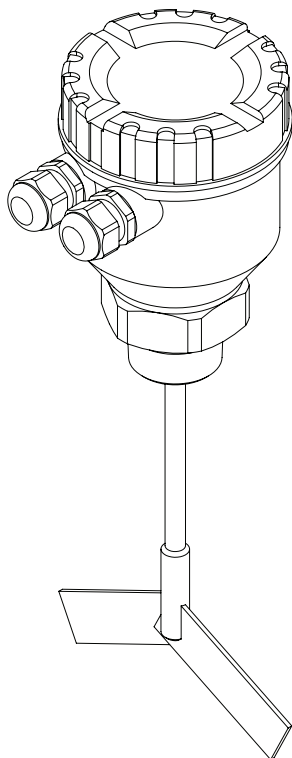


PROSENSE PLS SERIES

Rotating Paddle Bulk Solids Point Level Switch



OPERATING INSTRUCTIONS

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1 Document Information

1.1 Document function






These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from incoming acceptance and storage, mounting, connection, operation and commissioning through to troubleshooting.

1.2 Document conventions








1.2.1 Safety symbols

Symbol	Meaning
	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.



1.2.2 Electrical symbols

Symbol	Meaning
	Direct current A terminal to which DC voltage is applied or through which direct current flows.
	Alternating current A terminal to which alternating voltage is applied or through which alternating current flows.
	Direct current and alternating current <ul style="list-style-type: none"> • A terminal to which alternating voltage or DC voltage is applied. • A terminal through which alternating current or direct current flows.
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections. <ul style="list-style-type: none"> • Inner ground terminal: Connects the protective earth to the mains supply. • Outer ground terminal: Connects the device to the plant grounding system.





1.2.3 Symbols for certain types of information

Symbol	Meaning
	Permitted Indicates procedures, processes or actions that are permitted.
	Forbidden Indicates procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation Refers to the corresponding device documentation.
1., 2., 3. ...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.4 Symbols for graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1., 2., 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area Indicates a hazardous area.
	Safe area (non-hazardous area) Indicates a non-hazardous area.

1.2.5 Symbols for tools

Symbol	Meaning
	Flat blade screwdriver
	Allen key
	Open-ended wrench
	Torx screwdriver

2 Basic Safety Instructions

2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Follow instructions and comply with basic conditions

The operating personnel must fulfill the following requirements:

- Instructed and authorized according to the requirements of the task by the facility's owner/operator
- Follow the instructions in these Operating Instructions

2.2 Designated use

The ProSense PLS Series must only be used as a point level switch for specific bulk solids (Technical data section 8).

- The device may only be operated when installed.
- The manufacturer accepts no liability for damages resulting from incorrect use or use other than that designated. It is not permitted to convert or modify the device in any way.

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.

If working on and with the device with wet hands:

- Due to the increased risk of electric shock, gloves must be worn.

2.4 Operational safety

Risk of injury!

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Confirmed by the affixing of the CE mark to the device.

Certain models (-HAZ) have been certified by Factory Mutual (FM) for use in Hazardous Locations. See Technical data section 8.

3 Installation

3.1 Incoming acceptance, transport, storage

Compliance with the permitted environmental and storage conditions is mandatory. Precise specifications for this are provided in the Technical data section 8.

3.1.1 Incoming acceptance

On receipt of the goods, check the following points:

- Is the packaging or the content damaged?

- Is the delivery complete? Compare the scope of delivery against the information on your order form.

3.1.2 Transport and storage

Please note the following:

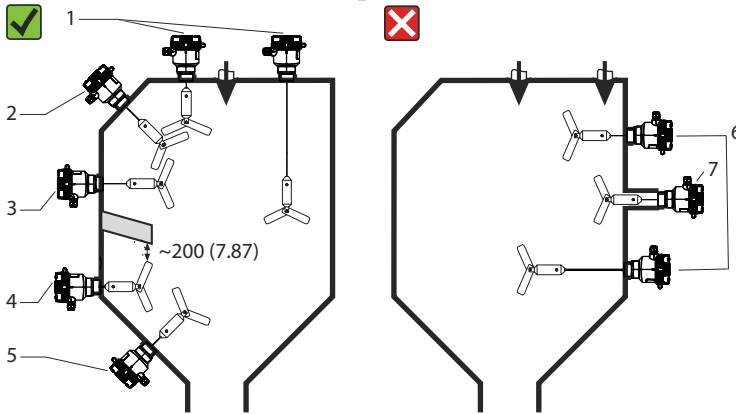
- Pack the device so that it is protected against impact for storage and transport. The original packaging provides optimum protection.
- The permitted storage temperature is -20 to $+60^{\circ}\text{C}$ (-4 to $+140^{\circ}\text{F}$)

3.2 Installation conditions

Correct and incorrect installation positions are indicated in the illustration below.

The device must be protected against continuous direct sunshine. The PLS Series sensors are designed to be used outdoors. To extend the life of the sensor a protective cover or enclosure should be used.

The dimensions of the device are provided in the Technical data section 8.



Orientations of the point level switch, dimensions in mm (in).

Permitted orientations	Forbidden orientations
1: Vertical from the top	6: In direction of solids flow
2: Angled from the top	7: Installation coupling too long
3: From the side	
4: From the side with protective cover against falling solids	
5: From the bottom (device must be protected against shot-type loads)	

Ambient temperature range

–20 to 60 °C (–4 to 140°F)

Medium temperature range

–20 to 80 °C (–4 to 176°F)

Mechanical load of optional indicator light

The optional indicator light must be protected against mechanical load (impact energy > 1 J).

More information is provided in the Technical data section 8.

3.3 Installation instructions

NOTICE

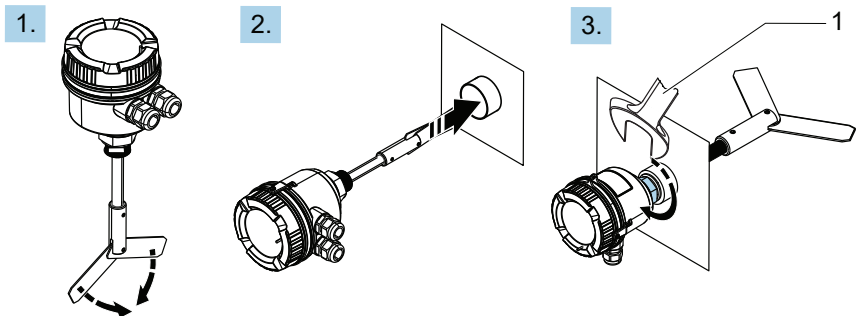
The device can be damaged if handled incorrectly during installation

Do not turn the housing to tighten the process connection. Once the process connection has been tightened, the housing can be aligned so that the cable entries point downwards.

NOTICE

The hinged rotating paddle does not function correctly when the transport lock is secured.

- Remove the transport lock (plastic net around the rotating paddle) prior to installation.

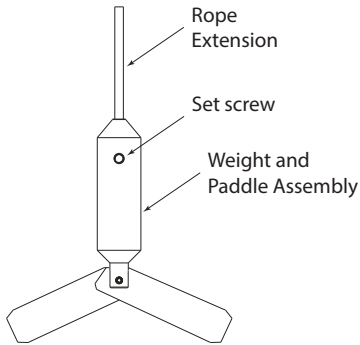


Installation of the unit with the hinged rotating paddle

1. Open-ended wrench AF 60

NPT connection does not have a process seal and the threads must be sealed, e.g. using a Teflon tape.

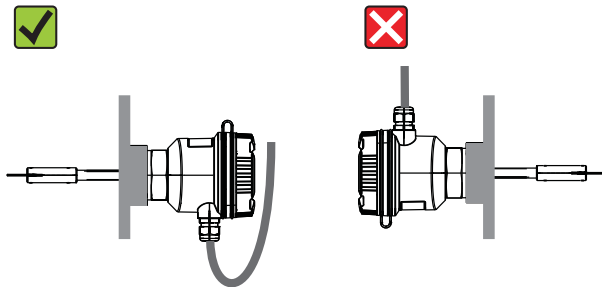
3.3.1 Cut rope to length



For units with the rope extension, the rope can be shortened by the user.

1. Using a 3mm hex key loosen the set screw so that the rope moves freely.
2. Remove the rope from the weight and paddle assembly.
3. Cut the rope to the desired length. Desired length should include portion required to be fully inserted into the weight and paddle assembly.
4. Push rope into weight and paddle assembly until it is fully seated.
5. Tighten the set screw using a 3mm hex key.

3.3.2 Turning the housing to the right position

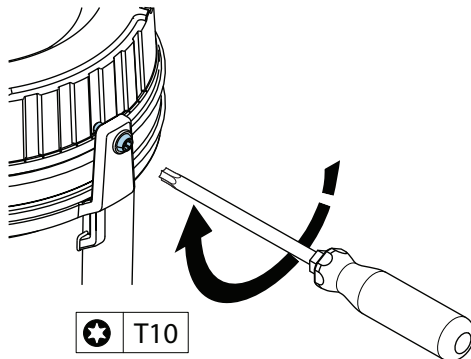


Correct housing position

3.3.3 Installation in hazardous areas

When installing the point level switch in a hazardous area, the securing screw must be tightened to prevent the cover from opening.

Additional installation instructions for hazardous areas are provided in the separate FM drawing for the device (-HAZ models only).



Tightening the cover securing screw. This is a combination screw; a flat-blade screwdriver can be used as an alternative to a T10 Torx screwdriver.

3.4 Post-installation check

- Is the process connection securely tightened?
- Do the cable entries point downwards and are they tightened?
- Is the cover securely closed and the securing screw securely tightened?

4 Wiring

4.1 Connection instructions

WARNING

Danger! Electric voltage!

- The entire connection of the device must take place while the device is de-energized.

CAUTION

Pay attention to additional information provided.

- The protective ground conductor must be connected before any other connection is established.
- Before commissioning the device, make sure that the supply voltage matches the voltage specifications on the nameplate.

- Provide a suitable switch or power-circuit breaker in the building installation. This switch must be provided close to the device (within easy reach) and marked as a circuit breaker.
- An overload protection element (rated current ≤ 10 A) is required for the power cable.

NOTICE

High temperatures can damage the cables and the device.

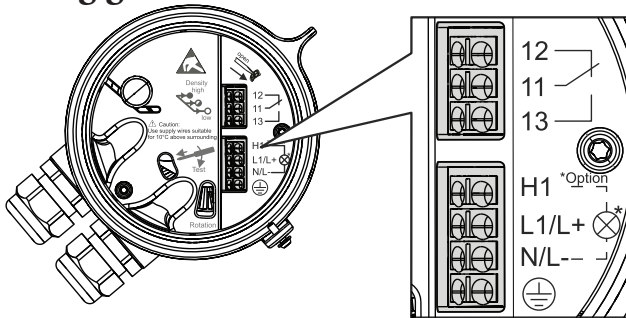
- Use cables that are suitable for temperatures 10°C (18°F) above the ambient temperature.

NOTICE

If the protection plugs supplied are used for the cable entries the cable gland must be tightened to maintain the IP rating.

- The protection plugs supplied are designed to protect against contamination during transport and storage. Each entry point must have either a cable gland or indicator light installed. If a cable entry is not used the cable gland must be tightened around the included plug or an appropriately rated M20 x 1.5 blanking plug must be installed to maintain IP rating.

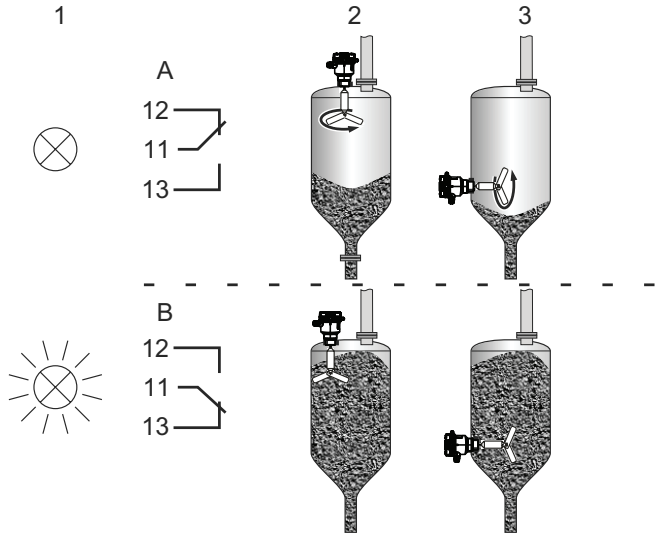
4.2 Quick wiring guide



Terminal assignment of the point level switch

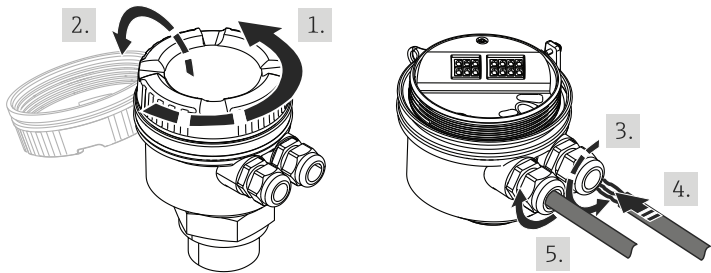
Symbol	Description	Symbol	Description
	Protective ground	H1	Connections for optional PLS Series indicator light
N (AC) / L- (DC)	Power connection	N/L-	
L1 (AC) / L+ (DC)	Power connection	11	Changeover contact
		12	Normally closed contact
		13	Normally open contact

4.2.1 Switching states

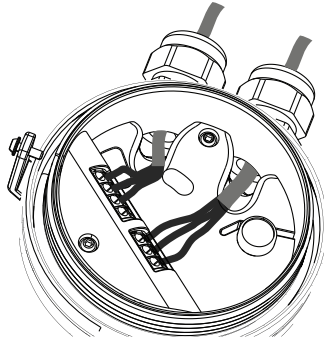


	1 = Indicator light (optional, not for -HAZ models)	2 = Full signaling	3 = Refill signaling	Shaft rotation	Internal light
A	OFF	OFF	ON	YES	ON
B	ON	ON	OFF	NO	ON

4.2.2 Inserting the cable



Removing the housing cover and inserting the cables



Connecting the cable to the terminals

4.3 Post-connection check

Device condition and specifications	Notes
Are cables damaged or the device damaged?	Visual inspection
Electrical connection	Notes
Does the supply voltage match the specifications on the device nameplate?	<ul style="list-style-type: none"> • 20 to 28 VDC • 115 V AC • 230 V AC
Are the mounted cables connected correctly and strain-relieved?	-
Are the cable glands securely tightened?	The plugs delivered with the device provide dust protection during transport and storage. If a cable entry is not used the cable gland must be tightened around the included plug or an appropriately rated M20 x 1.5" blanking plug must be installed to maintain IP rating.

5 Operation

⚠ WARNING

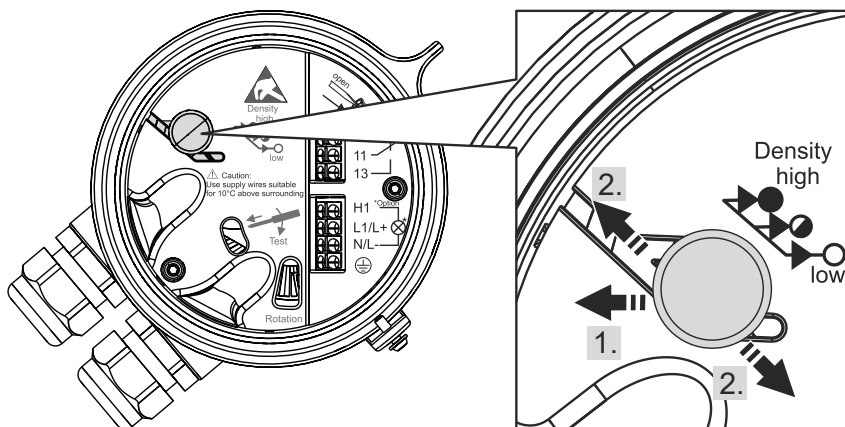
The device is not explosion-protected if the housing is open.

The device may only be opened in the hazardous area if no supply voltage is applied. Therefore the device may only be operated in a de-energized state or outside the hazardous area. **Only -HAZ models are FM certified for installation in hazardous areas.**

5.1 Setting the switching threshold (sensitivity)

The switching threshold can be set in 3 stages via an operating element that is accessible from above. The threshold can also be set during operation (in the non-hazardous area):

- Minimum: 80 g/l (4.99 lb/ft³)
- Adjustable in 3 stages depending on the density of the bulk solids: low, medium (factory default), high



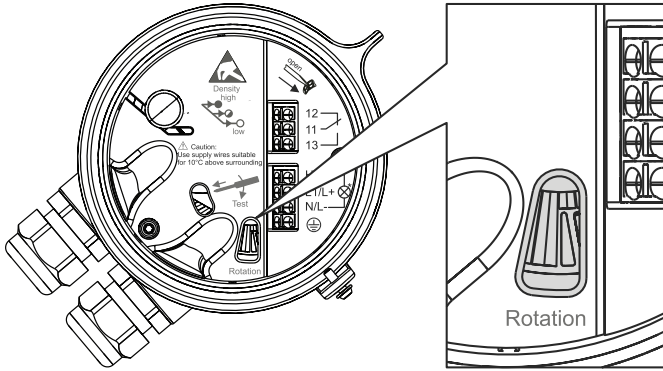
Setting the switching threshold

Setting the switching pressure

1. Move the operating element counterclockwise as illustrated.
2. Move the operating element to the desired position and let it click into place.

5.2 Rotational movement display

The shaft's rotational movement is indicated by a ratchet disk fitted on the drive axle of the paddle. The viewing area is lit up by an LED to make it easier to see. The rotational movement of the disk, and therefore also the shaft, can be checked through an inspection opening in the cover of the internal compartment when the cover is closed.



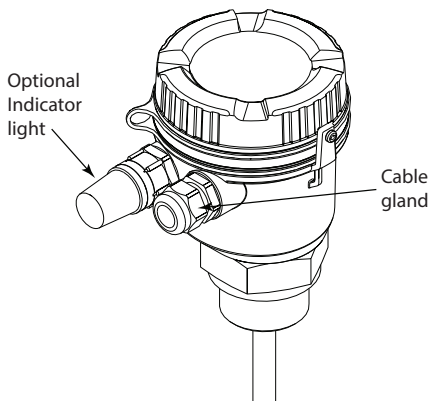
Inspection glass to observe rotational movement

5.3 Indicator light (optional)

The point level switch can be fitted with an optional indicator light that lights up when the rotating paddle stops. Not for use with -HAZ hazardous area models.

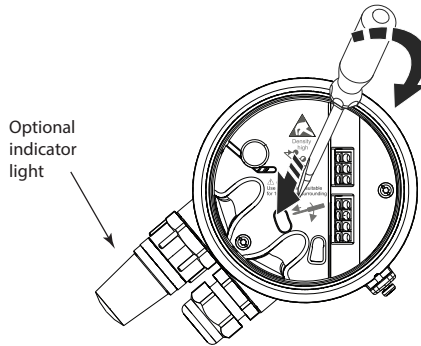
Installation:

1. Remove either the left or the right pre-installed cable gland using an open-ended wrench AF 24.
2. Using an open-ended wrench AF 24 install the indicator light into the available cable entry. Turn until the face of the cable entry and the light are flush. Do not over tighten.
3. Install the black wire into the H1 terminal and the blue wire into the N/ L1- terminal.
4. Test the light by performing a switching test as described in section 5.4 (also see section 4.2.1 for Switching states).



5.4 Testing the internal switch

When the housing cover is open, the function of the internal switch to switch off the motor can be checked by inserting a screwdriver into the opening provided in the electronics cover and by moving the handle in the direction of the arrow.



Testing the internal switch

6 Commissioning

6.1 Post-installation and post-connection check

Checklists:

- Post-installation check section 3.4
- Post-connection check section 4.3

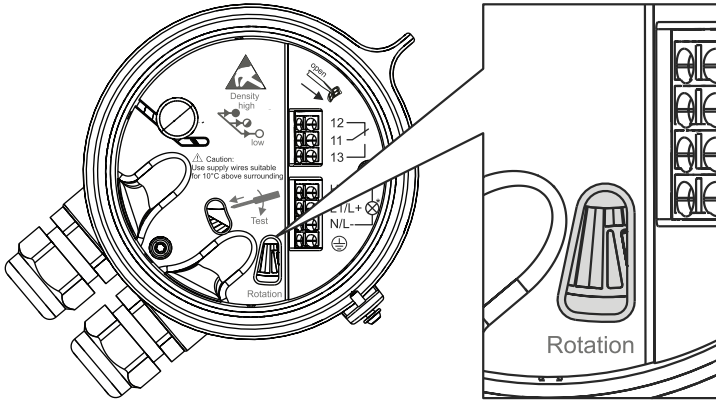
6.2 Setting the switching pressure (sensitivity)

The switching threshold can be adapted to the weight of the bulk solids in 3 stages via an operating element that is accessible from above (also possible during operation):

- Minimum: 80 g/l (4.99 lb/ft³)
- Adjustable in 3 stages depending on the density of the bulk solids: low, medium (factory default) and high. See section 5.1.

6.3 Switching on the device

The shaft starts to turn as soon as the supply voltage is switched on. The rotational movement can be observed from the outside.



Window to observe rotational movement

7 Troubleshooting

Functional testing of the point level switch by testing the internal switch.
See section 5.4 Testing the internal switch.

8 Technical data

8.1 Input

8.1.1 Measured variable

Level (in line with the orientation and length)

8.1.2 Measuring range

The measuring range depends on the installation location of the device and the selected length of the shaft 100 to 300 mm (3.94 to 11.81 in) or the rope extension up to max. 2,000 mm (6.56 ft).

8.2 Output

8.2.1 Output signal

Binary

8.2.2 Switch output

Function

Switch a floating changeover contact.


Switching behavior

On/Off

Switching time


From paddle standstill until output of the switch signal: 20°, corresponds to 3.5 s

Switching capacity


- According to EN 61058: 250 V AC 5E4, 6(2) A
 - 24 VDC, 3 A
 - Min. switching load 300 mW (5V or 5mA minimum)
 - See FM drawing for additional switch output ratings.
-  After a current >100 mA is actuated, it is no longer possible to guarantee the switching function with a switching current I <100 mA.

8.3 Power supply

8.3.1 Terminal assignment

Symbol	Description	Symbol	Description
	Protective ground	H1	Connections for optional PLS Series indicator light
N (AC) / L- (DC)	Power connection	N/L-	
L1 (AC) / L+ (DC)	Power connection	11	Changeover contact
		12	Normally closed contact
		13	Normally open contact

8.3.2 Supply voltage

- 20 to 28 VDC
 - 115 VAC 50/60 Hz
 - 230 VAC 50/60 Hz
-  An overload protection element (rated current ≤ 10 A) is required for the power cable.

8.3.3 Power consumption


Max. 3.5 VA

8.3.4 Terminals

Terminals with spring terminal design

Permitted cable cross-sections

Rigid	0.2 to 2.5 mm² (24 to 14 AWG)
Flexible	
Flexible with wire end ferrule without plastic ferrule	0.5 to 2.5 mm² (22 to 14 AWG)
Flexible with wire end ferrule with plastic ferrule	0.5 to 1.5 mm² (22 to 16 AWG)

 Use supply wires suitable for 10 °C (18 °F) above the ambient temperature.

8.4 Performance characteristics

8.4.1 Shaft speed

1 rpm

8.4.2 Sensitivity

Can be adjusted using an operating element accessible from the top.

- Minimum: 80 g/l (4.99 lb/ft³)
- Depending on the density of the bulk solids adjustable in three stages: low, medium (default), high

Reference temperature 25°C ±5°C (77°F ±9°F)

Humidity 20 to 60% relative humidity

8.4.3 Mechanical operating life

500,000 switching operations

8.5 Installation

Special mounting instructions

Side load on the shaft

Max. 60 N

Load on the rope

Max. 1,500 N

Operating pressure (abs.)

0.5 to 2.5 bar (7.25 to 36.3 psi)

Housing can be rotated 360 °

To adjust to the direction of the cable entries (pointing downwards)

Cable entries

The plugs delivered with the device provide dust protection during transport and storage. If a cable entry is not used the cable gland must be tightened around the included plug or an appropriately rated M20 x 1.5 blanking plug must be installed to maintain IP rating.

Mechanical load of optional indicator light

The optional indicator light must be protected against mechanical load (impact energy > 1 J).

Optional indicator light specifications

PLS-L24

Voltage: 20-28 VDC

Current: 80 mA

Light life: 2,000 h

PLS-L115

Voltage: 115 VAC

Current: 20 mA

Light life: 6,000 h

PLS-L230

Voltage: 230 VAC

Current: 1.5 mA

Light life: 10,000 h

8.6 Environment

The device must be protected against continuous direct sunshine. The PLS Series sensors are designed to be used outdoors. To extend the life of the sensor a protective cover or enclosure should be used.

All values not indicated as per DIN EN 6054-1.

8.6.1 Ambient temperature range

–20 to 60°C (–4 to 140°F)

8.6.2 Storage temperature

–20 to 60°C (–4 to 140°F)

8.6.3 Climate class

EN60654-1, Class C2

8.6.4 Degree of protection

IP66

8.6.5 Shock resistance

As per EN 60068-2-27: 30g

8.6.6 Vibration resistance

As per EN 60068-2-64: 0.01g²/Hz

8.6.7 Electromagnetic compatibility

Electromagnetic compatibility in accordance with all the relevant requirements of the EN 61326 series. For details refer to the Declaration of Conformity.

- Interference immunity: as per IEC 61326-1, industrial environment
- Interference emission: as per IEC 61326-1, Class B

8.6.8 Electrical safety

Class I equipment, overvoltage category II, pollution degree 2

8.6.9 Altitude

< 2,000 m (6,560 ft) over MSL

8.7 Process

8.7.1 Medium temperature range

–20 to 80°C (–4 to 176°F)

8.7.2 Process pressure range

≤ 1.5 bar (21.8 psi) overpressure (e.g. when silo is filled)

8.7.3 Solids weight

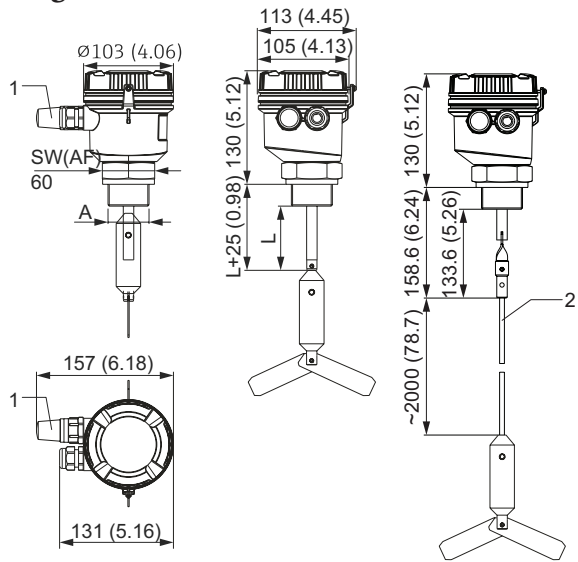
≥ 80 g/l (4.99 lb/ft³)

8.7.4 Grain size

≤ 50mm (1.97 in)

8.8 Mechanical construction

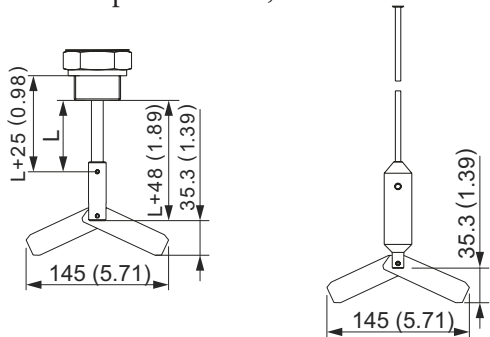
8.8.1 Design, dimensions



Dimensions of the point level switch, dimensions in mm (in)

1 Indicator light (optional)

2 Version with rope extension, can be shortened. See section 3.3.1.



Dimensions of the rotating paddle, for shaft and rope extension, dimensions in mm (in)

Dimensions depending on the version		
A	Process connection	NPT 1½"
L	Length of shaft	100mm, 200mm, 300mm, and 2000mm rope

8.8.2 Weight

Version / part	Weight (approx.)
with shaft 100 mm (3.94 in)	910 g (2.0 lb)
Rope extension	1665 g (3.67 lb)

8.8.3 Materials

Designation	Material
Housing	Polycarbonate
Captive screw cap	Polyamide
Cover seal	Silicone
Housing seal	Viton
Shaft	1.4305 / 303 stainless steel
Rope extension	1.4401 / 316 stainless steel
Paddle	304 stainless steel
Shaft seal	Nitrile Rubber
Process connections	PBT (Polybutylene Terephthalate)

8.8.4 Cable entries

2 x cable gland, M20 x1.5

Note: Only 1 x cable gland M20 x 1.5 is available when one of the indicator light accessories (PLS-L24, PLS-L115, or PLS-L230) is installed.

Permitted cable diameter
5 to 9 mm (0.2 to 0.35 in)

8.9 Operability

8.9.1 Local operation

Rotational movement display

The shaft's rotational movement is indicated by a reflector disk fitted on drive shaft of the paddle and can be monitored through a sight opening in the drive/terminal cover. The disk's viewing area is lit up by an LED to make it easier to see.

Setting the switching threshold (sensitivity)

The switching threshold can be adapted to the weight of the bulk solids in 3 stages via an operating element that is accessible from above (also possible during operation):

- Minimum: 80 g/l (4.99 lb/ft³)
- Adjustable in 3 stages depending on the density of the bulk solids: low, medium (factory default), high

8.10 Certificates and approvals

8.10.1 CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

8.10.2 FM Certification

All explosion protection data is provided in separate documentation which is available at AutomationDirect.com.

Note: Indicator light accessories (PLS-L24, PLS-L115, or PLSL230) are not intended for use with -HAZ models. The indicator lights are not FM certified and shall not be used in hazardous areas.



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