

Technical Description / Mounting Instruction

Particle Concentration Sensor PKM-Vx



Revised Instruction Manual

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measure analyse optimise

NIVUS AG

Burgstraße 28
8750 Glarus, Switzerland
Phone +41 55 6452066
Fax +41 55 6452014
swiss@nivus.com
www.nivus.com

NIVUS Austria

Mühlbergstraße 33B
3382 Loosdorf, Austria
Phone +43 2754 5676321
Fax +43 2754 5676320
austria@nivus.com
www.nivus.com

NIVUS Sp. z o.o.

ul. Hutnicza 3 / B-18
81-212 Gdynia, Poland
Phone +48 58 7602015
Fax +48 58 7602014
biuro@nivus.pl
www.nivus.pl

NIVUS France

12 rue Principale
67870 Bischoffsheim, France
Phone +33 388 999284
info@nivus.fr
www.nivus.fr

NIVUS Ltd., United Kingdom

Furzen Hill Farm
Coventry Road, Cubbington
Royal Leamington Spa
CV32 7UJ, Warwickshire
Phone +44 8445 332883
nivusUK@nivus.com
www.nivus.com

NIVUS Middle East (FZE)

Prime Tower
Business Bay Dubai
31st floor, office C-3
P.O. Box: 112037
Phone +971 4 4580502
middle-east@nivus.com
www.nivus.com

NIVUS Korea Co. Ltd.

#2301 M-Dong Technopark IT Center,
32 Songdogwahak-ro, Yeonsu-gu,
INCHEON, Korea 21984
Phone +82 32 2098588
Fax +82 32 2098590
jhwon@nivuskorea.com
www.nivuskorea.com

NIVUS Vietnam

238/78 Phan Trung Street
Tan Tien Ward, Bin Hoa City
Dong Nai Province, Vietnam
Phone +84 94 2623979
jhwon@nivuskorea.com
www.nivus.com

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Translation

If the device is sold to a country in the European Economic Area this instruction manual must be translated into the language of the country in which the device is to be used.

Should the translated text be unclear, the original instruction manual (German) must be consulted or a member company of the NIVUS-Group must be contacted for clarification.

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Names

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Revision History

Rev.	Modifications	Responsible Editor	date
02	Title page and addresses updated; sensor type PKM-V1xxKL... (70°; flat shape) added; Chap. "2.2 Warning Notices on the Device (optional)", "10 Scope of Delivery", "14 Return", "15 Product Construction and Overview", "17 Specifications and "18 Equipment/Device Versions" updated; information on "Mounting in Flow Direction" added in Chap. "21 Notes on Sensor Mounting", "22 Sensor Positioning in the Measurement Section" and "23 Sensor Mounting", Chap. "23.1 Principles of Sensor Mounting", "23.2.5 Alignment of Wedge Sensors", "23.3.1 Cable cover sheets / cable cover", "31 Accessories and "Approvals, Certificates and Declarations of Conformity" updated; various minor changes in text and layout	MoG	22.05.2023
01	Chap. "17 Specifications": Measurement range concentration at low noise values changed from 0...2.500 mg/l to 10...2.500 mg/l	MoG	25.01.2021
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General

1 About this Manual



Important

READ CAREFULLY BEFORE USE.

KEEP IN A SAFE PLACE FOR LATER REFERENCE.

This instruction manual is for the PKM-Vx particle concentration sensors and serves their intended use. This instruction manual is oriented exclusively to qualified expert personnel.

Read this instruction manual carefully and completely prior to installation or connection since it contains relevant information on this product. Observe the notes and particularly follow the warning notes and safety instructions.

If you should have problems to understand information contained within this instruction manual either contact a member company of the NIVUS-Group or one of the distributors for further support. The member companies of the NIVUS-Group cannot be held responsible for damage to persons or material due to incorrectly understood information in this instruction.

1.1 Applicable Documentation

For the installation and operation of the complete system extra instruction manuals or technical descriptions may be required apart from this manual.

- Instruction Manual for the NivuParQ 850 transmitter
- Technical Description for the Ex Separation Module iXT0

These manuals are provided with the respective devices or are available as download on the NIVUS homepage.

1.2 Signs and Definitions used

Representation	Meaning	Remarks
	(Action) Step	Execute action steps. Should action steps be numbered observe the specified order of the steps.
	Cross-reference	Refers to further or more detailed information.
	Refers to a documentation	Refers to an accompanying documentation.
>Text<	Parameter or menu	Indicates a parameter or a menu that is to be selected or is described.

Tab. 1 Structural elements within the manual

1.3 Abbreviations used

1.3.1 Colour code for wires and single conductors

The abbreviations of colours for wire and single conductor labelling follow the international colour code according IEC 60757.

BK	Black	BN	Brown	RD	Red
OG	Orange	YE	Yellow	GN	Green
BU	Blue	VT	Violet	GY	Grey
WH	White	PK	Pink	TQ	Turquoise
GNYE	Green/Yellow	GD	Gold	SR	Silver

1.3.2 Article Names

NP8x	Transmitter NivuParQ 8x
PKM	Particle concentration sensor for full and partial fillings

Safety Instructions

2 Used Symbols and Signal Words

2.1 Information on the Valuation of Accident Levels



The general warning symbol indicates the risk of personal injuries or death. In the text section the general warning symbol is used in combination with the signal words described below.

DANGER



Warning in high degree of risk

Indicates a high-risk, **imminently** hazardous situation which will result in death or serious injury if not avoided.

WARNING



Warning in medium degree of risk and personal injury

Indicates a **possible** danger with medium risk which may result in a life-threatening situation or (severe) bodily injury if not avoided.

CAUTION



Warning in personal injury or property damage

Indicates a possible danger with moderate risk which may result in minor or moderate personal injury or property damage if not avoided.

WARNING



Danger by electric voltage

Indicates a medium-risk, **imminently** hazardous situation caused by electric shock which will result in death or (serious) injury if not avoided.



Important Notice

Contains information that needs to be highlighted.
Indicates a potentially harmful situation that may damage the product or something in its environment if not avoided.



Note

Contains tips or information.

2.2 Warning Notices on the Device (optional)



General Warning Notice

This symbol refers the operator or user to content in this manual. Consideration of the information contained herein is necessary to maintain the protection provided by the unit for installation and in operation.



Protective earth connection

This symbol refers to the protective conductor terminal of the device. Depending on the type of installation, the unit may only be operated with a suitable protective earth connection in accordance with applicable laws and regulations.



Fig. 2-1 Warning Label ESD Protection

3 Special safety and Precautionary Measures

When working with the NIVUS equipment, the following safety and precautionary measures must be observed and followed generally and at all times. These warnings and notes are not repeated for each description within the document.

WARNING



Check danger due to explosive gases

Before starting assembly, installation and maintenance work, be sure to check that all regulations on safety at work have been observed and that there is no possible risk of explosive gases. Use a gas warner for the check.

When working in the sewer system, make sure that no electrostatic charge can occur:

- *Avoid unnecessary movements to reduce the building-up of static charges.*
- *Discharge any static electricity present on your body before you start installing the sensor.*

Disregarding may result in personal injury or damage to the system.

WARNING



Germ Contamination

Due to the frequent use of the sensors in the waste water sector, parts can be contaminated with dangerous germs. Therefore, appropriate precautions must be taken when coming into contact with cables and sensors.

Wear protective clothing.

WARNING



Observe Occupational Safety Regulations!

Before and during mounting works, compliance with all work safety regulations must always be ensured.

Disregarding may lead to personal injury.

WARNING**Do not disable Safety Devices!**

It is strictly forbidden to disable the safety devices or to change their mode of operation. Disregarding may result in personal injury or damage to the system.

WARNING**Disconnect the Sensor/Transmitter from Mains Power**

Disconnect the system from the mains power before starting maintenance, cleaning and/or repair work (only by qualified personnel). Disregarding may lead to electric shock.

**Commissioning only by qualified Personnel**

The entire measuring system may only be installed and commissioned by qualified personnel.

4 Warranty

The sensors were functionally tested prior to shipping. When used for the intended purpose (see Chap. "6 Intended Use") and in compliance with the instructions, the applicable documents (see Chap. "1.1 Applicable Documentation") and the safety information and instructions contained therein, no functional restrictions are to be expected and flawless operation should be possible.



Please also refer to the following chapter "5 Disclaimer".

**Limitation of Warranty**

In case of disregarding the safety notes and instructions in this document, the companies of the NIVUS-Group reserve the right to limit the warranty.

5 Disclaimer

The companies of the NIVUS-Group assume no liability

- for consequential damages resulting from a change in this document. The companies of the NIVUS-Group reserve the right to change the contents of this document including this disclaimer without prior notice.
- for personal injury or damage to property resulting from **failure to comply** with the **applicable regulations**. For connection, commissioning and operation of the sensors, all information and higher-level legal regulations of the country (in Germany e.g. the VDE regulations), such as valid Ex regulations as well as the safety and accident prevention regulations applicable to the respective individual case shall be observed.
- for personal injury or damage to property resulting from **improper handling**. For safety and warranty reasons, all work on the sensors that goes beyond the installation and connection measures may only be carried out by NIVUS personnel or by persons or companies authorised by NIVUS.
- for personal injury or damage to property resulting from the operation of the sensors in a **technically faulty** condition.

- for personal injury or damage to property resulting from **improper use**.
- for personal injury or damage to property resulting from failure to observe the **safety instructions** in this instruction manual.
- for missing or incorrect readings due to **improper installation or faulty parameterisation/programming** and for any consequential damage resulting therefrom.

6 Intended Use



Important Notice

*The sensors are intended exclusively for the purpose mentioned below.
Any other use beyond this, any conversion or modification of the sensors without written agreement with the companies of the NIVUS-Group is considered improper use.
The companies of the NIVUS-Group are not liable for any damage resulting from this.
The operator alone bears the risk.*

The PKM-Vx particle concentration sensors, in conjunction with the NivuParQ 850 transmitter, are designed for continuous measurement of particle concentration in lightly to heavily polluted media in open canals and partially and fully filled pipes of larger dimensions.

The sensors are designed and produced according to the current state of the art and the recognised safety rules at the time of publication of this document. Nevertheless, risks of personal injury or damage to property cannot be completely ruled out.

The permissible maximum limit values in Chapter "17 Specifications" must be observed. All cases of use deviating from these limit values, which have not been approved by NIVUS GmbH in writing, are excluded from the liability of the NIVUS-Group.

7 Ex Protection

The PKM-Vx particle concentration sensors are partly (see Chap. "18 Equipment/Device Versions") designed for use in areas with explosive atmospheres of zone 1.

The following conditions must be observed:

- Protect the sensor from shocks, falls or other damage
- Maintenance and repair shall only be carried out **outside** the Ex area

DANGER



Danger by electrostatic Discharge

Do **not** wipe the sensor with a dry cloth.

In case of disregard, the explosion protection of the device is no longer given due to possible static charge.

Possible ignition in an explosive atmosphere poses a danger to the user's life.

Sensor Approvals

 See Chap. "17 Specifications".



Validity of the Ex Approval

The Ex approval is only valid in conjunction with the corresponding marking on the nameplate of transmitter and the sensors.

The Ex-version of the sensors is matched to the NIVUS transmitters regarding the assessment of intrinsically safe electrical systems according to EN 60079-25.

When using transmitters from other manufacturers, the operator must carry out a system assessment in accordance with EN 60079-25.

The technical data required here for the Ex version of the sensors can be found in the EU type examination certificate TÜV 14 ATEX 142076 (iXT).



Declarations of Conformity and Test Certificates

For installation and commissioning, the declarations of conformity and test certificates of the approving body must be strictly observed.

8 Duties of the Operator



Important Notice

In the EEA (European Economic Area), the national transposition of the Framework Directive (89/391/EEC) as well as the associated individual directives and, in particular, the Directive (2009/104/EC) concerning the minimum safety and health requirements for the use of work equipment by workers at work, as amended, must be observed and complied with.

In Germany, the Ordinance on Industrial Safety and Health must be complied with.

Obtain the local operating licence and observe the associated conditions. In addition, you must comply with environmental protection requirements and local legal requirements for the following:

- Safety of personnel (accident prevention regulations)
- Safety of work equipment (protective equipment and maintenance)
- Product Disposal (Waste Management Act)
- Materials Disposal (Waste Management Act)
- Cleaning (Cleaning Agents and Disposal)

Connections

As the operator, before activating the sensor or the entire measurement system, make sure that the local regulations (e.g. for the electrical connection) have been observed during installation and commissioning.

Keep the Instruction Manual for future Reference

Keep the instruction manual in a safe place and ensure that it is always available and can be consulted by the user of the product.

Hand over the Instruction Manual

When selling the sensors, this instruction manual must be handed over with them. The manual is part of the standard delivery.

9 Requirements for the Personnel

Installation, commissioning and maintenance may only be carried out by personnel who fulfil the following conditions:

- Qualified personnel with appropriate training
- Authorisation by plant operator



Qualified Personnel

in the sense of these instructions or the warnings on the product itself are persons who are familiar with the installation, assembly, commissioning and operation of the product and who have the qualifications appropriate to their job, such as

- I. training and instruction or authorisation to switch circuits and devices/systems on and off, to earth and to label them in accordance with the standards of safety technology.*
 - II. Training or instruction in accordance with safety technology standards in maintenance and use of appropriate safety equipment.*
 - III. First Aid Training*
-

Delivery, Storage and Transport

10 Scope of Delivery

The standard delivery of the particle concentration sensor comprises:

- Particle concentration sensor PKM-Vx (according to delivery documents)
- Technical description / mounting instructions (declarations of conformity) including all information required for mounting and operation of the sensor (printed copy or link to the NIVUS download centre)

Check additional accessories according to the order against the delivery note.

11 Inspection upon Receipt

Check the delivery for completeness and apparent intactness immediately after receipt. Report any transport damage immediately to the delivering carrier. Also send a written report to NIVUS GmbH in Eppingen.

Incomplete deliveries must be addressed in writing within two weeks to your responsible representative or directly to the head office in Eppingen.



Observe the two-week deadline

Complaints received later will not be recognised.

12 Storage

Observe the minimum and maximum values for external conditions such as temperature and humidity according to Chapter "17 Specifications".

Protect the sensor from corrosive or organic solvent vapours, radioactive radiation and strong electromagnetic radiation.

Store the sensor in the original packaging.

13 Transport

Protect the sensor from strong impacts, shocks, jolts or vibrations.

Transport the sensor in the original packaging.

Otherwise, the same conditions apply with regard to external influences as for storage (see Chap. "12 Storage").

14 Return

In the event of a return, send the sensor to NIVUS GmbH in Eppingen carriage paid and in the original packaging.

Items that have not been sufficiently franked will not be accepted!

In general, a return note (incl. RMA return number) must be requested from the NIVUS customer service before returning the goods. Without this RMA number, the incoming goods cannot be assigned accordingly.

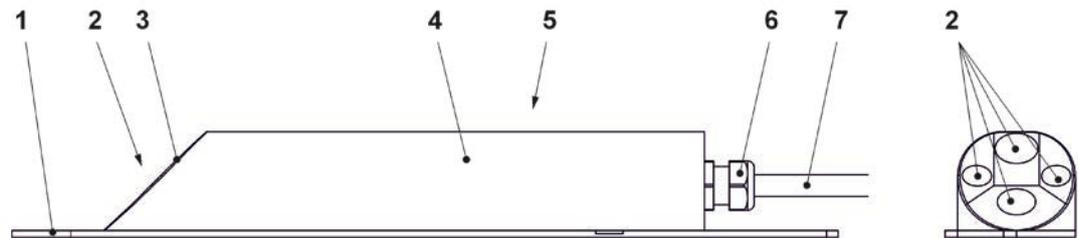


See Chap. "27.3 Customer Service Information".

Product Specification

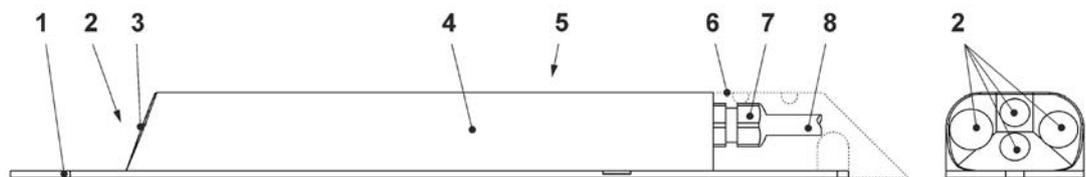
15 Product Construction and Overview

15.1 Sensor Components



- 1 Mounting plate/base plate
- 2 (Piezo/sound transducer) sensors for particle concentration measurement
- 3 Acoustic coupling layer
- 4 Sensor body
- 5 Temperature sensor (without illustration; inside the sensor body on the circuit board)
- 6 Cable gland
- 7 Sensor cable

Fig. 15-1 Sensor construction PKM-V1xxKT...



- 1 Mounting plate/base plate
- 2 (Piezo/sound transducer) Sensors for particle concentration measurement
- 3 Acoustic coupling layer
- 4 Sensor body
- 5 Temperature sensor (without illustration; inside the sensor body on the circuit board)
- 6 Cable cover (factory screwed to the sensor)
- 7 Cable gland
- 8 Sensor cable

Fig. 15-2 Sensor construction PKM-V1xxKL... (with cable cover)

15.2 Sensor Dimensions

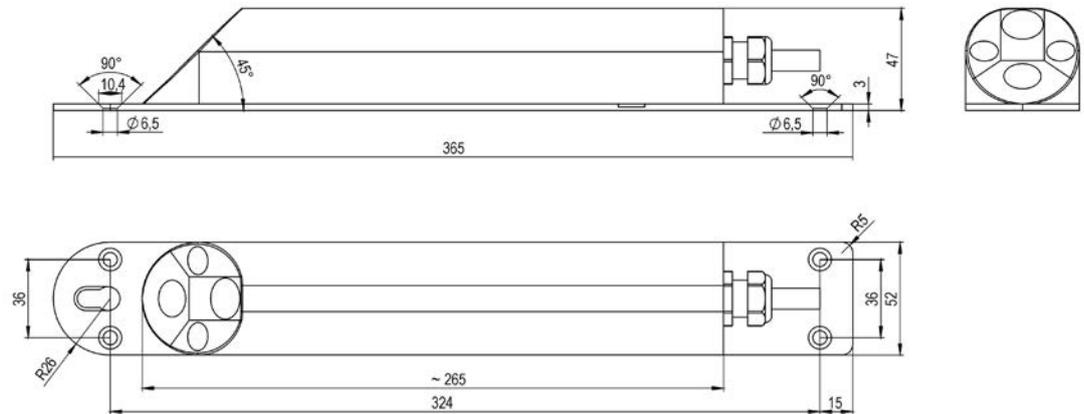


Fig. 15-3 Sensor dimensions PKM-V1xxKT...

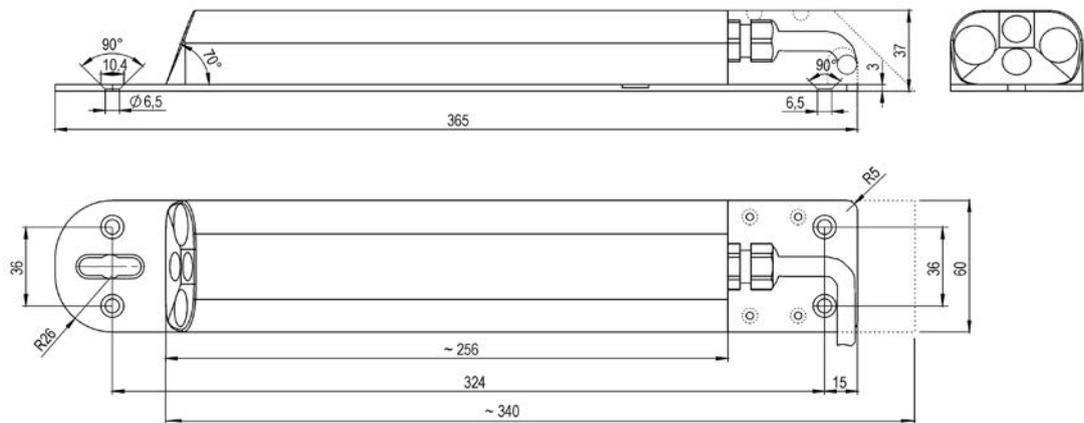


Fig. 15-4 Sensor dimensions PKM-V1xxKL... (with cable cover)

16 Device ID

The information in this instruction manual only applies to the sensor type indicated on the title page. The nameplates are attached to the mounting/base plate or the sensor body or at the end of the cable (protected by means of a transparent protective tube) and contain the following information:

- Name and address NIVUS GmbH
- CE label
- Marking of the series and type with article number and serial number
- Year of manufacture: the first four digits of the serial number refer to the year of manufacture and the week number (2303.....)
- Ex protection marking (for sensors in Ex version)
- Ambient conditions in operation

It is important for all queries and spare parts orders that the article number and serial number of the respective device are specified correctly. This is the only way to ensure proper and fast processing.



Fig. 16-1 Nameplate Sensor PKM-Vx (Example Ex Device)

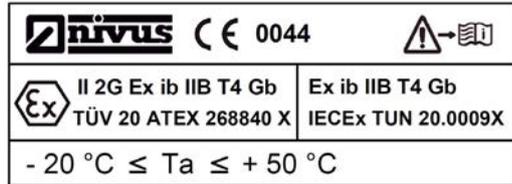


Fig. 16-2 Ex Nameplate Sensor PKM-Vx (addition)



Fig. 16-3 Nameplate Sensor Cable PKM-Vx (Example Ex Device)

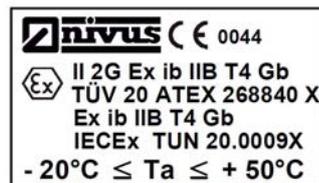


Fig. 16-4 Ex Nameplate Sensor Cable PKM-Vx (addition)



Check nameplates

Check by means of the nameplates whether the supplied device corresponds with your order.



The Declarations of Conformity and the Type Examination Certificate can be found at the end of this instruction manual.

17 Specifications

Measurement Conditions	
Medium type	Stormwater and combined sewage, flowing waters
Minimum filling level	- Sensor PKM-V1xxKT...: 15 cm with calm flow / calm water surface - Sensor PKM-V1xxKL...: 7 cm with calm flow / calm water surface
Canal dimensions	Min. DN250
Area of Use	PKM-V1xxxKT: medium to high levels

	PKM-V1xxxKL: low levels
Flow Velocity	Min. 0.1 m/s with rainwater Min. 0.2 m/s in rivers / natural water bodies Max. 3 m/s (independent of medium)
Mass density	1100...2650 g/l
Calming section upstream of sensor	1 m at $v_{\text{average}} = 0.1$ m/s 4 m at $v_{\text{average}} = 0.5$ m/s 7 m at $v_{\text{average}} = 1$ m/s
Particle Concentration Measurement	
Measurement Principle	Backscatter and Attenuation
Measurement Frequencies	1, 2, 3, 4, 6, 7 and 9 MHz
Resolution Particle Size Classes	Five Size Classes: < 63 μm / 63...100 μm / 100...200 μm / 200...400 μm / 400...1000 μm
Detection Air Bubbles	Can be activated manually
Measurement Range Concentration	50...6000 mg/l 10...6000 mg/l (at low noise levels/optimal conditions)
Beam Angle in angular degrees [°]	$\pm 2.5^\circ$ @ 1 MHz $\pm 1.5^\circ$ @ 2 MHz $\pm 1^\circ$ @ 3 MHz $\pm 1^\circ$ @ 4 MHz $\pm 0.7^\circ$ @ 6 MHz $\pm 0.6^\circ$ @ 7 MHz $\pm 0.5^\circ$ @ 9 MHz
Angle of incidence [°] to the horizontal	45° or 70°
Max. Penetration depth or measuring point in the medium	40 cm (in beam direction)
Min. Distance to solid objects	40 cm (in beam direction)
Recommended position for sampling	Min. 20 cm distance from the sensor (above or to the side)
Update rate of measurement	20 Hz
Sensor Properties	
Ex Approvals (option) / other Approvals (option)	ATEX: TÜV 20 ATEX 268840 X IECEX: TUN 20.0009X  II 2G Ex ib IIB T4 Gb / Ex ib IIB T4 Gb

Protection	IP68
Operation Temperature	-20 °C...+50 °C / Ex version -20 °C...+60 °C / Non-Ex version
Storage Temperature	-30 °C...+60 °C
Operation Pressure	Max. 4 bar without pressure measurement cell; Max. 1 bar with pressure measurement cell
Cable Lengths	10 / 15 / 20 / 30 / 40 / 50 / 60 / 70 / 80 / 90 / 100 m
Cable Types	LiYC11Y 2x1.5 + 1x2x0.34 without pressure measurement cell; LiYC11Y 2x1.5 + 1x2x0.34 + PA 1.5 / 2.5 with pressure measurement cell
Outside Cable Diameter	8.4 mm ± 0.25 mm without pressure measurement cell; 9.75 mm ± 0.25 mm with pressure measurement cell
Materials in contact with the medium	Polyurethane / stainless steel 1.4571 (AISI 316 Ti) / Polyoxymethylene (cable cover sensor PKM-V1xxKL...) / PPO GF30 / PEEK without and with pressure measurement cell; Hastelloy® with pressure measurement cell
Temperature Measurement	
Measurement Range	-20 °C...+60 °C
Measurement Uncertainty	±0.5 K
Level Measurement - Pressure	
Measurement Range	0...500 cm
Zero Point Drift	Max. 0.75 % of final value (0...50 °C)
Measurement Uncertainty	< 0.5 % of final value

Tab. 2 Specifications

18 Equipment/Device Versions

The PKM-Vxx particle concentration sensor is manufactured in different versions. The table below provides an overview on the different versions. The table below provides an overview on the different versions.

The exact sensor type can be specified by means of the article number.

PKM-	Particle Concentration Sensor		
	Type	Version	
	V100	KT	Wedge sensor made of PPO with PEEK sensor face; angle of incidence to the horizontal 45°; mounting / base plate 1.4571 (AISI 316 Ti)
		KL	Wedge sensor made of PPO with PEEK sensor face; angle of incidence to the horizontal 70°; mounting / base plate 1.4571 (AISI 316 Ti)

	V10D	With pressure measurement cell for level measurement				
		KT	Wedge sensor made of PPO with PEEK sensor face; angle of incidence to the horizontal 45°; mounting / base plate 1.4571 (AISI 316 Ti)			
		KL	Wedge sensor made of PPO with PEEK sensor face; angle of incidence to the horizontal 70°; mounting / base plate 1.4571 (AISI 316 Ti)			
		ATEX Approval				
		0	None			
		E	Zone 1			
		Cable length (max. 150 m / with pressure cell up to 30 m possible)				
		10	10 m			
		15	15 m			
		20	20 m			
		30	30 m			
		40	40 m			
		50	50 m			
		60	60 m			
		70	70 m			
		80	80 m			
		90	90 m			
		99	100 m			
		xx	Special length upon request			
		Sensor Connection				
		K	Cable end pre-assembled for connection to NivuParQ, for Type V100			
		L	Cable end pre-assembled for connection to NivuParQ, for Type V10D			
		Pipe length				
		0	For wedge sensor			
PKM-						0

Tab. 3 Product Structure

 Accessories see Chapter "31 Accessories".

Installation and Connection

WARNING



Checking for explosive atmosphere using a gas warner

When connecting sensors to transmitters, the metallic sensor bottom plate must not exceed an earthing resistance of 1 GΩ after installation in a measurement section.

Before carrying out mounting/maintenance work, check explosive atmosphere by means of a gas warning device.

When carrying out this work, make absolutely sure that no electrostatic charge can occur.

19 General Mounting Instructions

During installation, observe the following instructions on ESD and installation location.

- Ensure proper installation.
- It is essential to follow applicable legal or company guidelines.

Improper handling may result in injury and/or damage to the sensors.



Important Notice

Observe the following instructions for avoiding Electrostatic Discharge (ESD).

The sensitive electronic components inside the sensor can be damaged by static electricity. The companies of the NIVUS-Group recommend the following steps to prevent damage to the sensors due to electrostatic discharge:

- Discharge any static electricity possibly present before you touch electronic components of the sensors (such as circuit boards and the components on them).
- Avoid unnecessary movements to reduce the building-up of static charges.

20 Electrical Installation

CAUTION



Always disconnect the measurement system from the mains

Whenever work is carried out on the measuring system or the sensors, the transmitter must be disconnected from the power supply.

Observe the electrical data given on the nameplate.

For electric installation follow the legal requirements of the according country (in Germany: e.g. VDE 0100).

21 Notes on Sensor Mounting



Leakage due to removal of components

Removal or loosening of the bottom plate, base plate or cable gland of the sensor will cause leakage and result in failure of the measurement/sensor.

As a matter of principle, **no parts** may be **removed** from the sensor.

Non-compliance may have negative consequences in terms of warranty and liability. See Chap. "4 Warranty" and "5 Disclaimer".



Sensor mounting in flow direction possible/required

Contrary to the usual mounting direction (against the flow direction) of the NIVUS sensors, the PKM sensors **can** (sensor PKM-V1xxKT...) or **must** (sensor PKM-V1xxKL...) be mounted **in the flow direction**.

The following conditions and recommendations also apply to installation in the direction of flow.

The sensors in the illustrations are shown against the direction of flow.

Before and during the installation of sensors, it is essential to observe the following:

- Correct sensor position
- Required calming sections
- Sensor mounting and fastening
- Cable routing

Please also note the information on sensors with integrated pressure measurement cell in Chap. "25 Pressure Compensation Elements".

22 Sensor Positioning in the Measurement Section



Sensor mounting in flow direction possible/required

Contrary to the usual mounting direction (against the flow direction) of the NIVUS sensors, the PKM sensors **can** (sensor PKM-V1xxKT...) or **must** (sensor PKM-V1xxKL...) be mounted **in the flow direction**.

The following conditions and recommendations also apply to installation in the direction of flow.

The sensors in the illustrations are shown against the direction of flow.

22.1 Selecting the Measurement Section

The mounting of the sensors at the measurement place is extremely dependent on the local conditions.

Therefore, care must be taken to ensure good hydraulic conditions and a sufficient calming section upstream of the installation location.

22.1.1 Conditions for Calming Sections

- Falls, bed jumps, fixtures and channel profile changes upstream of the measurement must be avoided.
- Avoid lateral supply lines directly upstream or downstream of the measurement.
- **Sedimentation:** Select the measuring section in such a way that no deposits (sand, rubble, mud) are present in the measuring section or can be deposited subsequently.

Sedimentation is caused by insufficient drag forces within the flow profile and indicate insufficient gradient or structural defects (such as a negative partial gradient) within the measuring section.

Observe required minimum flow velocity according to DWA A110.

- **Part Filled Pipes:** Do not exceed a filling level of 80 % in the pipe. From a filling level of about 80 % of the nominal diameter, pipes can temporarily block. In order to avoid pulsation in the measurement section, the diameter must be selected so that a filling level of 80 % is not exceeded (independent of Q_{\min} or Q_{\max} for standard discharges; 2 QTW).
- Avoid **changes in slope** within the measurement section.
- **Inlet and outlet section:** The straight inlet section must be at least 5x DN. The outlet section must be at least 2x DN. In case of changes or disturbances of the hydraulics and disturbance of the flow profile, longer calming sections are required.
- **Level measurements:** Select an installation site with as few waves as possible and with a water level line parallel to the channel bottom.

22.1.2 Support in the selection/assessment of the measurement place

If in doubt when selecting or assessing the planned measurement place, contact your NIVUS representative or the internal sales department (Sales@nivus.com) at NIVUS GmbH in Eppingen.

The following documents must be provided for the assessment of the measurement place:

- Sketches or drawings showing the structural situation at, upstream and downstream of the planned installation location
- Photos of the planned measurement place

22.2 Sensor Positioning Examples

The illustrations in this chapter show examples of different applications to demonstrate:

- well-suited measurement sections
- less suitable measurement sections
- the correct sensor position in the measurement section
- problem applications, also critical hydraulic conditions

The numerical values given in the examples are guidelines and recommendations based on many years of experience. Depending on the hydraulic conditions (roughness, additional hydraulic disturbances, high flow velocities, etc.), much larger distances may also be required.



Sensor mounting in flow direction possible/required

Contrary to the usual mounting direction (against the flow direction) of the NIVUS sensors, the PKM sensors **can** (sensor PKM-V1xxKT...) or **must** (sensor PKM-V1xxKL...) be mounted **in the flow direction** (see Fig. 22-1).

The following conditions and recommendations also apply to installation in the direction of flow.

The sensors in the most illustrations are shown against the direction of flow.

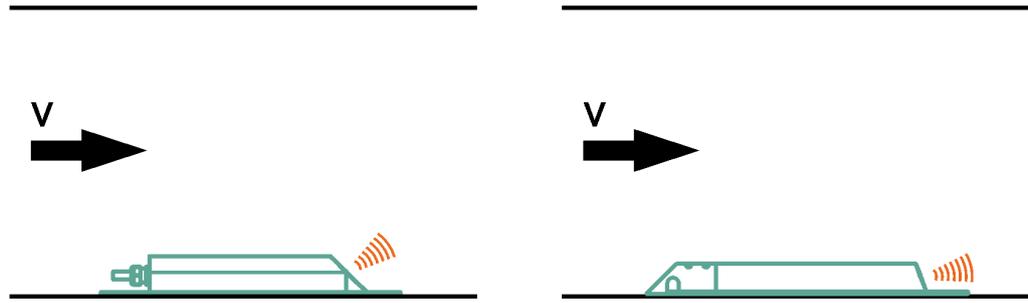


Fig. 22-1 Sensor position in the direction of flow



Note

The sensors shown in the following illustrations are only example sensors.



Note

If you use a separate air-ultrasonic sensor to detect the level, then you must always mount it **upstream** of the particle concentration sensor. Coordinate variations with NIVUS.

As standard, the wedge sensor is installed in the centre on the channel bottom.

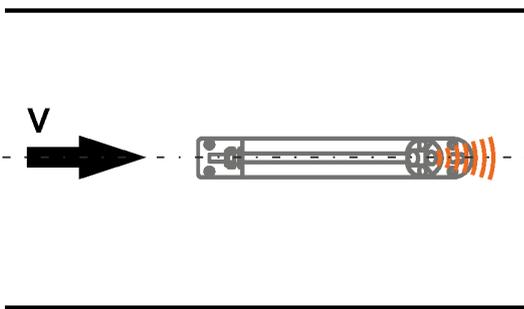


Fig. 22-2 Sensor position in the channel centre

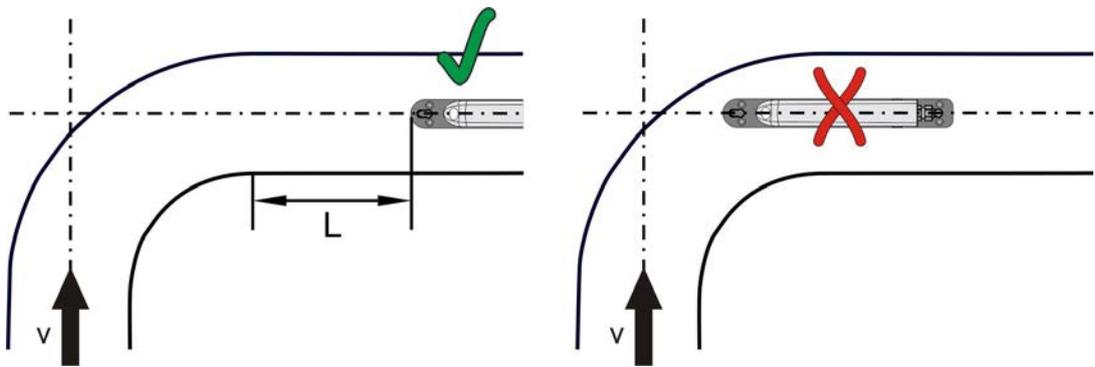
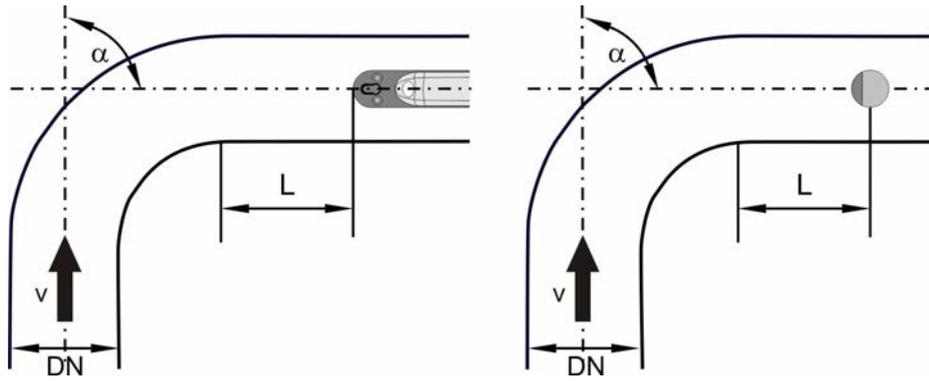


Fig. 22-3 Sensor position behind curves or bends

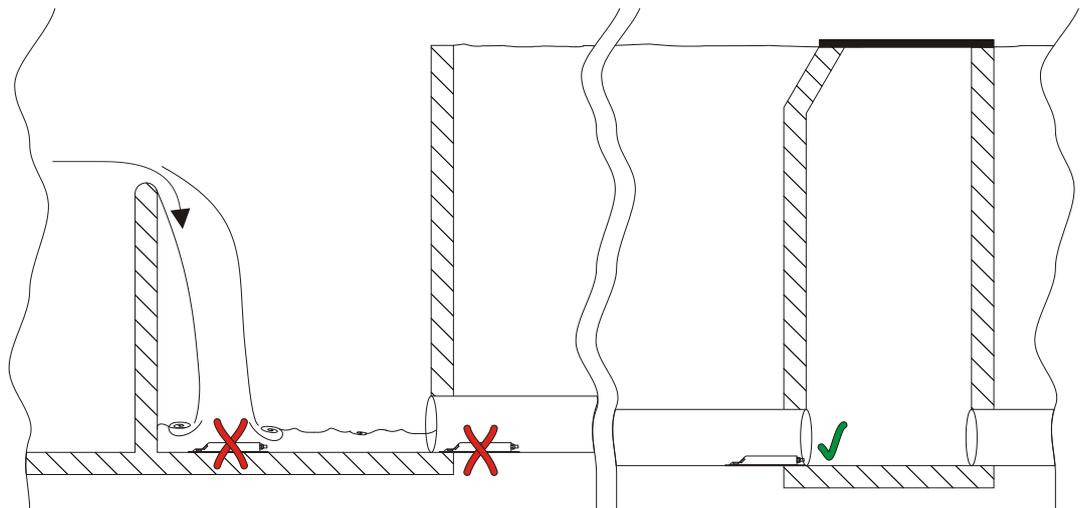


α = Change of the flow direction

Fig. 22-4 Sensor position behind curves or bends

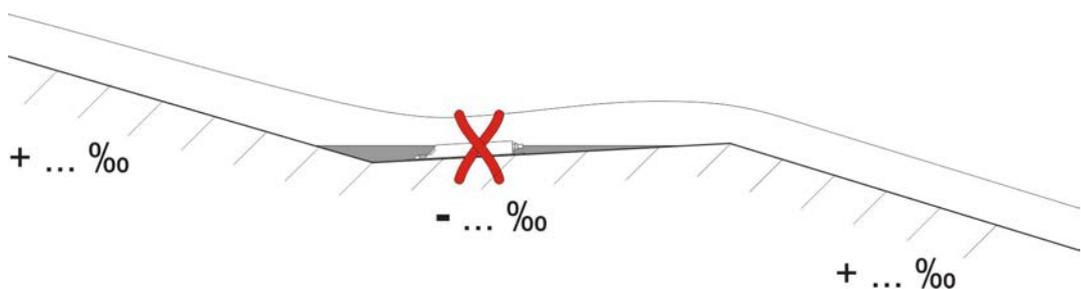
Sensor Type	Change of the Flow Direction α	$v \leq 1 \text{ m/s}$	$v > 1 \text{ m/s}$
PKM-Vx	$\alpha \leq 15^\circ$	$L \geq \text{min. } 3x \text{ DN}$	$L \geq \text{min. } 5x \text{ DN}$
	$\alpha \leq 45^\circ$	$L \geq \text{min. } 5x \text{ DN}$	$L \geq \text{min. } 10x \text{ DN}$
	$\alpha \leq 90^\circ$	$L \geq \text{min. } 10x \text{ DN}$	$L \geq \text{min. } 15...20x \text{ DN}$

Tab. 4 Sensor position dependent on upstream curve angle



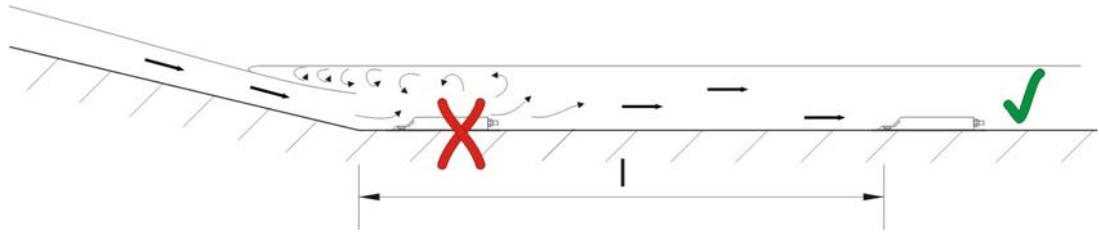
- × Error! High air entrainment
- ✓ Distance sufficient for even flow (depending on application 10...50x DN)

Fig. 22-5 Discharge canal or fall – eddying



- × Error! Risk of silting due to negative slope

Fig. 22-6 Negative slope - risk of silting



- × Error! Change of slope = risk of air entrainment in the medium
- ✓ Distance; depending on slope and flow velocity value
 $l = \text{min. } 20 \times \text{DN}$

Fig. 22-7 Error due to change in slope

23 Sensor Mounting



Sensor mounting in flow direction possible/required

Contrary to the usual mounting direction (against the flow direction) of the NIVUS sensors, the PKM sensors **can** (sensor PKM-V1xxKT...) or **must** (sensor PKM-V1xxKL...) be mounted **in the flow direction**.

The following conditions and recommendations also apply to installation in the direction of flow.

The sensors in the illustrations are shown against the direction of flow.

23.1 Principles of Sensor Mounting

WARNING



Explosion hazard due to explosive gases in the environment

Persons may be injured.

- Before starting installation work, check for possible danger from explosive gases with a gas warning device.
- Observe occupational safety regulations.
- During installation, make sure that no electrostatic charge can occur.
- If necessary, take the necessary measures to avert danger.

WARNING



Danger by electric voltage

When drilling in wet rooms or in filled pipes, dangerous fault currents can occur and lead to personal injury.

Use an electronic personal protection adapter.

CAUTION



Risk of damage to the unit and malfunctions

Check sensor suitability for the application with regard to pressure, temperature and measurement method.

See Chap. "17 Specifications".

Sensor Mounting in dirty Media

In channels and flumes with too low a slope or where backwater occurs, sedimentation can quickly occur at the bottom of the flume in the case of dirty media. This easily leads to silting and silting up of the sensor, which is mounted on the channel bottom. As a result, measurement failure or unstable measurement reading may occur.

Possible countermeasures:

- Set the sensor higher with the help of a wedge support customer's own, adapted to the conditions on site
- Install the sensor on the side of the channel wall

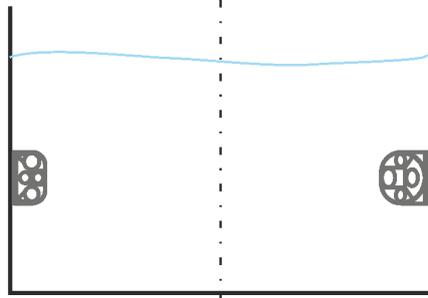


Fig. 23-1 Sensor mounting on the wall

23.2 Wedge Sensors

23.2.1 Basic Instructions for Wedge Sensor Mounting

- Do not remove any parts of the wedge sensor. If the base plate or the cable glands of the sensor are loosened or removed, then the sensor is leaking. Penetrating water destroys the electronics. This leads to measurement failure in the long run.
- Do not widen the mounting holes on the base plate.
- Do not bend the base plate of the wedge sensor.
- Attach mounting parts for wedge sensors flat with the mounting plate. If screws or other fastening parts protrude into the measuring medium, then there is a risk of sensor build-up in the wastewater area. Sensor build-up leads to malfunctions or measurement failure.
- Mount the wedge sensor on an exactly flat surface. Uneven ground leads to sensor body breakage.

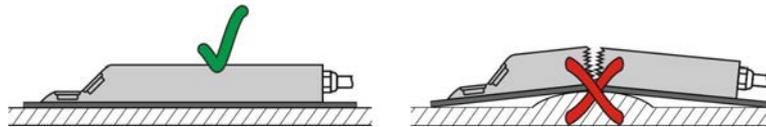


Fig. 23-2 Wedge sensor mounting on flat ground

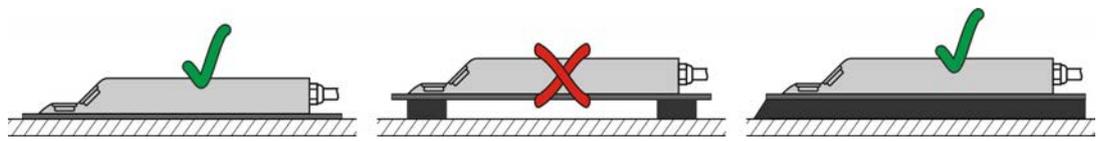
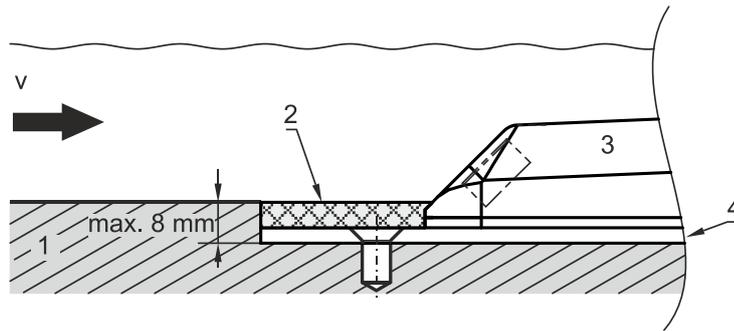


Fig. 23-3 Elevated wedge sensor

23.2.2 Wedge sensor without integrated pressure measurement cell

Observe when mounting the sensor:

- Mount wedge sensors without integrated pressure measurement cell, if possible, in a (previously self-created) recess (max. 8 mm) (see Fig. 23-4).
- After completing the installation work, seal the remaining gaps with permanently elastic material (silicone or similar).



- 1 Channel bottom
- 2 Silicone or similar
- 3 Sensor body
- 4 Mounting plate/base plate

Fig. 23-4 Lowered wedge sensor

23.2.3 Wedge sensor with integrated pressure measurement cell

Observe when mounting and operating the sensors:

- Do not countersink combination sensors with integrated pressure measurement cell into the mounting location. Sealing or soiling lead to measurement distortions of the level measurement. The measurement is inaccurate or fails completely.
- Do not remove the cover above the pressure measurement cell. This protects the pressure measurement cell from external influences. Removal of the cover will void the warranty.
- Do not touch the pressure measurement cell. Do not use a water jet for cleaning. Contact with fingers, brushes, water jets, etc. will damage the pressure measurement cell and lead to measurement failures.
- Always operate sensors with integrated pressure measurement cell with pressure compensation element. Penetrating moisture can destroy the sensor electronics of sensors with integrated pressure measurement cells.



Note

When using a sensor with a pressure measurement cell, note that physically induced measurement errors can occur at high flow velocities and low levels (Bernoulli effect).

If there is a risk of silting/sludge

- Mount sensors with integrated pressure measurement cell off-centre. The pressure measurement cell detects the level above the sensor.

OR

- Set the sensor higher with the help of a wedge support (customer's own, adapted to the conditions on site).

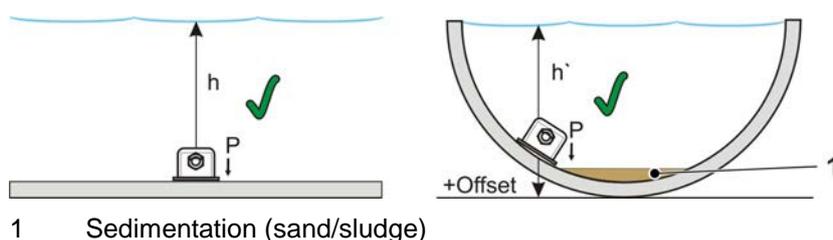
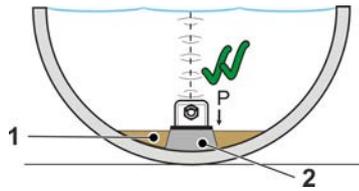


Fig. 23-5 Sensor with integrated pressure measurement cell: Mounting off-centre



- 1 Sedimentation (sand/sludge)
- 2 Wedge support (customer's own, adapted to the conditions on site)

Fig. 23-6 Sensor with integrated pressure measurement cell: Mounting with wedge support

Air hose integrated in cable

For wedge sensors with integrated pressure measurement cell, there is an air hose in the sensor cable. This air hose is used to compensate for the fluctuating atmospheric air pressure.

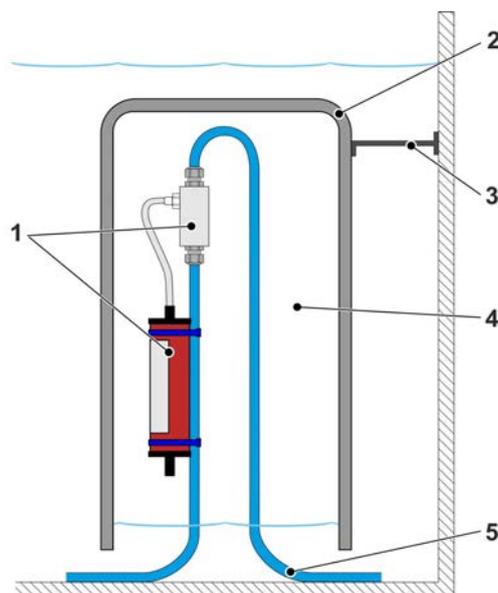
Observe when handling the air hose:

- Do not kink the cable with the air hose.
- Do not seal the air hose.
- Do not extend the cable end by means of a hermetically sealed junction box.
- Do not use air filters of other types.

If this is not observed, the level cannot be measured correctly by means of the pressure measurement cell.

Mounting of the required/associated pressure compensation element

- Select the mounting location so that the pressure compensation element is easily accessible for maintenance and checks.
- Install in non-flooded/floodable area; attach flood protection if necessary.
Info: Flood protection prevents water from entering the air filter of the pressure compensation element and the pressure sensor, but distorts the measurement result in the event of overflow.



- 1 Pressure Compensation Element
- 2 Airtight flood protection, opening must point downwards

- 3 Fastening against buoyancy
- 4 Air cushion
- 5 Sensor cable

Fig. 23-7 Example of a flood protection

⇒ For more information on the pressure compensation element see Chap. "25 Pressure Compensation Elements".

23.2.4 Required Tools and Materials

The following tools and materials required for mounting wedge sensors are not included in the scope of delivery:

- (Impact) drill with matching (stone) drill bit
- 4 stainless steel screws with countersunk head (M5x30...M5x70 mm)
- 4 suitable dowels
- Appropriate screwdriver
- Cable cover sheets or similar

Do not use: Stud bolts or similar fastening material.

Other special tools and materials may be required for special applications.

⇒ Mounting accessories see Chap. "23.3 Mounting Accessories".

23.2.5 Alignment of Wedge Sensors

The bevelled side (sound transducer) of the sensor points in the flow direction.

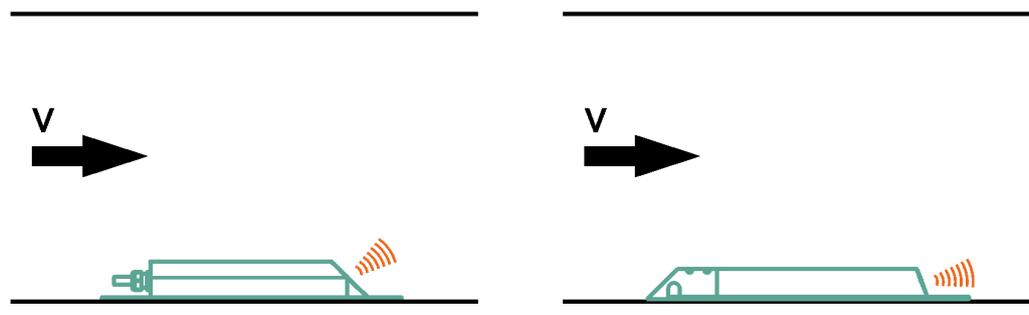


Fig. 23-8 Sensor position in the direction of flow

The PKM sensors can be installed without any problems or should even be installed **in the direction of flow** in order to obtain optimum measurement results. However, very close attention must then be paid to ensure that no turbulence is induced by the sensor cable.

⇒ See also Chap. "23.2.7 Cable routing".

23.2.6 Fastening the Sensor

➡ Procedure:

1. Provide countersunk screws and suitable dowels: Select the length of the countersunk screws so that a secure and permanent sensor fastening is ensured.
2. Drill holes at the desired mounting location according to the dowel size.
3. Insert the dowels into the drill holes.
4. Screw on the sensor so that the countersunk screws are completely countersunk into the mounting/base plate. This reduces eddying and build-up.
5. Seal any gap on the mounting/base plate with silicone or similar suitable material. There must be no gap between the mounting/base plate of the sensor and the ground.

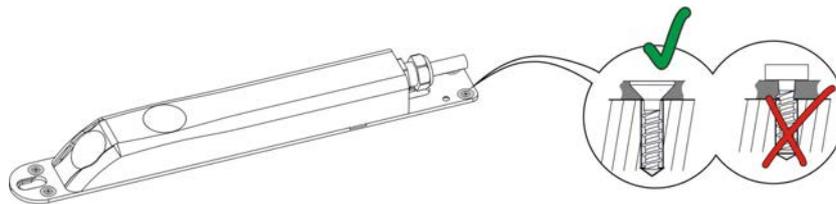


Fig. 23-9 Fastening the wedge sensor

23.2.7 Cable routing

Observe when laying the cable:

- Do not lay the sensor cable loosely, unprotected or across the medium. Dirt carried in the medium can build up on the cable.
Result: Sensor damage or cable breakage.
- To avoid disturbance due to electrical interference, do not lay sensor cables close to motor supply lines and power lines.
- Do not go below the minimum bending radius of the cable of 10 cm.
- Route the sensor cable out to the same side as the sensor. Do not run the cable over the bottom of the canal or through the medium (see Fig. 23-10).

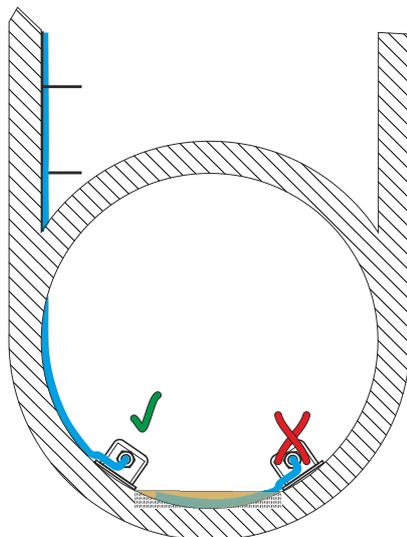
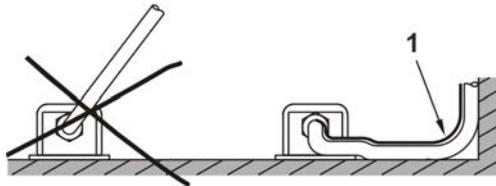


Fig. 23-10 Cable routing for wedge sensor

➡ Procedure for laying the cable:

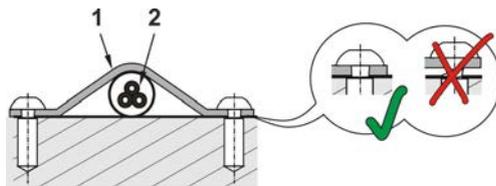
1. Run the cable behind the wedge sensor on the channel bottom to the channel wall, observing the min. bending radius of 10 cm.
2. To prevent build-up:
cover the cable with a thin, medium-resistant stainless steel sheet
OR
lay the cable in a slot and then seal it with permanently elastic material.
3. On curves, additionally fasten the cable to the ground with a clamp.

➡ Cable cover sheets see Chap. "23.3.1 Cable cover sheets / cable cover".



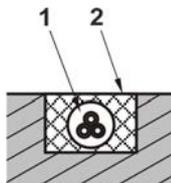
1 Protective cover/cable protection sheet

Fig. 23-11 Cable laying in the medium



1 Stainless Steel Sheet/Cable Cover, Types ZMS 140, ZMS 141 or ZMS 142
2 Cable

Fig. 23-12 Mounting example: cable with cable cover sheet



1 Cable
2 Permanently Elastic Material

Fig. 23-13 Mounting example: cable laid in slot

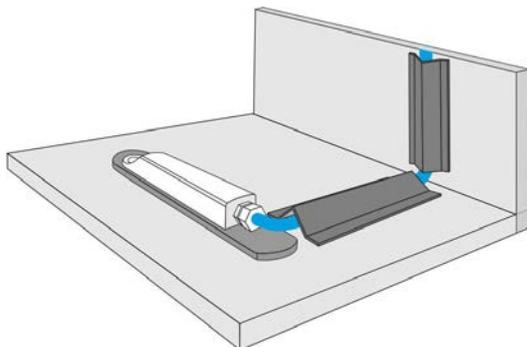


Fig. 23-14 Mounting example: cable laying with ZMS 140 cable cover sheet

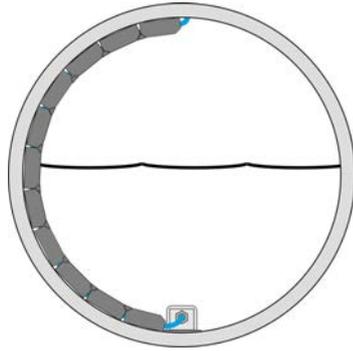
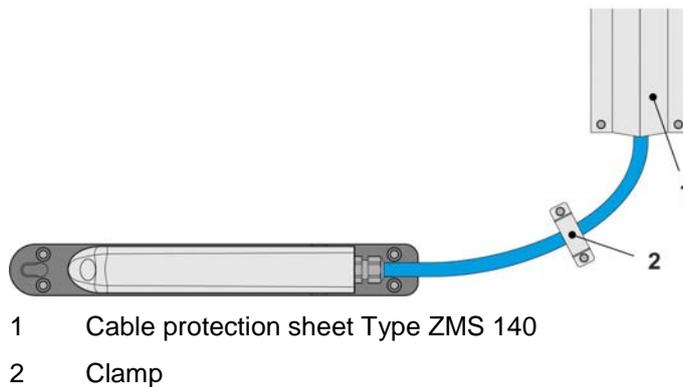


Fig. 23-15 Mounting example: cable laying with ZMS 141/142 cable cover sheet



- 1 Cable protection sheet Type ZMS 140
- 2 Clamp

Fig. 23-16 Mounting example: cable laying with cable cover sheet and clamp

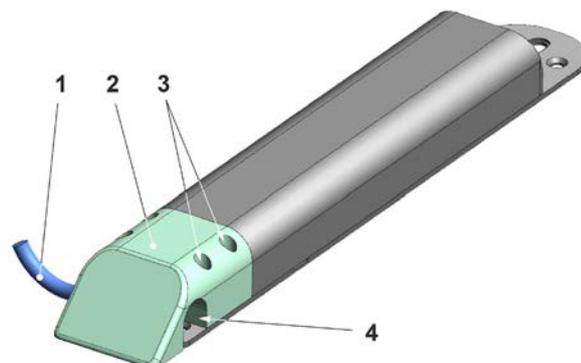
Special Conditions for sensor PKM-V1xxKL...

The PKM-V1xxKL... sensor is delivered ex works with the **cable cover** (Fig. 23-17 Pos. 2). This ensures that when the sensor is installed in the direction of flow, no turbulence can occur due to the geometry of the sensor and the cable.

For **laying** the cable, if necessary, follow the preparatory procedure below (laying on the other side of the sensor) and in any case observe the previous descriptions / installation examples in this chapter and carry them out on site depending on the situation.

➡ Preparatory procedure for leading out / laying the cable on the other side of the sensor:

1. Unscrew the fastening screws (Fig. 23-17 Pos. 3) and remove the cable cover (Fig. 23-17 Pos. 2).
2. Route the cable (Fig. 23-17 Pos. 1) to the other side of the sensor and fasten the cable cover again with the fastening screws (route the cable through the respective side opening Fig. 23-17 Pos. 4).



- 1 Cable
- 2 Cable cover (factory screwed to the sensor)

- 3 4x Fastening screws
- 4 Openings in the side of the cable cover

Fig. 23-17 Mounting example: cable cover for PKM-V1xxKL... sensor

23.3 Mounting Accessories

23.3.1 Cable cover sheets / cable cover

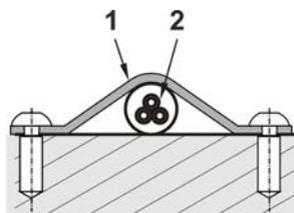
Cable cover sheets / cable covers are for preventing build-up on sensor cables. Cable cover sheets made of 1.4571/AISI 316 Ti (each 1 m long) or the plastic cable cover for the PKM-V1xxKL... sensor are available from NIVUS.

Variants:

Type	Description	Use
ZMS 140	rigid	To cover 1 sensor cable. For even surfaces and straight cable runs.
ZMS 141	bendable	To cover up to 3 sensor cables. For straight and slightly curved surfaces such as the inside of concrete pipes and masonry, curved canals. Suitable for laying larger cable radii.
ZMS 142	bendable	To cover 1 sensor cable with max. Ø 12 mm or 2 sensor cables with max. Ø 8.5 mm. For slightly curved surfaces such as the inside of concrete pipes and masonry, curved canals. Suitable for laying larger cable radii.
---	Polyoxy-methylene	Only for the flat PKM sensor; Screwed to the sensor ex works (Fig. 23-17, Fig. 23-21); If the cable is to point to the other side: Remove cable cover, lay cable in the other direction and screw cable cover back on; See also "Preparatory procedure for leading out / laying the cable on the other side of the sensor" on page 34

Tab. 5 Overview cable cover sheets / cable cover

Cable cover sheets are supplied with the appropriate corrosion-free fastening material.



- 1 Cable Protection Sheet
- 2 Cable

Fig. 23-18 Cable laying with cable cover sheet

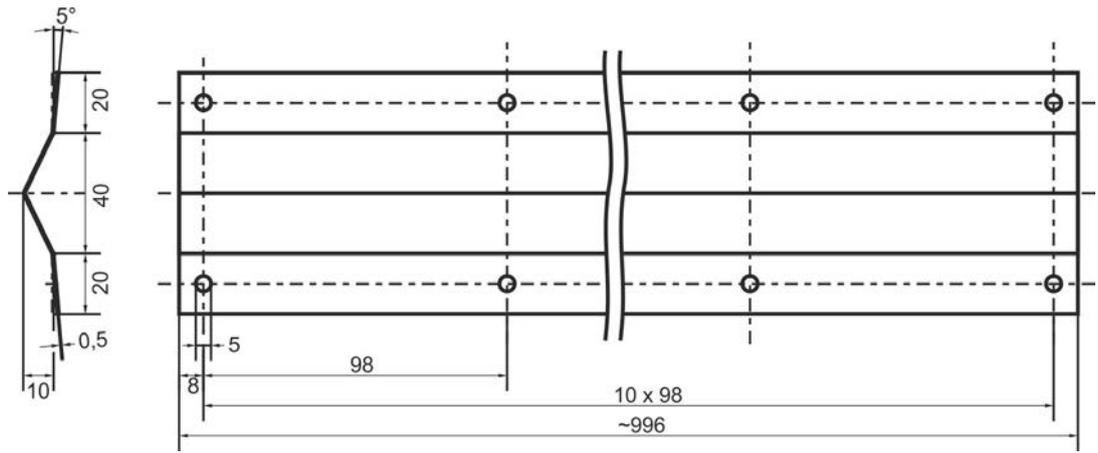
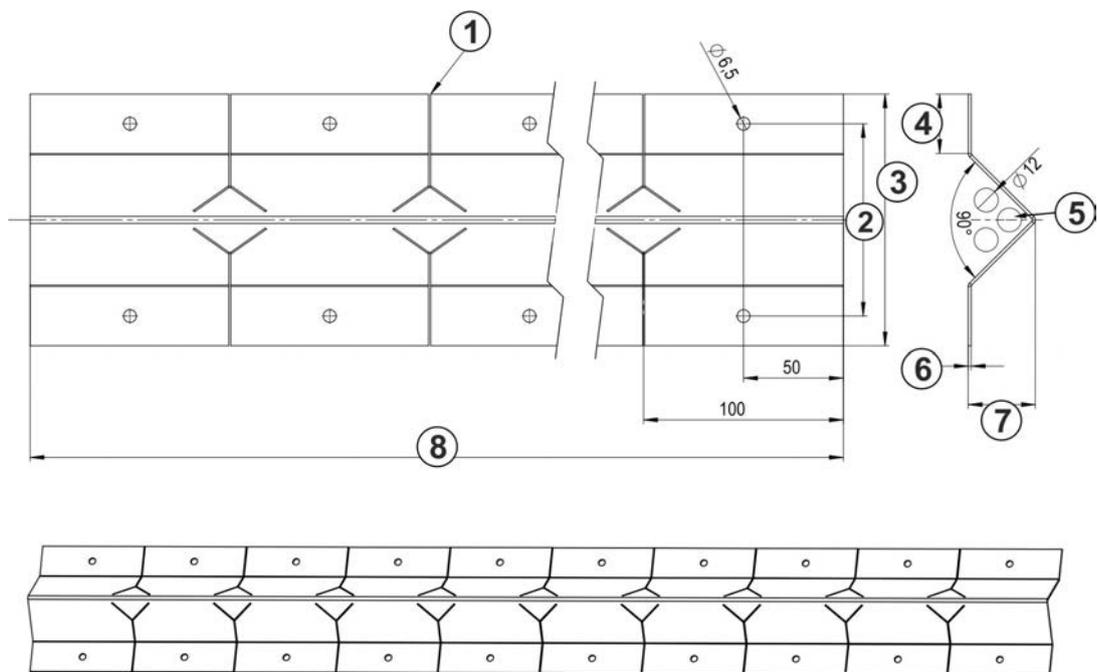


Fig. 23-19 Dimensional drawing cable protection sheet Type ZMS 140



	ZMS 141	ZMS 142
1	Y-bending edges every 100 mm	Y-bending edges every 100 mm
2	97 mm	47 mm
3	127 mm	62 mm
4	30 mm	15 mm
5	For max. 3 sensor cables	For max. 2 sensor cables
6	1.5 mm	1 mm
7	34 mm	16 mm
8	1000 mm	996 mm

Fig. 23-20 Dimensional drawing cable protection sheet Types ZMS 141 and ZMS 142



Fig. 23-21 Cable cover on PKM-V1xxKL... sensor

24 Cable Extension

The sensor cable of the sensor can be extended, depending on the sensor connection (see Tab. 6) and taking into account the basic conditions described below.

DANGER



Risk of personal injury

Observe the maximum possible cable lengths in the Ex area.

See EU Type Examination Certificate(s) at the end of these instructions.



Important Notice

Cable extensions and sensor connections may only be carried out by qualified personnel. This is to prevent damage to the sensor.



Important Notice

Improper connections that create increased contact resistances or the use of incorrect cables may lead to disturbances or measurement failure.

If you extend the sensor cable via a junction box, use a metal junction box. Be sure to connect the shield of the incoming and outgoing cable to the junction box ground.

Basic Conditions for Cable Extension

If the cables are to be extended, the preparation of an intrinsic safety certificate is required. For this, the following **points/specifications** must be considered/included:

- The cable specifications of the cable extension used and the sensor cable.
- When using overvoltage protection elements, additionally their internal capacitance and inductance.
- The capacitances and inductances that can be connected for the supply circuit.
- The capacitances and inductances that can be connected for the RS485 circuit.

Moreover, the following two **conditions** must be met during project planning, selection and installation in accordance with EN 60079-14:

- $C_o \geq C_i + C_k$
- $L_o \geq L_i + L_k$

with

C_o = maximum permissible external capacitance of the corresponding iXT circuit

C_i = effective internal capacitance of the PKM sensor and, if used, of the overvoltage protection element for the corresponding circuit

C_k = Total cable capacitances of the sensor cable and the cable extension used for the corresponding circuit

L_o = maximum permissible external inductance of the corresponding iXT circuit

L_i = effective internal inductance of the PKM sensor and, if used, of the overvoltage protection element for the corresponding circuit

L_k = Total cable inductances of the sensor cable and the cable extension used for the corresponding circuit

NIVUS cable specifications particle concentration sensor PKM-Vx

- Cable capacitance (blue/red): 100 pF/m
- Cable inductance (blue/red): 0.76 µH/m

These values are of great importance in an Ex application if the operator has to provide an intrinsic safety certificate for his plant and has to consider the connectable external capacitance C_o or inductance L_o .

Laying cables in the Ground

The cable permanently connected to the sensor is not intended for permanent direct burial. If the cable is to be laid in the ground, sand, gravel or similar, then use additional protective tubes or protective hoses.

Select the inner diameter, bending radius and type of installation of these additional protective guides in such a way that the installed signal cable can be removed without problems afterwards and a new signal cable can be pulled in.

Possible Cable Extensions

Sensor Connection		Sensor Type	Cable Extension
K	Sensor without pressure measurement cell, cable end pre-assembled for connection to NivuParQ 8x	PKM-V100	Cable extension with single shielded signal cable.
L	Sensor with pressure measurement cell, cable end pre-assembled for connection to NivuParQ 8x	PKM-V10D	Cable extension is only possible if the pressure compensation element type <i>ZUBO DAE</i> by NIVUS is used: Connect the sensor cable end to the terminals of the junction box of the pressure compensation element and extend it from there with a single shielded signal cable.

Tab. 6 Cable extensions depending on the connection

For extension NIVUS recommend cable type A2Y(L) 2Y 6x2x0.8 (or higher number of conductors).

➡ Procedure for cable extension with cable type A2Y(L) 2Y:

1. Extend the two twisted signal lines (RxTx) for bus communication with one wire each.
2. Combine the remaining cores in equal numbers to form two core strands for UE+ and for GND.
3. Depending on the distance between the sensor and the transmitter, extend these core strands with one or more parallel-connected core(s) per connection line.
Solder or crimp parallel wires for UE+ and GND together for each supply line.

Tab. 7 shows the overview for the minimum number of conductors per connection for the **signal cable** type A2Y(L) 2Y.

The minimum number of cores per connection is specified as follows:

- $x(y)$

with

x = min. total number of conductors incl. data lines

y = Conductors for power supply + and -

The cable lengths given below refer to non-Ex sensors.

Extension to	Minimum number of cores per connection Sensor - Transmitter		Remarks
	10 m Cable on Sensor	30 m Cable on Sensor	
30 m	4 (2)	Not applicable	
50 m	4 (2)	4 (2)	
70 m	4 (2)	4 (2)	
100 m	4 (2)	4 (2)	
150 m	6 (4)	6 (4)	
200 m	6 (4)	6 (4)	
250 m	8 (6)	8 (6)	Commissioning by NIVUS customer service required
300 m	8 (6)	8 (6)	
400 m	10 (8)	10 (8)	
500 m	12 (10)	12 (10)	
700 m	14 (12)	16 (14)	
1000 m	20 (18)	20 (18)	

Tab. 7 Minimum number of conductors per connection

Cable Extension with other Cable Types

- Internationally, signal cables of other types with a minimum diameter of 0.8 mm² and a common cable shield can be used. If you are uncertain about the suitability of the signal cable, contact NIVUS and enclose a detailed cable type data sheet.
- Extension by equivalent cables with other cross-sections on request.

Common cable extension of multiple sensor cables

In an application with several flow velocity sensors, you can extend the sensor cables with a common signal cable.



Important Notice

Joint extensions of different applications or joint extensions of separate level and flow velocity measurements in a common signal cable are not permitted.

25 Pressure Compensation Elements

25.1 General

Sensors with integrated pressure measurement cell may only be operated with a NIVUS pressure compensation element.

The pressure equalisation element is provided with two drying capsules or with drying granulate. These prevent moisture from penetrating and protect the electronics.

- ➡ Check the drying capsules / granulate (depending on the environment) at regular intervals.
- ➡ Replace the drying capsules / drying granulate if necessary.
- ➡ Observe the maintenance information in Chap. "27.1.2 Pressure Compensation Element for PKM Sensors".

CAUTION



Sensor damage due to moisture ingress

Penetrating moisture can irreparably destroy the electronics inside the sensor.

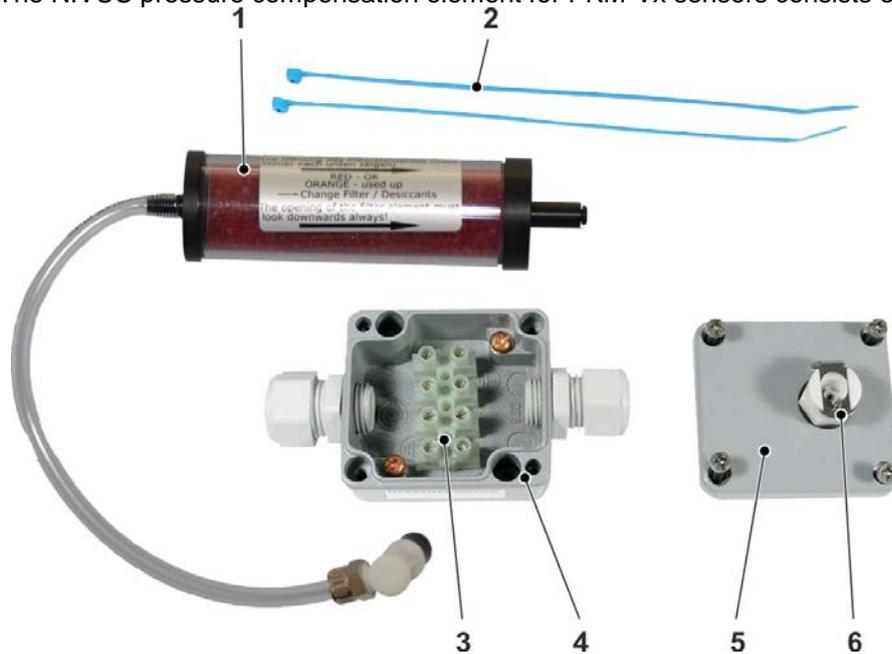
- *Always operate sensors with integrated pressure measurement cell with pressure compensation element. The drying granulate / drying capsules prevent the ingress of moisture.*
- *Never operate sensors with integrated pressure measurement cell without or with used drying granulate / drying capsules.*
- *Check drying granulate / drying capsules regularly and replace if necessary.*

➡ Accessories see Chap. "31 Accessories".

For sensors with pressure measuring cell (type V10D), the cable of the sensor must **not** be extended. The maximum uninterrupted cable length is 30 m. A junction box with pressure compensation (pressure compensation element) must then be installed to extend the cable. This pressure compensation element must also be installed if the cable of a sensor with integrated pressure measurement cell is to be connected directly to a transmitter of the types NivuParQ 8x.

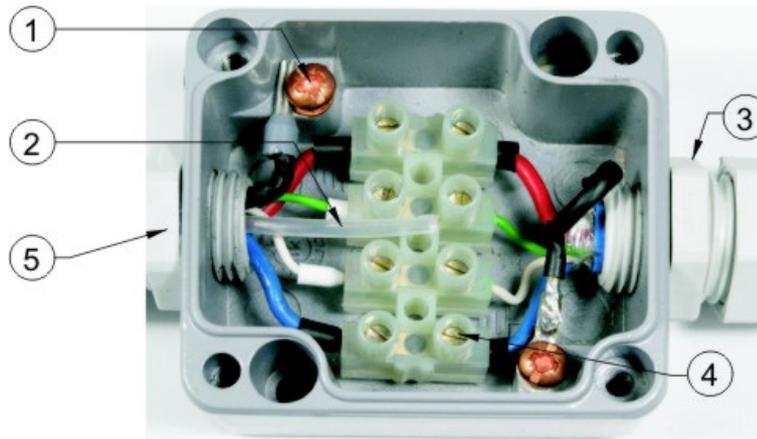
It is available at NIVUS under item number *ZUB0 DAE*.

The NIVUS pressure compensation element for PKM-Vx sensors consists of several parts:



- 1 Filter element consisting of air filter, air hose and air hose connector
- 2 Cable tie
- 3 Terminal Clamps
- 4 Junction box
- 5 Junction box cover
- 6 Self-closing socket for the air hose connector

Fig. 25-1 Parts of the pressure compensation element



- 1 Shield connection
- 2 Air hose
- 3 Side to transmitter
- 4 Terminal Clamps
- 5 Side to flow velocity sensor

Fig. 25-2 Junction box, open

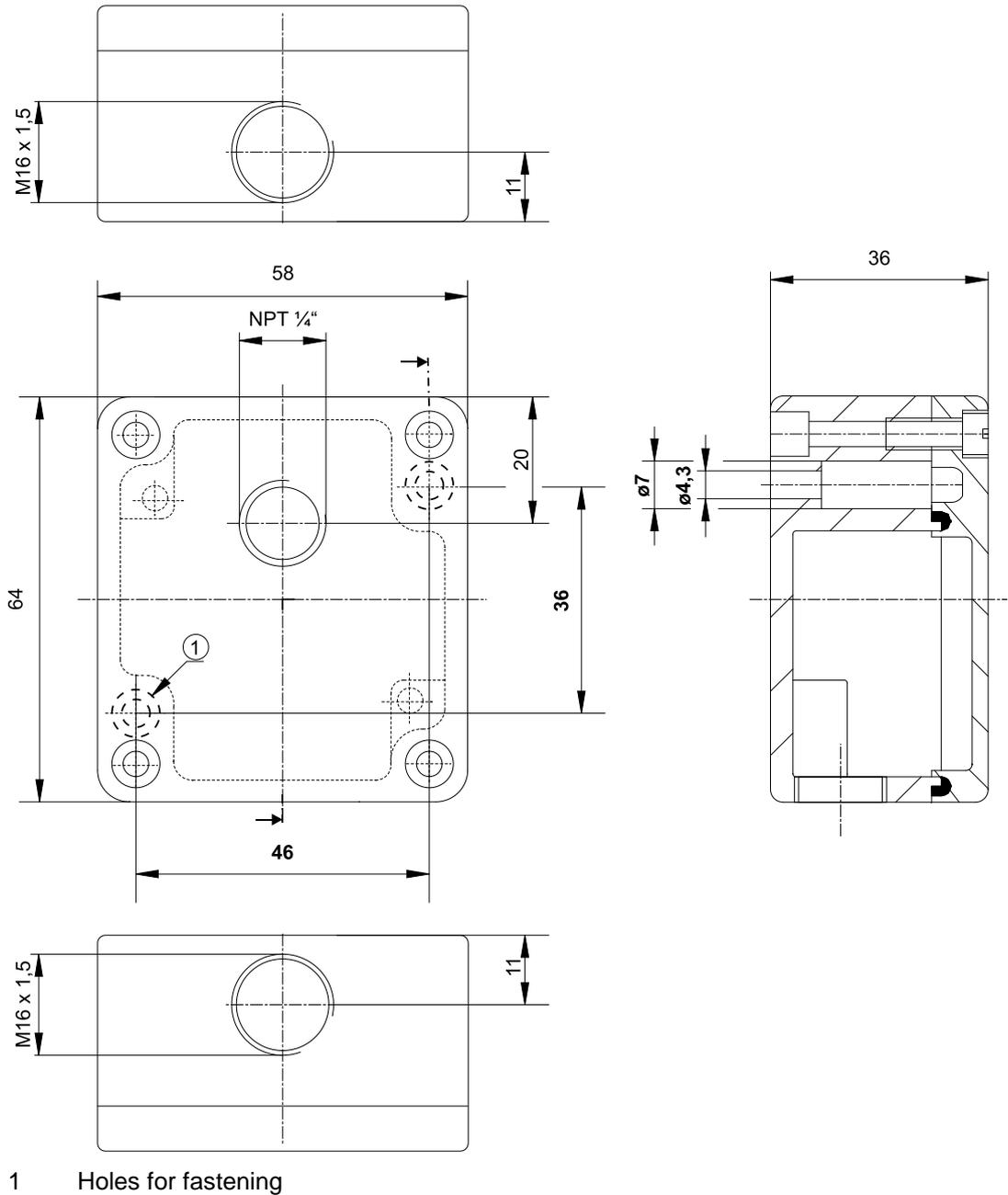


Fig. 25-3 Junction box, dimensions

25.1.1 Connecting Pressure Compensation Element and Air Filter



Important Notice

Install the junction box with air pressure compensation in an area where there are no corrosive gases and which is permanently protected from any flooding.

The shield of the incoming and outgoing cable must be connected to the shield connections of the metal junction box. Otherwise, measurements may be distorted or fail.

*The filter cover of the air filter must **always point downwards** to protect it from water drops.*

For the extension from the junction box to the transmitter use a signal cable type A2Y or another suitable signal cable with integrated common shield.

➡ Procedure:

1. Connect the 5-core cable coming from the sensor identically to the terminal strip in the junction box. Make sure that only the power supply (red + blue cable) and the signal bus lines (white + green) are connected to the terminal strip (Fig. 25-2).
2. Connect the cable shield (black) to one of the two shield connection terminals located in the box (Fig. 25-2 Pos.1).
3. Attach the air filter to one of the two cables with the two cable ties supplied so that the filter cover points downwards (Fig. 25-4).
4. Snap the air hose connector into the socket integrated in the cover (Fig. 25-1 Pos. 6).
5. Put on the junction box cover and screw it on.

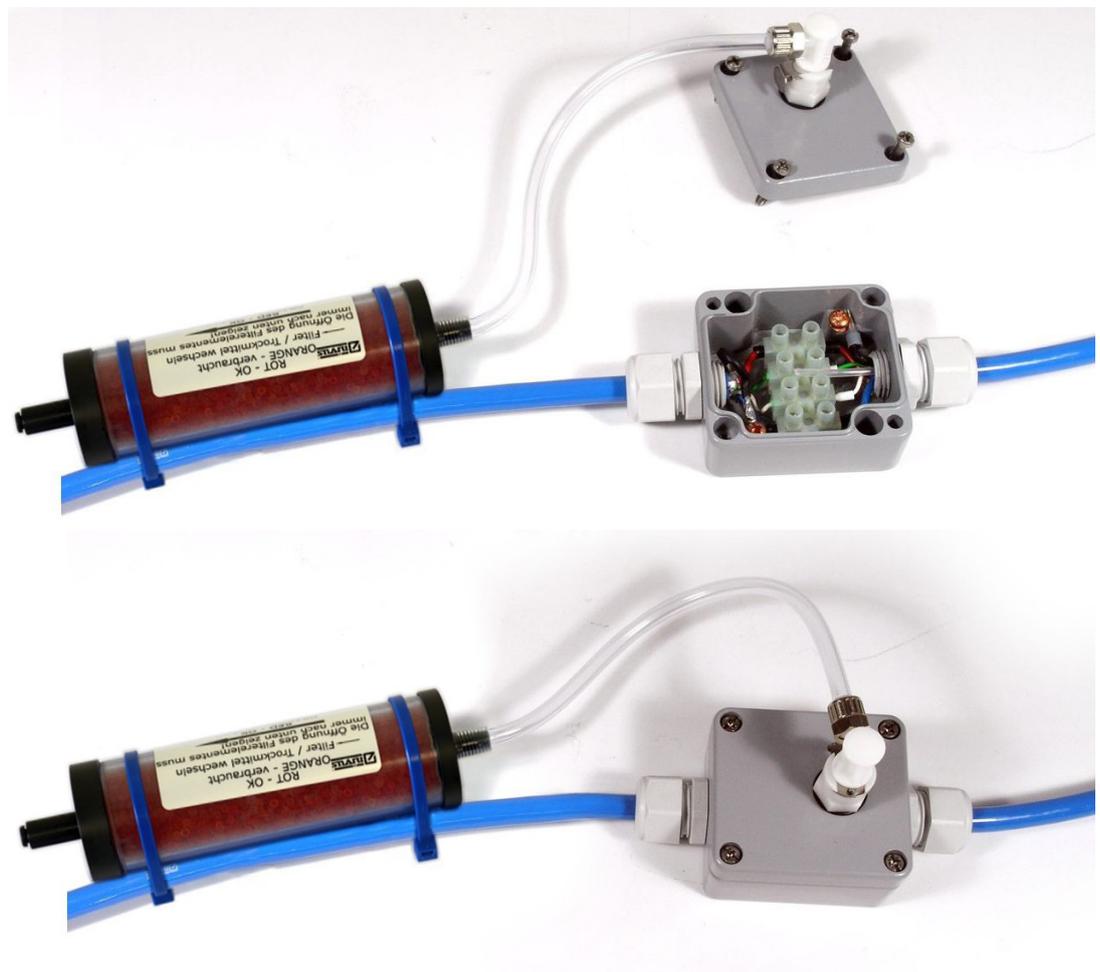


Fig. 25-4 Ready mounted pressure compensation element



Important Notice

The measurement incl. pressure compensation element must not be operated with the air hose connector disconnected, as an automatic self-sealing of the socket integrated in the cover leads to a shift of the zero point of the level measurement.

26 Resistance List

CAUTION



Damage due to aggressive media

In principle, there is a risk of pitting on the stainless steel mounting plate or on the pipe sensor jacket with media containing chloride. Hydrogen sulphide (H₂S - danger of diffusion through cable sheath) and various organic solvents can corrode the sensor material.

The installation of the sensors or the laying of the cables may only be carried out in media that are resistant to them. Otherwise, the sensors and cables may be destroyed.

The wetted parts of the sensors consist of the following components as standard:

- V4A/AISI 316 Ti (ground plate or pipe sensor jacket)
- PPO GF30 (sensor body)
- PEEK (sensor crystal cover)
- Polyurethane (cable sheath and cable gland)
- PTFE (gasket of the sensor screw joint)
- PVDF (sensor body CSM-V100K)

When using sensors with a pressure measurement cell, the following materials are added:

- Hastelloy® C-276
- Viton® (PA/PR)

The sensor system is resistant to normal domestic wastewater, sewage and rainwater as well as mixed water from municipalities and local authorities. Resistance is also not a problem in many industrial plants (e.g. BASF, Bayer, Currenta etc.). Nevertheless, sensor systems are not resistant to all substances and substance mixtures.

Observe that in the case of substance mixtures (simultaneous presence of several substances), catalytic effects may occur under certain circumstances, which do not appear in the presence of the individual substance. These catalytic effects cannot be completely tested due to the infinite possibilities of variations.

If in doubt, contact your local NIVUS representative and request a free material sample for long-term testing.

For special applications with highly aggressive media or for media containing solvents, sensors made of solid PEEK with Hastelloy or titanium base plate or corresponding tube sensors made of highly resistant special steels are available. Sensor cables immersed in the medium can be supplied specially sheathed with FEP (resistance to organic solvents or hydrogen sulphide).

MEDIUM	FORMULA	CONCENTRATION	HDPE	PPO GF30	PUR	PEEK	FEP	V4A	Hastelloy C 276	Viton (PA/PR)	PA GF30	PVDF	PP-H
Acetaldehyde	C ₂ H ₄ O	40 %	3/3	4	4	1	(1)	(1)	0	4/4	2/4	4/4	3/4
Acetic acid	C ₂ H ₄ O ₂	10 %	1/1	2	3	1	1/1	1/1	1	(3)	4/4	1/1	1/1
Acetone	C ₃ H ₆ O	40 %	1/1	4	4	1	(1)	1/1	1	4/4	1/0	3/4	1/3
Allyl alcohol	C ₃ H ₆ O	96 %	1/3	2	0	1	1/1	1/1	0	4/4	3/0	(2)	2/2
Aluminium chloride	AlCl ₃	10 %	1/1	2	0	1	1/1	3/4	1	1/0	1/0	1/1	1/1
Ammonium chloride	(NH ₄)Cl	watery	1/1	1	0	1	1/1	1/2L	1	1/1	3/4	1/1	0/0
Ammonium hydroxide	NH ₃ + H ₂ O	5 %	1/1	2	4	1	1/1	1/1	1	(2)	(2)	(2)	1/1
Aniline	C ₆ H ₇ N	100 %	1/2	3	4	1	1/1	1/0	1	2/4	3/4	1/4	2/3
Benzene	C ₆ H ₆	100 %	3/4	3/4	2	1	1/1	1/1	1	3/3	2/0	1/3	3/4
Benzyl alcohol	C ₇ H ₈ O	100 %	3/4	3	2	1	1/1	1/1	1	1/0	4/4	1/1	4/4
Boric acid	H ₃ BO ₃	10 %	1/1	1	1	1	1/1	1/1	1	1/1	1/0	1/1	1/1
Bromic acid	HBrO ₃	concentr.	0/0	0	3	1	0/0	(4)	0	(2)	(4)	(1)	3/0
Butanol	C ₄ H ₁₀ O	techn. pure	1/1	2	3	1	1/1	(1)	1	3/4	1/0	(2)	1/2
Calcium chloride	CaCl ₂	spirituous	1/0	1	1	1	1/1	1/2L	1	1/1	4/4	1/1	1/1
Carbon disulphide	CS ₂	100 %	4/4	2	0	1	1/1	1/1	1	1/0	3/0	1/0	4/4
Carbon tetrachloride	CCl ₄	100 %	4/4	3	4	1	1/1	1/1L	1	1/1	4/4	1/1	4/4
Caustic soda	NaHO	50 %	1/1	1	3	1	1/1	1/3	1	3/3	1/0	1/1	1/1
Chlorine	Cl ₂		4/4	3	3	1	1/1	1/0	0	1/1	4/4	1/0	4/4
Chlorine water	Cl ₂ x H ₂ O		3/0	2	0	1	(1)	2/0L	1	1/0	4/4	1/1	3/4
Chlorobenzene	C ₆ H ₅ Cl	100 %	3/4	3	4	1	1/1	1/1	1	3/4	4/4	1/1	3/4
Chloroform	CHCl ₃	100 %	3/4	4	4	1	1/1	1/1	1	4/4	3/4	1/1	3/4
Chloromethane	CH ₃ Cl	techn. pure	3/0	4	4	1	1/0	1/1L	0	4/4	(3)	1/0	4/4
Chromic acid	CrO ₃	10 %	1/1	1	0	1	1/1	1/2	1	1/1	4/4	1/1	1/1
Citric acid	C ₆ H ₈ O ₇	10 %	1/1	1	1	1	1/1	1/1	1	1/1	1/1	1/1	1/1
Diesel	—	100 %	1/3	2	0	1	(1)	(1)	0	1/1	1/1	1/1	1/3
Ethanedioic acid	C ₂ H ₂ O ₄ x 2H ₂ O	watery	1/1	2	0	1	1/1	1/3	2	1/1	4/4	1/1	1/1
Ethanol	C ₂ H ₆ O	96 %	1/0	1	1	1	1/1	1/1	1	3/0	1/0	1/1	1/1
Ethyl acetate	C ₄ H ₈ O ₂	100 %	1/3	3	3	1	1/1	(1)	0	4/4	1/0	1/1	1/3
Ethyl alcohol	C ₂ H ₆ O	100 %	1/0	1	1	1	1/1	1/1	0	3/0	1/0	1/1	0/0
Ethylen chloride	C ₂ H ₄ Cl ₂		3/3	4	3	1	1/1	1/1L	1	3/0	3/0	1/1	3/4
Ferric chloride	FeCl ₃	saturated	1/1	2	3	2	1/1	4/4	0	1/1	3/0	1/1	1/1
Formaldehyd dilution	CH ₂ O	10 %	1/1	1	2	1	1/1	1/1	1	3/0	3/3	1/1	1/1
Glycerin	C ₃ H ₈ O ₃	90 %	1/1	1	2	1	1/1	1/1	1	1/1	1/0	1/1	1/1
Heptane	C ₇ H ₁₆	90 %	2/3	1	1	1	1/1	1/1	1	1/1	1/0	1/1	0/0
Hexane	C ₆ H ₁₄	100 %	2/3	1	2	1	1/1	1/1	1	1/1	4/4	1/1	2/3
Hydrochloric acid	HCl	1-5 %	1/1	1	3	1	1/1	4/4	1	1/1	4/4	1/1	1/1
Hydrofluoric acid	HF	50 %	1/1	2	3	1	1/1	4/4	2	1/3	4/4	1/1	1/1
Hydroxypropionic acid	C ₃ H ₆ O ₃	3 %	1/1	1	0	1	1/1	1/1	1	1/1	(3)	1/1	1/2
Isopropanol	C ₃ H ₈ O	techn. pure	1/1	1	2	1	1/1	(1)	1	1/1	1/0	0/0	1/1
Magnesium chloride	MgCl ₂	watery	1/1	1	2	1	1/1	1/0L	1	1/1	1/0	1/1	1/1
Mercuric chloride	HgCl ₂	watery	1/1	1	0	1	1/1	(4)	1	1/1	4/4	1/1	1/1
Methanol	CH ₄ O		1/1	1	2	1	1/1	1/1	1	3/4	2/0	1/1	1/1
Methyl acetate	C ₃ H ₆ O ₂	techn. pure	1/0	3	0	1	1/0	1/1	1	4/4	1/0	1/1	1/3
Nitric acid	HNO ₃	1-10 %	1/1	1	3	1	1/1	1/1	1	1/1	4/4	1/1	1/1
Nitrobenzene	C ₆ H ₅ NO ₂		3/4	3	4	1	1/1	1/1	0	4/4	4/4	1/1	2/4
Oleic acid	C ₁₈ H ₃₄ O ₂	techn. pure	1/3	1	1	1	(1)	1/1	0	2/2	1/0	1/1	1/3
Ozone	O ₃		3/4	2	2	1	1/1	0/0	0	1/0	4/4	(1)	3/4
Petrol, unleaded	C ₉ H ₁₂ - C ₁₂ H ₂₆		2/3	3	2	1	1/1	1/1	1	(1-3)	1/0	1/1	3/4
Petroleum	—		1/1	1	1	1	1/1	1/1	1	1/1	(1)	1/0	1/3
Petroleum	—	techn. pure	1/3	3	1	1	(1)	1/1	0	1/0	1/0	0/0	1/3
Phenol	C ₆ H ₆ O	100 %	2/3	3	2	1	1/1	1/1	1	2/3	4/4	1/1	1/2
Phenylmethane (Toluol)	C ₇ H ₈	100 %	3/4	3	3	1	1/1	1/1	0	3/3	1/0	1/1	3/4
Phosphoric acid	H ₃ PO ₄	85 %	1/1	1	0	1	1/1	1/3	1	1/1	4/4	1/1	1/2
Potassium hydroxide	KHO	10 %	1/1	1	3	1	1/1	1/1	1	4/4	1/0	1/1	1/1
Potassium nitrate	KNO ₃	watery	1/1	1	0	1	1/1	1/1	1	1/1	1/0	1/1	1/1
Sodium bisulphite	NaHSO ₃	watery	1/1	1	0	1	(1)	1/1	1	1/0	1/0	1/1	1/1
Sodium carbonate	Na ₂ CO ₃	watery	1/1	1	3	1	1/1	1/1	1	1/1	1/0	1/1	1/1
Sodium chloride	NaCl	watery	1/1	1	2	1	1/1	1/2	1	1/1	1/1	1/1	1/1
Sodium sulphate	Na ₂ SO ₄	watery	1/1	1	0	1	1/1	1/1	1	1/1	1/0	1/1	1/1
Sulphuric acid	H ₂ SO ₄	40 %	1/1	1	3	1	1/1	2/3	1	1/1	4/4	1/1	1/1
Trichloroethylene	C ₂ HCl ₃	100 %	3/4	4	4	1	1/1	1/1L	1	1/3	3/0	1/0	4/4
Vegetable oils	—		0/0	1	1	1	(1)	1/1	0	1/0	0/0	1/1	1/3

Tab. 8 Resistance List

Resistance List Legend

Resistances

Two values are given per medium:

left figure = value at +20 °C

right figure = value at +50 °C

0	no information available/no statement possible
1	very good resistance/suitability
2	good resistance/suitability
3	limited resistance
4	no resistance
K	no general information possible
L	risk of pitting or stress corrosion cracking
(°)	estimated value

Material Name

HDPE	High-density Polyethylene
FEP	Tetrafluorethylene-Perfluorpropylene
V4A	Stainless steel 1.4401 (AISI 316)
PPO GF30	Polyphenyloxylene with 30 % glass fibre content
PU	Polyurethane
PEEK	Polyetheretherketone
PA	Polyamide
PVDF	Polyvinylidenfluoride

Maintenance and Cleaning

WARNING



Disconnect the System from Mains Power

Disconnect the unit from the mains and secure the higher system against being switched on again before starting maintenance, cleaning and/or repair work (only by qualified personnel).

Disregarding may lead to electric shock.

WARNING



Check danger due to explosive gases

Before starting assembly, installation and maintenance work, be sure to check that all regulations on safety at work have been observed and that there is no possible risk of explosive gases. Use a gas warner for the check.

When working in the sewer system, make sure that no electrostatic charge can occur:

- Avoid unnecessary movements to reduce the building-up of static charges.
- Discharge any static electricity present on your body before you start installing the sensor.

Disregarding may result in personal injury or damage to the system.

WARNING



Germ Contamination

Due to the frequent use of the sensors in the waste water sector, parts can be contaminated with dangerous germs. Therefore, appropriate precautions must be taken when coming into contact with cables and sensors.

Wear protective clothing.

27 Maintenance

27.1 Maintenance of the Wedge Sensors

27.1.1 Wedge Sensors with Pressure Measurement Cell

The level measurement of sensors with pressure measurement cell is subject to a long-term drift for physical reasons (see Chap. "25.1.1 Connecting Pressure Compensation Element and Air Filter").

Therefore, NIVUS recommend a 0-point calibration after every six months. Please contact the NIVUS customer service.

The best calibration results are achieved when the water level is as low as possible or when the sensor is dismantled and removed from the medium.

The wedge sensors with pressure measurement cell are additionally equipped with a filter element with drying granulate or with drying capsules at the connection plug or at the pressure compensation element.

The drying granulate and the drying capsules are subject to natural wear, which is dependent on:

- Measurement duration
- Measurement interval
- Fluctuations in atmospheric pressure
- Environmental conditions

Check the air filter or the drying capsules at regular intervals or before each use. Wear is indicated by the colour change of the drying granulate or the drying capsules (see sticker on the pressure compensation element).

If the colour of the drying granulate starts to change, then change the drying granulate or replace the filter element with a new filter element of the same design. When the colour of the drying capsules starts to change, change them.

➡ For spare parts see Chap. "31 Accessories".

27.1.2 Pressure Compensation Element for PKM Sensors

Check the filter element at regular intervals when using PKM sensors with pressure measurement cell and pressure compensation element. The intervals depend on the prevailing humidity and can be between 2 and 12 weeks, depending on the application. Wear of the air filter is indicated by the colour change of the drying granulate (see sticker on the air filter). If the drying granulate has discoloured by more than 50 %, then you must change it or replace the filter element.

➡ For spare parts see Chap. "31 Accessories".

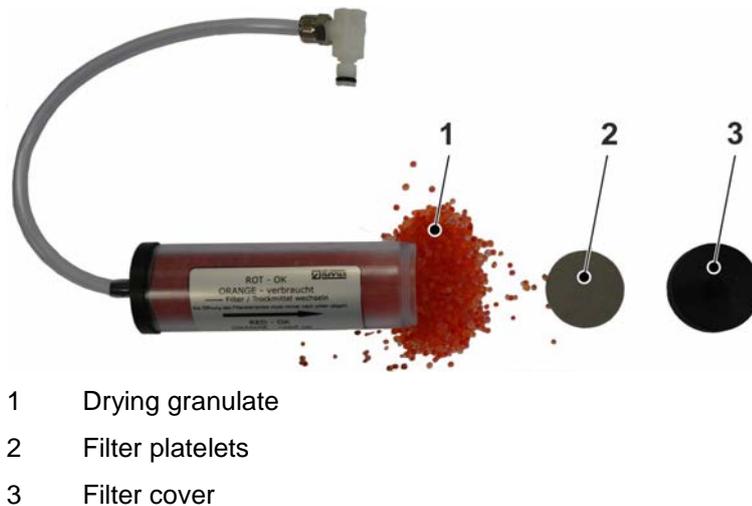


Fig. 27-1 Air filter, open

27.2 Maintenance Interval

The companies of the NIVUS-Group of companies recommend an **annual check** of the entire measuring system by the NIVUS customer service.

Depending on the area of application of the measuring system, the maintenance interval may vary. The scope of maintenance and its intervals depend on the following factors:

- Measurement principle of the sensors
- Material wear
- Measurement medium and channel hydraulics
- General regulations for the operator of the measurement system
- Environmental conditions

NIVUS recommends having the measurement system completely be inspected by a legally associated company or subsidiary of NIVUS-Group after **latest ten years**.

Generally, the verification of instruments and sensors is a basic measure in order to improve operational reliability and to increase the lifetime.

27.3 Customer Service Information

For the recommended annual inspection of the entire measuring system or complete maintenance after ten years at the latest, contact our customer service:

NIVUS GmbH - Customer Centre

Phone +49 7262 9191-922

customercenter@nivus.com

28 Cleaning

28.1 Principles of Cleaning

In heavily polluted media with a tendency to sedimentation, it may be necessary to clean flow velocity sensors at regular intervals. The intervals depend on the application. Use a brush with plastic bristles, a street broom or similar for this purpose.

CAUTION



Damage due to the use of hard objects or high-pressure cleaners

- *Never use hard objects such as wire brushes, rods, scrapers or similar to clean the sensor.*
- *The use of water jet cleaning is only permissible up to a permissible flushing pressure of max. 4 bar (see chapter "17 Specifications") (e.g. hosing down with a water hose).*
- *As a matter of principle, **do not** clean flow velocity sensors with pressure measuring cell (type V10D) **with a water jet.***
- *Do not clean sensors with high-pressure cleaners. The use of high-pressure cleaners may damage the sensor and lead to measurement failure.*

28.2 Cleaning of the Wedge Sensors

CAUTION



Material damage and measurement errors due to loose parts

Removal or loosening of bottom plate or cable gland of the sensor will cause leakage and result in failure of measurement and sensor.

Do not remove any parts of the sensor.

CAUTION



Damage to the pressure measurement cell during cleaning

Never clean the pressure measurement cell with a water jet. To clean the pressure measurement cell, simply immerse the sensor in a bucket of water and gently swirl it to clean it.

The cover of the pressure measurement cell is sealed with a sticker on the bottom plate. This warning sticker must not be damaged or removed under any circumstances. Do not loosen the screws below the sticker.

Non-compliance may have negative consequences in terms of warranty and liability. See Chap. "4 Warranty" and "5 Disclaimer".

If in doubt, have the pressure probe cleaned by NIVUS customer service.

DANGER



Danger by electrostatic Discharge

Do **not** wipe the sensor with a dry cloth.

In case of disregard, the explosion protection of the device is no longer given due to possible static charge.

Possible ignition in an explosive atmosphere poses a danger to the user's life.

The sensor enclosure complies with protection class IP68 when closed and is not very sensitive. Nevertheless, a high-pressure cleaner must **not** be used for cleaning.

Do **not** use aggressive cleaning agents or solvents. Instead, it is better to use mild household cleaners or soap suds.

Rinse the connection duct milled into the mounting plate for pressure measurement with water **immediately after each removal** to prevent deposits from sticking. To do this, immerse the sensor in water several times.

29 Dismantling/Disposal

Improper disposal may be harmful to the environment.

➡ Dispose of device components and packaging materials in accordance with the applicable local environmental regulations for electrical products:

1. If possible, drain the measurement place.
2. Use a suitable tool to disconnect the connected cables from the transmitter.
3. Remove the sensors from the canal or the pipeline.



EU WEEE Directive

This symbol indicates that the requirements of Directive 2012/19/EU on waste electrical and electronic equipment must be observed when disposing of the device. NIVUS GmbH support and promote the recycling or environmentally sound, separate collection/disposal of waste electrical and electronic equipment to protect the environments and human health. Observe the local laws and regulations on disposal.

NIVUS GmbH is registered with the EAR, therefore public collection and return points in Germany can be used for disposal.

30 Installation of Spare Parts and Wearing Parts

We expressly draw your attention to the fact that spare parts and accessories which have not been supplied by us have also not been tested and approved by us. The installation and/or use of such products may therefore negatively alter or invalidate the design properties of your measurement system.

NIVUS are not liable for damage caused by the use of non-original parts and non-original accessories.

31 Accessories

Article No	Description
<i>ZUB0 DAE</i>	Pressure compensation element; For connecting sensors with integrated pressure measurement cell and open cable end (cable tail); Material: aluminium / plastic; Protection class: IP54 (except filter element)
<i>ZUB0 FILTER</i>	Replacement filter element; With connector and connection hose for connecting sensors with integrated pressure measurement cell to the pressure compensation element <i>ZUB0 DAE</i> .
<i>ZUB0 FILTER MAT</i>	Drying granulate; To refill used air filters of the filter element <i>ZUB0 FILTER</i> , 1 kg (for approx. 25 refills)
<i>ZUB0 FILTER MAT5</i>	Drying granulate; To refill used air filters of the filter element <i>ZUB0 FILTER</i> , 200 g (for approx. 5 refills)
<i>ZUB0 RMS2 8SP</i>	Base sheet for RMS2 for sensor, 45°, for simultaneous installation of PKM and OCL sensors
<i>ZUB0 RMS2 8SPF</i>	Base sheet for RMS2 for sensor, 70°, sensor mounting in flow direction

Tab. 9 Spare parts for the PKM particle concentration sensor

More accessories and spare parts can be found in the current NIVUS price list.

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Approvals, Certificates and Declarations of Conformity

DE / EN / FR	EU Konformitätserklärung									
	<i>EU Declaration of Conformity</i> <i>Déclaration de conformité UE</i>	NIVUS GmbH Im Taele 2 75031 Eppingen Telefon: +49 07262 9191-0 Telefax: +49 07262 9191-999 E-Mail: info@nivus.com Internet: www.nivus.de								
	Für das folgend bezeichnete Erzeugnis: <i>For the following product:</i> <i>Le produit désigné ci-dessous:</i>									
	<table border="1"><tr><td>Bezeichnung:</td><td>Partikelkonzentrationssensor</td></tr><tr><td><i>Description:</i></td><td><i>Particle concentration sensor</i></td></tr><tr><td><i>Désignation:</i></td><td><i>Capteur de concentration de particules</i></td></tr><tr><td>Typ / Type:</td><td>PKM-V1xxKT0... / PKM-V1xxKL0...</td></tr></table>	Bezeichnung:	Partikelkonzentrationssensor	<i>Description:</i>	<i>Particle concentration sensor</i>	<i>Désignation:</i>	<i>Capteur de concentration de particules</i>	Typ / Type:	PKM-V1xxKT0... / PKM-V1xxKL0...	
Bezeichnung:	Partikelkonzentrationssensor									
<i>Description:</i>	<i>Particle concentration sensor</i>									
<i>Désignation:</i>	<i>Capteur de concentration de particules</i>									
Typ / Type:	PKM-V1xxKT0... / PKM-V1xxKL0...									
	erklären wir in alleiniger Verantwortung, dass die auf dem Unionsmarkt ab dem Zeitpunkt der Unterzeichnung bereitgestellten Geräte die folgenden einschlägigen Harmonisierungsvorschriften der Union erfüllen: <i>we declare under our sole responsibility that the equipment made available on the Union market as of the date of signature of this document meets the standards of the following applicable Union harmonisation legislation:</i> <i>nous déclarons, sous notre seule responsabilité, à la date de la présente signature, la conformité du produit pour le marché de l'Union, aux directives d'harmonisation de la législation au sein de l'Union:</i>									
	<ul style="list-style-type: none">• 2014/30/EU• 2011/65/EU									
	Bei der Bewertung wurden folgende einschlägige harmonisierte Normen zugrunde gelegt bzw. wird die Konformität erklärt in Bezug auf die nachfolgend genannten anderen technischen Spezifikationen: <i>The evaluation assessed the following applicable harmonised standards or the conformity is declared in relation to other technical specifications listed below:</i> <i>L'évaluation est effectuée à partir des normes harmonisées applicable ou la conformité est déclarée en relation aux autres spécifications techniques désignées ci-dessous:</i>									
	<ul style="list-style-type: none">• EN 61326-1:2013									
	Diese Erklärung wird verantwortlich für den Hersteller: <i>This declaration is submitted on behalf of the manufacturer:</i> <i>Le fabricant assume la responsabilité de cette déclaration:</i>									
	NIVUS GmbH Im Taele 2 75031 Eppingen Germany									
	abgegeben durch / <i>represented by / faite par:</i> Udo Steppe (Geschäftsführer / <i>Managing Director / Directeur général</i>)									
	Eppingen, den 16.03.2023									
	Gez. <i>Udo Steppe</i>									



UK Declaration of Conformity

NIVUS GmbH
Im Täle 2
75031 Eppingen

Telefon: +49 07262 9191-0
Telefax: +49 07262 9191-999
E-Mail: info@nivus.com
Internet: www.nivus.de

For the following product:

Description:	Particle concentration sensor
Type:	PKM-V1xxKT0... / PKM-V1xxKL0...

we declare under our sole responsibility that the equipment made available on the UK market as of the date of signature of this document meets the standards of the following applicable UK harmonisation legislation:

- SI 2016 / 1091 The Electromagnetic Compatibility Regulations 2016
- SI 2012 / 3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The evaluation assessed the following applicable harmonised standards or the conformity is declared in relation to other technical specifications listed below:

- BS EN 61326-1:2013

This declaration is submitted on behalf of the manufacturer:

NIVUS GmbH
Im Täle 2
75031 Eppingen
Germany

represented by:

Udo Steppe (Managing Director)

Eppingen, 16/03/2023

Signed by *Udo Steppe*



NIVUS GmbH
Im Täle 2
75031 Eppingen

Telefon: +49 07262 9191-0
Telefax: +49 07262 9191-999
E-Mail: info@nivus.com
Internet: www.nivus.de

DE / EN / FR

EU Konformitätserklärung

EU Declaration of Conformity

Déclaration de conformité UE

Für das folgend bezeichnete Erzeugnis:

For the following product:

Le produit désigné ci-dessous:

Bezeichnung:	"Ex" Partikelkonzentrationsensor
<i>Description:</i>	<i>"Ex" particle concentration sensor</i>
<i>Désignation:</i>	<i>"Ex" capteur de concentration de particules</i>
Typ / Type:	PKM-V1xxKTE... / PKM-V1xxKLE...

erklären wir in alleiniger Verantwortung, dass die auf dem Unionsmarkt ab dem Zeitpunkt der Unterzeichnung bereitgestellten Geräte die folgenden einschlägigen Harmonisierungsvorschriften der Union erfüllen:

we declare under our sole responsibility that the equipment made available on the Union market as of the date of signature of this document meets the standards of the following applicable Union harmonisation legislation:

nous déclarons, sous notre seule responsabilité, à la date de la présente signature, la conformité du produit pour le marché de l'Union, aux directives d'harmonisation de la législation au sein de l'Union:

- 2014/30/EU
- 2014/34/EU
- 2011/65/EU

Bei der Bewertung wurden folgende einschlägige harmonisierte Normen zugrunde gelegt bzw. wird die Konformität erklärt in Bezug auf die nachfolgend genannten anderen technischen Spezifikationen:

The evaluation assessed the following applicable harmonised standards or the conformity is declared in relation to other technical specifications listed below:

L'évaluation est effectuée à partir des normes harmonisées applicable ou la conformité est déclarée en relation aux autres spécifications techniques désignées ci-dessous:

- EN 61326-1:2013
- EN 60079-11:2012
- EN IEC 60079-0:2018 / AC:2020-02

Ex-Kennzeichnung / *Ex-designation* / *Marquage Ex* :

⊕ II 2G Ex ib IIB T4 Gb

EU-Baumusterprüfbescheinigung / *EU-Type Examination Certificate* / *Attestation d'examen «UE» de type:*

TÜV 20 ATEX 268840 X Issue: 01

Notifizierte Stelle (Kennnummer) / *Notified Body (Identif. No.)* / *Organisme notifié (N° d'identification)*

TÜV NORD CERT GmbH, Am TÜV 1, 45307 Essen, Germany

(0044)

Diese Erklärung wird verantwortlich für den Hersteller:

This declaration is submitted on behalf of the manufacturer:

Le fabricant assume la responsabilité de cette déclaration:

NIVUS GmbH
Im Täle 2
75031 Eppingen
Germany

abgegeben durch / *represented by* / *faite par:*

Marcus Fischer (Geschäftsführer / *Managing Director* / *Directeur général*)

Eppingen, den 19.04.2023

Gez. *Marcus Fischer*



UK Declaration of Conformity

NIVUS GmbH
Im Täle 2
75031 Eppingen
Telefon: +49 07262 9191-0
Telefax: +49 07262 9191-999
E-Mail: info@nivus.com
Internet: www.nivus.de

For the following product:

Description: "Ex" Particle concentration sensor

Type: PKM-V1xxKTE... / PKM-V1xxKLE...

we declare under our sole responsibility that the equipment made available on the UK market as of the date of signature of this document meets the standards of the following applicable UK harmonisation legislation:

- SI 2016 / 1091 The Electromagnetic Compatibility Regulations 2016
- SI 2016 / 1107 The Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016
- SI 2012 / 3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

The evaluation assessed the following applicable harmonised standards or the conformity is declared in relation to other technical specifications listed below:

- BS EN 61326-1:2013
- BS EN 60079-11:2012
- BS EN IEC 60079-0:2018 / AC:2020-02

Ex-designation:

⊕ II 2G Ex ib IIB T4 Gb

EU-Type Examination Certificate:

TÜV 20 ATEX 268840 X Issue: 01

Notified Body (Identif. No.):

TÜV Nord CERT GmbH, Am TÜV 1, 45307 Essen, Germany

(0044)

This declaration is submitted on behalf of the manufacturer:

NIVUS GmbH
Im Täle 2
75031 Eppingen
Germany

represented by:

Marcus Fischer (Managing Director)

Eppingen, 19/04/2023

Signed by *Marcus Fischer*



Translation

(1) **EU-Type Examination Certificate**

(2) Equipment and protective systems intended for use in potentially explosive atmospheres, **Directive 2014/34/EU**

(3) **Certificate Number** TÜV 20 ATEX 268840 X **Issue:** 01
(4) for the product: Particle Concentration Measuring Sensor type PKM-xxxxxx
(5) of the manufacturer: **NIVUS GmbH**
(6) Address: Im Täle 2
75031 Eppingen
Germany

Order number: 8003054575
Date of issue: See date of signature

- (7) The design of this product and any acceptable variation thereto are specified in the schedule to this EU-Type Examination Certificate and the documents therein referred to.
- (8) The TÜV NORD CERT GmbH, Notified Body No. 0044, in accordance with Article 17 of the Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in the confidential ATEX Assessment Report No. 23 203 340933.
- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN IEC 60079-0:2018/AC:2020-02 **EN 60079-11:2012**
except in respect of those requirements listed at item 18 of the schedule.
- (10) If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions for Use specified in the schedule to this certificate.
- (11) This EU-Type Examination Certificate relates only to the design, and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.
- (12) The marking of the product shall include the following:

 **II 2 G Ex ib IIB T4 Gb**

TÜV NORD CERT GmbH, Am TÜV 1, 45307 Essen, notified by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The deputy head of the notified body

 Digital unterschrieben
von Drews Anke
Datum: 2023.04.05
14:17:12 +02'00'

Hanover office, Am TÜV 1, 30519 Hannover, Tel. +49 511 998-61455, Fax +49 511 998-61590

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Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH



(13) **SCHEDULE**

(14) **EU-Type Examination Certificate No. TÜV 20 ATEX 268840 X** **Issue 01**

(15) **Description of product:**

The particle concentration measuring sensor type PKM-xxxxxxx permits the determination of the particle size distribution, particle concentration and optionally the spatially resolved flow velocity in 16 scan layers of liquid media, especially in the wastewater sector, by means of ultrasonic measuring technology.

In addition, the level of the medium can be measured via an integrated hydrostatic pressure measuring cell.

Type code:

PKM-	Type	Particle Concentration Measuring Sensor
V100		without level and flow velocity measurement
	KT	Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
	KL	Wedge sensor made of PPO with PEEK adapter; base plate 1.4571, flat design 70° approach surface
	RT	PPO tube sensor with PEEK adapter; base plate 1.4571
	ST	Rod sensor made of 1.4571
V1V1		with flow velocity measurement
	KT	Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
V1VD		with flow velocity measurement and pressure measuring cell for level measurement
	KT	Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
V10D		without flow velocity and with pressure measuring cell for level measurement
	KT	Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
	KL	Wedge sensor made of PPO with PEEK adapter; base plate 1.4571, flat design 70° approach surface
	ATEX- Approval	
	0	without
	E	Zone 1
		Cable length
	xx	
		Sensor connection
	x	Pipe length
	0	

This certificate may only be reproduced without any change, schedule included.
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Schedule to EU-Type Examination Certificate No. TÜV 20 ATEX 268840 X Issue 01

Thermal data:

Permissible ambient temperature range during operation: $-20\text{ °C} \leq T_a \leq +50\text{ °C}$

- (16) Drawings and documents are listed in the ATEX Assessment Report No. 23 203 340933
- (17) **Specific Conditions for Use:**
The particle Concentration Measuring Sensor type PKM-xxxxxx has to be installed and used in such a way that electrostatic charging from operation, maintenance or cleaning is excluded.
- (18) **Essential Health and Safety Requirements:**
No additional ones.

- End of EU-Type Examination Certificate -

This certificate may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH

	<h2 style="text-align: center;">IECEX Certificate of Conformity</h2>		
INTERNATIONAL ELECTROTECHNICAL COMMISSION IEC Certification System for Explosive Atmospheres <small>for rules and details of the IECEx Scheme visit www.iecex.com</small>			
Certificate No.:	IECEX TUN 20.0009X	Page 1 of 4	<u>Certificate history:</u> Issue 0 (2020-07-21)
Status:	Current	Issue No: 1	
Date of Issue:	2023-04-05		
Applicant:	NIVUS GmbH Im Täle 2 75031 Eppingen Germany		
Equipment:	Particle Concentration Measuring Sensor type PKM-xxxxxx		
Optional accessory:			
Type of Protection:	Intrinsic safety		
Marking:	Ex ib IIB T4 Gb		
Approved for issue on behalf of the IECEx Certification Body:		Anke Drews	
Position:		Deputy Head of IECEx Certification Body	
Signature: (for printed version)			
Date: (for printed version)			
<ol style="list-style-type: none">1. This certificate and schedule may only be reproduced in full.2. This certificate is not transferable and remains the property of the issuing body.3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.			
Certificate issued by:			
TÜV NORD CERT GmbH Hanover Office Am TÜV 1, 30519 Hannover Germany			

	<h2>IECEX Certificate of Conformity</h2>	
Certificate No.:	IECEX TUN 20.0009X	Page 2 of 4
Date of issue:	2023-04-05	Issue No: 1
Manufacturer:	NIVUS GmbH Im Täle 2 75031 Eppingen Germany	
Manufacturing locations:	NIVUS GmbH Im Täle 2 75031 Eppingen Germany	
<p>This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended</p>		
<p>STANDARDS : The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards</p>		
IEC 60079-0:2017 Edition:7.0	Explosive atmospheres - Part 0: Equipment - General requirements	
IEC 60079-11:2011 Edition:6.0	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"	
<p>This Certificate does not indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.</p>		
<p>TEST & ASSESSMENT REPORTS: A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:</p>		
Test Report:		
DE/TUN/ExTR20.0011/01		
Quality Assessment Report:		
DE/TUN/QAR13.0011/09		

	<h2>IECEX Certificate of Conformity</h2>
Certificate No.: IECEX TUN 20.0009X	Page 3 of 4
Date of issue: 2023-04-05	Issue No: 1
EQUIPMENT: Equipment and systems covered by this Certificate are as follows:	
Description of product: The Particle Concentration Measuring Sensor type PKM-xxxxxxx permits the determination of the particle size distribution, particle concentration and optionally the spatially resolved flow velocity in 16 scan layers of liquid media, especially in the wastewater sector, by means of ultrasonic measuring technology. In addition, the level of the medium can be measured via an integrated hydrostatic pressure measuring cell.	
Type code and Electrical data: See attachment to IECEX TUN 20.0009X issue No.1	
Thermal data: Permissible range of the ambient temperature $-20\text{ °C} \leq T_a \leq +50\text{ °C}$	
SPECIFIC CONDITIONS OF USE: YES as shown below: The particle Concentration Measuring Sensor type PKM-xxxxxx has to be installed and used in such a way that electrostatic charging from operation, maintenance or cleaning is excluded.	



IECEX Certificate of Conformity

Certificate No.: **IECEX TUN 20.0009X**

Page 4 of 4

Date of issue: 2023-04-05

Issue No: 1

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above)

Proof of conformity of the extended Particle Concentration Measuring Sensor type PKM-xKLxxx to IEC 60079-0:2017 and IEC 60079-11:201. This flat PKM wedge sensor variant with 70° approach surface was developed to be able to measure the particle concentration even at low levels (less than 10 cm).

Annex:

[Attachment to IECEX TUN 20.0009X issue No.1.pdf](#)

TÜV NORD CERT GmbH
Hannover Office
Am TÜV 1
30519 Hannover
Germany



Page 1 of 3
Attachment to IECEx TUN 20.0009X issue No.: 1

Description:

The Particle Concentration Measuring Sensor type PKM-xxxxxx permits the determination of the particle size distribution, particle concentration and optionally the spatially resolved flow velocity in 16 scan layers of liquid media, especially in the wastewater sector, by means of ultrasonic measuring technology. In addition, the level of the medium can be measured via an integrated hydrostatic pressure measuring cell.

Type code:

PKM-	Type	Particle Concentration Measuring Sensor
	V100	without level and flow velocity measurement
		KT Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
		KL Wedge sensor made of PPO with PEEK adapter; base plate 1.4571, flat design 70° approach surface
		RT PPO tube sensor with PEEK adapter; base plate 1.4571
		ST Rod sensor made of 1.4571
	V1V1	with flow velocity measurement
		KT Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
	V1VD	with flow velocity measurement and pressure measuring cell for level measurement
		KT Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
	V10D	without flow velocity and with pressure measuring cell for level measurement
		KT Wedge sensor made of PPO with PEEK adapter; base plate 1.4571
		KL Wedge sensor made of PPO with PEEK adapter; base plate 1.4571, flat design 70° approach surface
		IECEX- Approval
		0 without
		E Zone 1
		Cable length
		xx
		Sensor connection
		x Pipe length
		0

P17-F-610

Rev. 01 / 06.18

TÜV NORD CERT GmbH
Hannover Office
Am TÜV 1
30519 Hannover
Germany



Page 2 of 3
Attachment to IECEx TUN 20.0009X issue No.: 1

Electrical data:

Signal and supply circuit
 (Connection wires (cable tail):
 Red (X1): [+]
 Blue (X2): [GND])

In type of protection intrinsic safety Ex ib IIB
 Only for connection to certified intrinsically safe circuits.
 Maximum values:

$U_i = 10.5 \text{ V}$
 $I_i = 640 \text{ mA}$
 $P_i = 6.72 \text{ W}$

Effective internal capacitance C_i
 Effective internal inductance L_i
 The following applies to the permanently connected cable
 Capacitance per unit length
 Inductance per unit length unit

Capacitance of the permanently connected cable C_c
 Inductance of the permanently connected cable L_c
 $C_c = 90 \text{ pF/m}$
 $L_c = 0.76 \text{ µH/m}$

The connection of the signal and supply circuit to the Ex isolation module type iXT0-xxx and iXT0 xxx according to IECEx TUN 14.0014 is permitted.

Connection wire black X3

Shield

Interface RS485
 (Wires (cable tail):
 White (X5): [RxTx+]
 Green (X4): [RxTx-]
 Blue (X2): [GND])

In type of protection intrinsic safety Ex ib IIB
 with following maximum values:

$U_o = 5.4 \text{ V}$
 $I_o = 125 \text{ mA}$
 $P_o = 168.75 \text{ mW}$
 Characteristic line: linear
 Effective internal capacitance C_i is negligibly small
 Effective internal inductance L_i is negligibly small

The maximum permissible values for the external inductance L_o and the external capacitance C_o have to be taken from the following table:

Ex ib IIB	L_o [mH]	10	5	0.5	0.2	0.001
	C_o [µF]	12	15	28	37	1000

At connection of the RS485 ([RxTx+] und [RxTx-]) interface to belonging measuring transducers with active intrinsically safe circuits, the rules for the interconnection of intrinsically safe circuits have to be observed.

Maximum values:
 $U_i = 10.74 \text{ V}$
 $I_i = 236.3 \text{ mA}$
 $P_i = 634.4 \text{ mW}$

The internal pressure and temperature circuits (X6...X12) are designed in type of protection intrinsic safety Ex ib IIB and are not accessible to the user.

TÜV NORD CERT GmbH
Hannover Office
Am TÜV 1
30519 Hannover
Germany



Page 3 of 3
Attachment to IECEx TUN 20.0009X issue No.: 1

Thermal data:

Permissible ambient temperature range during operation: $-20\text{ °C} \leq T_a \leq +50\text{ °C}$

Details of change:

Proof of conformity of the extended Particle Concentration Measuring Sensor type PKM-xKLxxxx to IEC 60079-0:2017 and IEC 60079-11:2011.

This flat PKM wedge sensor variant with 70° approach surface was developed to be able to measure the particle concentration even at low levels (less than 10 cm).

Specific Conditions of Use:

The particle Concentration Measuring Sensor type PKM-xxxxxx has to be installed and used in such a way that electrostatic charging from operation, maintenance or cleaning is excluded.

P17-F-610

Rev. 01 / 06.18