

Technical and Installation Instruction for Radar sensors OFR

(Original Manual – German)



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Translation

If the device is sold to a country in the European Economic Area (EEA) this instruction handbook 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 handbook (German) must be consulted or the manufacturer contacted for clarification.

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Names

The use of general descriptive names, trade names, trademarks and the like in this handbook does not entitle the reader to assume they may be used freely by everyone. They are often protected registered trademarks even if not marked as such.

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2 General



Important

READ CAREFULLY BEFORE USE

KEEP IN A SAFE PLACE FOR LATER REFERENCE!

This "Technical Instruction for Radar Sensors" is for the initial start-up as well as for the connection of sensors to NIVUS transmitters and is primarily intended for trained expert personnel. The technical instructions moreover contain information on the installation of radar sensors and therefore shall be read carefully prior to installation or use.

This Technical instruction incl. Installation instruction is part of the Radar Sensor delivery and shall be available to users at any time. The safety instructions contained therein must be followed.

In case of selling the Radar Sensor this technical description must be provided to the purchaser.

Detailed information on how to operate the sensors in connection with NIVUS transmitters can be found in the accompanying transmitter instruction manual.

3 Safety Instructions and Hazard Warnings

3.1 Used Hazard Warnings

Use the following safety guidelines to help ensure your own personal safety and to help protect your equipment and working environment from potential damage.

DANGER



Hazard warnings

are framed and labelled with a warning triangle.

This indicates an immediate high risk threatening life and limb.



Danger by electric voltage

is framed and labelled with the Symbol on the left.

Indicates a hazard with a high risk of electric shock.

WARNING



is framed and labelled with a "STOP"-sign.

Indicates a hazard with moderate risk that can result in a life-threatening situation or (severe) bodily injury if it is not avoided.

CAUTION



is framed and labelled with a "STOP"-sign.

Indicates a potentially hazardous situation that may result in minor or medium injury or could result in material damage.



Note

Indicates a situation that will not result personal injury.



Important Note

Indicates a situation that could cause damage on this instrument if it is not avoided.

Contains information that should be highlighted.

For connection, initial start-up and operation of the Radar Sensors the following information and higher legal regulations (e.g. in Germany VDE), such as Ex-regulations as well as safety requirements and regulations in order to avoid accidents, must be kept.

All operations, which go beyond steps to install or to connect the sensor, must be carried out by NIVUS staff only due to reasons of safety and guarantee.

3.2 Safeguards and Precautions

WARNING



Germ contamination

Please note that due to the operation in the waste water field the measurement system and cables may be loaded with dangerous disease germs. Respective precautionary measures must be taken to avoid damage to one's health.

WARNING



Regulations for health and safety at work have to be observed

Before starting installation work, observing the work safety regulations need to be checked to prevent accidents.

WARNING



Do not disable safety devices!

It is strictly prohibited to disable the safety devices or to change the way they work.

3.3 Device Identification

The instructions in this technical description are valid only for the type of sensor indicated on the title page.

The article number can be found where the cable enters the sensor body as well as on a nameplate on the end of the cable. This nameplate is protected against weathering and abrasion by using a transparent shrunk-on hose and contains the following:

- Name and address of manufacturer
- CE label
- Type labelling and series identification (serial number).
- Year of manufacture

It is important for queries and replacement part orders to specify type, year of manufacture and serial number (Article no. if necessary). This ensures correct and quick processing.

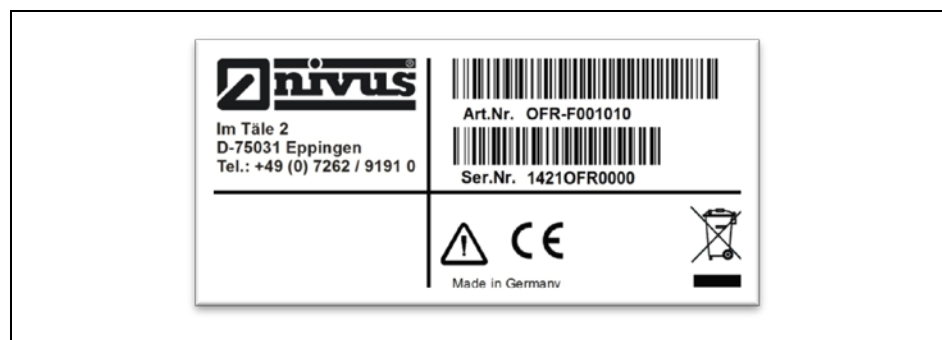


Fig. 3-1 Nameplate flow velocity sensor, type OFR

3.4 Installation of Spare Parts and Parts subject to wear and tear

We herewith particularly emphasize that replacement parts or accessories, which are not supplied by us, are not certified by us, too. Hence, the installation and/or the use of such products may possibly be detrimental to the device's ability to work.

Damages caused by using non-original parts and non-original accessories are left at user's risk. Appropriate accessories and spare parts can be found in chapter 9.

3.5 User's Responsibilities



Important Note

In the EEA (European Economic Area) national implementation of the framework directive 89/391/EEC and corresponding individual directives, in particular the directive 89/655/EEC concerning the minimum safety and health requirements for the use of work equipment by workers at work, as amended, are to be observed and adhered to.

In Germany the Industrial Safety Ordinance must be observed.

The customer must (where necessary) obtain any local **operating permits** required and observe the provisions contained therein.

In addition to this, he must observe local laws and regulations on

- personnel safety (accident prevention regulations)
- safety of work materials and tools (safety equipment and maintenance)
- disposal of products (laws on wastes)
- disposal of materials (laws on wastes)
- cleaning (cleansing agents and disposal)
- environmental protection

Connections

Before operating the device the user has to ensure, that the local regulations (e.g. for operation in channels) on installation and initial start-up are taken into account, if this is both carried out by the user.



Note

This instruction manual is part of the standard delivery and must be available to the user at any time.

The safety instructions contained therein must be strictly followed.



Note

For installation and operation of the complete system, the Instruction Manual for the flow measurement transmitter OCM Pro CF must also be used in addition to this technical description

3.6 Sensor versions

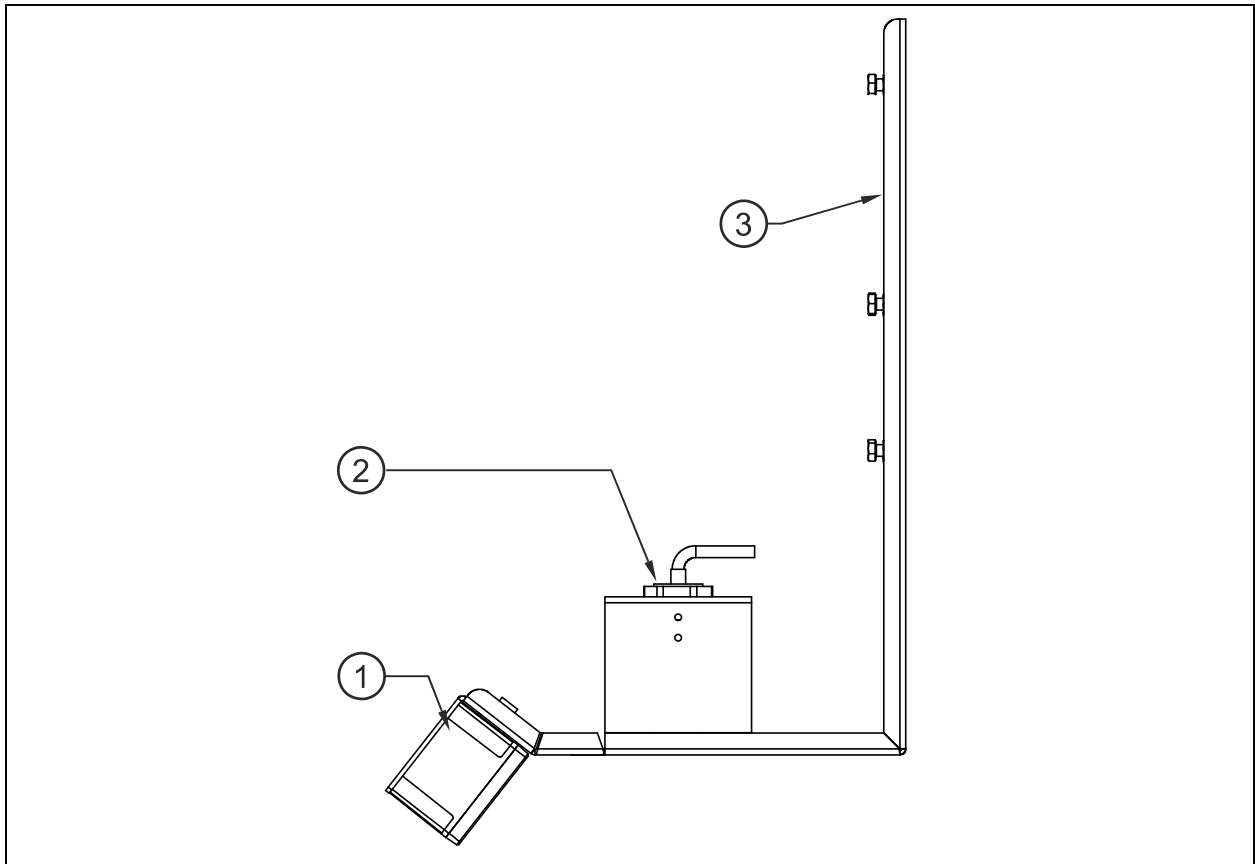
The Radar sensors are available in various constructions and additionally vary in cable length, cable connection as well as various special versions and materials. The article number can be found where the cable enters the sensor body as well as on a nameplate on the end of the cable. This nameplate is protected against weathering and abrasion by using a transparent shrunk-on hose.

| OCF- | Type | | | |
|------|------|---|-------------------------|---|
| | 00 | Standard version for various pipe and channel shapes. 5 relays, 3 mA outputs (galv. isolated), 1 mA input (galv. isolated with 2-wire sensor supply) or for external level measurement , integrated 3-step controller | | |
| | | Enclosure | | |
| | | W0 | wall mount IP65 | |
| | | | Power Supply | |
| | | AC | 85 - 265 V AC, 47-63 Hz | |
| | | DC | 20 - 28 V DC | |
| | | | Approvals | |
| | | | 0 | none |
| | | | E | Intrinsically safe sensor supply in Ex zone 1 |
| OCF- | 00 | W0 | | |

Fig. 3-2 Type key for Radar sensors, type OFR

4 Overview and use in accordance with the requirements

4.1 Overview



- 1 Sensor OFR
- 2 Sensor for level measurement (P-series or i-series sensors)
- 3 Combi holder made of stainless steel (ZUB0OFRHAL)

Fig. 4-1 Overview radar, level sensor and holder

4.2 Use in accordance with the requirements



Note

The Radar sensors are exclusively intended to be used for purposes as described below. Modifying or using the sensors for other purposes without the written consent of the manufacturer will not be considered as use in accordance with the requirements.

Damages resulting from this are left at user's risk.

The sensors are designed for a lifetime of approx. 10 years. After that period an inspection in addition with a general overhaul has to be made.

The various radar sensors have to be used in accordance to their regulations as described below.

Please necessarily observe the maximum permissible limit values as specified in chapter 5. Any cases varying from these conditions without written consent of NIVUS GmbH are entirely left at owner's risk.

OFR-P 001

The Radar sensors are designed to measure the flow velocity on the surface of liquid media. The sensor has to be connected to the NIVUS measurement transmitter, type OCM Pro CF.

5 Specifications

Radar sensor

| | |
|-------------------------|--|
| Measurement principle | Radar Doppler |
| Measurement frequency | 24 GHz ISM Band |
| Velocity range | ± 20 m/s (depending on RCS*) |
| Measurement uncertainty | <ul style="list-style-type: none">- flow velocity (v_{average}) within path ± 2 % of measurement value- flow (Q): ± 2-5 % of measurement value (depending on hydraulic conditions)- velocity offset $< \pm 5$ mm/s |
| Protection | IP67 |
| Operating temperature | -20 °C to +50 °C |
| Storage temperature | -30 °C to +70 °C |
| Cable length | 10/15/20/30/50/100 m; |
| Type of cable | LiYC11Y 2x1,5+1x2x0,34 |
| Outside cable diameter | 8,5 mm |
| Sensor types | OFR- P 001 |

*RCS= Radar Cross Section

The specifications of the measurement transmitter, refer to the instruction manual of stationary flow measurement transmitter >OCM Pro CF<.

6 Storing, Delivery and Transport

6.1 Receipt

Please check your delivery if it is complete and in working order according to the delivery note immediately after receipt. Any damage resulting from transport or transit shall be instantly reported to the carrier. An immediate, written report must be sent to NIVUS GmbH Eppingen as well.

Please report any shortcoming due to delivery to your representative or directly to NIVUS GmbH Eppingen within two weeks in writing.



Mistakes cannot be rectified later!

6.2 Delivery

The standard delivery of the Radar sensors contains:

- The instruction manual with the certificate of conformity. Here, all necessary steps to correctly install and to operate the sensors are listed.
- One Radar sensor OFR, depending on type (IP68 field enclosure or IP54 enclosure)

Additional accessories depending on order. Please check by using the delivery note.

6.3 Storing

The following storing conditions shall be strictly adhered to:

| | |
|-------------------|------------------|
| max. temperature: | +70 °C (158 °F) |
| min. temperature: | - 30 °C (-22 °C) |
| max. humidity: | 100 % |

The Sensors shall be protected from corrosive or organic solvent vapours, radioactive radiation as well as strong electromagnetic radiation.

6.4 Transport

The Sensors are designed for harsh industrial conditions. However do not expose them to heavy shocks or vibrations.

Transportation must be carried out in the original packaging.

6.5 Return

The units must be returned at customer costs to NIVUS Eppingen in the original packaging.

Otherwise the return cannot be accepted!

7 Operating principle

The OFR measurement system utilises the Doppler Effect to detect surface velocities. The radar sensor transmits radar waves onto the water surface in a defined angle. These radar waves are reflected from the water surfaces due to formation of waves and are detected by the sensor subsequently. Both signals are correlated with each other and then are evaluated using the Doppler effect. The results are used to calculate the surface velocity.
The radar sensor must not contact the water surface.

8 Sensor Mounting and Fastening



Important Note

In order to prevent the radar sensor from being damaged the steps described within this section of the manual shall be executed by trained expert personnel exclusively.

The executing company shall have extensive expertise and a sufficient background on installation and commissioning of ultrasonic measurement systems in part filled applications.

In other cases either contact the NIVUS commissioning service or an authorised specialist company.

8.1 General Installation regulations

WARNING



Danger prevention measures

Please ensure to observe all regulations on safety at work as well as danger due to explosive gases prior to the beginning of installation works. Respective measures to avert danger shall be taken if required.

The non-observance may result in injury to persons!

CAUTION



Regulations for health and safety at work have to be observed

Using divers can be necessary for the installation of radar sensors and cable layout. Diving works require compliance with particular regulations on safety at work. Carefully prepare such measures separately and consult the respective authorities for according approvals in time.

Instructed installation companies will require sufficient expertise as well as valid approvals for underwater installation.



Norms and Standards

The knowledge of standards is an indispensable requirement for a safe and proper measurement site selection and sensor fastening in waters or rivers.

See DIN EN-ISO 748 and DIN EN ISO 6416.



Permissions from public authorities

Prior to the sensors installation at bridge piers, embankments, groynes etc.; at the laying of cables as well as the operation of the facilities in public waters, a written authorisation from the competent authority must be obtained.

It is strongly recommended to carefully read the General Installation Regulations as well as the Hints on Sensor Installation prior to installation.

The non-observance of this notes may cause interferences in the measurement. The manufacturer explicitly states that all approvals and work regulations shall be obtained and observed.

The sensors shall be fastened durably and reliably.
Use only non-corrosive fastening material!

The optional fastening material is designed for normal flow conditions at the measurement place. Do not install the sensor in floodable areas.
Sensor fastening shall be implemented as follows (e.g. by using the combi holder available from NIVUS GmbH):

- the horizontal level adjustment must be independent from the vertical level adjustment
- during alignment ensure proper indication of direction with a max. permissible deviation of $\pm 2^\circ$ above the water surface (e.g. by using a portable instrument)
- $\pm 2^\circ$ max. permissible deviation of vertical alignment
- easy removal of sensors for maintenance or cleaning, no divers or special equipment should be required if possible.
- Realignment after maintenance shall be avoided if possible.

8.2 Choosing Calming Sections

8.2.1 General Notes

Clear and defined hydraulic conditions are indispensable prerequisites for accurate measurements. This is why one has to be especially attentive to the required hydraulic calming sections.

- When measuring in open channels and waters the measurement place must have a defined and constant flow cross section. Moreover there must be a well-developed flow profile featuring a stable flow velocity if possible available.
- The measurement place generally should be such to comply with DIN EN-ISO 748 and DIN EN ISO 6416.
- Strictly avoid falls, steps or obstructions, fittings, changes of the channel profiles, changes in slopes or supplies from the side upstream as well as downstream of the measurement site!

The drawings Fig. 8-1 to Fig. 8-5 give an example of appropriate, ill-suited and problematic applications.

The drawings illustrate the features of appropriate measurement places. Furthermore the drawings explain critical hydraulic conditions which might prevail.

In case of being uncertain regarding choice or assessment of planned measurement sections please your NIVUS representative or the flow department (hotline-worldwide@nivus.com) at NIVUS GmbH in Eppingen.

In order to assess the measurement place the following documents shall be available:

- Sketches or drawings
- Photos of planned measurement sections

8.2.2 Conditions in waters and open channels

In waters the following criteria must be respected:

- As a basic requirement, the surface on the chosen measurement place shall feature wave movement since smooth water surfaces cannot reflect the radar waves back to the sensor.
- The water bed should be stable and free of sedimentation or scour holes.
- The bank should have a definite shape and a stable formation and do not have a disposition to changes.
- There should be no weeds, stones, piles, steps, sills or similar within the measurement path. Such obstructions affect the flow profile and cannot be detected by the OFR.
- The surface movement must have the same velocity as the entire flow cross section. Gusts e.g. might influence the wave velocity on the surface.

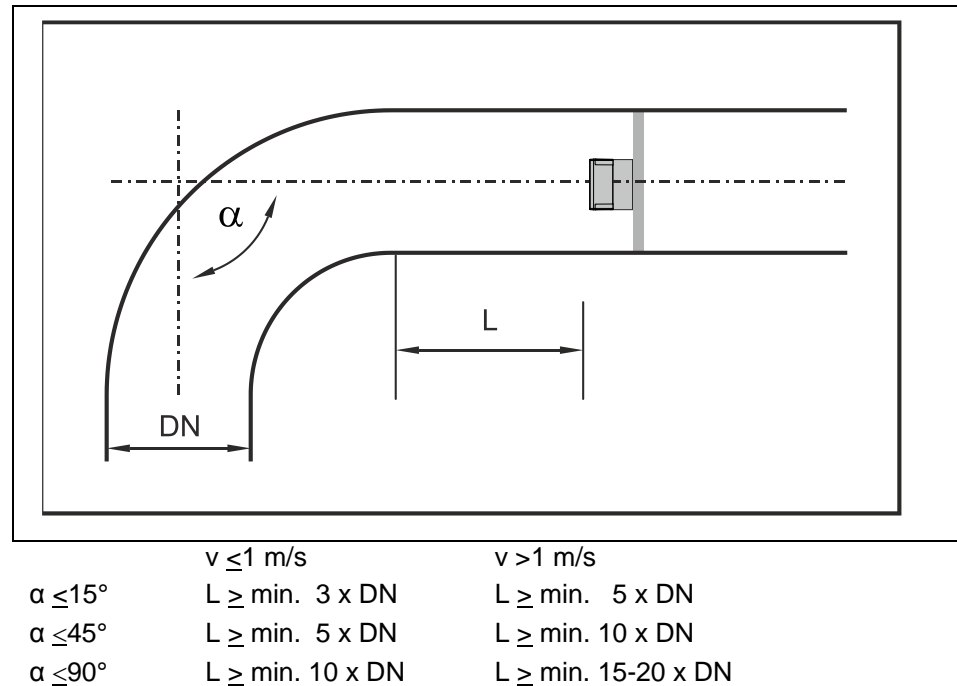
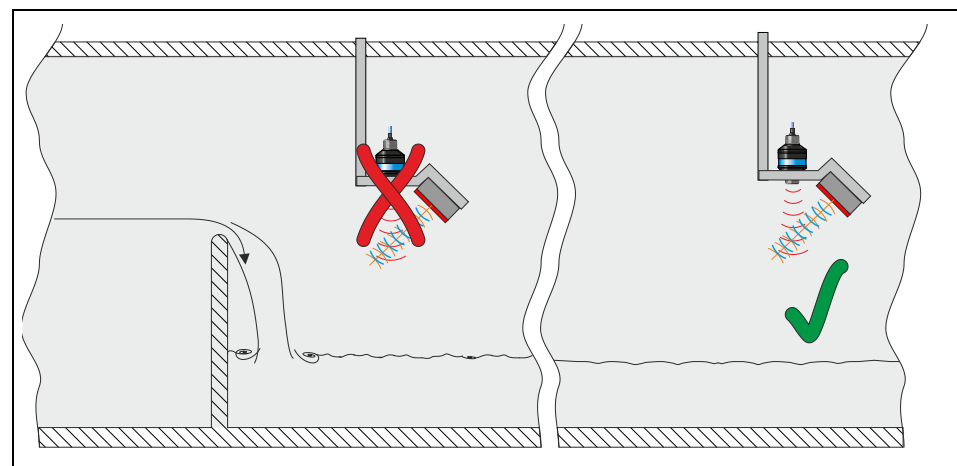
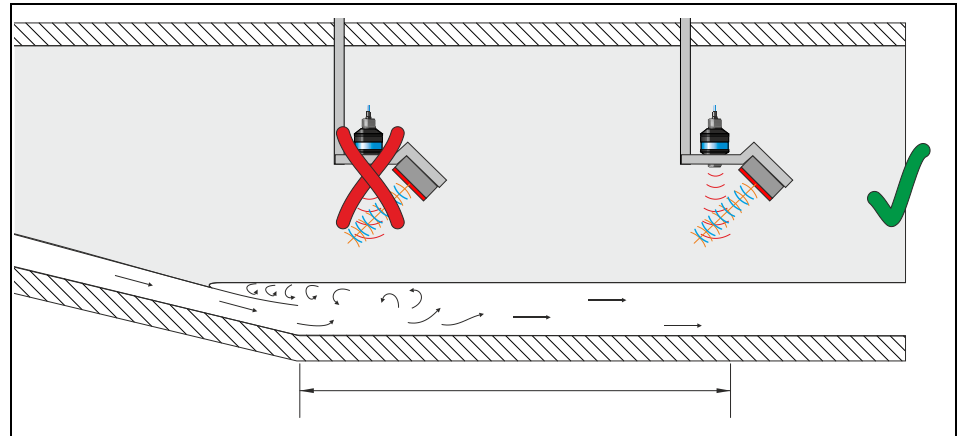


Fig. 8-1 Sensor position behind curves or elbows



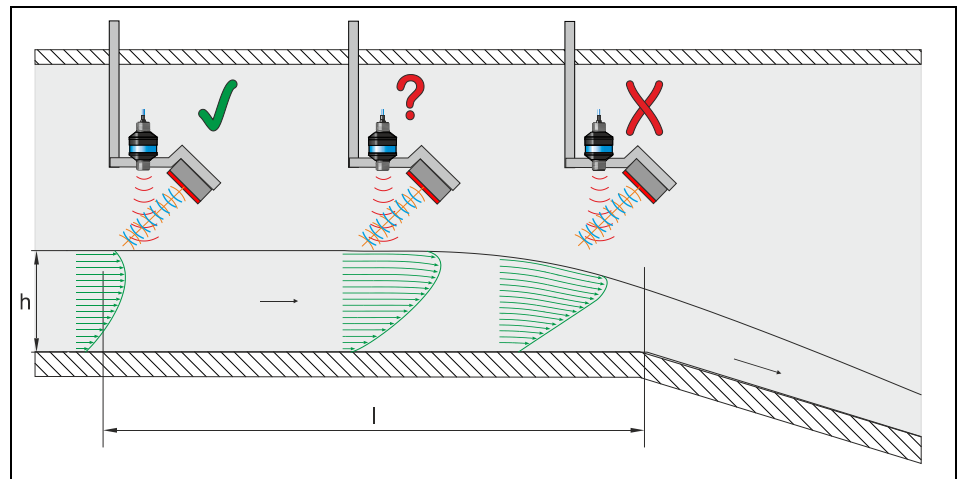
- ✗ = Error! Indefinable flow conditions
- ✓ = Sufficient distance to obtain straight flow
(10 ... 50 x diameter depending on application)

Fig. 8-2 Measuring behind fall – turbulence



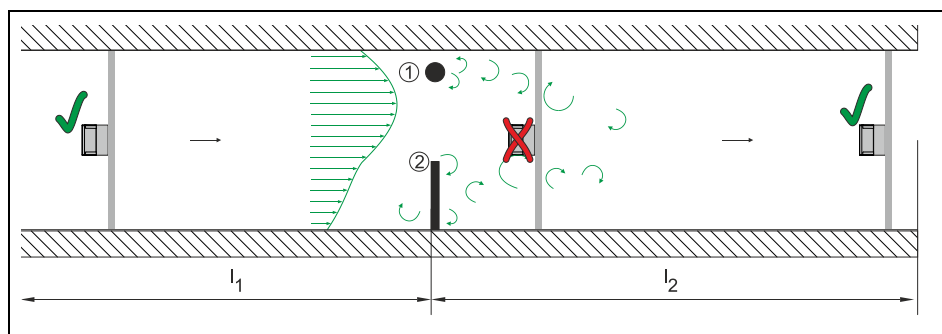
- ✗ = Error! Alternation of slope = alternation of flow profile
- ✓ = Distance depending on slope and flow velocity value
- $l = \min. 20 \times \text{diameter}$

Fig. 8-3 Error caused by alternation of slope



- ✗ = Error! Transition from flowing to shooting
Faulty level and velocity measurement
- ? = Critical measurement point, not recommended! Begin of sinking flow
- ✓ = Distance $l = \min. 5 \times h_{\max}$ at place of installation

Fig. 8-4 Error caused by alternation of flow profile in front of slope alternation or fall



(1) = Fixtures

(2) = Obstruction

h_{\max} = max. level/height

* = Error caused by vortex formation!

✓ = Distance l_1 (upstream of obstruction) = min. 5 x DN

Distance l_2 (downstream of obstruction) = min. 10 x DN

in case of flow velocities >1 m/s

Fig. 8-5 Errors caused by fixtures or obstructions (top view)

8.3 Installation Instructions

- Ensure proper installation!
- Comply with existing legal standards or operational guidelines!
- Injuries or/and damage to the sensors can cause by improper handling!



Note

To avoid disturbances from electrical interferences, the sensor cable must not be laid close to engine (motor) lines or main power lines.

The installation of sensors in open channels or water bodies always requires previous planning. A measuring point inspection is required. Mounting options might be very individual.

The radar sensor of the measurement system must be installed in a centred position above the geometry to measure.



Note

High accurate, vibration-free and firm installation and sensor alignment are necessarily required to ensure the measurement to operate properly!

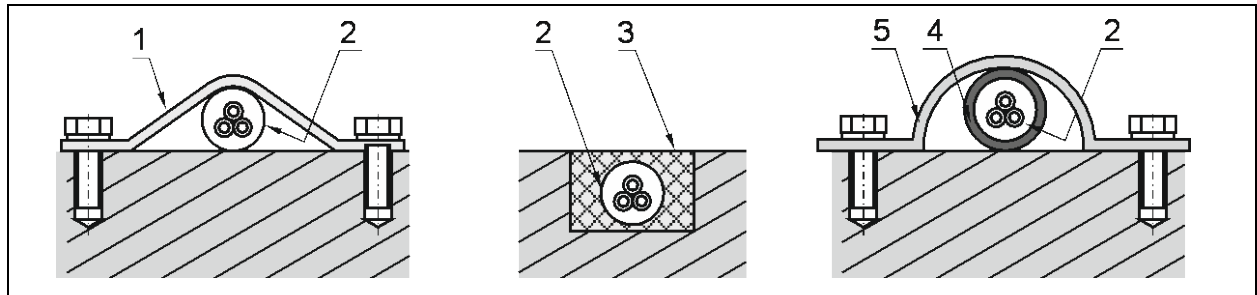
Sensor cables shall be laid according to applicable VDE installation regulations. Required cable covers and / or empty cable conduits can be purchased from NIVUS (see chapter 9).



Important Note

Risk of cable break!

*The minimum bending radius of the standard signal cable is 10 cm (3.94 in).
Smaller radii may result in cable break!*



- 1 Stainless steel sheet/cable cover, e.g. Type ZMS 140
- 2 Cable
- 3 Permanently elastic material
- 4 Empty conduit
- 5 Pipe clamp

Fig. 8-6 Suggested cable layout

9 Accessories and Mounting aids

9.1 Combi holding device for Radar sensor and Level sensor



Please observe to install the holding device accurately in horizontal and vertical position. We recommend to use a spirit level as installation aid.

There are several holder versions available for fastening of OFR sensors on vertical walls (Type ZUB0OFRHAL), bridges or similar.

Ordered radar sensors are delivered pre-installed on a combi holder.

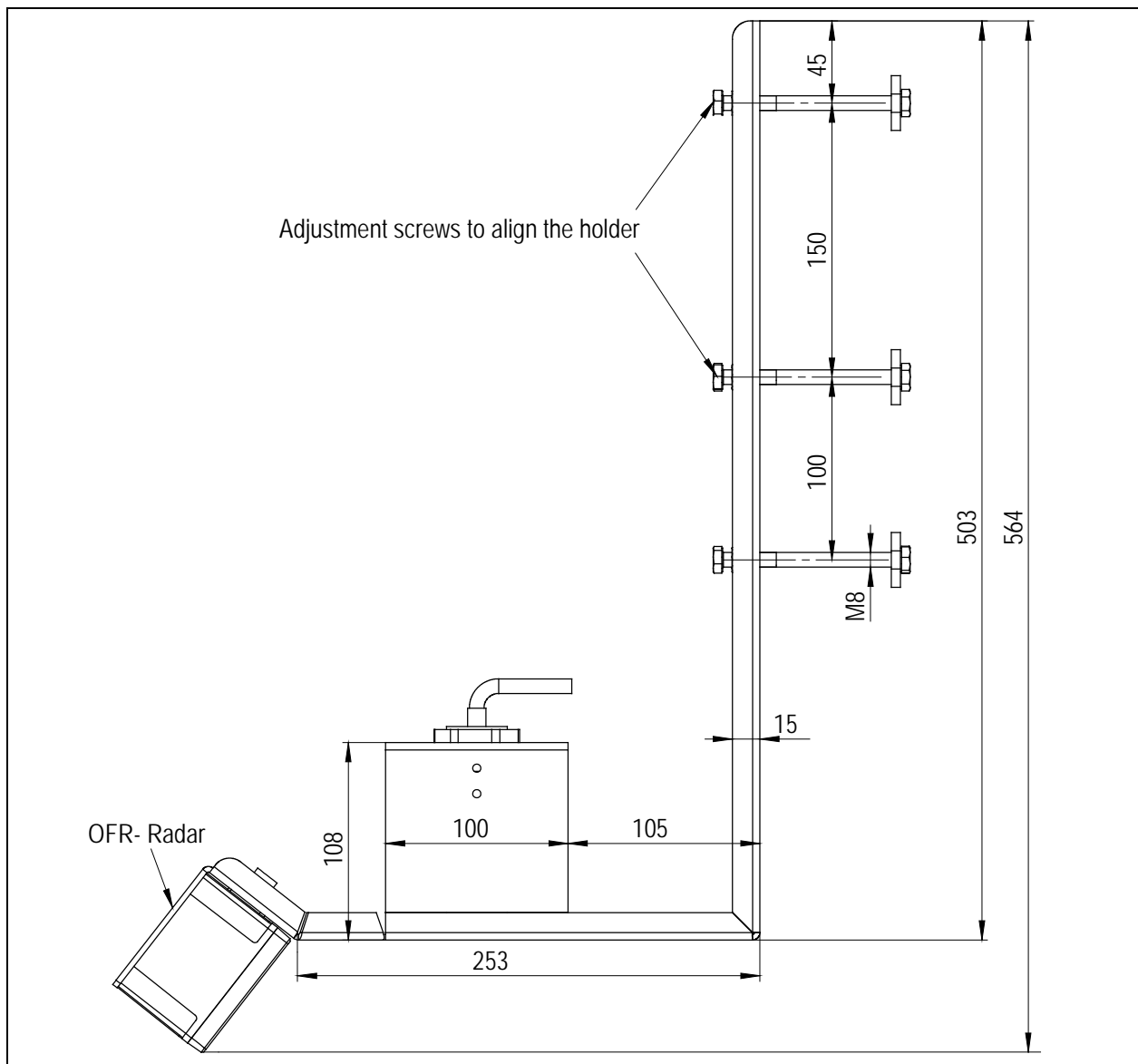
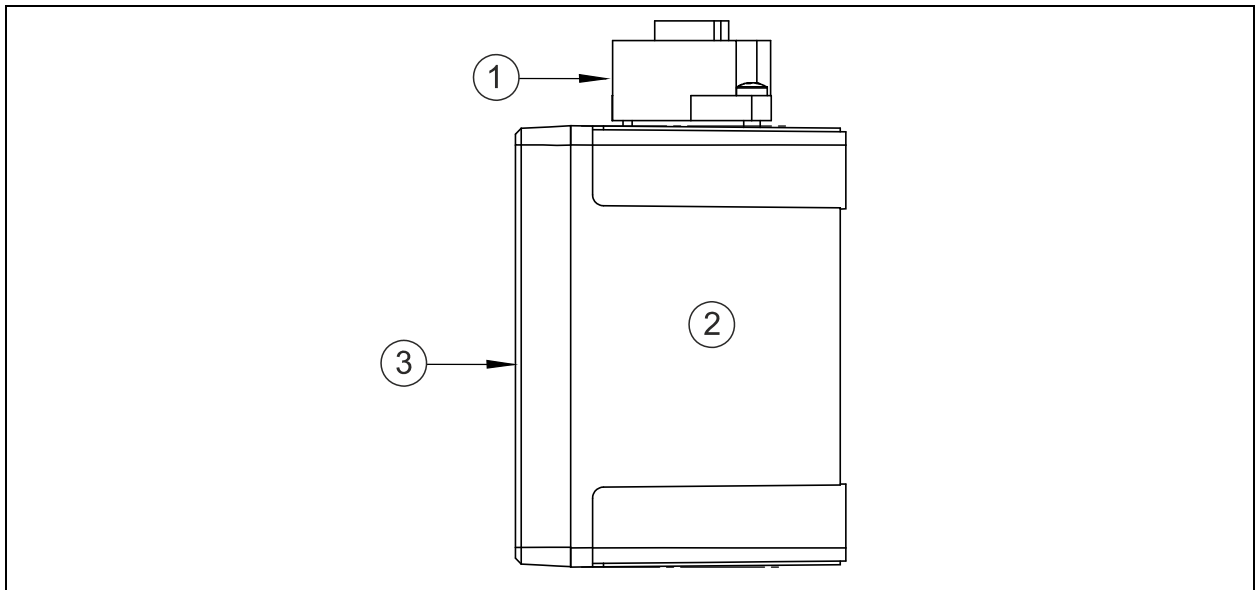


Fig. 9-1 Holders for radar sensor Type ZUB0OFRHAL

The holders are supplied including the fastening materials below:

- 4x hex head bolt M8x30
- Dowels „SX 8x60“
- 6 washers

10 Design and Dimensions of OFR Sensor



- 1 Connection fitting
- 2 Sensor body
- 3 Face of the sensor / Antenna

Fig. 10-1 Basic construction of Radar sensor

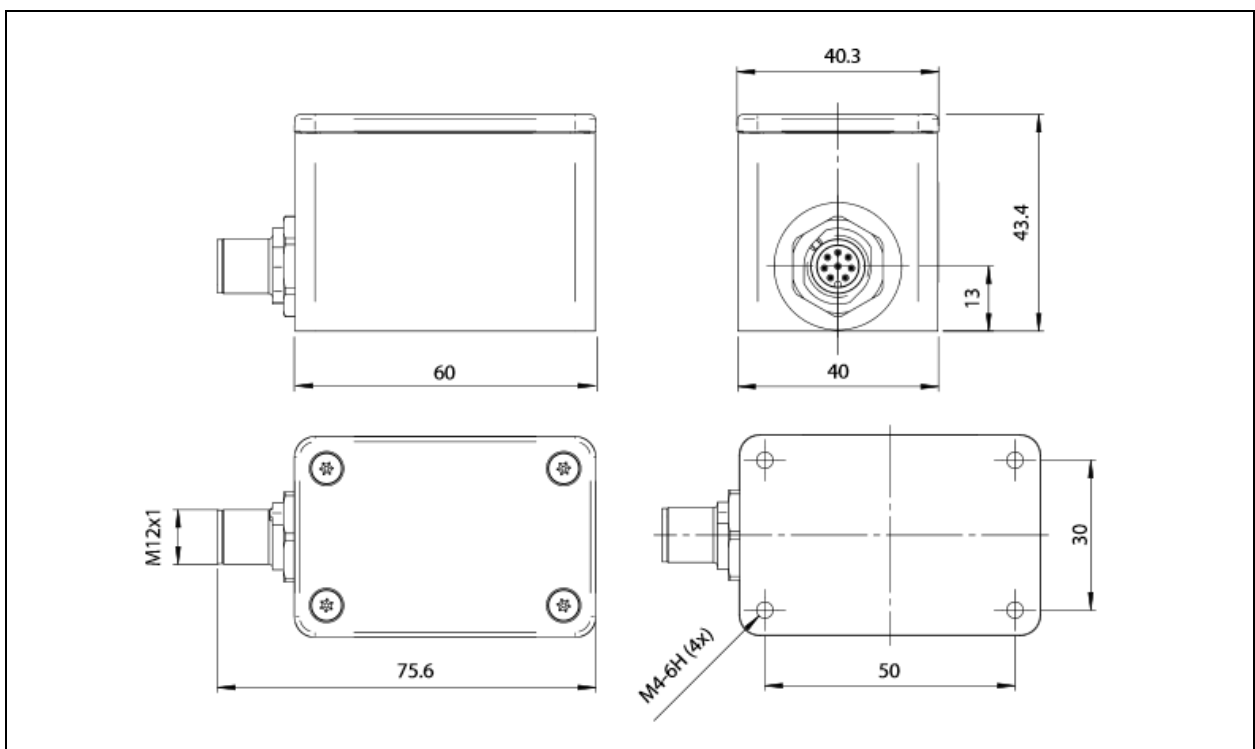


Fig. 10-2 Dimensions Radar sensor type OFR P001

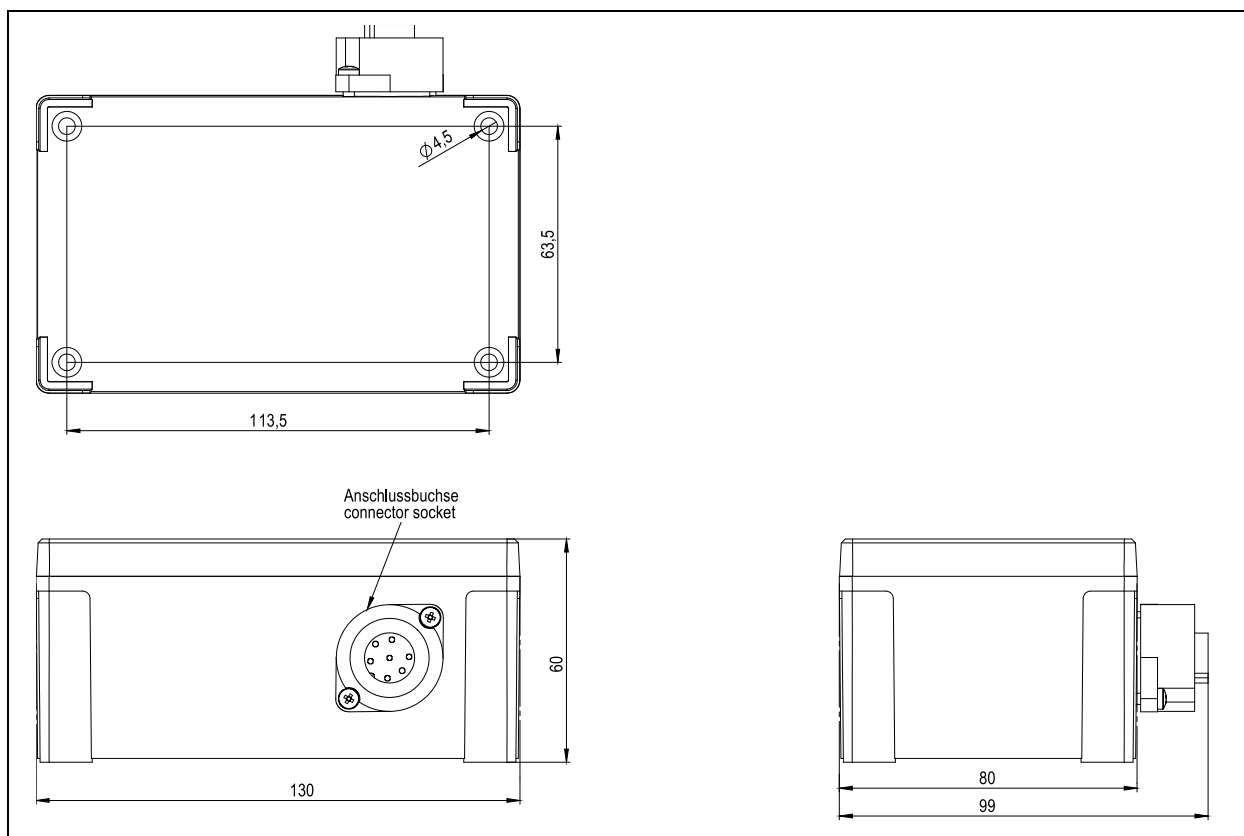


Fig. 10-3 Dimensions Radar sensor type OFR F001

10.1 Configuration of cables

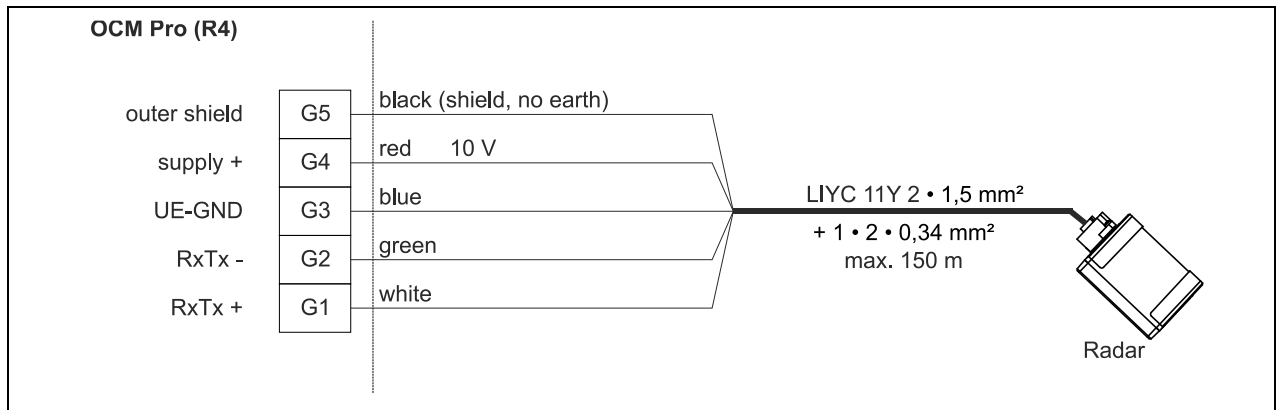


Fig. 10-4 Configuration of cables to transmitter, type OCP-R4

10.2 Sensor cable / Configuration of cables

The sensors are pre-equipped with a cable Type „LiYC11Y 2x1.5+1x2x0.34“ in various possible lengths.

Extend cables only by using the same cable type.



Observe allowed cable extension

Extensions from different applications or extensions from separate level and flow velocity measurements shall never share the same signal cable!

11 Maintenance and Cleaning

It may be necessary to clean the flow velocity sensor regularly in cause of pollution. To do so, use a brush with plastic bristles, a broom or similar.

WARNING



Damage by hard objects

No hard objects such as wire brushes, rods, scrapers or similar shall be used to clean the sensor.

Using a high pressure cleaner may damage the sensor resulting in measurement failure and is therefore absolutely not allowed!

The measurement place must be checked periodically.

Probably the measurement place has to be cleaned and must be kept free from vegetation. The Radar sensor needs "clear view" to the surface of the measured media.

12 Dismantling/Disposal

The device shall be disposed of according to local regulations for electronic products.

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EG-Konformitätserklärung

EC Declaration of Conformity

Déclaration de conformité CE

Für das folgend bezeichnete Erzeugnis:

We hereby declare that the design of the:

Le produit désigné ci-dessous:

Bezeichnung:

Description / Désignation:

Typ / Type / Type:

Oberflächenradar

Surface radar / surface radar

OFR-xxxx...

wird bestätigt, dass es mit den folgenden Richtlinien übereinstimmt:

as delivered complies with the following EC directives:

est certifié, conforme aux directives CE suivantes:

- 1999/5/EG

Die Geräte stehen im Einklang mit den folgenden harmonisierten Normen oder Dokumenten:

The devices furthermore comply with the following harmonised standards or documents:

En outre, ces appareils satisfont aux normes et documents harmonisés désignés ci-après:

Gesundheits- und

Sicherheitsanforderungen (Art. 3(1)(a))

- EN60950-1:2005 (2. Edition)/A1:2009
- EN60950-1:2006/A11:2009/A1:2010/A12:2011
- EN62311:2008

EMV Anforderungen (art. 3(1)(b)):

- EN301 489-1 V1.9.2
- EN301 489-3 V1.4.1

ERM Spektrum (art. 3(2)):

- EN300 440-1 V1.6.1
- EN300 440-2 V1.4.1

Diese Erklärung wird verantwortlich für den Hersteller / Importeur:

This declaration is submitted on behalf of the manufacturer / importer:

Le fabricant / importateur assume la responsabilité de cette déclaration:

NIVUS GmbH • Im Taele 2 • 75031 Eppingen, Allemagne

abgegeben durch / represented by / faite par:

Ingrid Steppe (Geschäftsführerin / Managing Director / Gérante)

Eppingen, den 07.05.2014

Gez. *Ingrid Steppe*