood (see Fig. 58 ⑩).
10 Remove the hood.
11 Loosen the six protection tube screws (see Fig. 58 ⑬). Turn the protection tube lightly and pull it off upwards.
12 Visually inspect O-rings (see Fig. 58 ①,②) at this opportunity and replace if there is any visible wear or damage (see “Replacing the protection tube O-ring”, page 103).
13 Connect and switch the sender/receiver unit power supply on.
14 Tighten or loosen the laser alignment adjustment screws (see Fig. 59, page 101 ①), and check the alignment (see “Checking laser alignment”, page 102) until the alignment is correct.
15 Disconnect power supply.
16 Refit the probe protection tube. Fasten with the six protection tube screws (torque 5 Nm).
17 Fit the cover and tighten the screws (2 Nm).
18 Bring the sender/receiver unit to the measuring location.
19 Connect the potential equalization line.
20 Fit the purge gas hose and switch on the purge gas supply.
21 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
22 Insert the connector plug and secure with the plug protection guard (see “Connection line and plug protection guard.”, page 32).
23 Put the complete device back into operation (switch on voltage and check measured and status values).

13.6.2 Checking the laser beam for free passage

The laser beam must pass centrically through the aperture plate, readjust the aperture plate when this is not the case with a correctly adjusted laser.

Criterion: As required

Ex-condition: Checking and setting the aperture plate can be carried out in the Ex-area when the purge gas supply and potential equalization remain connected and the absence of a potentially explosive atmosphere has been verified with a gas warning device.

Work steps:

1 Disconnect the entire device (control unit and sender/receiver unit) from the power supply.
2 Loosen the flange screws. Remove the sender/receiver unit from the duct. If necessary, allow to cool down.
3 Place the enclosure rear side of the sender/receiver unit on a flat surface.
4 Loosen both screws (see Fig. 58, page 101 ⑪) (SW 7) of the hood (see Fig. 58 ⑩).
5 Remove the hood.
6 Loosen the six protection tube screws (see Fig. 58 ⑬). Turn the protection tube lightly and pull it off upwards.
7 Visually inspect O-rings (see Fig. 58 ①,②) at this opportunity and replace if there is any visible wear or damage (see “Replacing the protection tube O-ring”, page 103).
8 Check the beam transmission as shown in the Figure (see “Checking the beam path”, page 119).
9 Readjust the aperture plate when necessary.
10 Remove existing deposits in the beam path on the aperture opening, the sintered metal filter and on the outlet openings of the purge gas.
11 Refit the probe protection tube (torque 5 Nm).
12 Replace the cover and fasten it again (torque 2 Nm).
13 Switch on the purge gas supply.
14 Fit the sender/receiver unit on the duct flange (torque 20 Nm).
15 Connect the potential equalization line.
16 Put the complete device back into operation (switch on voltage and check measured and status values).

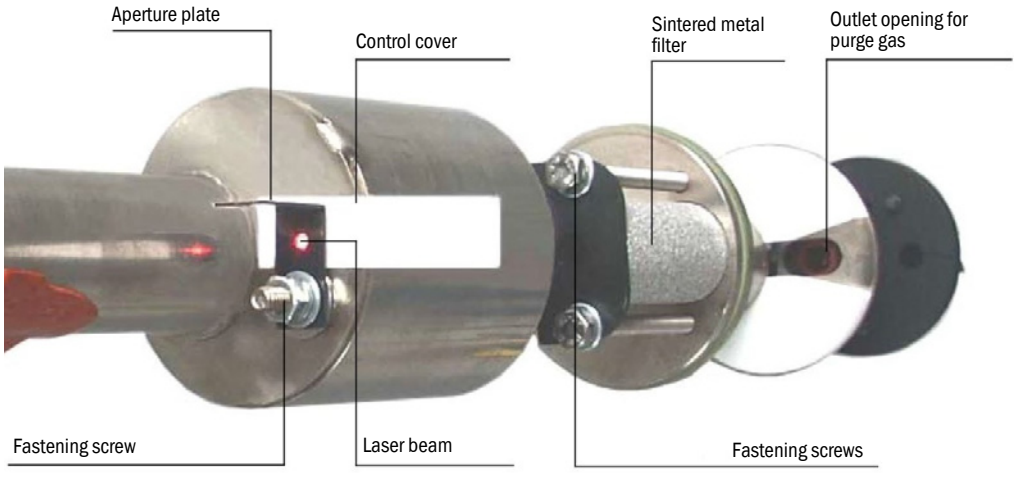


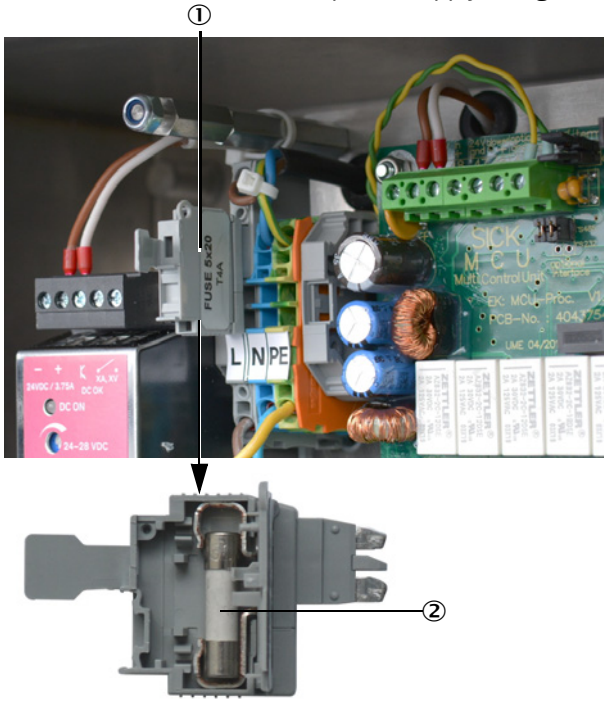
Fig. 68: Checking the beam path

13.7 MCUDH Ex control unit troubleshooting measures

13.7.1 Replacing the fuse

WARNING:
Risk of explosion when using an unspecified fuse
There is a risk of explosion when a different type of fuse is used.
▶ Only use fuses of type 522.723 from Eska.

1 Disconnect the control unit from the power supply and observe the waiting time before opening the door.
2 Take suitable precautions to prevent dust from entering the enclosure.
3 Open the control unit door. Remove fuse holder (1) and open.
4 Remove the transparent fuse cover.
5 Replace defective fuse (2) (see “Other accessories”, page 136).
6 Close and attach the fuse holder.
7 Close the door. Switch the power supply on again.



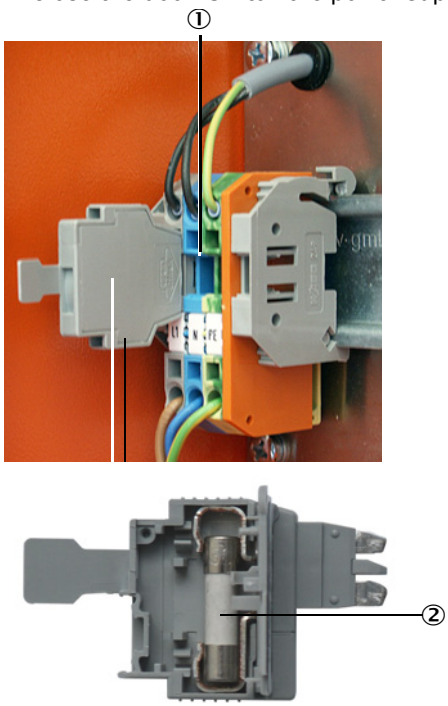
① Fuse holder
② Fuse

Fig. 69: Replacing the MCUDH Ex fuse (shown with fuse cover removed)

13.8 MCU control unit troubleshooting measures

13.8.1 Replacing the fuse

1 Disconnect the control unit from the power supply and observe the waiting time before opening the door.
2 Take suitable precautions to prevent dust from entering the enclosure.
3 Open the control unit door. Remove fuse holder (1) and open.
4 Remove the transparent fuse cover.
5 Replace defective fuse (2) (see “Other accessories”, page 136).
6 Close and attach the fuse holder.
7 Close the door. Switch the power supply on again.



① Fuse holder
② Fuse

Fig. 70: Replacing the MCU fuse (shown with fuse cover removed)

13.9 Sending in devices

Information on sending a device to the factory for inspection or repair, see “Return delivery”, page 123.

14 Decommissioning

14.1 Switch-off states

The measuring system must be decommissioned:

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

NOTICE:
Purge gas supply
An interruption in the purge gas supply to a duct-mounted sender/receiver unit can damage the device.
▶ Never switch off or interrupt the purge gas supply when the sender/receiver unit is fitted on the duct.

Information on transport and storage of the device components: see “Transport and storage”, page 47.

14.2 Switching off and dismantling

WARNING:
Connect potential equalization when working on the measuring system
Static charge can lead to explosions.
▶ Connect the potential equalization as first task during assembly and as last task during disassembly.

Work to be performed

▶ Disconnect the connection line to the control unit.
▶ Dismantle the sender/receiver unit from the duct.

WARNING:
Danger to health through gas and hot parts when the device is removed from the duct
▶ Only remove the sender/receiver unit on systems with hazard potential (higher internal duct pressure, hot, aggressive, explosive gases/dusts) when the system is at a standstill.
▶ Take suitable protection measures against local or plant-specific hazards.
▶ Secure switches that should not be switched on again for safety reasons with signs and safeguards to prevent unintentional switching.

▶ Close off the flange with tube with a blind flange (see “Fastening technology”, page 135).
▶ Switch off the purge gas supply.
▶ Unscrew the purge gas hose from the connections.
▶ Disconnect the control unit from the supply voltage.
▶ Disconnect the potential equalization.

14.3 Return delivery

Before shipping:

- ▶ Contact your local SICK representative. The addresses are on the back cover of the Operating Instructions.
- ▶ The SICK 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 SICK:
  - Repair flat rates.
  - Arrangements for packaging and transport (see “Transport and storage”, page 47).
  - Replacement devices or putting the device back into operation by SICK Service.

Preparatory work

- ▶ Clean all device components. Remove any residues that are potentially hazardous to health.
- ▶ Complete the Return Form.
- ▶ Observe the transport instructions (see “Transport”, page 47).

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 subassemblies containing residual substances harmful to the environment
The following subassemblies could contain substances that have to be disposed of separately:
- Electronics: capacitors, rechargeable batteries, batteries.
- Display: Liquid contained in the LC display.
- All parts in contact with the sample gas can be contaminated with harmful substances.

15 Technical data

DUSTHUNTER SP100 Ex-3K system (Zone 2/22)

Table 31: Technical data, complete system

Measured variable	Scattered light intensity (dust concentration output in mg/m³ after gravimetric comparison measurement)
Measuring principle	Scattered light measurement (forward dispersion)
Spectral range	640 nm ... 660 nm Laser, protection class 2, capacity <1 mW
Measuring range (freely adjustable) Dust concentration	0 ... 5 mg / m³ /0 ... 500 mg/m³ Higher measuring ranges on request
Certified measuring ranges Dust concentration	0...7.5 mg/m³ (additional measuring ranges 0...10, 0...15, 0...50, 0...100, 0...200, 0...500 mg/m³)
Response time (t90)	1 ... 600 seconds Freely adjustable
Precision	≤2% of measuring range end value
Process temperature Standard version DHSP-T2xxxxEx3K High temperature version DHSP-T4xxxxEx3K	 -15 °C ... +220 °C -15 °C ... +400 °C
Process pressure With instrument air (from customer)	 -100 hPa ... +100 hPa (rel)
Process gas moisture	Non-condensing
Internal duct diameter	≥ 0.25 m
Compliances	Approved for systems requiring approval: 2001/80 /EC (13. BImSchV) 2000/76/EC (17. BImSchV) 27. BImSchV TI-Air EN 15267 EN 14181 2010/75/EU 2014/34/EU 2014/30/EU U.S. EPA PS-11 compliant
Electrical safety	CE
Control functions	Automatic self-test (linearity, contamination, drift, aging) Contamination limits: At 30% warning, at 40% malfunction Manual linearity test via reference filter

DHSP-TxxxxEx-3K sender/receiver unit (Zone 2/22)

Table 32: Technical data, sender/receiver unit DUSTHUNTER SP100 Ex-3K

Ambient temperature	-15 °C ... +60 °C
Ex approvals	
ATEX	II 3G Ex nR op is IIC T6 Gc II 3D Ex tc op is IIIC T85 °C Dc
Protection class	IP66
Weight	
Nominal length 435 mm	≤ 14.2 kg
Nominal length 735 mm	≤ 15.2 kg
Power supply	
Voltage	24 V
Power consumption	≤ 4 W
Protection class	III

Connection line with connector plug

Table 33: Technical data, connection line

Temperature range	
Movable	-5 °C ... +70 °C
Fixed installation	-40 °C ... +80 °C
Minimum bending radius	
Movable	15 × line diameter
Fixed installation	6 × line diameter
Available lengths	5 m / 10 m / 25 m / 50 m / 100 m Other lengths on request
Line type	Lappkabel, Unitronic Li2YCY v (TP) 2 mm^2×2 mm^2×0.5 mm^2
Burning behavior	Flame-retardant acc. to IEC 60332-1-2

Conventional MCU control unit

Table 34: Technical data, MCU control unit

Description	Unit to control system components, and evaluate and output the data you provide
Ambient temperature	-40 °C ... +60 °C
Protection class	IP65
Analog outputs	1 output 0/2/4 ... 20 mA, 750 Ω Galvanically isolated
Analog inputs	2 inputs 0...20 mA, measuring resistance 110 Ω Not galvanically isolated
Digital outputs	5 relay contacts: 48 V, 1 A Potential-free; for status signals
Digital inputs	4 potential-free contacts
Interface module Type of field bus integration	Various communication modules available (Ethernet, Modbus®, PROFIBUS,Profibus etc.)
Ethernet Option 1 Option 2	 Ethernet CoLa-B (remote in safe area) Ethernet Modbus® TCP (remote in safe area)
Display	LC display Status LEDs: “Operation”, “Warning” and “Malfunction”
Operation	Via display or SOPAS ET software
Dimension (W×H×D)	300 mm 300 mm 220 mm
Weight	≤ 3.7 kg
Power supply Voltage	 90 V...250 V (AC) 24 V (DC) (external supply)
Frequency	47 Hz ... 63 Hz
Power consumption	Max. 50 W
Protection class: Version with power supply unit MCU NWxxx	 I

MCUDH Ex-3K control unit (Zone 2/22)

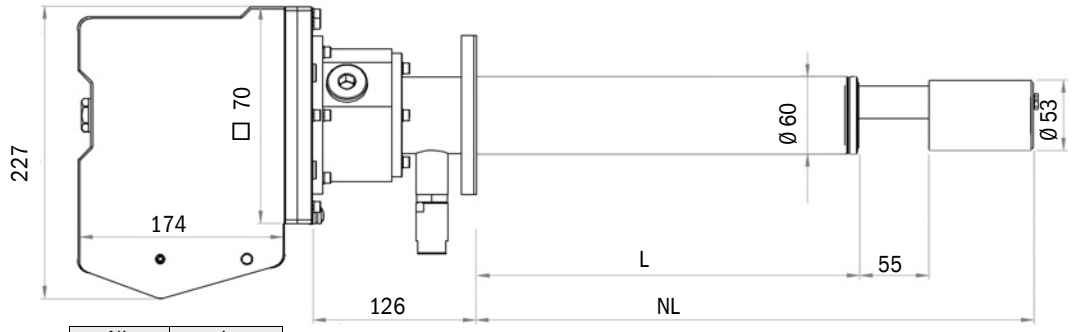
Table 35: Technical data, MCUDH Ex-3K control unit

Description	Unit to control system components, and evaluate and output the data you provide
Ambient temperature Version with power supply unit MCUDH Ex-3K NSxxx Version without power supply unit MCUDH Ex-3K N2xxx	 -25 °C ... +50 °C -40 °C ... +60 °C
Ex approvals Version with power supply unit MCUDH Ex-3K NSxxx Version without power supply unit MCUDH Ex-3K N2xxx	 II 3G Ex ec nA nC IIC T4 Gc II 3D Ex tc IIIC T85 °C Dc II 3G Ex ec IIC T4 Gc II 3D Ex tc IIIC T85 °C Dc
Protection class	IP65
Analog outputs	1 output 0/2/4 ... 20 mA, 750 Ω Galvanically isolated
Analog inputs	2 inputs 0...20 mA, measuring resistance 110 Ω Not galvanically isolated
Digital outputs	5 relay contacts: 48 V, 1 A Potential-free; for status signals
Digital inputs	4 potential-free contacts
MODBUS Type of field bus integration	 RTU RS-485 (via optional Interface module; only one module per MCU possible)
Ethernet Option 1 Option 2	 Ethernet CoLa-B (remote in safe area) Ethernet Modbus® TCP (remote in safe area)
Display	LC display Status LEDs: “Operation”, “Warning” and “Malfunction”
Operation	Via display or SOPAS ET software
Dimension (W×H×D)	300 mm 300 mm 220 mm
Weight	≤ 8.8 kg
Power supply Voltage	 90 V...250 V (AC) 24 V (DC) (external supply)
Frequency	47 Hz ... 63 Hz
Power consumption	Max. 50 W
Protection class: Version with power supply unit MCUDH Ex-3K NSxxx Version without power supply unit MCUDH Ex-3K N2xxx	 I III

15.1 Dimensional drawings and part numbers

All measures are specified in mm.

15.1.1 DHSP100Ex-3K sender/receiver unit



NL	L
435	300
735	600

Fig. 71: Sender/receiver unit dimensions

Table 36: Part numbers, sender/receiver unit

Name	Part No.
Sender/receiver unit DHSP-T4V11EX3KT6	1091012
Sender/receiver unit DHSP-T2V11EX3KT6	1091010
Sender/receiver unit DHSP-T2H11EX3KT6	1091014
Sender/receiver unit DHSP-T4V21EX3KT6	1091013
Sender/receiver unit DHSP-T2V21EX3KT6	1091011

15.1.2 Flange with tube

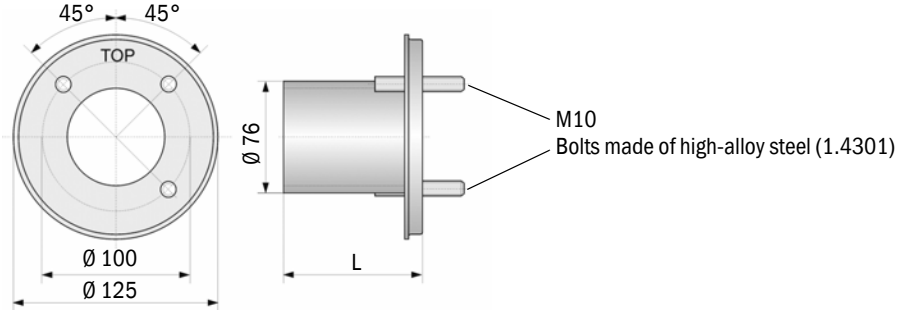


Fig. 72: Dimensions, standard flange with tube

Table 37: Part numbers, standard flange with tube

Name	Part No.	Usage on
Material, flange and tube: 1.0254 (unalloyed structural steel)		
Flange with tube, Øi 70 mm, L 130 mm	2017845	DHSP-Txx1, DHSP-Txx2
Flange with tube, Øi 70 mm, L 240 mm	2017847	
Flange with tube, Øi 70 mm, L 500 mm	2017849	DHSP-Txx2
Material, flange and tube: 1.4571 (high-alloy steel)		
Flange with tube, Øi 70 mm, L 130 mm	2017846	DHSP-Txx1, DHSP-Txx2
Flange with tube, Øi 70 mm, L 240 mm	2017848	
Flange with tube, Øi 70 mm, L 500 mm	2017850	DHSP-Txx2

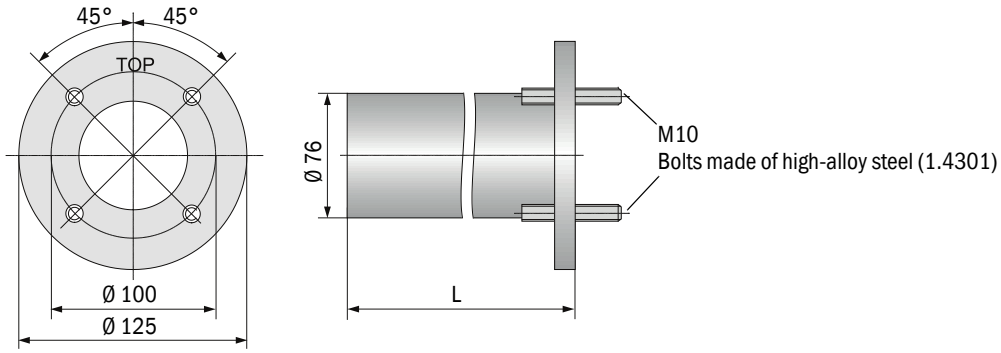
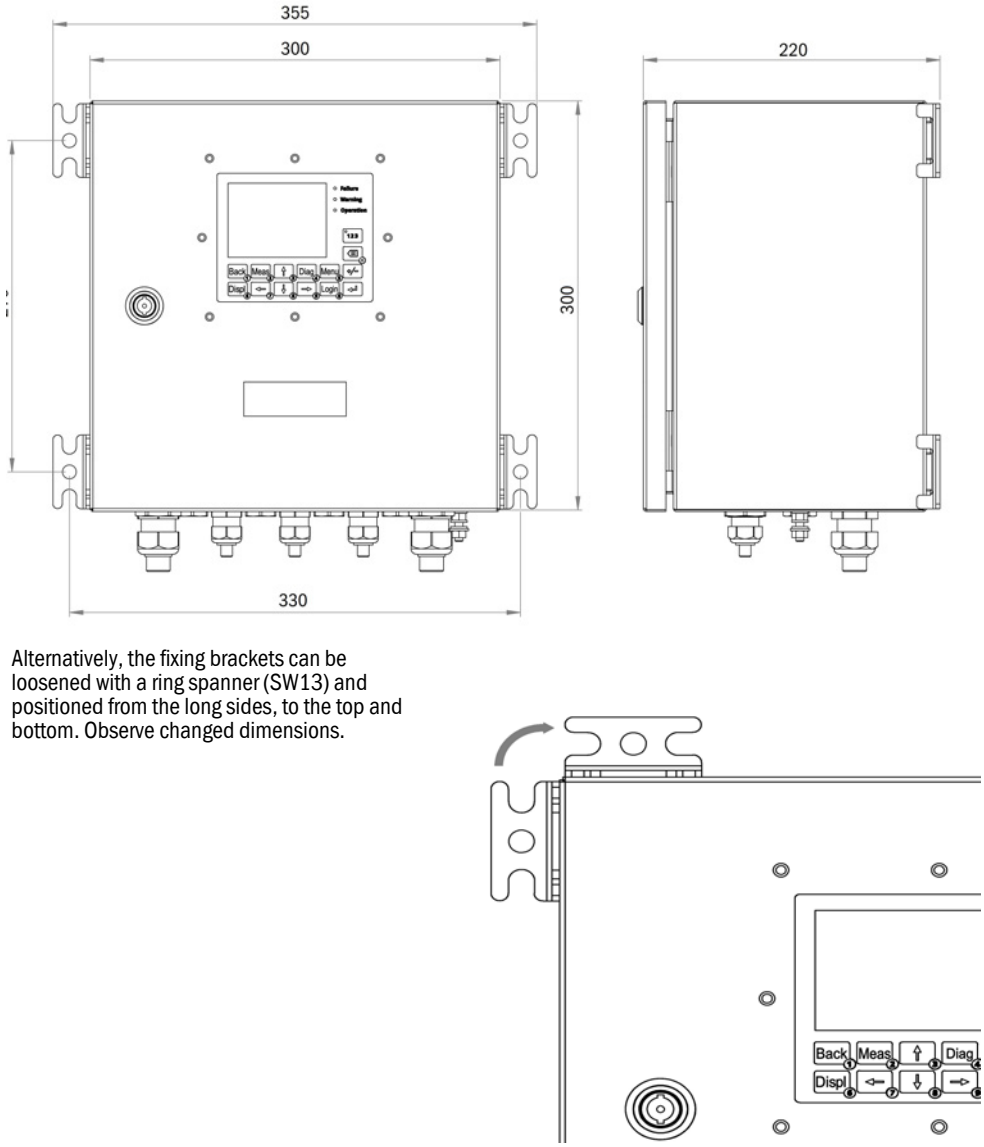


Fig. 73: Dimensions, flange with tube (4 bolts)

Table 38: Part numbers, flange with tube (4 bolts)

Name	Part No.	Usage on
Material flange: 1.4571 (high-alloy steel); material tube: 1.0254 (unalloyed structural steel)		
Flange with tube, Øi 70 mm, L 130 mm	2115419	DHSP-Txx1, DHSP-Txx2
Flange with tube, Øi 70 mm, L 240 mm	2115420	
Flange with tube, Øi 70 mm, L 500 mm	2115421	DHSP-Txx2
Material, flange and tube: 1.4571 (high-alloy steel), with 3.1 Material Certificate		
Flange with tube, Øi 70 mm, L 130 mm, with 3.1 Material Certificate	2115404	DHSP-Txx1, DHSP-Txx2
Flange with tube, Øi 70 mm, L 240 mm, with 3.1 Material Certificate	2115417	
Flange with tube, Øi 70 mm, L 500 mm, with 3.1 Material Certificate	2115418	DHSP-Txx2

15.1.3 MCUDH Ex-3K control unit



Alternatively, the fixing brackets can be loosened with a ring spanner (SW13) and positioned from the long sides, to the top and bottom. Observe changed dimensions.

Fig. 74: Dimensions, MCUDH Ex-3K control unit

Table 39: Part numbers, MCUDH Ex-3K control unit

Name	Part No.
MCUDH Ex-3K NSYDN00000MNOE control unit in wall enclosure, supply voltage 115/230 V AC, without integrated purge gas supply, with display, with integrated Interface module RS485 Modbus® ASCII/RTU	1106647
MCUDH Ex-3K NSYDN00000NNOE control unit in wall enclosure, supply voltage 115/230 V AC, without integrated purge gas supply, with display, without integrated Interface module	1109325
MCUDH Ex-3K N2YDN00000MNOE control unit in wall enclosure, supply voltage 24 V DC, without integrated purge gas supply, with display, with integrated Interface module RS485 Modbus® ASCII/RTU	1109326
MCUDH Ex-3K N2YDN00000NNOE control unit in wall enclosure, supply voltage 24 V DC, without integrated purge gas supply, with display, without integrated Interface module	1109327

15.1.4 MCU control unit

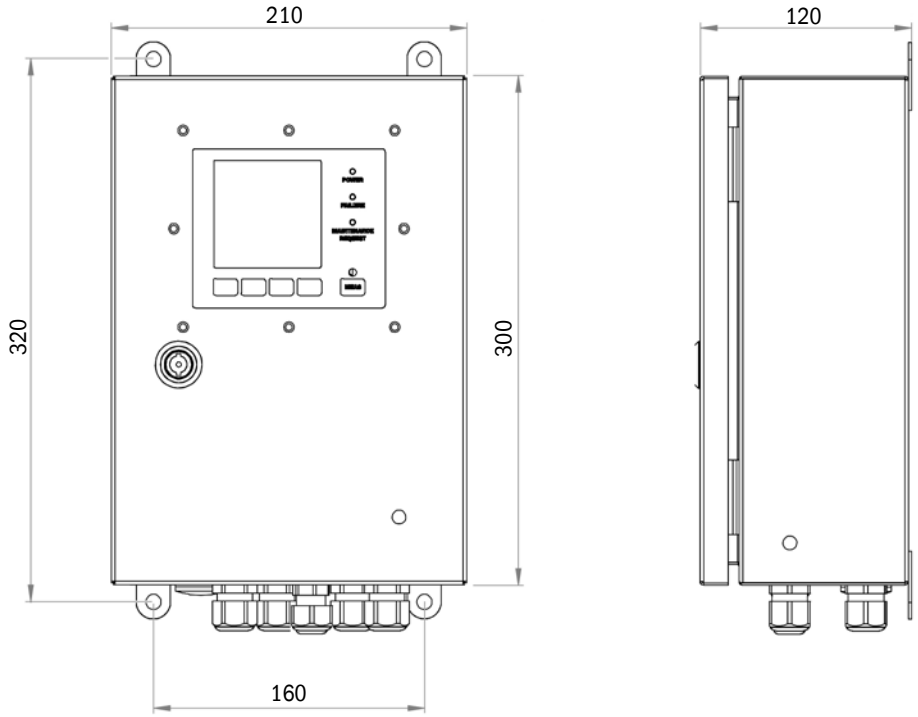


Fig. 75: Dimensions, MCU-N control unit

Table 40: Part numbers, MCU control unit

Name	Part No.
MCU-N2ONN00000NNNE control unit (without LC-Display) - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 24 V DC	1080505
MCU-NWODN00000NNNE control unit - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC	1080506
MCU-N2ODN01000NNNE control unit - with 3 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 24 V DC	1045003
MCU-NWODN01000NNNE control unit - with 3 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC	1045001
MCU-NWODN00000BNNE control unit - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 Ethernet, COLA-B, Puls Interface module	1080507
MCU-NWODN00000MNNE control unit - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 Modbus® RS485 Interface module	1081996
MCU-NWODN01000JNNE control unit - with 3 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 Modbus® Interface module	1064639
MCU-NWODN01000ENNE control unit - with 3 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 Ethernet, CoLa-B Interface module	1047195
MCU-NWODN01000CNNC control unit - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 CAN bus Interface module - Emission V 01.02.00 Software	1056869
MCU-NWODN01000DSNE control unit - with 3 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 Modbus® ASCII/RTU, PULS Interface module - 1 Ethernet Interface module	1082232
MCU-NWODN00000PSNE control unit - with 1 analog and 5 relay outputs - with 4 digital and 2 analog inputs - supply voltage 90...250 V AC - 1 PROFIBUS, RS485, PULS Interface module - 1 Ethernet, CoLa-B, Service Interface module	1084573

16 Spare parts

Only spare and consumable parts from SICK may be used.

16.1 Consumable parts

16.1.1 Consumable parts, DUSTHUNTER SP100 Ex-3K

Spare and consumable parts set

Table 41: Spare and consumable parts set, SP100 Ex-3K sender/receiver unit

Name	Part No.
Spare and consumable parts set DUSTHUNTER SP100 Ex-3K	2120587

The components contained in the set are listed in the following Table with their quantity and a recommendation for the replacement interval. For a description of the work necessary for replacement, see “Maintenance work on the sender/receiver unit”, page 101.

Table 42: Contents, spare and consumable parts set, SP100 Ex-3K sender/receiver unit

Name	Number	Replacement interval
O-ring protection tube top	3	In case of damage
O-ring protection tube bottom	3	In case of damage
Flat seal, flange	3	Every 2 years
Screw, cleaning opening	1	In case of damage
Seal, cleaning opening	10	In case of damage
Seal, reducer	3	In case of damage
Reducer	1	In case of damage
Seal, non-return valve	3	In case of damage
Screws and spring washers, hood	4	In case of damage
Screws and spring washers, protective tube	6	In case of damage
Safety screw, plug protection guard	2	In case of damage
Sinter filter	3	Every 2 years
Screws, potential equalization	4	In case of damage

Consumable parts to be purchased separately

Table 43: Consumable parts, SP100 Ex-3K sender/receiver unit

Name	Part No.
Flange seal k100	7047036
Sinter filter	7047714
Optics cloth	4003353

16.1.2 Consumable parts, MCUDH Ex-3K / MCU control unit

Table 44: Consumable parts, MCUDH Ex-3K

Name	Part No.
Button cell, BR1632A for MCUDH Ex-3K	2114601
Button cell for conventional MCU	2085319

For the MCUDH Ex-3K, the use of a button cell other than the one marked as associated in the Table is not permitted.

16.2 Spare parts

16.2.1 Spare parts, DUSTHUNTER SP100 Ex-3K

Table 45: Spare parts, SP100 Ex-3K sender/receiver unit

Name	Part No.
Protection tube, NL 435 mm 3.1 (SS)	4103878
Protection tube, NL 735 mm 3.1 (SS)	4103880
Hood 3.1 (SS)	4093574
Non-return valve	5320060
O-ring protection tube top	5329376
O-ring protection tube bottom	5314122

16.2.2 Spare parts, control unit

Table 46: Spare parts, MCUDH Ex-3K / MCU control unit

Name	Part No.
Set, line glands, MCUDH Ex-3K (2× M20 (6...12 mm); 2× M20 (10...14 mm); 2× M25 (14...18 mm)	2115594
Fuse sets, T 4 A 250 V (suitable for MCUDH Ex-3K control unit)	2115062
Fuse sets, T 2 A 250 V (suitable for MCU control unit)	2054541

17 Accessories

17.1 Weather hood housing

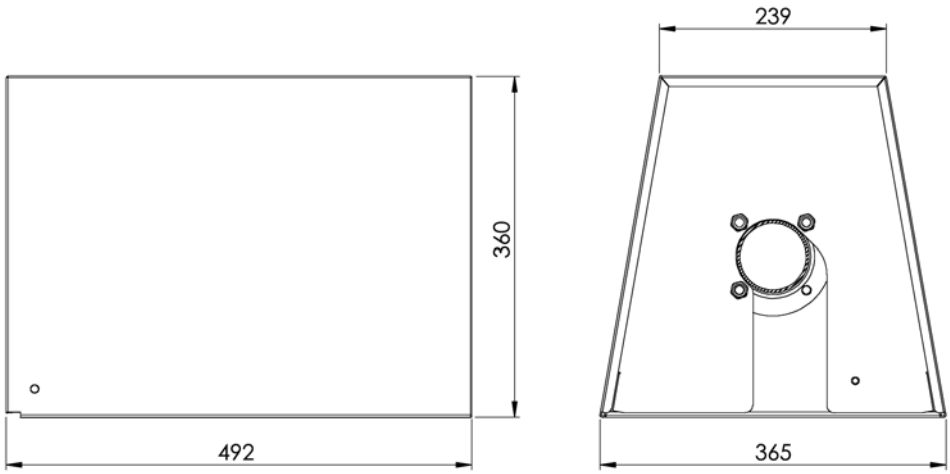


Fig. 76: Weather hood housing for the sender/receiver unit (dimensions in mm)

Table 47: Part number, weather hood housing

Name	Part No.
Weather hood housing for sender/receiver unit with NL up to 735 mm, for Ex-zone	2108971

17.2 Connection technology

17.2.1 Sender/receiver - control unit line

Name	Part No.
Connection line, length 5 m	2102782
Connection line, length 10 m	2102783
Connection line, length 25 m	2102784
Connection line, length 50 m	2102785
Connection line, length 100 m	2102786
Other lengths on request	

17.3 Fastening technology

Table 48: Part numbers, assembly parts

Name	Part No.
Assembly kit, flange (for sender/receiver unit with NL 435 mm and 735 mm)	2018184
Blind flange for temporary closure of the flange with tube	4108524

17.4 Optional accessories

17.4.1 Options for MCUDH Ex-3K control unit

The Interface module Modbus® ASCII/RTU is a retrofit option when an MCUDH Ex-3K without integrated module was ordered. The optional Interface modules Ethernet and Modbus® TCP/IP of the MCUDH Ex-3K must not be used in the Ex-zone. To use these options, an MCUDH Ex-3K with integrated Interface module is required and a signal line must be laid from the integrated module in the Ex-area to which the optional modules can be connected (see “Communication options”, page 62).

Table 49: Part numbers, optional accessory, MCUDH Ex-3K control unit

Name	Part No.
Interface module RS485 / Modbus® ASCII/RTU	2048958
Interface module Ethernet / CoLa-B (remote separate module)	2069666
Interface module Ethernet / Modbus® TCP/IP (remote separate module)	2069664
Remote-Display 100, without power supply unit	2117058
Remote-Display 100, with power supply unit	2117059
SOPAS Service Kit (adapter cable USB-RS485)	2097408
Plug adapter for SOPAS Service Kit	6075779
24 V DC power supply unit for supplying optional remote modules	6059059
Connection line with plug for connection outside the Ex-zone (5 m)	7042017

17.4.2 Options for MCU control unit

Table 50: Part numbers, optional accessories, MCU control unit

Name	Part No.
Interface module Ethernet / CoLa-B for SOPAS ET,	2072693
Interface module Ethernet / Modbus® TCP/IP	2059546
Interface module RS485 / Modbus® ASCII/RTU	2048958
Interface module RS485 / PROFIBUS	2048920
Service Interface module Ethernet / CoLa-B (only applicable as second module for optional use of the local Service interface via Ethernet)	2069667
Analog input module, 2 channels, 0/4 mA ... 22 mA, 100 Ω,	2034656
Analog input module, 2 channels, 0/4 mA ... 22 mA, 500 Ω,	2034657
Digital output module, 4 channels, as NO contact, 48 V AC/DC, 0.5 A	2034661
Digital output module, 2 channels, as changeover contact, 48 V AC/DC, 5 A or 30 V AC/DC, 2 A	2034659

17.5 Other accessories

17.5.1 Device check accessories

Table 51: Part numbers, device check

Name	Part No.
DHSP control filter set for linearity check	2049045

18 Annex

18.1 Compliances

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

- EU directive: 2014/30/EU (EMC)
- EU directive: 2011/65/EU (RoHS)
- EU directive: 2014/34/EU (ATEX)

Applied EN standards:

- EN 60529, Degrees of protection provided by enclosures (IP code)
- EN 61010-1 Safety requirements for electrical equipment
- EN 61000-6-2 Electromagnetic compatibility
- EN 61326, Electrical equipment for measurement, control and laboratory use - EMC requirements
- EN 50581, Guideline for the implementation of RoHS
- EN 14181, Stationary source emissions - Quality assurance of automated measuring systems
- EN 60079-0:2012-08
- EN 60079-15:2010-05
- EN 60079-28:2015-09
- EN 60079-31:2014-07

18.2 Electrical protection

- MCUDH control unit: Protection class 1 according to EN 61010-1.
- MCU control unit: Protection class 1 according to EN 61010-1.
- Insulation coordination: Overvoltage category II in accordance with EN61010-1.
- 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.

18.3 Approvals

Approvals

The DUSTHUNTER SP100 Ex-3K is performance-tested according to EN 15267 and may be used for continuous emission monitoring in systems requiring approval according to EU Directives.

18.4 Licenses

Exclusion of liability

The firmware for this device has been developed using Open Source Software. Any changes to the Open Source components are in the general responsibility of the user. All warranty claims are excluded in this case.

The following exclusion of liability applies to the GPL components in relation to the rights holders: This program is distributed in the hope that it will be of use, but with no guarantee of this; neither is there any implied guarantee of marketability or suitability for a particular purpose. See GNU (General Public License) for details. With regard to the other Open Source components, we refer to the liability disclaimers of the copyright holders in the license texts on the CD delivered.

Software licenses

In this product, SICK uses unchanged and, as far is necessary and in compliance with relevant license conditions, changed Open Source Software.

The firmware of this device is therefore subject to the copyrights listed on the CD delivered. Please refer to the CD delivered for a complete list of the Open Source programs used as well as the relevant license conditions.

Source codes

The source codes for the Open Source programs used in this device can be requested using the following e-mail address: info.pa@sick.de. Please enter as subject “Open Source Software”.

8020216/19YN/V3-0/2020-12

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