Operating Instructions
VM400

Single Point Air Velocity Monitor
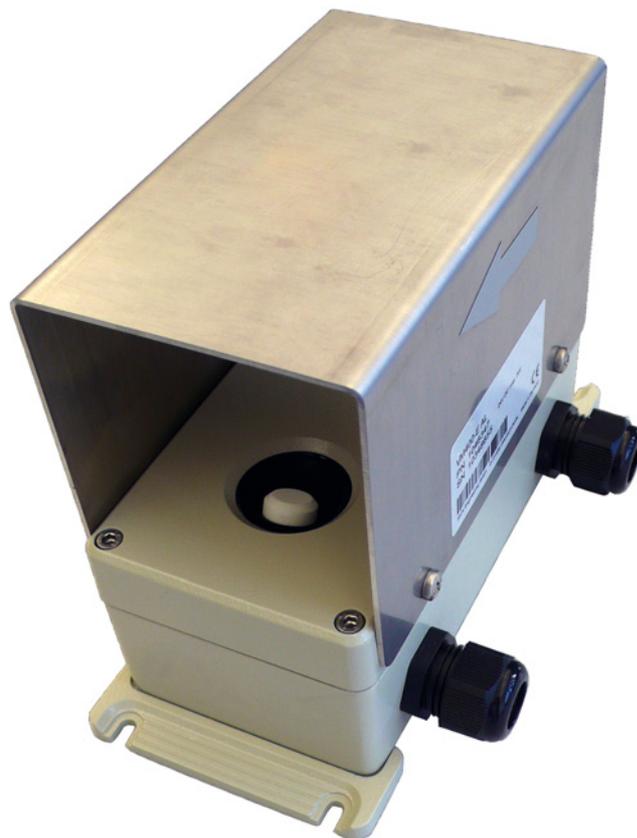
Described product

Product name: VM400
Versions: VM400S-AL
                  VM400E-AL

Manufacturer

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

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Original document

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Warning symbols

⚠ Hazard (general)

⚡ Hazard by voltage

🌳 Hazard for the environment/nature/organic life

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

[⚡] Important information on electric or electronic functions

💡 Nice to know

+**i** Supplementary information

+**i**↪ Link to information at another place

CONTENTS

CONTENTS

VM400

1   For your safety

Operating safety
Intended use
Responsibility of user

1.1   **Operating safety**

Read and always observe the safety and warning information in this Operating Instructions.

> **WARNING: Danger through defective device**
> The VM400 is likely to be unsafe when it:
> - Shows visible damage on the outside.
> - Has been penetrated by moisture.
> - Has been stored or operated under irregular conditions.
>
> When safe operation is no longer possible:
> ▸ Put the VM400 out of operation, separate all connectors from the power supply and secure against unauthorized start-up/commissioning.

> **WARNING: Risks through electric voltages**
> ▸ Do not interrupt protective conductor connections.

1.2   **Intended use**

1.2.1   **Purpose of the device**

Devices of the VM400 series only serve for single point air velocity measurements in the atmosphere in road tunnels, rail tunnels, mines or similar traffic infrastructure.

1.2.2   **Application limitation**

- ▸ The system is operated in accordance with the technical data and specifications regarding assembly, connection, ambient and operating conditions. →p. 49, »Specifications« (Refer also to the documentation supplied and the order documents.)
- ▸ All of the measures required to maintain the device, e.g. maintenance and inspection, transport and storage, are provided.
- !▸ Do not change or remove any components at and within the device if this is not described or specified in official information of the manufacturer.
  Otherwise:
  - – the device could become a danger
  - – the device is out of every guarantee of the manufacturer.

1.3   **Responsibility of user**

1.3.1   **Intended users**

- ▸ The VM400 may only be installed, started and maintained 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.

Correct use
- ▸ Only use the VM400 as described in this Operating Instructions. The manufacturer is not responsible for any other use.
- ▸ Carry out the specified maintenance work.
- ▸ Do not remove, add, or change any components in the device unless such changes are officially allowed and specified by the manufacturer. Otherwise
  - – the device may become dangerous
  - – the manufacturer's guarantee becomes invalid

Special local conditions

▸ In addition to this Operating Instructions, observe all local laws, technical rules, and company-internal instructions valid at the site where the device is installed.

Safety precautions examples:

▸ Attach warning signs to the device.
▸ Position warning signs in the operating area.
▸ Inform persons who can be in the area on safety-relevant aspects.

Keep the documents

▸ Keep this Operating Instructions and all associated documents available for reference.
▸ Pass the documents on to a new owner.

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VM400

2　Product description

Product identification
Device description
Signals and interfaces

Product identification

Product name:	VM400
Product version:	VM400S-AL with analog and digital outputs
	VM400E-AL with analog and digital output and Ethernet interface
Housing:	Wall mounting housing
Serial no. (S/N):	from 09068561
Firmware-Version:	from 1.0.03
Manufacturer:	Endress+Hauser SICK GmbH+Co. KG
	Bergener Ring 27 · 01458 Ottendorf-Okrilla · Germany

The type label is located on the upper housing (cover) front, see figure 1, p. 12.

2.1.1 Features of the VM400

The VM400 Air Velocity Monitor is a single point measuring device. That means it measures continuously the air velocity in the atmosphere in road tunnels, rail tunnels, mines or similar traffic infrastructure.

With its compact design the VM400 comprises the following product features:

● Precise measuring results – also at very low velocities
● Non-sensitive against contamination
● Long maintenance intervals based on the non-contact measuring system
● No mechanically moving parts
● Simple system integration

2.2 Device description

Figure 1   Device housing
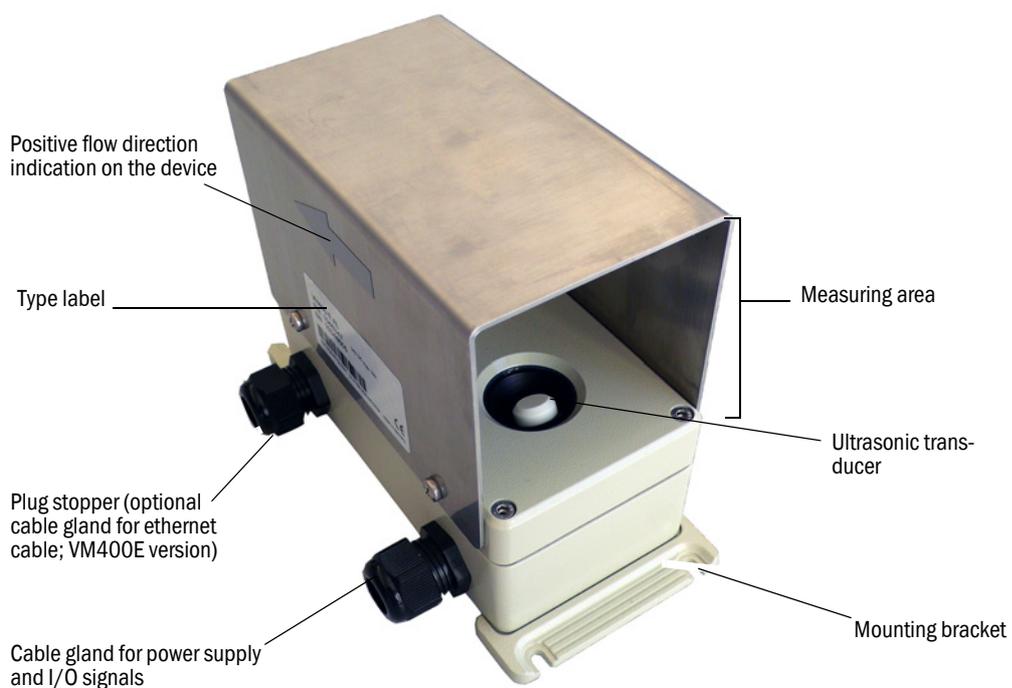
2.2.1 Measuring principle

The measuring principle is based on the transit time difference of an ultrasound beam in two opposite directions. The ultrasonic transducers are designed in a certain angle to the air flow direction as shown in figure 2. Both transducers transmit and receive ultrasound pulses alternately.

Depending on the angle of the ultrasound directions and the air flow velocity, the transit time of the respective sound direction varies the higher the flow velocity is. The air velocity now is determined from the difference between both transit times, independent of the sound velocity.

Figure 2   Measuring principle of the VM400
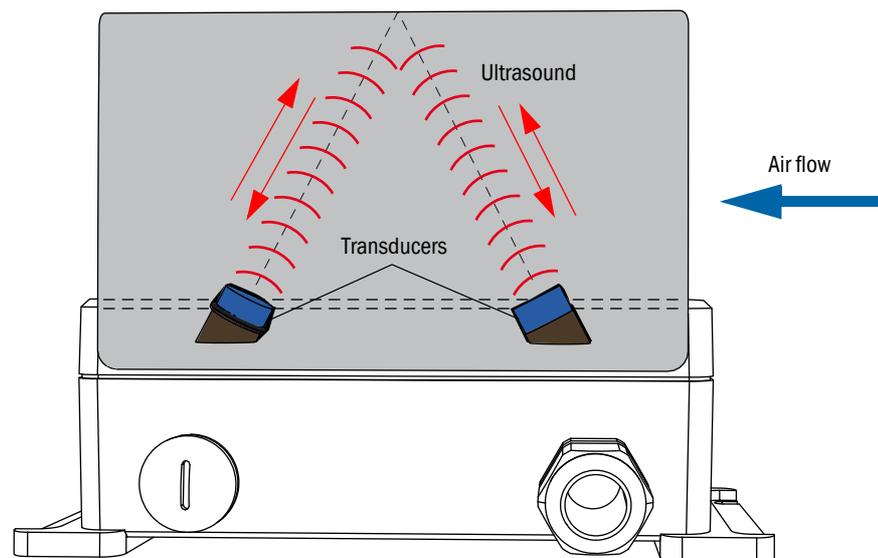
This well approved measuring principle provides the following advantages:
● Non-contact principle
● Very robust against contamination
● Precise measuring results at very low air velocities

2.3 Signals and interfaces

According to the device versions the following interfaces are available:
● VM400S with
    – 1 analog output for the measuring value output
    – 2 digital outputs for output of actual device states
    – 1 RS232 serial interface (for service work only)
● VM400E with
    – 1 analog output for the measuring value output
    – 2 digital outputs for output of actual device states
    – 1 RS232 service interface (for service work only)
    – Ethernet interface for LAN communication

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VM400

3   Installation

Scope of delivery
Preparation of the measurement point
Installation of the VM400

3.1   Scope of delivery

- VM400 Air Velocity Monitor with attached mounting brackets for hole diameters of Ø 5 mm
- Optional mounting brackets with 4 heavy duty screw anchors and screws (M8 x 55) if larger hole diameters (Ø 9 mm) are necessary.

Checking the scope of delivery

▸ Check the scope of delivery according to the order confirmation/delivery note.

3.2   Preparation of the measurement point

3.2.1   Short safety hints

> **!** *NOTICE:* **Responsibility of User**
> ▸ Refer to the → »Responsibility of user« (p. 8)

> **⚠** **WARNING: When carrying out installation activities**
> ▸ When carrying out the installation work, observe the relevant safety regulations and safety instructions at all times. → »For your safety« (p. 7).
> ▸ If possible, carry out any installation work while the tunnel or the relevant mounting location is closed or save.
> ▸ Take suitable protective measures against possible hazards.
> ▸ The cabling for the power supply of the VM400 must be installed and secured according to the relevant regulations.

3.2.2   Work/activities carried out by the customer

> **!**
> - The basis for the determination of the measurement point is the preceding project planning, the information in the final inspection record and the regulations of the local authorities.
> - The equipment operator is responsible for the determination of the measurement point (e.g. the determination of a representative sampling point).
> - The equipment operator is responsible for the preparation of the measurement point (e.g. load carrying capacity, cabling/wiring for the device).

▸ Determine the installation location
▸ Observe the space requirements for the VM400. (→ p. 17, §3). Provide for additional space for maintenance work (cleaning of the cover plate).
▸ Observe the maximum cable lengths (→ p. 17, §3 or as planned).
▸ Provide the +24 V DC power supply for the VM400.
▸ Lay the signal lines.

Unless otherwise agreed with Endress+Hauser or an authorized representative, all of the installation work must be carried out by the customer. This includes:

- Preparing and laying all cables for the power supply and signal cables.
- Connecting the power supply and signal cables to the device
- Installing the switches and power fuses
- If necessary attaching the optional mounting brackets for the VM400 device
- Connecting of all cables and signals, etc.
- Mounting of the VM400 device

3.2.3 Possible arrangement on the measuring location

Figure 3   Example of a mounting arrangement for two VM400 devices
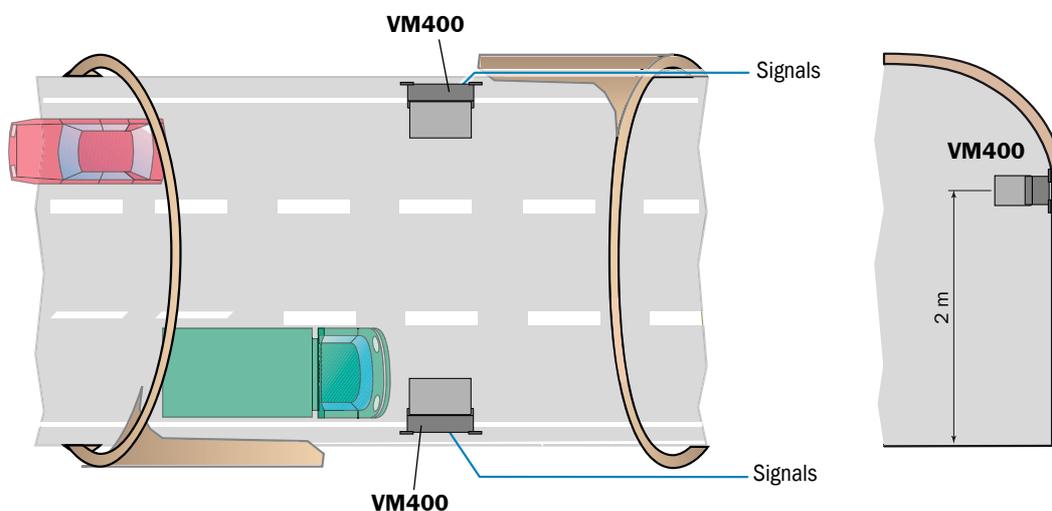
- The device must be mounted horizontally. It is preferred to install it on a vertical aligned part of the tunnel wall (see figure 3) or a plain area.
- The correct height depends strongly on the aerodynamic peculiarity of each individual tunnel.
  A higher installation point (approx. 2 m) is recommended to minimize impacts to the measurement of turbulent flow caused by passing cars.
- ▸ **DO NOT MOUNT** the VM400 device close to any obstacle in the tunnel (e.g. traffic signs, lights, traffic lights) or fans. A minimum distance of at least 20 times the maximum diameter of the obstacle is recommended.

> [!] *NOTICE:* Special safety hints
> - Plan adequate cable cross-sections for the signal connections and power supply. Recommendation: 8 x 0.5 … 0.75 mm^2.
> - The cable ends for connecting the VM400 device must have adequate reserve length.

> +**i**
> - VM400S: power supply, I/O cable: up to 1,000 m
> - VM400E: power supply, I/O cable: up to 500 m
> - Ethernet cable: up to 100 m

- ▸ An arrow on the front side of the device indicates the positive flow direction. See figure 1, p. 12
- ▸ Preferred installation: cable inlet at bottom of device.
- ▸ Depending on the flow direction inside the tunnel, a negative measuring value is given out in one of the two sides of the tunnel. These negative measuring values are corrected as follows:
- ▸ By setting the parameter AO on ±0-20 m/s the measuring value is always positive. To correct flow direction,
  - additional limit value relay is used.
  - insert manually corrective negative algebraic signs in evaluation programm
  - install device upside down with cable leads at top

3.3   **Installation of the VM400**

3.3.1   **Installation steps**

The following procedure summarizes all necessary steps.

1   **Step**: Drilling of the mounting holes on the tunnel wall or appropriate mounting area:
    Regular mounting brackets
    ▸   Drill 4 holes with 5 mm hole diameter according the drilling plan as shown in figure 4.

Figure 4   Drilling plan
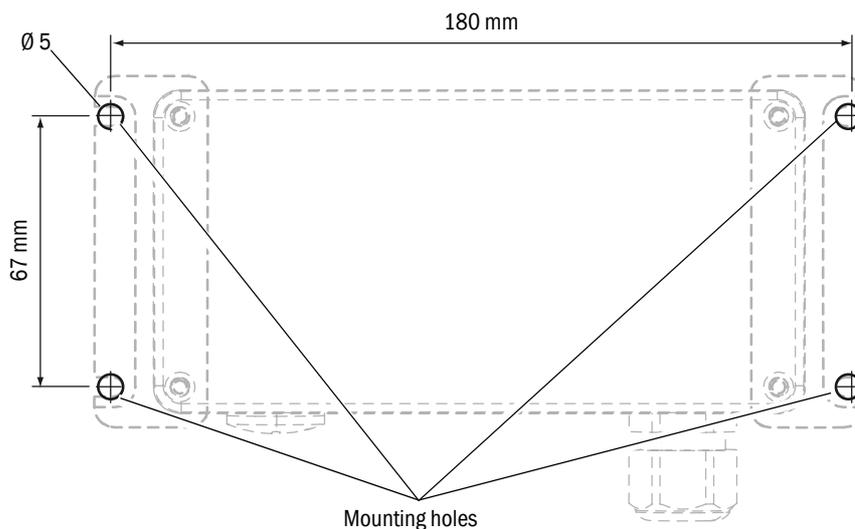
Mounting holes

Optional mounting brackets for larger hole diameters (Ø9 mm)
▸   Drill 4 holes with 9 mm hole diameter according the drilling plan for the optional
    mounting brackets as shown infigure 5.

Figure 5   Drilling plan for the optional mounting brackets

Mounting holes

4 screws for mounting of the optional
brackets
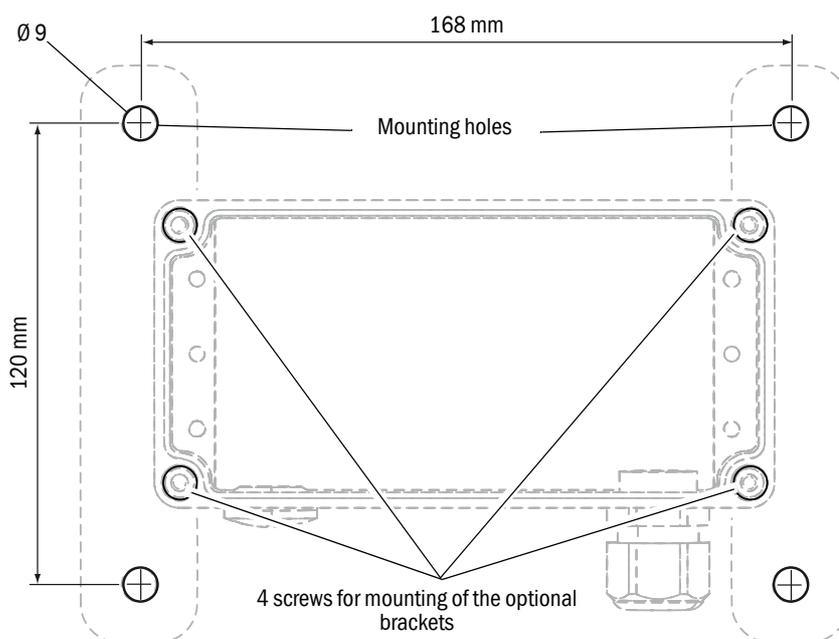
+**i**   Step 2 decribes the steps for attaching the optional mounting brackets. If you ordered the device with the regular brackets they are already attached. Follow with step 3.

2 Step: Attaching the optional mounting brackets onto the device housing:

▸ Remove the upper housing of the device and set it aside (upside down). See right picture of figure 6.

Figure 6   Disassembly of the device housing

Cover plate

Upper housing

Hexagon screw
(inner hexagon head)
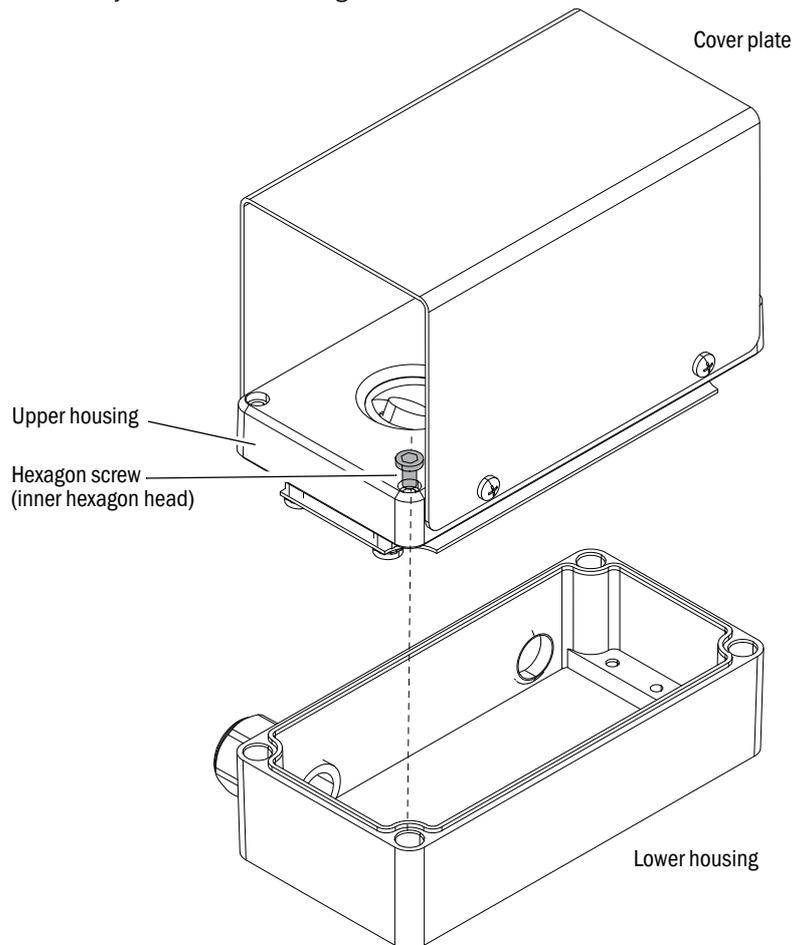
Lower housing

▸ Place the optional mounting brackets onto the lower housing and fasten them using the 4 hexagon screws

Figure 7   Attaching of the mounting brackets

Hexagon screw

Optional mounting brackets
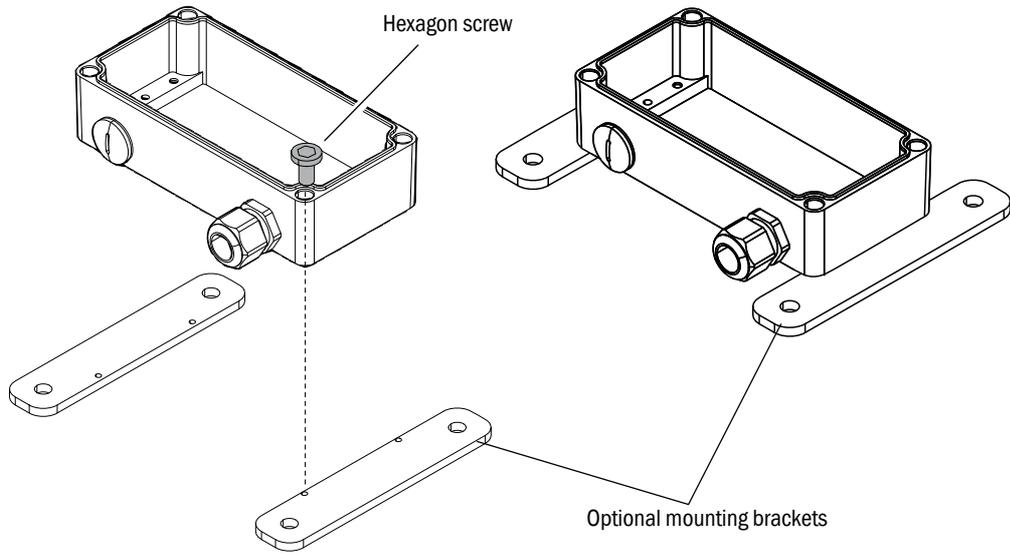
3 Step: Connecting the relevant signal and power supply cable:

> ⚡ **CAUTION: Fuse protection (supplied by customer) and fire protection according to EN61010-1**
> Necessary fuse protection required before connecting the I/O signals and power supply:
> ● Power supply: max. 8 A
> ● Relay outputs: max. 150 W for both relays
> ▸ Use appropriate fuse protection depending of the relevant wire cross-section of the I/O signal and power supply cable.

▸ Insert the cable for the I/O signals and power supply through the cable gland

Figure 8   Inserting the signal cable (VM400S)

Electronics board

Terminal for I/O and power supply

Earthing

Signal and power supply cable

Cable gland
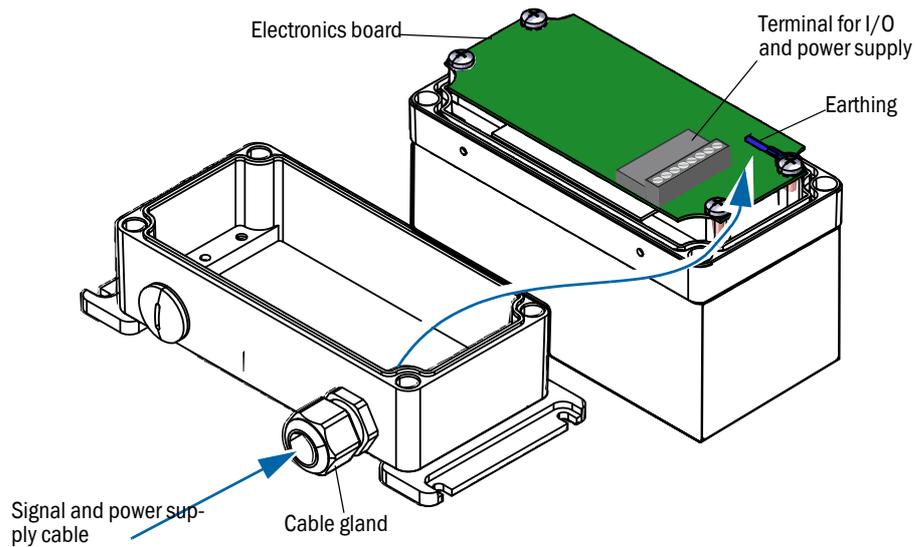
▸ Remove the pluggable terminal strip from the electronics board.

▸ Connect the wire ends to the terminals for I/O signals and power supply on the terminal strip.

▶ Connect the pluggable terminal strip to the board on the upper housing again. See figure 10, p. 22.

▶ Connect an appropriate earth conductor to the earth screw. See figure 10, p. 22.

Figure 9   Inserting the signal cables with Ethernet connection (VM400E version)
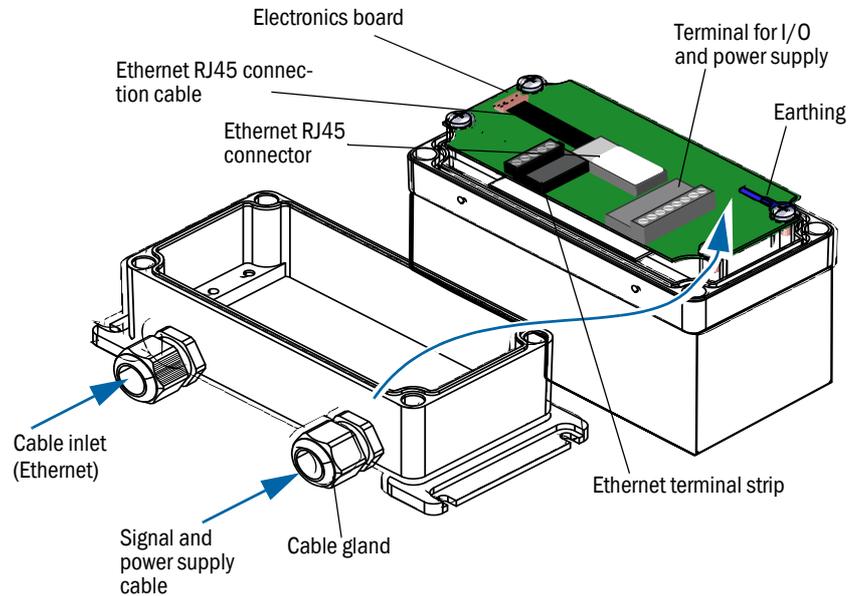
▶ Options for the Ethernet connection (VM400E only)
  – Ethernet terminal strip
  – Ethernet RJ45 connector (therefore please remove the Ethernet RJ45 connector cable)

> **!** *NOTICE:* **Sufficient cable length inside the device**
>   ▶ Take care for sufficient cable length inside the device housing. Additional cable length is needed to open the upper device housing with „closed" cable glands.

Figure 10 Connections on the electronics board at the back side of the upper housing (VM400S)

Terminal connections of I/O signals and power supply

Fuse protection:
Power supply: max. 8 A
Relays: max. 150 W

Shield connector

Jumper for setting the analog output

RS232 (service)
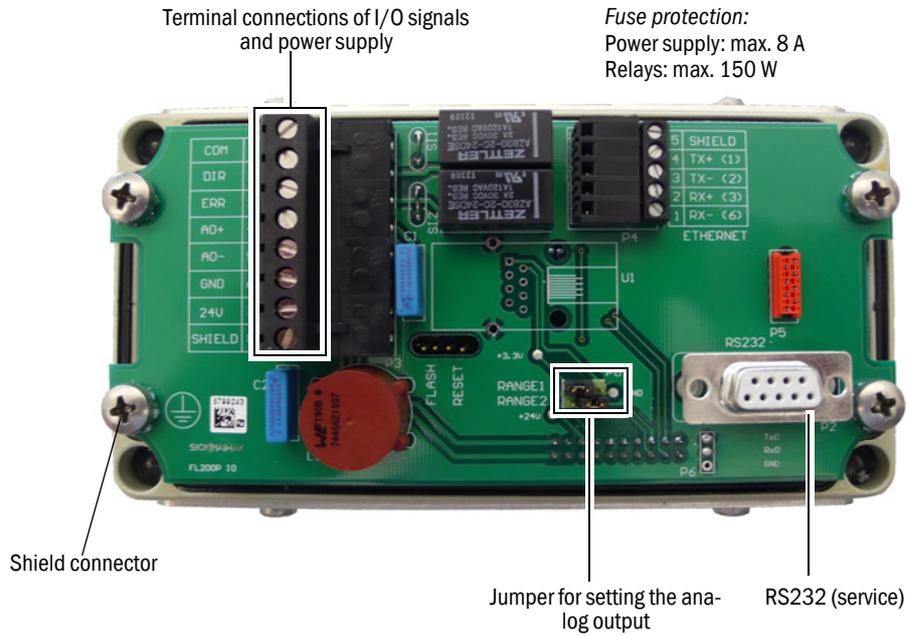
Table 1

Terminal	Function
1 COM	Common for relay 1 and 2
2 DIR	Output relay 1: negative air velocity
3 ERR	Output relay 2: data valid
4 AO+	Analog output +
5 AO-	Analog output -
6 GND	Ground
7 +24 V	+24 V power supply
8 SHIELD	Screen

4 **Step:** Setting the 2 jumper for configuration of the analog output:
Factory settings: -20 ... +20 m/s; 4 ... 20 mA

Available range	Jumper setting
Measuring range: -10 ... +10 m/s	Range 1 / Range 2
Measuring range: -20 ... +20 m/s	Range 1 / Range 2 — Factory setting
Measuring range: 0 ... ±20 m/s	Range 1 / Range 2
Reserved for settings via SOPAS software	Range 1 / Range 2

Figure 11   Connections on the electronics board at the back side of the upper housing (VM400E)
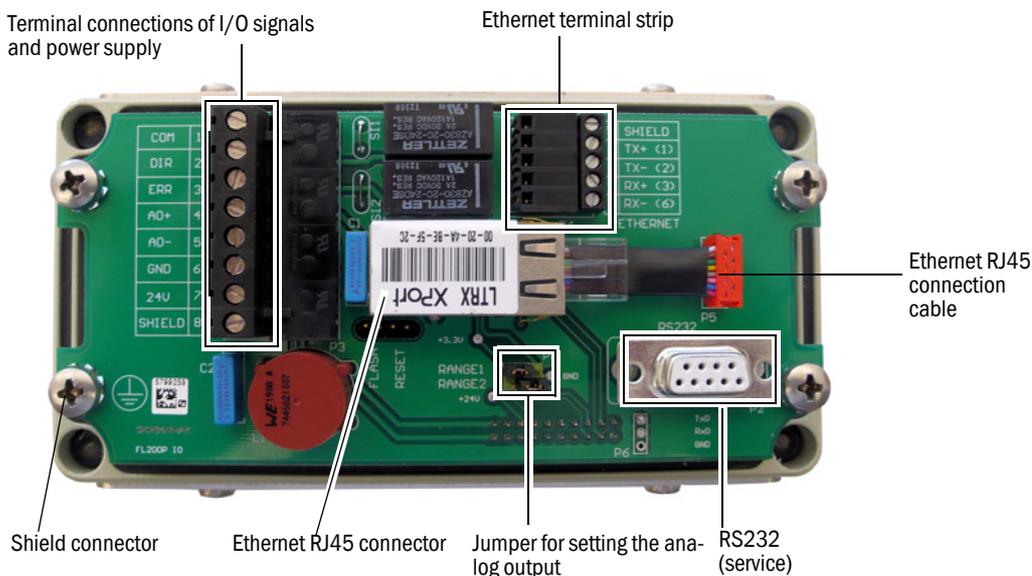
Fuse protection:
Power supply: max. 8 A
Relays: max. 150 W

5 Step: For VM400E only: Selecting pins of the Ethernet terminal strip:

Table 2   Color codes of Ethernet terminal strip

Pin	Signal	Connector (EIA-TIA 568 A)	Color code	
1	Rx-	6	orange	
2	Rx+	3	orange/white	
3	Tx-	2	green	
4	Tx+	1	green/white	
5	Screen	Screen	-	

If an Ethernet switch is used for connecting the host/PLC and the end device, the connection must be crossed-over. I.e.: The transmitter and receiver wires must be exchanged.

In case the RJ45 connector shall be used for connecting the device to the host / PLC, the internal Ethernet cable must first be removed. Then the RJ45 connector of the cable must be installed using suitable crimping tools.

3.3.2 Interface protocol "Message" (VM400E only)

As an additional feature of the V400E, this interface protocol "Message" enables the sending of ASCII telegrams with measuring and device data. The "Message" is sent automatically every 10 seconds. It can be turned off. See instructions in chapter 4.4.2

The protocol "Message" contains following data:

VM400|SICK12	Device and location of installation (if entered)
1106587	Time stamp of the telegram [ms]
0x10022	Device status
+0.00	Flow velocity [m/s]
344.58	Speed of sound [m/s]
33.8	Device temperature [°C]
22.0	Air temperature [°C]
25.4	SNR A/B [dB]
25.2	SNR B/A [dB]
59.3	AGC A/B [dB]
61.0	AGC B/A [dB]
0.0	Error rate A/B [%]
0.0	Error rate B/A [%]
<CRLF>	End of telegram

> **!**
> - For a precise allocation of "Message" telegram and measuring point it is important to parameterize the device location!
> - "Message" telegrams can be received and logged with any terminal program. (e.g. HyperTerminal)

Figure 12   Example of a message telegram
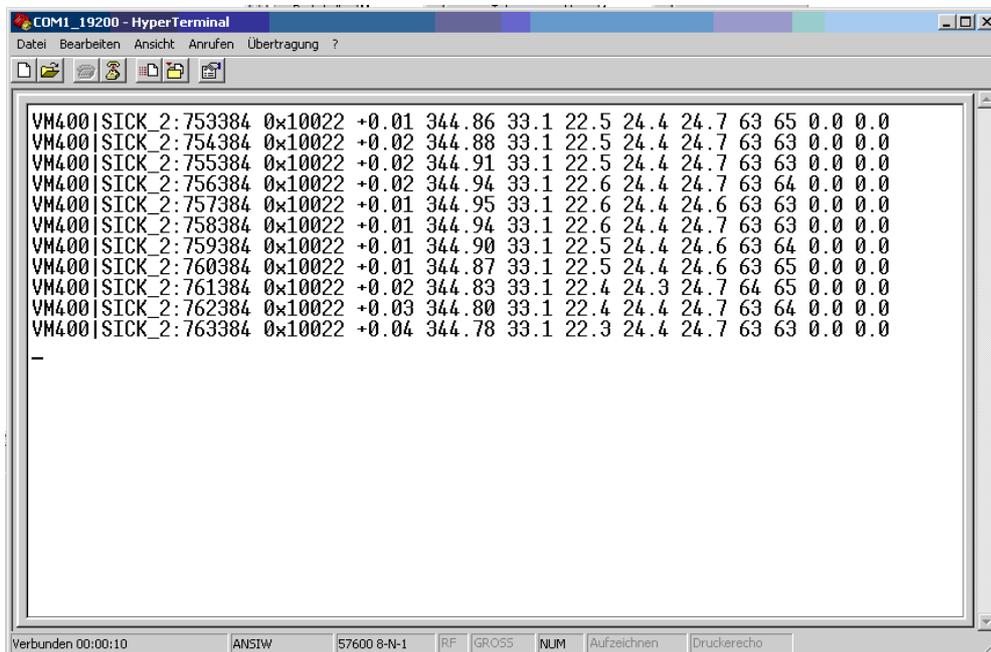
The following table shows the decoding of the device status. .

Table 3   Codes and description of device status

Bit	Description
0x00001	Malfunction
0x00002	Maintenance active
0x00004	Maintenance request
0x00008	Negative flow velocity
0x00010	Limit exceeded
0x00020	Operation
0x00040	-reserved-
0x00080	-reserved-
0x00100	Initialization
0x00200	Signal search
0x00400	-reserved-
0x00800	Parameter error
0x01000	Limit range
0x02000	Heavy noise
0x04000	No signal
0x08000	-reserved-
0x10000	-reserved-
0x20000	Data valid
0x40000	-reserved-
0x80000	-reserved-

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VM400

4   Commissioning / switch on

Necessary know-how for commissioning

Shut off the device

Checking of the device operation state (visual inspection)

4.1   Necessary know-how for commissioning

> **!**   *NOTICE:*
> - ▶ Refer to the → »Responsibility of user« (p. 8)

> **⚠**   **WARNING: When carrying out installation activities**
> - ▶ When carrying out the commissioning work, observe the relevant safety regulations and safety instructions at all times. → »For your safety« (p. 7).
> - ▶ If possible, carry out any commissioning work while the tunnel or the relevant mounting location is closed or save.

4.2   Commissioning of device VM400

4.2.1   Switching on the power supply

- ▶ Switch on the power supply for the VM400 on the relevant control cabinet (customer side).

4.2.2   Checking of the device operation state (visual inspection)

Identifying of a secure operation state

- No obstacles in the air flow area
- No visible damages on the device (has to be checked at delivery)

> **⚠**   **CAUTION: Danger by insecure operation state**
> *If the device is or could be in an insecure operation state:*
> - ▶ Decommission the device, that means shut off the power supply, disconnect the power supply and signal cable.
> - ▶ Secure it against unallowed or accidentally commissioning.

4.2.3   Checking of possible malfunction indication

- ▶ Check the signal (customer side) of relay 2 (terminals 3/1) if a malfunction message is indicated.

4.2.4   Checking of measuring values

- ▶ Check the signal (customer side) of the analog output if a plausible value is indicated.
- ▶ Check relay 1 (terminals 4/5) for correct indication of the flow direction.

4.3   **Commissioning of device VM400E using SOPAS ET**

4.3.1   **Installing the SOPAS ET Operation and Configuration Software**

> **+i**   For installing, you need administrator rights.

Prerequisites
- Laptop/PC with:
    - Processor: Pentium III (or comparable type)
    - RS232 interface
    - Working memory (RAM): At least 256 MB
    - Operating system: MS Windows 98SE/ME/2000/XP/Vista (not Windows 95/98/NT)
- The SOPAS ET software must be installed on the laptop/PC.
- The power supply must be switched on.

> **+i**   Start the file "setup.exe" when the start screen does not appear.

Installing the SOPAS ET Software
Insert the delivered CD in the PC drive, select the language, select "Software" and follow the instructions

Connecting the device
▸ Connect the RS232 cable to the VM400 and laptop/PC or use an Ethernet cable. Default network parameter: IP-address: 192.168.0.10, network: 255.255.255.0. Port: 2111
▸ Start the software from the "SICK/SOPAS" start menu.
▸ The start dialog appears on the screen (can be deactivated for further software use).

Fig. 13   Start dialog

Project choice

Deactivation of the start dialog
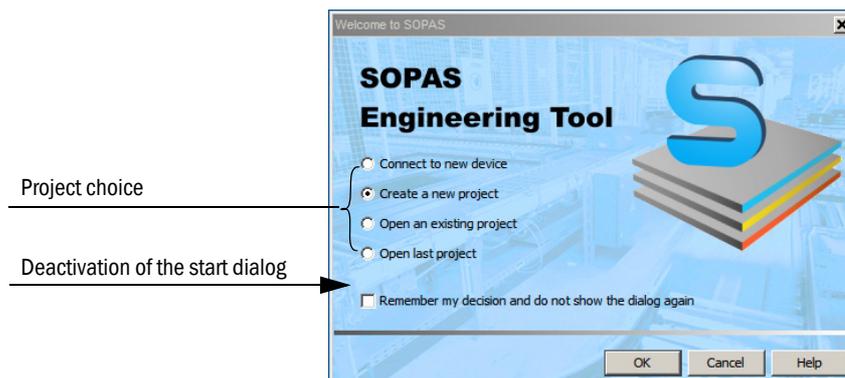
Select „Create a new project" and confirm with "OK"-button.

Fig. 14   Start menu
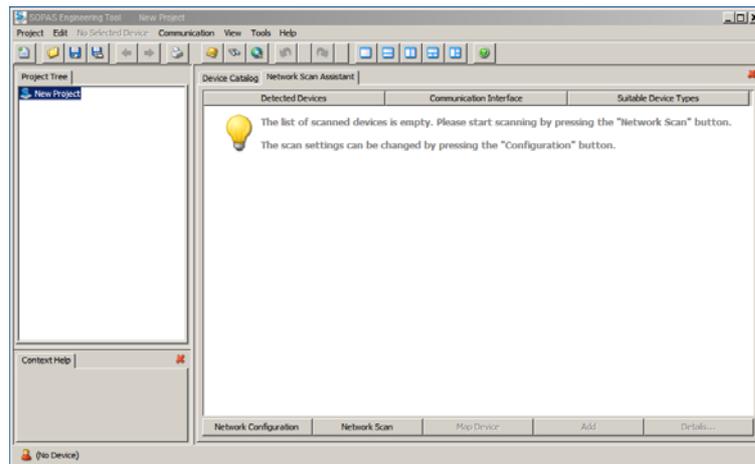
Change of language settings

▸ If required, select the desired language in the "Tools / Options / Language" menu, con-firm with "OK", and restart the program.

▸ Network Scan Assistant: Click the "Network Configuration" button in the start menu (→ p. 30, Fig. 14) and select "Standard Protocol".

Select one available interface in the "Select COM Ports" group, click the "Advanced..." but-ton and configure according to figure 15 (settings only required during the first connection to the measuring system) and confirm with „OK"

Fig. 15   Interface selection and configuration
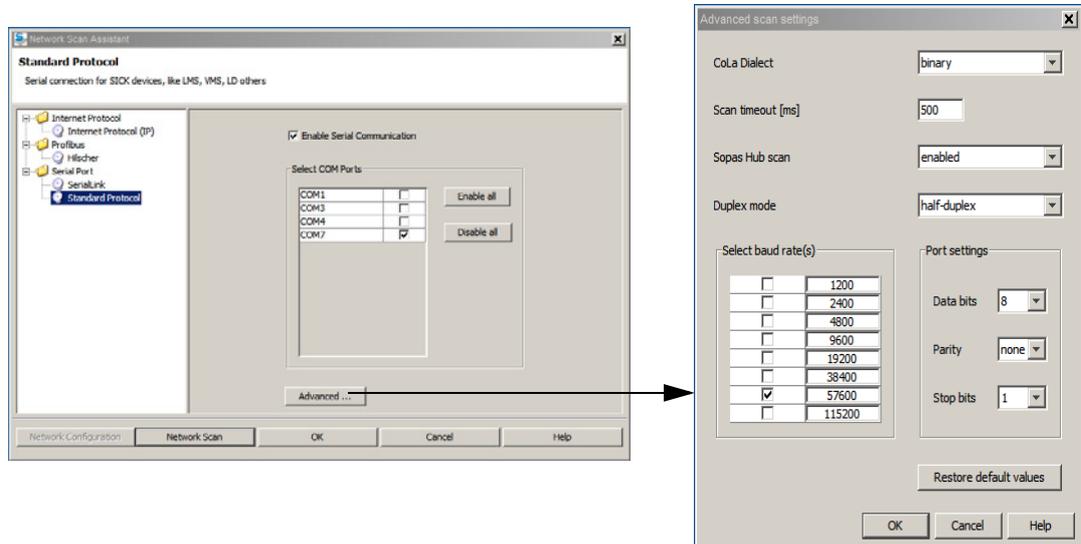
▸ Click the "Network Scan" button in the "Network Scan Assistant" directory and the fol-lowing window appears.

Fig. 16   Search for connected VM400E
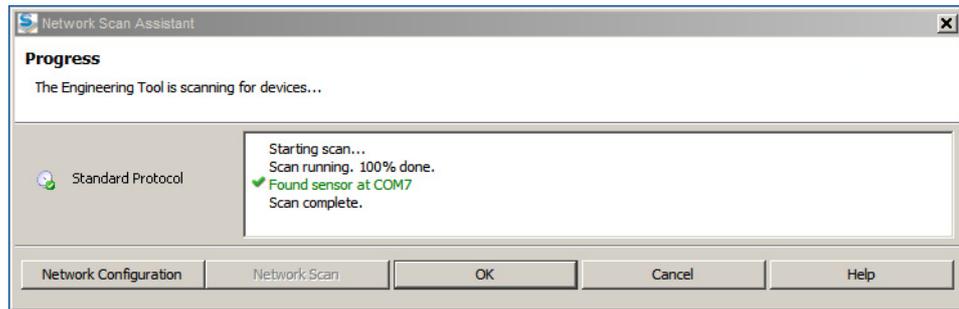
▶ Confirm search with "OK".

4.3.2   Information for using the program

Device selection VM400

Select the required devices from 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).

Fig. 17   Selecting required devices
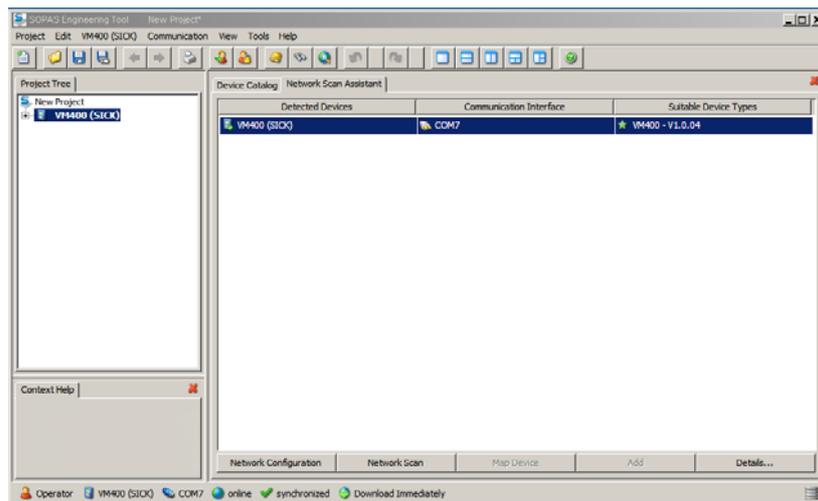
4.3.3 Navigation in SOPAS ET

Available menus

This section describes the navigation and possible parameter settings of VM400E using SOPAS ET.

Overview

The menu "Overview" contains information about device identification, system status and measured values.

Figure 18   SOPAS ET – Overview
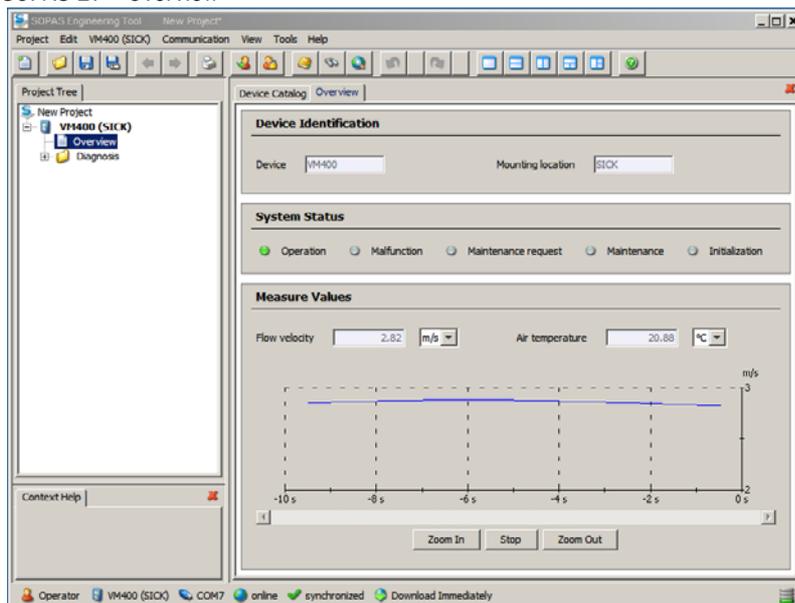
Device information

Product related data for identification (serial number, firmware version,...) as well as mounting location (if entered by customer) are shown in subpage "Diagnosis / Device information"

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Figure 19   SOPAS ET – Device Information
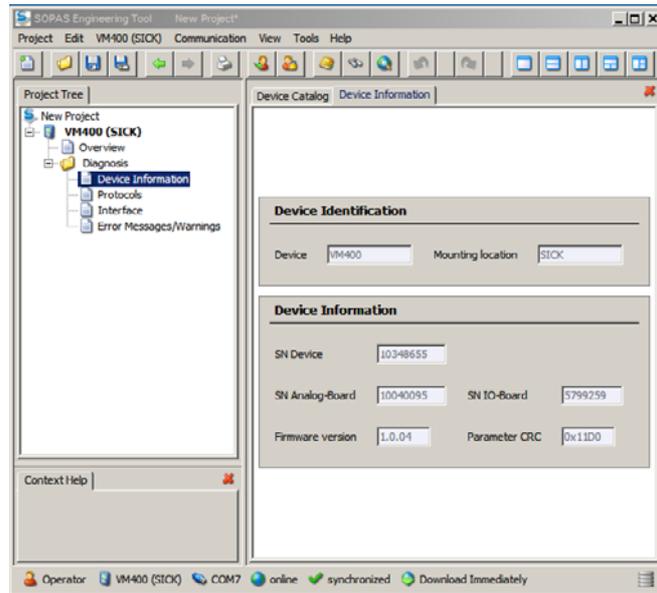
Protocol

It is possible to print and export a system check protocol. For the export to a PDF-file, file name and file location have to be specified.

Figure 20   SOPAS ET – Protocols
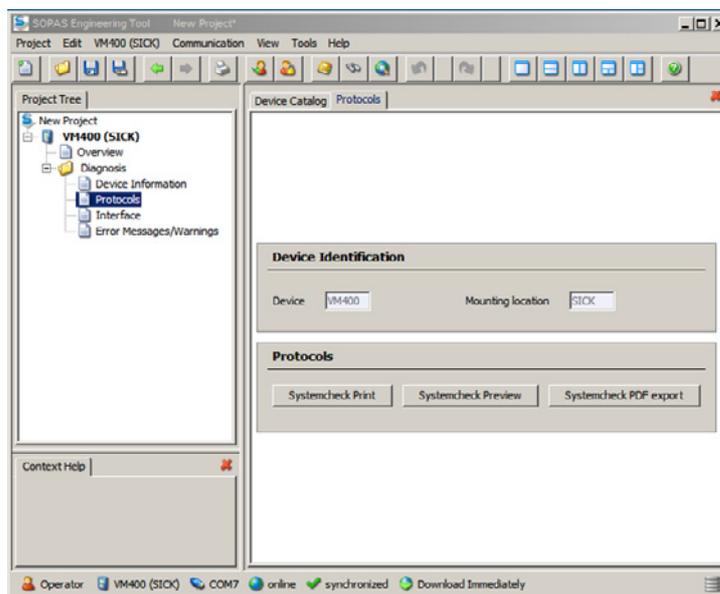
Figure 21   SOPAS ET – Example of a protocol
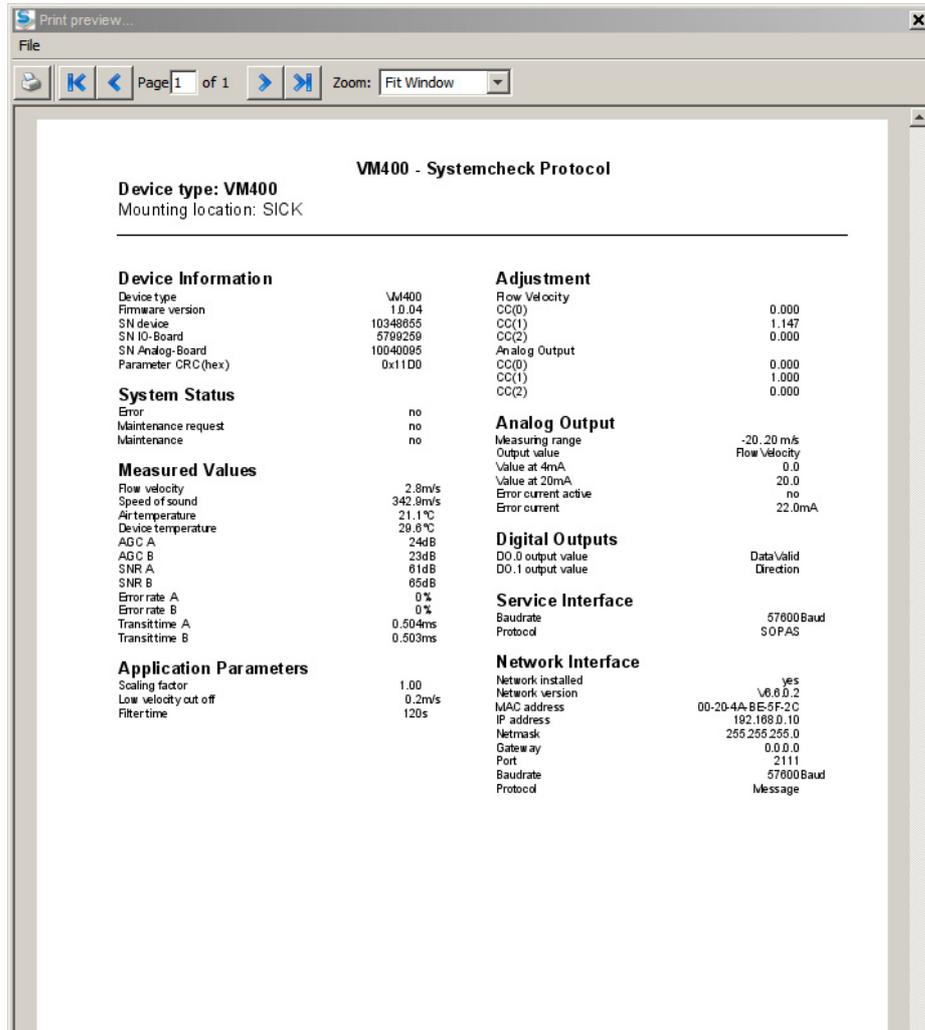
Interface

Status of digital and analog outputs as well as parameter settings of the network interface are available.

Table 4   Settings for the Digital output

Digital Output 0		Digital Output 1	
On	Device is functioning correctly	On	negative flow direction relative to arrow on device cover
Off	Malfunction	Off	positive flow direction relative to arrow on device cover

Measurement ranges can be selected using jumper settings (Step 4 on page 20).

Figure 22   SOPAS – Interface
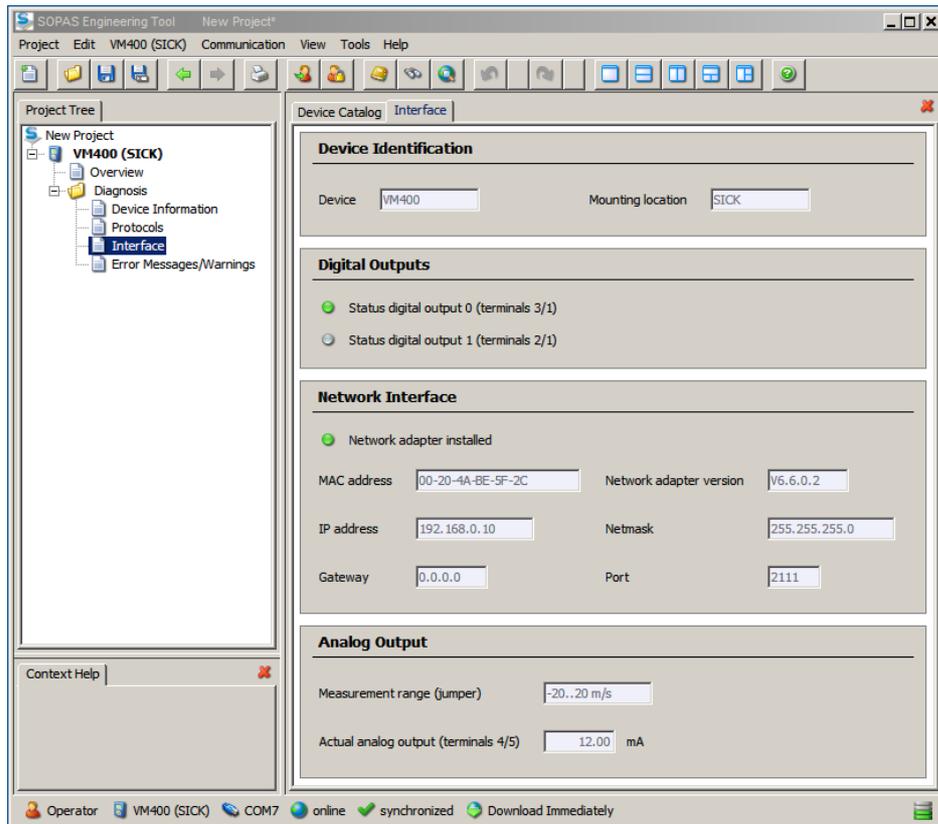
Error messages and warnings

The subpage "Diagnosis / Error Messages/Warnings" contains information about the system status and possible errors and warnings. The descriptions are shown in detail in chapter 7.

Figure 23   SOPAS ET – Error Messages/.Warnings
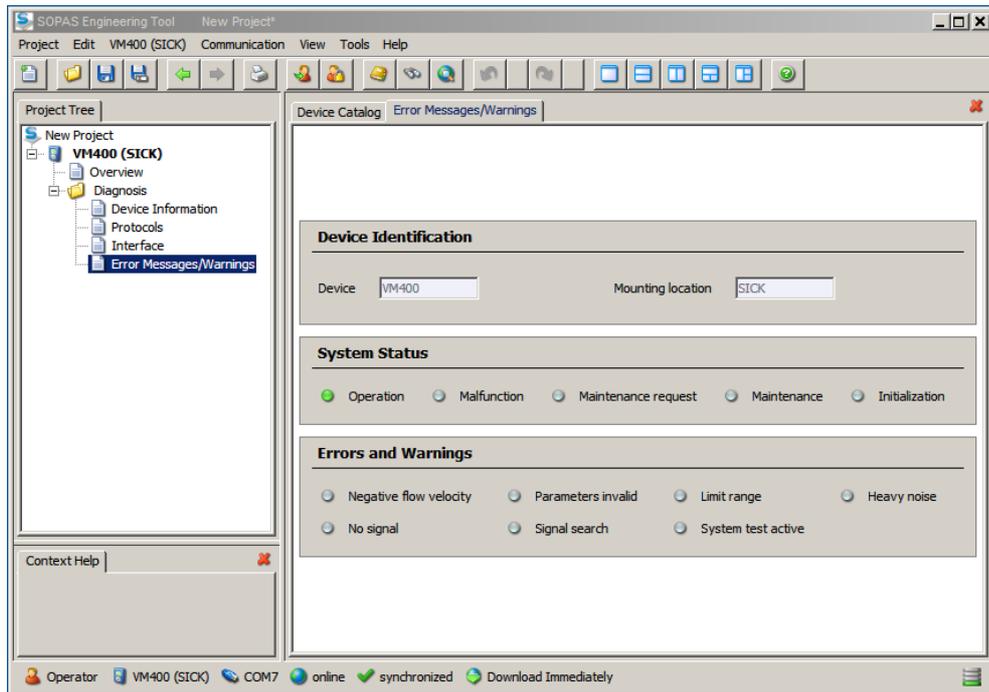
4.3.4   **Possible parameterization**

Certain device functions are first accessible after a password has been entered. Access rights are assigned in two levels:

User level		Access to	Password
0	Operator	Displays measured values and system states	–
1	Authorized Client	In addition to User level „Operator" configuration of Ethernet parameter of mounting position is possible	„sickoptic"

The Level 1 password is contained in the Annex.

Figure 24   SOPAS ET – Password
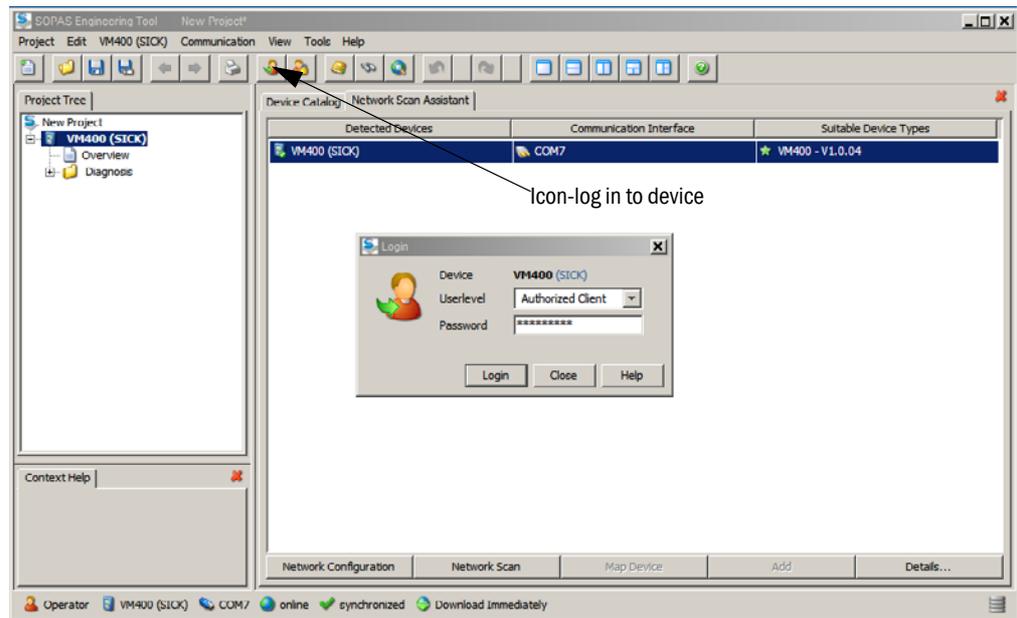
Maintenance Mode

Switch the VM400E to Maintenance Mode: go to the subpage „Maintenance / Mainte-nance Mode", and click the „Set Maintenance" button. The activated maintenance mode is indicated by a status indicator lamp in this subpage and on the status information.

Figure 25   SOPAS Maintenance mode
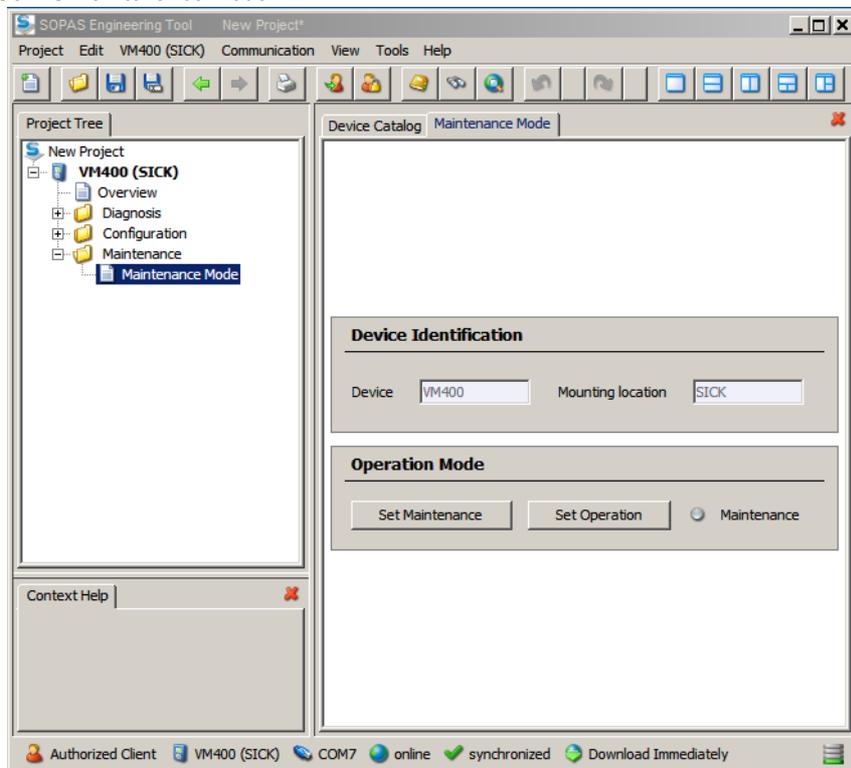
▸ Enter the installation location

▸ In maintenance mode the mounting location can be entered in subpage "Diagnosis / Device Information"

Configuring the Ethernet interface and protocol „Message"

Default values for network parameters are shown in fig. 26

To change the address, go to subpage "Configuration / Interface Parameters", enter the parameters and confirm by clicking "Write parameters". Clicking "Write default values" will change to parameters as defined. This can take up to 5 seconds.

In maintenance mode the "Message" protocol can be switched on/off on subpage "Configuration / Interface Parameters". If set on "SOPAS" no protocol "Message" will be sent.

Figure 26   SOPAS ET – Interface Parameters
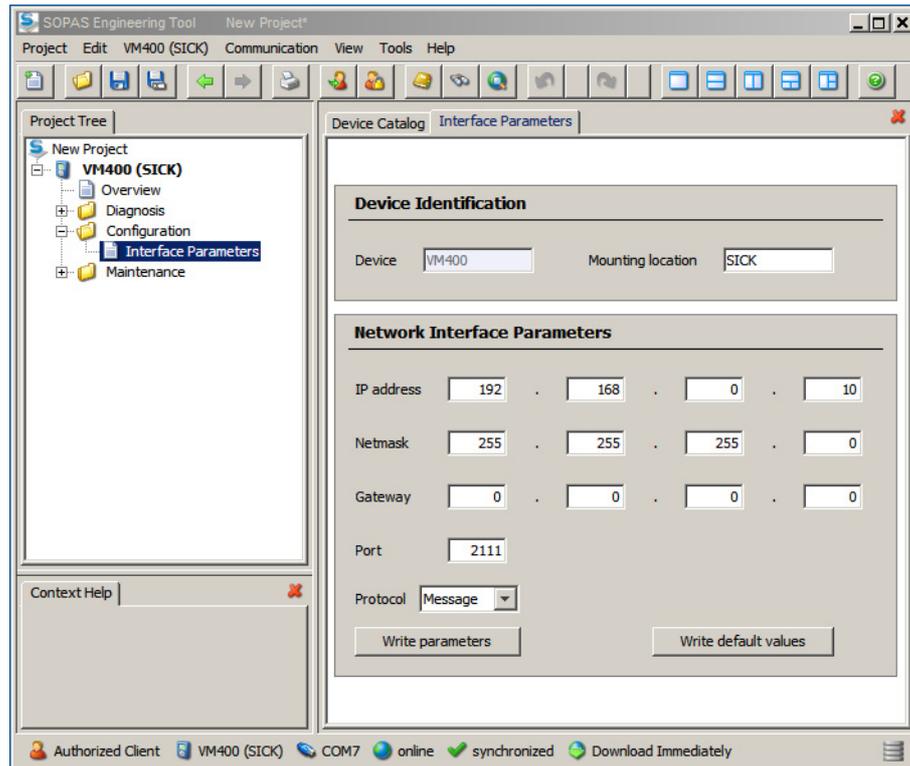
After setting the parameter switch to operation mode: go to subpage "Maintenance / Maintenance Mode", and click the "Set Operation" button.

Endress+Hauser

VM400

5   Decommissioning

Preparations for the decommissioning
Shut off the device
Environmentally compatible disposal/recycling

5.1 **Preparations for the decommissioning**

▸ Inform the relevant personnel or authorities.
▸ Activate appropriate safety arrangements.

5.2 **Shut off the device**

▸ Switch off the power supply for the VM400 including power supply for relays.

5.2.1 **Arrangements for permanent decomissioning**

+**i**↪   For the installation steps refer also to → »Installation steps« on p. 18, §3.3.1

▸ Dismount upper part of device (including electronics board).
▸ Remove cable connections from the board (pluggable terminal strip).
▸ Remove cable from the cable gland of the upper device part.
▸ Mount upper device part again.
▸ Dismantle the device with the mounting brackets.

5.2.2 **Storage**

▸ Clean the exterior of the housing including the mounting brackets. A mild cleaning agent can be used.
▸ If necessary clean the ultrasonic transducers with slightly warm water and soft brush.

⚠ **WARNING: Take care of the transducer surfaces**
!▸ Take care that the transducer surfaces are not damaged.
!▸ Do not use any aggressive liquids or hard brushes.

▸ Pack the VM400 for storage or transport (preferably in the original packing).
▸ Store the VM400 in a dry, clean room.

5.3 **Environmentally compatible disposal/recycling**

▸ The VM400 can be disposed off as industrial waste.

| ! | Observe the relevant local conditions for the disposal of industrial waste. |

The following subassemblies could contain substances that have to be disposed of separately:
● Electronics: Capacitors.

VM400

6   Maintenance

Necessary know-how for maintenance work
Preventive Maintenance schedule for the operator
Preventive maintenance

6.1   Necessary know-how for maintenance work

> **NOTICE:**
> ▸ Refer to the → »Responsibility of user« (p. 8)

> ⚠ **WARNING: When carrying out installation activities**
> ▸ When carrying out the maintenance work, observe the relevant safety regulations and safety instructions at all times. → »For your safety« (p. 7).
> ▸ If possible, carry out any maintenance work while the tunnel or the relevant mounting location is closed or save.

6.2   Preventive Maintenance schedule for the operator

Maintenance interval[1]	Maintenance activity	Remarks
>6 M ... 12 M	▸ Carry out a visible check on the complete device	Strong pollutions, corrosion traces

[1]   M = month

6.3   Preventive maintenance

The maintenance interval can be depending on the application conditions.

6.4   Spare parts

Item	Order no.
Upper housing part with electronics and transducers and gaskets for VMS400S	2046998
Upper housing part with electronics and transducers and gaskets for VMS400E	2048491
Stainless steel mounting brackets, incl. screw anchors	2049666

VM400

7   Clearing malfunction

Possible malfunctions
Error messages / warnings

7.1 **Possible malfunctions**

Possible cause	Remark
Power supply is not connected properly	▸ Check and if necessary repair the power supply cable and the relevant connections.
Main power supply is switched off or defective	▸ Check the main power supply (customer side) VM400. ▸ If necessary repair the main power supply
Invalid measured value (relay 2)	▸ Check for visible contamination on the device or an obstacle within the air flow and remove it if possible.
Implausible measured value	▸ Check for visible contamination on the device or an obstacle within the air flow and remove it if possible. ▸ Check the jumper settings for the analog output according to → p. 22, §4 and correct it if necessary.
No communication between measuring system and SOPAS ET program	▸ Check the interface settings ▸ Exit the SOPAS ET program, restart and establish the connection again. ▸ Contact Endress+Hauser Service department.

7.2   **Error messages/ warnings**

The actual device status can be looked at in SOPAS ET or Protocol „Message"

Table 5   Messages and their meanings

Status	Meaning
Operation	Device is in operation mode
Malfunction	Device is malfunctioning
Maintenance request	Check subpage „Error Messages/Warnings" for detailed information.
Maintenance	The device is in maintenance mode. Parameter settings can be changed
Initialization	Device is in initialization mode
Negative flow velocity	The flow speed is negative.
Parameter invalid	Contact Endress+Hauser service.
Limit range	The measured flow speed is outside the measuring range.
Heavy noise	The SNR value is too low. This can indicate either contamination or a defect.
No signal	No signal detected. This can indicate either contamination or a defect.
Signal search	No signal is detected. Signal is searched.
System test active	System test function has been activated. Measuring values are invalid.

VM400

8   Specifications

Conformities

Technical data of VM400S-AL and VM400E-AL

Dimensions

8.1   **Conformities**

The technical design of this instrument complies with the following EC directives and EN standards:

- EU Directive NSP 2006/95/EC (until 19 April 2016), 2014/35/EU (from 20 April 2016)
- EU Directive EMC 2004/108/EC (until 19 April 2016), 2014/30/EU (from 20 April 2016)

Applied EN standards:

- EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 61326, Electrical equipment for measurement technology, control technology and laboratory use - EMC requirements. Device fulfils emission limit class A.

8.1.1   **Electrical protection**

- Insulation: Class of protection 1 according to EN 61010-1.
- Insultation coordination: Measuring category III (low voltage) according to EN61010-1.
- Contamination: The sensor unit operates safely in an environment up to contamination level 3 (outside) and level 2 (inside) according to EN 61010-1.
- Electrical energy: The wiring system to the voltage supply of the system must be installed and fused according to the relevant regulations.

Technical data of VM400S-AL and VM400E-AL

Measuring parameters	
Measuring principle:	Ultrasonic transit time measurement
Measuring values:	Air velocity, flow direction, temperature [1]
Measuring ranges:	–20 m/s ... +20 m/s [2]
Accuracy:	● <5 m/s: ±0.1 m/s ● ≥ 5 m/s: ±2 %

Ambient conditions	
Operating temperature:	–30 ... +60 °C
Storage temperature:	–30 ... +60 °C
Humidity:	max. 95 %

Signals and interfaces	VM400S-AL	VM400E-AL
Analog output:	1 output: 4 ... 20 mA, max. load 750 Ω; electrically isolated	
Digital outputs:	2 relays: 48 V, 0.5 A; normally open contacts	
Interface:	RS232 (service)	● RS232 (service) ● Ethernet
Bus protocol		● Message (ASCII) ● SOPAS

Device	VM400S-AL	VM400E-AL
Mounting position:	Horizontal to flow direction (according to arrow mark on the cover)	
Protection class	IP 66/67	
housing material:	Aluminium	
Dimensions	figure 27, p. 52 and figure 27, p. 52	
Weigth:	1.4 kg	
Housing color:	RAL 7032	
Supply voltage:	24 V DC (±20 %), 1.7 W	24 V DC (±20 %), 3 W
Cable cross-section:	0.25 ... 1.5 mm^2	
Cable length:	Power and signals 1.000 m[3]	Power and signals 500 m[3] Ethernet 100 m

Optional components
Stainless steel mounting brackets with heavy duty screw anchors and screws

[1] VM400E version only, based on speed of sound

[2] Configurable using jumper settings

[3] Wire cross-section ≥ 0.5 mm^2

8.3   **Dimensions**

Figure 27   Dimensions VM400 with regular mounting brackets
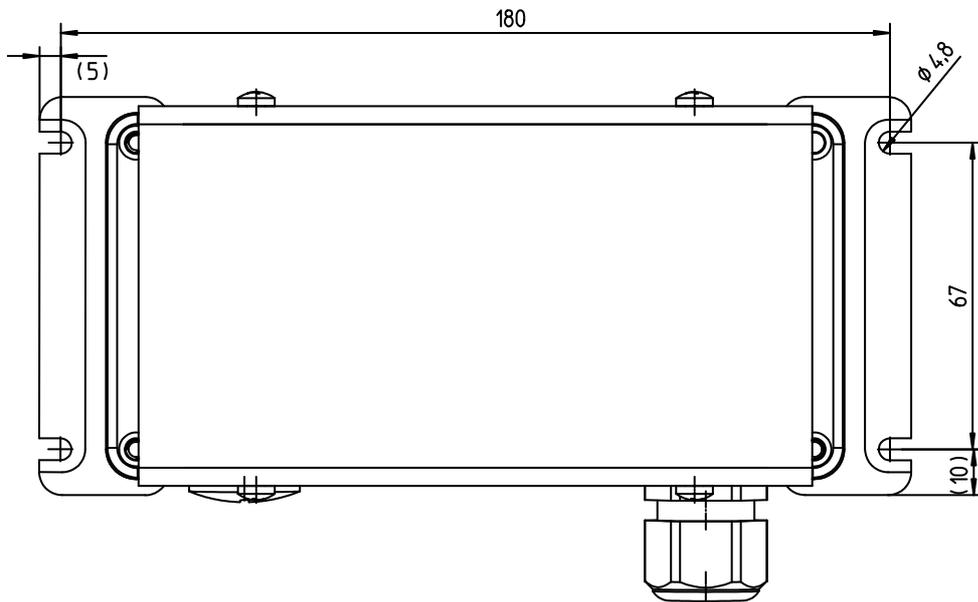
Figure 28   Dimensions VM400 with optional mounting brackets

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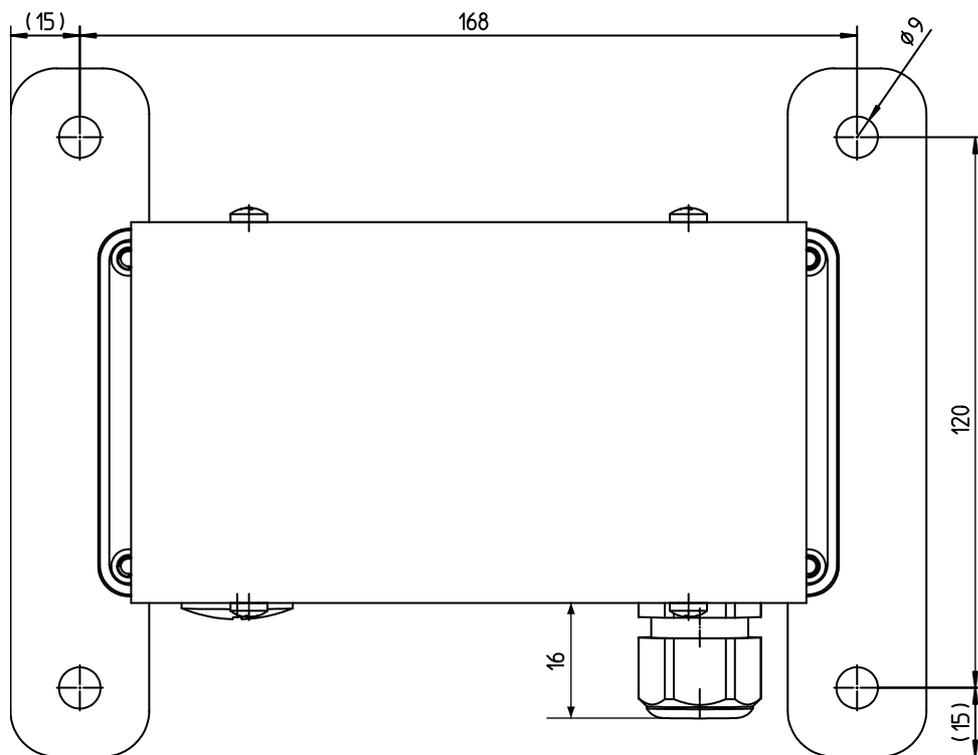
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