PAQUIN SENSORS
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Electronic Level Switch

- Selective Sensing detects only the target medium, ignores others
- Resistant to buildup and unaffected by foam or sticky residues on the electrode
- Explosion-Proof suitable for hazardous gas (Zone 0) and mining environments
- Robust Temperature Range -40°F to +221°F (-40°C to +105°C)
- Direct mount into tanks, pipes, funnels and more with various threaded or Tri-Clamp connections

About

The P104 Electronic Level Switch is a high-frequency sensor for reliable detection of liquids and pastes, unaffected by conductivity or deposits like foam. It features side or top-wall installation, a “Medium Window” function for selective media sensing, and operates effectively in multiphase systems. Housed in stainless steel, it offers PNP and NAMUR outputs and with explosion-proof variants for hazardous areas.

Applications

- ✓ Food & Beverage
- ✓ Chemical Refining & Manufacturing
- ✓ Pharmaceuticals
- ✓ Fuel & Oil Storage
- ✓ Hazardous Mining
- ✓ More

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Build Your Part Number

Series P104

Example: P104S7EPE120

Series
P104

Hazard Performance - *select one*	
S	Standard atmosphere (non-explosive)
E	For hazardous area with explosive gas atmosphere
M	For mine area with methane or coal dust

Electrode - *select one (refer to "Material Variant Media Applications" on page 3)*	
1	Insulated electrode (PEEK, sealing O-ring NBR) (Not for triclamp process connections)
2	Extended Insulated electrode (PEEK, sealing O-ring NBR) (Only for G1/2" process connection)
3	Insulated electrode (PEEK, sealing O-ring EPDM) (Not for triclamp process connections)
4	Extended Insulated electrode (PEEK, sealing O-ring EPDM) (Only for G1/2" process connection)
5	Insulated electrode (PEEK, sealing O-ring Viton) (Not for triclamp process connections)
6	Extended Insulated electrode (PEEK, sealing O-ring Viton) (Only for G1/2" process connection)
7	Insulated electrode (PTFE, without O-ring)
8	Extended Insulated electrode (PTFE, without O-ring) (Only for G1/2" process connection)

Process Connection - *select one; see diagrams on page 6*	
A	G ½" pipe thread
B	G ¾" pipe thread (Only with extended electrode)
C	M27 x 2 metric thread (Only with extended electrode)
D	Tri-clamp ¾" (Only with Insulated electrode (PTFE, without O-ring))
E	Tri-clamp 1 ½" (Only with Insulated electrode (PTFE, without O-ring))

Output - *select one*	
P	PNP Open Collector (Only for "S" hazard performance)
N	PNP Open Collector with diagnostic (Only for "S" hazard performance)
M	NAMUR (Only for "E" & "M" hazard performance)

Electrical Connection - *select one; see diagrams on page 7*	
E1	Stainless steel compression gland
E2	Plastic threaded cable gland
E3	M12x1, 4-pole
E4	Nickel-plated brass threaded cable gland
E5	Plastic cable gland with spiral
E6	Plastic cable gland for protective hose

Cable Length - *select one (for Electrical Connections 1,2,4,5,6)*	
	Cable length in meters (Example: 15 meters = 15)

Accessories – *optional; will be quoted as a separate line item*	
A1	Connector socket
A2	Standard steel welding flange
A3	Stainless-steel welding flange protective hose (for electrical connection)
A4	Stainless steel fixing nut
A5	Various types of seals (PTFE, Al, etc.)

Note: P104 is supplied with 1 magnetic pen for parameter settings and 1 seal

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Technical Parameters

Technical Parameters			
Electrical	Supply voltage	Standard: 7 ... 34 VDC Explosion-Proof: 8 ... 9 VDC	
	Power consumption	Standard: max. 5 mA DC Explosion-Proof: ≤ 1 mA disconnected, ≥ 2.2 mA connected	
	Max. switching current (PNP output)	Standard: 300 mA	
	Residual voltage – ON state	max. 1.5 V	
	Coupling capacity (housing - power) Dielectric strength	5 nF 500 VAC (50 Hz)	
	Max. internal values (Explosion Proof)	Ui = 12 VDC Ii = 15 mA Pi = 45 mW Ci = 15 nF Li = 10 µH	
	Cables LC values	typic C < 150 pF/m typic L < 0.8 µH/m	
Environmental	Explosion Class	Hazard Performance “E” Equipment protection by intrinsic safety "i" for use in potentially explosion atmosphere, II 1 G Ex ia IIB T5 Ga with intrinsically safe supply units. For use in hazardous area (explosive gas atmosphere), whole sensor zone 0, 1 and 2.	 60079-0 60079-11 60079-10-1
		Hazard Performance “M” Equipment protection by intrinsic safety "i" for use in potentially explosion atmosphere, IM1 Ex ia I Ma with intrinsically safe supply units. For use in the mine area with the occurrence of methane or coal dust.	 60079-0 60079-11 60079-10-1
	Protection Class	IP67 IP68	
Materials * Verify chemical compatibility with the media.	Cable (with Cable Outlets)	Standard Atmosphere with PNP: PVC 3 x 0.5 mm^2 Explosion Proof: PVC 2 x 0.75 mm^2	
	Weight without cable	0.33 lb	
	Housing	Stainless steel W.Nr. 1.4404 (AISI 316L)	
	End of sensor	Stainless steel W.Nr. 1.4301 (AISI 304)	
	Electrode coating	PEEK PTFE	
	Sealing O-ring	NBR EPDM (FPM) Viton	
	Cable Gland	Stainless steel W.Nr. 1.4571 / NBR Plastic PA / NBR Nickel-plated brass / PA / CR / NBR Nickel-plated brass / PA	

Material Variant Media Applications	
Variant (also applies to extended versions)	Description
Insulated electrode (PEEK, O-ring NBR)	For sensing various liquid, mashed and paste-like materials, appropriate also for fuel, oil or methanol, use from minimum temperature of 40°F (-40°C).
Insulated electrode (PEEK, O-ring EPDM)	For sensing various liquid, mashed and paste-like materials, appropriate also for acids, bases or alcohol, ammonia, acetone, chlorine, from minimum temperature of 40°F (-40°C).
Insulated electrode (PEEK, O-ring Viton)	For sensing various liquid, mashed and paste-like materials, appropriate also for fuel, oil, acids, bases or asphalt, tar, toluene, use from minimum temperature of -4°F (-20°C)
Insulated electrode (PTFE, without O-ring)	For sensing various liquid, mashed and paste-like materials, especially suitable for aggressive liquids, use from minimum temperature of 40°F (-40°C).

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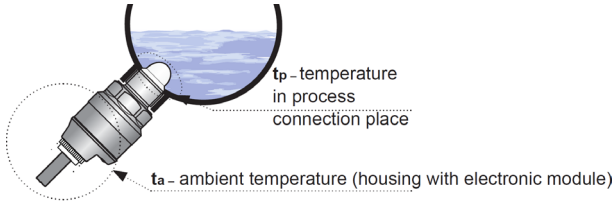
Technical Parameters

Temperature and Pressure Durability

Variant	Process Temperature	Ambient Temperature	Maximum Overpressure		T_p when T_a <122°F (<50°C) and t<1h
Standard Atmosphere, PEEK O-ring NBR / EPDM (with or without extension)	-40°F ... +221°F (-40°C ... +105°C)	-40°F ... +176°F (-40°C ... +80°C)	1450 PSI	10 MPa	Max 248°F (120°C)
Explosive Atmosphere, PEEK O-ring NBR / EPDM (without extension)	-40°F ... +212°F (-40°C ... +100°C)	-40°F ... +176°F (-40°C ... +80°C)	1450 PSI	10 MPa	Max 212°F (100°C)
Standard Atmosphere, PEEK O-ring Viton (with or without extension)	-4°F ... +221°F (-20°C ... +105°C)	-40°F ... +176°F (-40°C ... +80°C)	1450 PSI	10 MPa	Max 248°F (120°C)
Explosive Atmosphere, PEEK O-ring Viton (without extension)	-4°F ... +212°F (-20°C ... +100°C)	-40°F ... +176°F (-40°C ... +80°C)	1450 PSI	10 MPa	Max 212°F (100°C)
Standard Atmosphere, PTFE without O-ring	-40°F ... +221°F (-40°C ... +105°C)	-40°F ... +176°F (-40°C ... +80°C)	725 PSI to 122°F 362 PSI over 122°F	5 MPa to 50°C 2.5 MPa over 50°C	Max 248°F (120°C)
Explosive Atmosphere, PTFE without O-ring	-40°F ... +212°F (-40°C ... +100°C)	-40°F ... +176°F (-40°C ... +80°C)	725 PSI to 122°F 362 PSI over 122°F	5 MPa to 50°C 2.5 MPa over 50°C	Max 212°F (100°C)

Parameters of Functional Safety

Variant	PNP or NAMUR Output	PNP with Diagnostic
According to standard	EN 61508 ed.2	
Safety Function	MIN, MAX	
SIL	2	
Hardware Architecture	1oo1 without diagnostic	1oo1 with diagnostic
DC	0%	99%
PFH (T_{Proof}= 1 rok) (standard)	$2.218 * 10^{-7}$	$2.218 * 10^{-9}$
PFH (T_{Proof}= 1 rok) (explosive)	$2.238 * 10^{-7}$	-
λ_{DD} (standard)	0 FIT	219.6 FIT
λ_{DU} (standard)	221.8 FIT	2.2 FIT
λ_{DD} (explosive)	0 FIT	-
λ_{DU} (explosive)	223.8 FIT	-
$MTTF_D$ (standard)	514 years	
$MTTF_D$ (explosive)	510 years	-
valid version FW	v2	v3-diagnositc



Definitions

SIL .....Safety integrity level

DC .....Diagnostic cover

PFH.....Average frequency of dangerous failure per hour

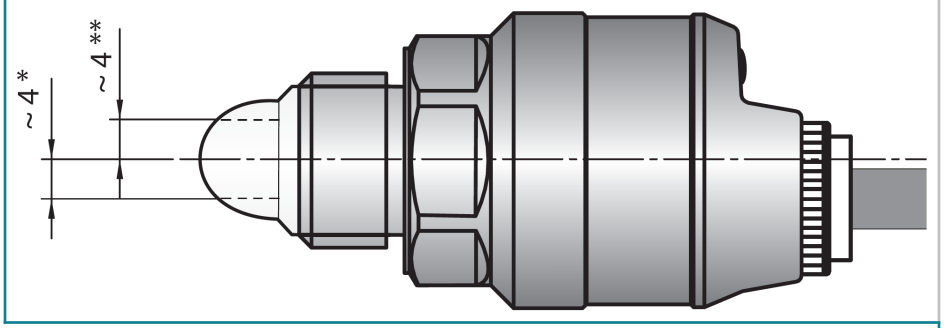
T_{Proof}.....Functional control period of the device safety function

$\lambda_{DD(DU)}$.....Detected (resp. undetected) dangerous failure rate per hour

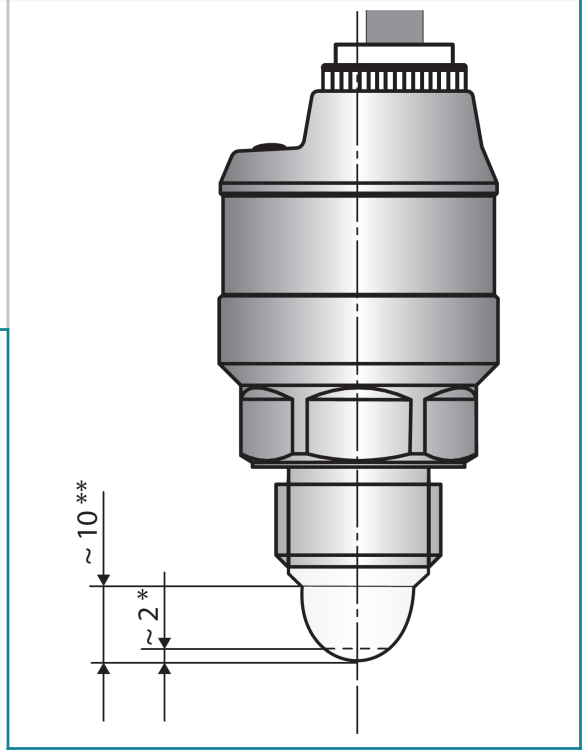
$MTTF_D$.....Mean Time To dangerous Failure

Sensor Switching Levels

Horizontal Mounting



Vertical Mounting



* Typical switch point position for water (factory setting).
** Typical switch point position for oil.

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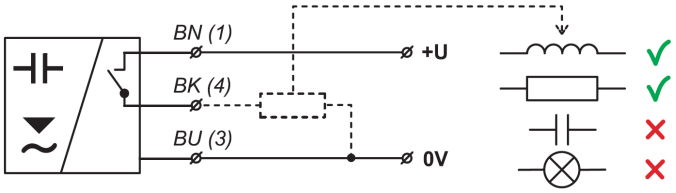
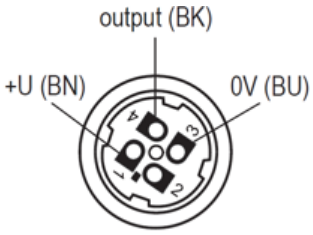
Technical Parameters

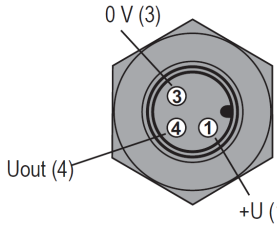
Electrical Connection

Variation / Feature	Details
Output Type – PNP	Only supports resistive or inductive loads; capacitive/low-resistance treated as short circuit.
Wiring – PNP Output	Brown (BN) → +U (Supply Voltage, pin 1) Blue (BU) → 0 V (Ground, pin 3) Black (BK) → Load Output (pin 4)
Cable Outlet Type (For Permanent Cable Connections)	Permanently attached PVC cables for direct connection to assessing units.
Wiring for Scheme	3-wire connection for standard atmosphere 2-wire for explosion proof (intrinsically safe)
Cable Requirements (Explosion Proof)	Cable length must comply with max permitted inductance & capacitance of safe circuit (e.g., NSSU, NDSU, NLCU)
Connection Type (For Connector 3)	Connected via compression or dismountable connector socket (socket not included).
Cable Length (For Connector 3)	Standard lengths: 2 m or 5 m (recommended cable diameter: 4–6 mm; cross-section: 0.5–0.75 mm²)
Connector Cable Diameter (For Connector 3)	Max 6 mm outer diameter when using dismountable connector sockets.

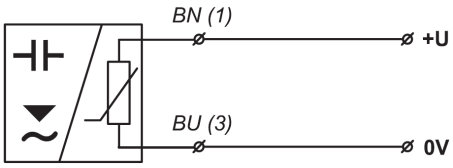


PNP output type sensor connection





Connection of the connector socket on sensor



NAMUR type sensors connection

⚠ Electrical connection can only be made when de-energized!

The source of the power voltage must comprise of a stabilized safe low power source with galvanic separation. In the event that a switch-mode power supply is used, it is essential that its construction effectively suppresses common mode interference on the secondary side. In the event that the switch-mode power supply is equipped with a PE safety terminal, it must be unconditionally grounded! Spark-safe devices must be powered from a spark-safe power source meeting the above-mentioned requirements.

⚠ In the event that the level meter (sensor) is installed in an outdoor environment at a distance greater than 20 m from the outdoor switchboard, or from an enclosed building, it is necessary to supplement the electrical cable leading to the level meter (sensor) with suitable overvoltage protection.

With regard to possible occurrence of electrostatic charge on non-conductive parts of the sensor for explosive areas, sensors must be grounded. It will be done using conductive tank, conductive lid of tank, or by the auxiliary plate electrode.

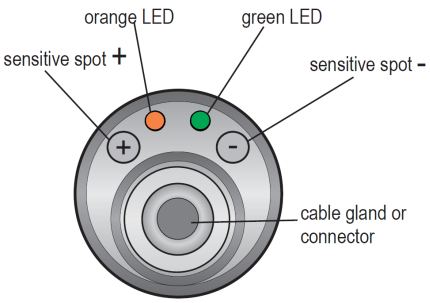
In the event of strong ambient electromagnetic interference, paralleling of conductors with power distribution, or for distribution to distances over 30 m, we recommend grounding the level meter (see above) and using a shielded cable.

Control Elements

Setting Scenarios

Settings are performed by placing the magnetic pen on the sensitive spot marked “+” or “–” located at the end of the sensor in two modes:

1. Quick settings - the user does not know precisely to what medium the sensor should be set, they only want to put the sensor into operation (usually upon receiving it) and check to see if the sensor is generally functional
2. Basic settings - the user has the medium available and can perform on the sensor its flooding and drainage
3. Medium window settings - the user has the medium available and can perform on the sensor its flooding and drainage



Top view of sensor control elements

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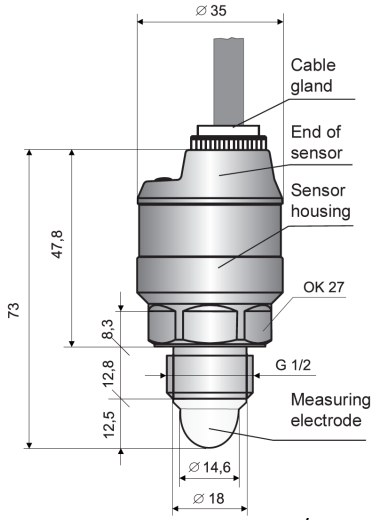
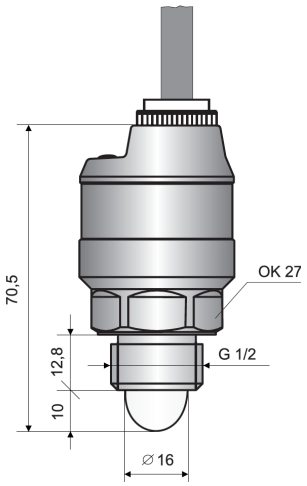
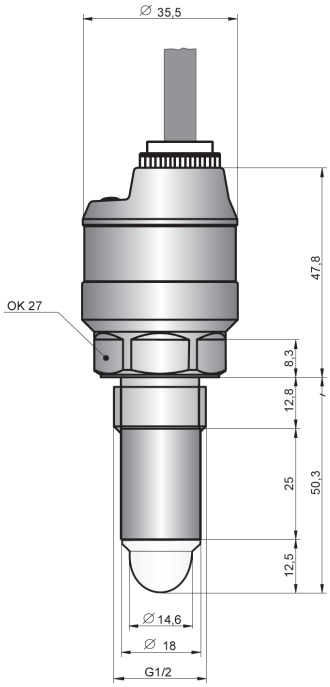
Process Connections



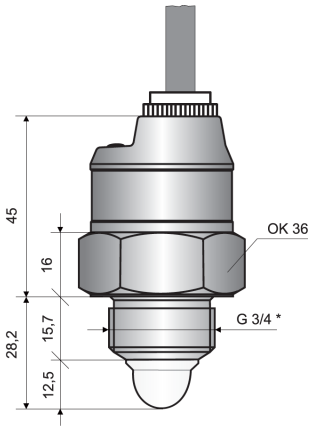
PEEK Electrode G1/2”



PTFE Electrode G1/2”

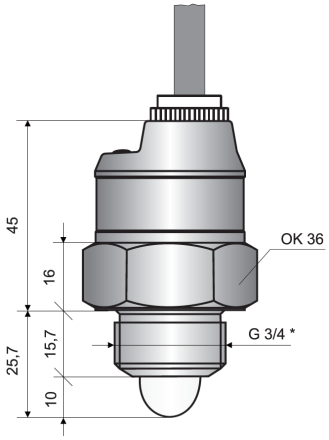


PEEK Extended Electrode G1/2”



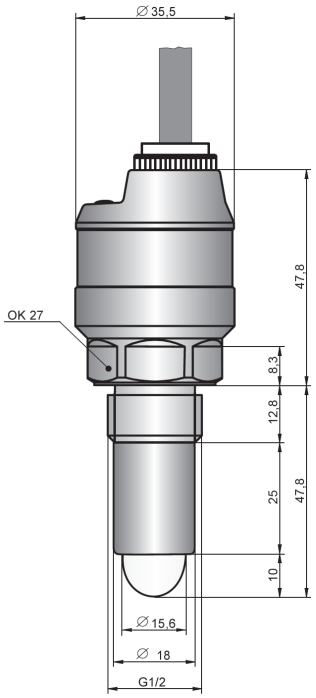
PEEK Electrode G3/4”

*Type of threads G3/4”; M27x2

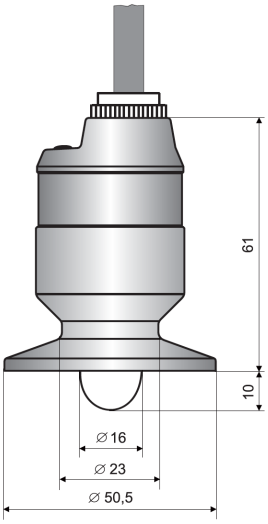


PTFE Electrode G3/4”

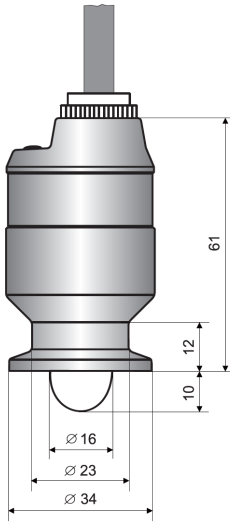
*Type of threads G3/4”; M27x2



PTFE Extended Electrode G1/2”



PTFE Electrode (1 ½” Tri-Clamp)



PTFE Electrode (3/4” Tri-Clamp)

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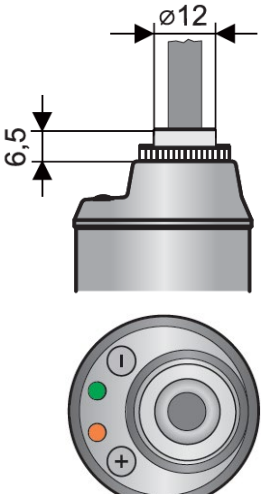
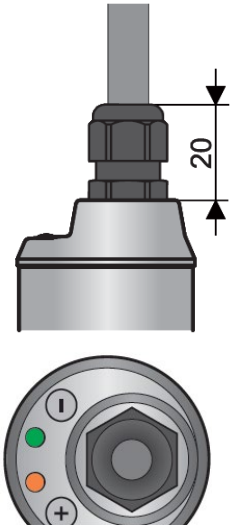
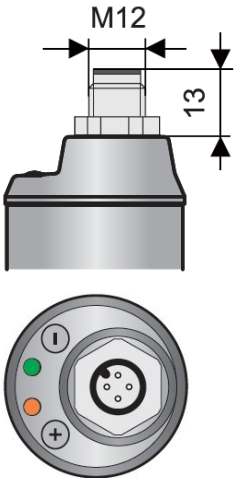
Electrical Connections



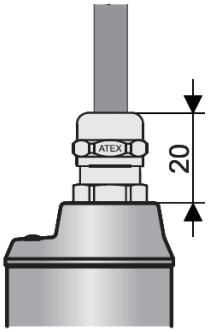
Variant “E1” with short stainless steel gland



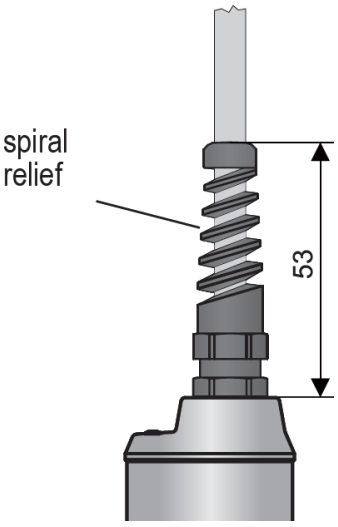
Variant “E2” with plastic threaded cable gland



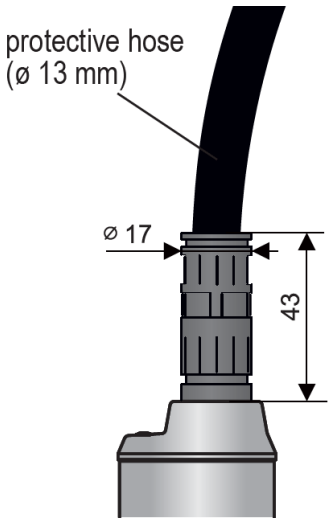
Variant “E3” with connector M12



Variant “E4” with nickel plated dustproof cable gland



Variant “E5” with plastic cable gland with spiral relief in case of increased mechanical wear on the cable



Variant “E6” with cable gland for protected hoses for using in an outdoor area or in area with increased moisture.

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Installation Instructions

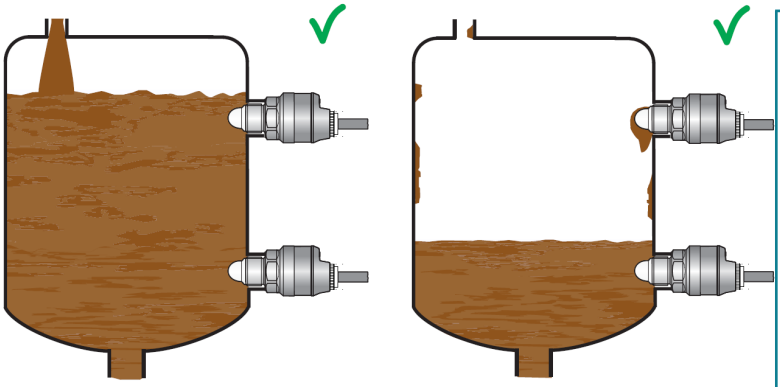
Level Sensors

The P104 level sensor can be mounted in horizontal or inclined position into the shell of a container, storage tank or pipe by screwing into the welding flange, or by affixing using a nut. Basic application recommendations are mentioned below.

⚠ During assembly into the metal tank or the storage tank, it is not necessary to separately ground the base of the level sensor

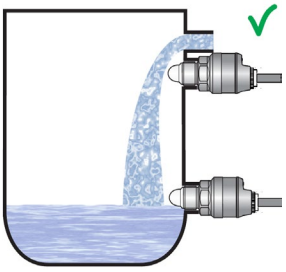
⚠ In the case of the use of an aggressive medium, it is necessary to prove the chemical compatibility of used materials of the sensor. This guarantee ceases when the product is chemically damaged.

Thanks to its design, the sensor is appropriate for detection of the level of viscous and simultaneously electrically conductive media (yoghurt, jams and jellies, mayonnaise, spreads, liquid soap, creams or pastes). After setting the sensitivity of the given media, it reliably reacts to the presence or absence of a medium level. On the contrary, the sensor does not react to remnants and coatings of viscous media on the measuring electrode.

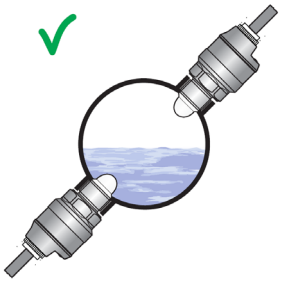


Side installation of sensors into a tank with viscous medium

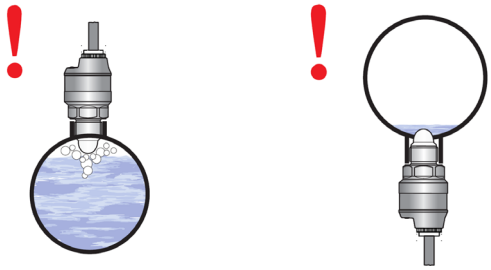
The sensor can be mounted in a tank or at medium inlets. After setting to the level of the given media the sensor does not react to the current of flowing medium.



It is recommended to install sensors in a horizontal pipe inclined from the side.

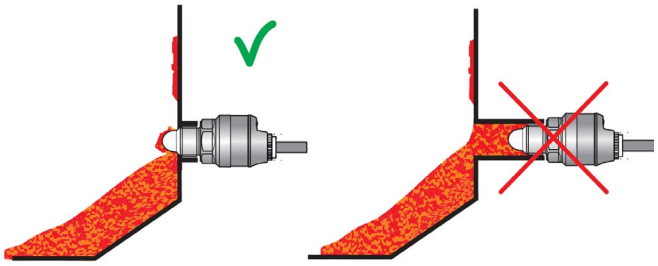


Upon vertical installation of the sensor in a pipe, pay attention to potential formation of air pockets or adhering remnants of liquid at the bottom of the pipe.

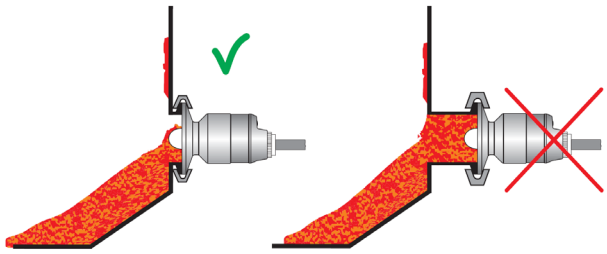


Installation of the sensor in a pipe

In the case of side wall mounting. it is necessary to avoid long fitting tubes, where sensed medium could remain. We recommend mounting the sensor so that the whole measuring electrode is inside the tank.



Correct and incorrect installation with a long tube

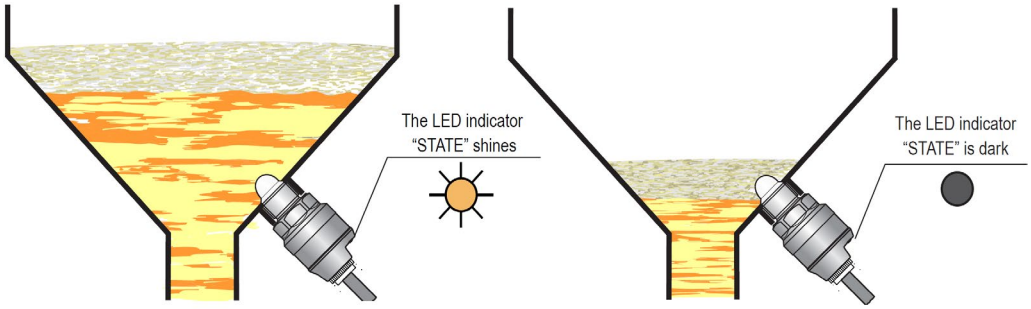


Correct and incorrect installation with a long tube for process connection with Tri-Clamp

⚠ Small Tri-clamp (3/4"), only for liquids with low viscosity.

Installation of the sensor for reliable checking of the level of a liquid with foam on the surface. Sensitivity of the sensor can be set to detect the liquid interface with foam. After a drop in the liquid level, the sensor does not react to coatings of foam on the electrode.

Monitoring the level of foam media



PAQUIN SENSORS
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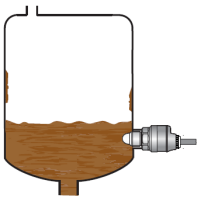
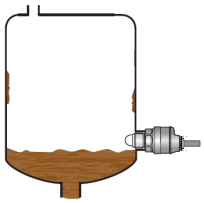
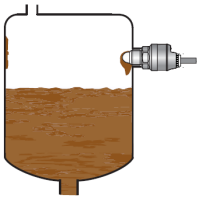
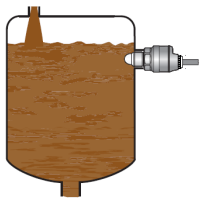
Function & Status Indication

Accessible for PNP Output with Diagnostic		
LED Indicator	Color	Function
"RUN"	Green	Measuring Function Indication Flashing – (approx. 0.4 s) – correct function of level detection Dark – incorrect installation or malfunction. Alternating flashing of the green and orange LED – error in settings Simultaneous shine of green and orange LED – when applying the mag. pen, when the setting is confirmed
"STATE:	Orange	Settings Indication Permanent shine – the sensor is closed Dark – the sensor is open 3 short flashes – settings confirmed Alternating flashing of the green and orange LED – error in settings Simultaneous shine of green and orange LED – when applying the mag. pen, when the setting is confirmed Periodic extinction (0.1 s) in closed mode - diagnosed function error Periodic lighting (0.1 s) in open mode - diagnosed function error

minimum level sensing	level state	mode	output state	state indicator
		O	CLOSED	 (illuminated)
		O	OPEN	 (not illuminated)

maximum level sensing	level state	mode	output state	state indicator
		C	CLOSED	 (illuminated)
		C	OPEN	 (not illuminated)

For safety reasons, we recommend using the setting of the mode "O" for min. level sensing (the sensor is closed upon immersion). It is for failure safety reasons – eventual failure of sensor behaves similarly as an exceeding of the limit state. Analogically, for the max. level it is recommended to set the mode "C" (the sensor is open upon immersion).

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Safety & Maintenance

Safety, Protections, Compatibility and Explosion Proof

The level sensor is equipped with protection against electric shock on the electrode, reverse polarity, output current overload, short circuit and against current overload on output.

Protection against dangerous contact is provided by low safety voltage according to 33 2000-4-41. Electromagnetic compatibility is provided by conformity with standards EN 55011 / B, EN 61000-4-2 to -6 and -8.

Explosion proof is provided by conformity with standards EN 60079-0, EN 60079-11, EN 50303. Explosion proof is verified FTZÚ – AO 210 Ostrava – Radvanice: FTZÚ 16 ATEX 0139X.

A declaration of conformity was issued for this device in the wording of Act No. 90/2016 Coll., as amended. Supplied electrical equipment matches the requirements of valid European directives for safety and electromagnetic compatibility.

Special conditions for safe use of Explosion Proof Variants

Explosion proof level switches are intended for connection to approved intrinsically safe supply units (insulating transducers) with galvanic separation. In the event that devices without galvanic separation (Zener barriers) are used, it is necessary to balance the potential between the sensor, resp. water level meter and the grounding barrier location.

The limit output parameters of intrinsically safe supply units (insulating transducers) must correspond to the limit input parameters of the sensor, resp. level meter. When assessing intrinsically safety of circuits, it is necessary to also take into consideration the parameters of the connected cable (namely its induction and capacity).

Design “E” can be used in zone 0, 1, and 2.

Design “M” is necessary to observe that temperature of any surface of apparatus, when coal dust can form a layer, do not exceed 212F°F (100°C).

Functional Safety

The P104 high-frequency level sensor meet the requirements of the safety integrity level according to the EN 61508 series of standards. The sensors are designed for liquid level detection applications with higher safety requirements:

- Overfill protection mode
- Anti-idle protection mode

The sensors meet the functional safety requirements of SIL 2 in both modes.

The sensor electronics have a 1oo1 architecture (single channel without P(R) diagnostics or single channel with PD diagnostics depending on the output variant).

It is recommended to perform a functional safety function check of the sensor once a year.

Use, Manipulation and Maintenance

The level meter does not require any personnel for its operation. Maintenance of this equipment consists in verification of integrity of the level meter and of the supply cable.

Activity in traffic:

- If the sensor is connected to an automatic control system or an emergency alarm system, its settings must not be interfered with during operation.
- If it is necessary to change the sensor settings, the entire system must be temporarily shut down and the process kept in a safe state by other means and measures.
- The signaling of fault conditions is described in the chapters.
- Signaling conditions or Signaling sensor conditions with diagnostics.

Action in the event of a fault:

- In the event of detected faults or fault signals, the entire system must be shut down and the process held in a safe state by other means and measures.
- If, as a result of a fault, sensor replacement is required, the manufacturer must be notified (including a description of the fault).

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Additional Images

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Paquin Sensors' product portfolio is designed to provide options to fit the most diverse range of specifications.

We collaborate with our customers to match the best product technologies with your unique application requirements.

Please contact us or call +1 (800) 831-8217 anytime to discuss your needs!