OPERATING INSTRUCTIONS

VMS420/VMS520
Track and trace systems

EN

SICK
Sensor Intelligence.

Contents

Contents

1 About these operating instructions

Please read through this chapter carefully, before you use the documentation and work with the VMS420/520 measurement system.

1.1 Described software version

Software/Tool	Function	Status
VMD420-2000	VMD420 firmware	From V 2.0
VMD520-2000	VMD520 firmware	From V 2.0
Description of VMD420 device	Device-specific software module for SOPAS	From V 01.02.00
Description of VMD520 device	Device-specific software module for SOPAS	From V 01.02.00
SOPAS	Configuration software	From V 2.12

Tab. 1 Described software version

1.2 Purpose of this document

These operating instructions are intended to guide **technical personnel** through the safe mounting, configuration, electrical installation, commissioning, operation, and maintenance of the VMS420/520 volume measurement system.

1.3 Target group

These operating instructions are intended for people who install, connect, commission, operate, and maintain the VMS420/520 volume measurement system.

1.4 Information depth

Note These operating instructions contain information about the following topics relating to the VMS420/520 volume measurement system:

- Product description
- Mounting
- Electrical installation
- Commissioning and configuration
- Maintenance
- Fault diagnosis and troubleshooting
- Technical data and dimensional drawings
- Ordering information
- Conformity and approval

Furthermore, when planning and using measurement systems such VMS420/520, technical expertise is required, which is not covered in this document.

Official and legal regulations for operating the VMS420/520 volume measurement system must always be complied with.

The SOPAS configuration software is used to configure (parameterize) the measurement system for the respective application on site. Operating the software is described in chapter **6.2 Configuration and adjustment**.

Note Please also refer to the VMS information on the Internet at

http://www.sick.com/group/DE/home/products/product_portfolio/system_solutions/Seiten/volume_measurement_systems.aspx

1.5 Abbreviations used

BCC Block Character Check

CAN Controller Area Network = Standardized field bus system that uses a message-based data exchange protocol

CCD Charge-coupled Device, CCD camera = line scan camera, e.g. for reading bar codes

CS Checksum

EEPROM Electrically Erasable Programmable Read-only Memory = electrically erasable and programmable non-volatile memory

HTML Hypertext Markup Language = page description language in the Internet

LED Light Emitting Diode

RAM Random Access Memory = direct-access volatile memory

RIS Reflectivity Information System = remission information system

ROM Read-only Memory (non-volatile)

SOPAS SICK OPEN PORTAL for APPLICATION and SYSTEMS Engineering Tool = Software for configuring the VMS

SST Interface

VMD Volume Measurement Device = scanner head

VMS Volume Measurement System from SICK AG

1.6 Symbols used

Reference Bold text indicates a cross-reference to in-depth information.

Recommendation Recommendations are designed to assist you in the decision-making process with respect to the use of a certain function or technical measure.

Note Notes provide information about the features of a device or application.

Explanation Explanations convey background knowledge about technical concepts.

MENU OPTION This font indicates a term in the SOPAS user interface.

1. / 2. Step-by-step Instructions that must be carried out in the order described are referred to as step-by-step instructions and are indicated by numbered lists. Carefully read and follow the instructions for action.

➢ **Take action** Instructions for taking action are indicated by an arrow. Carefully read and follow the instructions for action.

This symbol refers to additional documentation that is available.

WARNING

Warning

A warning indicates a specific or potential hazard. This is to protect you against accidents and protect devices from damage.

Carefully read and follow the warnings.

Software notes indicate where to make the appropriate settings in the SOPAS configuration software.

2 Safety

This chapter concerns your own safety and the safety of the system operator.

➢ Please read through this chapter carefully before you work with the VMS or with a conveyor system equipped with a VMS.

2.1 Qualified safety personnel

The VMS420/520 volume measurement system must only be mounted, commissioned, and maintained by adequately qualified personnel.

The following qualifications are necessary for the various tasks:

2.1.1 Mounting and maintenance

- Practical technical training
- Knowledge of the current safety regulations in the workplace

2.1.2 Electrical installation and replacement of system components

- Practical electrical training
- Knowledge of current electrical safety regulations
- Knowledge of device control and operation in the particular application concerned (e.g., conveying line)

2.1.3 Commissioning, operation, and configuration

- Knowledge of the mechanical and electrical parameters of the conveying line and properties of the conveyor system that relate to control and operation
- Basic knowledge of the Windows operating system used
- Basic knowledge of data transmission
- Basic knowledge of the design and setup (addressing) of Ethernet connections when connecting the MSC800 to the Ethernet
- Basic knowledge of how to use an HTML browser (e.g., Internet Explorer) to access the online help

2.2 Applications of the device

The VMS volume measurement system is intended exclusively for use in industrial environments. Radio interference may result when used in residential areas.

The VMS measures objects with virtually any shape on flat conveyor systems.

- The VMS420 determines the length, width and height and can calculate the volume of the smallest box that fully encloses the object (box volume) from these values.
- The VMS520 determines the length, width and height.

The relevant system outputs this information via a data interface to a client-side computer for further processing.

2.3 Correct use

The VMS420/520 volume measurement system may only be used as described in section **2.2 Applications of the device**. It may only be used by qualified personnel in the environment in which it was mounted and initially commissioned by qualified safety personnel in accordance with these operating instructions.

The equipment may be operated in an industrial environment.

The VMS420/520 volume measurement system must not be used outdoors or in an explosion-protected environment.

Radio interference may result when used in residential areas.

If used in any other way or if alterations are made to the system or the devices are opened – including in the context of mounting and installation – this will void any warranty claims directed to SICK AG.

2.4 General safety notes and protective measures

WARNING

Safety notes

Observe the following points to ensure the correct and safe use of the VMS volume measurement system.

- The notes in these operating instructions (e.g., regarding use, mounting, installation, or integration into the machine controller) must be observed.
- The national and international legal specifications apply to the installation and use of the system, to its commissioning, and to recurring technical inspections, in particular:
  - The accident prevention regulations and work safety regulations
  - Any other relevant safety regulations
- The manufacturer and user of the system are responsible for coordinating and complying with all applicable safety specifications and regulations in cooperation with the relevant authorities.
- The checks must be carried out by qualified safety personnel or specially qualified and authorized personnel, and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- These operating instructions must be made available to the operator of the system. The system operator must be instructed by qualified safety personnel and must read the operating instructions.

WARNING

Risk of injury due to components tipping over

If mounting rails have been upended, it is possible they could tip over during mounting.

➢ Do **not** perform mounting work alone unless it is absolutely safe to do so.

➢ Where applicable, ask a second person to assist you with the mounting process.

➢ Wear safety shoes.

WARNING

Risk of injury due to electrical current

The VMS volume measurement system is connected to a 24 V DC voltage.

- ➢ Only authorized personnel are allowed to perform electrical installation work.
- ➢ The power supply must be disconnected when attaching and detaching electrical connections.
- ➢ Select and implement wire cross-sections and their correct fuse protection in accordance with the applicable standards.
- ➢ Observe the current safety regulations when working on electrical systems.

WARNING

Damage to the eye by laser beam

The VMS420/520 volume measurement system works with a red, class-2 laser. When exposed to the laser beam for longer periods of time, the retina of the eye may be damaged.

The laser output aperture is the front screen of the VMD.

Fig. 1: VMD Laser output aperture

- ➢ Never look directly into the beam path (similar to sunlight).
- ➢ Never point the laser beam at people.
- ➢ When mounting and adjusting the VMD, beware of reflections of the laser beam off reflective surfaces.
- ➢ Do not open the housing. (Opening does not interrupt the switching on of the laser diode by the reading pulse).
- ➢ Observe the applicable laser safety regulations according to IEC 60825-1 (latest version).

Laser power

The laser operates at a wavelength λ = 650 nm (visible red light). The output power of the laser beam is max. 7.5 mW at the laser output aperture.

The emitted radiation is harmless to human skin.

The VMD conforms to laser class 2 in accordance with IEC 60 825-1 (for publication date, refer to laser warning label on device). This ensures compliance with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50 of June 24, 2007.

Regular maintenance is not necessary to ensure compliance with laser class 2.

Improper use of the VMD can lead to hazardous radiation exposure and breach of the laser class.

Important During operation, the trigger is used to initially switch the 2D laser scanner on with the switch-on signal and switch it off again with the switch-off signal.

The 2D laser scanner is switched on constantly during free-running output of measured values.

Laser warning labels

A number of laser warning labels and laser warning symbols are to be found on the VMS420/520 volume measurement system.

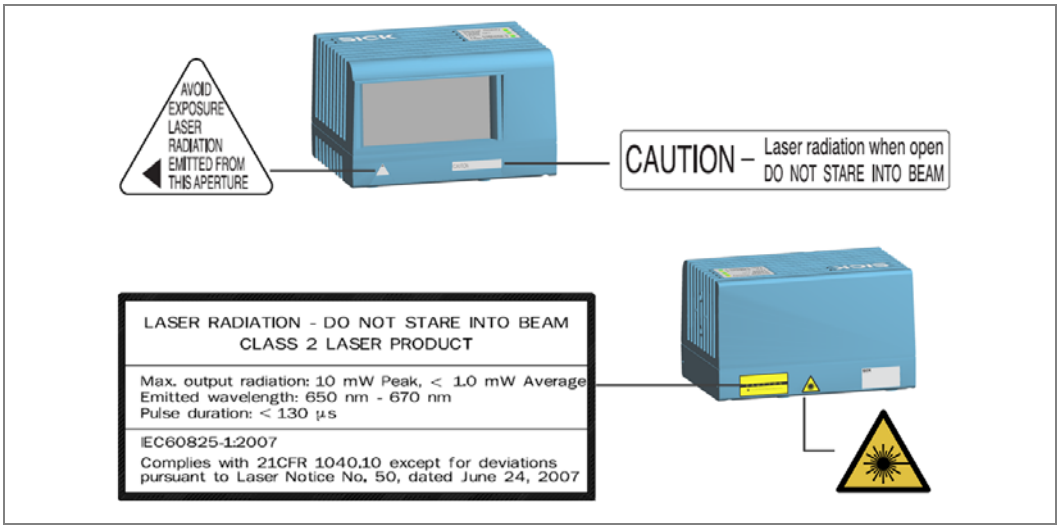


Fig. 2: Laser warning labels attached to the VMS

Translation of the English warning on the VMS

LASER RADIATION – NEVER LOOK INTO THE BEAM

CLASS 2 LASER PRODUCT

Maximum output power: 10.0 mW peak, average < 1.0 mW

Wavelength: 650 nm to 670 nm, pulse duration: < 130 µs

IEC60825-1:2007

This ensures compliance with 21 CFR 1040.10 except for the tolerances according to Laser Notice No. 50 of June 24, 2007.

Notes

- Before commissioning, the English laser warning label “LASER RADIATION – DO NOT STARE INTO BEAM” is to be replaced with a laser warning label in a language that the operators of the system understand. Laser warning labels in German/English and French/English are included in the scope of delivery. The laser warning labels “CAUTION …” and “AVOID EXPOSURE LASER …” are to be left in English.
- If the laser warning labels are covered when the VMS volume measurement system is built into a system/paneling, further warning labels (not included with delivery) must be attached next to the outlet opening for the laser beam on the system/on the paneling!
- The VMS automatically monitors beam generation and automatically shuts down the laser diode in the event of irregularities. If this happens, the red LED lights up and the scanner does not send any more measured values.
- Regular maintenance is not necessary to ensure compliance with laser class 2.

2.5 Protection of the environment

The VMS volume measurement system has been designed to minimize its impact on the environment. It consumes very little power.

Always act in an environmentally responsible manner at work. For this reason, please note the following information regarding disposal.

2.5.1 Power consumption

The VMS volume measurement system has a maximum power consumption of 50 W.

2.5.2 Disposal after final decommissioning

- Always dispose of unusable or irreparable devices in an environmentally safe manner in accordance with the relevant national waste disposal regulations.
- Dispose of all electronic assemblies as hazardous waste. The electronic assemblies are easy to dismantle.

Also see chapter **7.3 Disposal**.

Note SICK AG does not take back devices that are unusable or irreparable.

3 Product description

This chapter provides information on the specific features of the VMS volume measurement system. It describes the construction and operating principle of the device, in particular the various operating modes.

Note Always read this chapter before you mount, install, and commission the device.

3.1 Scope of delivery

The delivery of the VMS volume measurement system includes:

- Two VMD volume measurement devices
- Two mounting adapters for mounting and adjusting the VMDs, triaxial
- A CD-ROM that includes the following:
  - SOPAS configuration software
  - "VMS volume measurement system" operating instructions in German/English in PDF format
  - Free software "Adobe Acrobat® Reader™" for reading PDF files

3.2 Specific features

- Non-contact, active measurement method
- Measuring the length, width and height of cuboid objects
- Measuring the length, width and height of objects of virtually any shape
- Works with a very wide range of surface structures and on various flat conveyor systems
- Flexible system configurations
- Calculation of the volume of the smallest box that fully encloses the object (box volume)
- Calculation of the real volume

VMS420/VMS520 volume measurement system

Operating condition 1

	Length	Width	Height
Object dimension (max.)	≤ 2,600 mm	≤ 1,000 mm	≤ 1,600 mm
Object dimension (min.)	≥ 50 mm	≥ 50 mm	≥ 50 mm
Scale value (d)	5 mm	5 mm	5 mm
v: 0.1 m/s to 3.0 m/s			

Tab. 2 Specification of measuring range and measurement accuracy (operating condition 1)

Operating condition 2

	Length	Width	Height
Object dimension (max.)	≤ 2,600 mm	≤ 1,000 mm	≤ 1,600 mm
Object dimension (min.)	≥ 100 mm	≥ 100 mm	≥ 50 mm
Scale value (d)	10 mm	10 mm	5 mm
v: 0.1 m/s to 3.6 m/s			

Tab. 3 Specification of measuring range and measurement accuracy (operating condition 2)

Operating condition 3

	Length	Width	Height
Object dimension (max.)	≤ 2,600 mm	≤ 1,000 mm	≤ 1,600 mm
Object dimension (min.)	≥ 100 mm	≥ 100 mm	≥ 100 mm
Scale value (d)	10 mm	10 mm	10 mm
v: 0.1 m/s to 3.6 m/s			

Tab. 4 Specification of measuring range and measurement accuracy (operating condition 3)

The following operating conditions apply to the VMS520 MID only

In addition to the three operating conditions for the metric system (with scale divisions of 5 mm and 10 mm) that have already been described in these operating instructions (see sections **3.2**, **3.4.3**, **3.5**, and **9**), the VMS system can also output measured values using the Anglo-American system of units (inches).

To enable this, two additional operating modes have been defined along with the corresponding measuring ranges and scale intervals.

Operating condition 4

	Length	Width	Height
Object dimension (max.)	≤ 102.0"	≤ 39.0"	≤ 62.0"
Object dimension (min.)	≥ 2.0	≥ 2.0"	≥ 2.0"
Scale value (d)	0.2"	0.2"	0.2"
v: 0.1 m/s to 3.0 m/s (20 ft/min to 590 ft/min)			

Tab. 5 Specification of measuring range and measurement accuracy for VMS520 MID only (operating condition 4)

Operating condition 5

	Length	Width	Height
Object dimension (max.)	≤ 102.0"	≤ 39.0"	≤ 62.0"
Object dimension (min.)	≥ 4.0"	≥ 4.0"	≥ 2.0"
Scale value (d)	0.4"	0.4"	0.2"
v: 0.1 m/s to 3.6 m/s (20 ft/min to 700 ft/min)			

Tab. 6 Specification of measuring range and measurement accuracy for VMS520 MID only (operating condition 5)

The operating modes with the metric measured values remain valid even if the alternatives are used.

VMS520 volume measurement system

The system is certified in accordance with the Measuring Instruments Directive referred to in chapter **10.6 Conformity to EU directives**.

3.3 Operating principle of the device

3.3.1 Device components

The VMS volume measurement system comprises the following components:

- Two VMD volume measurement devices (1)
- Two mounting adapters for VMDs consisting of a mounting bracket (3) and mounting block (4)
- Connection cable for connecting the VMDs (2)

The components of the VMS volume measurement system are shown schematically in the following figure.

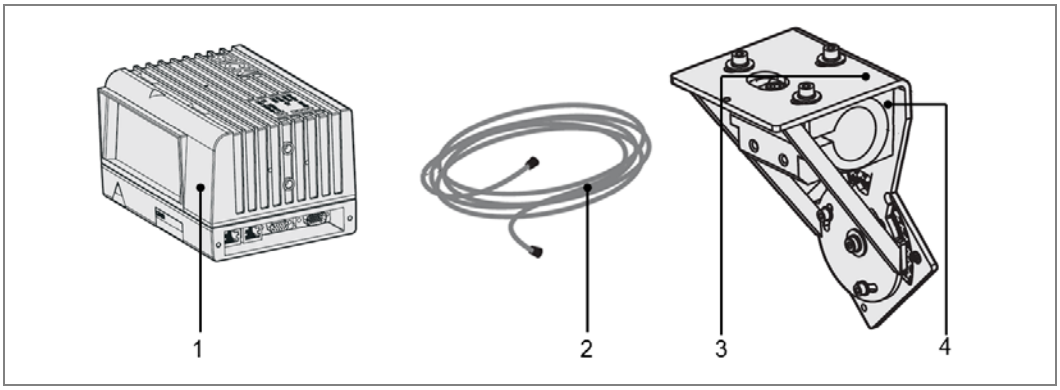


Fig. 3: Device components of the VMS volume measurement system

You can find the data sheet in chapter **9.1 VMS420/520 volume measurement system data sheet**.

You can find more dimensional drawings in chapter **9.2 Dimensional drawings**.

3.3.2 Operating principle of the VMS

Determining distance data

The VMS consists of two VMDs. These are installed above the conveyor system and perform non-contact scanning of the surface of the conveyor system and the transported objects. The system does not require any reflectors or position marks. This is an active system with a red light laser. It is not necessary to illuminate the objects. The VMS operates according to the principle of phase displacement (continuous wave).

The VMS volume measurement system measures cuboid objects and objects with virtually any shape on flat conveyor systems. The VMS carries out non-contact determination of the real volume of the object, and the length, width, height and volume of the smallest box that fully encloses the object.

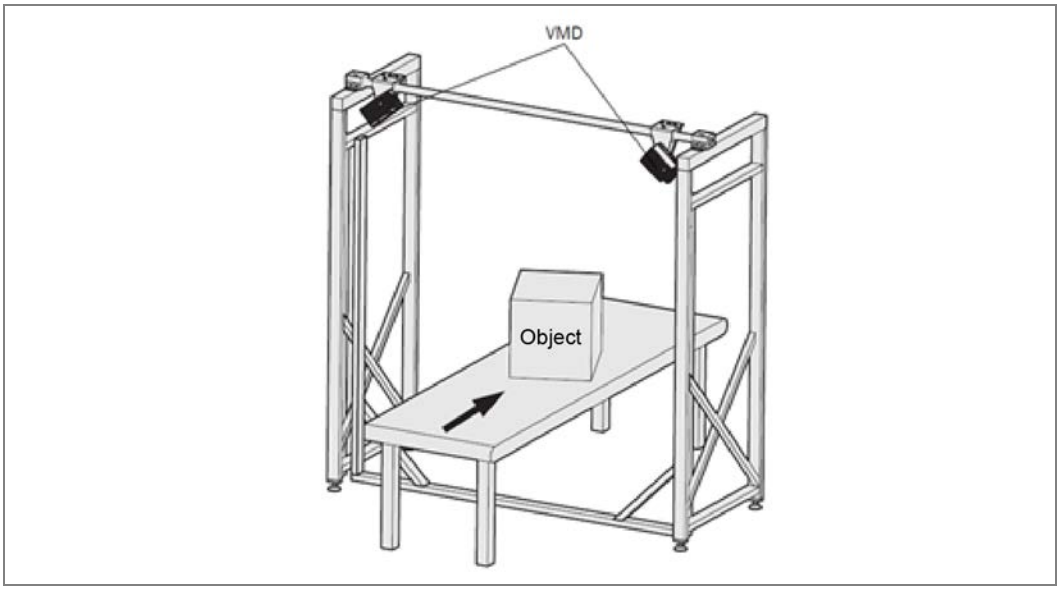


Fig. 4: Sketch of the VMS with frame above a conveyor system

Speed

The speed of the object is constantly configured or can be determined using an optional incremental encoder.

Resulting volume

The information about the three-dimensional object is available after collecting the distance data and calculation using the speed.

- The VMS420 determines the length, width and height and can calculate the volume of the smallest box that fully encloses the object (box volume) from these values.
- The VMS520 determines the length, width and height.

The data is made available for further processing via the interfaces of the VMS.

3.3.3 Measuring modes

The VMS can either be **triggered** or can operate in **free-running** mode.

Free-running mode

In free-running mode, the VMS detects the objects to be measured itself. The measurement starts when an object enters the scanning line and ends when the object leaves the scanning line. A minimum object gap ① must be maintained between the objects.

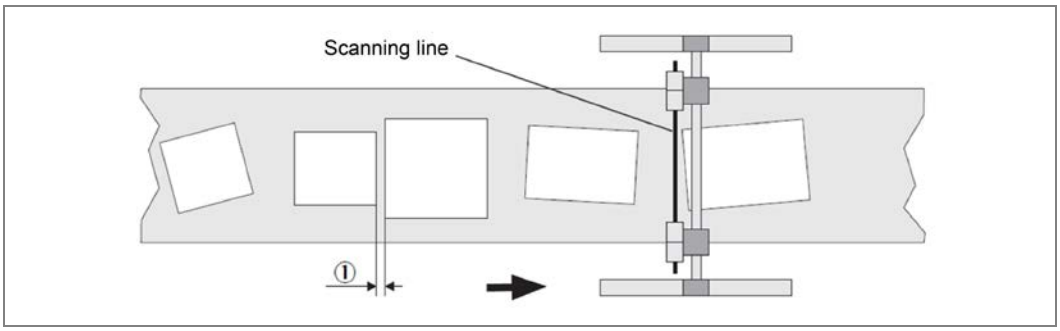


Fig. 5: Free-running mode

Triggered measurement with reading interval

During triggered measurement, the start and end of the measurement are determined by a reading interval.

In contrast with free-running measurement, it is of no consequence whether an object is entering the scanning line or leaving it. Between the start and end of the measurement, there is also no distinction made between a number of objects. Rather, precisely one measurement is carried out.

PROJECT TREE, VMDX20_XX00, PARAMETERS, DIGITAL INPUTS/TRIGGERS, TRIGGERING THE MEASUREMENT and READING INTERVAL sections

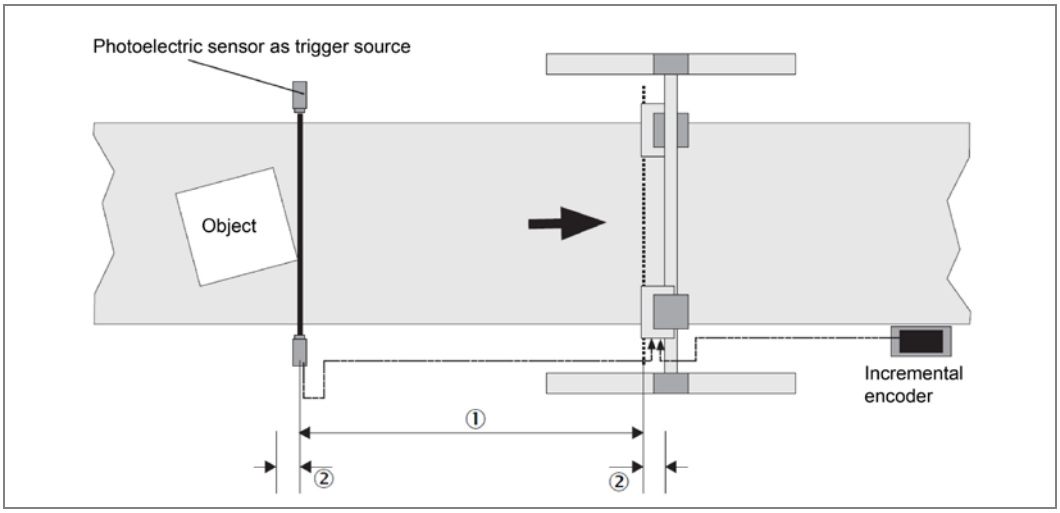


Fig. 6: Triggered measurement

The reading interval, during which the VMS measures, is defined by a trigger source, a path delay ①, and an expansion path ②.

Digital inputs are available as a trigger source or software triggers can be used via telegrams.

In the example, the object initializes the measurement by entering the photoelectric sensor (trigger source). After the path delay distance (defined in SOPAS) has been traveled ①, the VMS starts the measurement.

An expansion path, likewise defined in SOPAS, extends the reading interval at the start and at the end ②. This allows the realization of a tolerance for example.

Path-controlled triggering

An incremental encoder must be attached and configured for the path-controlled triggering described. It is used to determine the path traveled by an object from the belt speed. Different conveyor speeds or a stop of the conveyor system do not need to be taken into account for path-controlled triggering. The measurement begins or ends once a defined path distance has been traveled.

Alternatively, it is also possible to configure the triggering in a time-controlled manner in SOPAS:

PROJECT TREE, VMDX20_XX00, PARAMETERS, DIGITAL INPUTS/TRIGGERS, GENERAL SETTINGS section

Laser control

Note The laser diode remains switched off during active laser control, if no objects are being transported on the conveyor system. The service life of the system is increased as a result.

The laser remains switched on constantly if there is no laser control. This negatively influences the system's service life.

PROJECT TREE, VMDX20_XX00, PARAMETERS, DIGITAL INPUTS/TRIGGERS, LASER CONTROL section

During active laser control, the switching on of the laser is controlled by the configured reading interval or independently by its own source.

- Controlled by the reading interval

  The laser is controlled by the start or stop source configured in the READING INTERVAL section (see **Triggered measurement with reading interval**).

- Depending on the source

  The laser is controlled by the source configured in SOPAS. The control is independent of the settings made in the Reading interval section.

Note On the VMD slave, always configure the laser control as DEPENDENT ON SOURCE... and choose SW TRIGGER as source.

A photoelectric sensor is also attached to the VMS as a trigger, for example. If an object passes the photoelectric sensor, the laser is switched on.

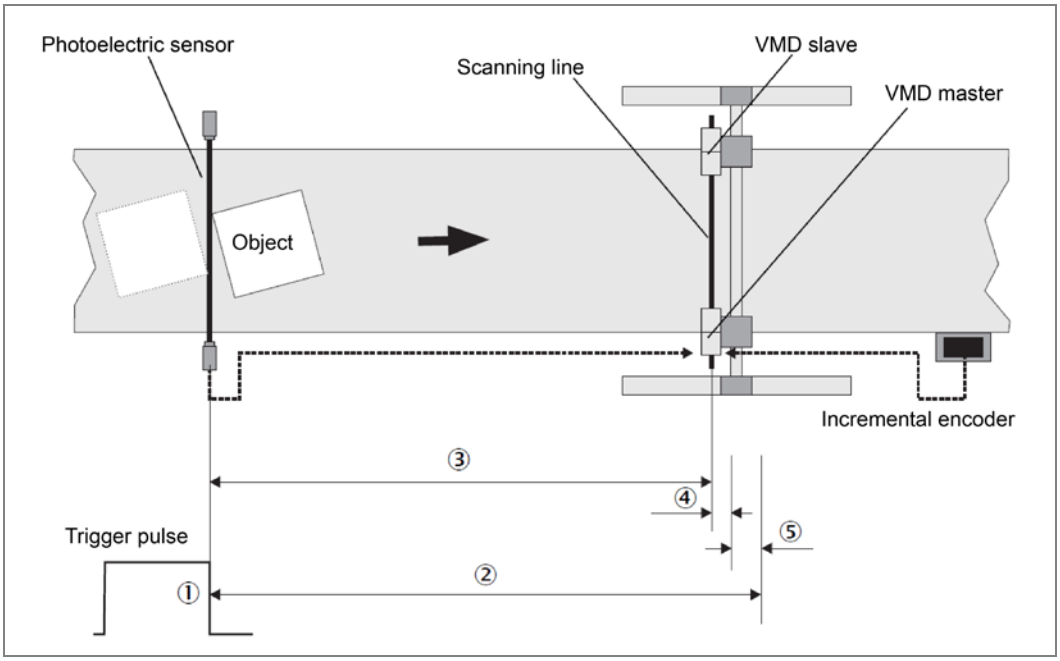


Fig. 7: Laser switch-off distance

When the rear edge of the object leaves the photoelectric sensor (trigger switches off) ①, the VMS starts to calculate the object's onward journey from the photoelectric sensor. To do this, an incremental encoder must be attached, which is used to determine the speed of the conveyor system (see chapter **10.4.2 General accessories**).

A laser switch-off distance ② is configured in SOPAS. This is formed by adding together the distance of the photoelectric sensor from the scanning line ③, the defined minimum object gap (default is 30 mm) ④ and a safety supplement (200 mm recommended) ⑤.

As soon as the VMS has calculated that the object has been transported through the scanning line of the VMS on the basis of the incremental encoder pulses, it switches its laser off.

If another object has passed the photoelectric sensor in the meantime, path calculation is zeroed by the triggering and started for the new object. So the lasers **remain switched on** if a number of objects are transported one after the other. Each object is measured individually.

You can also input a laser switch-off delay. If the conveyor system should stop after the trigger pulse for operational reasons or due to a fault, the laser diode is switched off after the configured laser switch-off delay.

3.3.4 Evaluation of the RIS values

To refine the measurement result, the VMS can also evaluate the measured objects' RIS values in addition to the distance values. The measurement result is improved and the evaluation becomes more stable as a result.

You must adapt the RIS evaluation parameters in SOPAS in accordance with the conveyor surface, its composition and status.

PROJECT TREE, VMDX20_XX00, PARAMETERS, MEASUREMENT ALGORITHMS, RIS EVALUATION

3.3.5 Focusing the camera

The VMS420/520 can be used as part of an overall system for volume measurement and package identification. The overall system consists of the VMS, the camera system and a modular system controller (MSC) for preparing and forwarding the data to a host.

The VMS measures objects on a conveyor system and transmits the coordinates and the trigger data to the camera system via the CAN interface. The CCD cameras are focused based on this data.

The camera focus function must be configured in SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, CAMERA FOCUS SETTINGS

If you do not use the camera focusing function, you must deactivate it.

Incremental settings

The VMS needs to know the speed of the conveyor system in order to calculate a three-dimensional volume from the measured two-dimensional data. Either the pulses from an incremental encoder can be accepted for this, or a constant speed can be used as a basis for the calculation.

Note In the VMS520, the incremental encoder, which is available as an accessory, must be used (see chapter **10.4.2 General accessories**) in order to achieve MID/OIML conformity. We also recommend that this incremental encoder be used in the VMS420.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INCREMENT CONFIGURATION/SYNC.

System increment

The encoder, which the VMS needs for volume calculation, is relatively sensitive. Devices that are attached to the VMS via a CAN bus and likewise use data from the encoder often cannot work with such fine data. This is why a system increment can be calculated from the pulses of the encoder and output via the CAN interface (see also chapter **3.8.4 CAN interface**).

- You can determine the system increment resolution using a splitter.
- Using an output splitter, you can also determine the output interval of the system increment.

3.4 Project planning

The VMS has a maximum working range of 3 m. The minimum distance between the zero point of the VMS measurement and the measuring object is 700 mm. The zero point is marked both on the top and the bottom of the housing. The working area of the VMS covers an angle of 70°.

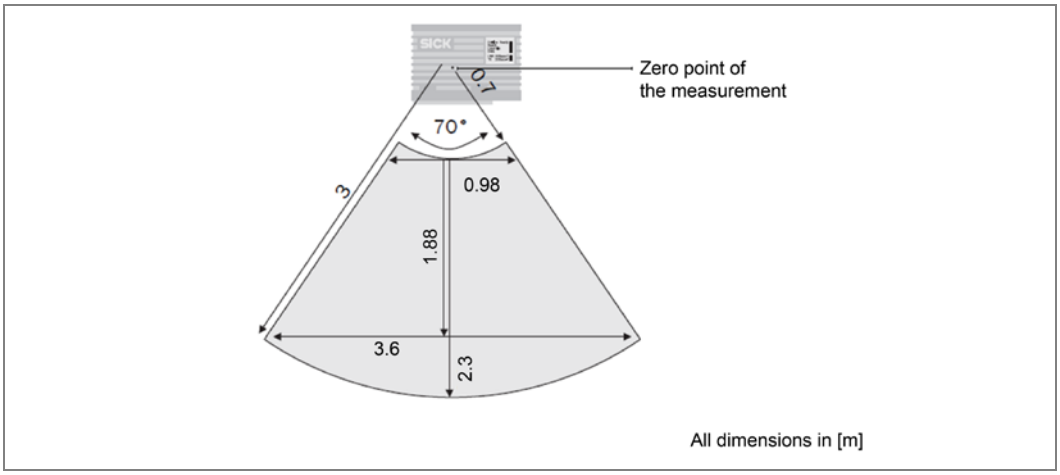


Fig. 8: Working area of the VMS volume measurement system

3.4.1 System requirements for the VMS volume measurement system

To operate the VMS volume measurement system, the following are required:

- Supply voltages VMD: 24 V DC ± 15% in accordance with IEC 364-4-41 (protective extra-low voltage), max. output 25 W
- Data interface: RS-232, RS-422 or Ethernet

3.4.2 Conveyor system requirements

The conveyor system must operate at a constant conveyor speed or an incremental encoder with a resolution of at least 0.2 mm/increment must be installed.

Notes

- The conveyor speed must not exceed 3.6 m/s.
- In the VMS520, the incremental encoder, which is available as an accessory, must be used (see chapter **10.4.2 General accessories**) in order to achieve MID/OIML conformity. We also recommend that this incremental encoder also be in the VMS420.
- The objects can be moved on a conveyor system with a flat conveyor surface. If the objects rotate, vibrate, roll, or slip on the conveyor system and on uneven conveying surfaces, the accuracy may be reduced and the data acquisition of the VMD may be impaired.

3.4.3 Object requirements

The minimum and maximum dimensions of the objects are summarized in the following table.

Operating condition 1

Object dimensions	Minimum value	Maximum value
Along the conveying direction	≥ 50 mm	≤ 2,600 mm
Transversely to the conveying direction	≥ 50 mm	≤ 1,000 mm
Height above the conveyor system	≥ 50 mm	≤ 1,600 mm

Tab. 7 Minimum and maximum dimensions of the objects (operating condition 1)

Operating condition 2

Object dimensions	Minimum value	Maximum value
Along the conveying direction	≥ 100 mm	≤ 2,600 mm
Transversely to the conveying direction	≥ 100 mm	≤ 1,000 mm
Height above the conveyor system	≥ 50 mm	≤ 1,600 mm

Tab. 8 Minimum and maximum dimensions of the objects (operating condition 2)

Operating condition 3

Object dimensions	Minimum value	Maximum value
Along the conveying direction	≥ 100 mm	≤ 2,600 mm
Transversely to the conveying direction	≥ 100 mm	≤ 1,000 mm
Height above the conveyor system	≥ 100 mm	≤ 1,600 mm

Tab. 9 Minimum and maximum dimensions of the objects (operating condition 3)

Note The smallest segments of a measurable object must be larger than 100 mm × 100 mm × 100 mm. Then, they can be taken into account during the measurement. The tips of objects that taper to a tip can therefore fail to give a measurement result under certain circumstances.

Objects that deviate from this requirement will be considered separately by the inspector, operator and/or system integrator.

3.4.4 Mounting requirements

The VMDs must be mounted as follows:

- Stable above the conveyor system (weight of the VMD: Approx. 2.3 kg, excluding mounting adapter)
- Shock- and vibration-free
- On the left and right above the conveyor system.

Recommendation

To achieve a high level of measurement accuracy, use the supplied mounting adapters and the hollow shaft, which is available as an accessory (see chapter **10.4.2 General accessories**).

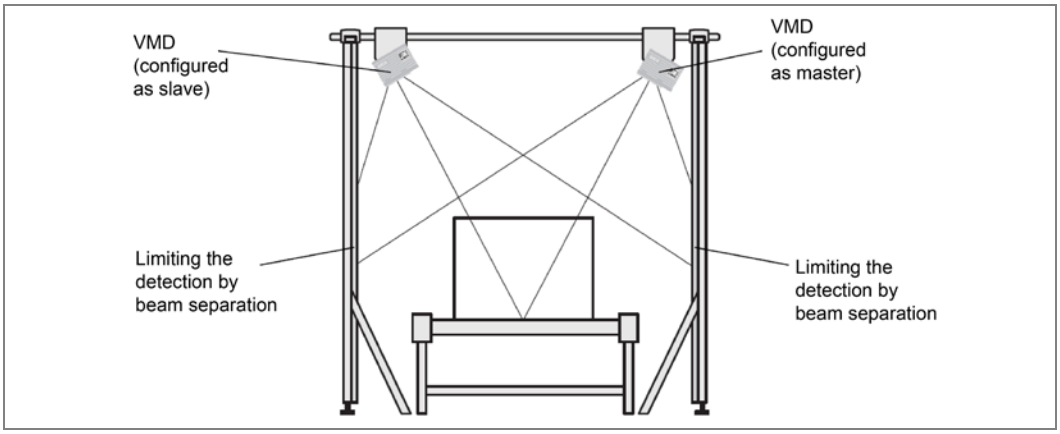


Fig. 9: Diagram of VMS installation above a conveyor system

To achieve an optimal measurement result, the following points should be observed.

- Typical vertical space requirement for the VMD installation: Approximately 700 mm above the tallest object
- The VMDs must have a clear view of the conveyor system.
- The laser beams of the VMD should not reach beyond the application space so that people or goods that are being transported on an adjacent conveyor system are not detected (limiting detection by beam separation).
- The maximum detection must be limited to the working range of three meters, as measuring inaccuracies may otherwise result.
- Sufficient distance of both VMDs from bends, induction lines, start/stop areas, areas with upward and downward inclines and breaks in the conveyor system

3.5 Calibration capability of the VMS520

The VMS520 has been tested in accordance with the Measuring Instruments Directive referred to in chapter **10.6**.

Using metrological tests, the following points have been certified for the measurement of cuboid and irregularly shaped objects that are non-reflective and non-transparent:

For conveyor speeds between 0.1 m/s and 3.0 m/s maximum.

Object dimensions	Minimum value	Maximum value	Achievable scale value d
Along the conveying direction	≥ 50 mm	≤ 2,600 mm	5 mm
Transversely to the conveying direction	≥ 50 mm	≤ 1,000 mm	5 mm
Height above the conveyor system	≥ 50 mm	≤ 1,600 mm	5 mm

Tab. 10 Certified, measurable object dimensions at a conveyor speed of 3.0 m/s

For conveyor speeds between 0.1 m/s and 3.6 m/s maximum:

Object dimensions	Minimum value	Maximum value	Achievable scale value d
Along the conveying direction	≥ 100 mm	≤ 2,600 mm	10 mm
Transversely to the conveying direction	≥ 100 mm	≤ 1,000 mm	10 mm
Height above the conveyor system	≥ 50 mm / ≥ 100 mm	≤ 1,600 mm	5 mm / 10 mm

Tab. 11 Certified, measurable object dimensions at a conveyor speed of 3.6 m/s

The conveyor speed must not exceed 3.6 m/s. A maximum of 960 objects per minute can be measured. The operating temperature must be between 0 and 40 °C.

Notes

- Observe the relevant applicable national law when using the VMS520 in calibratable applications. SICK can help you with this in an advisory capacity, if requested. This is not a substitute for legal advice, however.

- After a thorough check, the scale values for length, width and height must be determined for the application. These scale values must be entered such that they cannot be altered in row **d** on the certification label included with delivery (see the following figure). The certification label must be attached to the system such that it can be seen by the operator and associated with the volume measurement system.

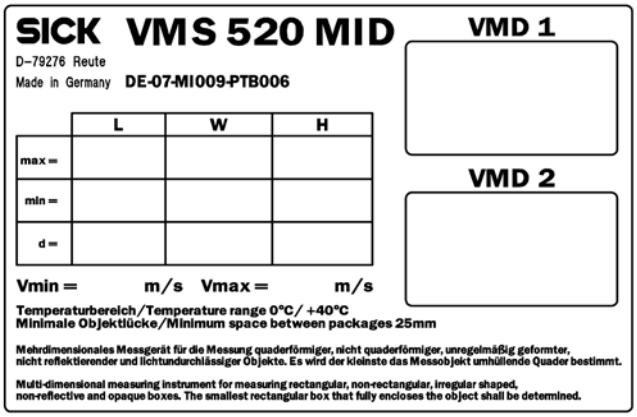


Fig. 10: Certification label to be attached for the VMS520 (illustration is purely an example)

How to benefit from the calibration capability of the VMS520:

- Check what steps are required for calibration according to the applicable national laws. SICK can help you with this in an advisory capacity, if requested. This is not a substitute for legal advice, however.
- To provide protection against tampering, we suggest applying seals and lead seals to defined locations on the VMS520 and any accessories that you may have. The operator must agree these suggestions with the relevant national testing body. Take note even when planning your application, that calibration seals can be applied to the VMD520 after mounting and calibration.

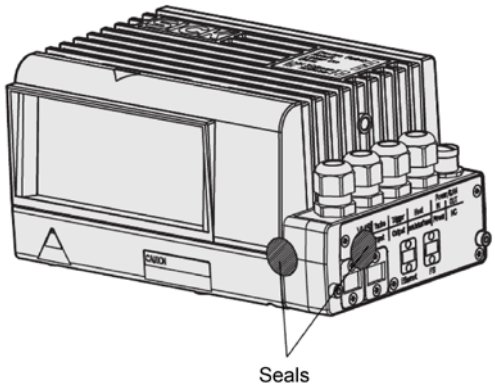


Fig. 11: Possible locations for applying seals on the VMD520

3.6 VMS scale values

The following scale values apply for object remissions from 10 to 200% and for recommended add-ons in accordance with SICK documentation. Restricted ranges for object remissions and object sizes allow greater accuracy. Glossy surfaces, shadowed areas of the objects, and other influences may reduce accuracy.

VMS dynamic scale values

The VMS can achieve scale values with different levels of detail, depending on the speed of the conveyor system. In principle, the following applies:

- The lower the speed, the finer the scale values.
- The higher the speed, the rougher the scale values.

The scale values that can actually be achieved or used must be determined and input into SOPAS during the calibration of the VMS520 or during the commissioning of the VMS420.

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES

The scale values are output in the basic measured data telegram 2 along with the length, width and height (see chapter **10.3.3 Basic measured data telegram 2 (metric values)**). You can also configure the user-defined measured data telegram so that it is used to output the scale values (see section **User-defined output format** in chapter **3.8.2 Host interface**). Also, the length, width and height of an object can be rounded to the scale values (see section **Rounding the measurement results** in chapter **3.8.2 Host interface**).

3.7 Status indicators

Six LEDs on the VMS volume measurement system give a visual indication of the operational status and any errors that occur.

LED	Display	Function
Device Ready	Green	Lights up after switching on if initialization and self-test were successful Device is ready
	Red	Error during initialization or self-test
Result	Green	Measurement condition fulfilled
Laser on	Green	Laser diode on
Data	Green	Flickers when the VMS is transmitting data to the computer on the host interface
LNK 10Base-T	Green	10BASE-T: Ethernet contacted
TX 10Base-T	Green	10BASE-T: Flickers when the VMS is transmitting data to the computer on the Ethernet interface

Tab. 12 Meaning of the LEDs

3.8 Data interface specification

The VMS has four different interfaces for configuring and transmitting measured values:

- You can configure the VMS with the help of SOPAS via the host interface, the terminal interface and the Ethernet interface.
- The VMS sends out the measured data in the form of telegrams via the host interface.
- In parallel with this, diagnostic data for a remote diagnostic tool (RDT) can be output via the terminal interface.
- The CAN interface is required to send the focusing data to the camera system when using the camera focus function.

3.8.1 Terminal interface

The terminal interface allows both the configuration of the VMS and the output of measured values. However, it is primarily intended for ensuring a secure data connection for the configuration (even if the host interface is operating at the same time). For this reason, the following interface parameters cannot be changed:

- 9,600 baud
- 8 data bits
- 1 stop bit
- No parity bit

Chapter **5.3.4 “Serial” connection** contains a description of the electrical interface.

3.8.2 Host interface

The host interface allows both the configuration of the VMS and the output of measured values.

You can configure the pins 6 to 9 either as RS-232 or as RS-422:

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, SERIAL HOST INTERFACE section, HARDWARE option

The interface parameters are freely configurable. The factory configuration for the host interface is
as follows:

- RS-232
- 9,600 baud
- 8 data bits
- 1 stop bit
- No parity bit

Note The interface parameter of the host interface can only be configured using the terminal interface or the Ethernet interface. Chapter **5.3.4 "Serial" connection** contains a description of the electrical interface.

Frame and coding for the telegrams

The VMS communicates with the connected application with the aid of telegrams.

You can configure the framing for the host interface in SOPAS:

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, SERIAL HOST INTERFACE section

For example, you can use two stop bytes (to end telegrams with CR/LF for example) or you can insert a block check byte before or after the stop byte.

Telegrams on the host interface

	Frame	Telegram	Frame
Designation	STX	Useful data (see chapter **10.2**)	ETX
Length (byte)	1	≤ 2,498	1 or 2
Description	Start of text character	ASCII-coded. This length depends on the previous send telegram.	End of text character

Tab. 13 Framing the telegrams on the host interface

Output unit

You can determine in SOPAS whether the data contained in the measured data telegrams are output as metric values or in inches:

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES

Rounding the measurement results

The measurement results are output as specified, accurate to 1 mm or to 1/100 inch. However, you can also round to the scale values on the VMS (see chapter **3.6 VMS scale values**):

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES

	Example 1	**Example 2**
Scale value	5 mm	10 mm
Measured object length	56 mm	56 mm
Object length output	55 mm	60 mm

Tab. 14 Example of rounded measurement results

Output time

In SOPAS, you can define when a measured data telegram is output:

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, OUTPUT CONTROL

- As soon as possible after leaving the scanning line ①
- After a certain distance from X position in relation to the rear edge of an object ②
- After a certain distance from X position in relation to the leading edge of an object ③

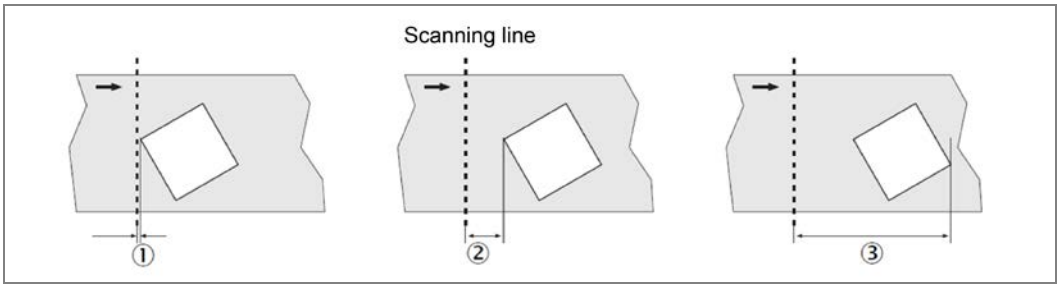


Fig. 12: Output time diagram

Note If you choose the option IN RELATION TO THE LEADING EDGE, you must make sure the distance entered is larger than the longest object to be measured. If an object reaches the distance entered, but has not yet left the scanning line (i.e. is still being measured), then a measured data telegram is not sent out yet. In such a case, this takes place only after the object has left the scanning line, – i.e. “as soon as possible”.

User-defined output format

You can define a custom measured data telegram for outputting measured data via the host interface:

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, OUTPUT FORMAT

For example, in this measured data telegram you can select and insert fixed strings, variables (such as object length or width), change the variables’ attributes or insert and define conditions.

3.8.3 Ethernet interface

The Ethernet interface has a data transmission rate of 10 Mbaud (10Base-T). The interface is designed as a TCP/IP peer-to-peer interface. Only half-duplex is supported. Make sure that your application's connection is configured to half-duplex.

The factory setting for the Ethernet interface is as follows:

- IP-ADDRESS: 192.168.0.1
- SUBNET MASK: 255.255.255.0
- TCP/IP PORT: 2111
- COLA PROTOCOL: COLA ASCII

If necessary, you must adjust the TCP/IP configuration of the Ethernet interface so that a connected PC (client) can communicate with the VMS via Ethernet:

PROJECT TREE, VMDX20_XX00, INTERFACES, ETHERNET, ETHERNET section

Chapter **5.3.1 "Ethernet" connection** contains a description of the electrical interface.

3.8.4 CAN interface

The VMS has a CAN interface, which can be used to connect it to a CAN bus.

For data communication via CAN (Controller Area Network), you must

- set the appropriate operating mode for the CAN bus on the VMS.
- configure identical data transmission rates on all of the bus' devices.
- assign a unique device number from 1 to 63 for each device on the CAN bus.

PROJECT TREE, VMDX20_XX00, INTERFACES, CAN, CAN section

Chapter **5.3.4 "Serial" connection** contains a description of the electrical interface.

4 Mounting

4.1 Overview of the Mounting Steps

- If required: Mount the frame in the desired area of the conveyor system.
- Definition of the VMD master and VMD slave

Note Generally, the VMD mounted on the right in the conveyor direction is defined as the master and the VMD mounted on the left is defined as the slave. So, the interfaces on the master point downward and the interfaces on the slave point upward.

- Mount the mounting adapters for the VMDs (master and slave) on a hollow shaft.
- Mount the hollow shaft on a frame using two mounting blocks for example (see chapter **10.4.2 General accessories**).

Note The hollow shaft must be mounted exactly at right angles to the conveyor system, so as not to impair the adjustment.

- Mount the VMD master on the mounting adapter.
- Connect the VMD master to the supply voltage and adjust.
- Mount the VMD slave on the mounting adapter.
- Connect the VMD slave to the voltage supply and adjust.
- Fit the limit to the detection by beam separation.

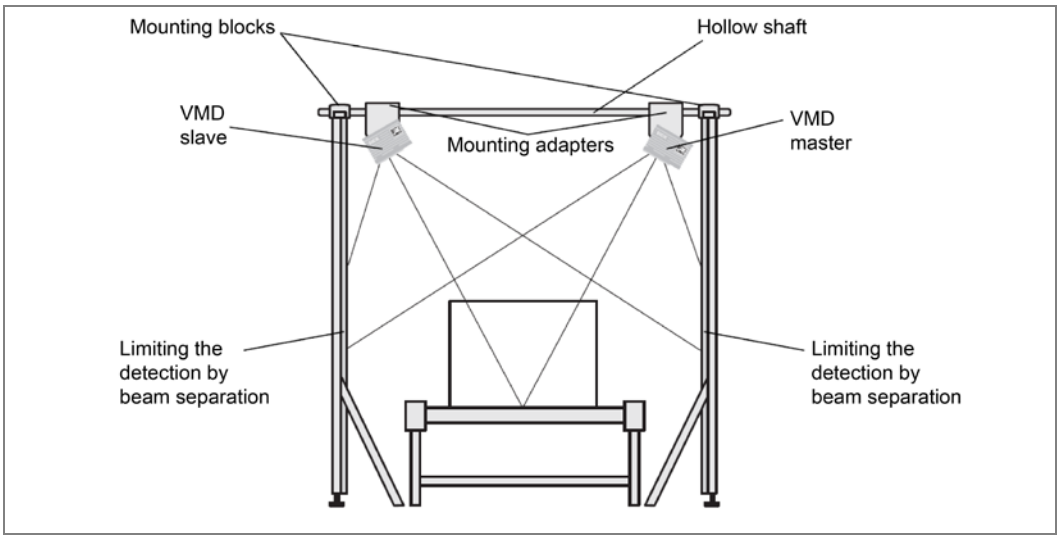


Fig. 13: Diagram of VMD mounting above a conveyor system

4.2 Preparation for mounting

The weight of a VMD is approx. 2.3 kg, the weight of the hollow shaft is approx. 20 kg.

Note More effort is required for mounting, adjusting and calibrating a VMS520 for a scale value of d ≥ 5 mm. Please take this into account during your planning!

We recommend that calibration be prepared, assisted and supervised by SICK.

4.3 Getting the components to be mounted ready

- Two VMD volume measurement devices
- Two mounting adapters for the VMDs
- Connection cable (for communication between master and slave)

4.3.1 Getting the accessories ready

The following accessories are required for the mounting adapter and for the VMD:

- Hollow shaft (see chapter **10.4.2 General accessories**).

  Use a hollow shaft for mounting the VMDs in all cases. You can find a dimensional drawing of the hollow shaft in chapter **9.2.4 Dimensional drawing of the hollow shaft for mounting the VMD**.
- Mounting block set for mounting the hollow shaft on the frame (see chapter **10.4.2 General accessories**)
- Three M8 × 12 screws with washers for mounting the mounting block on the mounting bracket (included with delivery)
- Three M8 × 12 screws with washers for mounting the VMD on the mounting adapter (included with delivery)

4.3.2 Getting the tools ready

- Plumb line
- Try square
- White adhesive tape, 10 m
- Felt tip pen (color should be clearly distinct from the color of the conveyor surface)
- Spirit level, for conveyor systems angled upwards/downwards
- Tape measure (up to 3,000 mm)
- Test object (see chapter **10.4.2 General accessories**)
- Tool

– Hexagon key set for mounting the male connector cover:

  – TORX screwdriver, T10

  – Precision screwdrivers

4.3.3 Mounting accessories

Two mounting adapters for mounting the two VMDs are included with the delivery. These can be finely adjusted triaxially.

The mounting adapter comprises a mounting bracket and a mounting block.

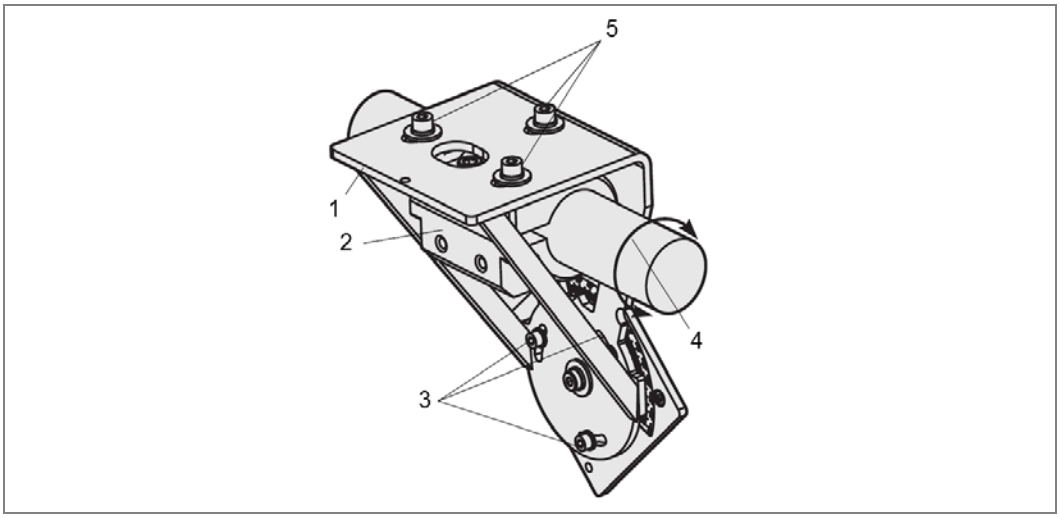


Fig. 14: Mounting adapter for the VMD

No.	Meaning
1	Mounting bracket
2	Mounting block
3	Adjustment screws for adjusting the γ angle
4	Direction of rotation on hollow shaft can be used to adjust the β angle
5	Screws for mounting the mounting block and for adjusting the α angle

Tab. 15: Mounting adapter for the VMDs

Notes You can find the dimensional drawings for the mounting adapter in:

- Chapter **9.2.2 Dimensional drawing of the mounting bracket of the mounting adapter**
- Chapter **9.2.3 Dimensional drawing of mounting adapter mounting block**
- Chapter **9.2.4 Dimensional drawing of the hollow shaft for mounting the VMD**

4.4 Mounting the VMD

1. Mount the mounting block on the mounting bracket at the designated position using three M8 screws ①.
2. Loosen the M10 fixing screw ⑨ a little and screw the setscrew ② in slightly so that the seat of the mounting block spreads slightly and can be pushed onto the hollow shaft ③.
3. Push the mounting adapter onto the hollow shaft. Slightly unscrew the setscrew ② so that the mounting adapter cannot slip off the hollow shaft.
4. Repeat steps 1 to 3 for the second mounting adapter.
5. For both mounting adapters, set the angle necessary for their use on the scale ④ of the mounting bracket.

Note The angle is dependent on the application and can be calculated for you by SICK.

6. Screw the screws ⑤ and screw ⑥ tight on both mounting adapters.

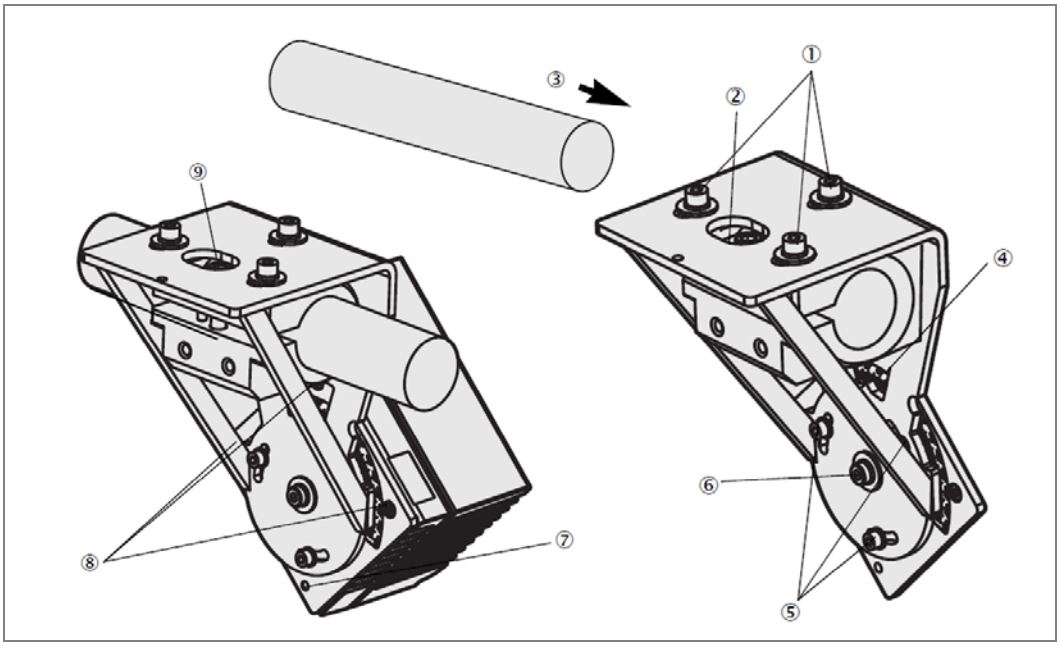


Fig. 15: Mounting and adjusting the VMDs

7. Insert the VMD master and VMD slave into the locating pins ⑦ provided on the mounting adapter and mount using three M6 screws ⑧.
8. Mount the hollow shaft e.g. on a frame above the conveyor system.

4.5 Dismantling the system

1. Switch off the supply voltage.
2. Disconnect the connection cables.
3. Remove the VMDs from the mounting adapters above the conveyor system.

Note On final decommissioning, please observe the requirements for environmentally sound disposal in chapter **2.5.2 Disposal after final decommissioning**.

5 Electrical installation

WARNING

Disconnect the power to the system

The system could inadvertently start while you are connecting the devices.

➢ Make sure that the entire system is disconnected from the power supply during the electrical installation work.

WARNING

Risk of injury due to electrical current

Only a qualified electrician or trained person working under the guidance and supervision of a qualified electrician is permitted to work on electrical systems or equipment and they must comply with the electrical regulations.

Note The VMS volume measurement system satisfies the requirements of Class A (industrial environment) of the generic EMC standard.

It may cause radio interference in a residential area. In this case, the injured party can request that the operator carries out appropriate interference suppression measures.

5.1 Overview of the installation steps

➢ Set up the voltage supply for the VMDs.

➢ Connect a PC to the VMD's terminal interface.

5.2 Electrical connections and cables

Inside the electrical connections, the VMS has interfaces for communicating externally and connections for external sensors.

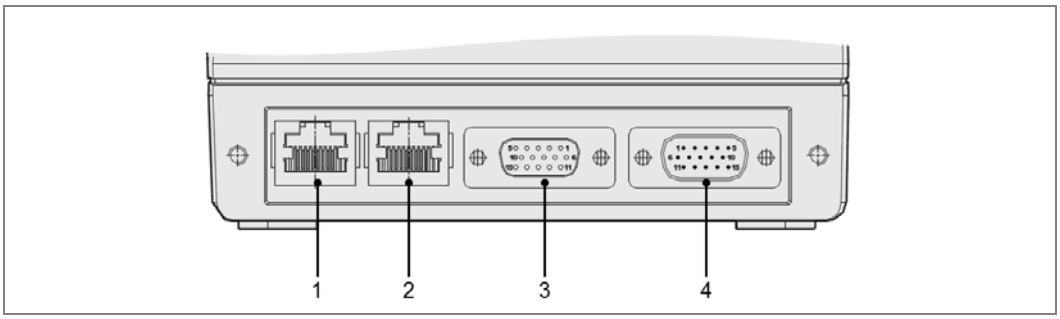


Fig. 16: Location of the electrical connections on the VMS

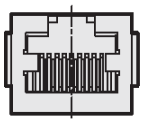
No.	Connection	Design	Function
1	Ethernet	RJ-45	TCP/IP communication, exchange of telegrams
2	System	RJ-45	Not used
3	I/O	D-Sub	Connecting external sensors, supply voltage
4	Serial	D-Sub	TCP/IP communication, exchange of telegrams, supply voltage

Tab. 16 Function of the electrical connections on the VMS

5.3 Pin assignment for the connections

5.3.1 “Ethernet” connection

A standard cat. 5 crossover cable is suitable for connecting the VMS.

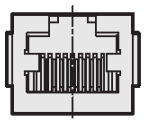


Pin	Signal	Function
1	TPOP	Ethernet interface
2	TPON	Ethernet interface
3	TPIP	Ethernet interface
4	Not assigned	–
5	Not assigned	–
6	TPIN	Ethernet interface
7	Not assigned	–
8	Not assigned	–

Tab. 17: Pin assignment for the “Ethernet” connection

5.3.2 “System” connection

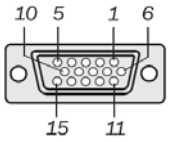
The “System” connection on the VMS is not used. The individual connections must not be assigned.



Pin	Signal	Function
1	FSIOP	Master/slave synchronization
2	FSION	Master/slave synchronization
3	FSIIP	Master/slave synchronization
4	Not assigned	–
5	Not assigned	–
6	FSIIN	Master/slave synchronization
7	Not assigned	–
8	Not assigned	–

Tab. 18: Pin assignment for the “System” connection

5.3.3 “I/O” connection



Pin	Signal	Function
1	VS	VMD supply voltage
2	IN3	Digital input 3 (trigger)
3	IN1	Digital input 1 (trigger)
4	Reserved	Must not be assigned!
5	GND	VMD ground
6	IN2	Digital input 2 (incremental encoder)
7	IN4	Digital input 4 (incremental encoder)
8	Reserved	Must not be assigned!
9	SENS_GND	Ground for digital inputs
10	Reserved	Must not be assigned!
11	Reserved	Must not be assigned!
12	Reserved	Must not be assigned!
13	Reserved	Must not be assigned!
14	Reserved	Must not be assigned!
15	Reserved	Must not be assigned!
Housing	–	Shield/ground

Tab. 19 Pin assignment for the “I/O” connection

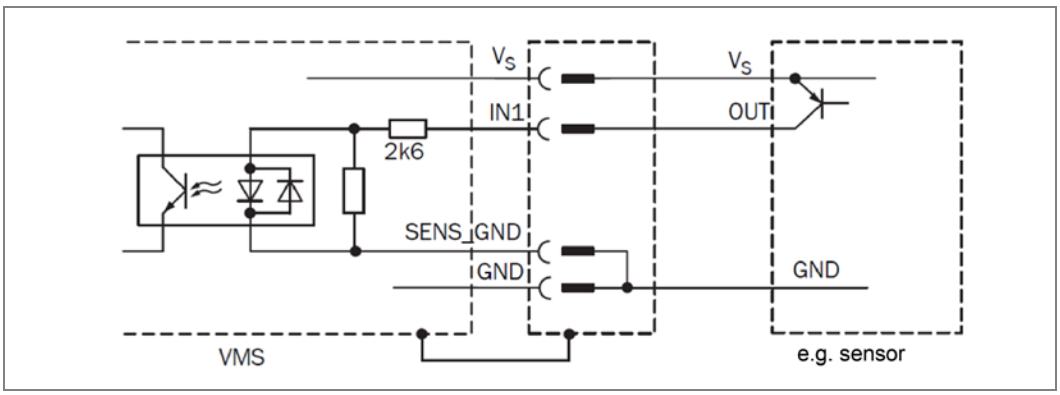
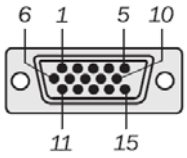


Fig. 17: Wiring for the digital inputs

5.3.4 “Serial” connection

You can configure pins 6 to 9 as either RS-232 or RS-422.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, SERIAL HOST INTERFACE section, HARDWARE option



Pin	Signal				Function
1	VS				VMD supply voltage
2	RS232	RxD_TRM			Terminal interface (receiver)
3		TxD_TRM			Terminal interface (sender)
4	Not assigned				-
5	GND				VMD ground
6	RS-232	Not assigned	RS-422	RD+ (HST)	
7		RxD (HST)		RD– (HST)	
8		Not assigned		TD+ (HST)	
9		TxD (HST)		TD– (HST)	
10	CAN_H				CAN interface 1 (IN/OUT)
11	Not assigned				–
12	CAN_H_2				CAN interface 2 (IN/OUT)
13	CAN_L_2				CAN interface 2 (IN/OUT)
14	Not assigned				–
15	CAN_L				CAN interface 1 (IN/OUT)
Housing	–				Shield/ground

Tab. 20: Pin assignment for the “serial” connection

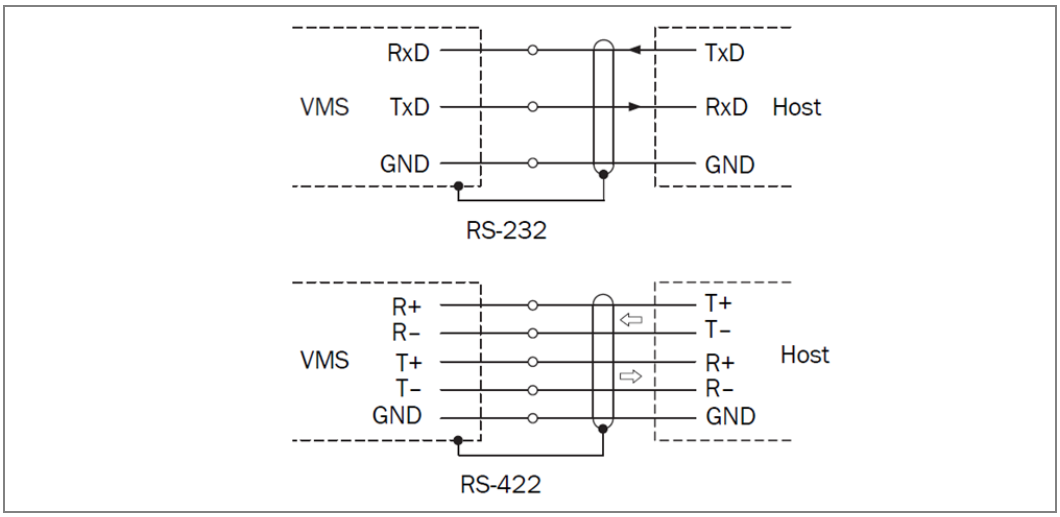


Fig. 18: Wiring for RS-232 or RS-422

5.4 Connection via the male connector cover

The VMS can also be connected via male connector covers. The enclosure rating IP 65 is achieved by the covering of the VMS' electrical connections ensured in this way (see chapter **10.4.4 Male connector cover sets**).

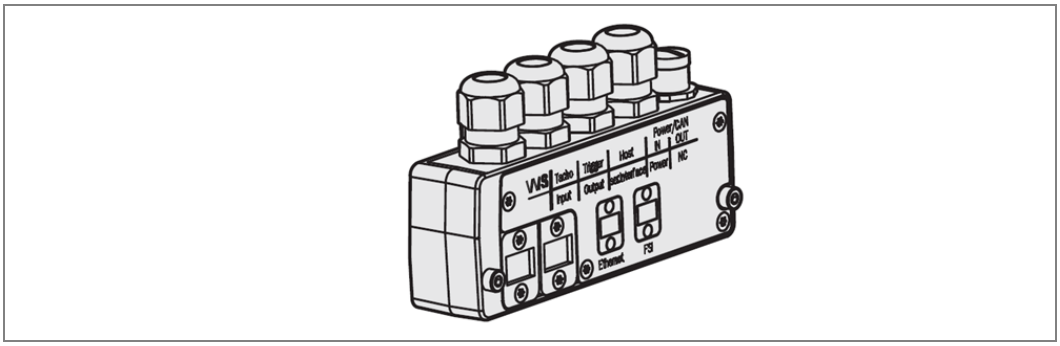


Fig. 19: Example of a male connector cover

The male connector covers contain a parameter memory and consequently allow a simple exchange of a VMS. The configuration is stored in the male connector cover and transferred after the exchange to the newly connected VMS.

Notes

- The parameter memory function is deactivated in the factory settings.
- The parameter set stored in the parameter memory always overwrites the VMS configuration. An already configured device can be reset to factory settings using a brand new male connector cover.
- Special Ethernet cables are required for connecting the male connector cover (see chapter **10.4.5 Accessories for male connector covers**).

You can find a detailed description of the electrical connections for the male connector cover in the document 8010817 – "Male connector covers for volume measurement system VMS4xx/5xx and laser measurement system LMS400".

5.5 Carrying out the electrical installation work

5.5.1 Overview of the connection steps

- Connect the voltage supply.
- Connect the host interface.
- Connect the PC (connect the terminal interface).

5.5.2 Auxiliary equipment

- Tool
- Digital measuring device (current/voltage measurement)

5.5.3 Connecting voltage supply

Note You can feed the supply voltage either to the “I/O” connection or to the “serial” connection.

1. Make sure that the voltage supply is switched off.
2. Connect the 24 V “supply voltage” input on the VMS to the corresponding voltage supply connection using a cable.

5.5.4 Connecting the PC

The VMD is operated and configured using the SOPAS configuration software.

1. Switch off the PC and the voltage supply.
2. Connect the PC and the VMD terminal interface using a 3-wire RS-232 data cable (null modem cable).
3. Switch on the PC and the voltage supply.
4. Carry out configuration (see chapter **6.2 Configuration and adjustment ff.**).

6 Commissioning


WARNING

Do not commission without testing by qualified safety personnel!

Before you put the volume measurement system into operation for the first time, you must have it checked and approved by qualified safety personnel. Observe the notes provided in chapter **2 Safety**.

Overview of the steps for commissioning

➢ Mount the VMS in the ordered version (see chapter **4 Mounting**).

➢ Carry out the electrical installation (see chapter **5 Electrical installation**).

➢ Configure and adjust the VMS using the SOPAS configuration software (see chapter **6 Commissioning**).

Note The RS-232 and RS-422 host interfaces cannot be used simultaneously during operation.

6.1 Quick stop and quick restart

6.1.1 Switching off the VMS

➢ Switch off the voltage supply for the VMS or detach the supply cable.

The VMS retains permanently stored parameters in the internal memory. Measured values at the interface are lost.

6.1.2 Switching on the VMS again

➢ Switch on the voltage supply for the VMS or reconnect the supply cable.

The VMS restarts operation with the most recently saved parameters.

6.2 Configuration and adjustment

The VMS volume measurement system is adapted to the measuring conditions on site. This enables measurement, analysis, and output properties to be configured as required.

The SOPAS configuration software supplied makes interactive configuration possible. You can use this software to configure and test the measuring properties, analysis behavior, and output properties of the system as required.

Help on using the program user interface, as well as for the individual options can be found in SOPAS:

- HELP menu, HELP: Detailed online help for the program user interface and individual options
- HELP window (bottom left in the program user interface): Context sensitive help for the currently active dialog

- Tool tips: Move the mouse pointer over an input field. A short text (tool tip) with information about valid entries appears.

Note Software access to the VMS is password protected. The default password for the maintenance technician is **main**. The password **client** is preset for authorized clients.

After configuring the device successfully, you must change the password so that it can fulfill its protective function.

6.3 Preparing for configuration and adjustment

For the configuration and adjustment of the VMS volume measurement system, you will need:

- SOPAS configuration software on CD-ROM
- PC/Notebook with Windows 98/NT 4.0/2000/XP and a serial interface (RS-232) PC/Notebook not included with delivery
- A standard cat. 5 crossover cable for connecting the PC and VMS
- Plumb line
- Try square
- Tape measure (up to 3,000 mm)
- Test object (see chapter **10.4.2 General accessories**)
- Felt-tip pen (color should be clearly distinct from the color of the conveyor surface)
- Tool
- White adhesive tape for black conveyor surfaces

The configuration and adjustment is prepared as follows:

1. Ensure that the VMD is properly mounted and electrically connected.
2. Install the SOPAS configuration software included in the delivery using the CD-ROM.
3. Connect the PC using the Ethernet interface on the VMD.

4. Start SOPAS and create a new project.
5. Configure the Scanning Assistant (SCANNING ASSISTANT tab CONFIGURATION button).

Note Check whether the CoLa dialect is set to AUTOMATIC DETECTION and enter the IP address for the VMD (see chapter **3.8.3 Ethernet interface**).

6. Then scan for connected devices (SCANNING ASSISTANT tab, SCAN button) and add the VMD to the SOPAS project tree.
7. Log into the device as an AUTHORIZED CLIENT (EXTRAS menu, LOG INTO DEVICE, factory-set password is **client**).
8. In PROJECT TREE, VMDX20_XX00, PARAMETERS open the device page DIGITAL INPUTS/TRIGGERS and choose the option OFF in the LASER CONTROL field.

   This switches on the VMS lasers permanently. The VMS scanning line can then be seen and this allows the VMS to be adjusted.

6.4 Adjusting the VMDs

For adjustment, see the figure in chapter **4.4 Mounting the VMD**.

6.4.1 Adjustment of the α angle

1. Draw a line in the conveying direction using a felt tip pen. To do this, start the conveyor system and hold the felt tip pen on the moving surface.
2. Loosen the three screws ① on the mounting adapter.
3. Align the scanning line of the VMD master at right angles to the line on the conveyor system.
4. Re-tighten the three screws ① on the mounting adapter.
5. Repeat the adjustment steps for the VMD slave.

6.4.2 Adjustment of the β angle

1. Place the test object (see **10.4.2 General accessories**) onto the conveyor system with the unmarked side face down.
2. Screw the setscrew ② in slightly so that the seat of the mounting block spreads slightly and the mounting adapter can be moved on the hollow shaft.
3. Rotate the mounting adapter on the hollow shaft until the scanning line and the adjustment line on the test object are parallel to one another.
4. Slightly unscrew the setscrew ② and tighten the M10 fixing screw ⑨ to adjust the position of the VMD and its vertical alignment.
5. To align the VMD slave vertically, rotate its mounting adapter on the hollow shaft until the scanning lines of master and slave coincide.

6.4.3 Adjustment of the γ angle

1. Loosen the screws ⑤ and screw ⑥ on both mounting adapters (master and slave).
2. Set the γ angle so that both VMDs can fully scan the largest possible object.

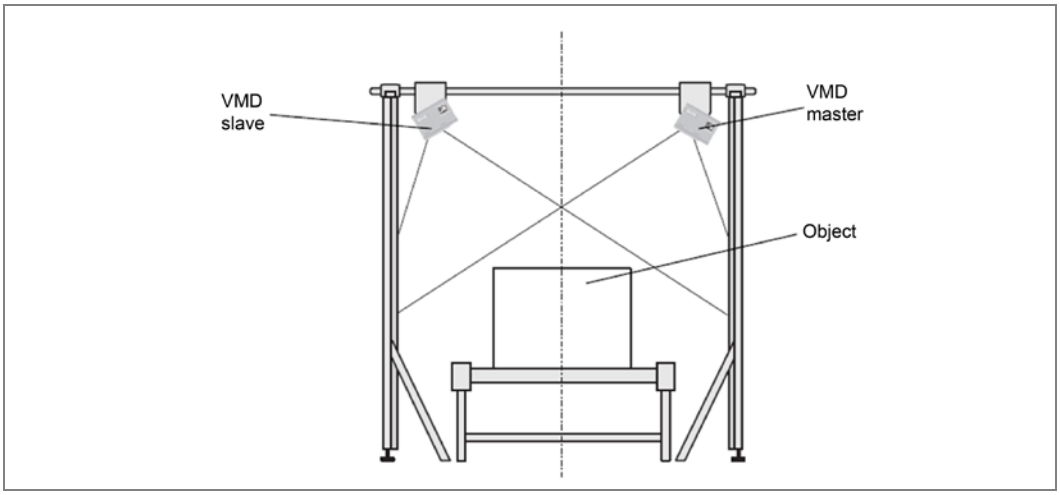


Fig. 20: Adjustment of the γ angle

3. Re-tighten the screws ⑤ and screw ⑥ on both mounting adapters (master and slave).

6.4.4 Checking whether the scanning lines of the two VMDs coincide

1. Place the tallest object to be measured or a corresponding test object onto the conveyor system and check whether both scanning lines coincide.
2. Re-adjust the VMDs if necessary.

6.5 Determine the coordinates and the angle γ using the installation setup.

An installation setup assistant is available for configuring the position of the VMD. You will find detailed instructions on every step of commissioning in this assistant.

Note The VMD must be able to scan the conveyor surface so as to allow the installation setup to work. Stick a black surface along the scanning line, e.g. using white adhesive tape.

6.5.1 Specifying the γ angle and the Y and Z coordinates

➢ Start the setup assistant in the menu VMDX20_XX00, COMMISSIONING, START INSTALLATION SETUP.

➢ Input the parameters GAMMA, Y COORDINATE AND Z COORDINATE for the VMD master and the VMD slave (see the figure that follows). It is sufficient to enter rough values here. The setup determines the accurate parameters in the following steps.

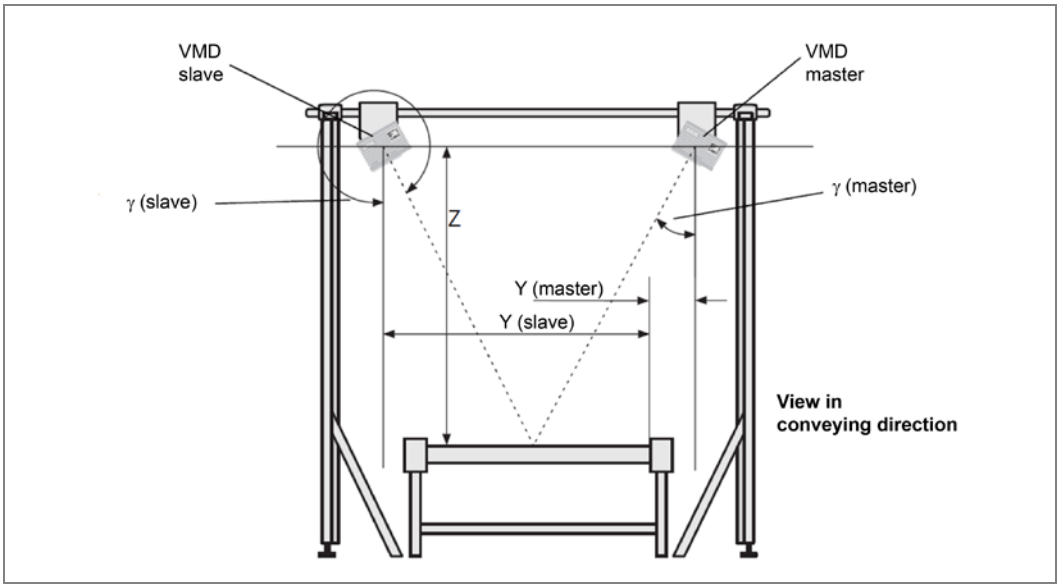


Fig. 21: γ angle and Y coordinate and Z coordinate

6.5.2 Detecting the conveyor surface

In the next step, the setup scans the surrounding contour of the VMD master and shows the scanning line it has seen. However, it cannot yet identify which part of the scanning line corresponds to the conveyor surface.

Therefore, you determine the position of the conveyor surface with the aid of marks.

Position two markers (M1 and M2) using the right mouse button. Make sure that the markers are as close as possible to the right and left edges of the conveyor system.

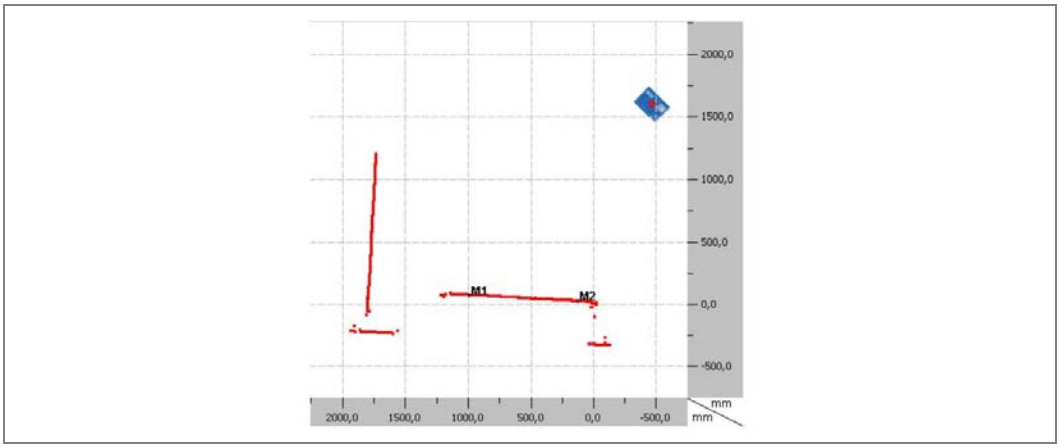


Fig. 22: Example of a scanned conveyor system (1)

➢ Click CALCULATE in the setup. The γ angle and the Z coordinate are calculated and the scanning line is drawn in horizontally in the image.

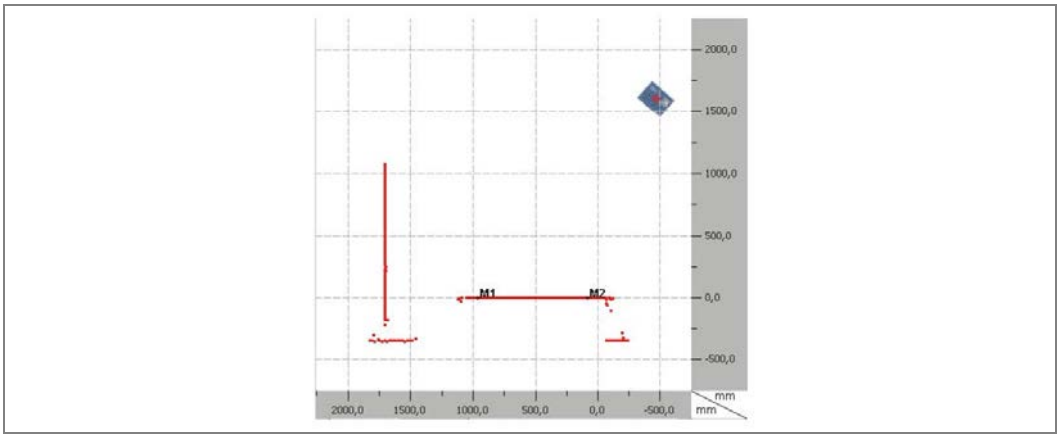


Fig. 23: Example of a scanned conveyor system (2)

➢ Go to the next step in the setup and carry out the process for the VMD slave.

6.5.3 Detecting the Y coordinate

➢ Place the test object upright on the left side of the conveyor surface.

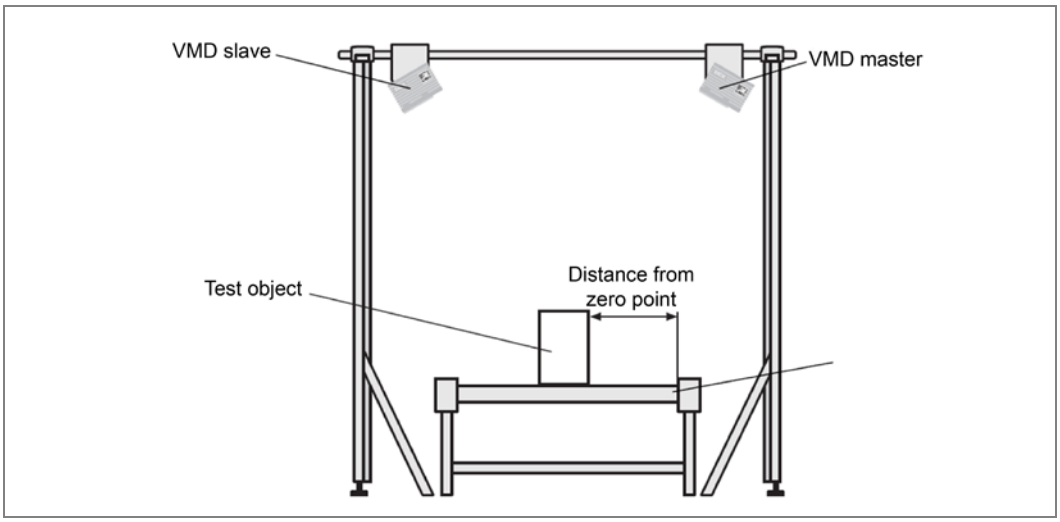


Fig. 24: Input the distance from the zero point

➢ In the next step in the setup, input the DISTANCE FROM THE ZERO POINT, the OBJECT WIDTH and the OBJECT HEIGHT.

Note The test object has the dimensions 202 x 302 x 402 mm (see chapter **10.4.2 General accessories**). You must measure the distance from the zero point.

The setup scans the surrounding contour and shows the scanning line it has seen. However, it cannot yet identify which part of the scanning line corresponds to the test object.

➢ Determine which part of the surrounding contour corresponds to the right side of the object on the scanning line. To do this, input two markers using the right mouse button.

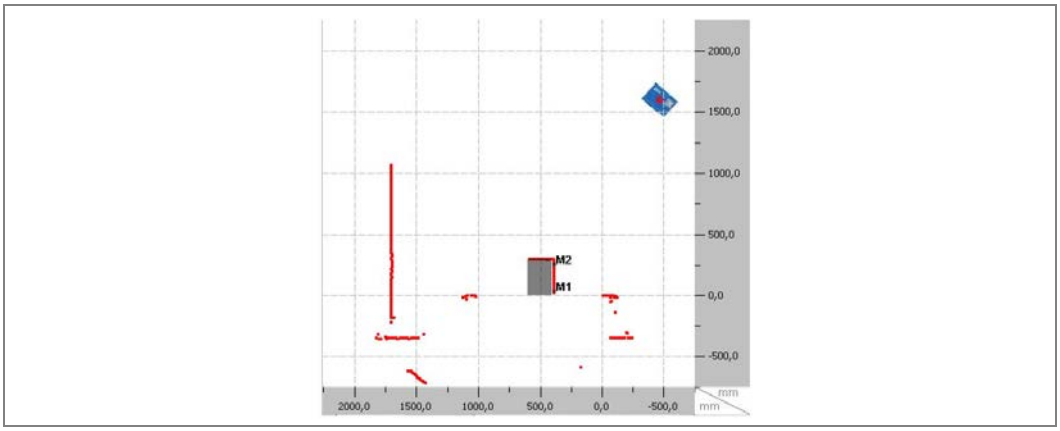


Fig. 25: Example of a scanned test object

➢ Click CALCULATE in the setup.

The setup calculates the distance of the VMD from the zero point and therefore its Y coordinate.

➢ Go to the next step in the setup and carry out the process for the VMD slave.

6.5.4 Accepting the parameters

To finish, the setup displays the new parameters for the VMD master and the VMD slave. If you accept these, they are saved in the devices.

Note The values are not displayed in the SOPAS user interface yet under PARAMETERS, POSITION.

This only occurs after the data is uploaded from the device.

COMMUNICATION menu, UPLOAD ALL PARAMETERS FROM THE DEVICE command

6.6 Determining the remaining parameters in SOPAS

A few more settings are needed in SOPAS to configure the VMS so that it is fundamentally ready for operation.

6.6.1 Configuring the VMD master using SOPAS

1. PROJECT TREE, VMDX20_XX00, PARAMETERS, POSITION, define the following parameters:
   MEASURING RANGE section
   - LEFT LIMIT: Width of the conveyor system
   - UPPER LIMIT: Maximum object height + approx. 50 mm
   - RIGHT LIMIT: Approx. 30 mm
   - LOWER LIMIT: Approx. –50 mm
2. PROJECT TREE, VMDX20_XX00, PARAMETERS, MEASUREMENT ALGORITHMS, activate VMD MASTER option.
3. PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section. Choose which measured data telegram should be output via the host interface (see chapter **10.3 Measured data telegrams reference**).
4. PROJECT TREE, VMDX20_XX00, PARAMETERS, BASIC PARAMETERS, define the following parameters:
   SCANNING SETTINGS, SCANNING AREA section
   - START ANGLE: 55°
   - ANGULAR RANGE: 70°

   Call up CURRENT DEVICE PARAMETERS, SCANNING FREQUENCY ASSISTANT section and under SETTING TYPE, select the option FREQUENCY.

   Input 370 Hz and in the next step, choose a setting with an angular resolution of at least 0.25°.
5. PROJECT TREE, VMDX20_XX00, PARAMETERS, INCREMENT CONFIGURATION/SYNC., MASTER/SLAVE SYNCHRONIZATION section
   - TYPE: MASTERSYNC
   - PHASE [°]: 30
6. PROJECT TREE, VMDX20_XX00, PARAMETERS, INCREMENT CONFIGURATION/SYNC., INCREMENT section. Select and configure the type for the connected encoder.
7. PROJECT TREE, VMDX20_XX00, PARAMETERS, DIGITAL INPUTS/TRIGGERS, define the parameters according to the chosen application.
8. PROJECT TREE, VMDX20_XX00, PARAMETERS, OBJECT SIZE, enter the object dimensions according to the chosen application.

6.6.2 VMD slave

Choose the settings in SOPAS in the same way as for the VMD master.

Please note the following differences:

PROJECT TREE, VMDX20_XX00, PARAMETERS, INCREMENT CONFIGURATION/SYNC., MASTER/SLAVE SYNCHRONIZATION section

SYNCHRONIZATION section

- TYPE: SLAVESYNC
- PHASE [°]: 0

6.7 Testing the configuration

Use the graphical display in the SOPAS monitor to verify the generated measured values and the measuring range online. Please note that the monitor cannot show the data in real time and therefore does not visualize all measured values.

6.7.1 Displaying the measurement results

Once the VMS application has been started, the measured values for the VMS are shown on the measurement results display using exactly the same output format as for the measured data telegram.

VMDX20_XX00, MONITOR, DISPLAYING THE MEASUREMENT RESULTS

6.7.2 VMS result list

Once the VMS application has been started, the last ten measurement results from the VMD are displayed in a table in the RESULT LIST section.

VMDX20_XX00, MONITOR, DISPLAYING THE RESULT LIST

6.7.3 Noise statistics

Depending on the wear, surface condition, etc., the conveying surface generates noise within the measurement when the scanning line is crossed. In order to determine the trigger threshold for object detection, it is helpful to determine the intensity of the noise.

To this end, the noise statistics make it possible to scan parts of the conveyor surface or the entire conveyor surface and to display the noise.

PROJECT TREE, VMDX20_XX00, MONITOR, DISPLAYING THE NOISE STATISTICS

6.7.4 Scan display

Using the graphical scan display in SOPAS, you can verify the measuring range of a VMD and the measured values online.

VMDX20_XX00, MONITOR, SCAN DISPLAY

6.7.5 3D object display

The 3D object display shows the measured objects on the conveyor system.

➢ Use the display, e.g. when setting up the system or for control during continuous operation.

VMDX20_XX00, MONITOR, 3D OBJECT DISPLAY

7 Maintenance

7.1 Maintenance during operation

The VMS volume measurement system is maintenance-free except for the care measures mentioned below. Maintenance is not necessary to ensure compliance with laser class 2.

Recommendation To achieve the full optical output of the VMS, the front screens and any additional front screens should regularly be checked for contamination. This is especially true in harsh operating environments (dust, abrasion, humidity, fingerprints).

The following maintenance work must be carried out at the specified time intervals:

Device	Maintenance task	Interval *	Carried out by
VMD	Cleaning the front screen	1x/month	Trained personnel
General	Visually inspect the electrical cabling and wiring for damage	1x/year	Specialist
	Check the measurement accuracy	1x/year	Specialist
	Carry out a functional test with a reference object	Whenever the system is started	Trained personnel
* The intervals depend on the ambient conditions and degree of contamination. In addition, the intervals must be defined according to how significant they are for the customer process.			

Tab. 21: Maintenance intervals

WARNING

Damage to the eye by laser beam

The VMS420/520 volume measurement system works with a red, class-2 laser. When exposed to the laser beam for longer periods of time, the retina of the eye may be damaged.

The laser output aperture is the front screen of the VMD.

Caution Incorrect use of the VMS may lead to dangerous radiation exposure and exceeding the laser class.

- Never look directly into the beam path (similar to sunlight).
- Never point the laser beam at people.
- When mounting and adjusting the VMD, beware of reflections of the laser beam off reflective surfaces.

➢ Do not open the housing. (Opening does not interrupt the switching on of the laser diode by the reading pulse).

➢ Observe the applicable laser safety regulations according to IEC 60825-1 (latest version).

Clean the front screen.

WARNING

Damage to the front screen

The front screen is made of glass. The optical output is weakened by scratches and streaks on the front screen.

➢ Do not use aggressive cleaning agents.

➢ Do not use abrasive cleaning agents.

➢ Avoid scratching and chafing movements on the front screen.

Contamination on the front screen of the VMD can cause incorrect measurements.

➢ Remove any contamination on the front screen to avoid incorrect measurements.

➢ Use a clean, soft brush to remove dust from the front screen.

➢ Then wipe the front screen with a clean, damp cloth.

Note Static charges cause dust particles to be attracted to the front screen. You can reduce this effect by using a SICK anti-static plastic cleaner (part number 5600006) and a SICK lens cloth (part number 4003353).

7.2 Replacing components

WARNING

Disconnect the power to the system

➢ Make sure the power supply for the entire system is disconnected throughout the entire time that you are replacing devices.

WARNING

Risk of injury due to electrical current

Only a qualified electrician or trained person working under the guidance and supervision of a qualified electrician is permitted to work on electrical systems or equipment and they must comply with the electrical regulations.

If the system or individual components need to be replaced, proceed as follows:

1. Switch off the voltage supply for the VMD and detach the connection.
2. Remove the connection cables from the VMD.
3. Loosen three M6 screws (see chapter **4.4 Mounting the VMD**) and replace the VMD.
4. Mount and adjust the replacement device (see chapter **4 Mounting**).
5. Configure the replacement device (see chapters **6.2 Configuration and adjustment ff.**).

Notes Repairs to VMS volume measurement system components may only be performed by qualified and authorized service personnel from SICK AG.

7.3 Disposal

Unusable or irreparable devices must be dismantled and disposed of in an environmentally safe manner in accordance with the relevant national waste disposal regulations.

SICK AG is not currently able to take back devices that are irreparable or unusable.

1. Dismantle the VMD housing.
2. Remove the electronic modules.
3. Remove the laser output aperture and send it for glass recycling.
4. Send the chassis and cover for die cast aluminum recycling.
5. Dispose of electronic components as hazardous waste.

8 Fault diagnosis

This chapter describes how to identify and remedy faults on the VMS volume measurement system.

8.1 Response to faults

WARNING

Cease operation if the cause of the malfunction has not been clearly identified

Immediately stop machine operation if you cannot clearly identify the fault and if you cannot safely remedy the problem.

8.2 SICK support

If you cannot remedy a fault with the help of the information provided in this chapter, please contact your respective SICK subsidiary.

8.3 Component fault indicators

The VMS automatically monitors beam generation and automatically shuts it down in the event of irregularities. In such cases, the following will occur:

- The **Device Ready** LED lights up red.
- The scanner no longer sends any measured values.

LED	Color	Meaning
Device Ready	Red	Fault during initialization or self-test or occurrence of errors during operation.

Tab. 22: LED display in the event of a fault in the VMD

To delete the fault status, proceed as follows:

➢ Switch off the VMS and turn it on again.

➢ If the fault persists after being switched on again or occurs again, then check the device status using SOPAS. If faults are listed there, please contact SICK Service.

8.4 Detailed fault analysis

The VMS saves faults that have occurred in a log. You can display this log using SOPAS.

➢ Connect SOPAS to the device.

PROJECT TREE, VMDX20_XX00, SERVICE, SYSTEM STATUS, OPERATING DATA and SYSTEM STATUS sections

8.4.1 The status log

- The status log is retained even after switching the device off and on again.
- The system distinguishes between four types of fault:
  - Information
  - Warning
  - Fault
  - Critical fault

  The system saves only the last five entries for each fault type.

Note Please contact SICK support for a more detailed analysis of the fault situation.

8.4.2 Log data during continuous operation also

In the SOPAS configuration software, the DATA RECORDER is available in the EXTRAS menu. You can use this to also log and analyze certain memory areas of the VMS in a targeted fashion during continuous operation.

9 Technical data

9.1 VMS420/520 volume measurement system data sheet

Type	**VMS420**	**VMS520**
Design	Two-scanner solution	
Laser output aperture	On the front	
Laser diode (wavelength)	Visible light (λ = 650 nm)	
Laser power	Max. 10 mW	
Laser class of the device	2	
Usable aperture angle	Max. 70°	
Detectable object shape	Virtually any, dimensions of objects must be at least 50 mm × 50 mm × 50 mm	
Min. object size (L × W × H) (Operating condition 1) at v = 0.1 m/s to 3.0 m/s	50 mm × 50 mm × 50 mm	
Min. object size (L × W × H) (Operating condition 2) at v = 0.1 m/s to 3.6 m/s	100 mm × 100 mm × 50 mm	
Min. object size (L × W × H) (Operating condition 3) at v = 0.1 m/s to 3.6 m/s	100 mm × 100 mm × 100 mm	
Certified scale value d (L × W × H) (Operating condition 1) at v = 0.1 m/s to 3.0 m/s	5 mm × 5 mm × 5 mm	
Certified scale value d (L × W × H) (Operating condition 2) at v = 0.1 m/s to 3.6 m/s	10 mm × 10 mm × 5 mm	
Certified scale value d (L × W × H) (Operating condition 3) at v = 0.1 m/s to 3.6 m/s	10 mm × 10 mm × 10 mm	
Object remission	10 to 200%	
Min. object gap at v = 2 m/s	25 mm	
Max. conveyor speed	3.6 m/s	
Optical indicators	6 LEDs per VMD	
Host interface	RS-232 or RS-422, data output format can be set	
Output data	Maximum dimensions (length, width, height) Box volumes Real volumes	Maximum dimensions (length, width, height)
Supply voltage/ power consumption	24 V DC ±15%/max. 50 W	
Housing	Die-cast aluminum	
Enclosure rating/protection class	IP 20 (in accordance with DIN 40050); with IP 65 male connector cover	
EMC test	EN 61000G6G2:2001/EN 61000G6G4:2001	
Thorough vibration/shock check	EN 60068G2G6, G27, G29, G64	
Weight	Approx. 2.3 kg per VMD	
Temperature (operation/storage)	0 °C ... +40 °C / –20 °C ... +70 °C	

Tab. 23: LED display in the event of a fault in the VMS

9.2 Dimensional drawings

9.2.1 Dimensional drawing of the VMD volume measurement system

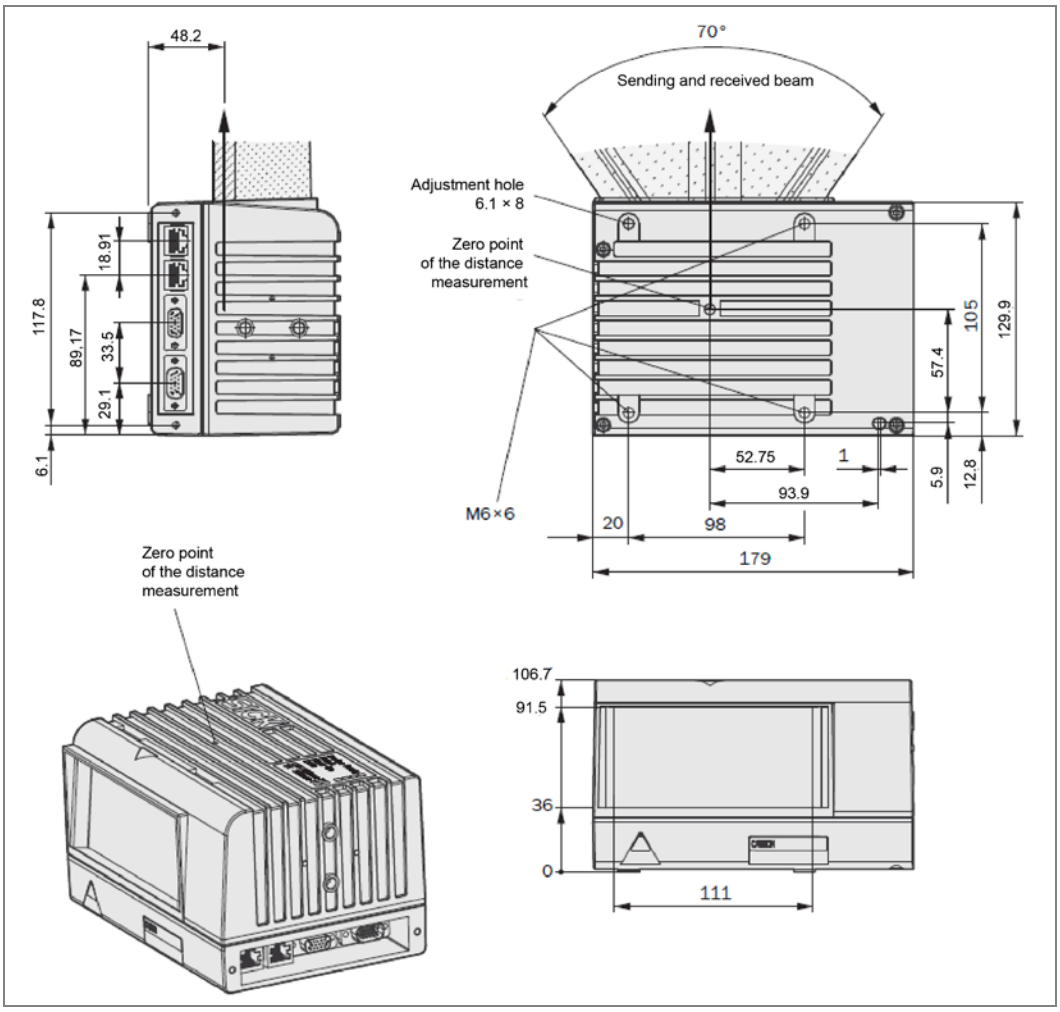


Fig. 26: VMD dimensional drawing

9.2.2 Dimensional drawing of the mounting bracket of the mounting adapter

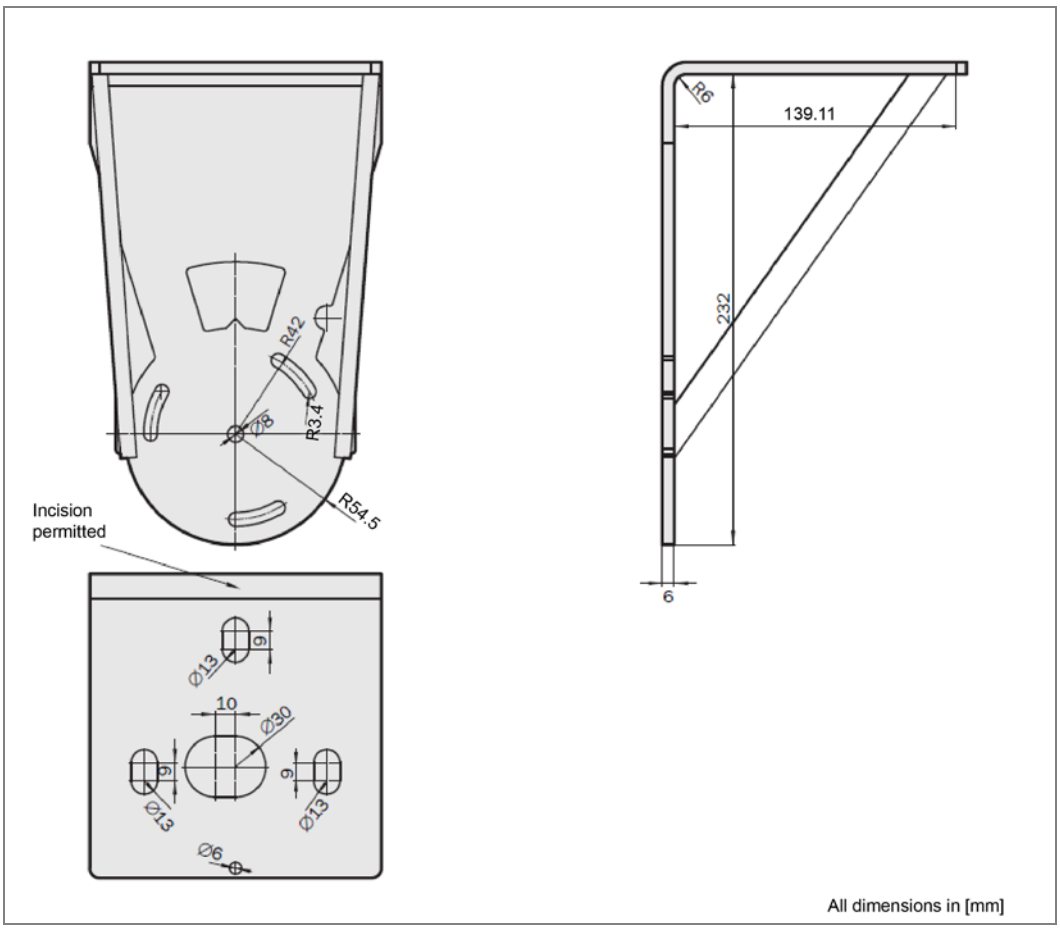


Fig. 27: Dimensional drawing of the mounting bracket of the mounting adapter

9.2.3 Dimensional drawing of mounting adapter mounting block

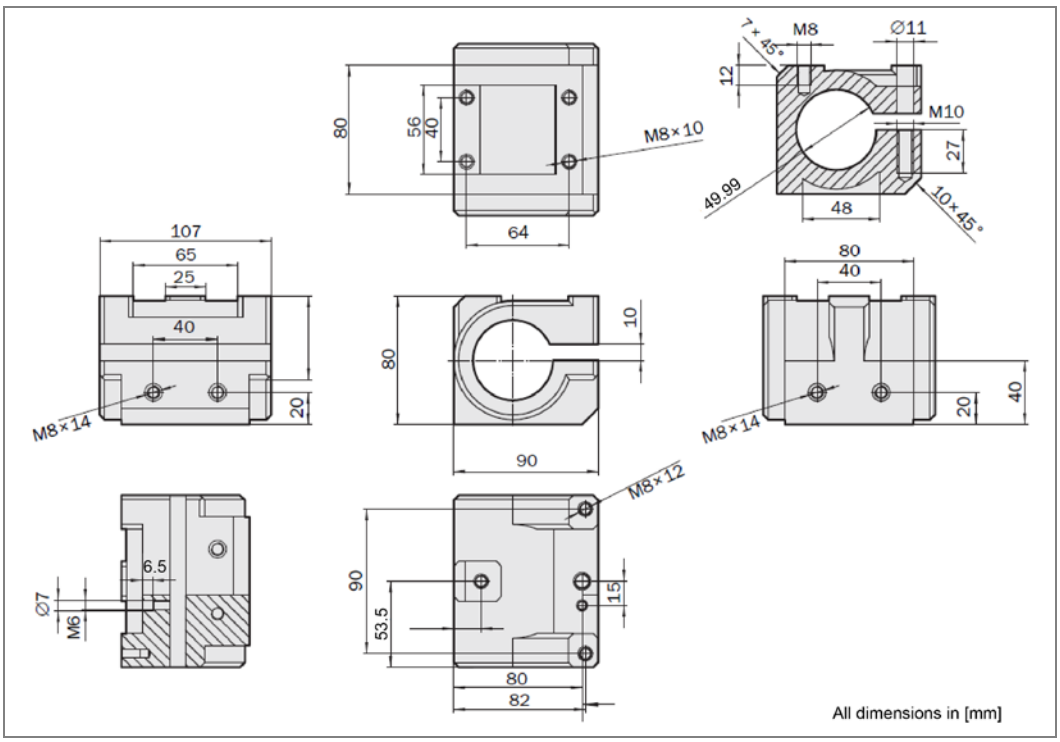


Fig. 28: Dimensional drawing of the mounting adapter mounting block

9.2.4 Dimensional drawing of the hollow shaft for mounting the VMD

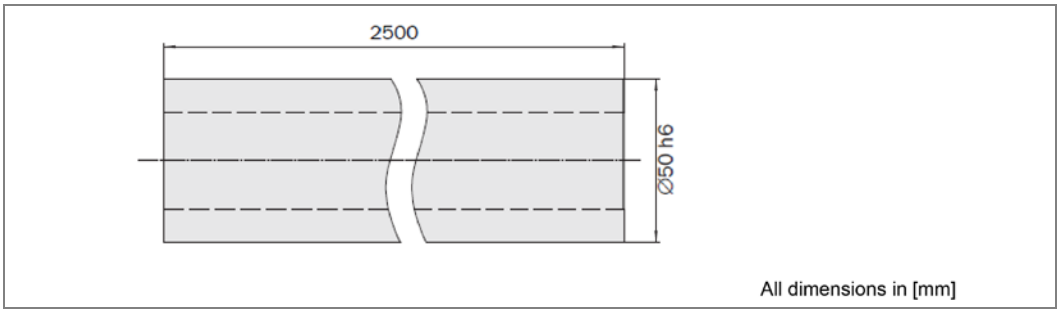


Fig. 29: Dimensional drawing of the hollow shaft for mounting the VMD

10 Annex

10.1 Overview of the appendices

The appendix contains the following supplements and additions:

- Telegram reference
- Ordering information
- Glossary
- Conformity to EU directives
- Figures and tables

10.2 Control telegrams reference

Notation

The individual telegram sections must each be separated by a semicolon (ASCII code 59, hex 3B)

.

All examples used in the following telegram lists refer to the CoLaA protocol.

Syntax errors

If the VMS detects an error in the syntax when receiving a telegram, it sends back an error telegram with an error code.

Telegram structure: **sFA** error code

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Syntax or logic error	string	3	sFA
Error code	Contains the error's type (see the following table)	string	4	FF00h … FFFFh
Telegram syntax I: Syntax or logic errors				

Error code	Possible cause	Corrective measure
FF79h	Unknown name	The method or parameter name is unknown, check for typing errors.
FFC8h FFC9h	User level too low	A higher user level is required for access to the method or the parameter – change to the user level specified.
FF??h	General syntax error	Check telegram syntax: Command type, command, number and value range of parameters

Tab. 24: Syntax or logic error

10.2.1 Object start

The VMS generates this telegram as soon as the object enters into the scanning line (see chapter **3.3.3 Measuring modes**). You must activate the telegram in SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, ACTIVATE OBJECT START TELEGRAM option

Telegram structure: **2B**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Signals the start of the object	string	2	**2B**
Telegram syntax II: Start of object				

10.2.2 Object end

The VMS generates this telegram as soon as the object leaves the scanning line (see chapter **3.3.3 Measuring modes**). You must activate the telegram in SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, ACTIVATE OBJECT START TELEGRAM option

Telegram structure: **2E**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Signals the end of the object	string	2	**2E**
Telegram syntax III: End of the object				

10.2.3 Heartbeat

The VMS generates this telegram after an interval, which can be set and during which objects may not be measured. As a result, even during idling, the application also gets the option to cyclically check the device status. You must activate the telegram in SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, ACTIVATE HEARTBEAT TELEGRAM option

Telegram structure: **HH**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Heartbeat is output at an interval set in SOPAS	string	2	**2HH**
Telegram syntax IV: Heartbeat				

10.2.4 Standby

The telegram sends the VMS into standby mode.

Request

Telegram structure: **2I**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Place the VMS in the “idle/standby” mode	string	2	**2I**
Telegram syntax V: “Standby” request				

Reply

Telegram structure: **2I**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	VMS in “idle/standby” mode	string	2	**2I**
Telegram syntax VI: Response to “standby” request				

Example Request: 2I
Response: 2I

10.2.5 Measurement mode

The telegram sends the VMS into measuring mode.

Note After switching on the VMS, it is not necessary to transfer the telegram to the VMS. The system enters measuring mode independently and signals this by outputting the value 201.

Request

Telegram structure: **20**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Place VMS in measuring mode	string	2	**20**
Telegram syntax VII: “Measuring mode” request				

Confirmation

Telegram structure: **20**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	VMS is placed in measuring mode	string	2	**20**
Telegram syntax VIII: Confirmation of the “measuring mode” request				

Reply

Telegram structure: **201**

Telegram section	Description	Variable type	Length (byte)	Value range
Command type	Approx. 120 seconds after receiving the request or 180 seconds after switching on, the VMS is in measuring mode	string	3	**201**
Telegram syntax IX: Response to the “measuring mode” request				

Example Request: 20
Confirmation: 20
Response: 201

10.3 Measured data telegrams reference

10.3.1 Basic measured data telegram (metric values)

You can choose the basic measured data telegram within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;SerialNumberMaster; SerialNumberSlave;Index;MeasurementStatus;CS

Telegram section	**Description**	**Variable type**	**Length (byte)**	**Value range**
Command	Start of measured data output	string	2	**DI**
Unit	M for metric in mm	string	1	**M** metric values
Length	Longest side of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Width	Width of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Height	Height of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
SerialNumberMaster	Outputs the serial number of the VMD master	string	8	**00000000** **99990000**
SerialNumberSlave	Outputs the serial number of the VMD slave	string	8	**00000000** **99990000**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax X: Basic measured data telegram (metric values)				

Example

Output	DI;M;0500;0400;0350;03404711;03404712;0123;0000;AC34

10.3.2 Basic measured data telegram (values in inches)

You can choose the basic measured data telegram within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;SerialNumberMaster; SerialNumberSlave;Index;MeasurementStatus;CS

Telegram section	Description	Variable type	Length (byte)	Value range
Command	Start of measured data output	string	2	**DI**
Unit	I for values in inches	string	1	**I** values in inches
Length	Longest side of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Width	Width of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Height	Height of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
SerialNumberMaster	Outputs the serial number of the VMD master	string	8	**00000000** **99990000**
SerialNumberSlave	Outputs the serial number of the VMD slave	string	8	**00000000** **99990000**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**

Telegram syntax XI: Basic measured data telegram (values in inches)

Example

Output	DI;I;00500;00400;00350;03404711;03404712;0123;0000;AC34

10.3.3 Basic measured data telegram 2 (metric values)

You can choose the basic measured data telegram 2 within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;ScaleValueLength; ScaleValueWidth;ScaleValueHeight;SerialNumberMaster; SerialNumberSlave1;SerialNumberSlave2; SerialNumberSlave3;Index;MeasurementStatus;CS

Telegram section	Description	Variable type	Length (byte)	Value range
Command	Start of measured data output	string	2	**DI**
Unit	M for metric in mm	string	1	**M** metric values
Length	Longest side of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Width	Width of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Height	Height of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
ScaleValueLength	Scale values of length, width and height in mm	string	4	**0000** **9999**
ScaleValueWidth	The relevant value depends on the values defined in SOPAS and the	string	4	**0000** **9999**
ScaleValueHeight	Speed of the conveyor system	string	4	**0000** **9999**
SerialNumberMaster	Outputs the serial number of the VMD master	string	8	**00000000** **99990000**
SerialNumberSlave1	Outputs the serial number of the VMD slave	string	8	**00000000** **99990000**
SerialNumberSlave2	Always outputs 00000000	string	8	**00000000**
SerialNumberSlave3	Always outputs 00000000	string	8	**00000000**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax XII: Basic measured data telegram 2 (metric values)				

Example

Output	DI;M;0500;0400;0350;0010;0010;0005;03404711;03404712; 00000000;0000000;0123;0000;AC34

10.3.4 Basic measured data telegram 2 (values in inches)

You can choose the basic measured data telegram 2 within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;ScaleValueLength; ScaleValueWidth;ScaleValueHeight;SerialNumberMaster; SerialNumberSlave1;SerialNumberSlave2; SerialNumberSlave3;Index;MeasurementStatus;CS

Telegram section	Description	Variable type	Length (byte)	Value range
Command	Start of measured data output	string	2	**DI**
Unit	I for values in inches	string	1	**I** values in inches
Length	Longest side of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Width	Width of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Height	Height of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
ScaleValueLength	Scale values of length, width and height in inch/100	string	4	**0000** **9999**
ScaleValueWidth	The relevant value depends on the values defined in SOPAS and the	string	4	**0000** **9999**
ScaleValueHeight	Speed of the conveyor system.	string	4	**0000** **9999**
SerialNumberMaster	Outputs the serial number of the VMD master	string	8	**00000000** **99990000**
SerialNumberSlave1	Outputs the serial number of the VMD slave	string	8	**00000000** **99990000**
SerialNumberSlave2	Always outputs 00000000	string	8	**00000000**
SerialNumberSlave3	Always outputs 00000000	string	8	**00000000**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax XIII: Basic measured data telegram 2 (values in inches)				

Example

Output	DI;I;00500;00400;00350;0400;0400;0200; 03404711;03404712;00000000;0000000;0123;0000;AC34

10.3.5 Extended measured data telegram (metric values)

You can choose the extended measured data telegram within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;BoxVolume;RealVolume;Angle; MeasurementStatus;Index;CS

Telegram section	**Description**	**Variable type**	**Length (byte)**	**Value range**
Command	Start of measured data output	string	2	**DI**
Unit	M for metric in mm	string	1	**M** metric values
Length	Longest side of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Width	Width of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Height	Height of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
BoxVolume	Box volume of the smallest box that fully encloses the object in cm^3	string	7	**0000000** **9999999**
RealVolume	Same value as box volume	string	7	**0000000** **9999999**
Angle	Angle of the smallest box that fully encloses the object in 1/10 degree	string	4	**± 000** **± 999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax XIV: Extended measured data telegram (metric values)				

Example

Output	DI;M;0500;0400;0350;0070000;0070000;+433;0000;0123;AC34

10.3.6 Extended measured data telegram (values in inches)

You can choose the extended measured data telegram within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;Volume;RealVolume;Angle; MeasurementStatus;Index;CS

Telegram section	Description	Variable type	Length (byte)	Value range
Command	Start of measured data output	string	2	**DI**
Unit	I for values in inches	string	1	**I** values in inches
Length	Longest side of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Width	Width of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Height	Height of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
BoxVolume	Box volume of the smallest box that fully encloses the object in $inch^3/10$	string	7	**0000000** **9999999**
RealVolume	Real volume of the smallest box that fully encloses the object in $inch^3/10$	string	7	**0000000** **9999999**
Angle	Angle of the smallest box that fully encloses the object in 1/10 degree	string	4	**± 000** **± 999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax XV: Extended measured data telegram (values in inches)				

Example

Output	DI;I;00500;00400;00350;0070000;0070000;+433;0000;0123;AC34

10.3.7 Extended measured data telegram 2 (metric values)

You can choose the extended measured data telegram within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;Angle;Index;MeasurementStatus; MeasurementStatus2;CS

Telegram section	**Description**	**Variable type**	**Length (byte)**	**Value range**
Command	Start of measured data output	string	2	**DI**
Unit	M for metric in mm	string	1	**M** metric values
Length	Longest side of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Width	Width of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Height	Height of the smallest box that fully encloses the object in mm	string	4	**0000** **9999**
Angle	Angle of the smallest box that fully encloses the object in 1/10 degree	string	4	**± 000** **± 999**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
MeasurementStatus2	0 = OK	string	8	**00000000** **99990000**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax XVI: Extended measured data telegram 2 (metric values)				

Example

Output	DI;M;0500;0400;0350;+433;0123;0000;00000000;AC34

10.3.8 Extended measured data telegram 2 (values in inches)

You can choose the extended measured data telegram within SOPAS.

PROJECT TREE, VMDX20_XX00, PARAMETERS, INTERFACES, HOST, OUTPUT VIA HOST INTERFACE section, MEASURED DATA TELEGRAM selection field

PROJECT TREE, VMDX20_XX00, PARAMETERS, DATA PROCESSING, UNIT/SCALE VALUES, UNIT/ROUNDING section, UNIT selection field

Telegram structure	**DI**;Unit;Length;Width;Height;Angle;Index;MeasurementStatus;MeasurementStatus2;CS

Telegram section	Description	Variable type	Length (byte)	Value range
Command	Start of measured data output	string	2	**DI**
Unit	I for values in inches	string	1	**I** values in inches
Length	Longest side of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Width	Width of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Height	Height of the smallest box that fully encloses the object in inch/100	string	5	**00000** **99999**
Angle	Angle of the smallest box that fully encloses the object in 1/10 degree	string	4	**± 000** **± 999**
Index	Telegram counter initialized with 1	string	4	**0000** **9999**
MeasurementStatus	0 = OK	string	4	**0000** **9999**
MeasurementStatus2	0 = OK	string	8	**00000000** **99990000**
CS	Checksum of the above-described commands in accordance with CRC 16	string	4	**0000h** **FFFFh**
Telegram syntax XVII: Extended measured data telegram 2 (values in inches)				

Example

Output	DI;I;00500;00400;00350;+433;0123;0000;00000000;AC34

10.4 Ordering information

10.4.1 Available systems

Part number	Device type	Designation
1041964	VMS420-2000	Volume measurement system
1043951	VMS520-2000S02	OIML- and MID-certified volume measurement system for measuring cubic and irregularly shaped bodies on belt conveyors
1046650	VMS520-2000S04	OIML- and MID-certified volume measurement system for measuring cubic and irregularly shaped bodies in crossbelt applications

Tab. 25: Available systems

10.4.2 General accessories

Part number	Device type	Designation
4039783	Hollow shaft	Length 2.5 m, d = 50 mm, h6 surface, hardened and ground, weight approx. 20 kg
2030886	Mounting block set	For mounting the hollow shaft on the frame
2039457	Incremental encoder	0.2 mm/increment Resolution
2034693	Photoelectric sensor set	WL18 with holder, open cable end
4040035	Test object	202 × 302 × 402 mm test object, indispensable for commissioning

Tab. 26: General accessories

10.4.3 Interface sets

Part number	Device type	Designation
2031362	CDM interface set	2x CDM490-0001 3 cables, male/female connector, 10 m 1 set of mounting material (sliding nuts, screws)
2031363	CDM/CMP interface set	2x CDM490-0001 2x CMP490 3 cables, male/female connector, 10 m 1 set of mounting material (sliding nuts, screws)

Tab. 27: Interface sets

10.4.4 Male connector cover sets

Part number	Device type	Designation
2031364	Male connector cover set, M screw fittings	1 Male connector cover, M screw fittings, master 1 Male connector cover, slave 1 power connection cable, CAN, 3 m 1 FSI cable for male connector covers
2031365	Male connector cover set, M12 male connector	1 Male connector cover, M12 screw fittings, master 1 Male connector cover, slave 1 power connection cable, CAN, 3 m 1 FSI cable for male connector covers 2 male connectors for triggers and incremental encoders 1 female cable connector for “Host” connection 1 cable, female connector stripped, 10 m
2031366	Male connector cover set cables (3 m)	1 male connector cover, master, 3 m 1 male connector cover, slave, 3 m 1 FSI cable for male connector covers 2x CDM490-0001 1 set of mounting material (sliding nuts, screws)
2031399	Male connector cover set cables (3 m) + voltage supply	1 male connector cover, master, with cable, 3 m 1 male connector cover, slave, with cable, 3 m 1 FSI cable for male connector covers 2x CDM490-0001 2x CMP490 1 set of mounting material (sliding nuts, screws)

Tab. 28: Male connector cover sets

10.4.5 Accessories for male connector covers

Part number	Device type	Designation
2031372	Communication cable	1 communication cable (3 m) for terminal interface in the male connector cover, with M screw fittings

Tab. 29: Accessories for male connector covers

10.4.6 Measuring head spare parts

Part number	Device type	Designation
1041723	VMD420-2000	Not calibratable
1041724	VMD500-2000	Calibratable

Tab. 30: Measuring head spare parts

10.5 Glossary

Note For other terms, see also the online help for the SOPAS configuration software.

Aperture angle α

Angle, within the bounds of which, the laser beam is deflected by the polygon mirror wheel. A v-shaped area, in which the objects to be measured must be located, is created radially in front of the laser output aperture in the scanning direction.

Box volumes

The VMS determines the length, width and height of an object and calculates the volume of the smallest box that fully encloses the object (the box volume) from these data.

Download

Process of transmitting the parameter set, which was modified offline using the SOPAS configuration software, from the PC to the VMD. SOPAS either always transmits a complete copy to the working memory (RAM) of the VMD, (COMMUNICATION menu, DOWNLOAD ALL PARAMETERS TO DEVICE) or only the parameters that have just been edited, using the context menu called using the right mouse button (COMMUNICATION menu, DOWNLOAD CHANGED PARAMETERS TO DEVICE). The parameter set is permanently saved in the EEPROM of the VMD using the menu VMDX20_XX00, PARAMETERS, SAVE PERMANENTLY.

Functional interfaces

Switching inputs and outputs of the VMS.

Host interface

Main data interface for the VMS with configurable data output format. Among other things, this is used for outputting the measurement result in the form of a telegram to the host/the programmable logic controller. It is used to integrate the VMS into the SICK network. Can be electrically connected as RS-232 or RS-422. Makes various transmission protocols available.

Line scanner

Scanner, which deflects its focused laser beam very fast with the aid of a polygon mirror wheel with axially parallel mirrors. As a result, it generates a light spot in the measuring plane, which runs repeatedly on a straight line (row) and is visible to the human eye owing to the relative inactivity as a “resting” scanning line.

Master/slave configuration

Specific arrangement and wiring connection of two VMD volume measurement devices.

Parameter set

Data set, using which the implemented functions are initialized and activated in the VMD. This is transmitted from VMD to SOPAS or vice versa using UPLOAD or DOWNLOAD.

RIS

Remission information system: The RIS value corresponds to the remission value without the use of the scaling factor. It reproduces the reflectivity of the object at the point of measurement determined by the system in percent. A small RIS value indicates a low reflectivity (generally a dark object).

Scanning line

See line scanner.

SOPAS

Configuration software, capable of running on Windows 98/NT 4.0/2000/XP. Used for offline configuration (adaptation to the reading situation on site) and online operation of the VMS in the dialog box.

SOPAS setup help

Online help, which assists with the use of the SOPAS configuration software. The functions of the VMS parameters are explained and the relevant set of values is specified in the help. This runs in an HTML browser, e.g., Internet Explorer or in I-ViewPro (supplied) and can be called up from SOPAS setup.

Terminal interface

Auxiliary data interface (RS-232) of the VMS with a fixed data output format. It can always be used to gain access to the VMD using the SOPAS configuration software. Among other things, it is used for outputting system and error messages.

Upload

Process of transmitting the parameter set from VMS to the PC and into the SOPAS configuration software. Parameter values are displayed on the tabs in the configuration software. This is a requirement if you wish to modify the current parameter set.

10.6 Conformity to EU directives

EU declaration of conformity (extract)

The undersigned, who represents the manufacturer below, hereby declares that the product complies with the regulations of the EU directive(s) below (including all relevant changes), and that it is based on the relevant standards and/or technical specifications.

Complete EU declaration of conformity for download

You can call up the EU declaration of conformity and the current operating instructions for the protective device by entering the item number in the search field at www.sick.com (item number: see the type label entry in the **Ident. no.** field).

Following standardization (sometimes referred to as “calibration” above), the system officially conforms to the following directive:

- Measuring Instruments Directive: 2014/32/EU (04/20/2016)

The customer will receive the certificate on completion of the standardization process.

10.7 Figures and tables

10.7.1 List of tables

10.7.2 List of figures

10.7.3 Keywords index

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