Vibration sensor

US67-VIB2...

3099110000/01/11.2024

Manufacturer
Weidmüller Interface GmbH & Co. KG
Klingenbergstraße 26
D-32758 Detmold, Germany
T +49 (0)5231 14-0
F +49 (0)5231 14-292083
www.weidmueller.com

Document no. 3099110000
Revision: 01/11.2024

Contents

1 About this documentation

These operating instructions are intended for all persons handling the product during its life cycle.
► Read the operating instructions completely before you install and start using the product.
► Keep the operating instructions after reading.

The operating instructions are considered part of the product.
► If you pass on the product to a third party, also pass on the operating instructions and the applicable documents.

1.1 Applicable documents

– Assembly instructions

All documents can be downloaded from the Weidmüller website www.weidmueller.com.

1.2 Illustrations and icons

► Action step
– Numbered lists

Sections of text next to this arrow contain notices which are not related to safety, but which provide important information regarding correct and effective work.

⚠ WARNING!

A note with the signal word “**WARNING!**” warns against a danger that can result in serious injury or death if it is not avoided.

⚠ CAUTION!

A note with the signal word “**CAUTION!**” warns against a danger that can result in injuries if it is not avoided.

ATTENTION!

A note with the signal word “**ATTENTION!**” warns against a danger that can result in damage to property or malfunctions of the product if it is not avoided.

Note for an electrician

Note referring to further documentation

Note for required tool

2 For your safety

2.1 Intended use

The sensors of the product family U67-VIB2... are intended for the measurement of vibration velocity, vibration acceleration and temperature on machines and mechanical systems. Typical applications include fans, blowers, electric motors, pumps, centrifuges, separators, generators, turbines and similar vibrating mechanical systems. The product may only be used in industrial environments within the technical specifications provided.

2.2 Personnel

The product must only be installed, put into operation, removed, and maintained by qualified electricians who are familiar with national and international laws, provisions and standards.

2.3 Safety notes

- The device is only intended for the application described in this document. Any other usage is unauthorised and can lead to accidents or damage to the device.
- Before carrying out any work on the device, it must be disconnected from the supply voltage.
- Connecting cables and extension cables must be protected against electrical interference and mechanical damage.
- Defective connecting cables and defective sensors must be replaced immediately.
- The device must not be modified or converted. Repairs may only be completed by Weidmüller.

cULus installation notes

The following additional installation notes apply for use within the scope of UL certification:

- Protection must be provided to prevent excessive power output in the event of a device fault. The protection must be applied to the supply and switching lines and can implemented by means of the following measures:
  - Fuses
  - Circuit breakers
  - Thermal cut-out
  - Impedance limiting circuits or similar means
- A circuit breaker suitable for 30 V / 3 A according to UL 489 / CSA C22.2 No.5 / IEC 60947-2 standard must be installed near the device.
- A fuse suitable for UL 248 / CSA C22.2 No.248 / IEC 60127 standard must be installed near the device. The fuse must have the triggering characteristic time-lag T.

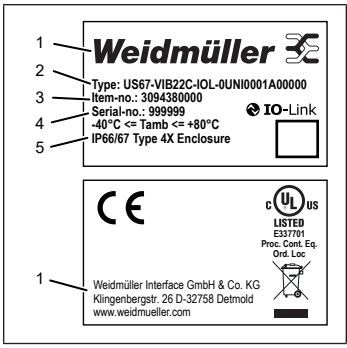
3 Product description

3.1 Product family

The vibration sensors of the product series US67-VIB20..., US67-VIB22... and US67-VIB24... are sensors for the measurement of vibration speed, vibration acceleration and temperature and can be used, for example, for monitoring the absolute bearing vibration on machines in accordance with the DIN ISO 10816 standard. The product series offer the following functions:

	US67-VIB20...	US67-VIB22...	US67-VIB24...
Outputs	Two outputs, freely configurable		
Output 1	Optional digital switching output	IO-Link or digital switching output	
Output 2	Analogue current output (4…20 mA)	Analogue current output (4...20 mA) or digital switching output	
Frequency range	10 Hz … 1000 Hz	10 Hz … 1000 Hz, configurable	1 Hz … 1000 Hz, configurable
Crest value formation	no		yes, 10 Hz … 10 kHz
Bearing Condition acc. to 13337-3	no		yes
Functional safety SIL 1 approval	see type plate		

3.2 Type plate



1 Manufacturer
2 Model, type designation
3 Order number
4 Serial number
5 Technical data

The following symbols are shown on the type plate.

IO-Link	IO-Link compatible
	Observe the disposal instructions
CE	EU conformity
cULus LISTED	cULus Listed

3.3 Product description

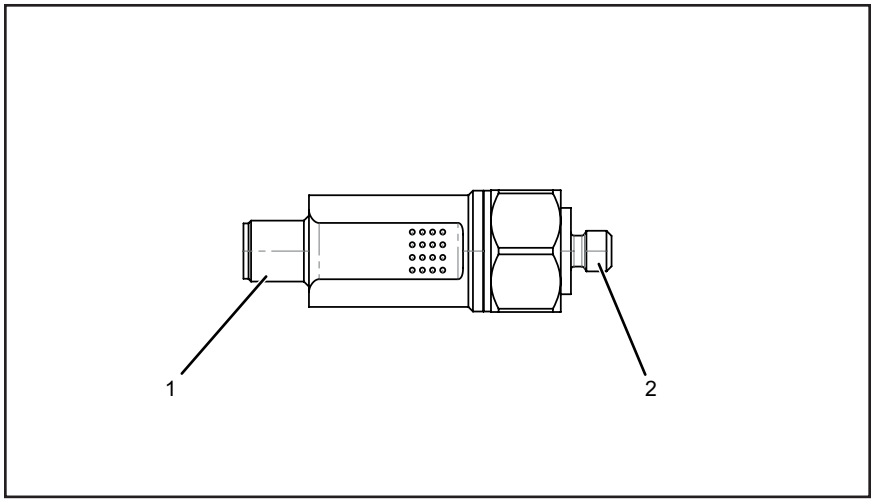


Figure 3.1 Device with M12 plug

1 M12 plug

2 Thread for installation

3.4 Dimensions

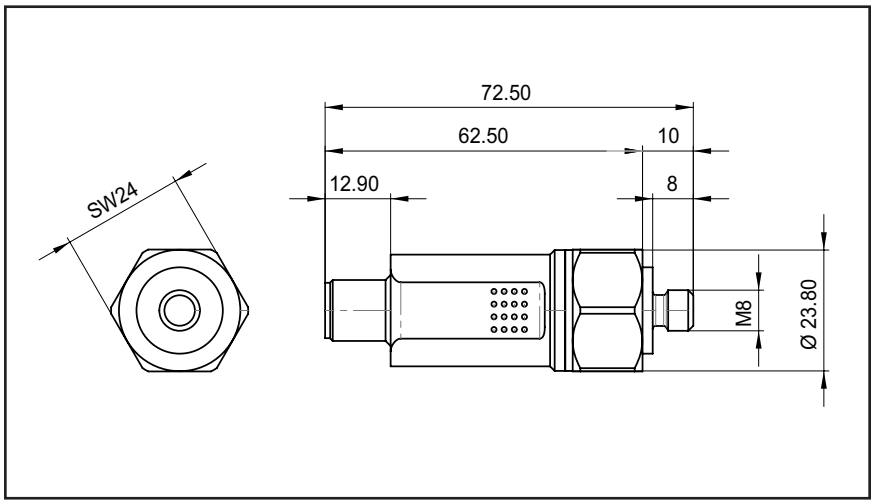


Figure 3.2 Device with M12 plug, Dimensions in mm

3.5 Technical data

	US67-VIB20...	US67-VIB22...	US67-VIB24
Accuracy	±10% (acc. to DIN ISO 2954) ±0.5% at calibration point		
Calibration point	90% measurement range at 159.2 Hz	1 g (rms) at 159.2 Hz	1 g (rms) at 159.2 Hz
Cross-sensitivity	< 5%		
Frequency range	10 Hz ... 1000 Hz	10 Hz ... 1000 Hz, selectable v_rms, a_rms, a_peak: 10 Hz ... 1000 Hz, selectable	1 Hz ... 1000 Hz, selectable v_rms, a_rms: 1 Hz ... 1000 Hz, selectable a_peak, crest and bearing condition: 10 Hz ... 10 kHz, calculated
Max. acceleration	±15 g		±48 g
Service life	10 years		
Electrical data			
Power supply[1]	18 ... 30 V DC[1]		
Max. current consumption	700 mA		320 mA
Max. current consumption without switching contacts	120 mA		
Output Out 1 (pin 4)			
Output signal	Optional digital switching contact	IO-Link or switching contact	
Output Out 2 (pin 2)			
Output signal	4 ... 20 mA (proportional to the measurement range)	4 ... 20 mA (proportional to the measurement range) or switching contact	
Switching contacts			
Output signal	Switching signal		
Electrical version	PNP		
Output function	NO contact / NC contact (low-active / high-active)		
Switching level[2]	0 V: Low 24 V: High[2]		
Current-carrying capacity per output	100 mA (Out 1) 500 mA (Out 2)		100 mA (Out 1) 100 mA (Out 2)
Short-circuit protection[1]	✓[1]		
Overload-proof[1]	✓[1]		
Fixation	Width across flats 24 (hexagon) M8 x 8 mm Pitch: 1.25 mm (standard)		
Measuring direction	Along the fixing axis		
Sensor tightening torque	8 Nm		
Max. torque of the M12 union nut on the plug	0.4 Nm		
Weight	90 g		
Degree of protection	IP 66/67, type 4X enclosure Product suitable for outdoor applications		
Ambient temperature T_A	$-40\ °C \leq T_A \leq +80\ °C$		
Measuring head temperature T_M	$-40\ °C \leq T_M \leq +85\ °C$		
Max. relative humidity (no condensation)	100%		
1) To operate the sensor in compliance with UL, the supply and data lines must be protected by a UL-approved fuse. 2) The high level corresponds to the supply voltage minus 2 V.			

3.6 Operating range of the vibration sensor

The operating range is independent of the measurement range and can be derived from the maximum acceleration (see Chapter 3.5). The maximum acceleration is identical across all frequencies. The maximum measurable vibration speed is given by the formula

$$v_{max} = \int a_{max}$$

For sinusoidal vibrations

$$v_{max} = \frac{a_{max}}{2\pi f}$$

The operating range of the vibration monitoring is limited by the maximum measurable vibration speed as a function of the frequency (see Fig. 3.3)

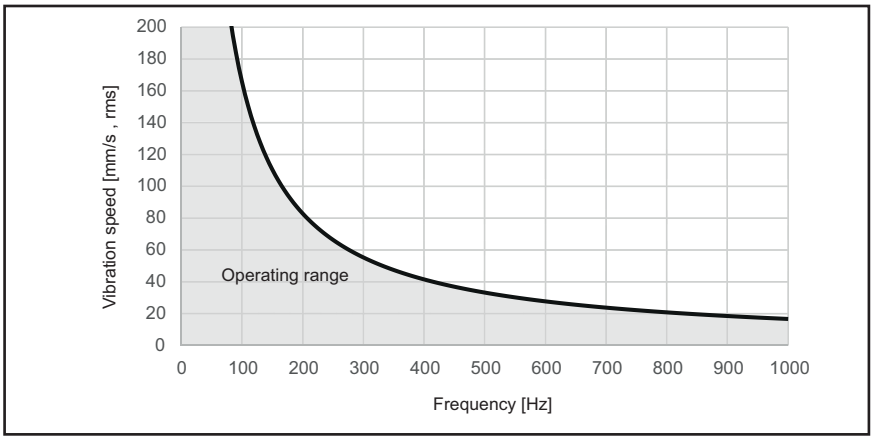


Figure 3.3 Operating range US67-VIB20... / US67-VIB22...

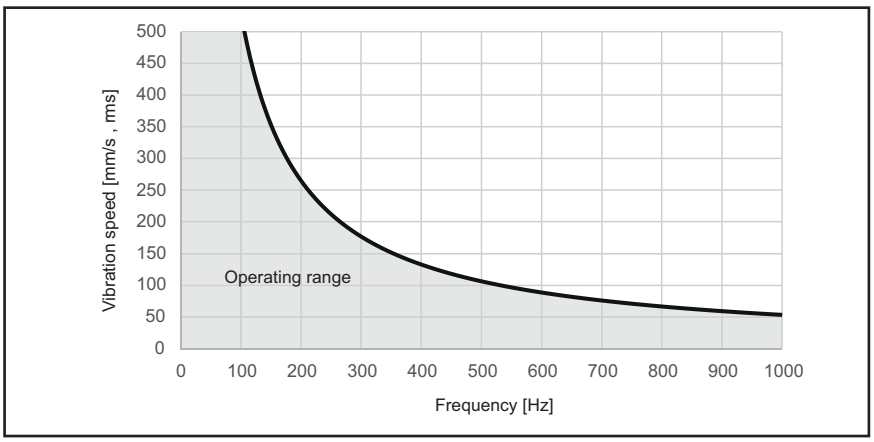


Figure 3.4 Operating range US67-VIB24...

	US67-VIB20... US67-VIB22...	US67-VIB24...
Frequency (Hz)	Maximum measurable vibration speed (mm/s, rms)	
250	66.2	212
400	41.4	132.5
1000	16.6	53

3.7 Typical frequency response

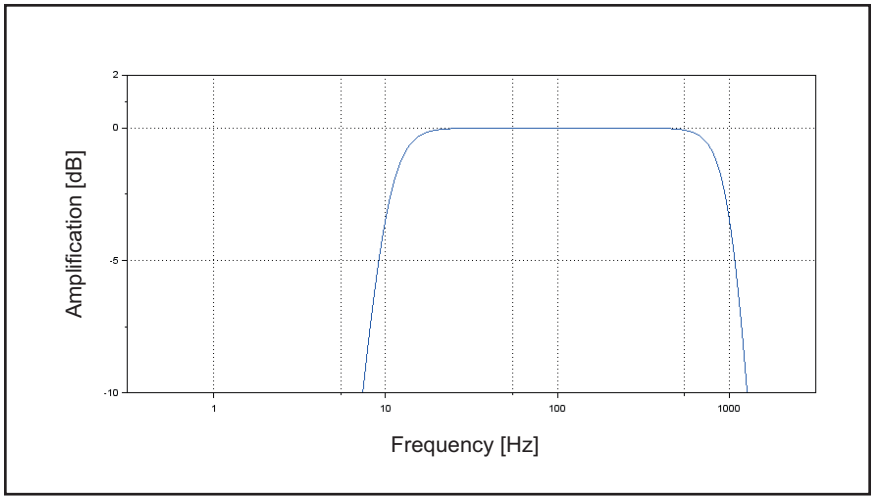


Figure 3.5 Typical frequency response 10 Hz bis 1000 Hz (US67-VIB20... / US67-VIB22...)

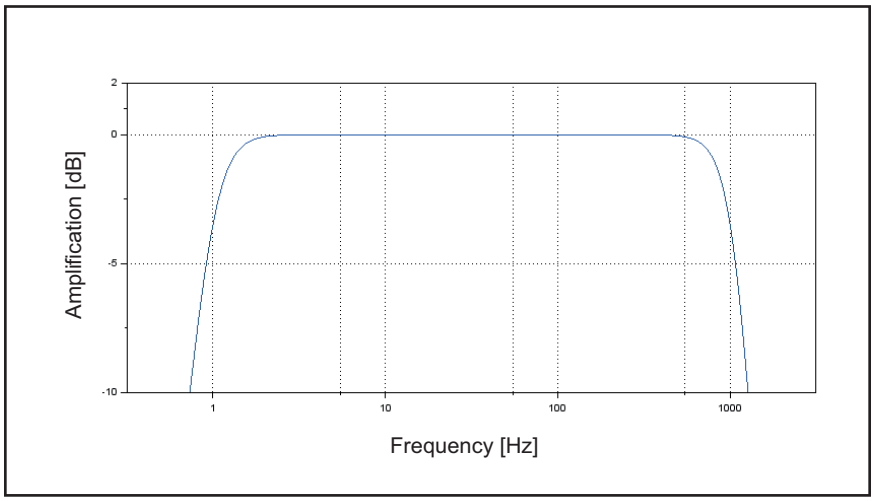


Figure 3.6 Typical frequency response 1 Hz to 1000 Hz (US67-VIB24...)

4 IO-Link product function

IO-Link is a globally standardised IO technology (IEC 61131-9) for communication with sensors and actuators. The powerful point-to-point communication is based on the 3-conductor sensor and actuator connection, without additional requirements for the cable material. IO-Link can be used to both read and write data. This requires an IO-Link master, which you can purchase separately.

The sensor meets the standard IO-Link System and Interface 1.1 (V.1.1.3) and Compliance IO-Link 1.1. Version 1.1.3 / Package 2020.
All parameters and addresses are listed in detail in a separate document for the interface description. In addition, Weidmüller provides an IO-DD (IO Device Description) file for the IO-Link master. You can finde the files and documents in the Weidmüller Support Center.

4.1 Overview of functions

Measured and process variables

The following measured and process variables can be called up continuously via IO-Link.
– RMS value for vibration speed (0.01 mm/s, rms)
– RMS value for vibration acceleration (0.01 g, rms)
– Peak value for vibration acceleration (0.01 g, peak)
– Temperature (1 °C)
– Status of the internal self-test
– Fault state
– States of all switching signals
– Crest value (only US67-VIB24...)
– Bearing condition (only US67-VIB24...)

Outputs

The two outputs can have the following assignments:

	Assignment		
	Option 1	**Option 2**	**Option 3**
Output 1	IO-Link interface	Switching contact	Unassigned
Output 2	Analogue output 4…20 mA	Switching contact	Disabled

All measured variables are available as analogue signals. The measurement range of the analogue signal can be freely selected in a defined range.

Switching signal

Two configurable switching signals (pre-alarm and main alarm) are available in the sensor for each measured or process variable. These can be output via IO-Link or one of the two outputs configured as switching contacts. The following settings can be made individually for each switching signal:

Setting	Description
Limit values	Adjustable in the respective unit of the measured variable
Time delay [ms]	1 ms … 60000 ms
Mode	0: deactivated 1: Alarm function (single point, limit value 2 is ignored) 2: Window function (the signal switches as soon as the value falls below limit value 2)
Hysteresis	Switching delay with respect to limitation. The limit is 2% by default and can only be freely configured for the temperature (0 K … 20 K).

Frequency ranges (filter settings)

Four predefined frequency ranges are available for selection:
– 10 Hz … 1000 Hz
– 10 Hz … 500 Hz
– 10 Hz … 100 Hz
– 10 Hz … 50 Hz

In addition, the following predefined frequency ranges can be selected for the product family US67-VIB24...:

– 1 Hz … 1000 Hz
– 1 Hz … 500 Hz
– 1 Hz … 100 Hz
– 1 Hz … 50 Hz

Maintenance data

The following data is available via IO-Link only and cannot be configured on the outputs.

Counter

It is possible to configure a further limit value per measured variable (independently of the previously mentioned switching signals). Relative to this limit value, there is a counter that counts the number of exceedances and a counter that counts the sum of the duration of the exceedances. An IO-Link event can be configured for both counters. This reports that a counter value to be configured has been exceeded.

Raw signal via BLOB

For detailed vibration analyses an acceleration signal can be recorded for a specific duration and transmitted with delay using a BLOB (binary large object).
The recording duration and sample rate can be configured via IO-Link. The maximum sample rate is 64 kHz with a 12 kHz low-pass filter. The memory can store up to 320,000 measurement points

5 Transport and storage

ATTENTION!

Product damage or faults

Improper transport and storage may result in damage to the product.

- ► Protect the product from harmful environmental influences and mechanical damage, e.g. by storing and transporting it in its original packaging.
- ► Store the product according to the recommended ambient conditions (see Chapter 3.5).

6 Mounting and installation

⚠ WARNING!

Gefahr des elektrischen Schlags

► Before carrying out any work on the device, it must be disconnected from the supply voltage.

► The housing of the sensor must be earthed via the machine earth of the mounting surface or via a separate protective conductor (PE).

Assembly and installation of the device is described in the installation instructions, document no. 3095670000. The document can be found in the Weidmüller product catalogue and in the product packaging.

► Observe the safety information (Chapter 2) and the information in the technical data (Chapter 3.5).

Select a mounting surface that fulfils the following requirements.
– The mounting surface is even and clean, i.e. free of paint, rust, etc.
– There is an M8 x 10 mm threaded hole on the assembly surface orthogonal to the axis of rotation.
– Suitable ambient conditions

The following applies to outdoor use or use with splash water: The sensor must be protected by a protective rubber sleeve (see accessories in the product catalogue)..

You can find additional documentation and other optional accessories in the product catalogue:
– Mounting adapter
– Connecting cables
– Protective metal hoses

7 Accessories

Order no.	Product description	Product characteristics	Suitable for		
Mounting adapter			**VIB2X**	**VIB4X**	**VIB6X**
3069360000	US67-MNT-00M08-00M06-000	Mounting adapter M8 - M6, AF24	✓	✓	–
3069470000	US67-MNT-00M08-000M8 -CON	Mounting adapter M8 - M8 Konus, AF30	✓	✓	✓
3072980000	US67-MNT-00M08-00M10-S30	Mounting adapter M8 - M10, AF30	–	–	✓
3073200000	US67-MNT-00M08-00M10-S24	Mounting adapter M8 - M10, AF24	✓	✓	–
3073210000	US67-MNT-00M08-00M12-S30	Mounting adapter M8 - M12, AF30	–	–	✓
3073300000	US67-MNT-00M08-00M12-S24	Mounting adapter M8 - M12, AF24	✓	✓	–
3073330000	US67-MNT-00M08-00M16-000	Mounting adapter M8 - M16, AF30	✓	✓	✓
3073360000	US67-MNT-00M08-00M20-000	Mounting adapter M8 - M20, AF30	✓	✓	✓
3073370000	US67-MNT-00M08-00M24-000	Mounting adapter M8 - M24, AF30	✓	✓	✓
3073380000	US67-MNT-00M08-00M30-000	Mounting adapter M8 - M30, AF30	✓	✓	✓
3073540000	US67-MNT-00M08-003/8-000	Mounting adapter M8 - 3/8" UNF 28A, AF24	✓	✓	–
3073550000	US67-MNT-00M08-01/4U-000	Mounting adapter M8 - 1/4" UNF 28 G, AF24	✓	✓	–
3073570000	US67-MNT-00M08-01/4N-000	Mounting adapter M8 - 1/4" NPT, AF24	✓	✓	–
3073690000	US67-MNT-00M08-01/2B-000	Mounting adapter M8 - 1/2" BSPT, AF24	✓	✓	–
3073700000	US67-MNT-00M08-0GLUE-000	Adhesive adapter M8 on adhesive surface	✓	✓	✓
3073740000	US67-MNT-00M08-0MAG1-000	Mounting adapter M8 to magnet flat	✓	✓	✓
3073750000	US67-MNT-00M08-0MAG2-000	Mounting adapter M8 on convex magnet	✓	✓	✓
Cables					
3106100500	SAIL-M12BG-4SD5.0UBL	Socket-open, length 5 m	–	✓	–
3106101000	SAIL-M12BG-4SD10UBL	Socket-open, length 10 m	–	✓	–
1890520500	SAIL-M12BG-8S5.0U	Socket-open, length 5 m	–	–	✓
1890521500	SAIL-M12BG-8S15U	Socket-open, length 15 m	–	–	✓
1812540150	SAIL-M12BG-4S1.5U	Socket-open, length 1.5 m	✓	–	–
1812540500	SAIL-M12BG-4S5.0U	Socket-open, length 5 m	✓	–	–
1812541000	SAIL-M12BG-4S10U	Socket-open, length 10 m	✓	–	–
3107900200	SAIL-M12BG-4SA2.0U	Socket-open, length 2 m	–	✓	–
3107900500	SAIL-M12BG-4SA5.0U	Socket-open, length 5 m	–	✓	–
1058500150	SAIL-M12GM12G-4S1.5U	Socket-pin, length 1.5 m	✓	–	–
1058500500	SAIL-M12GM12G-4S5.0U	Socket-pin, length 5 m	✓	–	–
1058501000	SAIL-M12GM12G-4S10U	Socket-pin, length 10 m	✓	–	–
Protective rubber sleeves					
3074630000	US67-SLV-VIB2X	Protective rubber sleeves	✓	–	–
3074640000	US67-SLV-VIB4X	Protective rubber sleeves	–	✓	–
3074650000	US67-SLV-VIB6X	Protective rubber sleeves	–	–	✓
Protective metal hose					
3074700000	US67-CON-VIB4x-01500	Protective metal hose, 1.5 m	–	✓	–
3074720000	US67-CON-VIB4x-04500	Protective metal hose, 4.5 m			
3074730000	US67-CON-VIB4x-09500	Protective metal hose, 9.5 m			
3074740000	US67-CON-VIB6X-01500	Protective metal hose, 1.5 m	–	–	✓
3074750000	US67-CON-VIB6X-04500	Protective metal hose, 4.5 m			
3074760000	US67-CON-VIB6X-09500	Protective metal hose, 9.5 m			

8 Troubleshooting

Fault	Possible cause	Recommended action
No measured value (4–20 mA)	No analogue output configured	Configure output
	No supply voltage	Check voltage supply Check supply line
	Interruption in connecting cable	Replace connecting cable
	Fuse defective	Replace fuse
	Connection polarity reversed	Correct connection polarity
	Vibration sensor defective	Replace vibration sensor
Switching contact does not switch	No switching contact configured	Configure switching contact
	Incorrect limit value set	Set correct limit value
	No supply voltage	Check voltage supply Check supply line
	Interruption in connection	Replace connecting cable
	Fuse defective	Replace fuse
	Connection polarity reversed	Correct connection polarity
	Vibration sensor defective	Replace vibration sensor
Incorrect measured value	Vibration sensor not installed with force fit	Install vibration sensor with force fit
	Vibration sensor installed in the wrong position	Install vibration sensor in the correct position
	EMC problems	See earthing concept in installation instructions

9 Product key

	US	67	-	VIB	2x	C	-	ANA IOL	-	0	016 032 UNI	0 A	0 A	00 01 02	A	0	0	000

Product series
US = u-sense

IP rating
67 = IP67

Product line function/ application
VIB = Vibration

Product line
20 = vrms/arms
22 = vrms/arms, IO-Link
24 = vrms/arms, crest, IO-Link

Power supply
C = Cable

Connectivity telemetry
ANA = analogue, (switching output)
IOL = IO-Link, (switching output)

EX approval
0 = non EX (standard)

Measured variable / measurement range
016 = vrms 0 ... 16 mm/s
032 = vrms 0 ... 32 mm/s
UNI = IO-Link configurable

Functional safety SIL approval
0 = no SIL (standard)
A = SIL 1

Material
0 = V2A (standard)
A = V4A

Frequency range
00 = 10 ... 1000 Hz (standard)
01 = IO-Link 10 ... 1000 Hz, configurable
02 = IO-Link 1 ... 1000 Hz, configurable

Temperature range of measuring head
A = -40 °C ... +85 °C

Electrical connection
0 = M12 plug (standard)

Mechanical connection
0 = M8x8, pitch 1.25 mm (standard)

Special (specific differentiation)
000 = none

If your desired configuration is not listed, please contact your responsible Weidmüller country representative.

10 Disassembly and disposal

The product must only be disassembled by qualified electricians who are familiar with the national and international laws, provisions and standards.

The product contains substances that may be harmful to the environment and human health. In addition, it also contains substances that can be reused through targeted recycling.

Observe the notes for proper disposal of the product. You can find the notes here: www.weidmueller.com/disposal.

11 CE conformity and standards

The device fulfils the requirements of the following EU directives and standards:

– 2014/30/EU Electromagnetic compatibility of electrical and electronic equipment
– 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

– EN 55011:2016 + A1:2017, + A11:2020
– EN 61000-6-3:2007 + A1:2011
– EN 61000-6-7:2015
– EN IEC 63000:2018