Operating Instructions
SMOTEC450

Smoke Detector

Endress+Hauser
People for Process Automation

Document Information

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Legal information
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Warning Symbols


Hazard (general)


Hazard by voltage


Hazard by laser radiation

Warning Levels / Signal Words

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

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

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

NOTICE
Hazard which *could* result in property damage.

Information Symbols


Important technical information for this product


Supplementary information


Link to information at another place

SMOTEC450

1 Important Information

Main hazards

Intended use

Responsibility of user

Deploying the SMOTEC450 for safety-critical measuring tasks (fire detection and signalisation)

1.1 Main hazards

1.1.1 Hazards through electrical equipment

The SMOTEC450 measuring system is operational equipment for use in industrial high-voltage current plants.

WARNING: Danger through mains voltage

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

1.1.2 Hazards through laser beam

The measuring unit of the SMOTEC450 contains a laser of class 2 (eye sure).

WARNING: Hazards through laser beam

- ⊗ Never look directly into the beam path
- ⊗ Do not point the laser beam at persons
- ► Prevent damaging reflections of the laser beam by reflective parts.
- ► Don‘t operate the laser module outside of the Measuring unit.

1.2 Intended use

Purpose of the device

The SMOTEC450 measuring system serves for continuous visibility measurements in traffic tunnels.

Correct use

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

1.3 Responsibility of user

1.3.1 General information

Designated users

The SMOTEC450 measuring system may only be operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Special local conditions

- ► Observe the valid legal regulations as well as the technical rules deriving from implementation of these regulations applicable for the respective equipment during work preparation and performance.
- ► Carry out work according to the local conditions specific for the equipment as well as operational hazards and regulations.

Retention of documents

Keep the Operating Instructions belonging to the measuring system as well as equipment documentation onsite for reference at all times. Pass the respective documentation on to any new owner of the measuring system.

1.3.2 Safety information and protective measures

Protection devices

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

Preventive measures for operating safety

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

Recognizing malfunctions

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

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

Avoiding damage

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

1.4 Deploying the SMOTEC450 for safety-critical measuring tasks (fire detection and signalisation)

The plant operator is always responsible for the plant safety. The following points have particularly to be taken into account:

- Plants with safety risks must always be redundantly monitored by a suitable measuring technique. Therefore the SMOTEC450 may not be used as the only link in a safety chain.
- The operator is **always** responsible for any switching thresholds or definition of switching criteria.
- Precautions have to be taken on time to ensure the safe operation of the plant while the SMOTEC450 is not available (e.g. during maintenance or repair).
- Endress+Hauser doesn't assume any liability for damages which result from a possible malfunction of the device.

SMOTEC450

2 Product Description

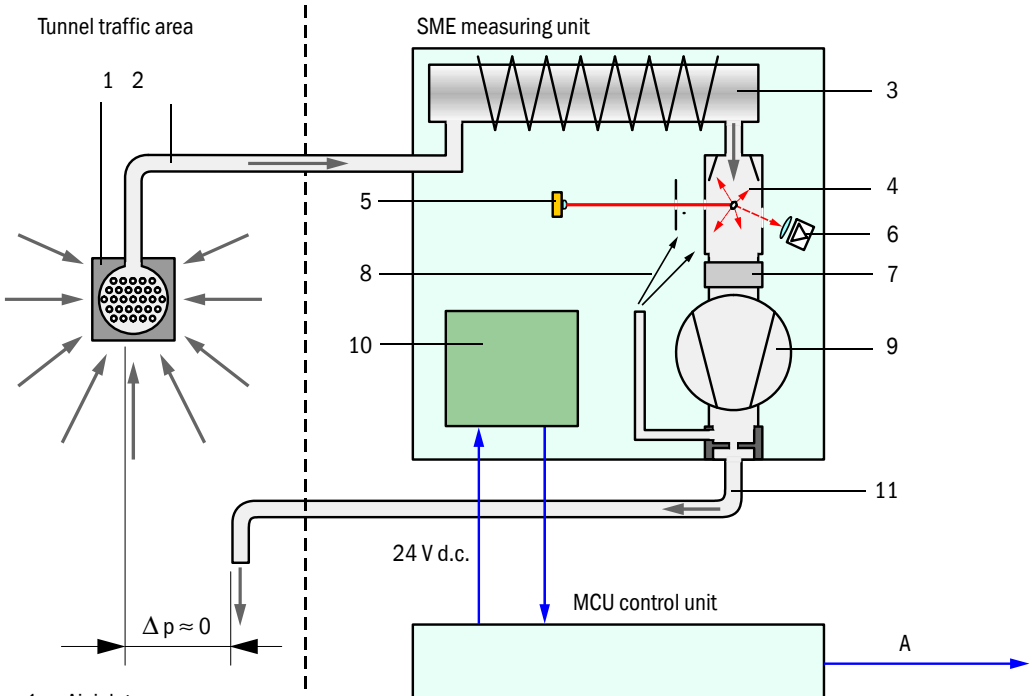
SMOTEC450 mode of operation
Device components

2.1 SMOTEC450 mode of operation

2.1.1 Functional principle

The SMOTEC450 runs as extractive system with in-situ measurement features. An air flow is suctioned from the traffic area in the tunnel via an extraction hose and fed to a heating chamber. The measuring air is heated inside this chamber so that possibly existing water drops (fog) are vaporized. The heated air is fed to the measuring cell in which the scattered light intensity as measure for the visibility is determined using a laser. The measuring air is conveyed by a blower. To prevent deposits in the blower an air filter is installed before. This prolongs the life time of the blower and allows to lead a partial flow of the clean air to the optics to keep them clean. The air flow rate is set at the factory and continuously monitored by measuring the inlet and heater temperatures.

Figure 1 SMOTEC450 basic design (shown with fog elimination)

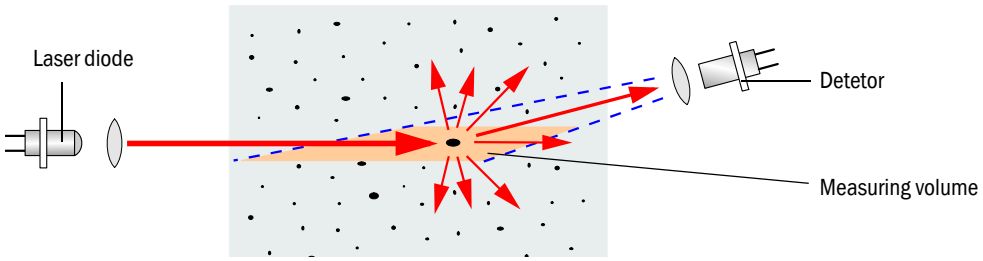


1 Air inlet
2 Suction hose
3 Heating chamber
4 Measuring cell
5 Laser
6 Receiver
7 Air filter
8 Purge-air
9 Blower
10 Processor board
11 Exhaust air hose
A Analog output 0 ... 20 mA
B Relay outputs
C Analog inputs
D Digital inputs
E Interface for control system

2.1.2 Scattered light measurement principle

The SMOTEC450 operates according to the scattered light measurement principle (forward scattering). Since it is extremely sensitive, this principle is particularly suitable for measuring very small particle concentrations.

Figure 2 Scattered light measurement principle



A laser diode beams the dust particles in the measured air flow with modulated light in the visual range (wavelength approx. 650 nm). The light scattered by the particles is recorded by a highly sensitive detector which is positioned in an angle of approx. 25 ° to the beam axis. The received signal is electrically amplified and supplied to the measuring channel of a microprocessor as central part of the measuring, control and evaluation electronics. The measuring volume in the measuring cell is defined by the intersection between the transmitted beam and the receiver aperture.

Lowest brightness changes of the transmitting power of the laser diode are continuously monitored (partial beam to the monitor receiver) and taken into account in the determination of the output signal.

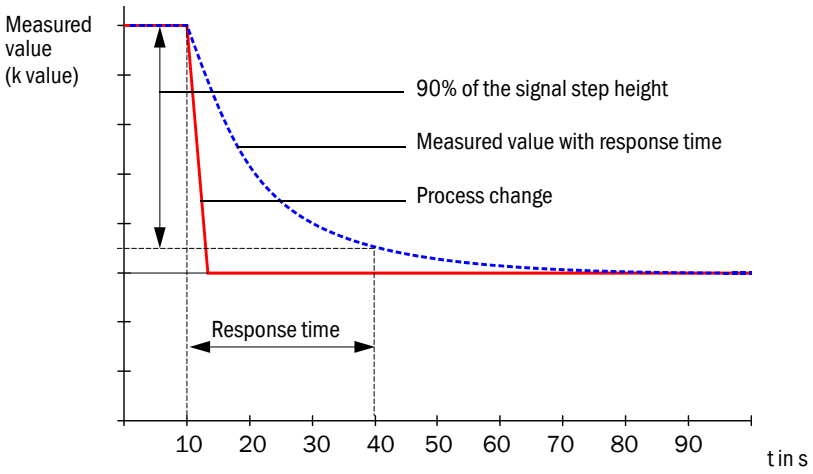
The primary measurand scattered light intensity is almost proportional to particle concentration. The measuring range is 1 ... 10,000 scattered light units. A limit in the range of 200 to 500 scattered light units can be set for fire monitoring (smoke detection) whereby this limit is clearly above the visibility values usually caused by vehicle emissions (approx. 20 ... 100 units) but still low enough for reliable and fast detection of smoke caused by fires.

The scattered light intensity is converted in the device to the k value used for visibility measurements which is output as the measured value. This is based on a factory calibration of the SMOTEC450 with a transmissiometer used as normal.

2.1.3 Response time

The response time is the time taken by the SMOTEC450 to reach 90 % of the end value after a sudden change in the measured value (see <kursiv>3). The response time is freely adjustable between 1 ... 600 s. Setting a higher response time provides better attenuation of transient fluctuations in the measured value and malfunctions to produce a "smoother" output signal.

Figure 3 Response time



2.1.4 Function check

A function check can be triggered at fixed intervals as from a definable starting timepoint for an automatic function check of the measuring system. The setting can be made using the SOPAS ET operating program (→ p. 66, §4.2.4). Any unallowed deviations from normal behavior that may occur are signaled as errors. A function check triggered manually can help localize possible error causes should a device malfunction occur.

A function check runs for approx. 120 s and consists of approx. 30 s measurement of contamination on optical surfaces and 90 s (default value) output of values determined.

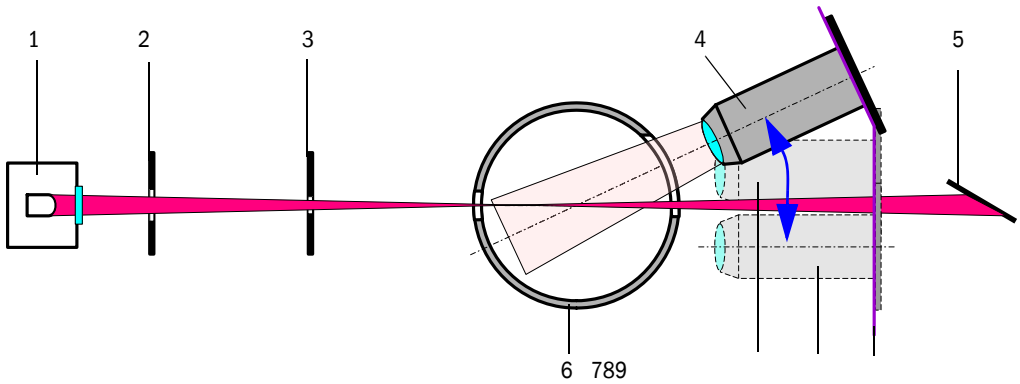
- The duration can be set as a parameter (→ p. 66, §4.2.4).
- The analog output must be activated to output check values on the analog output (→ p. 67, §4.2.5).
- The value measured last is output on the analog output during control value determination.
- If the check values are not output on the analog output, the current measured value is output when control value determination has completed.
- Relay 3 is activated during a function check (→ p. 40, Fig. 26).
- A function check is not started automatically when the measuring system is in "Maintenance" mode.
- "Function control" is displayed on the display module (option) of the control unit during the function check.
- If the start timepoint or cycle interval are changed, a function check timed between parameter setting and new start timepoint is still carried out.
- Changes to the interval time are first effective after the next start timepoint.

Contamination measurement

In order to measure the contamination on the optical boundary surfaces, the receiver is moved completely through the laser beam. The light emitted by the laser diode is therefore measured directly. The intensity value measured during the movement is compared with the factory settings to calculate a correction factor. Any occurring contamination is fully compensated in this way.

If the contamination value is lower than 50 %, an analog value is given out during the function check in a range between Live Zero and 20 mA and proportional to the contamination value. For contamination values higher than 50 % always the value is given out set for device status "Malfunction" (→ p. 67, §4.2.5).

Figure 4 Contamination and check value measurement



1 Laser module
2 Aperture 1
3 Aperture 2
4 Receiver in measuring position
5 Light trap
6 Measuring cell
7 Reference position at cycle start
8 Reference position at cycle end
9 Guideway

2.2 Device components

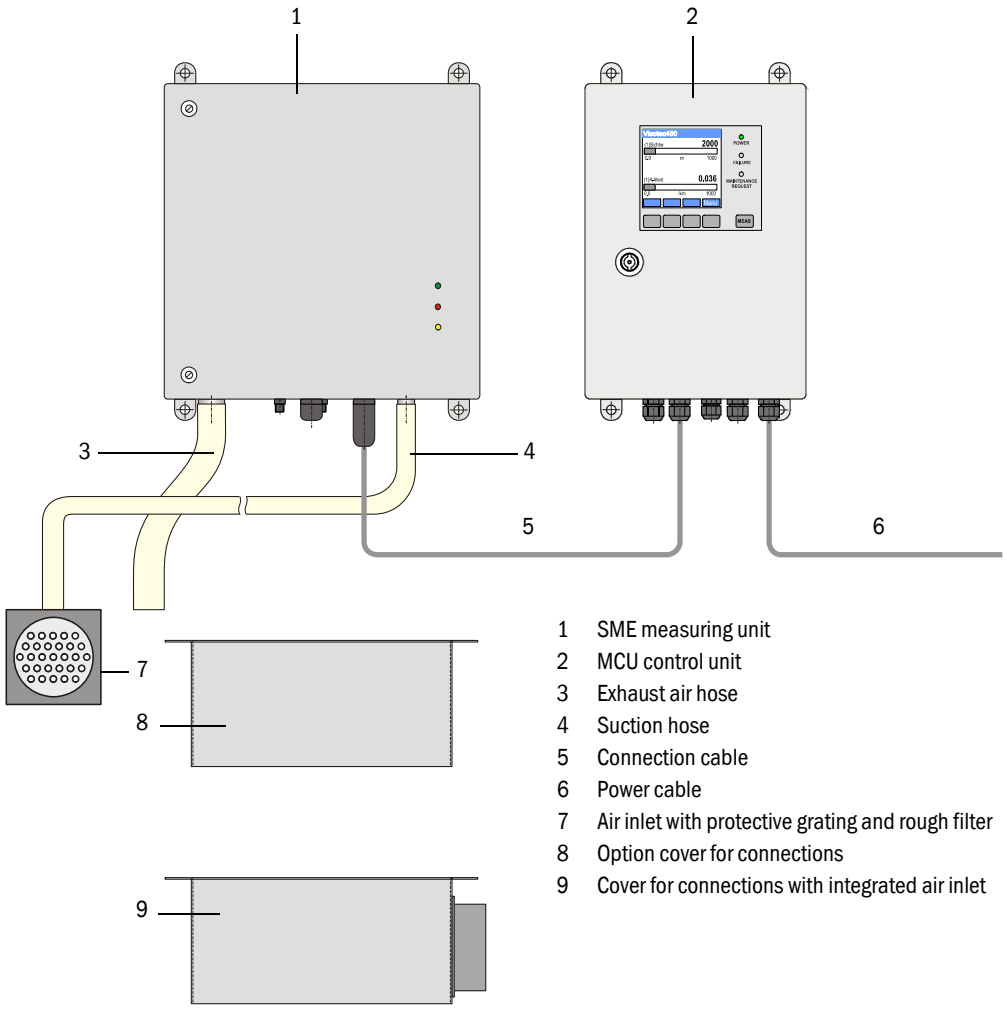
2.2.1 System overview

The measuring system comprises the following components:

- SME measuring unit
  for signal recording, signal processing and control of the device functions
- MCU control unit
  for control, evaluation and output of the data of max. 8 sensors connected via RS485 interface
- Air inlet with protective grating

  Alternative:
- Cover for connections with integrated air inlet
- Suction and exhaust air hose (set, length 5 m, 10 m, 15 m, other length on request)
- Connection cable to connect the measuring unit to the MCU (lengths 5 m, 10 m, 50 m, other length on request)
- Option cover for connections
- Option installation plate for measuring unit
- Option connection box for bus wiring

Figure 5 SMOTEC450 components



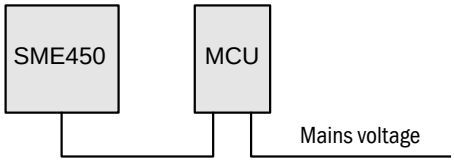
1 SME measuring unit
2 MCU control unit
3 Exhaust air hose
4 Suction hose
5 Connection cable
6 Power cable
7 Air inlet with protective grating and rough filter
8 Option cover for connections
9 Cover for connections with integrated air inlet

2.2.2 Communication between measuring unit and control unit

Standard variants

In this version, one measuring unit is connected to one control unit using the connection cable.

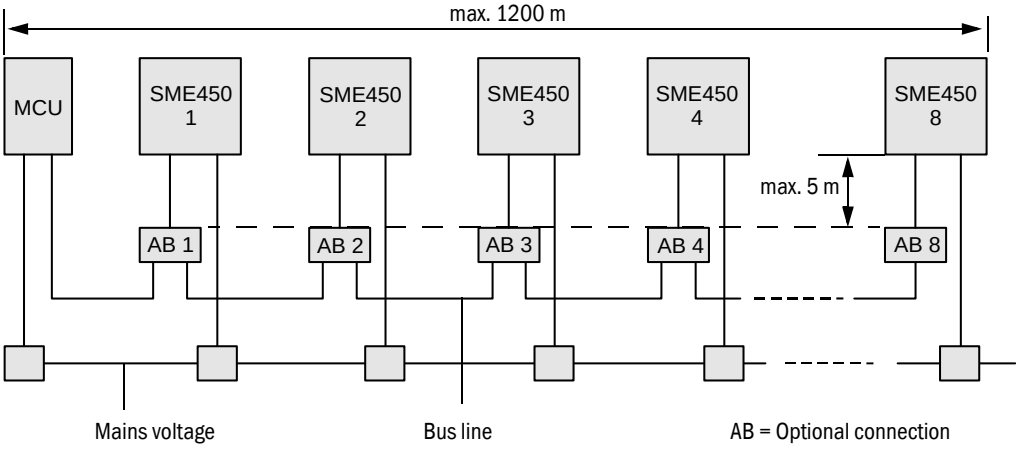
Figure 6 MCU - SME standard connection



Bus variants

In this version, up to 8 measuring units can be connected to one control unit via the RS485 interface. The measuring units must be provided with mains voltage separately in this case. The optional power supply unit must be installed in the measuring unit for this purpose.

Figure 7 MCU - SME bus connection



2.2.3 SME Measuring Unit

The measuring unit analyzes the particle concentration in the air that is extracted from the tunnel traffic area as a measure for the visibility prevailing in the tunnel.

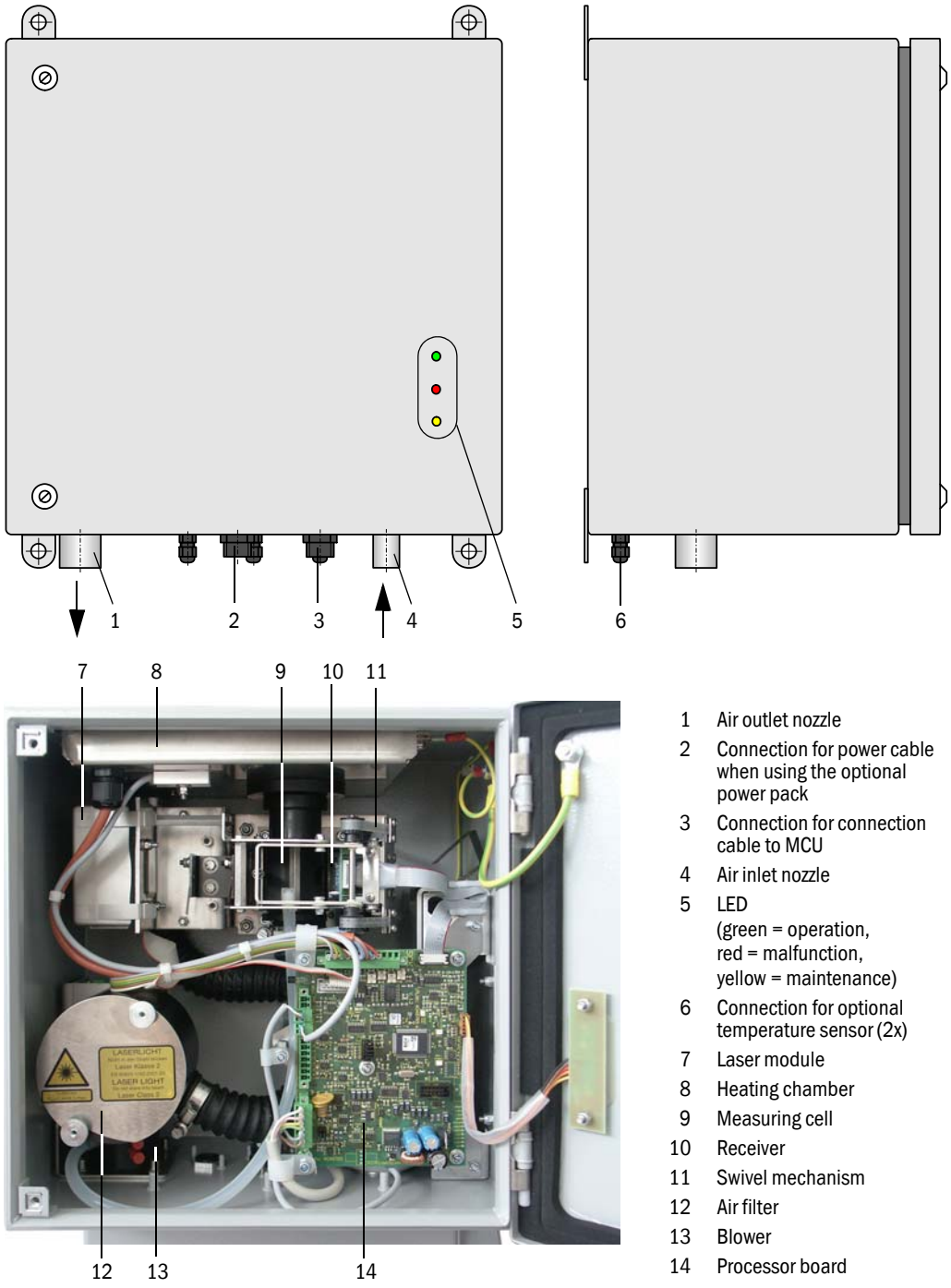
The measuring unit comprises the components (→ p. 18, Fig. 8):

- Measuring cell
- Laser module
- Processor control
- Heating chamber for fog damping
- Blower with air filter
- Housing for wall fitting, material 1.4571, coated gray (RAL7042)

When the measuring unit is installed as single connection to the control unit (see → p. 17, Fig. 6), the measuring unit is provided with 24 V d.c. from the power supply unit in the control unit via the connection cable.

For larger distances (→ p. 31, §3.1.5) or bus connection, the measuring unit with installed power pack must be used.

Figure 8 SME measuring unit



1 Air outlet nozzle
2 Connection for power cable when using the optional power pack
3 Connection for connection cable to MCU
4 Air inlet nozzle
5 LED (green = operation, red = malfunction, yellow = maintenance)
6 Connection for optional temperature sensor (2x)
7 Laser module
8 Heating chamber
9 Measuring cell
10 Receiver
11 Swivel mechanism
12 Air filter
13 Blower
14 Processor board

Accessories

1 Air inlet with protective grating

Subassembly for freely selectable position of the suction opening in the traffic area of the tunnel. The suction hose serves as connection to the air inlet connection in the measuring unit. The layout depends on the installation location (on the tunnel wall or intermediate ceiling).

2 Suction and exhaust air hose, set, lengths 5 m, 10 m, 15 m

Suction hose from Silicone (flexible), inner diameter 13 mm (outer diameter 19 mm); exhaust air hose from synthetic material, inner diameter 25 mm.

3 Cover for connections with integrated air inlet

This component consists of the air inlet with protective grating, a very short suction line and the cover for connections. With that it allows a very easy system assembly in the tunnel driving area and protects the SME connections against damage during tunnel cleaning using wash brushes.

4 Connection cable to connect the measuring unit to the MCU (lengths 5 m, 10 m, 50 m)

4-pole screened cable with socket for connection to the plug on the measuring unit and cable ends on the terminals in the MCU.

Other lengths on request.

Options

1 Cover for connections

Plan this option when the measuring unit is to be fitted in the traffic area without the cover with integrated air inlet. It protects the SME connections during tunnel cleaning with wash brushes so that the measuring unit does not have to be dismantled.

2 Temperature measurement with thermal element Ni-Cr-Ni, line 20 m (standard length) and electronic control

Measuring range:	- 50 ... +250 °C
Accuracy (not calibrated):	± 2 K (resolution ± 0,25 K)

This option can be used with longer suction lines (using the air inlet with protective screen subassembly) to measure the temperature at the suction location in addition to the air temperature measurement integrated in the SME. Installing further temperature measurement units allows early fire detection by monitoring the temperature at various locations in the traffic area.

3 Flow measurement (internal in SME)

Module with difference pressure sensor for monitoring and controlling the air flow rate through the measuring unit. Reductions of the cross-section in the suction hose caused by deposits or other causes are reliably detected and and included in the regulation of the optimal air flow rate what improves the functional reliability of the measuring system.

4 Power pack 24 V d.c., 75 W

This power pack serves separate power supply to the measuring unit when the distance between the measuring unit and the MCU is too large (power loss too high in the line) or when several measuring units are connected to one MCU (bus connection)

5 Installation plate

The measuring unit can be fitted and dismantled at the installation location in very simple and convenient way without tools when this option is used. In addition, the measuring unit can be secured by means of a lock.

Options 2, 3 and 4 can only be integrated in the measuring unit at the factory. Send the measuring unit to the manufacturer when these options are to be fitted later.

Type key

The following type codes identify the various selection options:

Type key measuring unit SME-XX-X-X-F-X

Power supply
- 24: 24 V d.c. from MCU
- WR: 90 ... 250 V a.c. with integrated power pack 24 V d.c. 75 W

Optional flow measurement
- N: without
- P: with difference pressure sensor

Optional temperature measurement with number of measuring points
- 0: without
- n: with thermoelement Ni-Cr-Ni, line 20 m and electronic control, n = 1 or 2

Fog elimination
- F: with
- N: without

Misc.

Example: SME-24-N-2-F-N

24 V d,c, from MCU
without flow measurement
with 2x optional temperature measurement
with fog elimination
without special features

2.2.4 MCU control unit

The control unit has the following functions:

- Control of data transfer and processing the data from the measuring unit(s) connected via RS485 interface
- Signal output via analog outputs (measured value) and relay outputs (device status)
- Signal input via analog and digital inputs
- Power supply for the connected measuring units via 24 V switching power pack with wide-range input
- Communication with host control systems via optional modules

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

Standard interfaces

Analog output	Analog inputs	Relay outputs	Digital inputs	Communication
0/2/4...22 mA (electrically isolated, active); for selectable output of: ● k value ● inlet temperature Optionally: ● flow rate ● temperature external 1x ● temperature external 2x Resolution 10 bits	2 inputs 0...20 mA (Standard; without electric isolation) Resolution 10 bits	5 changeover contacts (48 V, 1 A) to output status signals: ● Operation/malfunction ● Maintenance ● Function control ● Maintenance requirement ● Limit value	4 inputs to connect potential-free contacts (e.g. to connect a maintenance switch or trigger a function check)	● USB 1.1 and RS232 (on terminals) for measured value inquiries, setting parameters and software updates. ● RS485 for sensor connection

Figure 9 MCU control unit in wall-housing with options

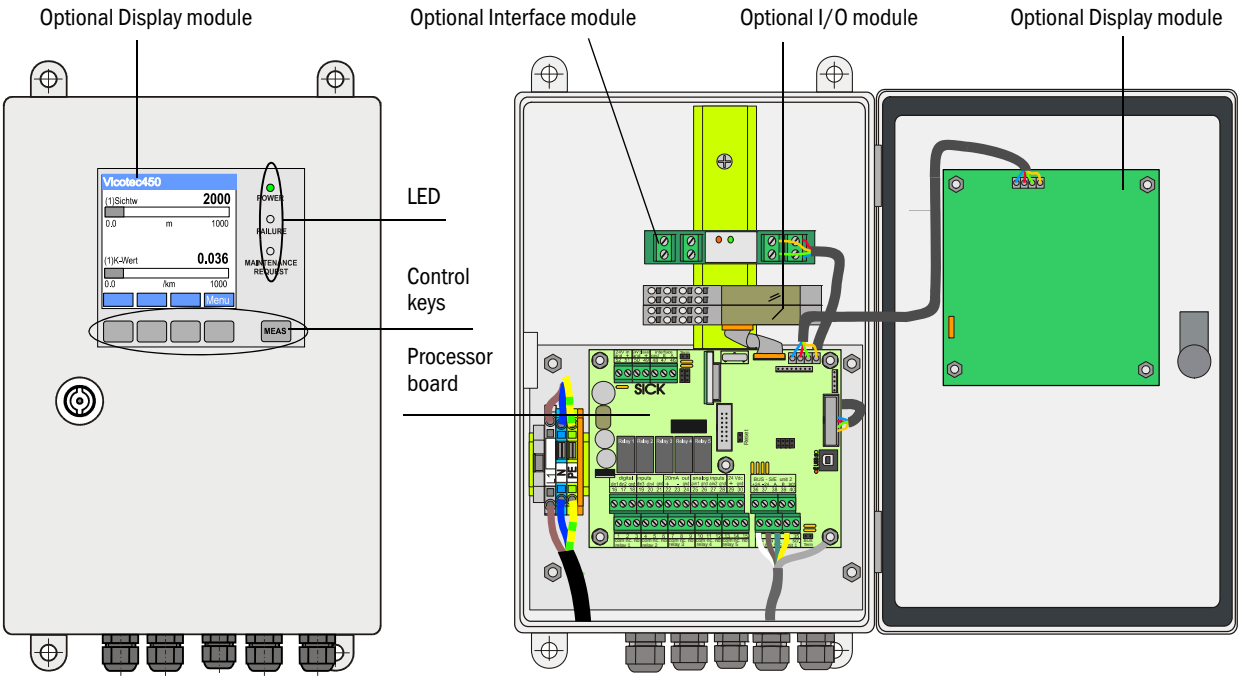
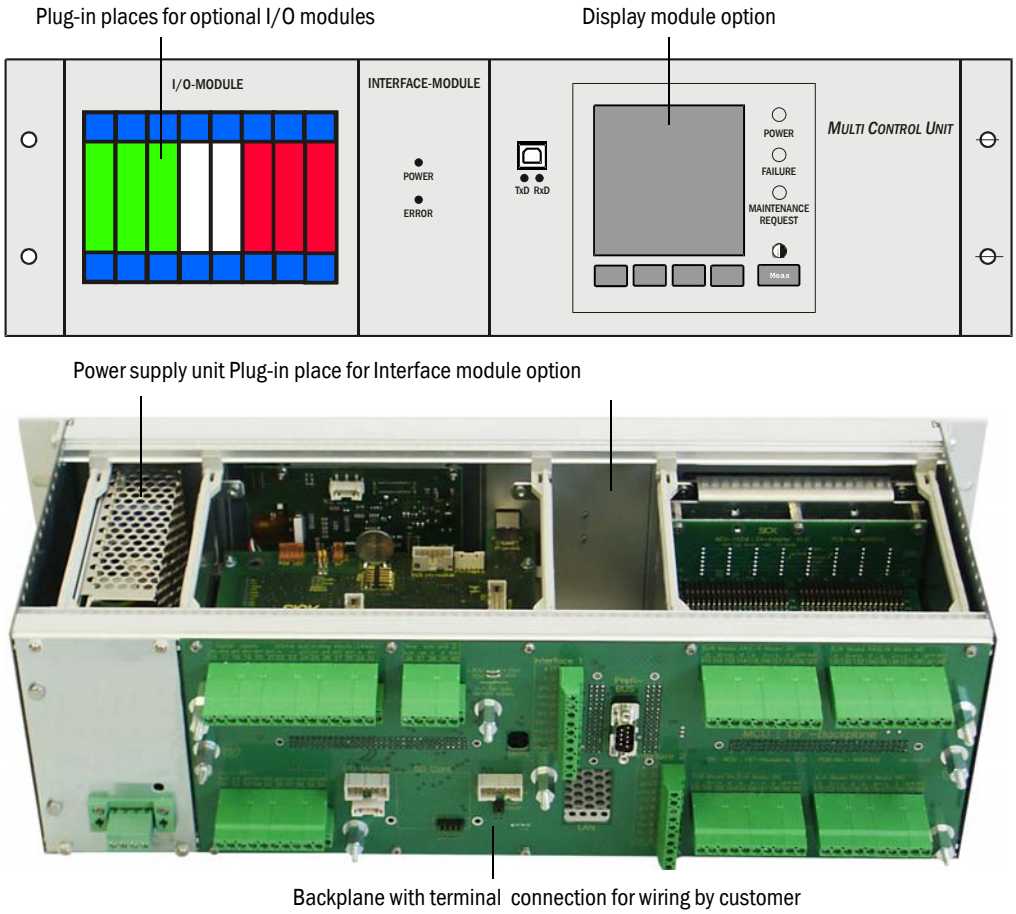


Figure 10 MCU control unit in 19" rack with options



Options

Using the following options, the functionality of the MCU can be extended considerably:

1 Display module

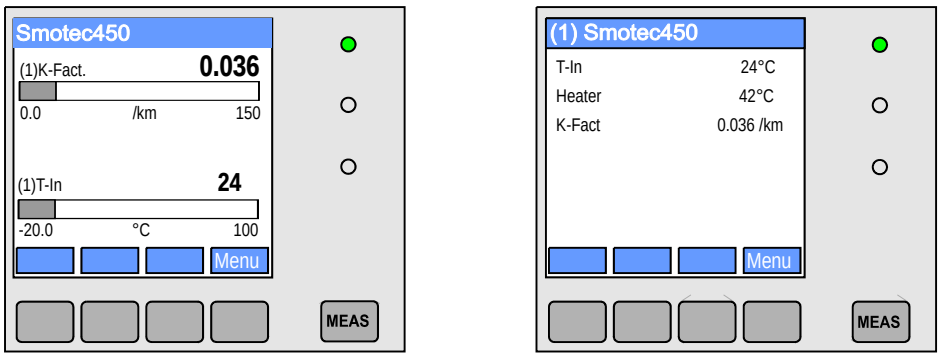
Module to display measured values and status information and for parameter setting, selection via control keys.

– Displays

Type		Display
LED	Power (green)	Voltage supply OK
	Failure (red)	Function fault
	Maintenance request (yellow)	Maintenance requirement
LC display	Graphic display (main screen)	– k value – Inlet temperature – Flow rate – Temperature external 1x – Temperature external 2x
	Text display	2 measured values (see graphic display) and 8 diagnosis values (→ p. 84, Fig. 79)

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

Figure 11 LC-Display with graphic (left) and text (right) display



– Control keys

Button	Function
Meas	● Toggle between text and graphic display ● Display the contrast setting (after 2.5 s)
Arrows	Select next/previous measured value page
Diag	Display alarm or fault message
Menu	Display main menu and selection of submenus

2 I/O module

For plugging on module carriers (MCU in wall-housing) or in plug-in module (MCU in 19" rack), communication via I²C bus, optionally as:

– 2x analog output 0/4 ... 22 mA to output further measured variables (load 500 Ω)
– 2x analog input 0/4 ... 22 mA to read in values from external sensors
– 4x digital input for connection of galv. isolated contacts
– 2x digital output (2 channels, changeover contacts, capacity 48 V AC/DC, 5 A)
– 4x digital output (4 channels make contacts, capacity 48 V AC/DC, 0,5 A)

- One module carrier is necessary for each module (to insert on top hat rail). One module carrier has to be connected to the processor board with a special cable, other module carriers can be docked to it.
- Max. 8 I/O modules can be plugged, max. 4 modules of these may be of the same type..

3 Interface Module

Module to pass measured values, system status and service information to higher level control systems, optional for Profibus or Ethernet, to plug onto hat rail (MCU in wall-housing) or on plug-in places (MCU in 19" rack).

The module is connected to the connection board by an accompanying cable.

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

Type code

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

Type code control unit: MCU-N X X X N X X X X X X N N E

Integrated purge-air supply
- N: without (no)

Power supply
- W: 90 ... 250 V a.c.
- 2: optional 24 V d.c.

Housing variants
- G: wall housing grey
- S: wall housing, stainless steel 1.4571 (coated grey)
- R: 19" housing

Display module
- N: without
- D: with

Other options
- N: without

Option Analog input (plugging module; 0/4...20 mA; 2 inputs per module)
- 0: without
- n: with, n = 1...4 1)

Option Analog output (plugging module; 0/4...20 mA; 2 outputs per module)
- 0: without
- n: with, n = 1...4 1)

Option Digital input (plugging module; 4 inputs per module)
- 0: without
- n: with, n = 1...4 1)

Option Digital output Power (plugging module; 48 V d.c.C, 5 A; 2 changeover contact per module)
- 0: without
- n: with, n = 1...4 1)

Option Digital output Low Power (plugging module; 48 V d.c., 0,5 A; 4 make contact elements per module)
- 0: without
- n: with, n = 1...4 1)

Option Interface module
- N: without
- E: Ethernet
- P: Profibus

- Special design
- N: no special features

EX-Zertifizierung
- N: no EX certification

Software
- E: Emission measurement

1): Maximmum number of all modules of the same type = 4

2.2.5 Mounting set

Various mounting sets are available to fasten the measuring unit, control unit and optional connection boxes at the tunnel wall or roof. The selection of a mounting set depends on the actual requirements. The table below lists the parts of the individual mounting sets and their applications.

Mounting set		Application		
Designation (Part no.)	Contents	Requirements	For component	Qty. per comp.
4D8-1.4571/PA (2031889)	● 4x Fischer plug S10 ● 2x hex. head screw 8x50 A4	No particular	Measuring unit and control unit in wall housing	1
2D4-1.4571/PA (2031890)	● 2x Fischer plug S6 ● 2x round head screw 3.5x40 A4		Connection box option	1
2M8-1.4571 (2031891)	● 2x plug SLM 8N A4 ● 2x hex. head screw 8x55 A4	Stainless steel only	Measuring unit, control unit and connection box option in stainless steel housing	2
4M8-1.4529 (2031887)	4x Fischer tie bolt FAZ 8/10 C	Aggressive ambient air	Measuring unit, control unit and connection box option in stainless steel housing	1

SMOTEC450

3 Assembly and Installation

Project planning
Assembly
Electrical installation

3.1 Project planning

3.1.1 Planning Steps

Plan the following before starting assembly and installation work:

- ► Determine the measuring locations.
- ► Select the system components according to usage conditions and customer demands (→ p. 17, §2.2.3 and → p. 21, §2.2.4).
- ► Determine the fitting locations for air inlet with protective grating (when used), measuring unit(s) and control unit.
- ► Plan the power supply and cabling.

3.1.2 Determining measurement locations and measuring unit arrangement in the tunnel

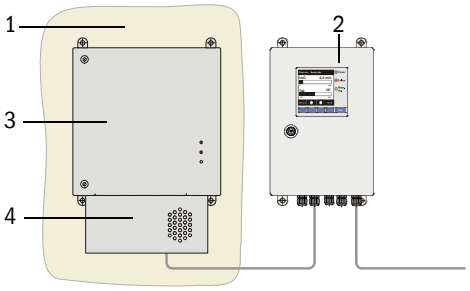
Measurement locations

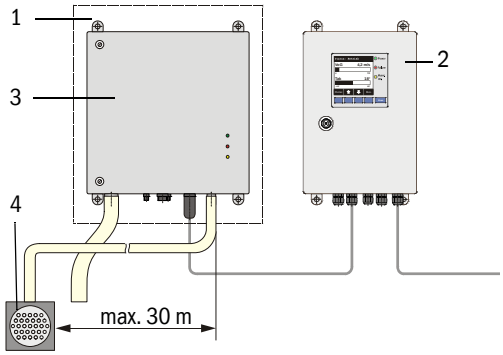
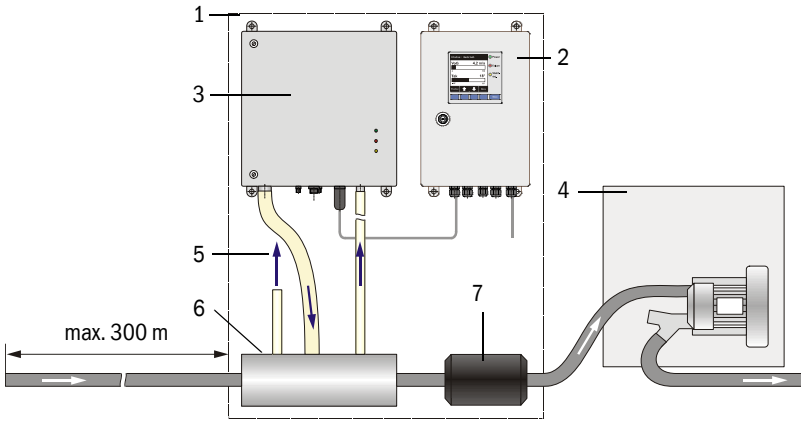
The usual criteria for tunnel ventilation are applicable for the distance between measuring units inside the tunnel when using the SMOTEC450 as visibility measuring device. Because this depends on many factors such as tunnel geometry, location, traffic volume and vehicle mix, the details shall be planned by experienced specialists.

Basicly the distance shall not be larger than 100 m to 150 m between two neighboring measuring points which serve as optical smoke detector. (See RABT2003, Astra modification proposal 2005).

Measuring unit arrangement

The measuring units can be installed in the tunnel in the following manner:

Measuring unit installation	Measured air extraction	Remarks
Directly in the traffic area on the tunnel wall  1 Tunnel wall 2 Control unit 3 Measuring unit 4 Cover with integrated air inlet	Via air inlet with protective grating or cover for connections with integrated air inlet (should be preferred due to lower installation effort)	Choose this arrangement when the respective measuring point will not be used to measure fog as visibility impairment. This is often the case for measuring points located less than 150 m from the tunnel portal. Prerequisite is sufficient space in the traffic area.

Measuring unit installation	Measured air extraction	Remarks
In recesses, switch cabinets for equipment in the tunnel traffic area, on intermediate ceilings or in operational rooms at an easily accessible location that can be reached without having to close the tunnel.  1 Control cabinet 2 Control unit 3 Measuring unit 4 Air inlet with protective grating	Via air inlet with protective grating and suction hose with a maximum length of 30 m	Choose the arrangement when: ● There is not enough clearance for in-situ measuring devices (transmissometer) in the tunnel traffic area ● Fixtures in the traffic area are not possible or desired for other reasons ● Measuring is required at especially inaccessible locations where transmissometers cannot be installed.
In operational rooms  1 Control cabinet 2 Control unit 3 Measuring unit 4 Blower 5 Measuring air feed for further evaluation systems (e.g. SIDOR) 6 Pipe manifold 7 Air filter	Via suction hoses up to 300 m in length with separate blower as bypass system	Only choose this arrangement when the previous installation options are not possible. Disadvantages: ● Much longer response time (long suction hose → particularly important when using the Smotec450 as smoke detector ● Suction hoses made from PVC or PE have unfavorable behavior in fire (PVC is not free from Halogen, PE is not self-extinguishing and can therefore spread fires further), and can become charged electrostatically → measured values can be falsified through changes in the measured air ● High effort for planning, installation and operation (could be higher than the device costs) ● Suction hoses made of stainless steel to be used preferably at this installation cause considerably higher costs. ● Dust particles can deposit in the suction hoses → reduced cross-section

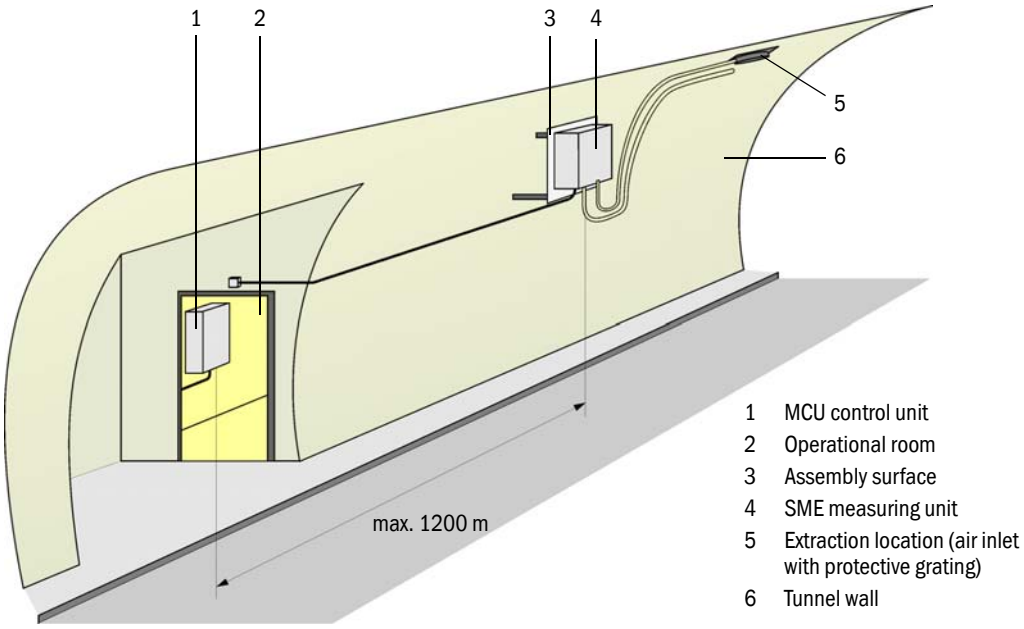
3.1.3 Installation locations

Mount measuring and control units at a vertical, level, easily accessible and protected location with enough clearance for opening the doors and laying air lines and cables (→ p. 32, §3.2.1 and → p. 34, §3.2.2). If the units are mountedon the tunnel wall in the traffic area make sure that there is sufficient distance between them and passing vehicles.

The extraction location must be in the traffic area, as possible centered on the tunnel ceiling.

Install the MCU control unit in an operational room if possible. The maximum distance to the measuring unit is 1200 m.

Figure 12 Installation locations



3.1.4 Suction and exhaust air hose

The following requirements have to be observed:

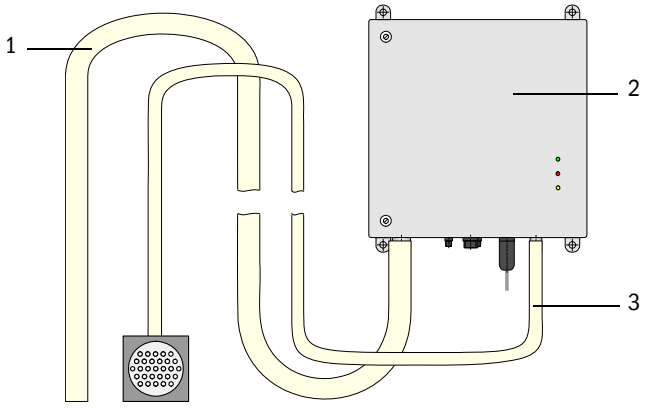
- Inside diameter of the suction hose from elastic material 13 mm and 16 mm for non-elastic material (connection via a flexible hose if possible).

> Outer diameter of the air inlet nozzle of the measuring unit 16 mm.

- Inside diameter of the exhaust air hose 25 mm.
- Minimal bend radiuses for suctionand exhaust air hose 200 mm.
- The exhaust air hose must not be much longer than the suction hose.
- The air pressure at the suction location and at the location where the SMOTEC450 exhaust air flows back into the environment must be approximately same.
- The exhaust air must not be led to operational rooms that are under overpressure.
- Suction and exhaust air hoses must run continuously downwards away from the measuring unit so that no water can collect in the hoses or penetrate the measuring unit. If this cannot be realized, lay the hoses at the extraction location and measuring unit at least straight down for a certain distance (→ Fig. 12 and → p. 31, Fig. 13). The hoses should be as short as possible.

- It may be necessary to install a water separator in case of long suction hoses, particularly if the hose is laid through areas with different temperatures.

Figure 13 Connection of suction and exhaust air hose if head is not available



1 Exhaust air hose
2 Measuring unit
3 Suction hose

A set consisting of suction and exhaust air hose with lengths of 5 m, 10 m and 15 m is deliverable by Endress+Hauser

3.1.5 Connection cable

The connection cable must have an adequate wire cross-section to cope with the power requirements for the blower and heating chamber when the MCU feeds the power supply to the measuring unit. This depends on the cable length (see following table).

Wire cross-section mm²	Specific resistance in Ω/km	Maximum cable length in m
0.5	40	25
0.75	25	40
1.00	18	55
1.5	14	70
2.5	8	130

Minimum voltage for SME is 20 V d.c.

For distances between the measuring and control units longer than 130 m, the measuring unit should be separately connected to the mains voltage using the optional power pack to keep the costs low.

3.2 Assembly

All of the assembly and installation work has to be carried out by the customer. This comprises mounting the measuring and control units and assembling the air inlet with protective grating and suction hose (if the cover with integrated air inlet is not used).

WARNING:

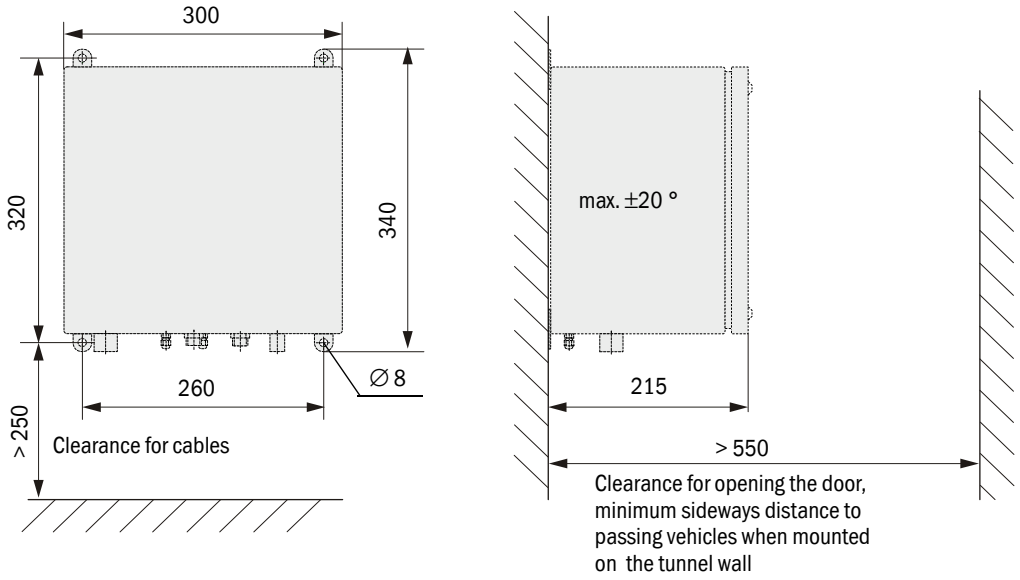
- ► Observe the relevant safety regulations as well as the safety notices in Section 1 when carrying all assembly work!
- ► If possible, only carry out assembly work when the tunnel is closed!
- ► Take suitable protection measures against possible hazards!

3.2.1 Mounting the measuring unit

Mount the measuring unit at a vertical, level, easily accessible and protected location.

NOTICE:
The connections must always be below.

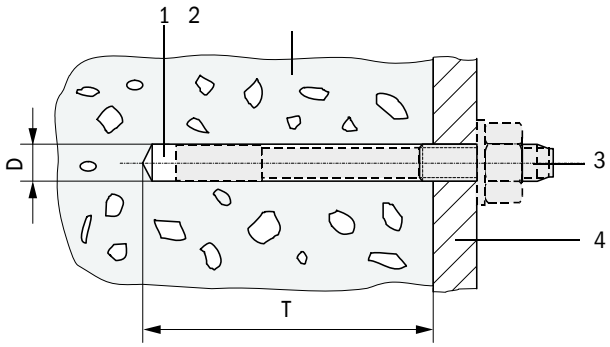
Figure 14 Measuring unit assembly dimensions



Activities

- ► Drill the holes according to p. 33, Fig. 15 (distances according to Fig. 14).
- ► Insert plugs (mounting sets 2D4/4D8-1.4571/PA, 2M8-1.4571) or tie bolts (mountings set 4M8-1.4529).
- ► Fasten the measuring unit using hexagon head screws or nuts.

Figure 15 Drill hole dimensions



1 Drill hole
2 Tunnel wall
3 Tie bolt with locking nut
4 Bracket of the measuring unit

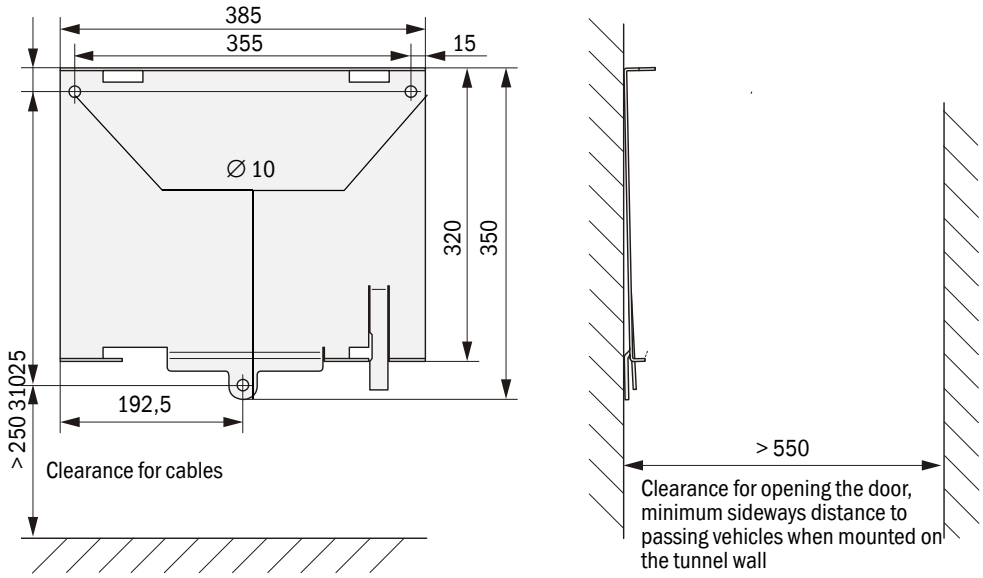
Mounting set	D [mm]	T [mm]	Remark
2D4-1.4571/PA	6	≥ 40	The plug should be flush with the tunnel wall.
4D8-1.4571/PA	10	≥ 70	
2M8-1.4571	12	≥ 60	
4M8-1.4529	8	≥ 65	The tie bolt must not protrude more than 12 mm from the tunnel wall.

Assembly of the measuring unit by using the optional installation plate

► Mount the measuring unit according to Fig. 16.

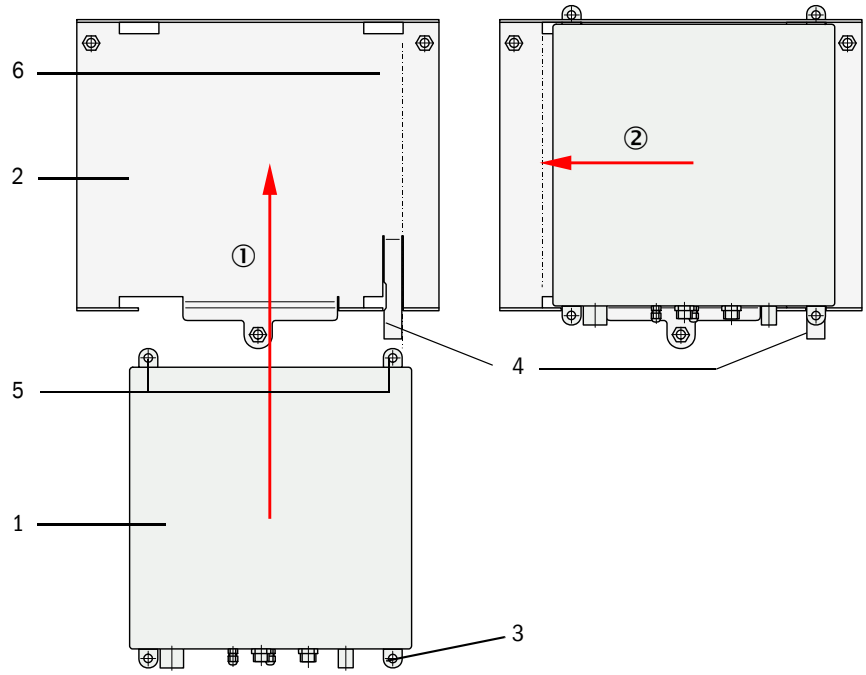
We recommend using M10 bolts on the fastening points on which the measuring unit can be positioned and fastened with self-locking nuts.

Figure 16 Assembly of the installation plate option



► Put the measuring unit (1) on the installation plate (2) o that the lower right bracket (3) lies on the securing plate (4), slide the upper brackets (5) into the accompanying jogs (6), and then move the measuring unit to the left till the securing plate is freely mobile and secure it.

Figure 17 Assembly of the measuring unit on the installation plate



3.2.2 Installing the air inlet with protective grating

Figure 18 Mounting dimensions for wall mounting

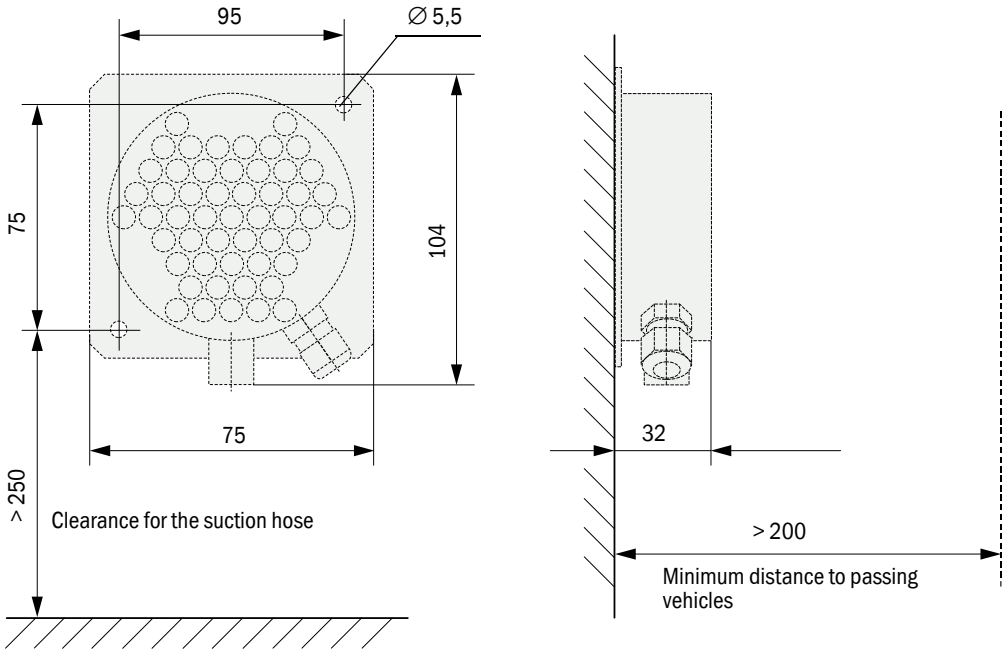
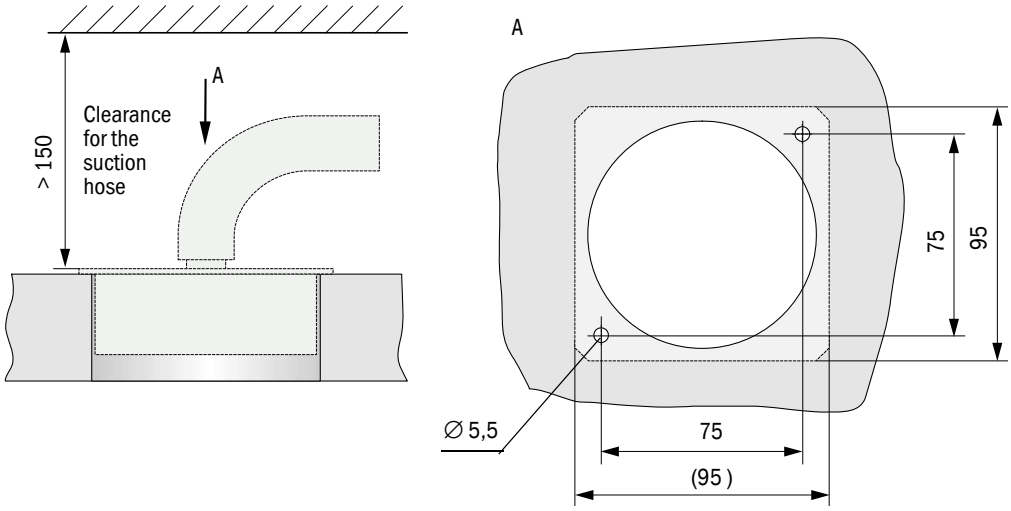


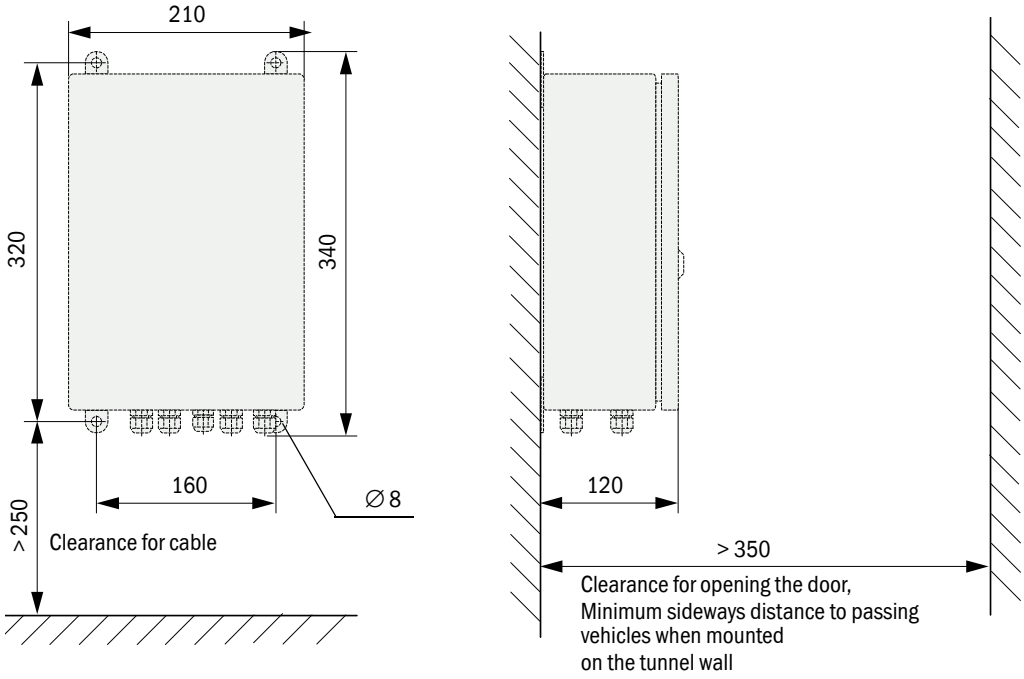
Figure 19 Mounting dimensions for installation on intermediate ceiling



3.2.3 Mounting the control unit in wall-housing

Mount the control unit in a vertical, level, easily accessible and protected location according to Fig. 20.

Figure 20 Mounting dimensions for MCU in steel sheet housing



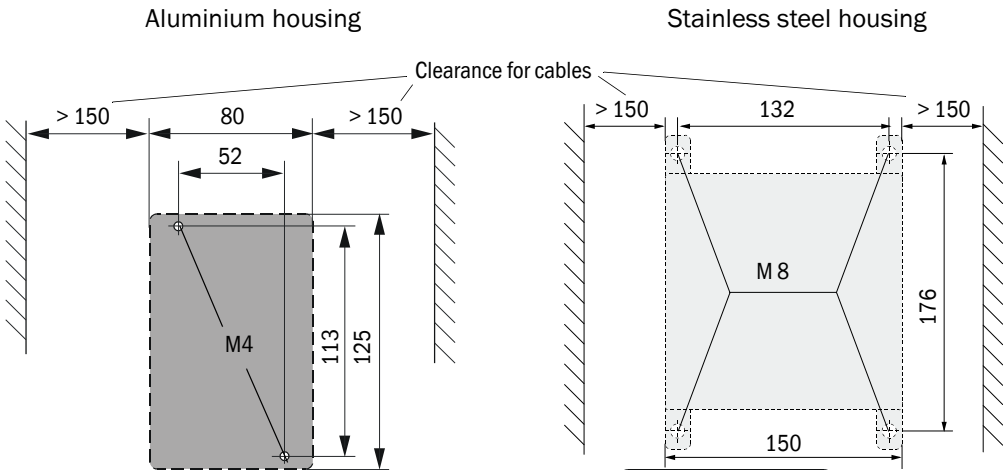
The respectively suitable mounting sets can be used to the fastening (→ p. 25, §2.2.5; installation → p. 33, Fig. 15).

- The MCU control unit can be installed up to 1200 m away from the measuring unit..
- We recommend installing the MCU in an operational room for trouble-free communication with the SMOTEC450.

3.2.4 Mounting the connection box option

Mount this component on a level base (tunnel wall or roof) as shown in Fig. 21. The respectively suitable mounting sets can be used to the fastening (→ p. 25, §2.2.5; installation → p. 33, Fig. 15).

Figure 21 Mounting dimensions for connection box option

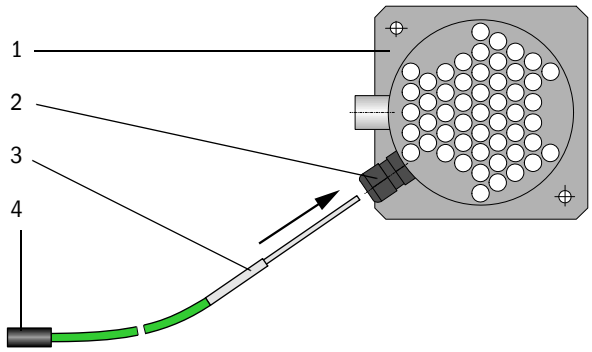


3.2.5 Installing the thermocouple of the temperature measurement option

The temperature measurement option with 1x thermocouple shall be installed as follows:

► If the air inlet with protective grating is used, slide the thermocouple into the screw fitting, and fasten it.

Figure 22 Installing the thermocouple in the air inlet with protective grating



1 Air inlet with protective grating
2 Screw fitting
3 Thermocouple
4 Connector

► It the cover with integrated air inlet is used, put the thermocouple into one of the srew fittings in the bottom of the measuring unit, and fasten it. If these both options (thermocouple and cover) are ordered clearly assigned to one measuring unit, the thermocouple is installed by the manufacturer.

► If other air inlets are used, the thermocouple has to be fastened into immediate proximity of the suction opening.

The thermocouples of the option temperature measurement with 2x thermocouple shall be installed in the traffic area of the tunnel so, that an optimal temperature monitoring is possible to the premature fire recognition.

3.3 Electrical installation

WARNING:
- ► Observe the relevant safety regulations as well as the safety notices in Section 1 when carrying all assembly work!
- ► Take suitable protection measured against possible local or plant-specific hazards.

3.3.1 General information, prerequisites

The assembly work described in §3.2 must have been completed before starting installation work.

All of the installation work must be carried out by the customer. This includes:

- ► Complete laying of power supply and signal cables.
- ► Connecting the power supply and signal cables to all system parts.
- ► Installing switches and mains fuses.

- ● Plan adequate cable cross-sections (→ p. 104, §7.1).
- ● When using the optional power pack, ensure that the cable ends of the connection cable and the power cable of the measuring unit are sufficiently long.
- ● Protect cable connectors not connected against moisture and dirt (screw cover on).

Demands on cable types for customer provided connection of measuring and control unit

A data line with twisted pairs and common screen is required to connect the measuring and control units. Do not use normal telecommunications cables.

The following cable types are well or very well suited for data transfers:

1 UNITRONIC LiYCY (TP) 4 x 2 x 0.75 mm²
Not suitable for underground installationg (protected laying required if necessary)

2 UNITRONIC Li2YCY (TP) 4 x 2 x 0.5 mm²
Alternative to item 1; not suitable for underground installation (protected laying required if necessary)

3 UNITRONIC Li2YCYv (TP) 4 x 2 x 0.5 mm²
Suitable for underground installation

4 Special cable type ASS 4 x 2 x 0.5 mm²
Silicone, halogen-free, high heat and cold resistance, cable sheath red (similar to RAL 3000)

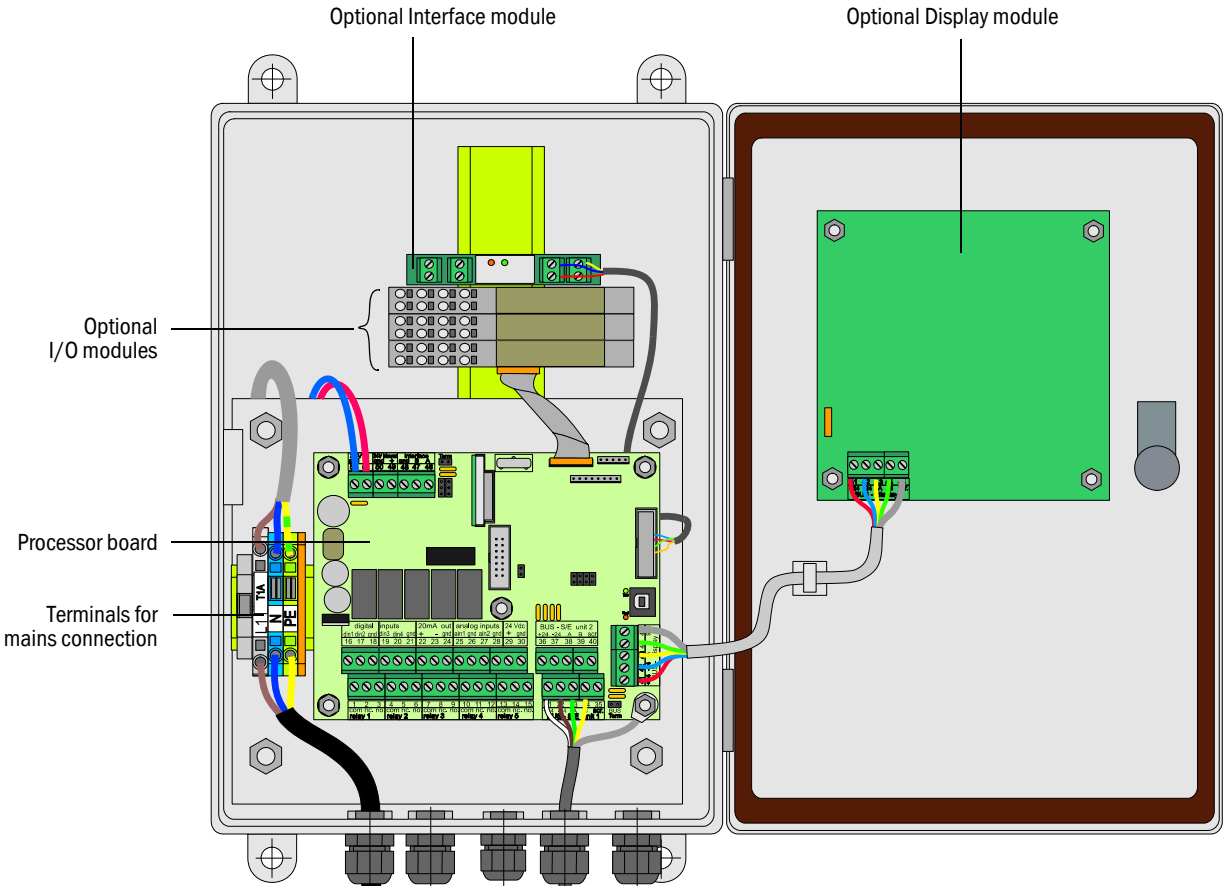
5 Accessories:
Braided cable sleeving PA-S 4, black, to provide mechanical protection and to cover the sheathing colour if necessary.

- ● Manufacturer of UNITRONIC cables: LAPP-Kabel
- ● Manufacturer of special cable: metrofunk KABEL-UNION GmbH

NOTICE:
- ● We cannot grant any warranty for proper function of the system if you use cables which do not comply with above specifications.
- ● Always use cables of the same type and ensure continuous screening.

3.3.2 Connecting the control unit in wall-housing

Figure 23 MCU in wall-housing



Work to be carried out

► Connect the connection cable according to → p. 40, Fig. 26 (standard connection) resp. → p. 41, Fig. 27 (bus variant).

If cables shall be used not provided by supplied by Endress+Hauser, connect them to a suitable 7-pole socket (→ p. 39, Fig. 25; E+H part no.7045569)

NOTICE:

► Only use cables with twisted-pairs and screen (e.g. UNITRONIC LiYCY (TP) 2 x 2 x 0.5 mm² from LAPPKabel; not suitable for underground laying).

► Connect cables for status signals (operation/malfunction, maintenance, function check, maintenance request, limit value), analog output, analog and digital inputs according to requirements (→ p. 40, Fig. 26, → p. 41, Fig. 27, Fig. 28, Fig. 29 and Fig. 30; only use cables with twisted-pairs and screen).

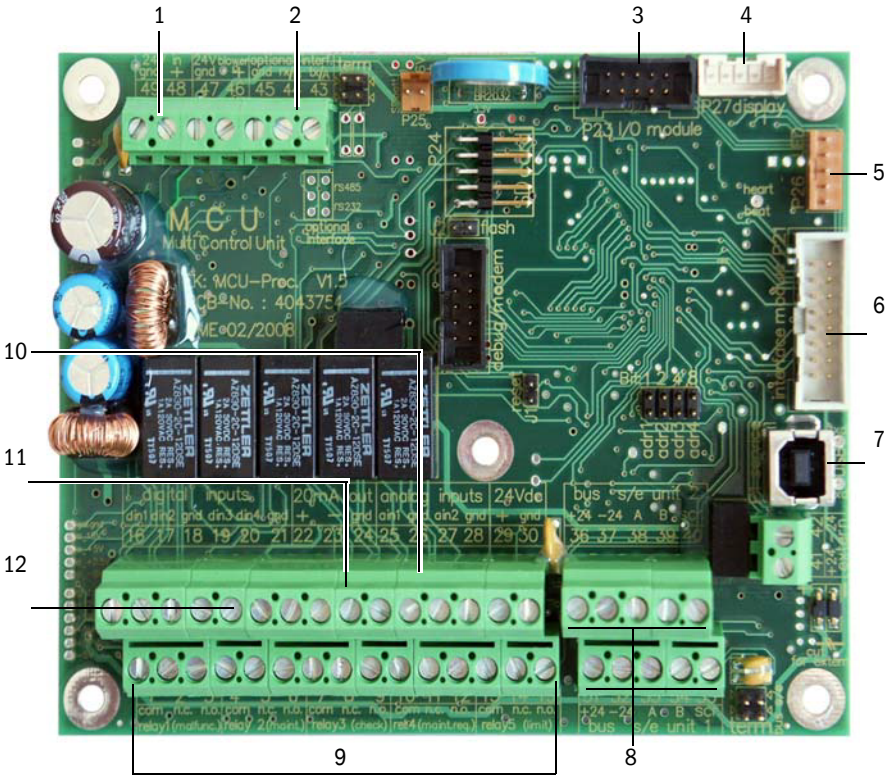
► Connect power cable to terminals L1, N, PE of the MCU (→ Fig. 23).

► Locks the not needed cable bushings with blind stoppers if the MCU is installed outdoors.

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

MCU processor board connections

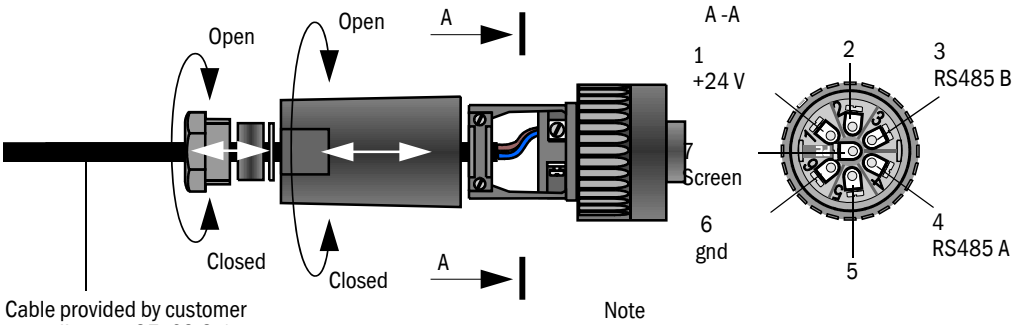
Figure 24 MCU processor board connections



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

Onsite connection cable connection to MCU

Figure 25 Plug-in connector connection on onsite cable

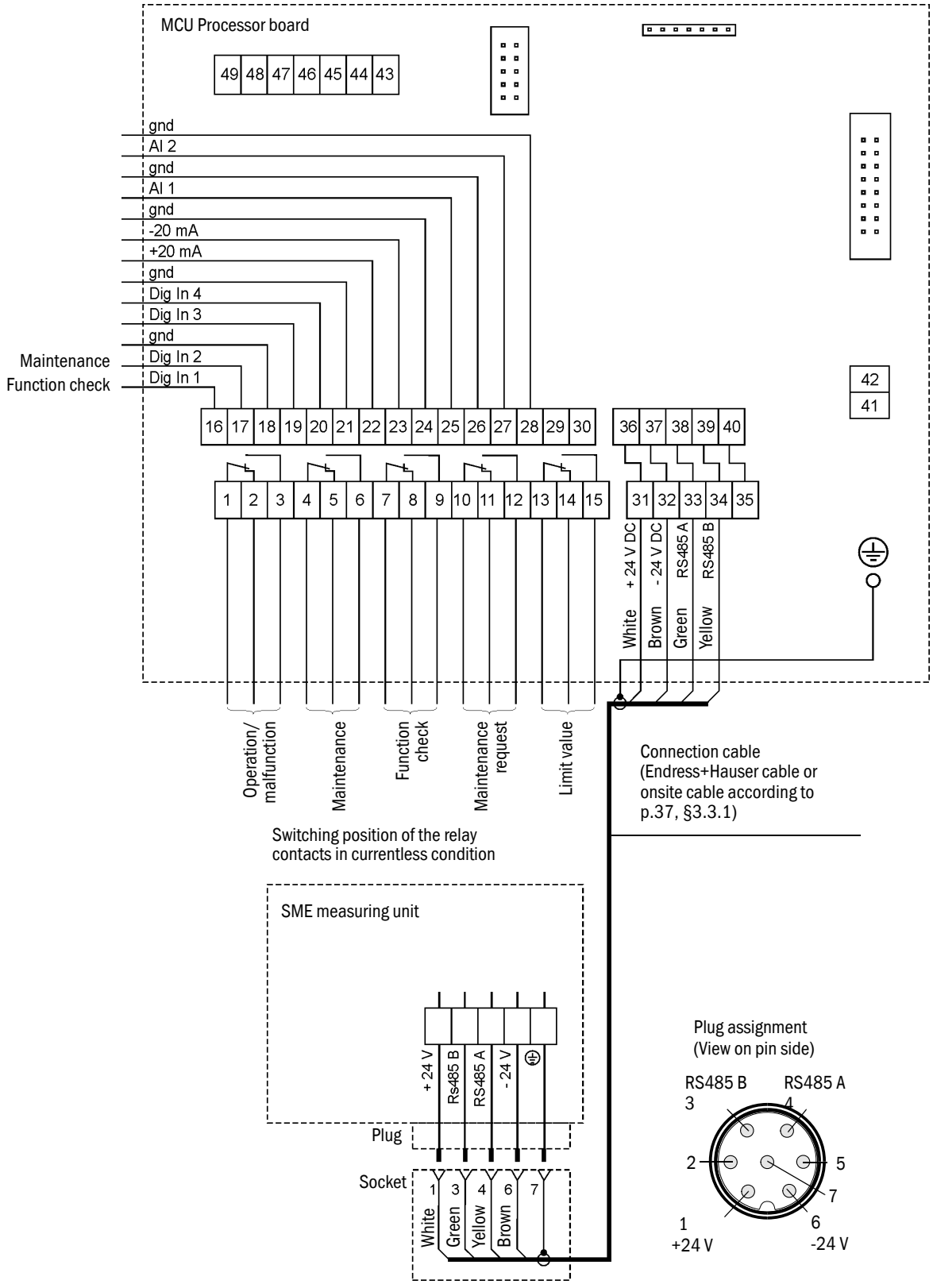


Cable provided by customer according to p.37, §3.3.1

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

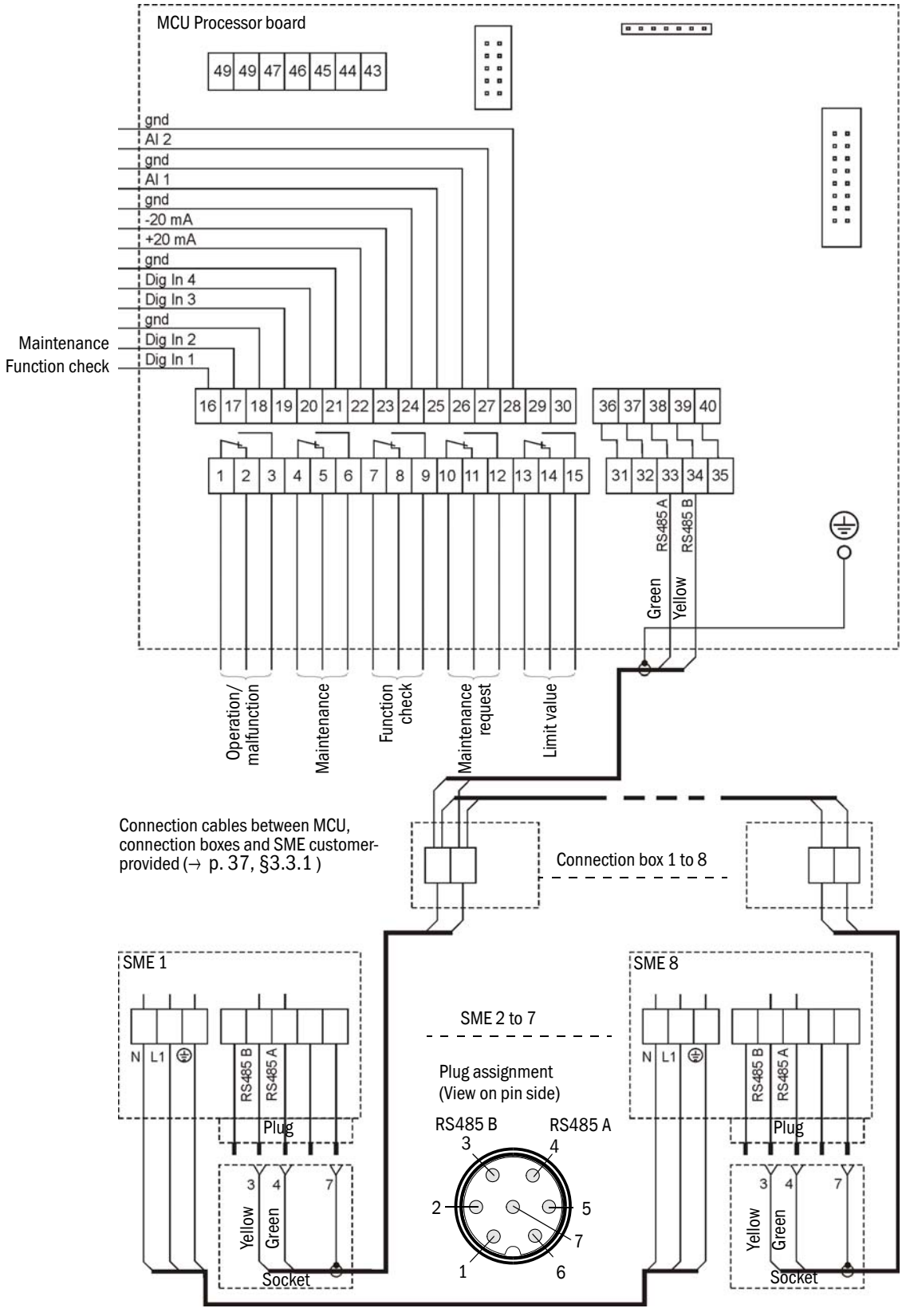
MCU - SME standard connection

Figure 26 MCU - SME standard connection



Bus connection

Figure 27 Bus connection



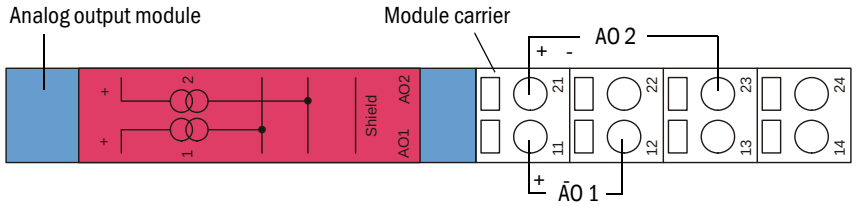
Fitting and connecting optional Interface and I/O modules

Plug interface modules and module carriers for I/O modules onto the hat rail in the MCU (→ p. 38, Fig. 23) and connect to the associated connection on the processor board with the cable with plug-in connector (→ p. 39, Fig. 24). Then plug the I/O module on the module carrier.

Connect I/O modules using the the terminals on the module carrier (→ Fig. 28, Fig. 29), the Profibus module using the terminals on the module and the Eternet module via customer provided network cable.

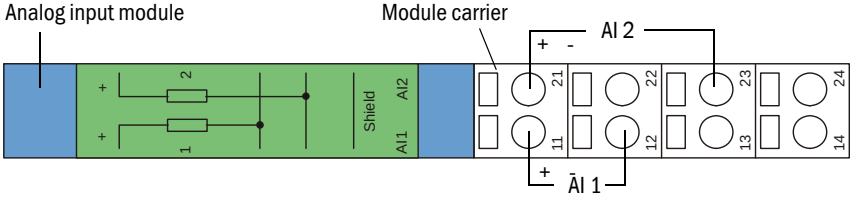
- Terminal assignment AO module

Figure 28 Terminal assignment analog output module



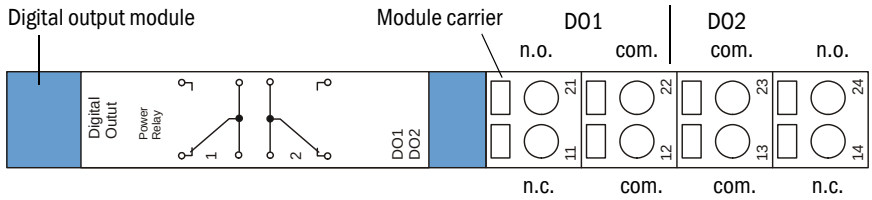
- Terminal assignment AI module

Figure 29 Terminal assignment analog input module



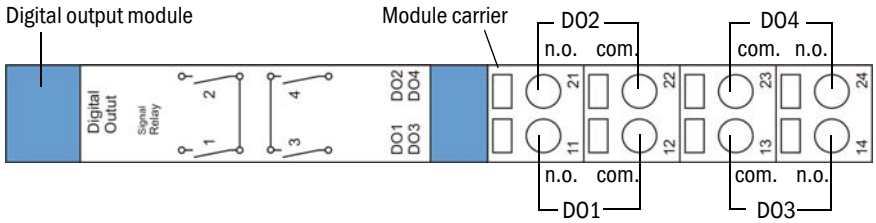
- Terminal assignment DO module (2 changeover contacts)

Figure 30 Terminal assignment digital output module



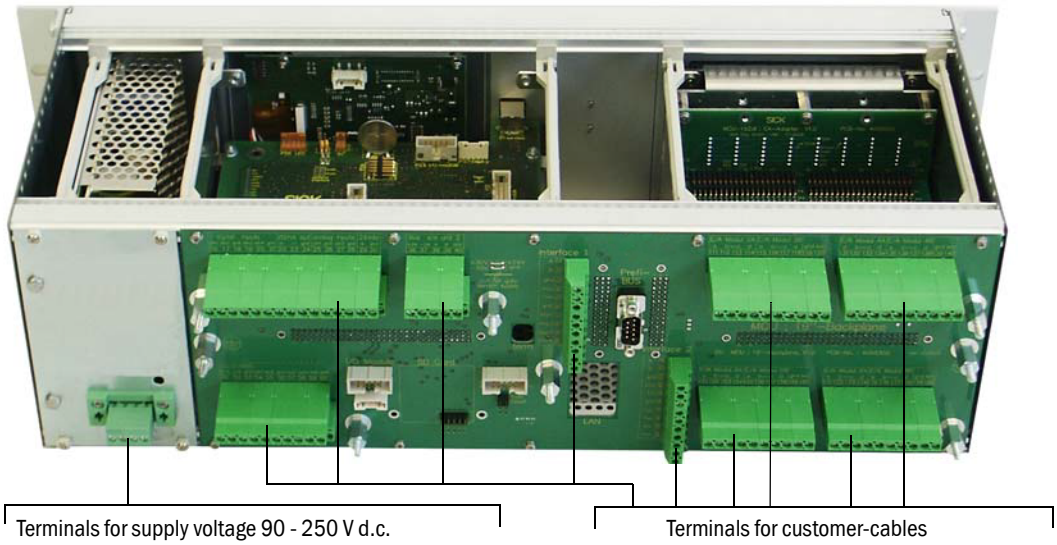
- Terminal assignment DO module Signal Relay (4 make contact elements)

Figure 31 Terminal assignment digital output module signal relay



3.3.3 Connecting the control unit in 19”rack

Figure 32 Connections on the MCU in 19" rack



Function	Connection	Terminal no.
Output relay 1 (operation/malfunction)	com	1
	n.c.	2
	n.o.	3
Output relay 2 (maintance)	com	4
	n.c.	5
	n.o.	6
Output relay 3 (function check)	com	7
	n.c.	8
	n.o.	9
Output relay 4 (maintenance request)	com	10
	n.c.	11
	n.o.	12
Output relay 5 (limit value)	com	13
	n.c.	14
	n.o.	15
Digital input	dig in 1	16
	dig in 2	17
	gnd	18
	dig in 3	19
	dig in 4	20
	gnd	21
Analog output	+	22
	-	23
	gnd	24
Analog input	AI 1	25
	gnd	26
	AI 2	27
	gnd	28

Function	Connection	Terminal no.
Connections for measuring unit	+24	31 (36)
	-24	32 (37)
	RS485 A	33 (38)
	RS485 B	34 (39)
	scr.	35 (40)
Input power supply 24V d.c.	24 V	41
	gnd	42
Output power supply 24V d.c.	24 V	43
	gnd	44
Input 30 V galv. separated	+	45
	-	46
RS232/485	tx/A	51
	rx/B	52
	gnd	53
Interface 1	A	71
	B	72
	gnd	73
	+Us	74
	-Us	75
	gnd	76
	imp+	77
	imp-	78
	res 1	79
	res 2	80

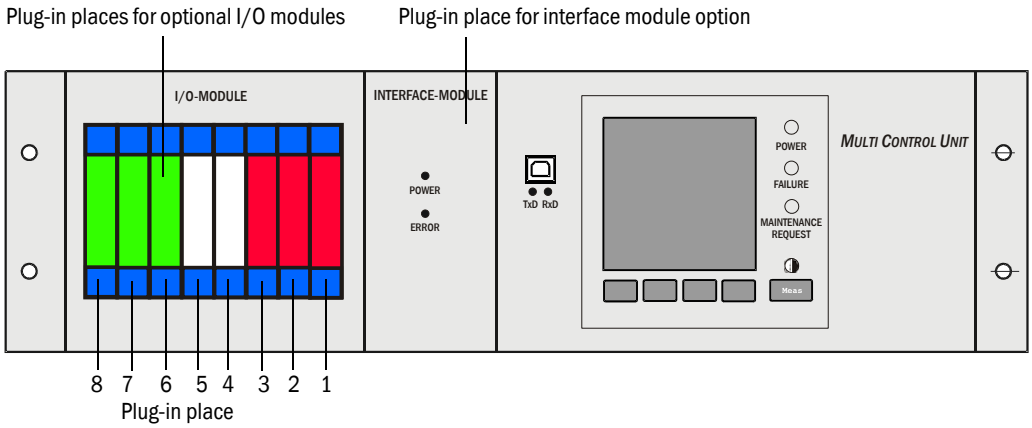
1):closed in currentless condition (normal closed)

2):open in currentless condition (normal open)

Installing and connecting optional I/O modules

Plug optional analog and digital modules on the plug-in places in the module carrier beginning with plug-in place 1 in the order AO → AI → DO → DI without gap. If single module types are not available, the respectively next one follows according to the mentioned order.

Figure 33 Plug-in places for optional modules

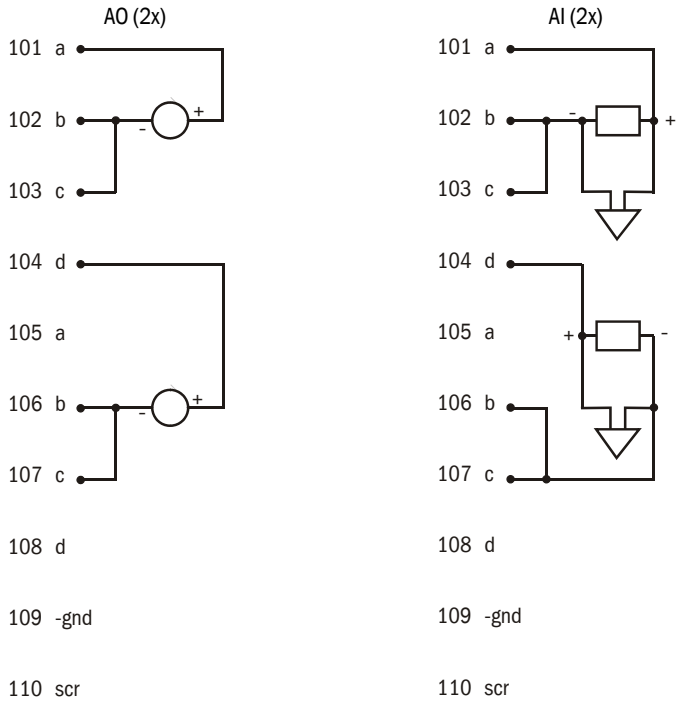


The connection of these modules is carried out at the terminals 101-180 of the backplane.

Followingly the connection of the modules is represented exemplarily to plug-in place 1. The connection of I/O modules at the other plug-in places 2-8 is carried out in the same manner.

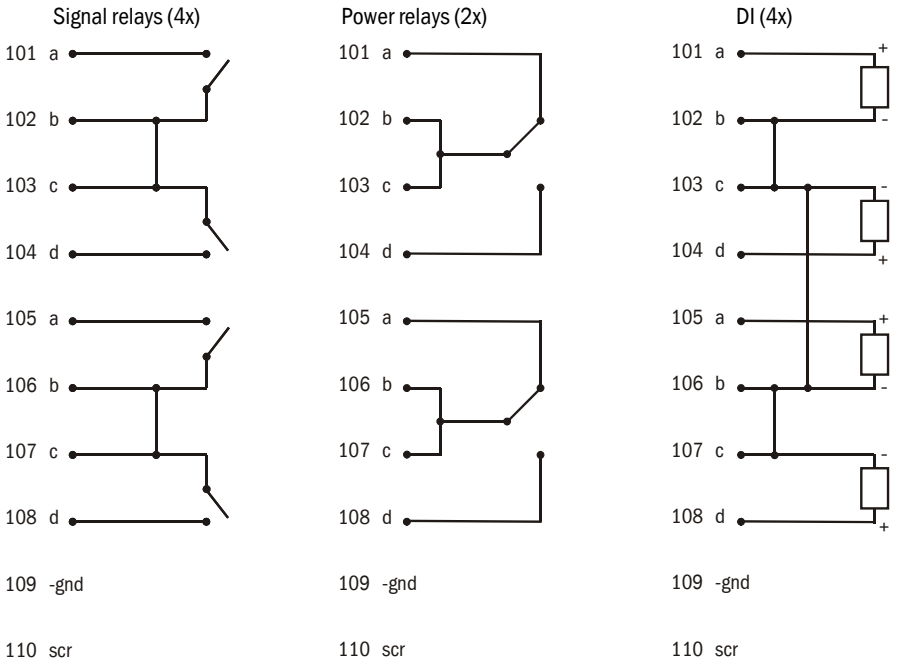
- Connection of analoge module

Figure 34 Connection of analog module at plug-in place 1 (terminals 101-110



- Connection of digital module

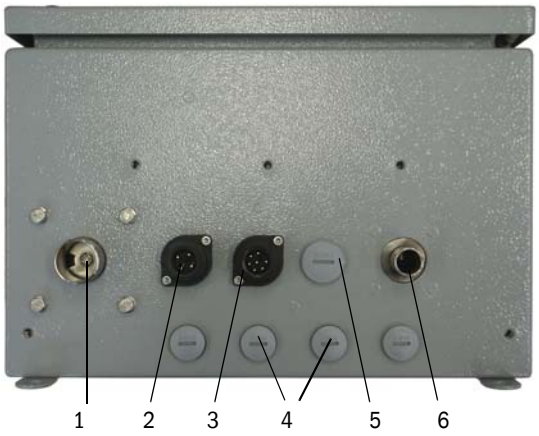
Figure 35 Connection of digital module at plug-in place 1 (terminals 101-110)



3.3.4 Connecting the measuring unit(s)

- ► Connect the connection cable to the MCU.
- ► Connect the suction and exhaust air hose.

Figure 36 Connections on underside of the measuring unit



1 Air outlet nozzle
2 Plug for separate power supply
3 Plug for connecting cable to the MCU
4 Blind plug *
5 Blind plug for additional cable
6 Air inlet nozzle

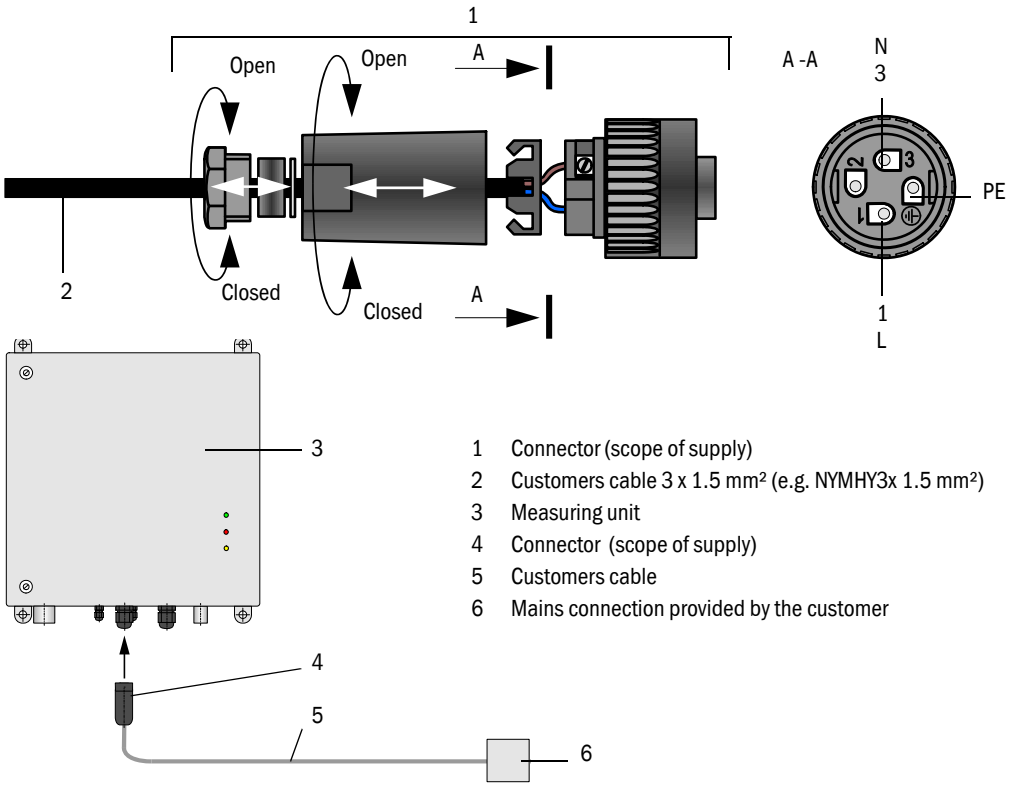
*: Replaced by sockets when temperature measurement option is installed

Connecting the measuring unit with optional power pack 24 V d.c. 75 W at mains voltage

The connector as a part of this option (scope of supply) has to be connected according to the following figure.

WARNING:
The cable may only be connected by an expert authorized to it!

Figure 37 Connecting the measuring unit with optional power pack 24 V DC 75 W at mains voltage



1 Connector (scope of supply)
2 Customers cable 3 x 1.5 mm² (e.g. NYMHY3x 1.5 mm²)
3 Measuring unit
4 Connector (scope of supply)
5 Customers cable
6 Mains connection provided by the customer

Connecting the optional temperature measurement

► Connect the plug connected to the measuring line to the accompanying socket on the measuring unit

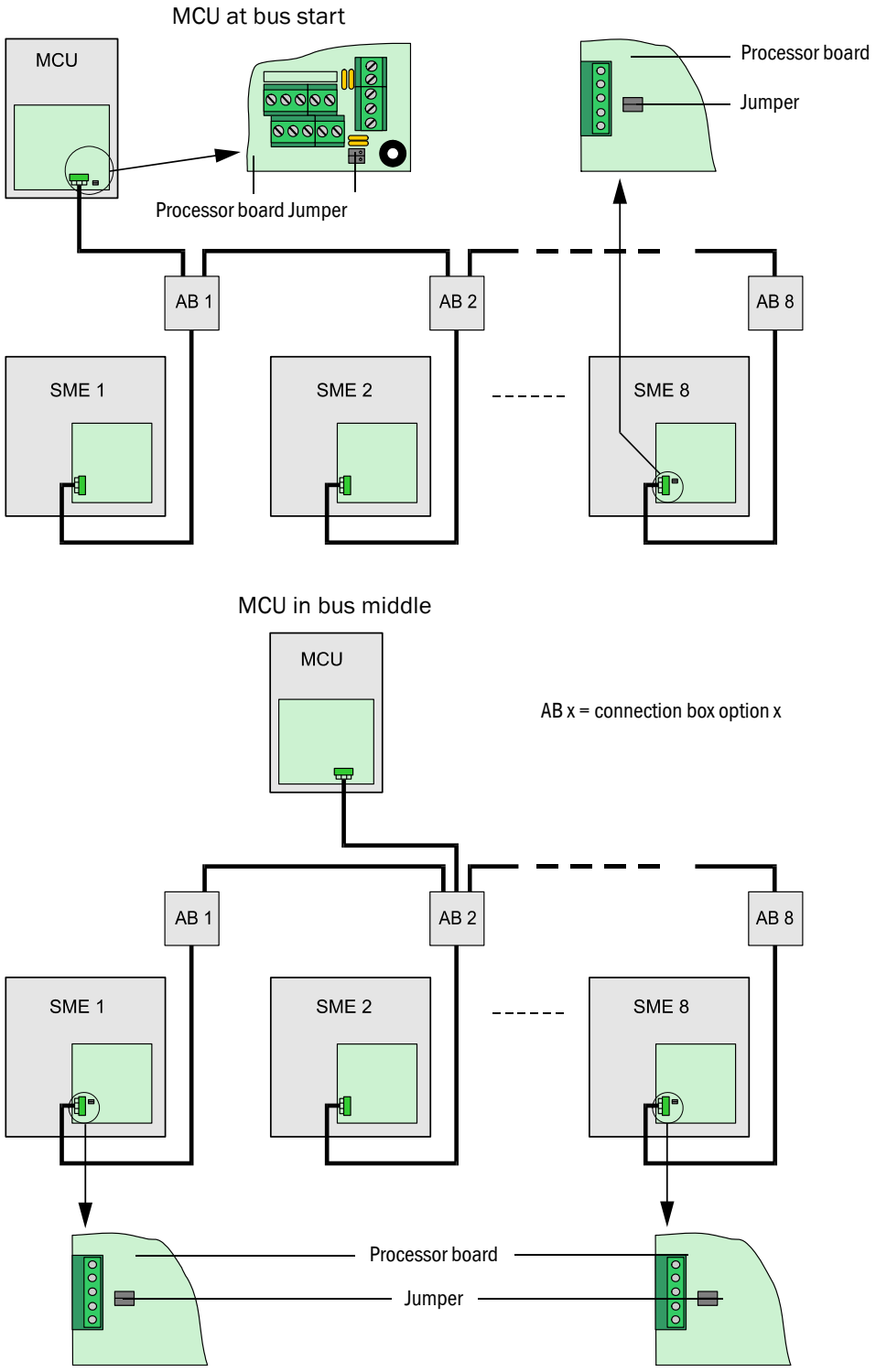
> ***NOTICE:***
> The assignment of the thermocouple(s) to the connector(s) at the measuring unit must be adhered to absolutely according to the identification since electronics and temperature sensor are adjusted on each other! Adhere to the equipment specific assignment if several measuring units with this option are used!

3.3.5 Terminating the SME - MCU connection

The RS485 connection between SME and MCU must be terminated with resistors at the begin and the end. These are inserted as jumpers on the pins marked "term" on the processor boards of SME and MCU.

Disconnect MCU and SME from power supply for checking (and correction if necessary).

Figure 38 Bus termination



3.3.6 Bus addressing

The bus addresses required for bus systems (several measuring units on one MCU) can be assigned per hardware or software. Hardware addressing is read in at the start of the SOPAS ET program and has a higher priority than software addressing.

Bus address and sensor number in the MCU (→ p. 64, §4.2.2) are always identical.

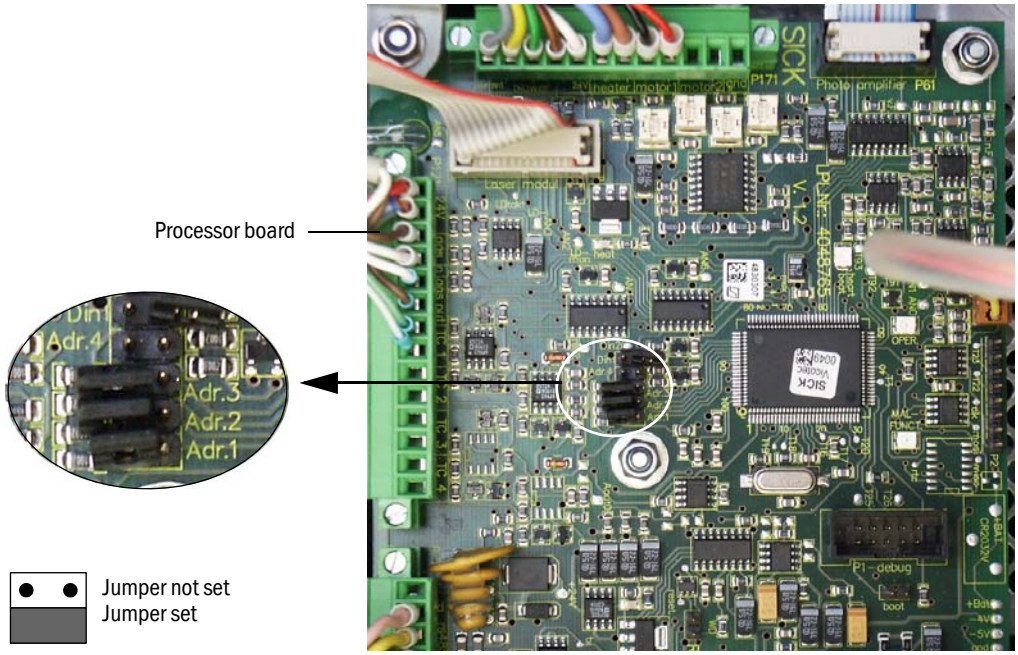
> ***NOTICE:***
> The measuring units must have different addresses. Identical addresses of several units causes the communication with the MCU to abort!

Hardware addressing

As standard, the addresses are assigned by setting jumpers on the processor board in the measuring unit (4 jumpers for hexadecimal addressing of addresses 1 to 8; → Fig. 39).

The address assigned to a measuring unit is shown on a label on the unit door.

Figure 39 Measuring unit addressing per hardware

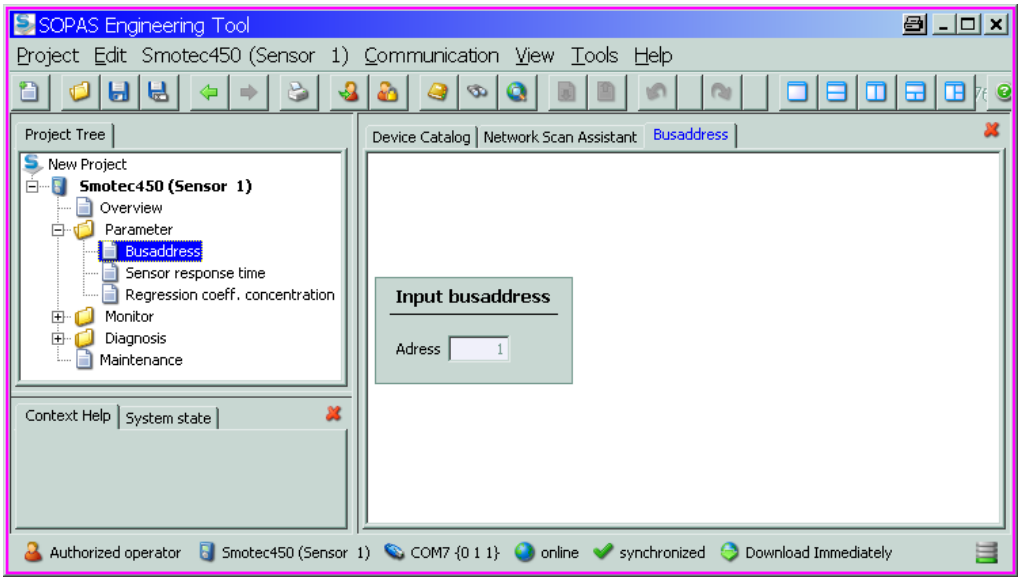


Address	Jumper	Address	Jumper	Address	Jumper	Address	Jumper
1	Adr.4 ●● Adr.3 ●● Adr.2 ●● Adr.1	3	Adr.4 ●● Adr.3 ●● Adr.2 Adr.1	5	Adr.4 ●● Adr.3 Adr.2 ●● Adr.1	7	Adr.4 ●● Adr.3 Adr.2 Adr.1
2	Adr.4 ●● Adr.3 ●● Adr.2 Adr.1 ●●	4	Adr.4 ●● Adr.3 Adr.2 ●● Adr.1 ●●	6	Adr.4 ●● Adr.3 Adr.2 Adr.1 ●●	8	Adr.4 Adr.3 ●● Adr.2 ●● Adr.1 ●●

Software addressing

As an alternative to hardware addressing, the addressing can also be assigned in the SOPAS ET porgram (→ Fig. 40). To do so, connect the measuring system to the SOPAS ET program, select the ”Smotec450” device file and set the measuring system to the ”Maintenance” mode.

Figure 40 ”Parameter / Busaddress“ directory



The default value for the bus address is always 1. Assign higher addresses to units already connected before connecting further measuring units to the bus.

SMOTEC450

4 Commissioning and Parameterization

Basics
Customer-specific parameterization
Setting optional interface modules
Parameterizing optional modules
Operating/setting parameters via the LC-Display

4.1 Basics

4.1.1 General information

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

The SMOTEC450 is delivered with default values set at the factory so that commissioning primarily involves checking cable and hose connections (visual control) and switching on the mains voltage. Zero point adjustment or calibration of the measuring system are not required.

The customer only needs to change parameters when the default values need to be modified (e.g. to set a limit value for smoke alarm). The SOPAS ET operating and parameterization program is delivered with the device and can be used in such cases. The menu structure simplifies changing settings. Further functions are also available (e.g. data storage, graphic displays).

4.1.2 Installing the operating and parameter program SOPAS ET

Administrator rights are required to install the program.

Requirements

- Laptop/PC with:
  - Processor: Pentium III (or comparable type)
  - USB interface (alternative - RS232 via adapter)
  - Working memory (RAM): At least 500 MB
  - Operating system: MS Windows 2000/XP/Vista (not Windows 95/98/NT)
- USB interface cable to connect the Laptop/PC to the measuring system (MCU).
- The operating and parameter program as well as the USB driver (scope of delivery) must be installed on the Laptop/PC.
- The power supply must be switched on.

NOTICE:
The SOPAS ET with version 02.22 (or higher) must be used for measuring units with firmware version 03.00.00 (otherwise no communication is possible).

Install the SOPAS ET program

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

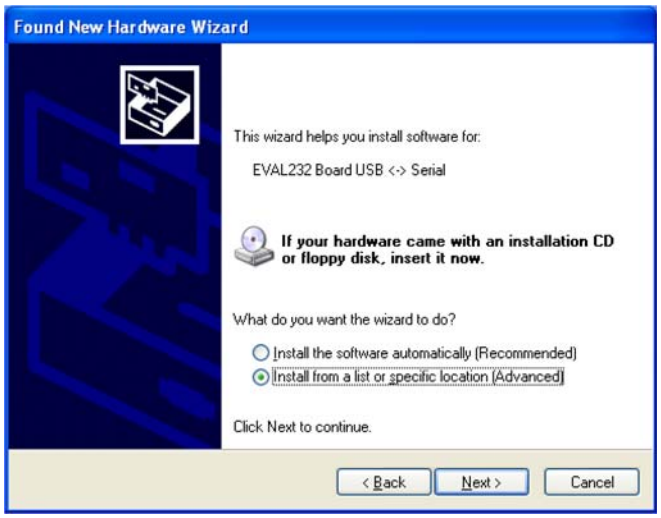
Start the file "setup.exe" when the start screen does not appear.

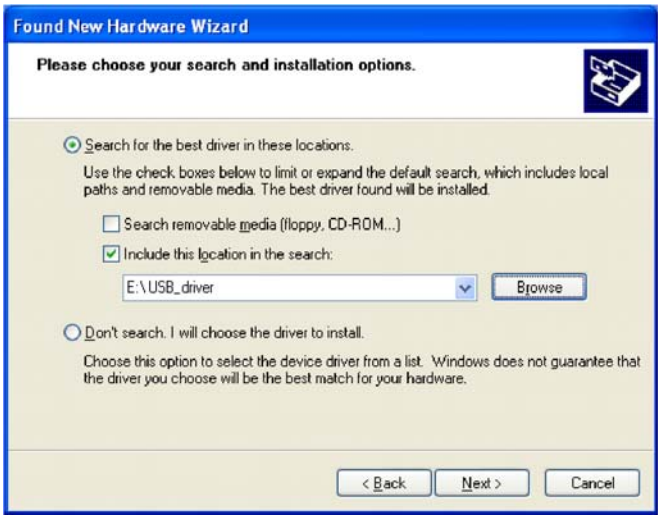
Install the USB driver

A special software driver is required for communication between the operating and parameter program SOPAS ET and the measuring system via the USB interface. Connect the MCU to the supply voltage and to the PC via USB cable to install the driver. A message appears on the display that new hardware has been detected. Then insert the delivered CD in the PC drive and follow the installation instructions (→ p. 53, Fig. 41).

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

Figure 41 Installing the USB driver





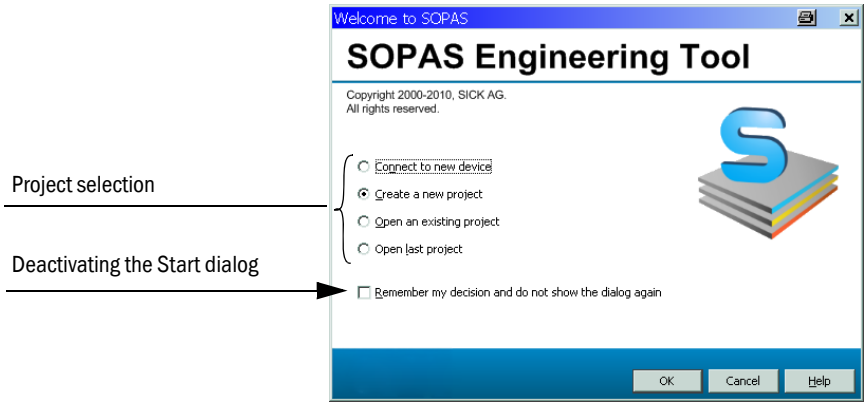
Der USB-Treiber erzeugt ein neues COM-Port, das für die Verbindung des Programms SOPAS ET zum Gerät zu benutzen ist (→ p. 55, §4.1.3.2).

4.1.3 Connecting the Device

4.1.3.1 Basic settings

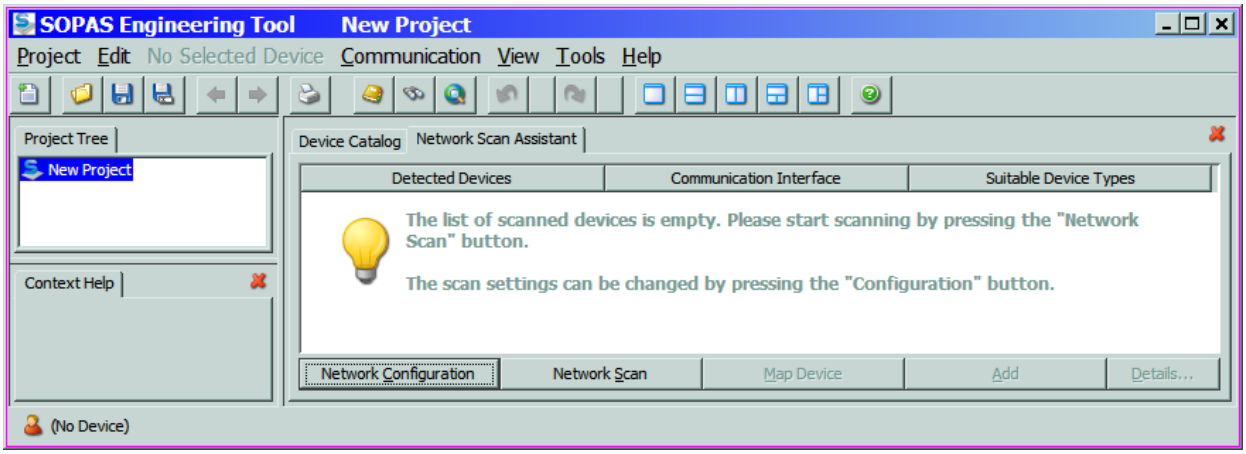
- ► Connect the USB cable to the MCU control unit (→ p. 39, Fig. 24) and Laptop/PC.
- ► Start the program from the "SICK\SOPAS" start menu.
- ► The start dialog appears on the screen (can be suppressed for the further program use).

Figure 42 Start dialog



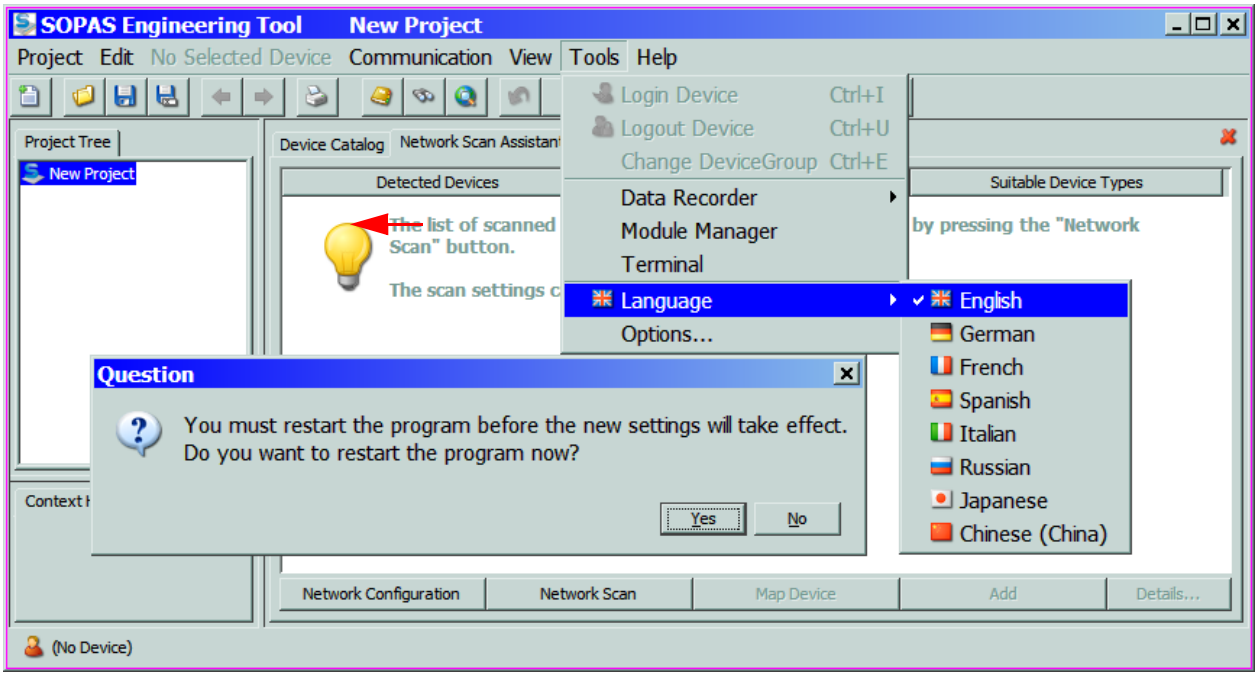
The following Start menu appears after confirmation with "OK".

Figure 43 Start menu



- ► If required, select the desired language in the "Tools / Options / Language" menu (→ p. 55, Fig. 44), confirm with "OK", and restart the program .

Figure 44 Change of language settings

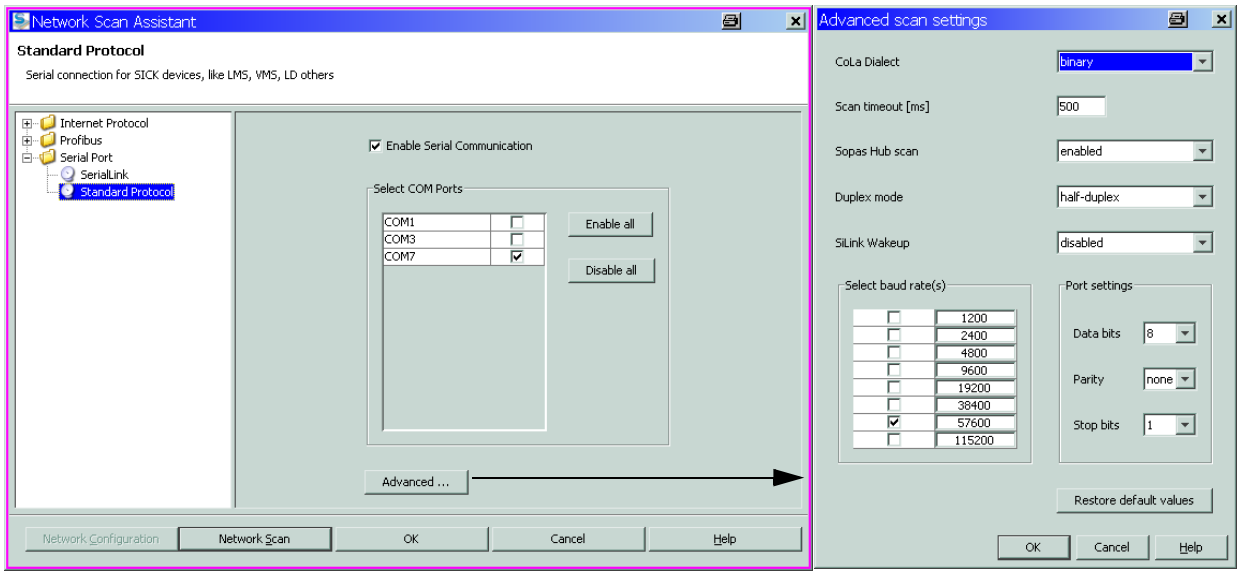


4.1.3.2 Configuring the interface

COM Port

- ► Click the "Network Configuration" button in the start menu (→ p. 54, Fig. 43) and select „Standard Protocol”.
- ► Select the COM port in the "Select COM Ports" group that appears after connection of MCU and Laptop/PC, click the "Advanced..." button and configure according to Fig. 45 (settings only required during the first connection to the measuring system).

Figure 45 Interface selection and configuration

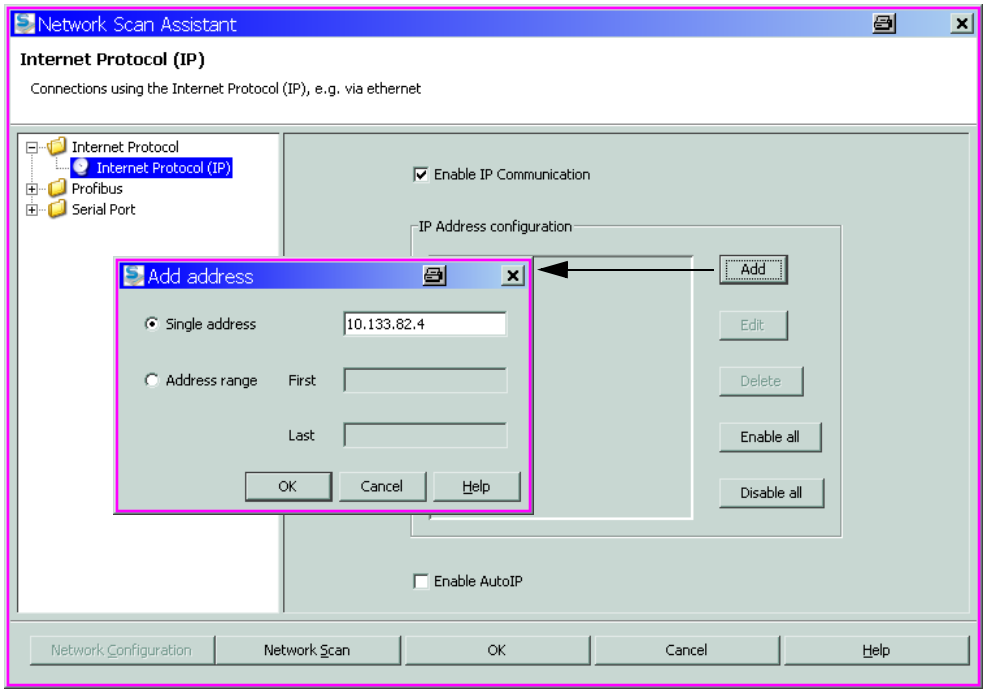


Ethernet

The Ethernet interface module (→ p. 113, §7.4.2) must be installed in the MCU (→ p. 38, §3.3.2) and configured (→ p. 79, §4.3.3) to get a connection to the measuringg system via Ethernet.

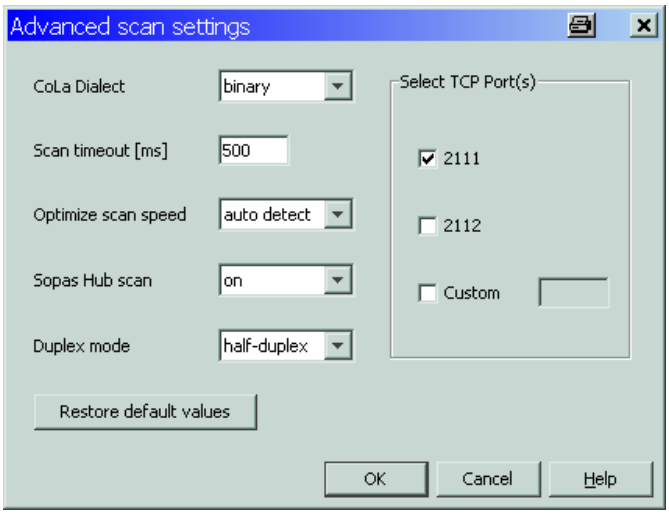
- ► Click the "Network Configuration" button in the start menu (→ p. 54, Fig. 43) and select "Internet Protocol (IP)".
- ► Click the "Add "button, enter the IP address and confirm with "OK".

Figure 46 Ethernet interface selection (example settings)



- ► Click the "Advanced..." button and configure the interface according to Fig. 47.

Figure 47 Configuring the Ethernet interface

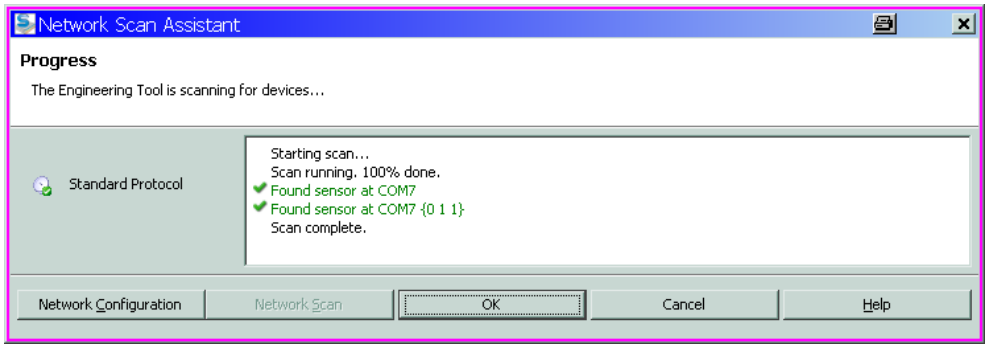


4.1.3.3 **Establish connection via "Network Scan Assistant" directory**

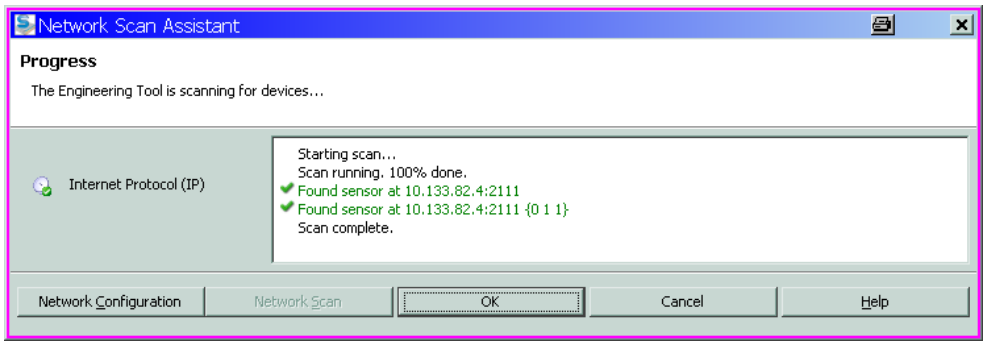
► Click the "Network Scan" button in the "Network Scan Assistant" directory.

Bild 48 Search for connected devices

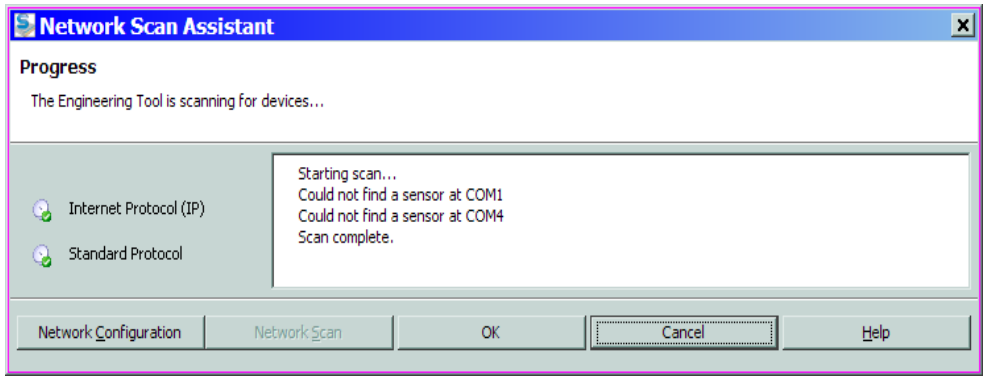
Connection via COM port



Connection via Ethernet



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



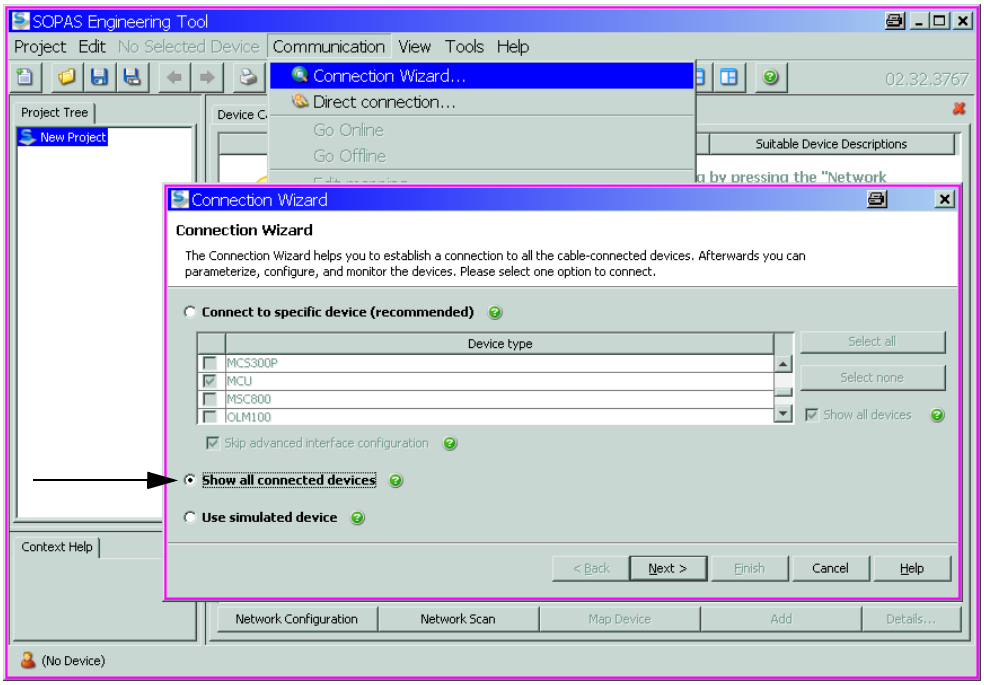
Problems with Ethernet connection can be caused by incorrect addressing → contact system administrator.

► Confirm search for connected devices with "OK".

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

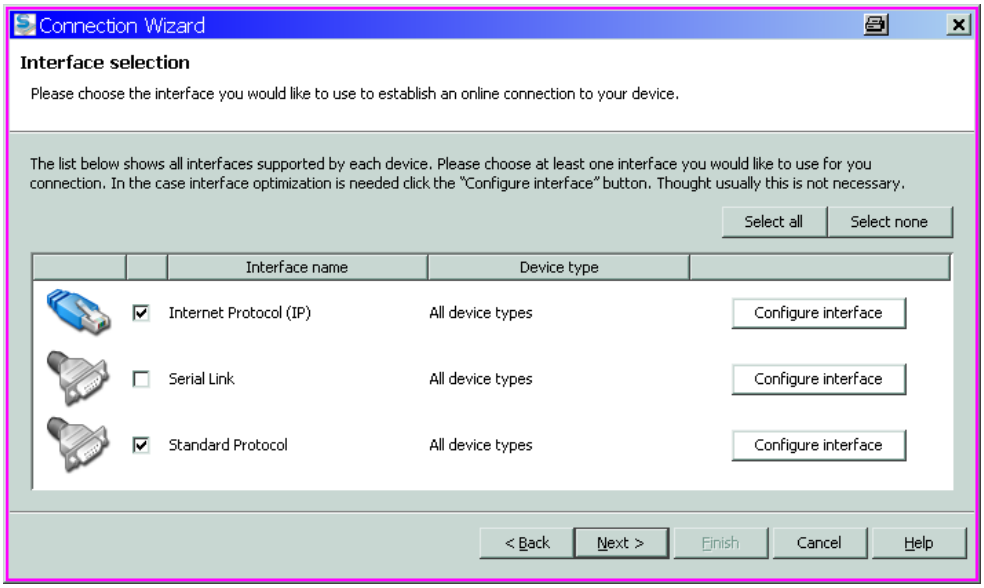
► Select "Communication / Connection Wizard" menu and activate "Show all connected devices".

Figure 49 "Communication / Connection Wizard" menu



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

Figure 50 Interface selection

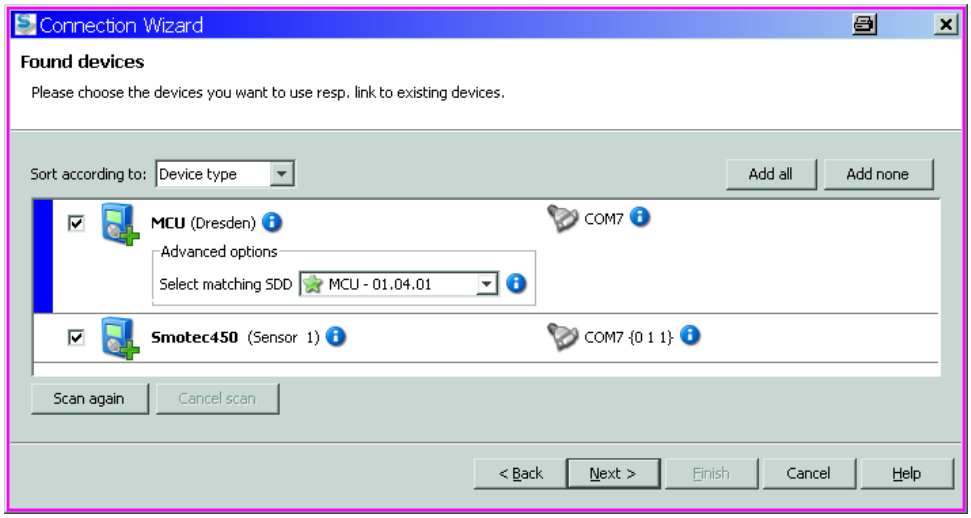


► Check interface configuration for setting according to p. 57, §4.1.3.3 and change accordingly if necessary.

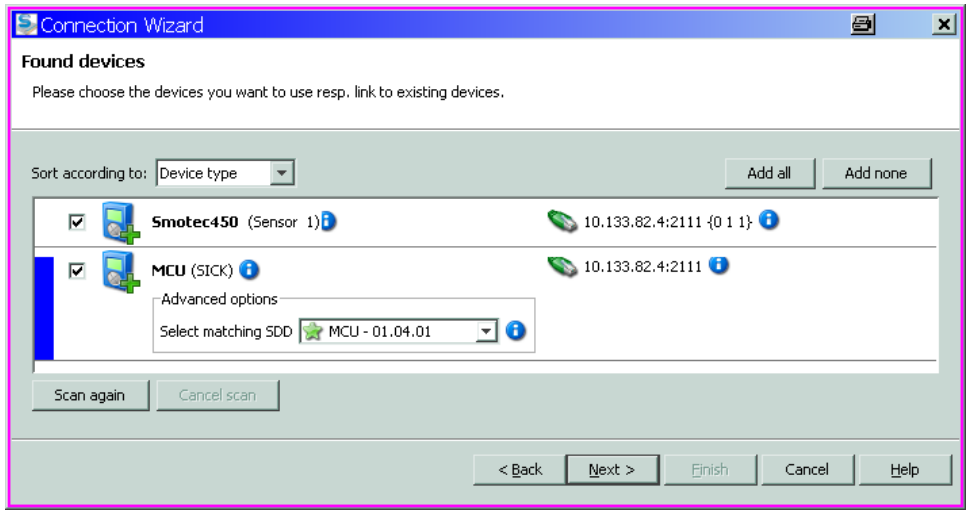
► Click "Next >" button.

Figure 51 Search for connected devices

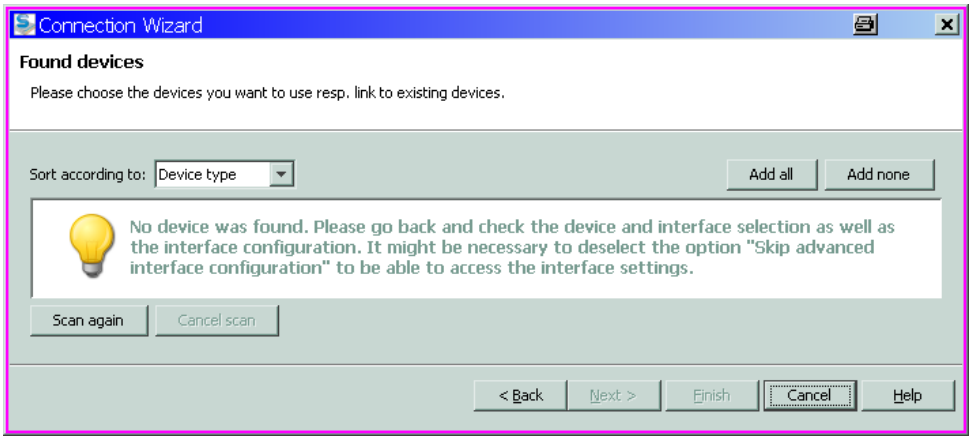
Connection via COM port



Connection via Ethernet



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

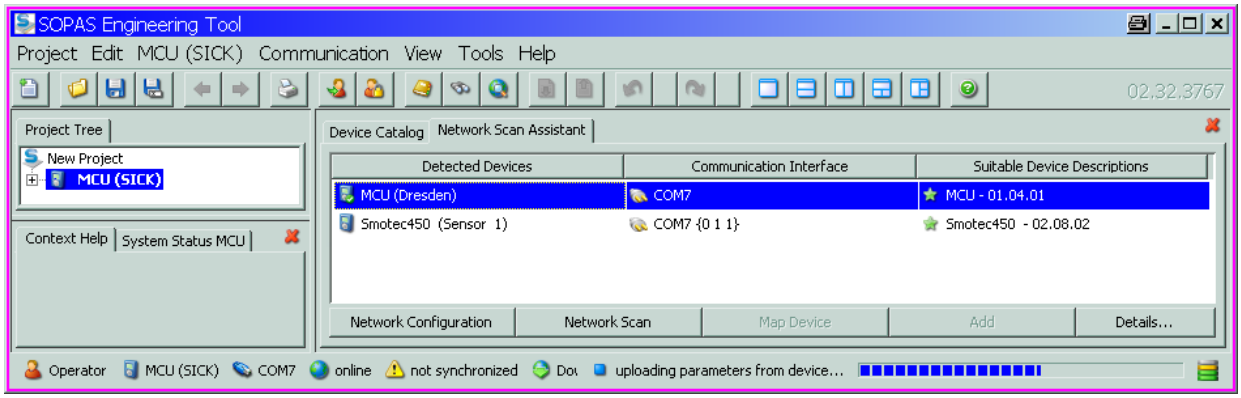


4.1.3.5 **Selecting the device**

Connection via COM port

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

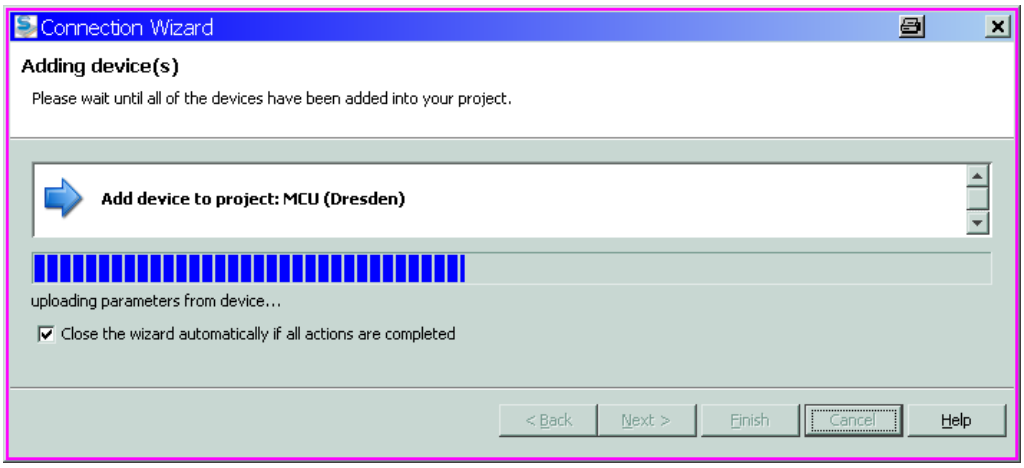
Figure 52 Selecting the device file



Connection via "Connection Wizard" menu

Activate the checkbox of the required device file in the "Connection Wizard / Found devices" (→ p. 59, Fig. 51) and Click "Next >" button. This transfers the device file to the "Project Tree" window.

Figure 53 Transferring the device file



4.1.4 Information on using the program

Password

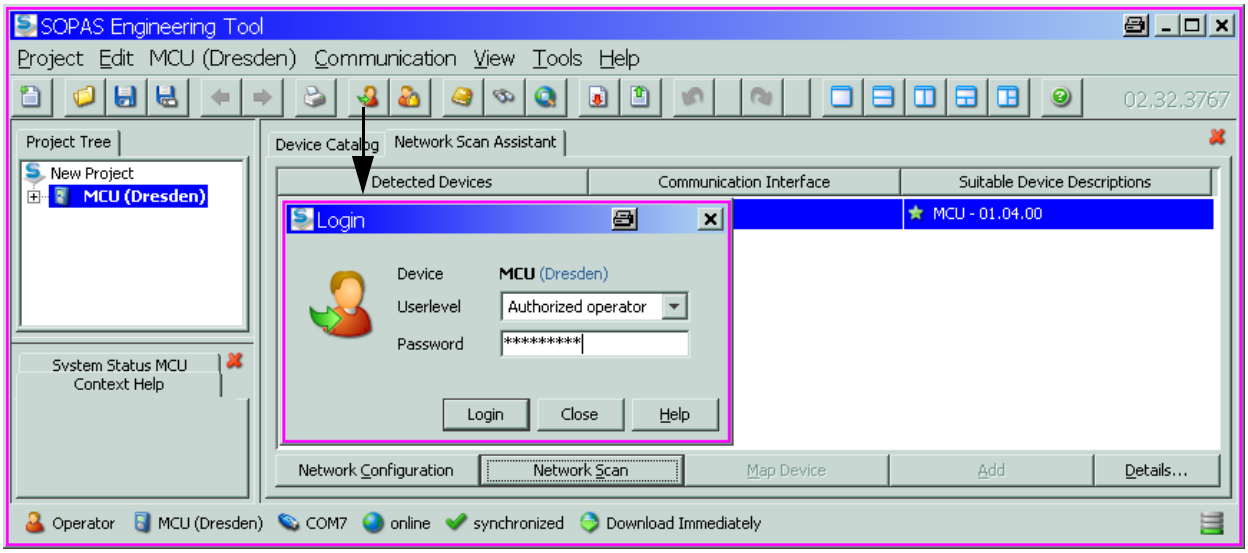
Certain device functions are first accessible after a password has been entered (→ Fig. 54). Access rights are assigned in 3 levels:

User level		Access to
0	Operator	Displays measured values and system states
1	Authorized Operator (Authorized Client) *	Displays, inquiries as well as start-up resp. adjustment to customer-specific demands and diagnosis of necessary parameters
2	Service	Displays, inquiries as well as all parameters required for service tasks (e.g. diagnosis and clearance of possible malfunctions)

*): Depends on the program version

The Level 1 password is contained in the Annex.

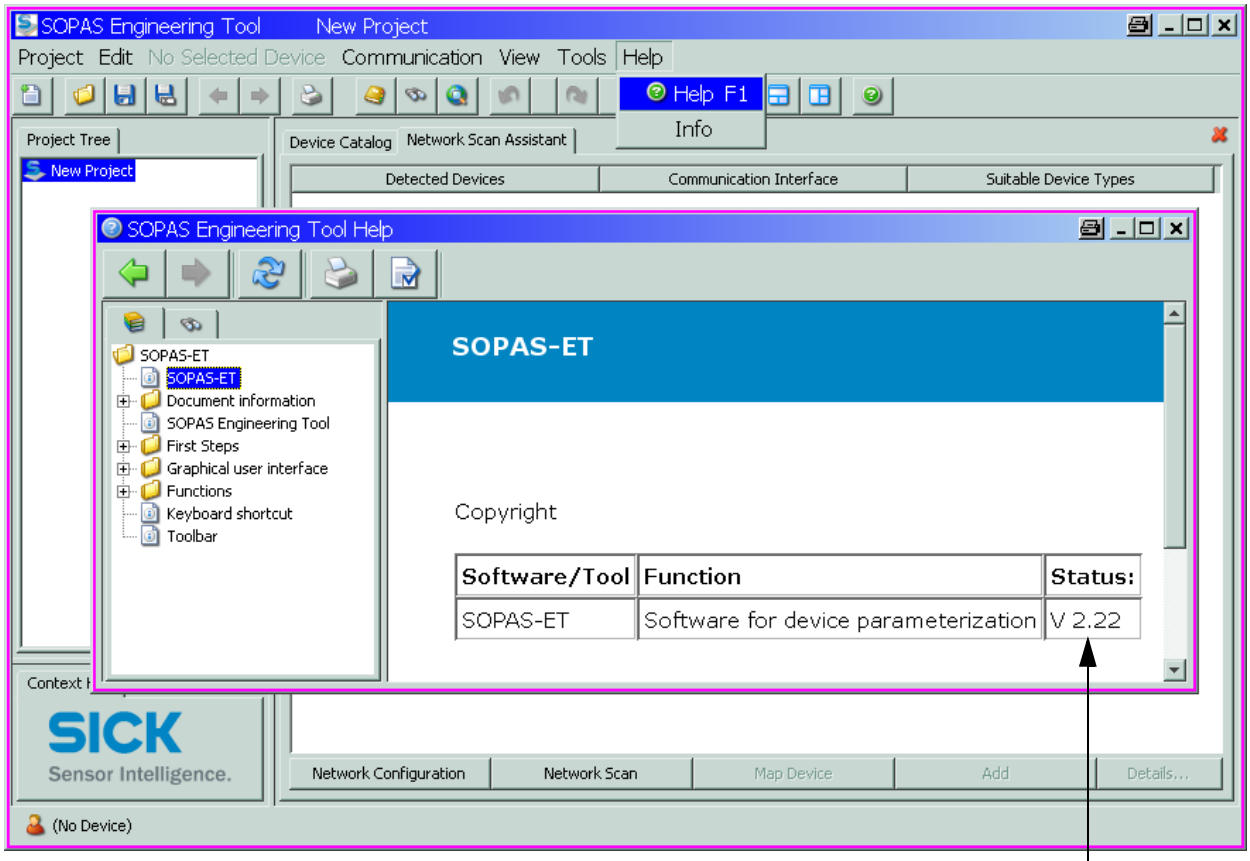
Figure 54 Password entry



4.1.5 Online help

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

Figure 55 Online help



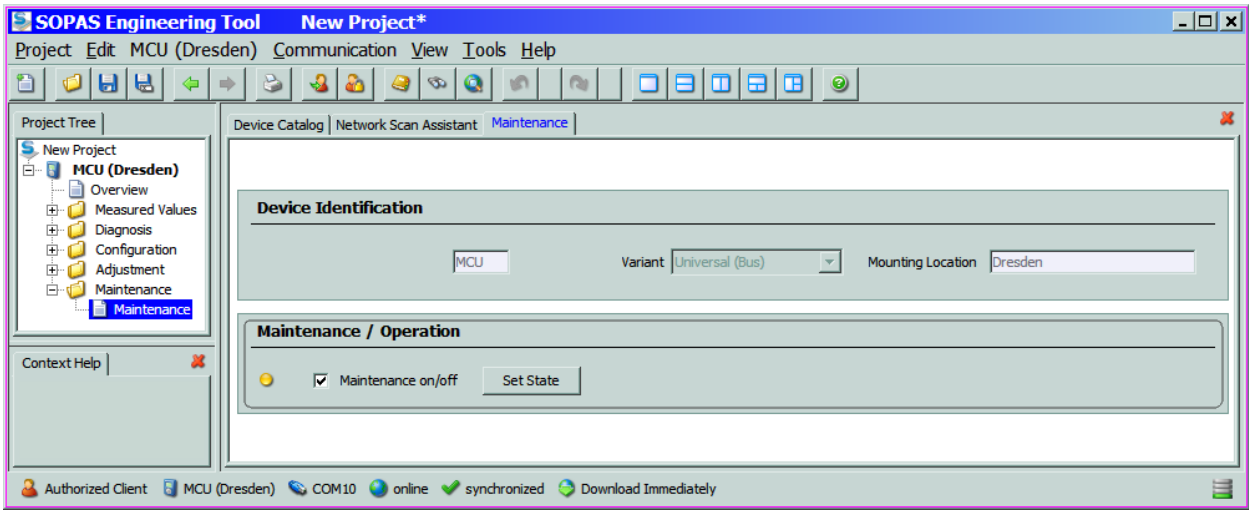
4.2 Customer-specific parameterization

Factory settings

Parameter		Value
Analog output setting (AO)	Live zero (LZ)	4 mA
	Upper measuring range value	20 mA
	Current during maintenance	0.5 mA
	Current by malfunction	no output on AO
Output on standard AO	Measured variable	k-Wert
	Value for LZ	0 /km
	Value for rating	150 /km
Limit value for smoke detection		15 /km
Check cycle		Every 24 h; no output of check values on standard analog output
Response time		60 s for all measured variables

Connect the measuring system to the SOPAS ET program and move the required device file to the "Project Tree" window (→ p. 60, §4.1.3.5) to set or change parameters. Then enter the password level 1 (→ p. 61, §4.1.4), and set the measuring system into maintenance mode (open the "Maintenance/Maintenance" directory, activate the "Maintenance on/off" check box, and press the button "Set State".

Figure 56 Setting maintenance mode



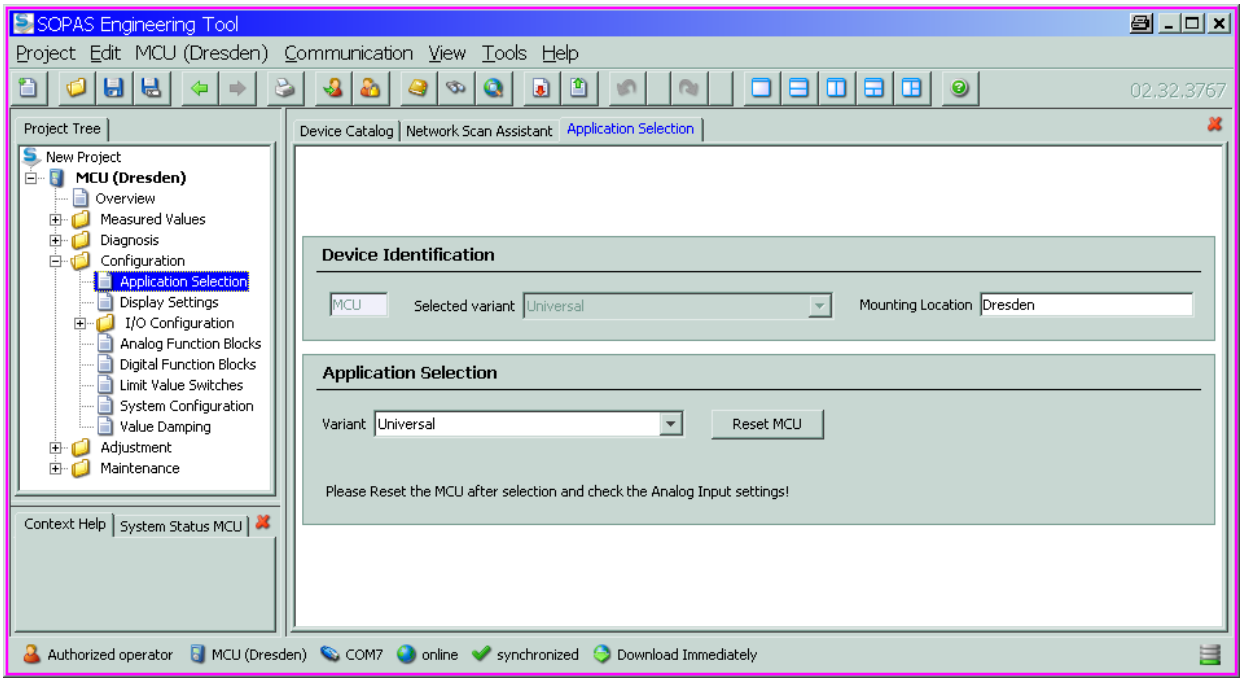
4.2.1 Assigning the sensor

The MCU must be assigned to the connected sender unit. A malfunctions is signalised in case of unconformity. If the setting is not possible at the factory (e.g. when several devices are delivered at the same time or the MCU is swapped later), the assignment must be made after installation. The following steps are then necessary:

- ► Select "MCU" device file and open to the "Configuration / Application selection“ directory.
- ► Click "Reset MCU" if the type shown in the window "Variant" ("Application selection" group) is correct ("Universal" for SMOTEC450).

The measuring unit must be connected to the MCU.

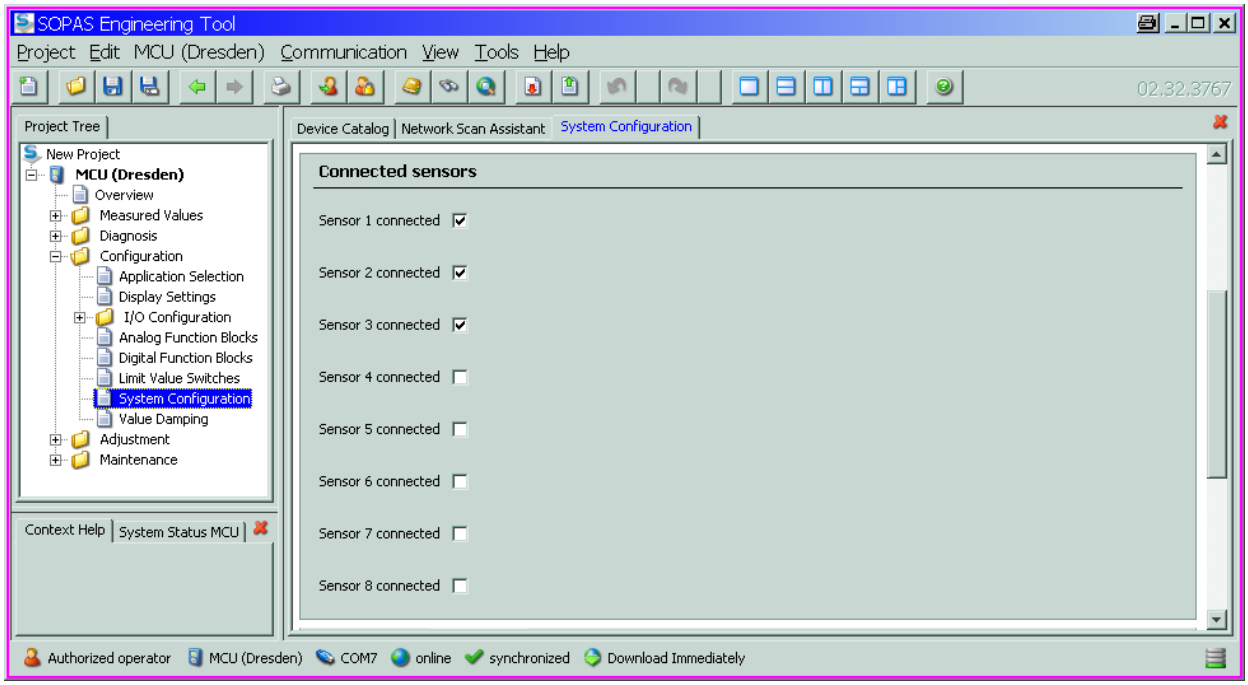
Figure 57 Assigning the sensor



4.2.2 Activating connected measuring units

All measuring units connected to the MCU must be activated for correct communication Check this in the "Connected sensor" group in the "Configuration / System Configuration" directory (→ p. 65, Fig. 58) and correct if necessary.

Figure 58 "Configuration / System Configuration" directory (example for settings)

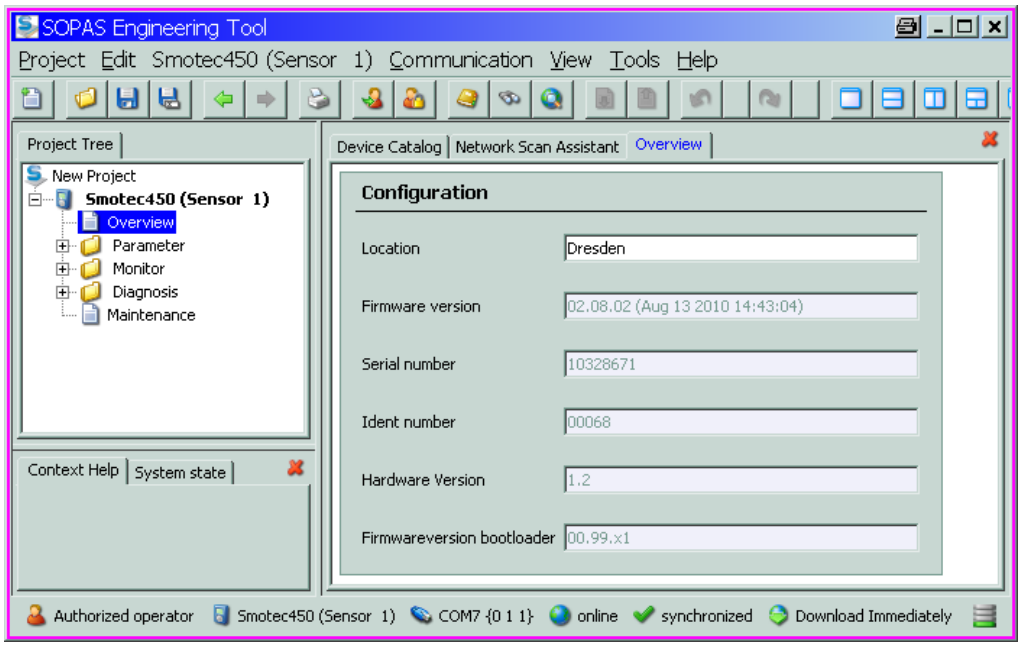


4.2.3 Assigning the measuring system to the installation location

Measuring unit and MCU can be assigned to the respective measuring place obviously.

- ► Select "Configuration / Application selection“ directory (→ p. 64, Fig. 57) for the MCU.
- ► Move the "SMOTEC450" device file in the "Project tree" window and select "Overview" directory for the measuring unit.
- ► Enter the desired name in the "Location" window.

Figure 59 "Overview" directory (example)

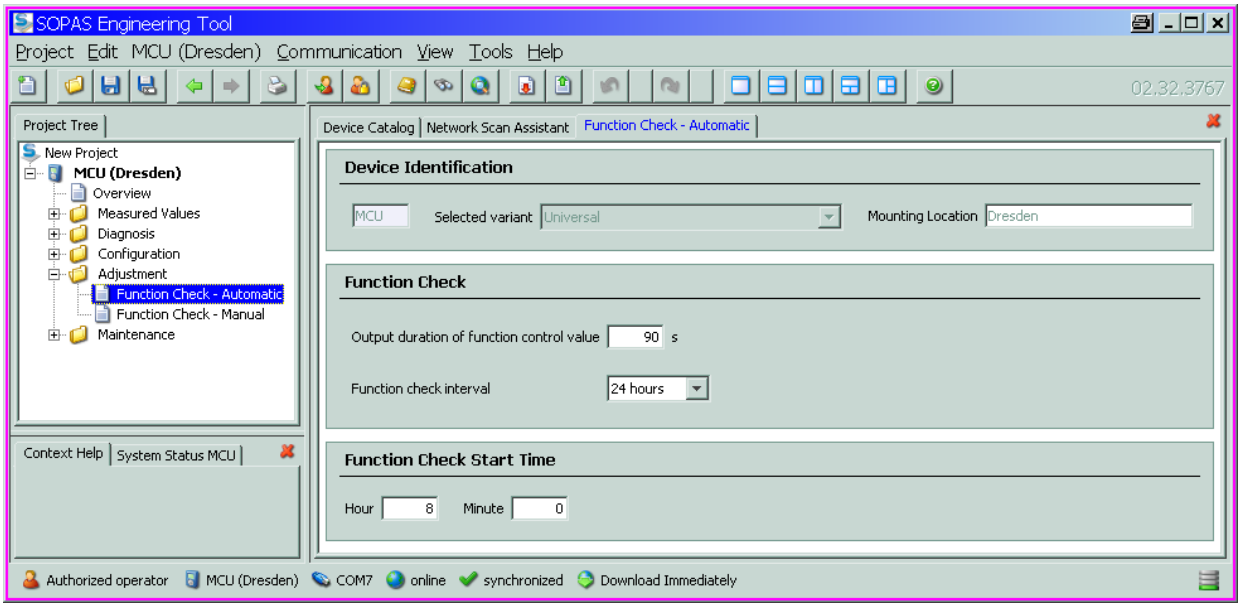


4.2.4 Determining the function check

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

Default values → p. 63, §4.2

Figure 60 "Adjustment / Function Check - Automatic" directory (example for settings)



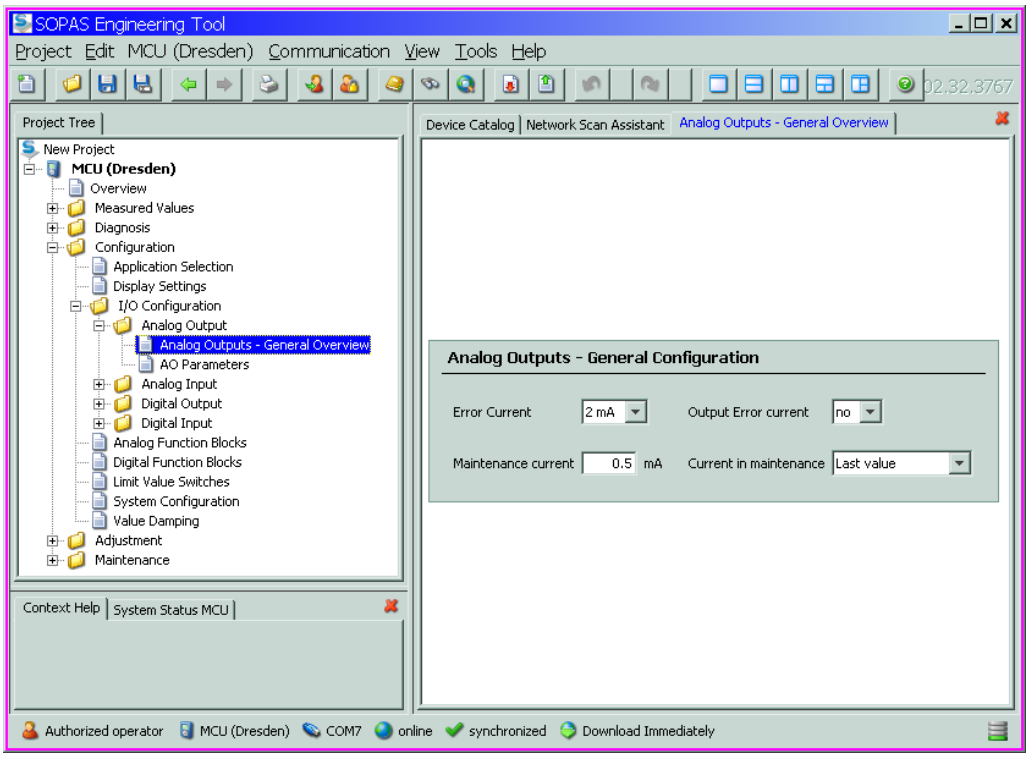
Entry field	Parameter	Remark
Output duration of function control value	Value in seconds	Output duration of control values
Function check interval	Time between two function checks	→ p. 14, §2.1.4
Function Check Start Time	Hours	Defining a start timepoint in hours and minutes
	Minute	

4.2.5 Parameterizing the analog output

Basic settings

The current to be output at the analog output in status "Maintenance" or "Malfunction" can be set in the "Configuration / I/O Configuration / Analog Output / Analog Outputs - General Overview" directory.

Figure 61 "Configuration / I/O Configuration / Analog Output / Analog Outputs - General Overview" directory (example for settings)

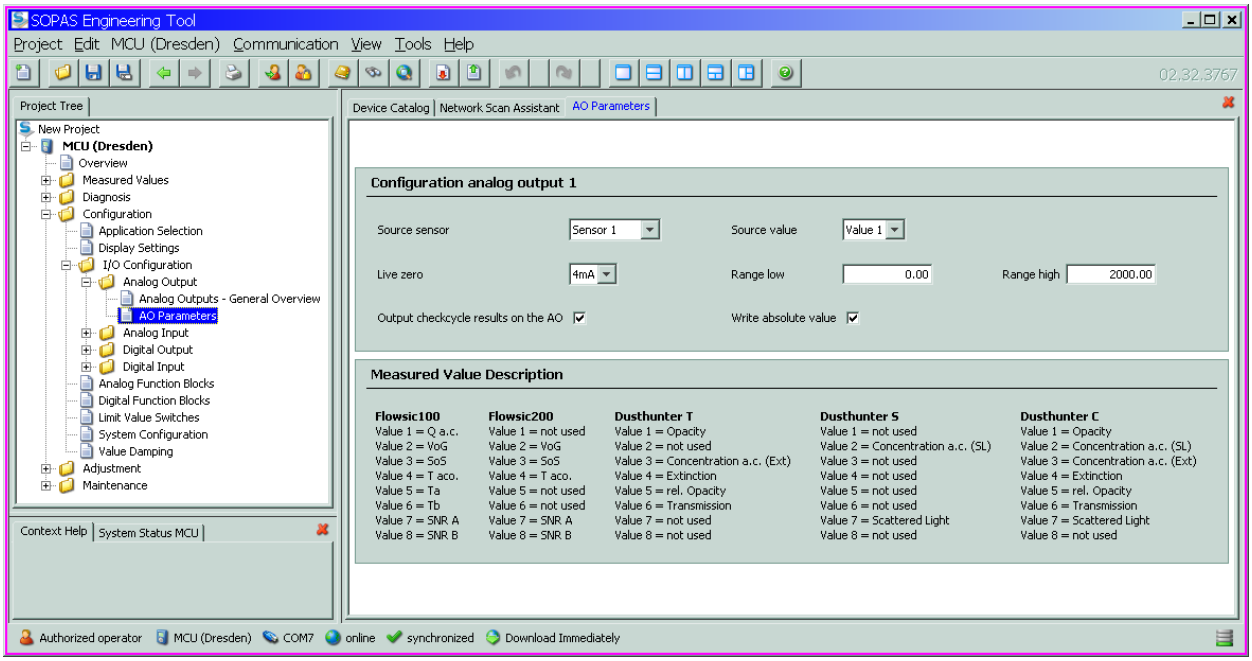


Entry field	Parameter	Remark
Error Current	Value < Live Zero (LZ) or > 20 mA	mA value to be output in "Malfunction" state (error case) (size depends on connected evaluation system).
Output Error current	yes	The error current is output.
	no	The error current is not output.
Maintenance current	Value if possible ≠ Live Zero	mA value to be output during maintenance
Current in maintenance	User defined value	A value to be defined is output during "Maintenance"
	Last value	The value measured last is output during "Maintenance"
	Measured value	The current measured value is output during "Maintenance".

Parameterization

The "Configuration / I/O Configuration / Analog Output / AO Parameters" directory allows to assign the signal source (measuring signal of a measuring unit) to the standard analog output (AO), and to define the values for Live Zero and measuring range.

Figure 62 "Configuration / I/O Configuration / Analog Output / AO Parameters" directory (example for settings)



Entry field	Parameter	Remark
Source sensor	Sensor 1 to 8	Measuring unit whose output signal has to be assigned to the analog output.
Source value	Value 1	k value [/km]
	Value 2	Inlet temperature [°C]
	Value 3	not available
	Value 4	not available
	Value 5 to 8	Selection of 2 Flow rate [l/min] 4 External Temperature 1 [°C] 5 External Temperature 2 [°C] The measurands are assigned in the predefined order (by the manufacturer, if the corresponding option is ordered; by Endress+Hauser service at refitting). If an option is not available, the next one moves up.
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.
Range low	Lower measuring range limit	Physical value at live zero
Range high	Upper measuring range limit	Physical value at 20 mA
Output check cycle results on the AO	Inactive	Control values (→ p. 14, §2.1.4) are not output on the analog output .
	Active	Control values are output on the analog output (the "Output control values at AO" checkbox in the "Adjustment / Function Check - Automatic" directory must be activated).
Write absolute value	Inactive	It's distinguished between positive and negative measured values.
	Active	The amount of the measured value is output.

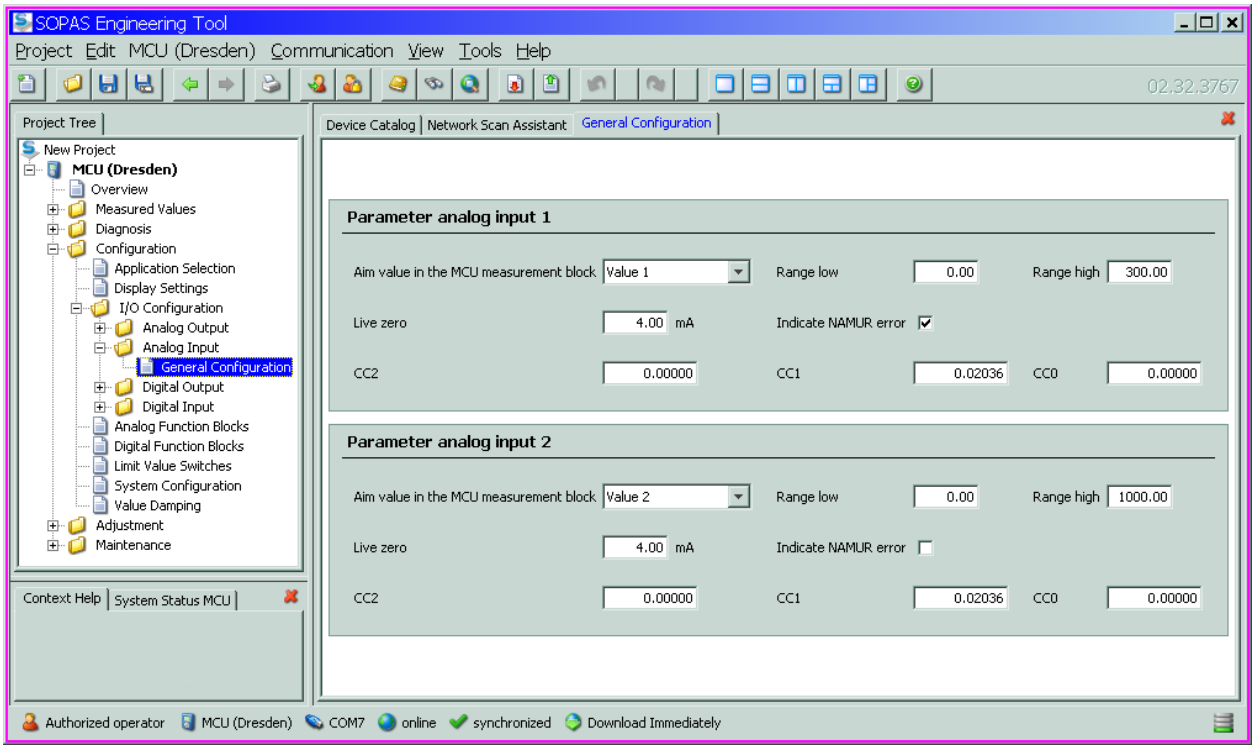
4.2.6 Parameterizing the analog inputs

Basic settings

The "Configuration / I/O Configuration / Analog input / General Configuration" directory allows the assignment of the standard analog inputs (groups "Parameter analog input 1" and "Parameter analog input 2") to measured values for possible scaling, and to define the respective measurement range.

> ***NOTICE:***
> The correction factors CC2, CC1 and CC0 are predefined by the manufacturer and only may be changed by the Endress+Hauser service.

Figure 63 "Configuration / I/O Configuration / Analog input / General Configuration" directory (example for settings)

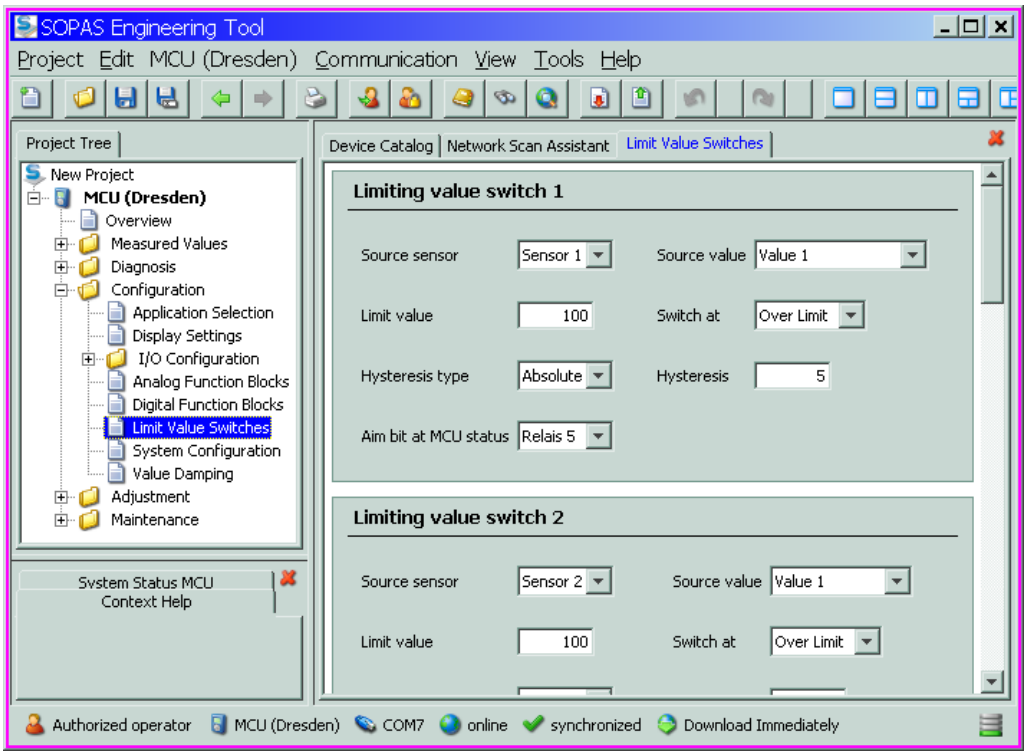


Entry field	Parameter	Remark
Aim value in the MCU measurement block	Value1 to 8	Variable to be assigned to the selected analog input
Range low	Lower measuring range limit	Physical value at live zero
Range high	Upper measuring range limit	Physical value at 20 mA
Live zero	Zero point value > 0 mA)	Specification of the mA value for measurement range beginning
Indicate NAMUR error	inactiv	No error is signalized for underflow or exceeding of the set current range (LZ to 20 mA).
	activ	An error is signalized for underflow or exceeding of the set current range (LZ to 20 mA).
CC2	square correction factor	Correction factors (predefined by the manufacturer) for calibrating the input variable Change only by Endress+Hauser service!
CC1	linear correction factor	
CC0	absolute correction factor	

4.2.7 Parameterizing the limit value relay

Select the "Configuration / Limit Value Switches" directory for parameterization.

Figure 64 "Configuration / Limit Values Switches" directory (example for settings)

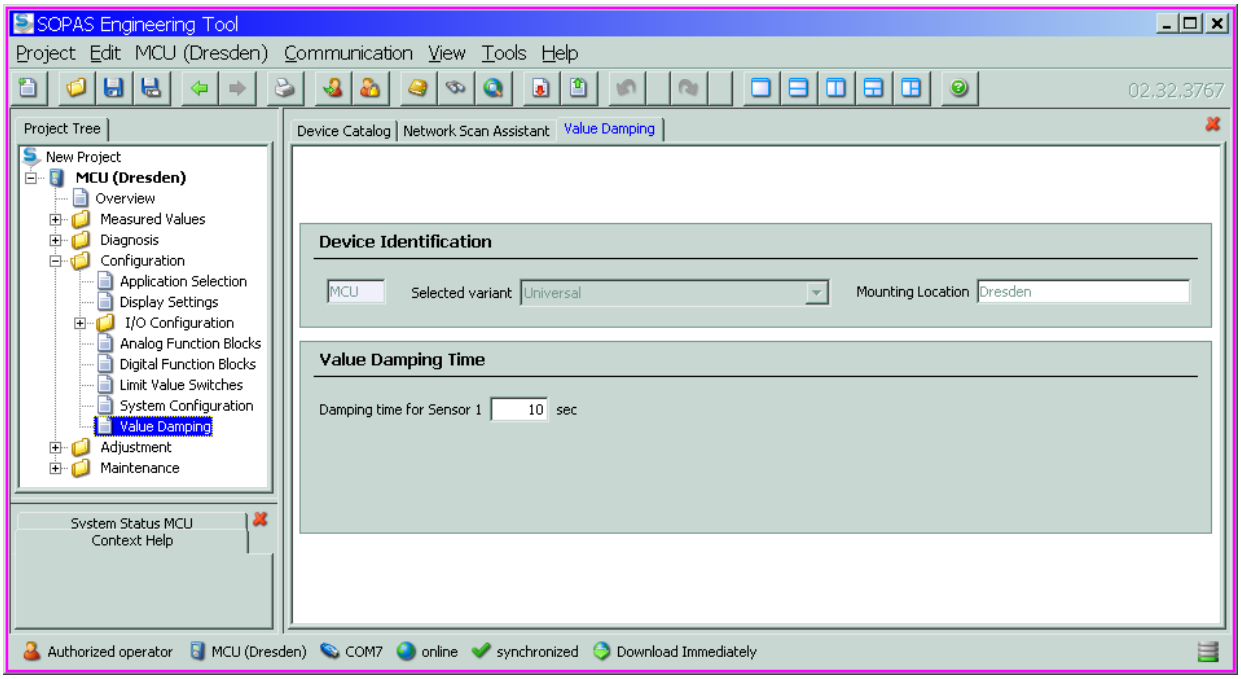


Entry field	Parameter	Remark
Source sensor	Sensor 1 to 8	Sensor to whose output signal a limit value shall be assigned
Source value	Value 1	k value [/km]
	Value 2	Inlet temperature [°C]
	Value 3	not available
	Value 4	not available
	Value 5 to 8	Selection of 2 Flow rate [l/min] 4 External Temperature 1 [°C] 5 External Temperature 2 [°C] The measurands are assigned in the predefined order (by the manufacturer, if the corresponding option is ordered; by Endress+Hauser service at refitting). If an option is not available, the next one moves up.
Limit value	Value	The limit value relay switches when the entered value is exceeded or fallen below.
Switch at	Over Limit	Specification of the switching direction
	Under Limit	
Hysteresis type	Percent	Assignment of the value entered in the "Hysteresis Type" field as relative or absolute value of defined limit value
	Absolute	
Hysteresis	Value	Defines a tolerance for resetting the limit value relay
Aim bit at MCU status	Relais 5	Aim bit = special memory in the MCU for monitoring limit values (futher aim bits → p. 76, §4.3.2.2)

4.2.8 Setting the response time

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

Figure 65 "Configuration / Value Damping" directory (display for one connected measuring unit)



Field	Parameter	Remark
Response time Sensor 1	Value in s	Response time for the selected measured variable (→ p. 14, §2.1.3)

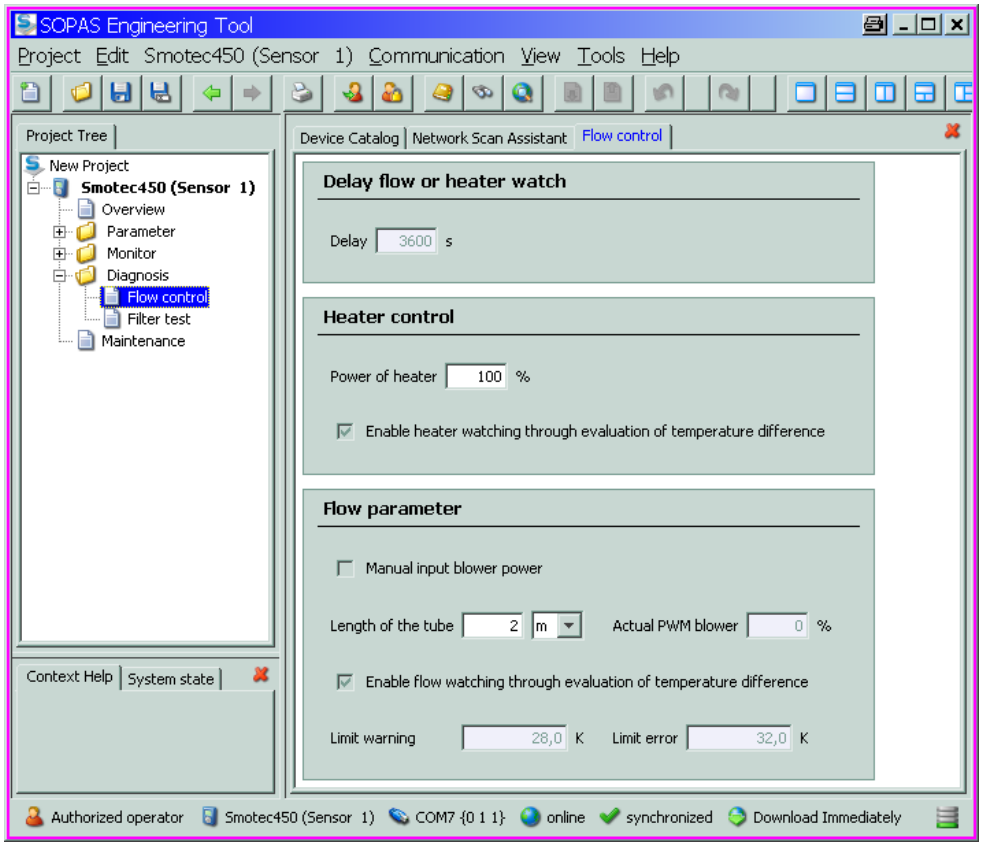
If more than one measuring unit is connected, a separate window exists for every measuring unit for the individual setting of the response time.

4.2.9 Adapting flow control settings

The flow rate is adjusted in the factory according to the length of suction and exhaust air hose. If the length has been modified (e.g. after changes to the installation), the blower output must be readjusted. The followings steps are required for this:

- ► Move the "SMOTEC450" device file in the "Project tree" window, set the measuring unit into "Maintenance" mode and enter level 1 password.
- ► Select the "Diagnosis / Flow control" directory.

Bild 66 "Diagnosis / Flow control" directory



► Check, whether the value shown on the window "Length of the tube" corresponds to the length of the installed suction hose. If not, enter the current hose length in the window "Length of the tube".

- The air flow rate is automatically adjusted according to the entered length of suction hose.
- The heating capacity is set to 100 % at the factory.
- The heating capacity can be set to 144 % for fog extraction (e.g. at installation of the measuring unity nearby the tunnel portal).
- Heater and flow control by means of temperature difference measurement (→ Fig. 66) are activated at the factory (contact Endress+Hauser service for the activation at older equipment). The "Delay flow or heater watch" group is only displayed in this case.
- If the temperature difference between inlet and heater temperature falls below the set values for "Limit warning" and "Limit error", a warning or error message is generated. The reaction time depends on the applikcation conditions (30 ... 60 min).
  Default values:
  Limit warning: 28 °C
  "Limit error: 32 °C
  When increasing the heating power, the limits will automatically be raised.

4.2.10 Data backup

All parameters relevant for recording, processing and input/output of measured values as well as current measured values can be saved and printed. This allows easy reentering of set device parameters as needed (e.g. after a firmware update) as well as the registration of device data or device states for diagnostic purposes.

The following options are available.

- Saving as a project (particularly advantageous for diagnosis and trouble shooting)
  This allows saving not only device parameters but also data logs.
- Saving as a device file
  Stored parameters can be processed without attached device and transferred into the device to a later time again.

See the Service Manual for a description.

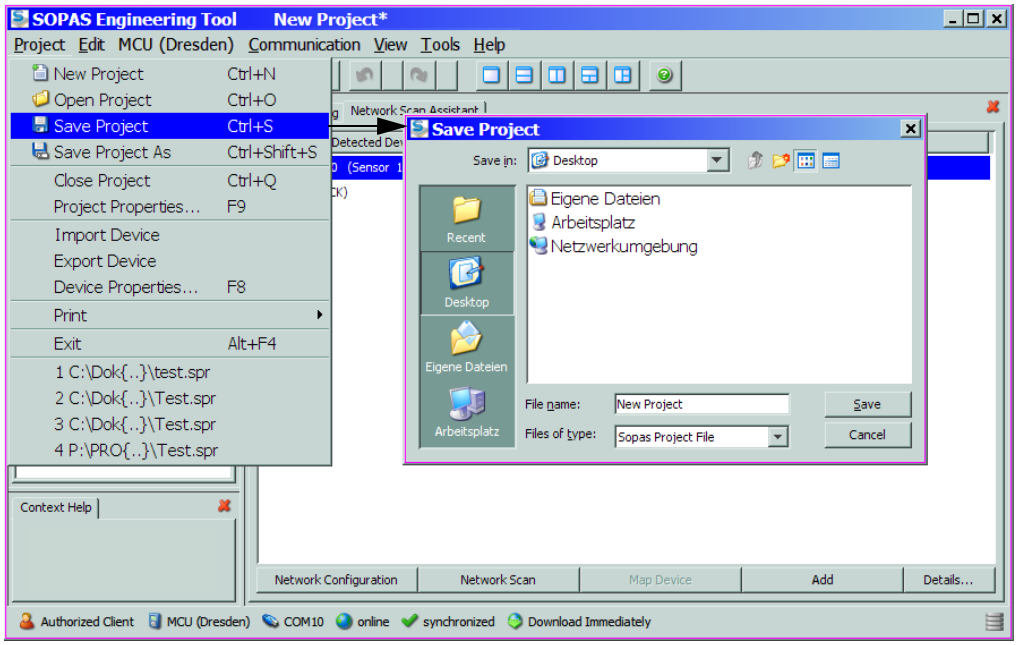
- Saving as a protocol
  Device data and parameters are recorded in the Parameter protocol.
  A Diagnosis protocol can be created for analysis of the device function and recognition of possible malfunctions.

Saving as a project

At frequent connections to the device we recommend to store a "project". For a renewed connection it is then only necessary to open this "project". All before stored data are transmitted automatically into the SOPAS ET.

For saving select the "Project / Export Device" menu and define target directory and file name. The name of the file to be stored can be chosen freely. It is useful to specify a name with a reference to the sampling point involved (name of the company, equipment name).

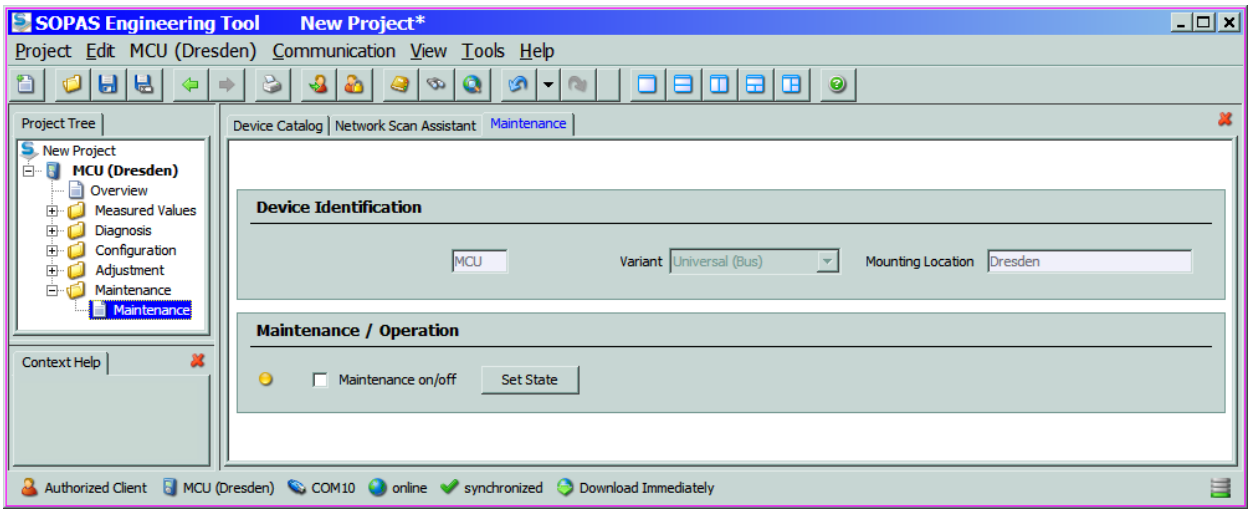
Figure 67 "Project / Save Project" menu



4.2.11 Starting normal measuring operation

Set the measuring system to "Measurement" mode after entering/modifying parameters. To do this, switch to the "Maintenance / Maintenance" directory, deactivate the "Maintenance on/off" checkbox and click "Set State" (→ Fig. 68). Standard start-up is now completed.

Figure 68 Setting the operational state



4.3 Parameterizing optional modules

4.3.1 Flow measurement option

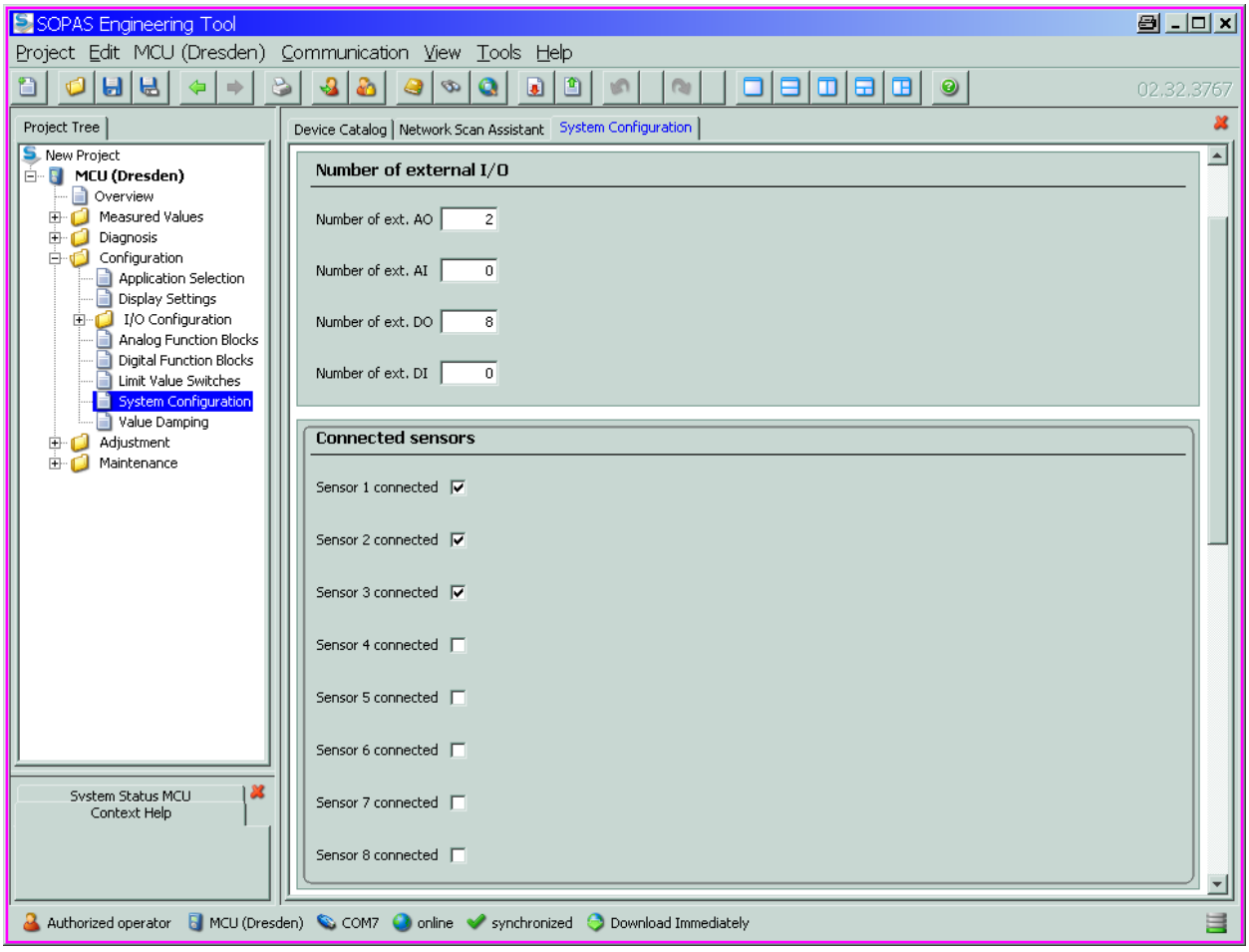
Measuring units containing this option are adjusted by the manufacturer in a way that further work at site is not required.

Changes only may be carried out by trained staff (password level „service“ required, see service manual).

4.3.2 Parameterizing analog and digital output modules

The modules installed in the MCU must be activated for this. Move the "MCU" device file in the "Project tree" window, select the ”Configuration / System Configuration” directory and check whether the number of outputs set in the ”Number of external I/O” group corresponds to the existing outputs (correct if necessary).

Figure 69 ”Configuration / System Configuration” directory (example for settings)



4.3.2.1 Optional analog outputs

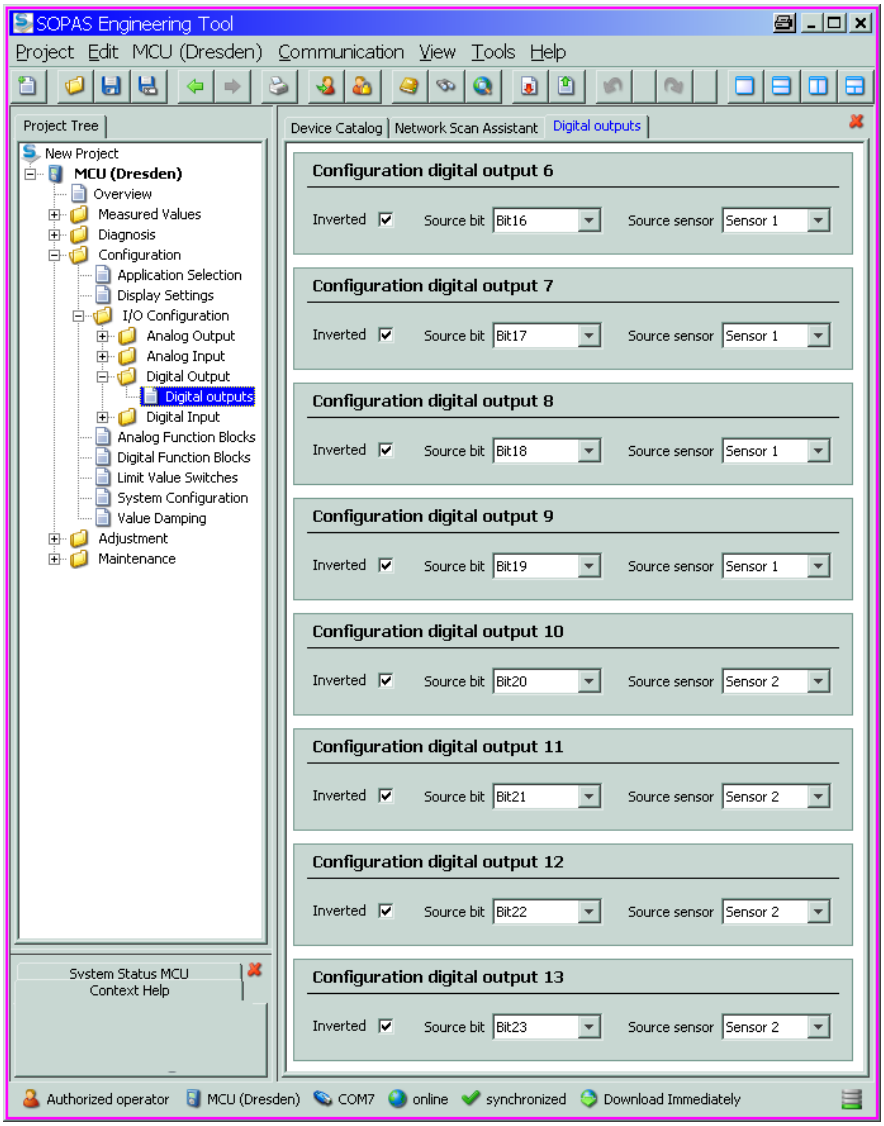
Settings can be carried out according to p. 67, §4.2.5 (→ p. 68, Fig. 62).

The basic settings ("Analog Outputs - General Overview" subdirectory; → p. 67, Fig. 61) apply to all available analog outputs in the same manner.

4.3.2.2 Optional digital outputs

Select the ”Configuration / I/O Configuration / Digital Output / Digital outputs” directory for entering parameters.

Figure 70 ”Configuration / I/O Configuration / Digital Output / Digital outputs” directory (example)

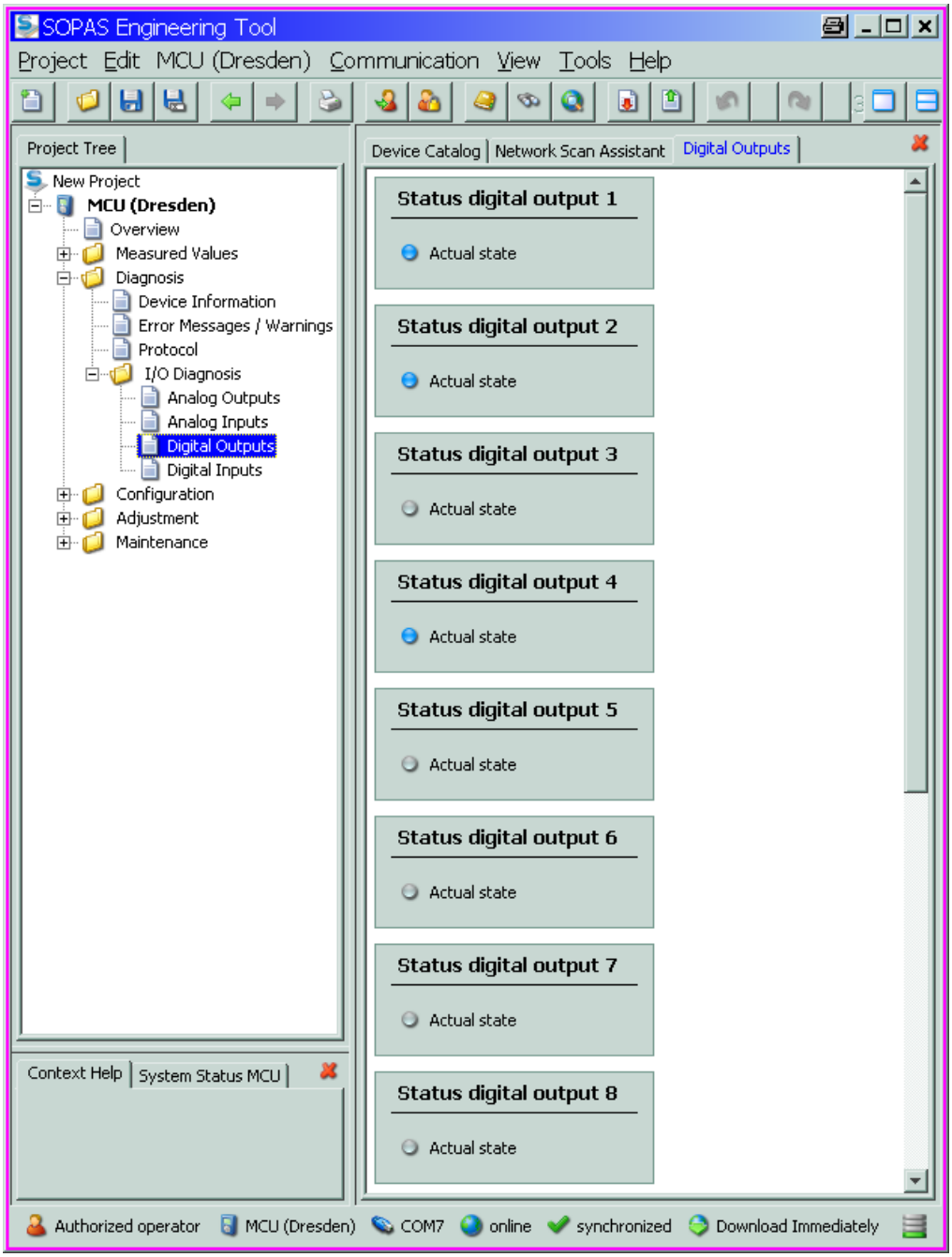


Field	Parameter	Remark
inverted	inactive	Specification of the switching direction
	active	
Source bit	Bit 0	Malfunction
	Bit 1	Maintenance
	Bit 2	Maintenance request
	Bit 3	Function check
	Bit 7	Operation (no malfunction)
	Bit 16 to 31	Aim bit of the limit value switch (→ p. 78, Fig. 72)
Source sensor	Sensor 1 to 8	Selection if the device status shall be output
	MCU	Selection if limit values shall be signalized

Checking settings

The current status of every relay is shown in the "Diagnosis / I/O / Digital Outputs" directory.

Figure 71 "Diagnosis / I/O / Digital Outputs" directory



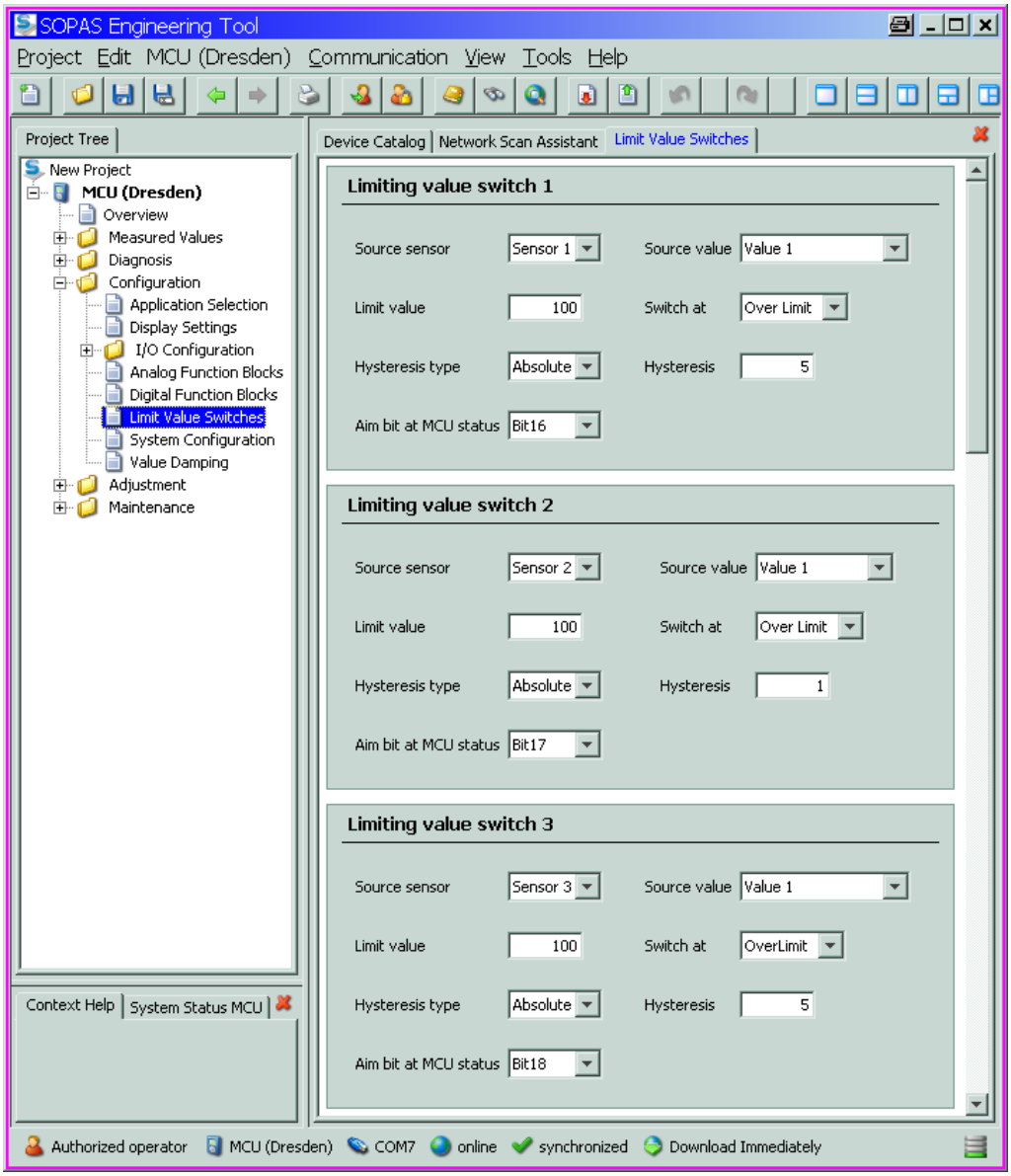
To check whether the relays switch as intended, measurement values which exceed the parameterised limits must be produced.

In addition, a circuit indicator can be connected to the respective relay output for an external check.

4.3.2.3 **Assigning and setting of limit value switches to optional digital outputs**

Select the "Configuration / Limit Values Switches" directory" for assigning. Settings can be carried out according to p. 70, §4.2.7.

Figure 72 "Configuration / Limit Values Switches" directory



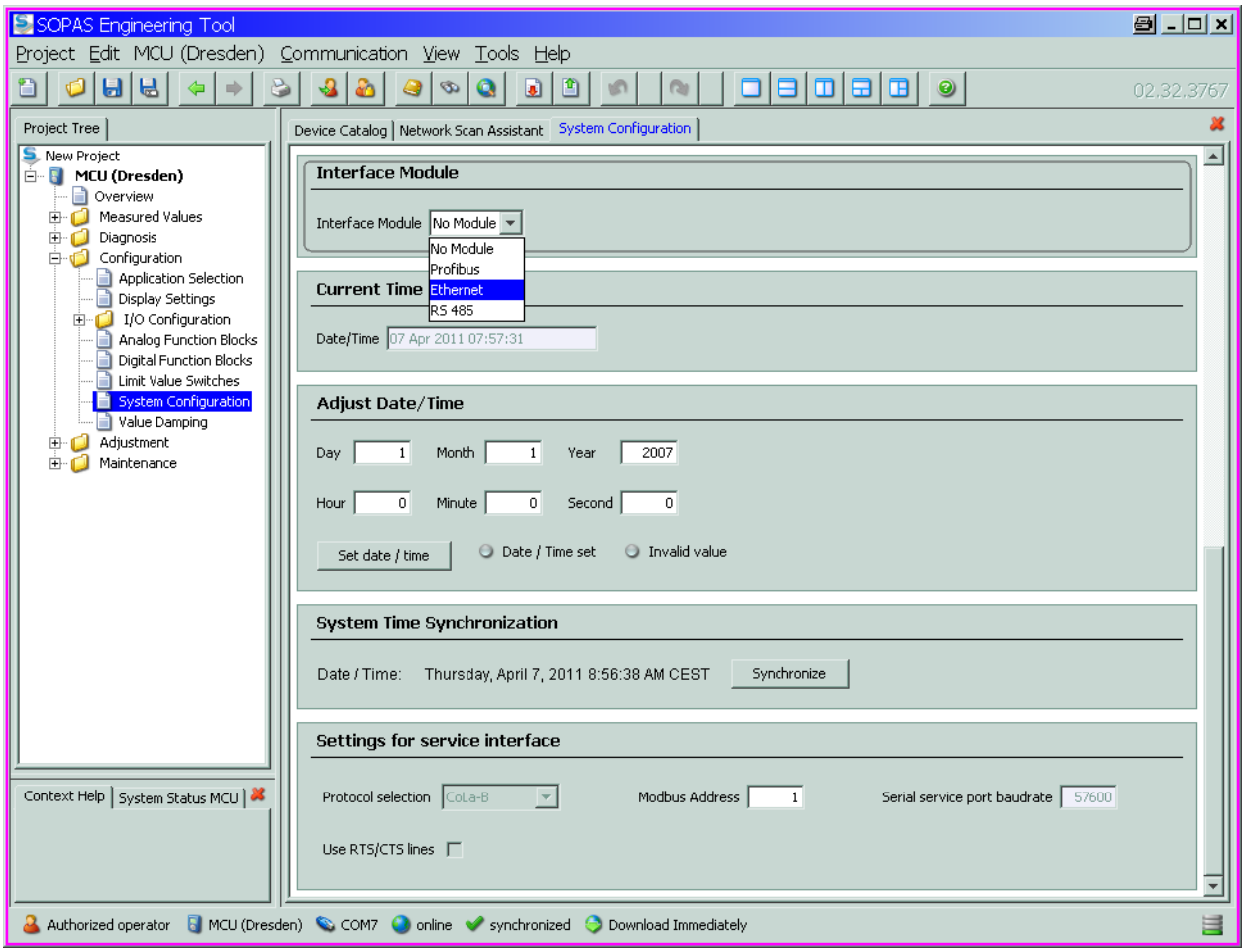
4.3.3 Setting optional interface modules

4.3.3.1 General information

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

- ► Select "MCU" device file, set the measuring system to "Maintenance" mode and enter the Level 1 password (→ p. 61, §4.1.4).
- ► Switch to the "Configuration / System Configuration" directory.
  The Interface module installed is shown as "Interface Module".
- ► Configure the Interface module according to requirements.

Figure 73 "Configuration / System Configuration" directory



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

4.3.3.2 Setting the Ethernet module parameters

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

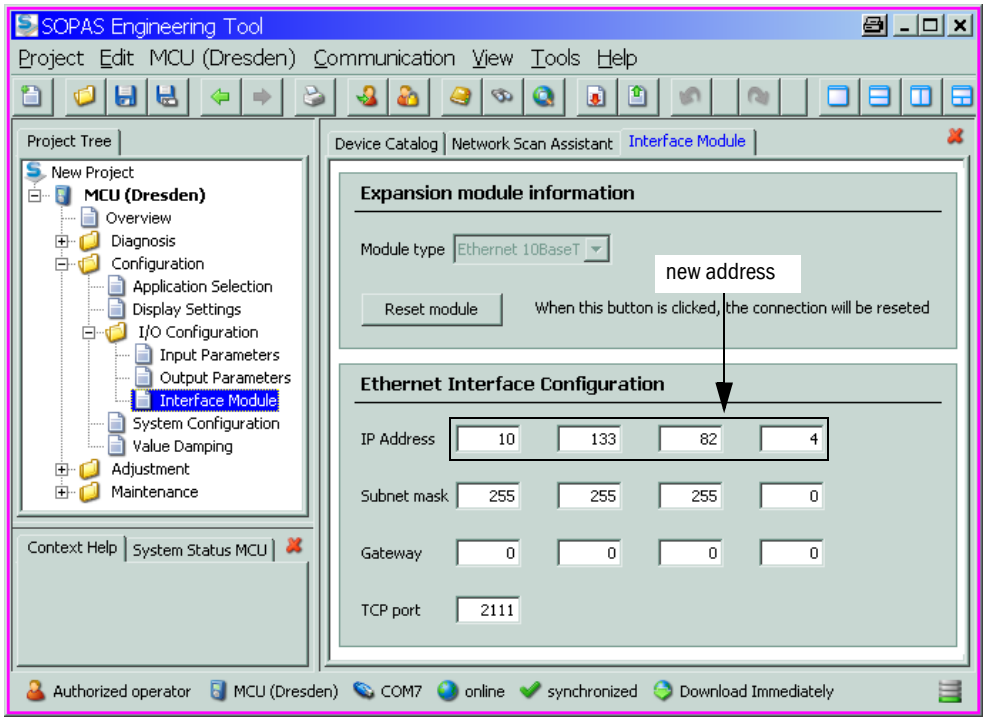
Assigning the Ethernet module a new IP address

An IP address specified by the customer is entered at the factory when the address is available when the device is ordered. Otherwise the standard address 192.168.0.10 is entered.

► Select the "Configuration / IO Configuration / Interface Module" directory.

► Enter the desired network configuration in the "Ethernet Interface Configuration“ group and click "Reset module" under "Expansion module information".

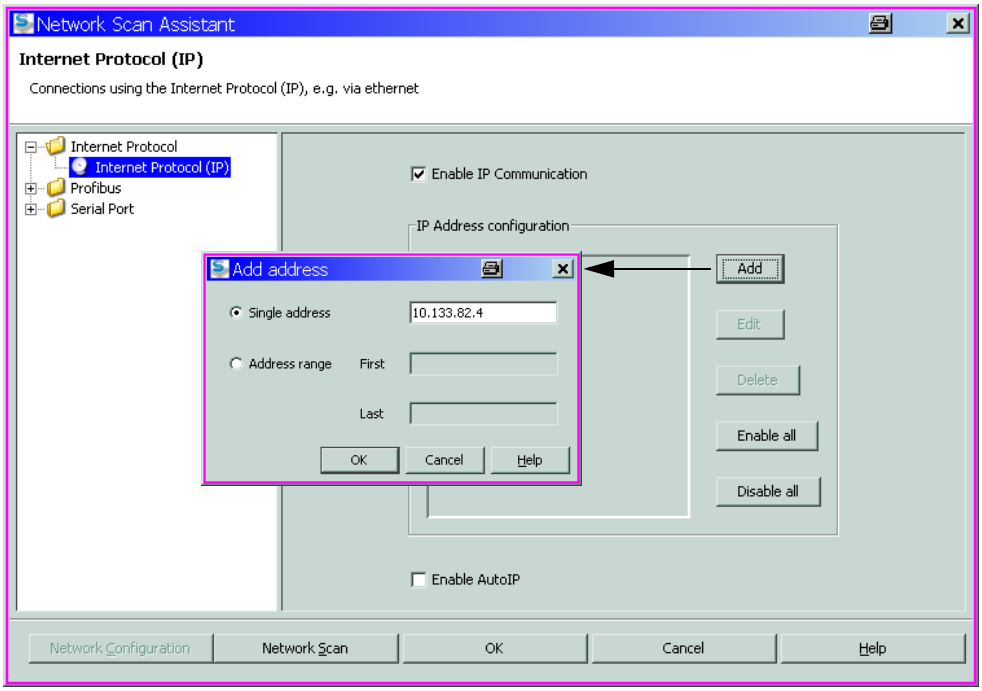
Figure 74 "Configuration / IO Configuration / Interface Module" directory



Assigning the new IP address to the SOPAS ET program

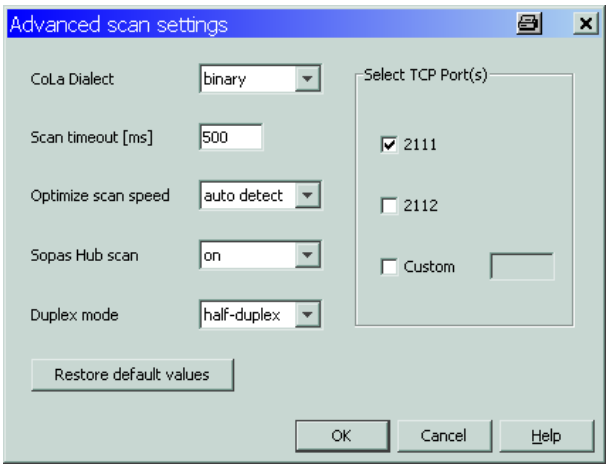
- ► Select the "Network Scan Assistant" register and click "Network Configuration".
- ► Select the "Internet Protocol (IP)" directory, set the "Enable IP Communication" entry field to active and click "Add".
- ► Enter the new IP address set in the "Configuration / IO Configuration / Interface Module"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

Figure 75 Entering the IP address (example)



- ► Click "Advanced..." in the "Internet Protocol (IP)“ window.
- ► Select port address "2111" and confirm with "OK" (all other settings and values according to Fig. 76).

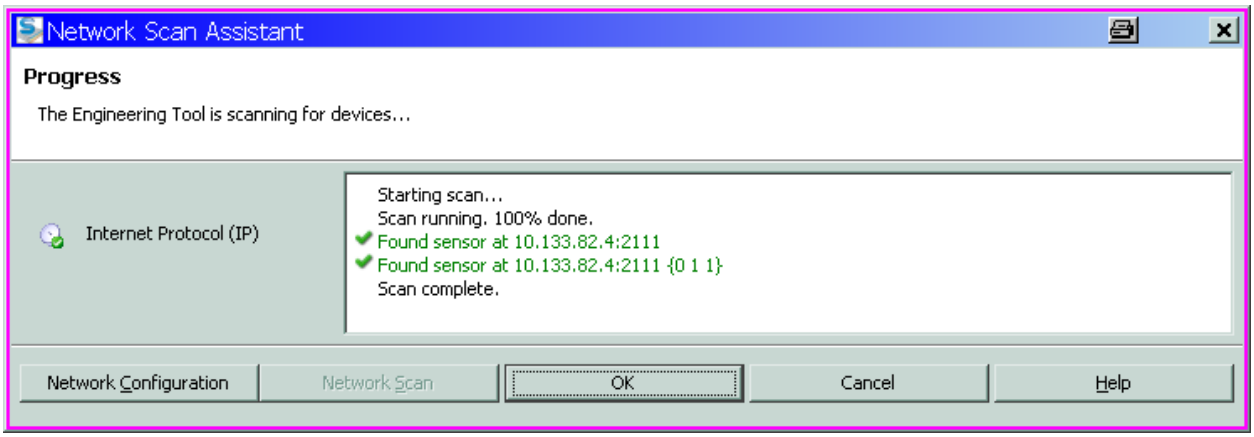
Figure 76 Specifying the TCP port



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

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

Figure 77 Network scanning



NOTICE:

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

- ► If measured values are transferred exclusively via Ethernet and used to control processes, disturbances are possible in the plant operation for which the manufacturer of the SMOTEC450 is not responsible.

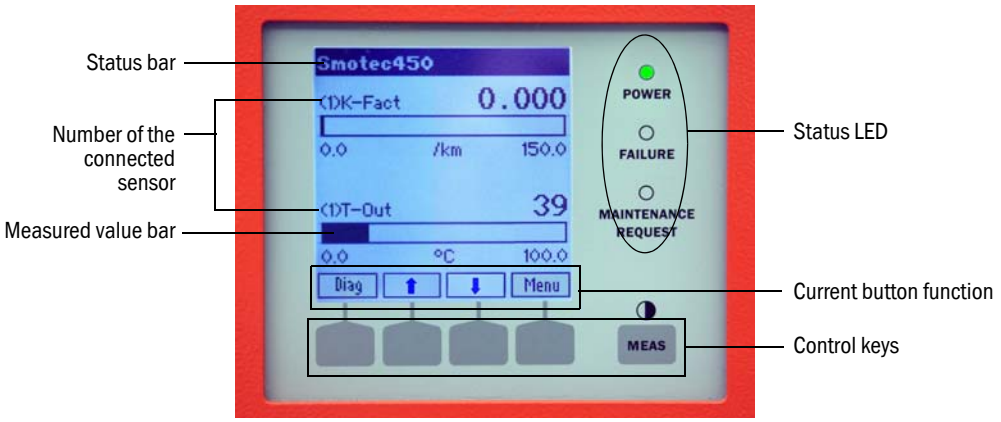
Increase the value in field "Scantimeout" from 500 ms to 3000 ms if disturbances appear in the Ethernet communication.

4.4 Operating/setting parameters via the LC-Display

4.4.1 General information on use

The display and operating interface of the LC-Display contains the functional elements shown in Fig. 78.

Figure 78 LC-Display functional elements



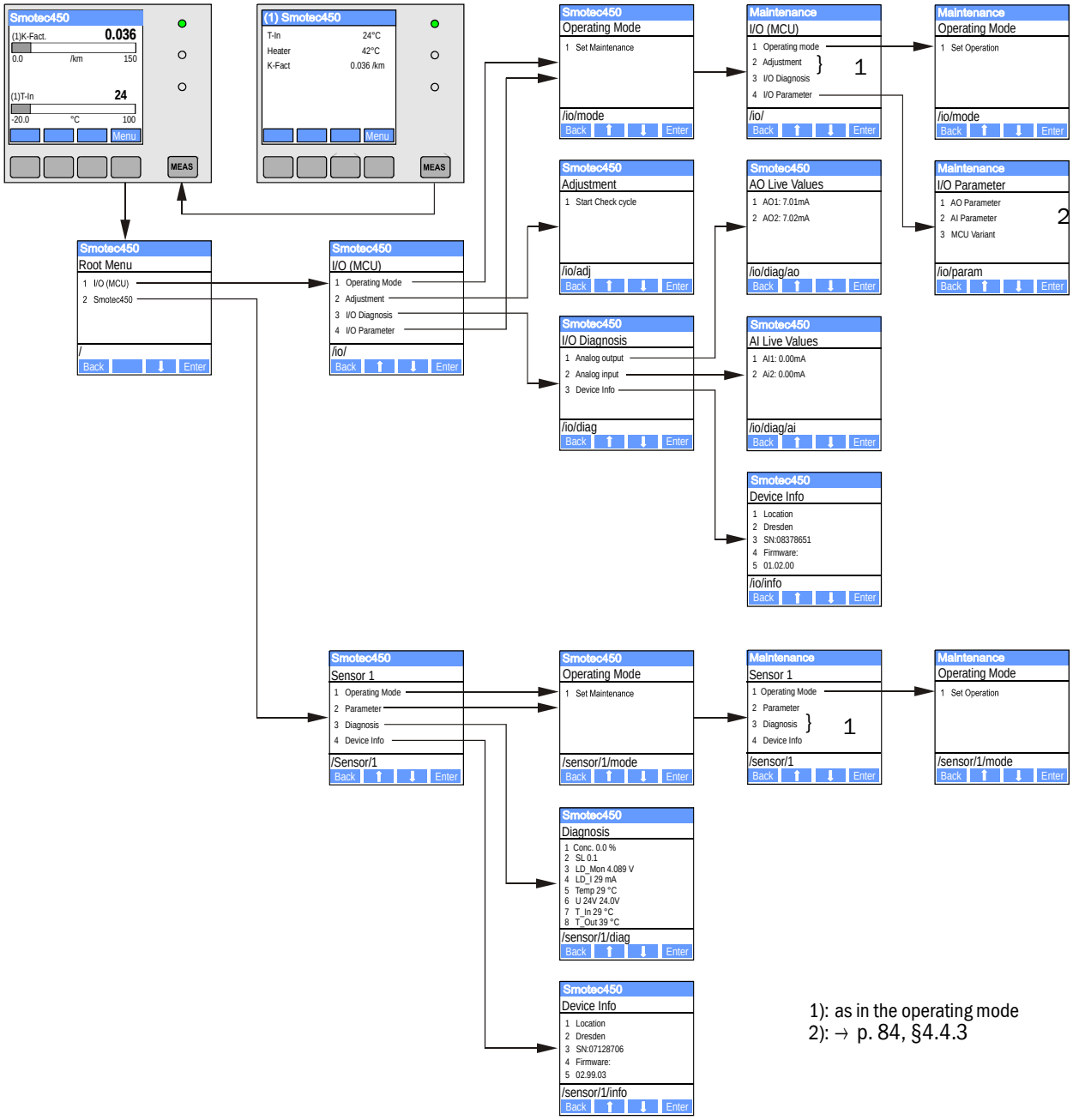
Button functions

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

Button	Function
Diag	Display diagnostic information (warnings and errors during a start using the Main menu, sensor information during a start using the Diagnostics menu; see <fett 9p>Fig. 79)
Back	Switch to higher level menu
Arrow ⇑	Scroll up
Arrow ⇓	Scroll down
Enter	Execution of the action selected with an arrow button (switch to a submenu, confirm parameter selected during parameter setting)
Start	Start an action
Save	Store a changed parameter
Meas	• Toggle between indication of the measurement values in bar (graphics display) or text form When connecting several measuring units to the MCU the measurement values of the individual measuring units are shown after each other. • Display the contrast setting (press the key minimum 2.5 s)

4.4.2 Menu structure

Figure 79 LC-Display menu structure



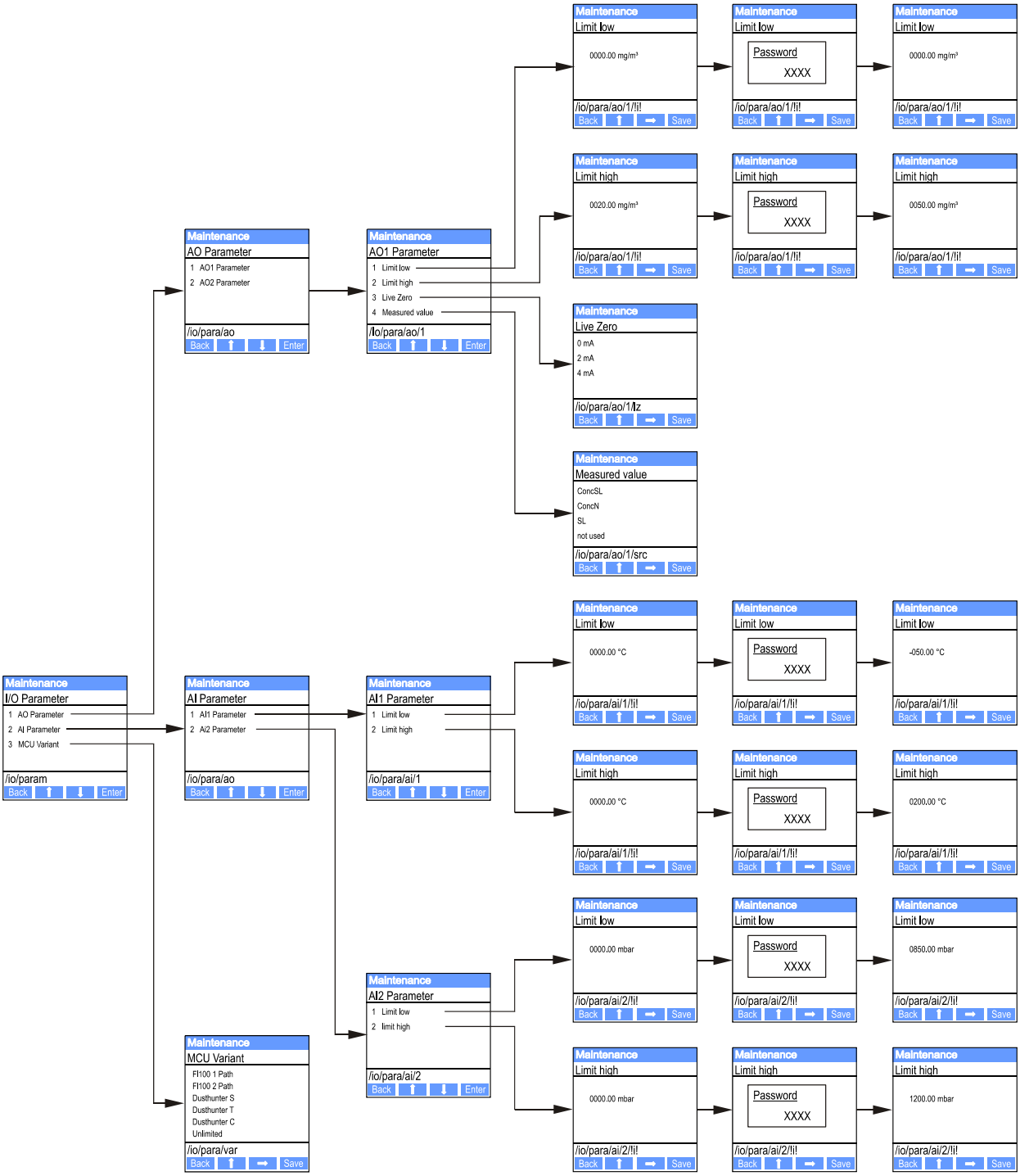
1): as in the operating mode
2): → p. 84, §4.4.3

4.4.3 Parameter setting

Analo outputs / analog inputs

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

Figure 80 Menu structure for setting the analog output / input parameters and assigning the MCU variant



Assigning the MCU variant

The following steps are required to assign the MCU later to the existing sender unit of the SMOTEC4500 (→ p. 64, §4.2.1), :

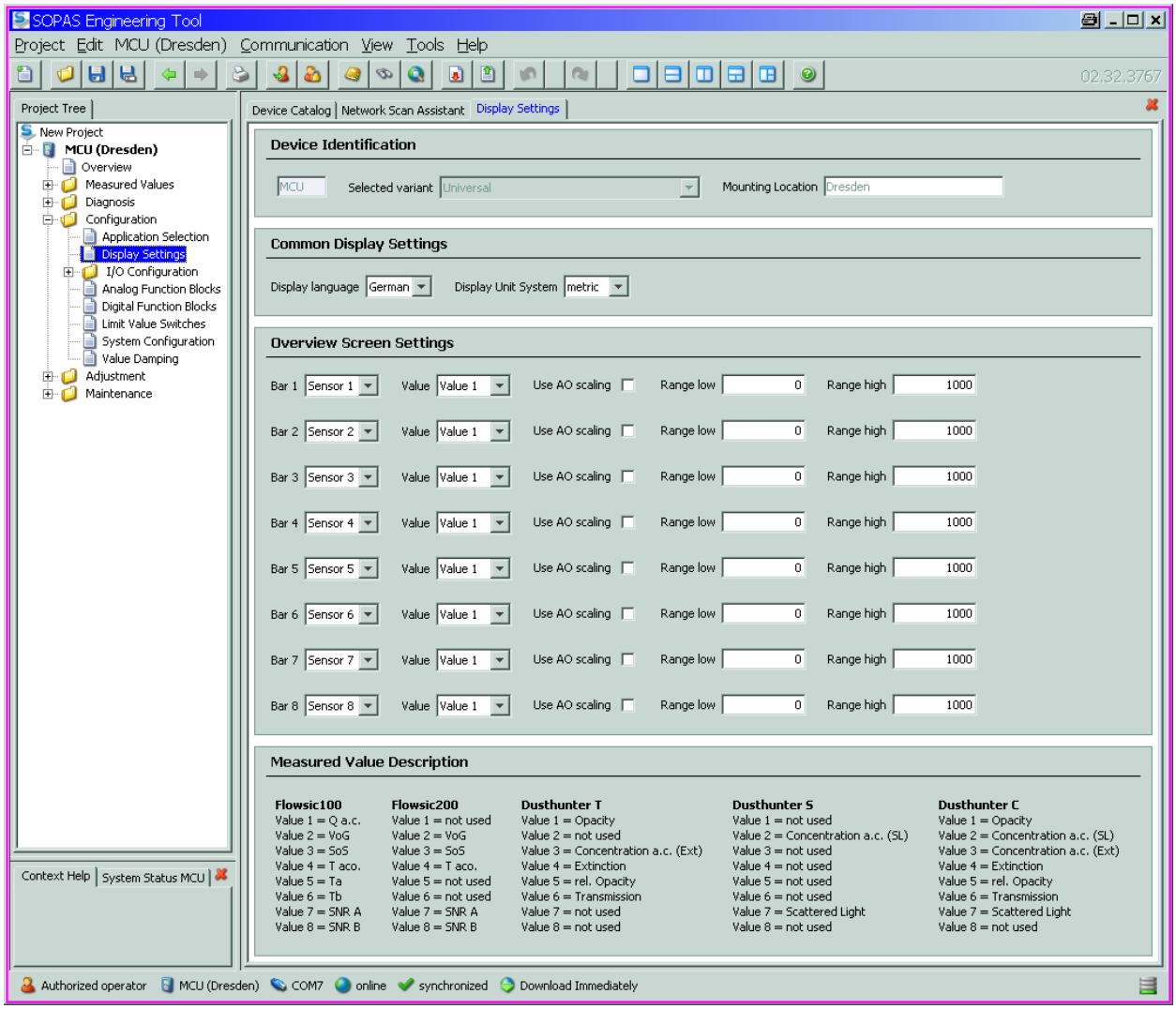
- ► Set the MCU in maintenance mode, call the „MCU Variant” submenu, and select the type „Universal (Bus)”.
- ► Enter the default password and store the type with „Save” (confirm 2x).

The other assigning possibilities are not practicable here.

4.4.4 Using SOPAS ET to modify display settings

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

Figure 81 "Configuration/Display Settimgs“ directory



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

Measured value assignment

MCU measured value	Measured value of the measuring unit
Value 1	k value [/km]
Value 2	Inlet temperature [°C]
Value 3	not available
Value 4	not available
Value 5 to 8	Selection of maximum 4 measurands from: 2 Flow rate [l/min] 4 External Temperature 1 [°C] 5 External Temperature 2 [°C] The measurands are assigned in the predefined order (by the manufacturer, if the corresponding option is ordered; by Endress+Hauser service at refitting). If an option is not available, the next one moves up.

SMOTEC450

5 Maintenance

General
Maintaining the measuring unit
Removal from service

5.1

General

The maintenance work to be carried out consists of:

- Checking and cleaning the optical boundary surfaces,
- Examining installed suction and exhaust air hoses,
- Checking the door of the measuring unit,
- Exchanging of air filter of the measuring unit.

Switch the SMOTEC450 to "Maintenance" mode before starting any maintenance work (→ p. 63, §4.2).

WARNING:
All activities must be carried out in line with the relevant safety regulations and instructions (→ p. 9, §1.3).

- The "Maintenance" mode can also be set by connecting an external maintenance switch to the terminals for Dig In2 (17, 18) in the MCU (→ p. 46, §3.3.4) or using the keys on the LC display on the MCU (→ p. 84, §4.4.2) if this option is availble.
- During "Maintenance" no automatic function check is carried out.
- The value set for "Maintenance" is output on the analog output (→ p. 67, §4.2.5). This also applies in case of malfunction (signalised at the relay output).
- The "Maintenance" state is reset when there is a voltage failure. In this case, the measuring system switches automatically to "Measurement" after the operating voltage is switched on again.

Switch back to measuring operation when the work has been completed → p. 74, §4.2.11 or open the contact at Dig In 2).

Maintenance intervals

The tunnel operator is responsible for defining the maintenance intervals. This will depend on the specific operating parameters and ambient conditions. Maintenance intervals are normally 1 year. Longer maintenance intervals are possible for favorable conditions.

The activities required and their completion must be documented by the operator in a maintenance log.

Maintenance contract

Regular maintenance activities can be carried out by the tunnel operator. These activities must be carried out by qualified persons (as described in Chapter 1) only. If requested, all maintenance activities can also be performed by the Endress+Hauser Service department, or an authorized service partner.

Auxiliary means required

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

5.2 Maintaining the measuring unit

CAUTION:
Do not damage any device parts during maintenance work.

5.2.1 Inspection work

- Check suction and exhaust air hoses.
  Check the hoses regularly for tight connection and any possible deposits inside them. If necessary, disconnect the hoses from the connections and flush with water.
- Check the light trap (→ Fig. 82) for contamination .
- Check the laser beam for free passage trough the aperture (→ Fig. 82) .
- Check the fan for audible running noises.
- Check the seal on the door of the measuring unit for intactness.

NOTICE:
A leaking door can lead to erroneous measuring results.

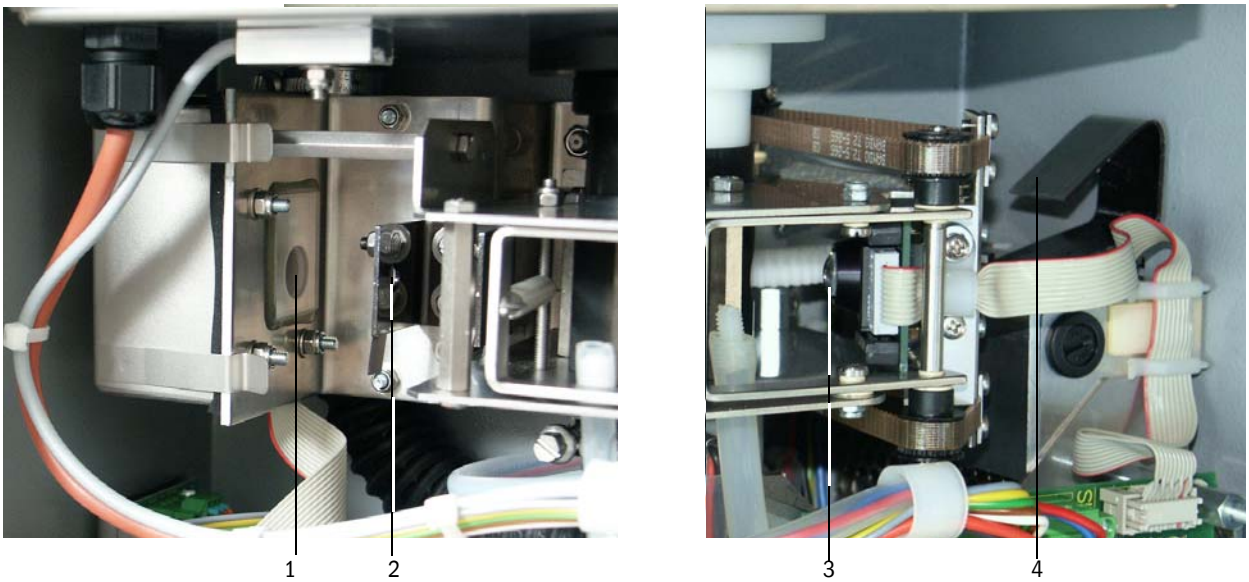
5.2.2 Cleaning the optical boundary surfaces of laser module and receiver

The optical boundary surfaces only have to be cleaned when deposits can be seen or before the contamination value reaches the limit of 30 % for warning (50 % for malfunction).

Activities

- Open the measuring unit door.
- Clean the optics carefully with cleaning sticks and, if necessary, the light trap as well.
- Close the door again.

Figure 82 Cleaning the optics



1 Sender lens
2 Aperture
3 Receiver optics
4 Light trap

5.2.3 Cleaning the rough filter in the air inlet

- Disconnect the measuring unit from the mains. (loosen the connection cable to MCU or mains voltage).

> When the fan is switched on, particles can come to the optics and contaminate them.

- Open the cover on the air inlet (→ p. 107, Fig. 93, → p. 108, Fig. 95).
- Remove the rough filter and clean it (if necessary, wash out), replace if necessary against a new filter (→ p. 114, §7.5).
- Put the rough filter again into the air inlet and close the cover.
- Reconnect the mains voltage.

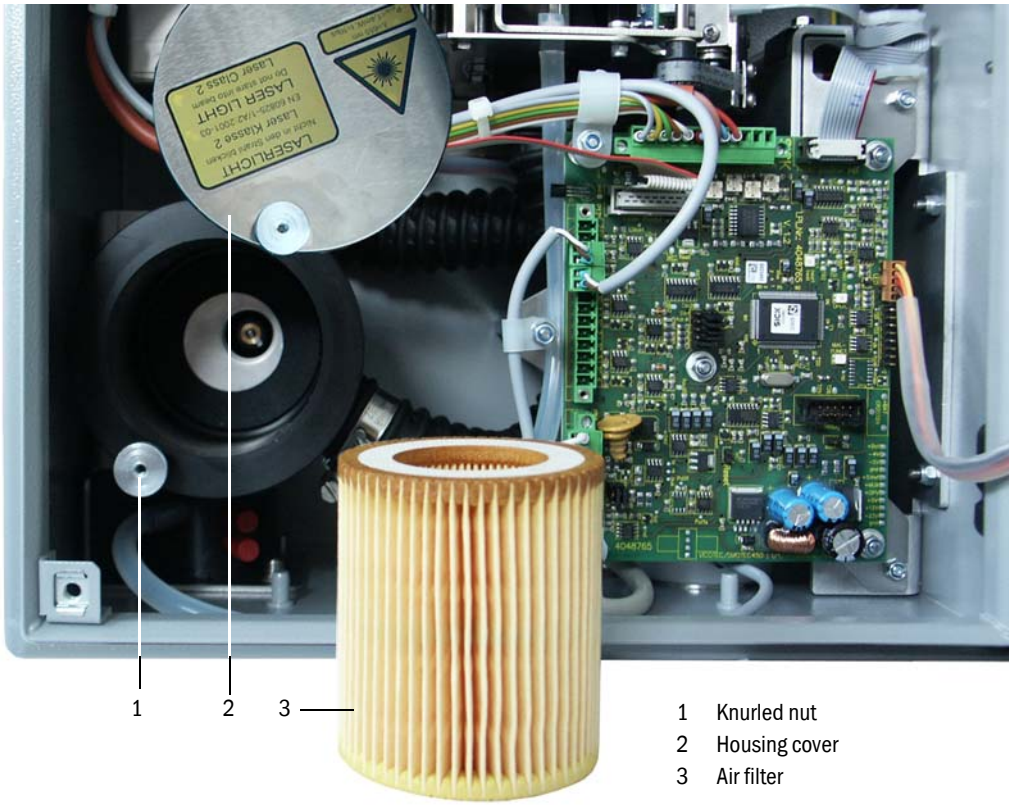
5.2.4 Replacing the air filter

Replace the air filter regularly with a new one. The interval should be 1 year.

Activities

- Disconnect the measuring unit from the mains. (loosen the connection cable to MCU or mains voltage)
- Open the door of the measuring unit.
- Turn the cover of the air filter housing up after loosening the knurled nuts.
- Remove the old the filter and insert a new one.
- Then replace the cover and fasten it.
- Close the door again tightly (tighten the lock screws firmly).
- Reconnect the mains voltage.

Figure 83 Replacing the air filter



1 Knurled nut
2 Housing cover
3 Air filter

5.3 Removal from service

Take the SMOTEC450 out of service during longer tunnel closures or construction work causing dust in the tunnel.

Alternatively the SMOTEC450 can further be operated in such cases if suction and exhaust air hose are connected to each other in a way that neither dust nor humidity can penetrate.

Activities

- ► Disconnect the connection cable to the control unit.
- ► Pull suction and exhaust air hoses off the connections, secure hose ends to prevent dirt and moisture penetrating the lines.
- ► Dismantle the measuring unit(s).
- ► Disconnect the control unit from mains voltage.

WARNING:

- When disassembling the system, observe the relevant safety regulations and the safety information in Chapter 1!
- Take suitable protection measures against possible local hazards or hazards arising from the plant!
- Secure switches that must not be activated for safety reasons with labels and safeguards to prevent unintentional activation.

Storage

- ► Store dismantled device parts in a clean, dry location.
- ► Take suitable measures to protect cable connectors against dirt and moisture.
- ► Ensure that no dirt or moisture can enter the suction and exhaust air hoses.

SMOTEC450

6 Malfunctions

General
Measuring unit
Control unit

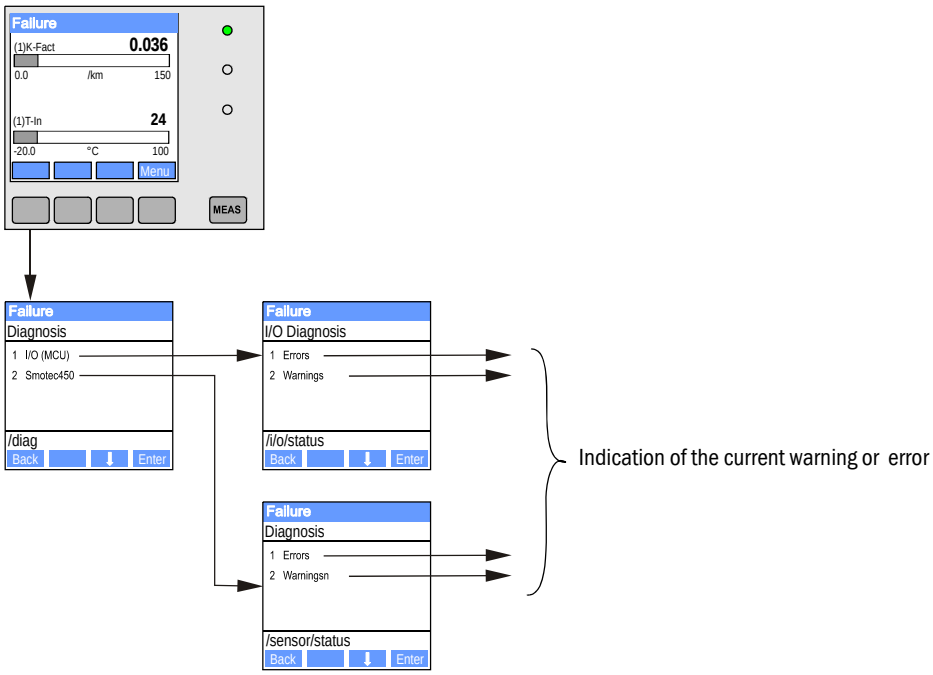
6.1 General

Warning or error messages are output in the following manner:

- On the MCU, the respective relay is switched on (→ p. 39, Fig. 24).
- "Maintenance requ." or "Failure" is displayed in the status bar of the LCD (→ p. 83, §4.4.1). In addition, the respective LED shines ("MAINTENANCE REQUEST" for warnings, "FAILURE" for errors).

  Possible causes are shown as a short information after pressing the key "Diag" on the menu "Diagnosis" and selecting the device ("MCU" or "SMOTEC450").

Figure 84 Display at the LCD



Detailed status information about the current device statust is provided by the "Diagnosis / Errors/Warnings" directory. Connect the measuring system to the SOPAS ET program and start the device file "SMOTEC450" or "MCU" (→ p. 60, §4.1.3.5) to display the relevant information.

The significance of the individual messages is described in more detail in a separate window after moving the cursor to the respective display. Clicking on the display shows a short description of possible causes and corrections under "Help" (→ p. 97, Fig. 85, → p. 99, Fig. 87).

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

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

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

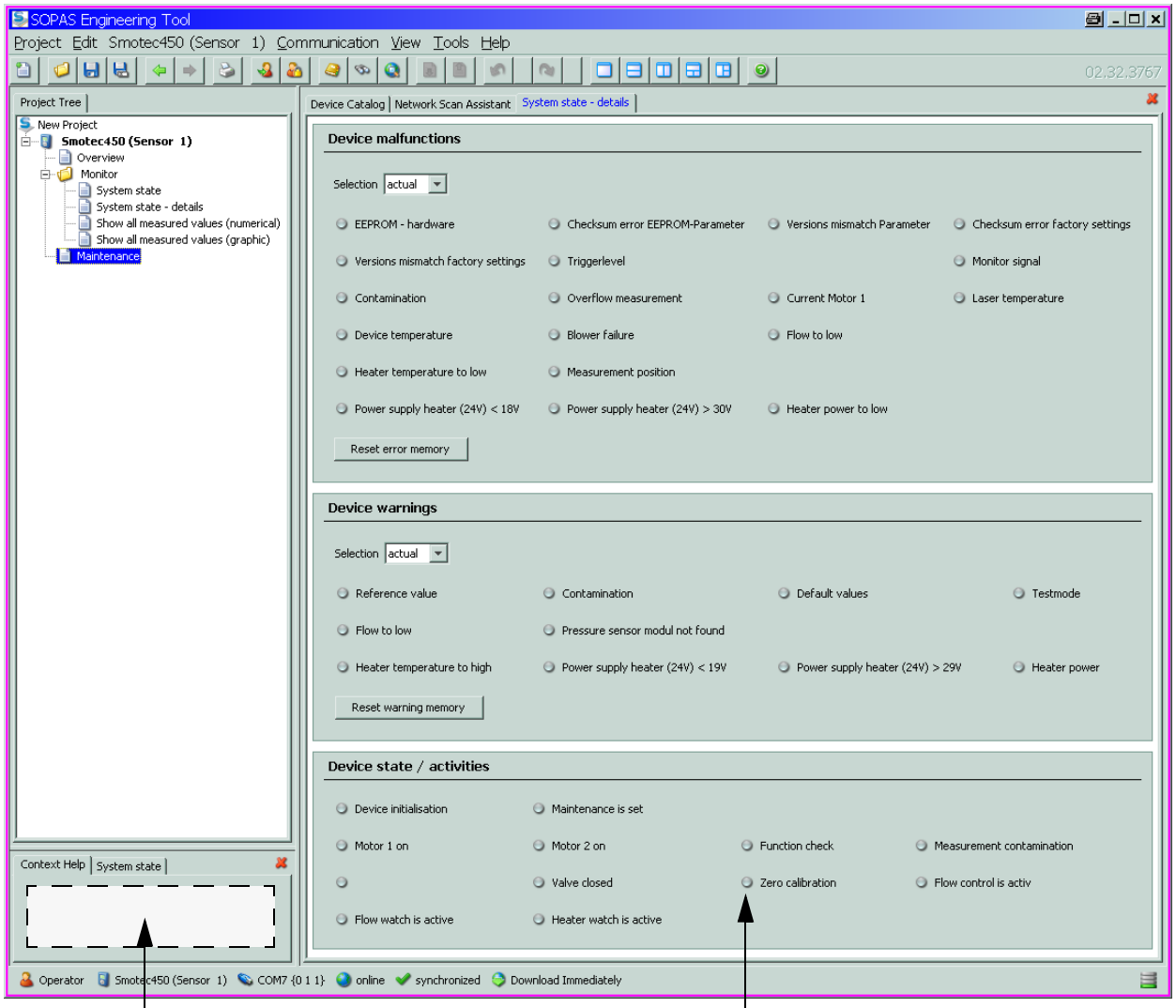
6.2 Measuring unit

6.2.1 Malfunctions

Symptom	Possible cause	Action
LEDs of the sender/ receiver unit are not on	• No supply voltage • Connection cable not connected correctly or defective • Defective plug connector	▶ Check plug connectors and cable. ▶ If the optional power pack is installed, check the fuse and replace if necessar ▶ Contact E+H service.

6.2.2 Warning and error messages in the SOPAS ET program

Figure 85 "Monitor / System state - details" directory



Warning or error messages currently existing or appeared earlier and stored in the error memory can be shown by selection of "actual" or "memory" in the "Selection" window.

The following malfunctions can be removed under circumstances at site.

Message	Significance	Possible cause	Action
Contamination	The current intensity of reception is lower than the the permitted limit value (→ p. 104, §7.1)	• Deposits on the optical interfaces • Unclean purge air	►Clean the optical surfaces (→ p. 91, §5.2.2). ►Check purge air filter (→ p. 92, §5.2.3) ►Contact Endress+Hauser service.
Overflow measurement	Reception intensity too high.	• Receiver not in measuring position • Relay for reception intensity damping defective	►Check the receiver position ►Trigger a checkl cycle and check procedure flow (→ p. 66, §4.2.4). ►Contact Endress+Hauser service.
Measurement postion *	Receiver not in measuring position	• Receiver not in measuring position • End position switch defective	►Check the receiver position ►Trigger a checkl cycle and check procedure flow (→ p. 66, §4.2.4). ►Contact Endress+Hauser service.
Blower failure		• Plug connector or cable defective • Blower defective	►Replace the blower (see Service Manual). ►Contact Endress+Hauser service.
Flow rate too small	Air flow rate too low	• Suction and/or exhaust air hose blocked • Pressure sensor and/or regulation at flow measurement option defective	►Check suction and exhaust air hose, clean if necessary (→ p. 91, §5.2.1). ►Check flow measurement option. ►Contact Endress+Hauser service.

*: From hardware version 1.3

6.2.3 Replacing the fuse for optional power pack

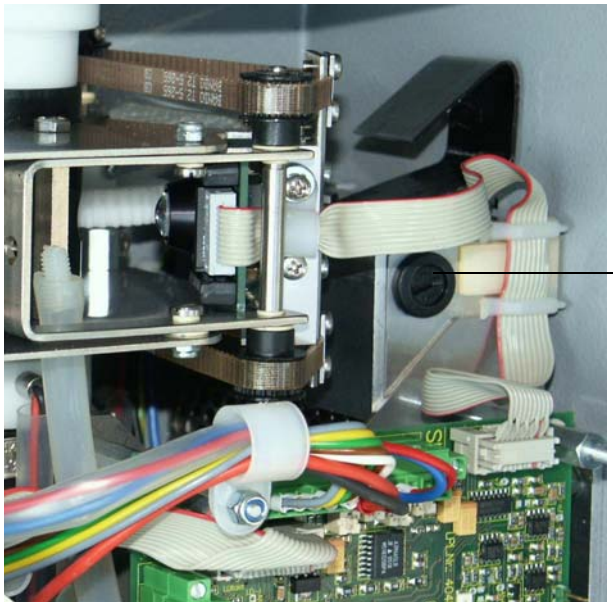
► Open the measuring unit door.

► Unscrew the fuse holder, replace the defective fuse and put in a new one (→ p. 114, §7.6, part no. 2054541)

► Screw in the fuse holder again.

► Close the door again tightly.

Figure 86 Fuse holder for optional power pack



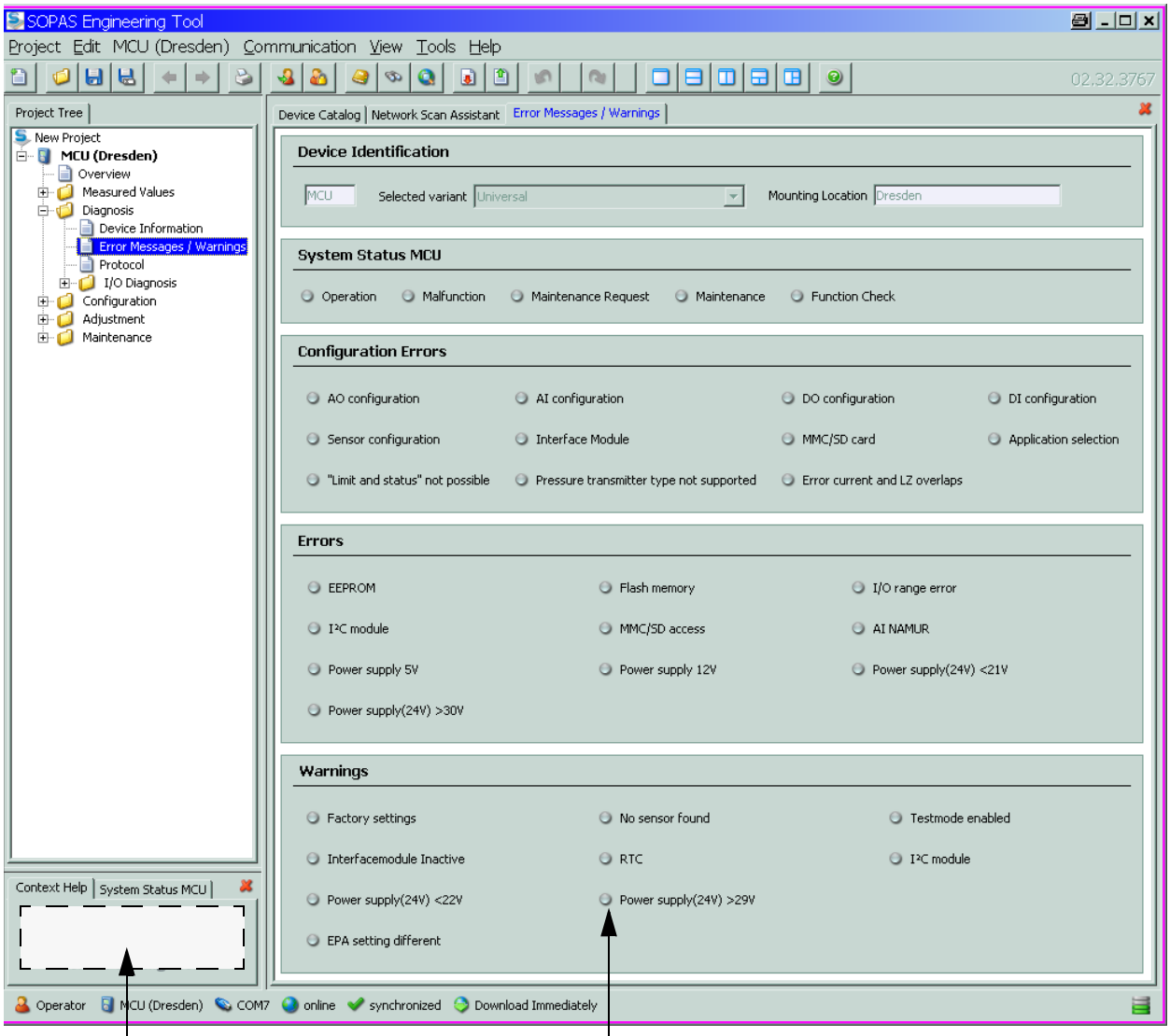
6.3 Control unit

6.3.1 Malfunctions

Symptom	Possible cause	Action
No display on the LCD (option)	• No supply voltage • Cable to the LCD not connected or damaged • Defective fuse	▶Check the power supply. ▶Check the connection cable. ▶Exchange the fuse. ▶Contact Endress+Hauser Service.

6.3.2 Warning and error messages in the SOPAS ET program

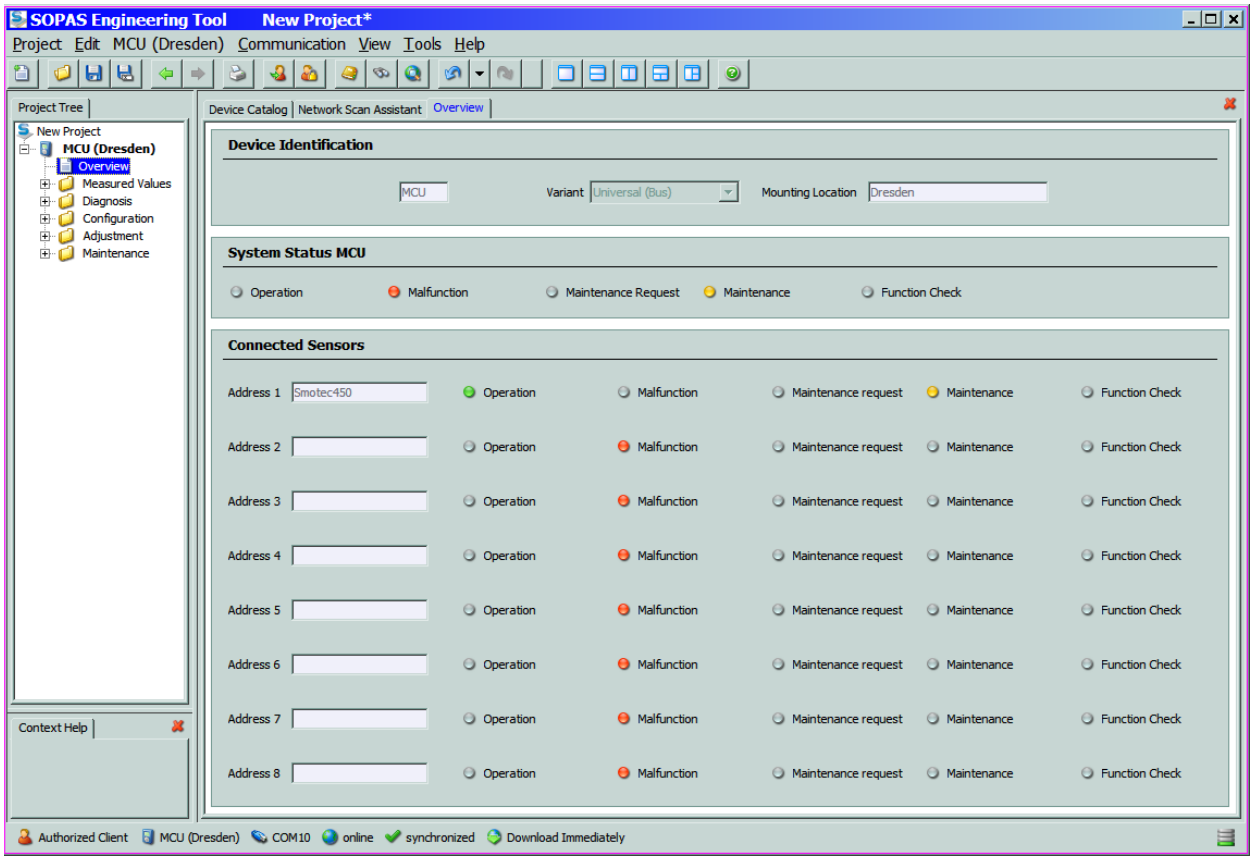
Figure 87 "Diagnosis / Errors/Warnings" directory



The following malfunctions can be removed under circumstances at site.

Message	Significance	Possible cause	Action
AO configuration	The number of optional modules does not match the number of analog outputs with parameter settings.	• No parameters set for AO • Connection error • Module failure	▶ Check the parameter settings (→ p. 67, §4.2.5). ▶ Contact Contact E+H service..
AI configuration	The number of optional modules does not match the number of analog inputs with parameter settings.	• No parameters set for AI • Connection error • Module failure	▶ Check the parameter settings → p. 69, §4.2.6). ▶Contact Endress+Hauser service.
DO configuration	The number of optional modules does not match the number of digital outputs with parameter settings.	• No parameters set for DO • Connection error • Module failure	▶ Check the parameter settings → p. 75, §4.3.2). ▶Contact Endress+Hauser service.
Sensor configuration	The number of available sensors does not match the number of connected sensors.	• Sensor failure • Communication problems on RS485 line	▶Check addressing and availability of the sensors (→ Fig. 88). ▶Correct sensor selection (→ p. 75, Fig. 69). ▶Contact Endress+Hauser service.
Interface module	No communication via interface module	• No parameters set for module • Connection error • Module failure	▶ Check the parameter settings (→ p. 80, §4.3.3.2). ▶ Contact Endress+Hauser service
Variant configuration error	MCU setting doesn't match attached sensor	• Sensor type was changed	▶ Correct application settings (→ p. 64, §4.2.1).
Testmode enabled	MCU is in test mode.		▶ Disable the "System Test" status ("Maintenance" directory)

Figure 88 "Overview" directory

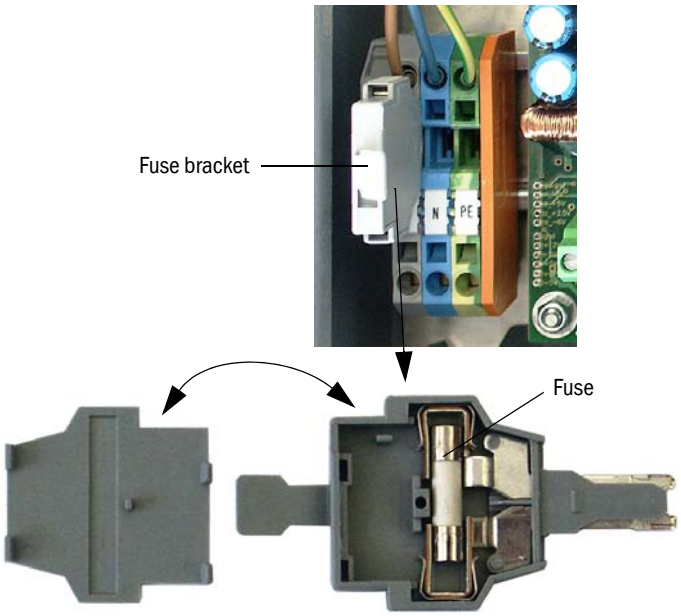


6.3.3 Replacing the fuse

MCU in wall housing

- ▶ Disconnect the measuring system from the mains.
- ▶ Open the door of the MCU control unit.
- ▶ Remove and open the fuse bracket.
- ▶ Replace the defective fuse against a new one (→ p. 114, §7.6).
- ▶ Close the fuse bracket and install.
- ▶ Close the door and connect the power supply.

Figure 89 Replacing the fuse

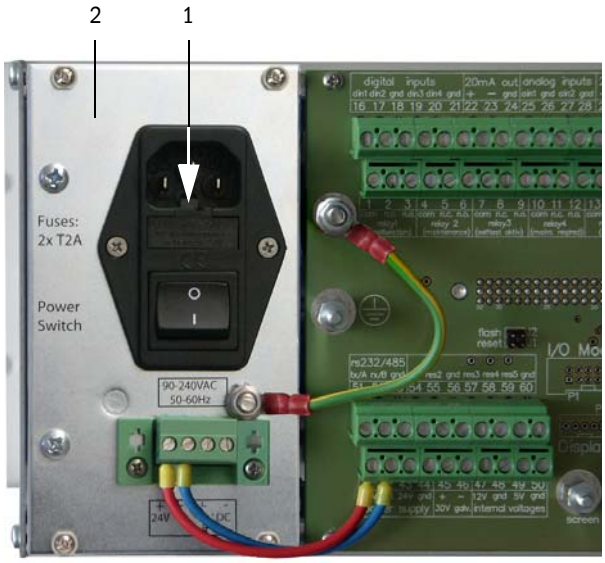


Control unit in the 19" rack

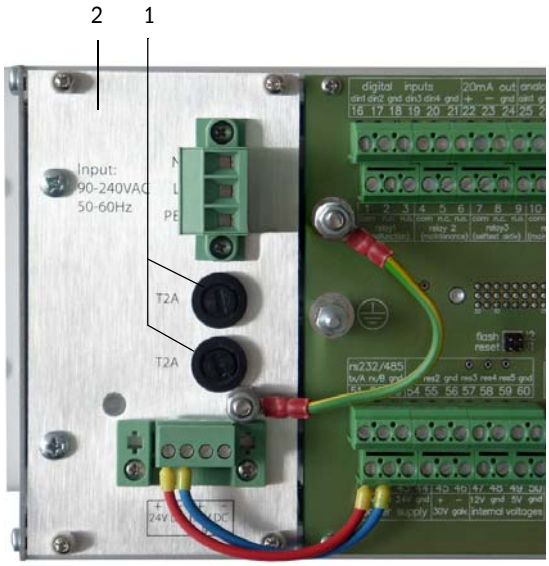
- ► Disconnect the measuring system from the mains.
- ► Pull control unit out of the 19" frame.
- ► Open fuse bracket (1) (on the back side of the power supply unit (2)).
- ► Replace the defective fuse against a new one (→ p. 114, §7.6).
- ► Close fuse bracket.
- ► Insert control unit and reconnect the mains voltage.

Figure 90 Changing the fuse

Power supply unit with plug connection



Power supply unit with terminal connection



SMOTEC450

7 Specifications

Technical data
Dimensions, part numbers
Accessories
Options
Consumable parts for 2-year operation
Spare parts
Password

7.1 Technical data

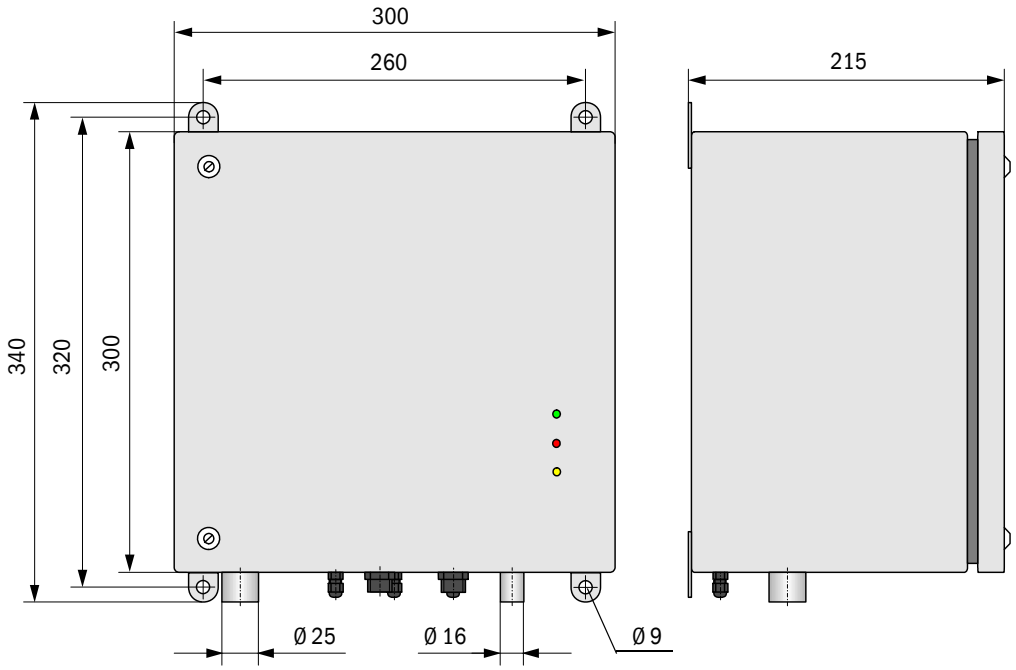
Measured value recording	
Measured variable	Scattered light intensity, converted to visibility (k value)
Measuring range	0 ... 2000/km, default setting 0 ... 150/km Limit value for smoke detection 15/km
Repeat accuracy	± 2 % of rating
Resolution	2/km
Reaction time	1 ... 600 s; freely selectable (without dwell time for suctioned air in the suction line)
Measuring delay	Dwell time in suction line = line length [m] / suction rate [m/s]
Suction rate	Approx. 3 m/s for suction hose inner diameter 13 mm and suction hose length max. 15 m
Temp. measurement option	Measuring range -50 ... +250 °C; accuracy (not calibrated) ± 2 K; resolution ± 0.25 K
Function check	
Automatic self-test	Linearity, contamination, drift, aging contamination limit values:30 % for warning;50 % for malfunction
Manual linearity check	With reference filter set
Output signals	
Analog output	0/2/4 ... 20 mA, max. load 750 W; resolution 10 bits; electrically isolated Further analog outputs when using I/O modules (option, → p. 21, §2.2.4)
Relay outputs	5 potential-free outputs (change-over contact) for operation/malfunction status signals, maintenance, function check, maintenance request, limit value; contact load 48 V, 1 A; Further relay outputs when using I/O modules (option, → p. 21, §2.2.4)
Input signals	
Analog inputs	2 inputs 0 ... 5/10 V or 0 ... 20 mA (without electrical isolation); resolution 10 bits Further analog inputs when using I/O modules (option, → p. 21, §2.2.4)
Digital inputs	4 inputs for connection of potential-free contacts (e.g. to connect a maintenance switch or trigger a function check) Further digital inputs when using I/O modules (option, → p. 21, §2.2.4)
Communication interfaces	
USB 1.1, RS 232 (on terminals)	For measured value inquiries and software updates per PC/laptop using the operating program
RS485	To connect measuring unit(s)
Option Interface module	To communicate with the Host PC, optional for Profibus, Ethernet
Power supply	
SME	Operational voltage: 24 V d.c. 90 ... 250 V a.c.; 50/60 Hz with integrated power pack Power input: Max. 35 W
MCU	Operational voltage: 90 ... 250 V a.c.; 50/60 Hz Power input:Approx. 50 W for SME power supply
Ambient conditions	
Temperature range	–30 ... +55 °C
Storage temperature	–40 ... +60 °C
Protection class	IP 66 (at proper installation)
Mass	
SME	Approx. 12 kg (stainless steel housing 1.4571)
MCU	Approx. 5 kg (stainless steel housing 1.4571)
Misc.	
Light source	Laser; laser class 2; power < 1 mW; wavelength approx. 650 nm Service life approx. 100,000 h (MTBF) at 20 °C
Electrical safety	According to EN 61010-1
Blower output	Approx. 30 ... 35 l/min

7.2 Dimensions, part numbers

All dimensions are specified in mm.

7.2.1 Measuring unit

Figure 91 Measuring unit



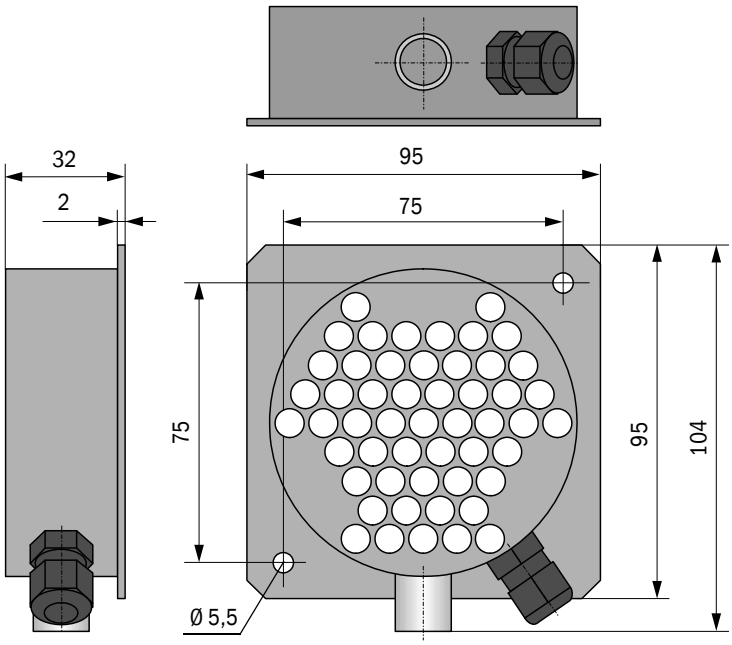
Name	Part no.
SME-WR-N-0-F measuring unit	1041750
SME-24-N-0-F measuring unit	1041749

Type key → p. 17, §2.2.3

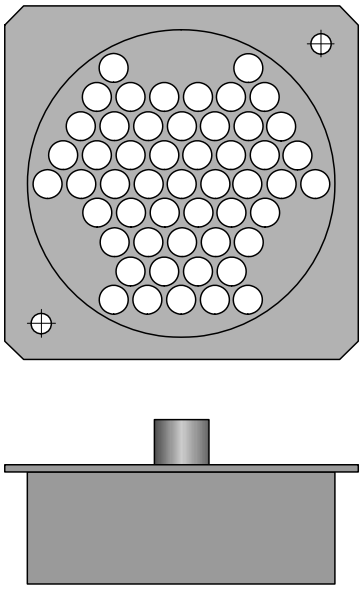
7.2.2 Air inlet with protective grating

Figure 92 Air inlet with protective grating

For wall fitting



For fitting on intermediate ceiling

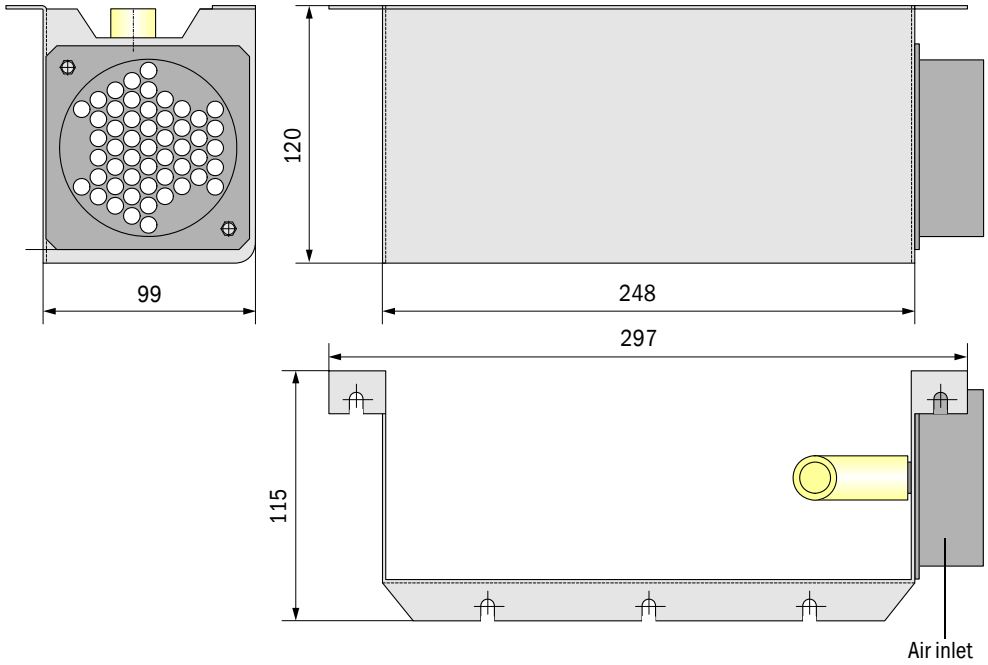


Dimensions and assembly dimensions as for wall fitting design

Name	Part no.
Air inlet with protective grating for wall fitting	2040848
Air inlet with protective grating for intermediate ceiling fitting	2040875

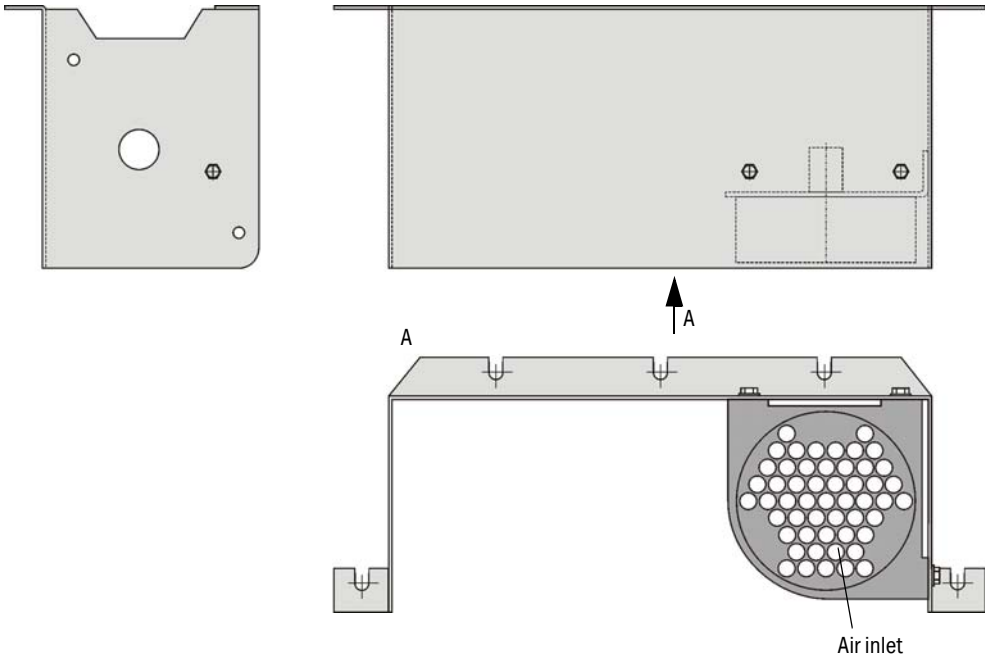
7.2.3 Cover with integrated air inlet

Figure 93 Cover with integrated air inlet from the side



Name	Part no.
Cover with integrated air inlet	2040850

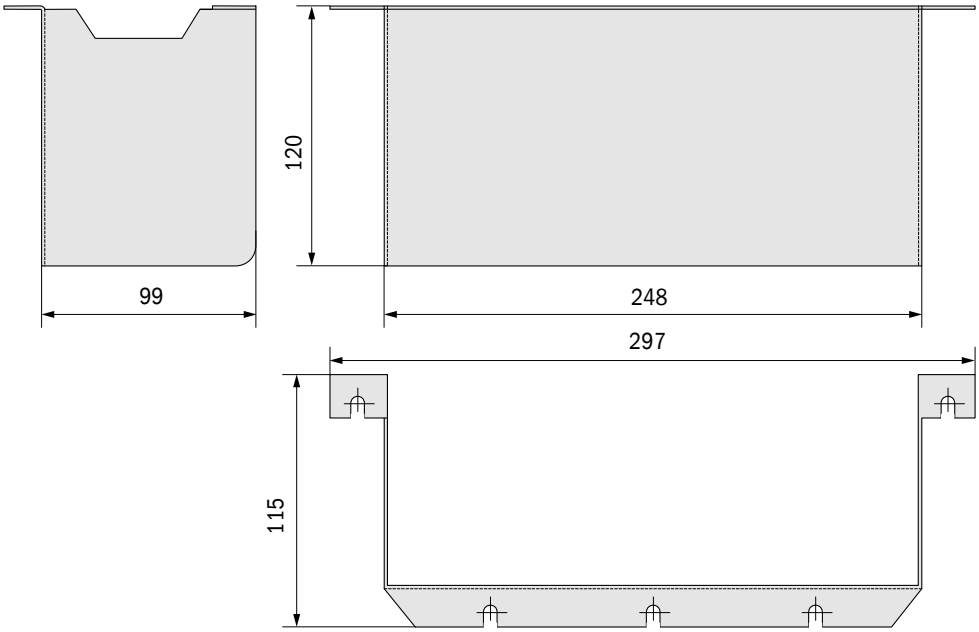
Figure 94 Cover with integrated air inlet from below



Component	Part No.
Cover with integrated air inlet concealed	2061799

7.2.4 Optional cover for connections

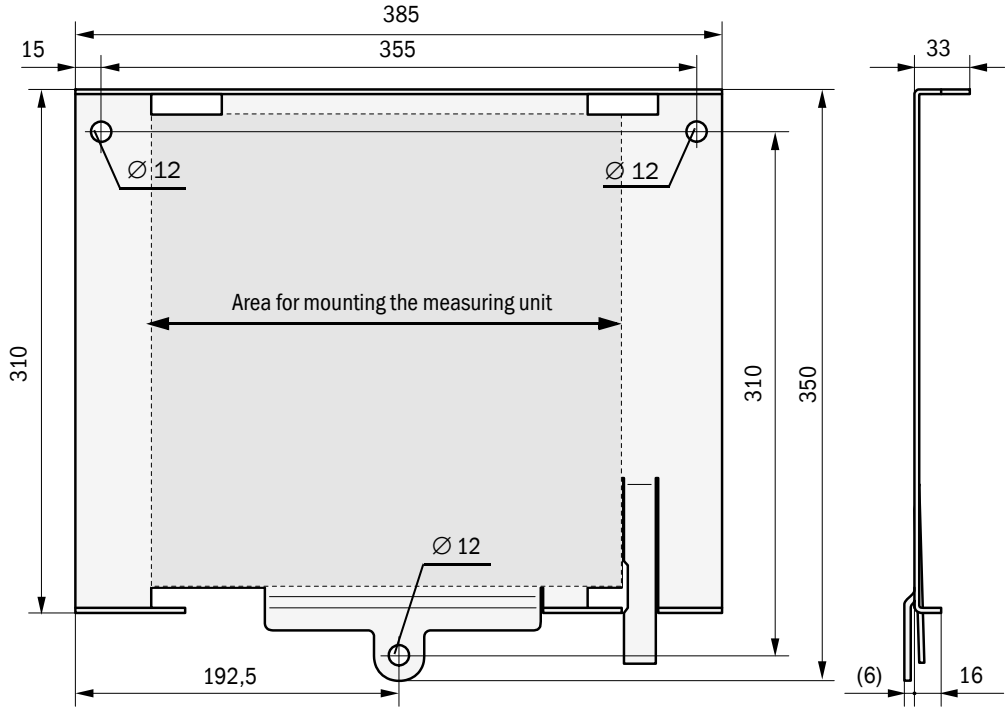
Figure 95 Optional cover for connections

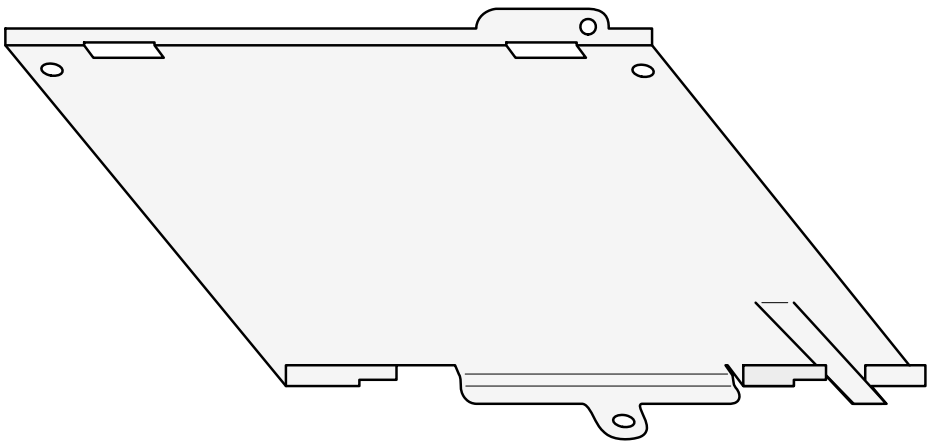


Name	Part no.
Optional connection cover	2040849

7.2.5 Optional installation plate

Figure 96 Installation plate option

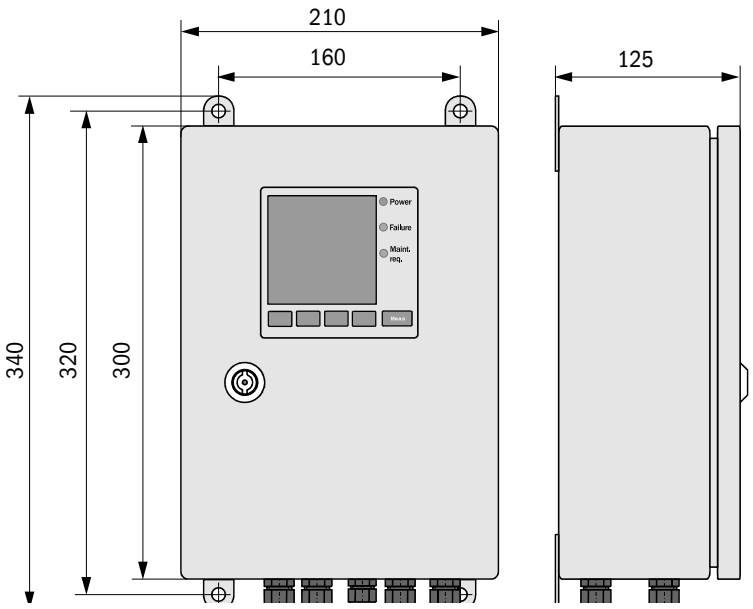




Name	Part no.
Installation plate	2040856

7.2.6 MCU control unit

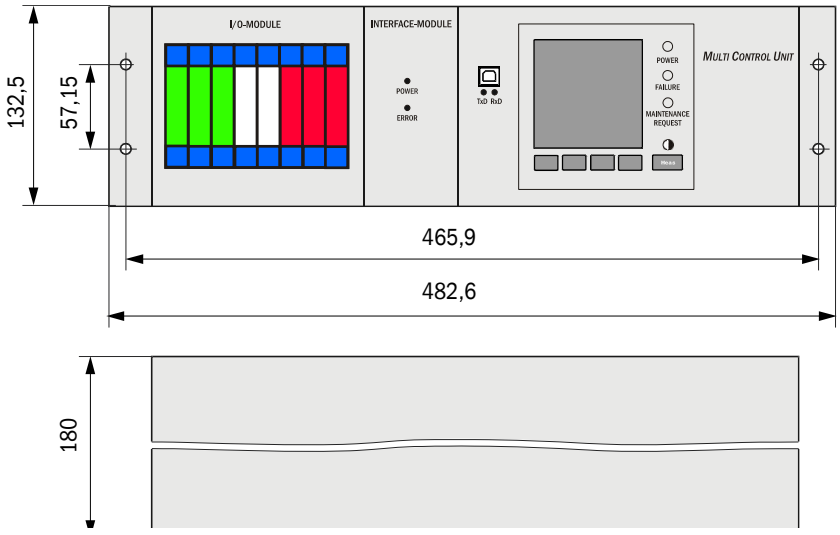
Figure 97 MCU control unit in wall housing (shown with LDC display option)



Name	Part no.
MCU-NWSNN00000NNNE control unit	1046298
MCU-N2SNN00000NNNE control unit	1046299
MCU-NWSDN00000NNNE control unit	1046113
MCU-N2SDN00000NNNE control unit	1046115

Type key → p. 21, §2.2.4

Figure 98 MCU control unit in 19” rack ((shown with LDC display optionl)



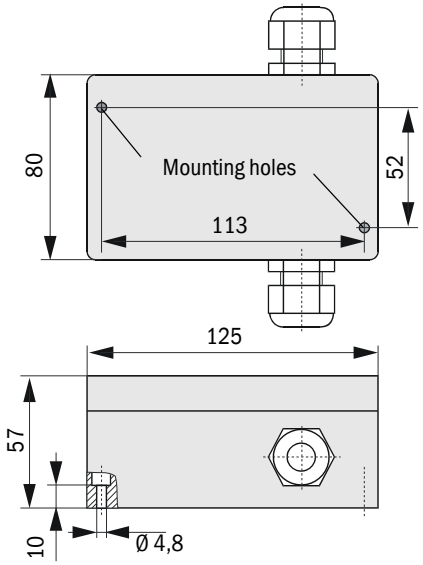
Name	Part no.
MCU-NWRDN00000NNNE control unit	1046288
MCU-N2RDN00000NNNE control unit	1046116

Type key → p. 21, §2.2.4

7.2.7 Optional connection box for connection cables

In aluminium case

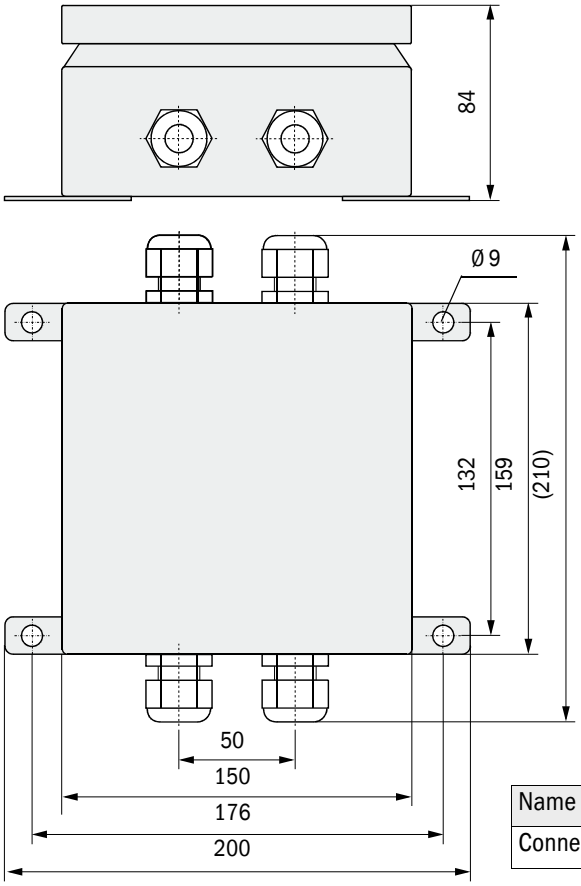
Figure 99 Connection box



Name	Part no.
Connection box	2046418

In stainless steel case

Figure 100 Connection box in stainless steel case



Name	Part no.
Connection box in stainless steel case	2048067

7.3 Accessories

7.3.1 Suction and exhaust air hose

Name	Part no.
Suction and exhaust air hose, set, length 5 m	2042078
Suction and exhaust air hose, set, length 10 m	2042079
Suction and exhaust air hose, set, length 15 m	2042098

7.3.2 Connection cable

Name	Part no.
Connection cable for SME to MCU connection, length 5 m	7042017
Connection cable for SME to MCU connection, length 10 m	7042018
Connection cable for SME to MCU connection, length 50 m	7042019

7.3.3 Mounting set

Name	Part no.
Mounting set 4D8-1.4571/PA	2031889
Mounting set 2D4-1.4571/PA	2031890
Mounting set 2M8-1.4571	2031891
Mounting set 4M8-1.4529	2031887

7.4 Options

7.4.1 SME measuring unit

Name	Part no.
Power pack 24 V d.c., 75 W	6033051
Temperature measurement with 1x thermocouple Ni-Cr-Ni, electronics module and line length 20 m (standard length)	2040852
Temperature measurement with 2 x thermocouple Ni-Cr-Ni, electronics module and line length 20 m (standard length)	
Flow measurement	2040847

7.4.2 MCU control unit

Name	Part no.
Analog input module, 2 channels, 100 W, 0/4...22 mA, electrically isolated	2034656
Analog output module, 2 channels, 500 W 0/4 ... 22 mA, electrically isolated per module	2034657
Digital input module, 4 channels, for potential-free contacts, max. 4.5 mA	2034658
Digital output module, 2 changeover contacts, contact load 48 V a.c./d.c., 5 A	2034659
Digital output module, 4 make contacts, contact load 48 V a.c./d.c., 0.5 A	2034661
Additional options for MCU in wall-housing	
Module carrier (one required for each AI, AO, DI or DO module)	6033578
Connection cable for optional I/O modules	2040977
Profibus DP V0 interface module	2040961
Ethernet interface module	2040965
Additional options for MCU control unit in19" rack	
I/O-Module carrier 19" (for installation of up to 4 AI/AO and DI/DO-modules)	2050589
Interface module 19" Profibus DP	2049334
Interface module 19" Ethernet	2048377

7.4.3 Accessories for device check

Name	Part no.
Check filter set	2043331

7.5 Consumable parts for 2-year operation

SME measuring unit

Name	Number	Part no.
Filter insert C1140 (only old versions with blower 6033052)	2	7047560
Filter insert	2	5324368
Rough filter (Air inlet with protective grating)	2	4050450
Optics cloth	2	4003353

7.6 Spare parts

Name	Part no.
Measuring unit	
Knurled nut M4	5313198
Socket 7 pole (for cnnection to MCU)	7045569
Socket 4 pole (for connection mains supply to measuring unit with optional power pack)	7045613
Fuse set T2A	2054541
Control unit	
Fuse set T2A (for MCU with mains supply)	2054541
Fuse set T4A (for MCU with 24 V supply)	2056334

7.7 Password

Passwort „Autorisierter Bediener“

Nach dem Start des Bedien- und Parametrierprogrammes SOPAS ET sind nur die Programmfunktionen verfügbar, die keinen Einfluss auf die Gerätefunktion haben.

Nicht eingewiesenes Personal kann keine Änderungen der Parameter vornehmen.
Zur Nutzung des erweiterten Funktionsumfanges wird das

Passwort **sickoptic** benötigt.

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

Password "Authorized operator"

After the start of the SOPAS ET operating and parameterization program, only menus are available which have no effect on the functioning of the device.
Untrained personnel cannot alter the device parameters. To access the extended range of functions the

password **sickoptic** must be entered

If a wrong key is pressed when entering the password, the window must be closed and then the entering repeated.

8029839/AE00/V2-2/2014-06

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