



Operating instructions  
Acceleration sensors

**GB**

**VSA/  
VSM/  
VSP**



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# 1 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system creator undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

## 2 Symbols used

- ✓ Requirement
- ▶ Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note  
Non-compliance may result in malfunction or interference.
-  Information  
Supplementary note

### **3 Intended use**

The device is designed for vibration detection on machines and systems and for measuring the acoustic emission (acceleration).

- For connection to diagnostic electronics (e.g. VSE)

## 4 Function

Acceleration sensors measure the acoustic emission (acceleration) on non-rotating surfaces. The output signal of the sensor is the unfiltered raw signal of the acceleration within the scope of the specifications indicated in the data sheet.

### 4.1 Measuring principles / interfaces

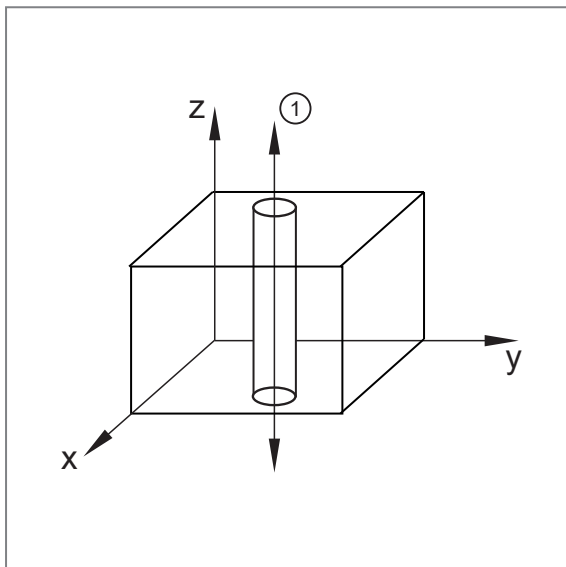
- MEMS sensors (Micro-Electro-Mechanical Systems) are based on a capacitive measuring principle.
- Piezo sensors use the piezo-electric effect.

Device family	Measuring principle*	Interface
VSA	MEMS	analogue current output
VSP	Piezo	IEPE
VSM	MEMS	(Integrated Electronics Piezo Electric), analogue voltage signal with constant supply current

\* Recommendation: use MEMS based sensors when measuring accelerations of moving objects.

### 4.2 Axis orientation

For all one-axis sensors, the z axis is the measuring direction. The z axis corresponds to the screwing direction.



1: Installation direction

### 4.3 Self-test

Together with ifm's diagnostic units (VSE), MEMS sensors offer the possibility to carry out a self-test.

The sensor's measuring cell is artificially excited. The response to this excitation is measured and evaluated via the measuring line. The function of the entire measuring chain, including the measuring cell, is actively monitored.

In the case of piezo sensors that are connected to a suitable evaluation unit (e.g. VSE diagnostic electronics), an operating point (constant current) is reached to allow wire break monitoring. Testing the measuring cell is not possible.

With VSM sensors, the self-test of the measuring cell is only carried out via the z axis.

- ▶ Connect the corresponding cables (z axis and self-test line) to the same terminal of a suitable evaluation unit (e.g. VSExxx).
- ▷ The self-test is carried out correctly.

## 5 Installation

The measuring direction should be in the direction of the main vibration. The main vibration is usually in radial direction to the shaft.

In case of fixed bearings with high axial force absorption or axial bearings, the recommended measuring direction is axial to the shaft.

- ▶ Mount only in a thick housing wall and vertically to the machine surface close to the bearing or at the end shield.
- ▶ Note the measuring direction of the sensor.
- ▶ Ensure a safe vibration transmission and allow no elastic intermediate layers.

Adapters of any kind have an impact on the vibration measurement. The mass, shape and stiffness of the adapter have an influence on the frequency response of the entire system. Both resonances and damping effects may occur in different frequency ranges.

- ▶ For all installation types, tighten the sensor with the tightening torque indicated in the data sheet.



- ▶ A tightening torque that is too low may lead to insufficient coupling between the sensor and the machine whereas a tightening torque that is too high may damage the sensor and the screw.

### 5.1 Prepare contact surface

- ▶ Prepare a clean and smooth contact surface that is free from any coating to fix the sensor.

The prepared contact surface must be a little larger than the sensor or the mounting adapter.

### 5.2 Types of mounting

The following table indicates the transferable measuring range of 3 different types of mounting.

Type of mounting	Frequency range
Screw	up to 15 kHz
Direct gluing	up to 8 kHz
Magnet	up to 3 kHz

#### 5.2.1 Screw

For the permanent installation of sensors a screw connection is the ideal and recommended method.

- ▶ Screw sensor.
- ▶ Increase the stiffness of the connection using screw retaining compound.

#### 5.2.2 Glue

Gluing is suitable for temporary measurements or if the surface is not suitable for a screw connection.

- ▶ Use an adhesive adapter so that the sensor can be replaced.
- ▶ Fix the sensor on the adhesive adapter.
- ▶ Fix the adapter-sensor unit to the machine according to the instructions of the glue used.
- ▶ Apply the adhesive layer as thinly as possible.



- ▶ In general, methyl-cyanoacrylate adhesives (e.g. Loctite 454) or epoxy adhesives (e.g. Loctite EA 3450) are used.





- ▶ When choosing a suitable adhesive always take the materials and the environmental conditions (e.g. temperature range) into account.

### 5.2.3 Magnet

Using magnets is only recommended for temporary measurements and is only suitable for magnetic surfaces.

- ▶ Fix the sensor to the magnet.
- ▶ Carefully fix the magnet-sensor unit to the machine.

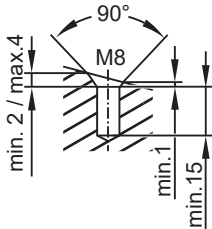


- ▶ Careless fixing can result in very high g-forces which may damage the sensor.

### 5.2.4 Fixing a sensor with a 90° cone

Bore the hole for the fitting according to the data sheet in compliance with common regulations and standards.

- ▶ On flat surfaces, make a conical bore hole or use a conical washer.
- ▶ Make a conical bore hole on tilted or curved surfaces.



## 6 Electrical connection



The unit must be connected by a qualified electrician.

- ▶ Observe the national and international regulations for the installation of electrical equipment.
- ▶ Disconnect power.
- ▶ Connect the device.

### 6.1 MEMS sensors with current output (VSA)

Connection of sensors with M12 connector or connecting cable with M12 connector

M12		Pin 1: L+
		Pin 2: Signal output (z axis)
		Pin 3: GND
		Pin 4: Self-test

Connection of sensors with connecting cable

Core colour	Signal
BN brown	L+
WH white	Signal output
BU blue	GND
BK black	Self-test
Drain wire	Cable shield

### 6.2 MEMS sensors with IEPE output (VSM)


Connection of sensors with connecting cable

Core colour	Signal
BN brown	IEPE x axis (if available)
WH white	IEPE z axis *)
BU blue	GND
BK black	Self-test *)
GY grey	IEPE y axis (if available)
Drain wire	Cable shield

\*) The self-test is only carried out via the z axis.


- ▶ Connect both cables (BK and WH) to the same terminal of a suitable evaluation unit (e.g. VSExxx).

Connection of sensors with M12 connector

M12		Pin 1: IEPE x axis (if available)
		Pin 2: IEPE z axis
		Pin 3: GND
		Pin 4: Self-test
		Pin 5: IEPE y axis (if available)

### 6.3 Piezo sensors with IEPE output (VSP)

Connection of sensors with M12 connector

M12		Pin 1: -
		Pin 2: IEPE z axis
		Pin 3: -
		Pin 4: GND

Connection of sensors with connecting cable

Core colour	Signal
BK black	GND
WH white	IEPE z axis
RD red	No connection
Drain wire	Cable shield

### 6.4 Connection to the VSE diagnostic electronics

VSE sensor input				Sensor output	
S1	S2	S3	S4	Current output	IEPE
9	16	20	24	BN: L+	n.c. (not used)
10	15	19	23	WH: measured signal	measured signal
11	14	18	22	BU: GND	GND
12	13	17	21	BK: self-test	n.c. (not used) / Self-test (if available)

### 6.5 Use of screened cables

- ▶ Use a screened cable to avoid conducted interference.
- ▶ All machine and electrical parts must be grounded.
- ▶ VSP devices: Fix the cable directly after the mounting location.



- ▷ Where several sensors are used on different machines, all devices must be connected to the same ground.
- ▷ This is to avoid induction loops via the diagnostic electronics.

#### 6.5.1 VSA / VSP devices

Recommendation: Screening on one side (preferably in the control cabinet).

In case of wired devices the screen is connected to the sensor housing and also to any existing M12 connector.

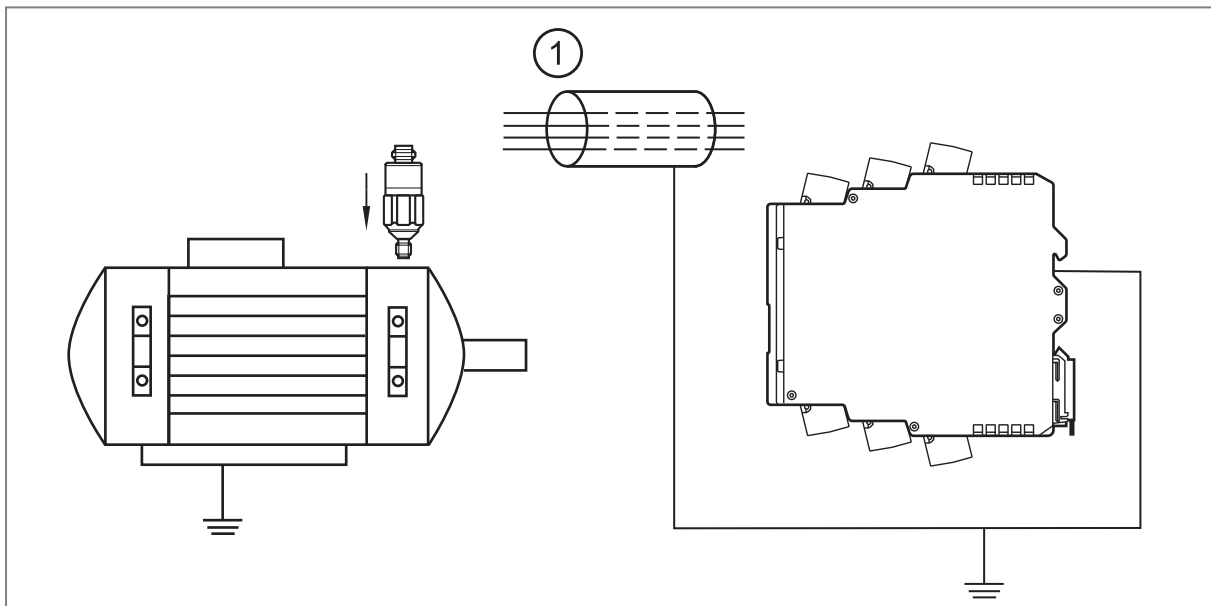
### 6.5.2 VSM devices

Recommendation: Screening on one side at the machine.

In case of wired devices the screen is connected to the sensor housing and also to any existing M12 connector.

## 6.6 Connection examples

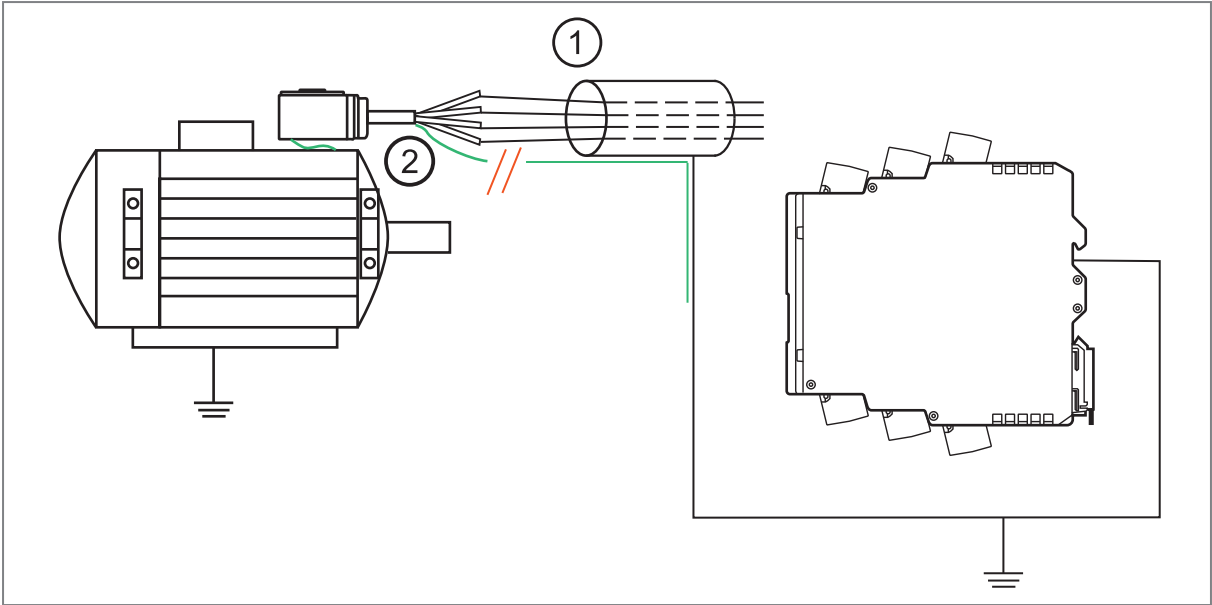
Recommended connection for sensors with M12 connector or connecting cable with M12 connector;  
Example VSA001



1: Screen

Recommended connection for sensors with connecting cable; Example VSA004

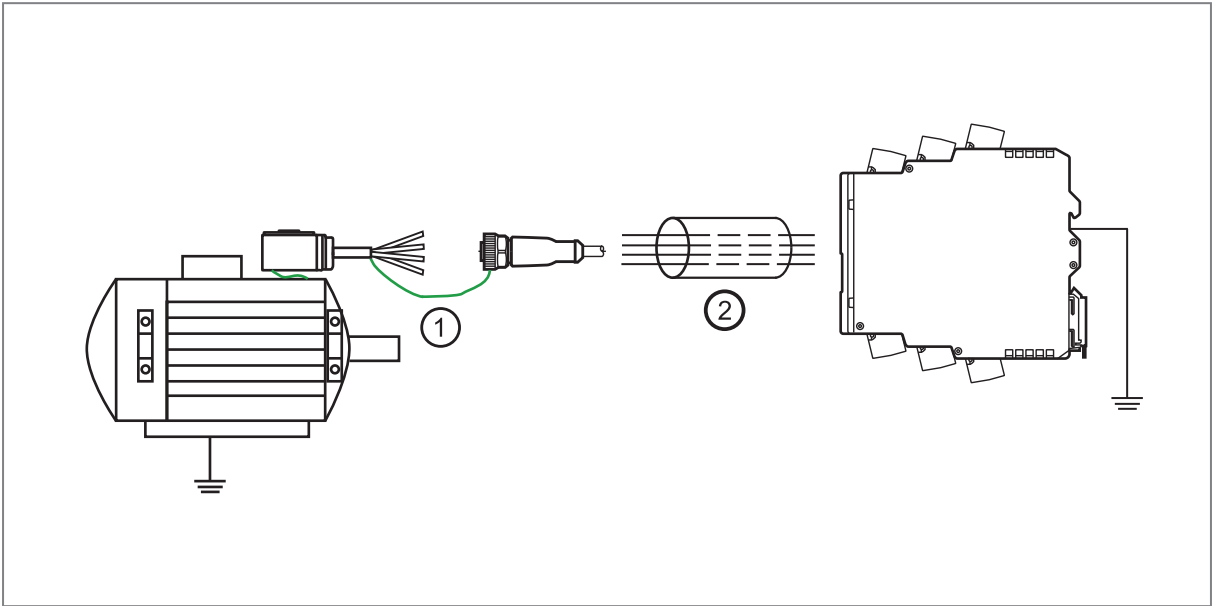
- Do not place the screen at the socket.



- 1: Screen
- 2: Drain wire

Recommended connection for VSM sensors with cable plug; Example VSM101

► Place the screen at the socket.



- 1: Drain wire
- 2: Screen

## **7 Maintenance, repair and disposal**

The operation of the unit is maintenance-free.

Only the manufacturer is allowed to repair the unit.

- ▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.