BA 535O/xx/en/11.04

I-LEVEL OMX 167
Hydrostatic Level Measurement

Operating Instructions

Table of contents

1 Safety instructions

1.1 Intended application

The I-LEVEL OMX 167 is a hydrostatic pressure sensor for measuring the level of fresh water, drinking water and wastewater.

The manufacturer shall not accept any liability for damage arising from improper use or if the device is used for purposes for which it was not intended.

1.2 Installation, commissioning, operation

The I-LEVEL OMX 167 is designed as fail-safe to the state of the art and comply with prevailing regulations and EC directives. If the devices are not used properly or for purposes for which they were not intended, they may become hazards arising from the particular application, e.g. product overflow through incorrect installation or adjustment. For these reasons, only trained personel authorised by the plant operator may install, connect electrically, commission, operate and maintain the measuring system. Trained personel must have read and understood these Operating Instructions and heed the instructions. Any changes and repairs to the devices may only be performed if the Operating Instructions expressly permit this.

1.3 Safety warnings and symbols

In order to emphasise safety or alternative processes, we have defined the following safety warnings and appended a pictogram to each one.

Safety warnings

Symbol	Meaning
	**Warning!** Warning indicates activities or processes which – if they are not performed properly – will lead to serious personal injury, a safety hazard or destruction of the device.
	**Caution!** Caution indicates activities or processes which – if they are not performed properly – will lead to personal injury or malfunctioning of the device.
	**Note!** Note indicates activities or processes which – if they are not performed properly – may have an indirect impact on functioning or an unforeseen response from the device.

Type of protection

	**Safe area (non explosion hazardous area)** This symbol in drawings in these Operating Instructions identifies a non explosion hazardous area. – Devices in a non explosion hazardous area must also be certified if connecting cables are routed in the explosion hazardous area.

Electrical symbols

	**DC voltage** A terminal to which a DC voltage is applied or through which a DC voltage flows.
	AC voltage A terminal to which a (sinusoidal) AC voltage is applied or through which an AC voltage flows.
	**Ground connection** A grounded terminal which is already grounded by a grounding system from the user's viewpoint.
	**Protective earth terminal** A terminal which must be grounded before any other connections are made.
	**Equipotential terminal** A terminal which must be connected with the equipment grounding system: this may be a potential matching line or a star-shaped grounding system, depending on national or corporate practice.

2 Identification

2.1 Device designation

I-LEVEL OMX 167 for hydrostatic level measurement, refer to Chapter 2.1.1.

2.1.1 Nameplate of I-LEVEL OMX 167

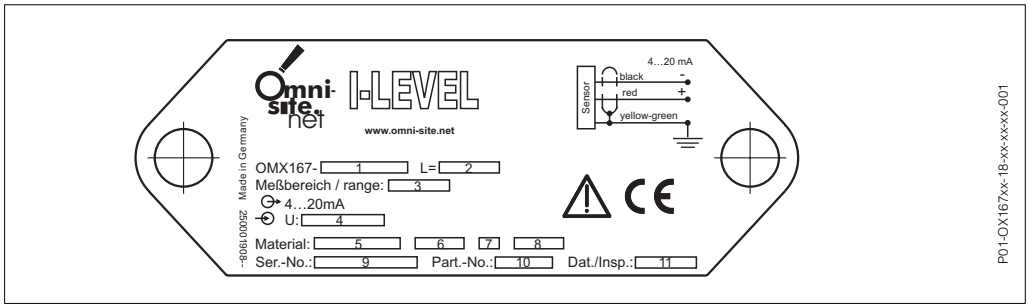


Fig. 1: Nameplate for I-LEVEL OMX 167

Nameplate A: Example

1 Order Code
2 Length of extension cable
3 Measuring range
4 Auxilary energy/Supply voltage: 10…30 V DC
5 Housing material: 316L
6 Measuring cell material: aluminium oxide Al_2O_3
7 Extension cable material: (PE or FEP)
8 Seal material: 1: Viton, 2: EPDM
9 Serial number
10 Part number
11 Test date/inspector

Note!
A sensor number and the measuring range are specified on each probe.
The nameplate does not specify the sensor number. If you need to assign a nameplate to a probe at a later date, please refer to the supplied calibration report. This is where the sensor and the serial number are specified.

2.2 Scope of supply

The scope of supply comprises:
- Optional accessories, refer to Chapter 7

Supplied documentation:
- Operating Instructions (this manual)
- Calibration report

2.2.1 CE symbol, Declaration of Conformity

The devices are designed fail-safe to the state of the art and left the factory in perfect condition with regard to safety. The devices comply with the prevailing standards and regulations contained in DIN EN 61010 “Safety requirements for electrical equipment for measurement, control and laboratory use”.
The measuring system described in these Operating Instructions therefore meet the statutory requirements of EC directives. Omni-site.net confirms the successful testing of the device by affixing the CE symbol.

3 Installation

3.1 Incoming acceptance

Check the following items on receipt of the product:
- Check whether the packaging or its contents are damaged.
- Check the delivered products for completeness and compare the scope of supply with your order data.

3.2 Installation conditions

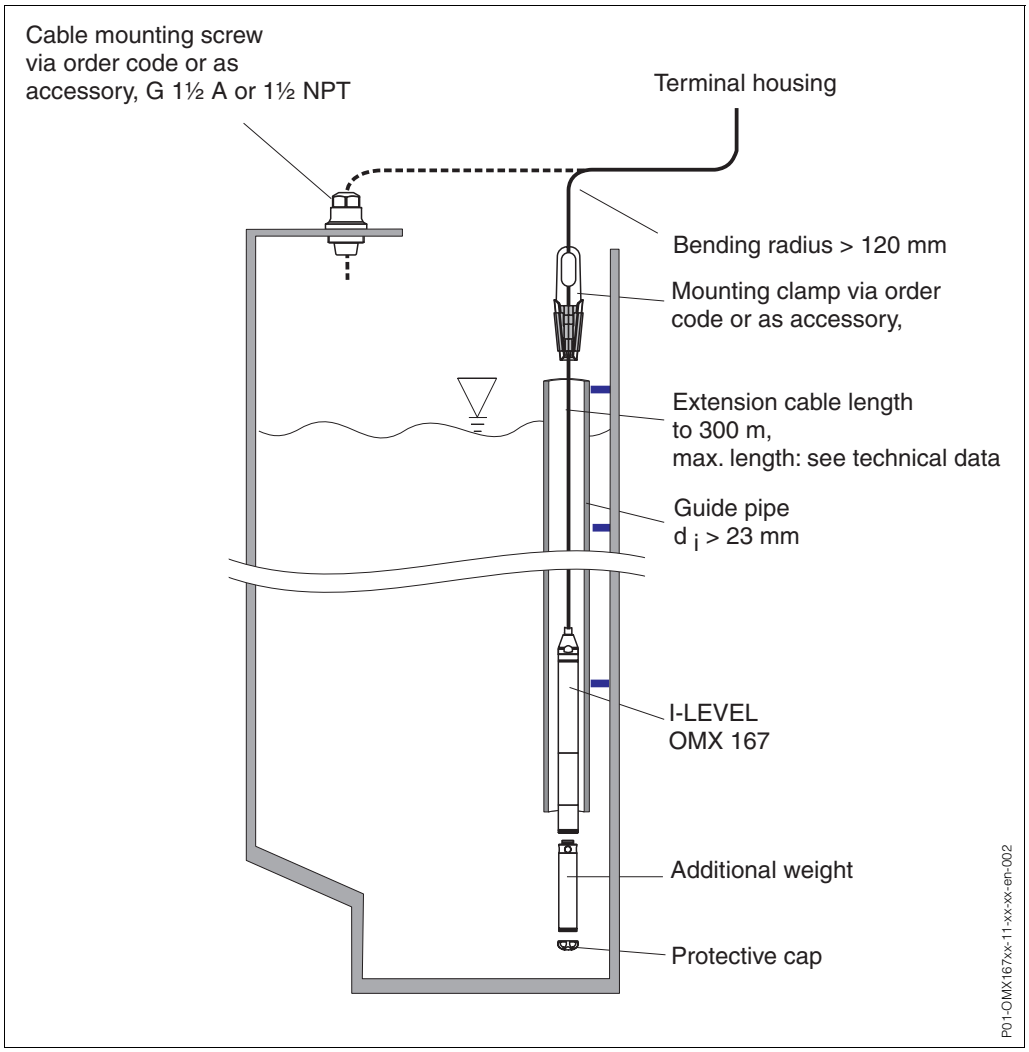


Fig. 2: Installation examples

Please note the following points:

- A sideways movement of the cable probe can lead to measuring errors. Therefore install the probe at a point free from flow and turbulence, or use a guide tube with an inner diameter of > 23 mm (> 0.91 inch).
- The cable must end in a dry room or in a proper terminal housing.
- Protective cap: to avoid mechanical damage to the measuring cell, the device is provided with a protective cap.

Note!
You can order protective caps as spare part directly from your Omni-site.net Service Organisation.

3.2.1 Installation dimensions

See Chapter 9.2 "Technical data, Dimensions" for the dimensions.

3.3 Installation instructions

3.3.1 Installing I-LEVEL with a mounting clamp

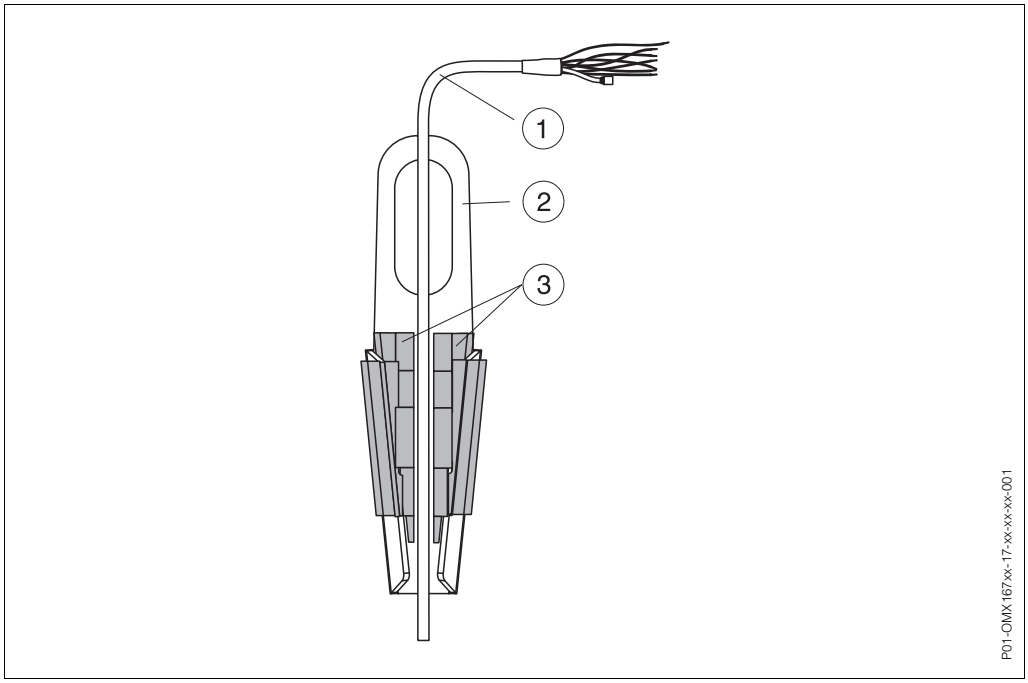


Fig. 3: Installing I-LEVEL OMX 167 with a mounting clamp

1 Extension cable
2 Mounting clamp
3 Clamping jaws

How to mount the mounting clamp:
1. Mount the mounting clamp (Pos. 2). When selecting the type of fixing, note the weight of the extension cable (Pos. 2) and the device (refer to Chapter 9.1.).
2. Raise clamping jaws (Pos. 3). Place extension cable (Pos. 1) acc. to Fig. 4 between clamping jaws.
3. Hold extension cable (Pos. 1) tight and push clamping jaws (Pos. 3) back down. Fix clamping jaws by tapping lightly.

3.3.2 Installing I-LEVEL with cable mounting screw

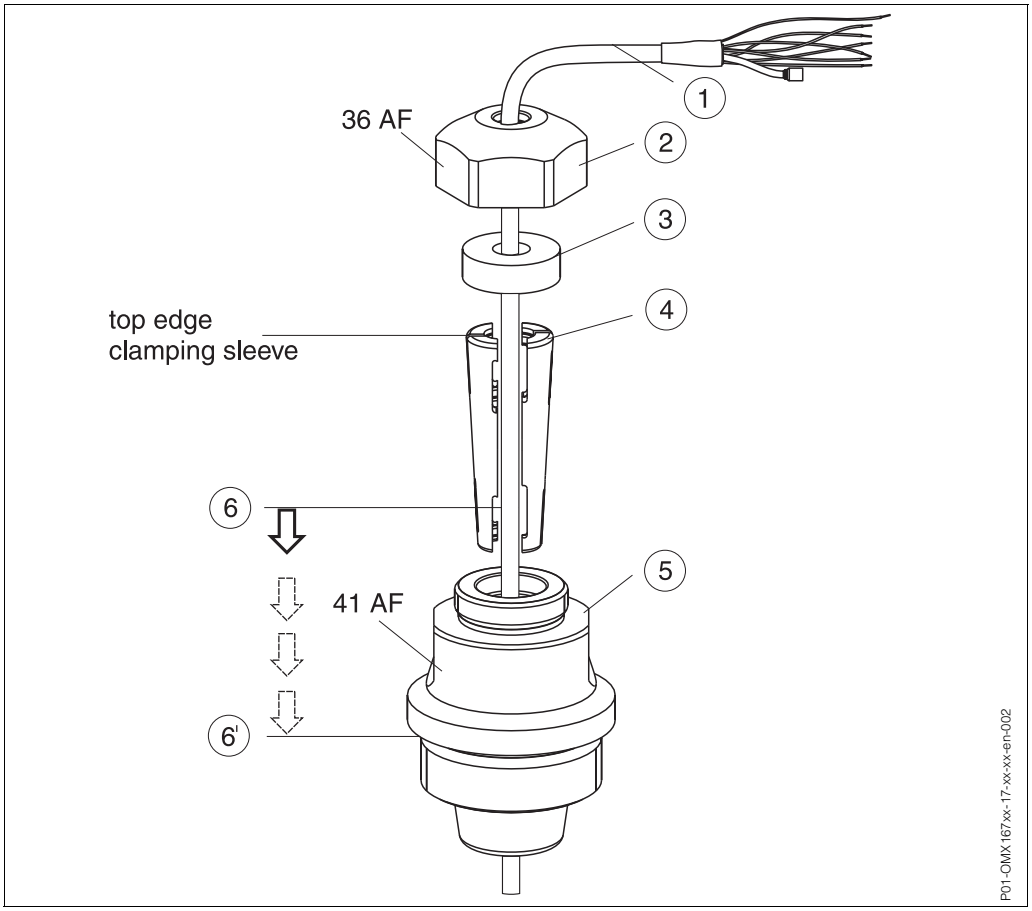


Fig. 4: Installing the I-LEVEL OMX 167 with cable mounting screw, here depicted with G 1 1/2 thread

1 Extension cable
2 Mounting screw cap nut
3 Sealing ring
4 Clamping sleeve
5 Mounting screw adapter
6 required length of extension cable and OMX 167 probe before assembly
6´ after assembly Pos. 6) is located next to the mounting screw with
G 1 1/2 thread: sealing surface of mounting screw adapter
1 1/2 NPT thread: thread run-out of mounting screw adapter

Note!
If you want to lower the level probe to a certain depth, place the top edge of the clamping sleeve 4 cm higher than the required depth. Then push the extension cable and the clamping sleeve into the adapter as described in the following section, Step 6.

How to mount the cable mounting screw with G 1 1/2 or 1 1/2 NPT thread:
1. Mark required length of extension cable, refer to "Note" on this page.
2. Insert probe through measuring opening and carefully lower on extension cable. Fix extension cable to prevent it from slipping.
3. Push adapter (Pos. 5) over extension cable and screw tightly in measuring opening.
4. Push sealing ring (Pos. 3) and cap (Pos. 2) from top onto cable. Press sealing ring into cap.
5. Place clamping sleeve (Pos. 4) around extension cable (Pos. 1)
6. Push extension cable and clamping sleeve (Pos. 4) into adapter (Pos. 5).
7. Push cap (Pos. 2) and sealing ring (Pos. 3) onto adapter (Pos. 5) and screw tightly to adapter (Pos. 5).

Note!
Remove the cable mounting screw in the opposite sequence of operation to installation.

3.4 Checking the installation

Check that all screws are seated firmly.

4 Wiring

4.1 Electrical connection

How to connect the devices:

- The supply voltage must match the specification on the nameplate, refer to Chapter 2.1.1.
- Switch off supply voltage before you connect the device.
- The cable must end in a dry room or in a proper terminal housing, IP 66/IP 67.
- Connect device acc. to Figures 5. A polarity protection is integrated in the I-LEVEL OMX 167. Changing the polarities will not destroy the devices.

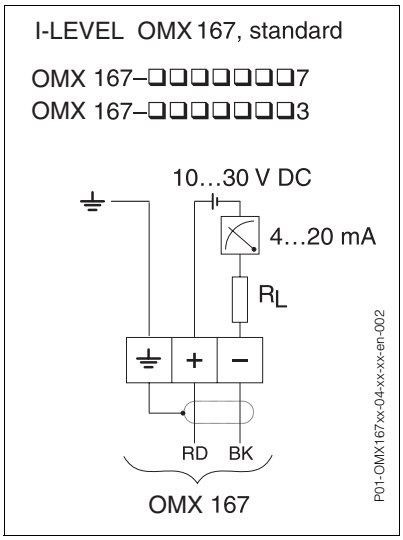


Fig. 5: Electrical connection

Wire colours
RD = red
BK = black
WH = white
YE = yellow
BU = blue
BR = brown

Supply voltage

Certificate	Supply voltage OMX 167
standard	10…30 V DC

Note!
The extension cable of the I-LEVEL OMX 167 is screened. For large distances between extension cable end and display and/or evaluation unit Omni-site.net recommends using a screened cable for the cable extension.

Power consumption/current drain

	OMX 167
Power consumption	≤ 0.675 W at 30 V DC
Current drain	max. ≤ 22.5 mA min. ≥ 3.5 mA

Load
The maximum load resistance is dependent on the supply voltage (U_b) and must be determined for every current loop separately. The total resistance resulting from the resistances of the connected devices, the connecting cable and if necessary, the resistor of the extension cable may not exceed the load resistance.

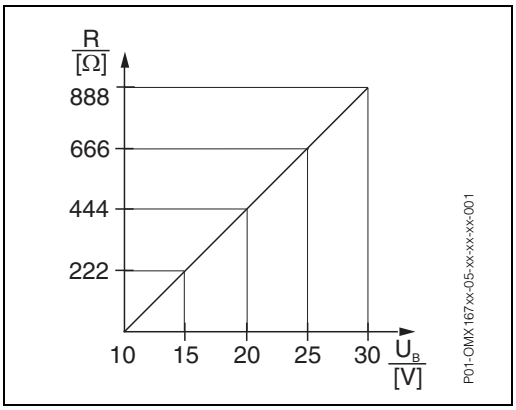


Fig. 6:
Load chart OMX 167 for estimating load resistance

Note!
Additional resistances, e.g. resistance of extension cable, must then be subtracted from the value determined from the diagram, as shown in the equation.

4.2 Wiring up the measuring unit

Overvoltage protection

Note!
In order to protect the I-LEVEL OMX167 from large transients, Omni-site.net recommends the installation of an overvoltage protector upstream and downstream of the display and/or evaluation device as shown in the figure.
The I-LEVEL OMX 167 has an integrated overvoltage protection to EN 61000 of ≤ 1.2 kV as standard.

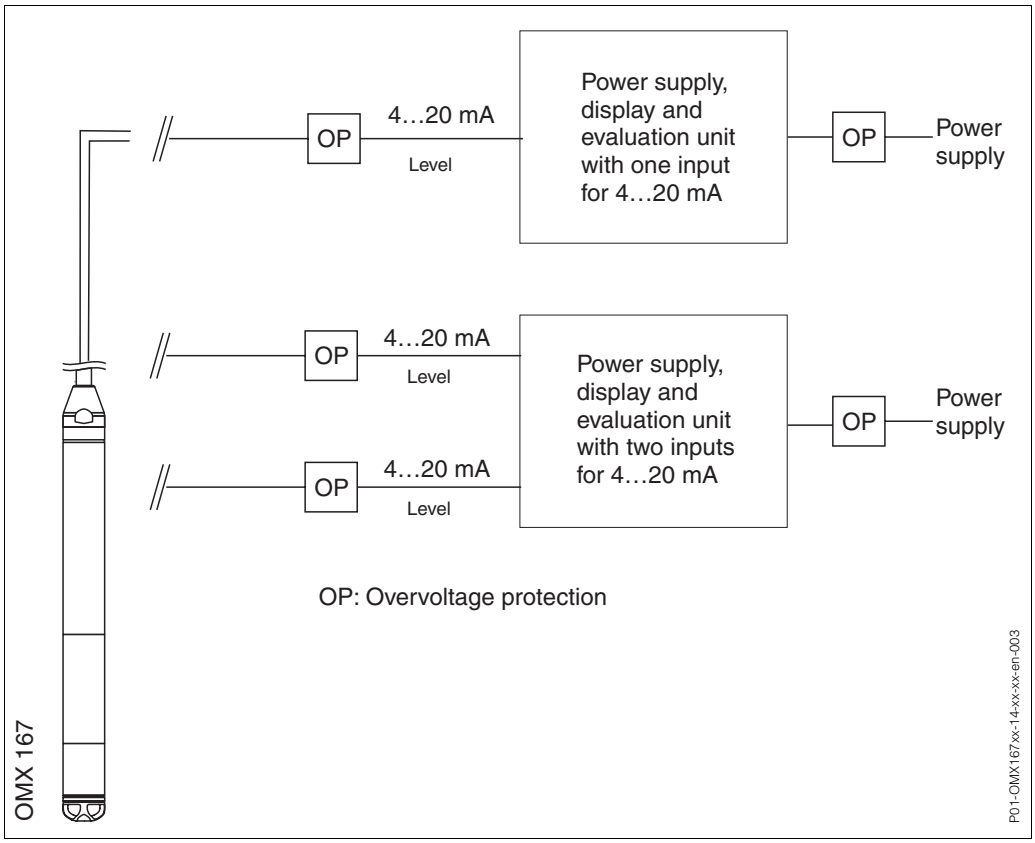


Fig. 7: Wiring up the measuring unit

4.3 Checking the wiring

After wiring up the measuring instrument, carry out the following inspections:
- Does the supply voltage match the specification on the nameplate?
- Is the device connected as shown in Figures 5?
- Are all the screws tightened?
- If terminal housing installed: are the cable glands tight?

5 Operation

Note!
Omni-site.net offers extensive measuring point solutions with display. For more information, please contact your nearest Omni-site.net Service Organisation. Please refer to the back page of this documentation for contact addresses.

6 Maintenance

No special maintenance work is required for the I-LEVEL OMX 167.

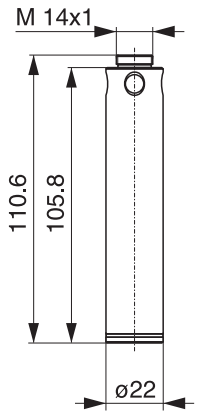
Cleaning the device exterior
When cleaning the exterior of the measuring device, please note the following:
- Do not use a cleaning agent that is aggressive to the housing surface or the seal.
- I-LEVEL OMX 167: avoid any mechanical damage to the membrane or the extension cable.

7 Accessories

There are a number of accessories available for the I-LEVEL OMX 167. You can order them separately from Omni-site.net.

Mounting clamp
Omni-site.net offers a mounting clamp for simple mounting. Refer to page 20.
Material: 1.4435 (AISI 316L)

Additional weight



To prevent sideways movement leading to measuring errors or to ensure that the device lowers into a guide tube, Omni-site.net provides additional weights. You can attach several weights to the OMX 167.

Material: 1.4435 (AISI 316L)
Weight: 300 g

Cable mounting screw
Omni-site.net offers cable mounting screws to simplify the installation of the OMX 167 and to close the measuring open.
Refer to page 20. Material: 1.4301 (AISI 304)
cable mounting screw with G 1 1/2 A thread
cable mounting screw with 1 1/2 NPT thread

8 Trouble-shooting

8.1 Faults on I-LEVEL OMX 167

Error description	Cause	Action
No measuring signal	Connection of 4…20 mA line incorrect	Connect device acc. to Chapter 4.1, Figs. 5
	No supply voltage over 4…20 mA line	Check current loop
	Supply voltage too low (min. 10 V DC)	Check supply voltage Total resistance greater than max. load resistance, refer to Chapter 4.1 page 12.
	I-LEVEL defective	Replace I-LEVEL

8.2 Spare Parts

Note!
You can order spare parts directly from your nearest Omni-site.net Service Organisation.

Membrane protective cap
Refer to Fig. 3, page 8

Pressure compensation set
Teflon filter and sleeve for extension cable, refer to Fig. 3, page 8

9 Technical Data

9.1 Technical Data I-LEVEL OMX 167

Applications

Applications	The I-LEVEL OMX 167 is a hydrostatic pressure sensor for measuring the level of fresh water, drinking water and wastewater.

Input Parameters

Measured variable	Hydrostatic pressure of a liquid
Measuring range	• Nine fixed pressure measuring ranges in psi, ftH_2O, bar and mH_2O, • Customer-specific measuring ranges between 1.5…300 psi (0.1…20 bar); factory-calibrated and special measuring ranges on request
Input signal	Change in capacitance of the ceramic measuring cell

Output Parameters

Output signal	4…20 mA for hydrostatic pressure measured value, two-wire
Load	see Chapter 4.1, section "Load"

Auxilary energy

Electrical connection	see Chapter 4.1, integrated polarity protection
Supply voltage	10…30 V DC
Cable specification	see Chapter 4.1, section "Cable specification"
Power consumption	≤ 0.675 W at 30 V DC
Current drain	Max. current drain: ≤ 22.5 mA; Min. current drain: ≥ 3.5 mA
Residual ripple	No effect for 4…20 mA signal up to ± 5% residual ripple within permissible range

Performance characteristics

Reference operating conditons	DIN EN 60770 T_U= 25 °C
Accuracy	Linearity including hysteresis and repeatability as per DIN EN 60770: ± 0.2% of Full Scale
Long-term stability	±0.1 % of Full Scale per year
Influence of medium temperature	• Thermal change in zero signal and output span for typical temperature range 0…+30°C (+32…+86°F): ± 0.4 % (± 0.5 %)* of span • Thermal change in zero signal and output span for the total medium temperature range –10…+70°C (+14…+158°F): ± 1.0 % (± 1.5 %)* of span • Maximum temperature coefficient (T_K) in zero signal and output span: 0.15 %/10 K (0.3 %/10 K)* of span * Specifications for sensors 1.5 psi (3 ft H_2O, 0.1 bar, 1 mH_2O), 10 psi (20 ft H_2O, 0.6 bar, 6 mH_2O)
Warm-up period	20 ms
Rise time (T90-time)	80 ms
Setting time	150 ms

Ambient Conditions

Ambient temperature range	–10…+70°C (+14…+158°F), (= Medium temperature range)
Storage temperature	–40…+80°C (–40…+176°F)
Ingress protection	IP 68, permanently hermetically sealed
Elektromagnetic compatibility	Interference emission to EN 61326; Equipment Class B Interference immunity to EN 61326, Appendix A (industrial usage)
Overvaltage protection	Integrated overvoltage protection to EN 61000-4-5 ≤ 1.2 kV Install overvoltage protection ≥ 1.2 kV, external if necessary.

Process Conditons

Medium temperature range	–10…+70°C (+14…+158°F) For devices approved for use in hazardous areas, see Safety Instructions.
Medium temperature limits	–20…+70°C (–4…158°F) (You may operate the OMX 167 in this temperature range. The values quoted in the specifications may then be exceeded, e.g. measuring accuracy. Also refer to DIN 16086.)

Mechanical Construction

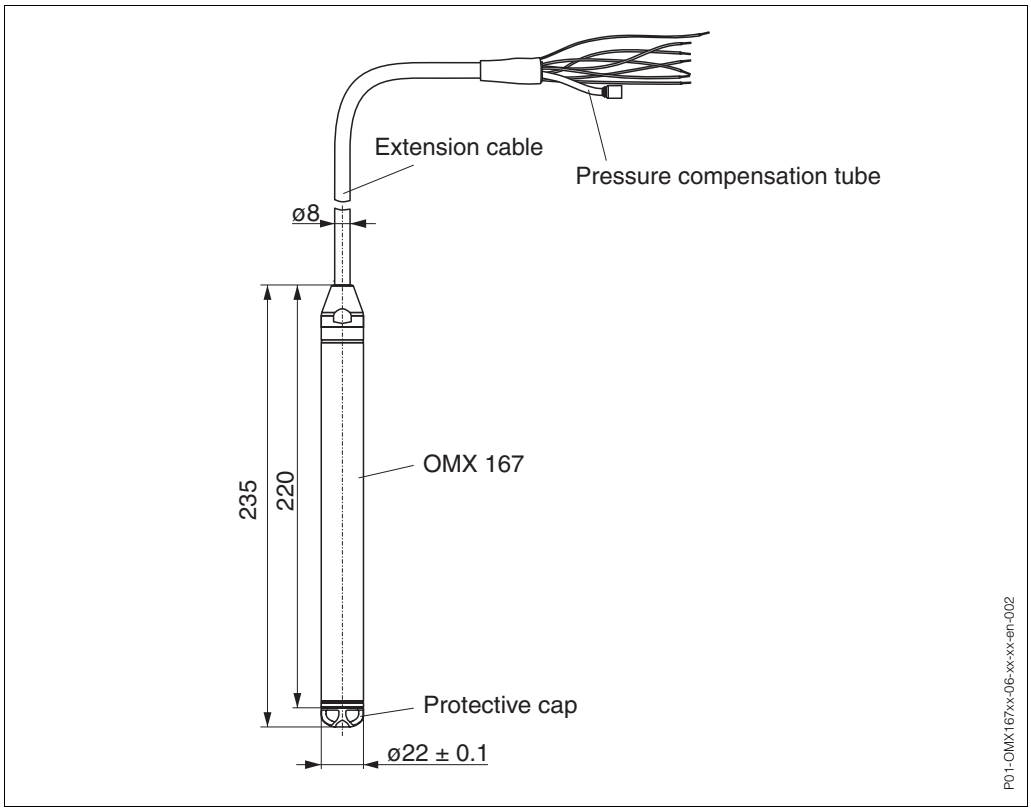
Constructions, Dimensions	see Chapter 9.2
Weight	– Cable probe: 290 g – Extension cable: 52 g/m – Mounting clamp: 170 g – Cable mounting screw G 1 1/2 A: 770 g – Cable mounting screw 1 1/2 NPT: 724 g – Additional weight: 300 g
Materials	Cable probe: – Cable probe 1.4435 (AISI 316L) – Process ceramic: Al_2O_3 aluminium oxide ceramic – Seal (internal): EPDM or Viton – Protctive cap: PE-HD (high-density polyethylene) – Extension cable insulation: PE (polyethylene), for more details, see section "Extension cable" optional: – Mounting clamp 1.4435 (AISI 316L) and glass fibre reinforced PA (polyamide) – Cable mounting scew G 1 1/2 A: 1.4301 (AISI 304) – Cable mounting screw 1 1/2 NPT: 1.4301 (AISI 304) – Additional weight: 1.4435 (AISI 316L)

Mechanical Construction (continuation)

Extension cable	Construction – Slip-resistant extension cable with strain-relief members made of Kevlar; screened using aluminium-coated film; insulated with polyethylene (PE), black; copper wires, twisted – Pressure compensation tube with Teflon filter Cross section – OMX 167: 3 x 0.227 mm^2 + pressure compensation tube with Teflon filter – Total outer diameter: 8.0 mm ± 0.25 mm (0.315 inch ± 0.0098 inch) – Pressure compensation tube with Teflon filter: Outer diameter OD = 2.5 mm (0.098 inch), Internal diameter ID = 1.5 mm (0.059 inch) Cable resistance – Cable resistance per wire: ≤ 0,09 Ω/m Cable length – Max. free suspended length (mechanical stability under load): 1000 m (39370 inch) further technical data – Minimum bending radius: 120 mm (4.724 inch) – Tensile strength: ≥1200 N – Cable extraction force: ≥ 450 N (The extension cable could be extracted from the cable probe at a tensile force ≥ 450 N.) – Approved for use with drinking water – Increased resistance to UV light

9.2 Dimensions

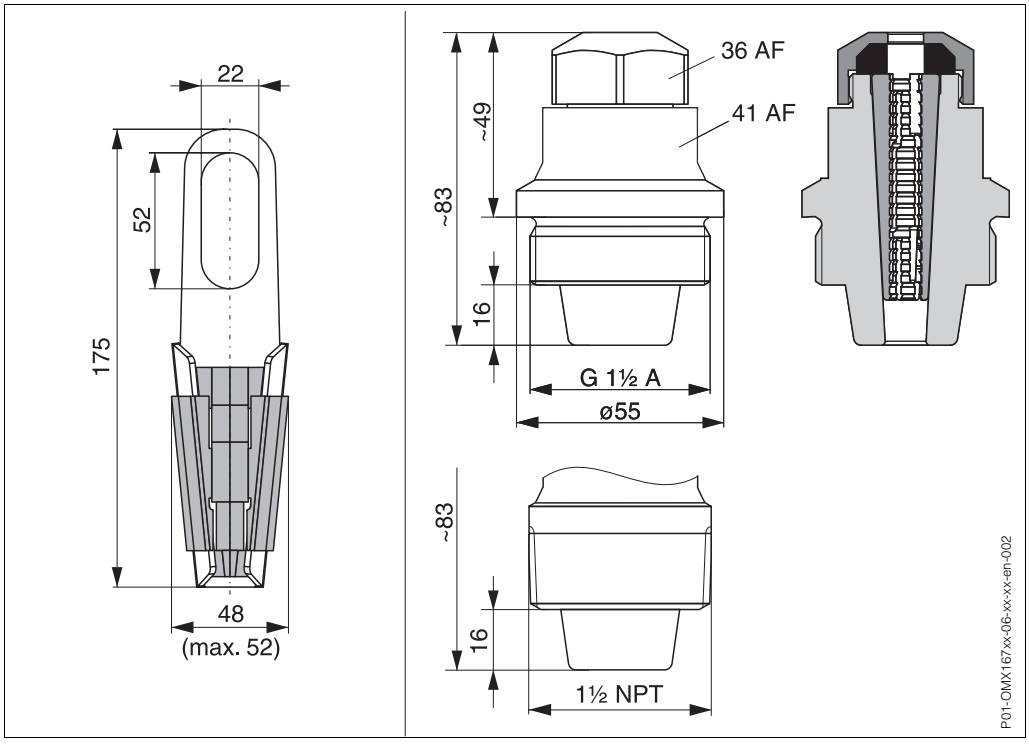
Dimensions of cable probe



Dimensions of cable mounting screw G 1 1/2 A
OMX 167-❑3❑❑❑❑❑❑

Dimensions of mounting clamp
OMX 167-❑2❑❑❑❑❑❑

Dimensions of cable mounting crew 1 1/2 NPT
OMX 167-❑4❑❑❑❑❑❑



10 Appendix

10.1 Functions and system design

The ceramic measuring cell is dry, i.e. pressure acts directly on the rugged ceramic diaphragm of I-LEVEL OMX 167 and causes it to move by about max. 0.005 mm. The effects of air pressure on the liquid surface are transferred via a pressure compensation tube through the cable to the rear of the ceramic diaphragm and compensated. Pressure-dependent changes in capacitance caused by diaphragm movement are measured at the electrodes of the ceramic carrier. The electronics convert the movement into a pressure-proportional signal which is linear to the medium level.

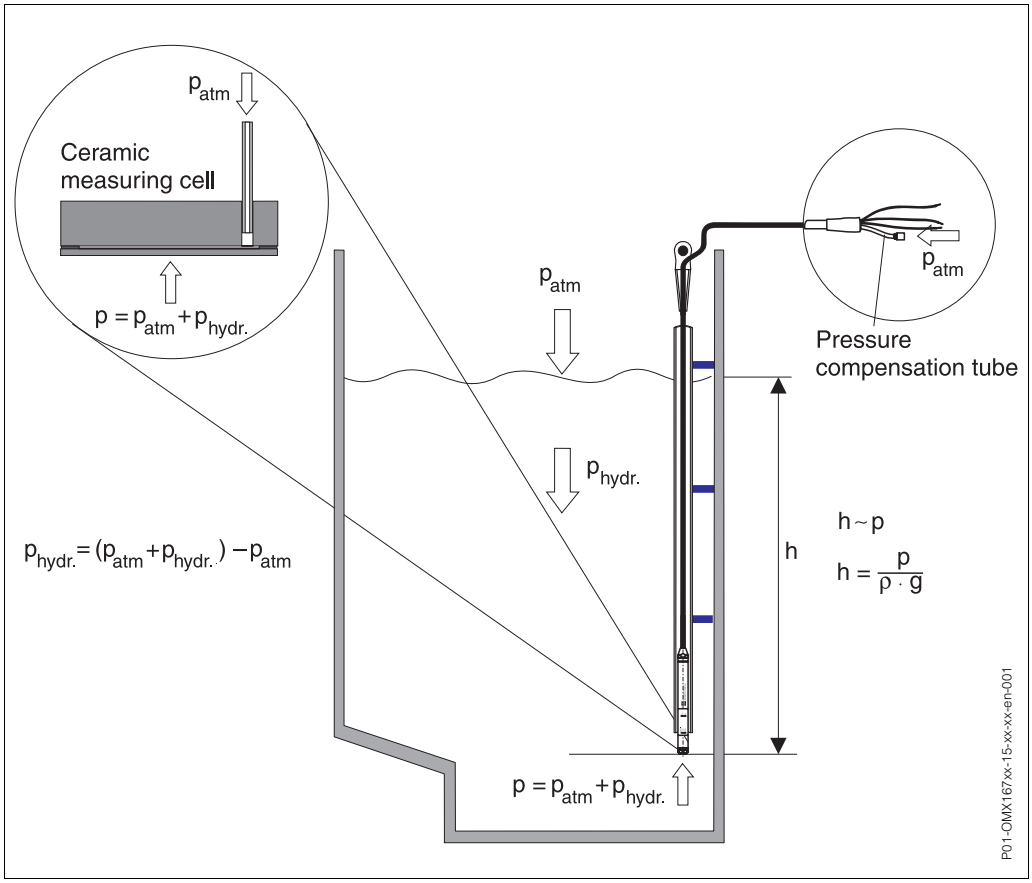


Fig. 8: Functions and system design

h = level height
p = total pressure = hydrostatic pressure + atmospheric pressure
ρ = medium density
g = gravitational acceleration
$p_{hydr.}$ = hydrostatic pressure
p_{atm} = atmospheric pressure

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