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NIVOROTA

ROTARY PADLE LEVEL SWITCH

USER'S MANUAL

NIVELCO

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1. INTRODUCTION

The new **NIVOROTA E-700/800** rotary paddle level switches of the well-known NIVELCO design can be used for detecting the level of lumpy materials, powders, and granules. Mounted onto tanks, silos, and hoppers, they monitor and control the level, filling, and emptying of stored materials such as stones, fly ash, sand, coal, feed, beet slices, etc.

A low-power electric motor drives the paddle, which rotates freely in the absence of the material. Its rotation in the **EK□ / EH□** is mono-directional; in the **EL□ / EM□**, it is bidirectional. When the medium reaches the paddle, the output contact switches from NC state to NO state, and the motor is turned off. When the material level drops, the paddle runs free again, the motor is reactivated, and the switch returns to its original state (NC). In the case of low-level detection, the material usually covers the blade, with the output contact staying in NO state, and the motor stopped. When the material drops to a level where the paddle can rotate freely again, the motor restarts and the control switch returns to the NC position.

The process connection can be threaded (1" or 1½" BSPT) or a mounting plate. It is recommended to use adapters for threaded connection points other than the standard version. The mounting plate can be attached to the unit with a threaded process connection. Mounting nuts are available for mounting onto a bracket, depending on the size of the process connection. A suitable paddle must be chosen for every particular medium density. The single-blade paddle is recommended for higher density materials and granular solids, while the 3-blade paddle is recommended for lower density materials, powders, and solids. The 1-blade paddle or 2-blade paddle with flexible coupling can also be used with a suitable threaded connection, while the 3-blade paddles can only be installed using a mounting plate.

If the standard version's insertion length is not enough, there are rod or cable extension types available, depending on the application. For light materials with moderate stress, the solution is to use (Ø10) pipe extension. The device's shaft must be protected against being hit by falling stones or other coarse materials by using a flexible coupling. If the insertion length is customized for any technical reason, the rod-extended design with an adjusting unit is recommended. This can be ordered separately. In the case of a cable version, if the desired length falls between two available sizes, the desired length can be achieved by cutting the cable to the appropriate size. The counterweight stretches the cable to avoid the paddle climbing up onto the medium surface. If additional stiffening of the cable probe is required, a rigid pipe can be ordered as an accessory.

Caution! If the pipe is cut to size, at least 30 mm (1.2") must be left free between its top end and the cable rope assembly connector.

If the medium temperature exceeds +120 °C (+248 °F), a high-temperature version must be used, equipped with a heat sink, raised from the process connection, and only available with aluminum housing.

Dust-Ex versions are available for use in hazardous environments.

2. TECHNICAL DATA

2.1 GENERAL DATA

Version	Standard		High-temperature EM□– / EH□–7□□
	EL□– / EK□–7□□	EL□– / EK□–8□□	
Insertion length (L)	Standard: 200 mm (7.85") – Rod extension: 0.3…3 m (1…10 ft) Cable extension: 1…3 m (3.3…10 ft)		
Number and material of the blades	1.4571 (316Ti) / 1, 2, 3; as per order code		
Rotation speed	~1 rpm (@50 Hz)		
Material of wetted parts	1.4571 (316Ti) Stainless Steel, Material of the seal: NBR		1.4571 (316Ti) Stainless Steel, Material of the seal: FPM
Medium density (guideline value)	min. 0.1 kg/dm³		
Medium temperature	-20…+120 °C (-4…+248 °F)	-20…+80 °C (-4…+176 °F)	-20…+200 °C (-4…+392 °F)
	Ex variant: see 2.2 Explosion protection data		
Ambient temperature	-30…+60 °C (-22 °F … +140 °F)		
Relative humidity	max. 90%		
Process pressure	max. 3 bar (0.3 MPa, 43.5 psig)		
Output	SPDT 250 V AC, 6 A, AC1		
Paddle-rotation / shutdown indication	Two-toned (green/red) LED		
Power supply	Nominal value: 230 V AC (50/60 Hz) +10% -15%, 120 V AC (50/60 Hz) +10% -15% 24 V AC (50/60 Hz) +10% -15%, 24 V DC (18…28 V DC) (1)		
Process connection	1" BSPT; 1½" BSPT; mounting plate (BSPT thread can also be screwed into BSP or NPT thread)		
Power consumption	max. 4 VA (4 W)		
Electrical connection	2x M20x1.5 plastic cable glands, for Ø6…Ø12 mm (Ø0.25…Ø0.5") cable 2x internally threaded ½" NPT connection for protective pipes 2x terminal blocks for 0.5…1.5 mm² (AWG20…AWG15) wire cross section		
Electrical protection	Class I.		
Ingress protection	IP67		
Housing material	Powder-coated aluminum	Plastic (PBT)	Powder-coated aluminum
Weight	Standard: 1.6 kg (3.52 lb), Rod-extended: 1.6 kg (3.52 lb) + extension 1.6 kg/m (1 lb/ft), Cable-extended: 2.6 kg (5.73 lb) + extension 1.4 kg/m (0.94 lb/ft), counterweight: 1 kg (2.2 lb)		

(1) The EK□/ EH□–□□□–4M, –8M use 24 V DC (-15%...+10%)

The connection between the device housing and the process connection is rigid, it cannot be turned or twisted!

2.2 Explosion protection data

Type	Standard EL□–, EK□–7□□–5,6,7,8Ex	High-temperature EM□–, EH□–7□□–5,6,7,8Ex
Ex marking	Ⓔx II 1/2 D Ex ta/tb IIIC T85°C…T135°C Da/Db	Ⓔx II 1/2 D Ex ta/tb IIIC T85°C…T200°C Da/Db
Ex power supply	E□□–7□□–5Ex: U_0 ≤ 253 V AC E□□–7□□–6Ex: U_0 ≤ 132 V AC E□□–7□□–7Ex: U_0 ≤ 26.4 V AC E□□–7□□–8Ex: U_0 ≤ 28 V DC	
Process and ambient temperature	See: "2.2.1 Temperature data for Ex certified models"	
Cable entry	M20x1.5 cable gland with "Ex ta" certification	
Cable outer diameter	Ø6…Ø12 mm (Ø0.25…Ø0.5")	
Electrical connection	Wire cross-section: 0.5…1.5 mm² (AWG20…AWG15)	
Ex reference document number	eka7021m0600h_07	

2.2.1 Temperature data for Ex certified models

Type	Temperature class	T85°C	T100°C	T135°	T200°C
Standard temperature **EL□–, EK□–7□□–5,6,7,8Ex**	Maximum surface temperature	+60 °C (+140 °F)	+90 °C (+194 °F)	+120 °C (+248 °F)	–
	Maximum medium temperature				
	Maximum ambient temperature		+60 °C (+140 °F)	+50°C (+122 °F)	
	Waiting time for opening the cover	40 min	30 min	10 min	
High-temperature **EM□–, EH□–7□□–5,6,7,8Ex**	Maximum surface temperature	+60 °C (+140 °F)	+90 °C (+194 °F)	+120 °C (+248 °F)	+200 °C (+392 °F)
	Maximum medium temperature				
	Maximum ambient temperature	+60 °C (+140 °F)			
	Waiting time for opening the cover	40 min	30 min	15 min	0 min

2.3 Accessories

- User's manual
- Warranty Card
- EU Declaration of Conformity
- 1-, 2- or 3-blade paddle (as per order code), 2 peaces split pin, 2 cable gland

2.4 Order code

NIVOROTA E □ □ – □ □ □ – □ (1)

Version	Code
Standard	**K**
High-temperature	**H**
Standard bidirectional version	**L**
High-temperature bidirectional version	**M**

Probe version / Paddle / Process connection	Code
Standard / Single-blade paddle / 1" BSPT	**A**
Standard / Single-blade paddle / 1½" BSPT	**H**
Standard / 3-blade paddle / 1½ " BSPT	**F**
With rod extension / Single-blade paddle / 1½" BSPT	**R**
With cable extension / Single-blade paddle / 1½" BSPT	**K**
With cable extension / 3-blade paddle / 1½" BSPT	**L**

Housing	Code
Aluminum	**7**
Plastic (2)	**8**

Code	Insertion length [m (ft)]		Code
0	0 (0)	0 (0)	**0**
1	1 (3.3)	0.1 (0.3)	**1**
2	2 (6.6)	0.2 (0.6)	**2**
3	3 (10)	0.3 (1)	**3**
		0.4 (1.3)	**4**
		0.5 (1.6)	**5**
		0.6 (2)	**6**
		0.7 (2.3)	**7**
		0.8 (2.6)	**8**
		0.9 (3)	**9**

Power supply / Certificate	Code
230 V AC	**1**
120 V AC	**2**
24 V AC	**3**
24 V DC	**4**
230 V AC / Ex ta/tb IIIC (ATEX)	**5**
120 V AC / Ex ta/tb IIIC (ATEX)	**6**
24 V AC / Ex ta/tb IIIC (ATEX)	**7**
24 V DC / Ex ta/tb IIIC (ATEX)	**8**

(1) The order codes of Ex versions end in 'Ex'

(2) No Ex-version available, no high-temperature variant available

Accessories

Paddles

Type / material	Code
Single-blade curved, 168 mm (6.6") / 1.4571 (316Ti)	EAL-701-1
Single-blade curved, 120 mm (4.7") / 1.4571 (316Ti)	EAL-702-1
2-blade flexible, 170 mm (6.7") / 1.4571 (316Ti)	EAL-703-1
2-blade flexible, 120 mm (4.7") / 1.4571 (316Ti)	EAL-704-1
Single-blade straight, 170 mm (6.7") / 1.4571 (316Ti)	EAL-705-1
Single-blade straight, 70 mm (2.8") / 1.4571 (316Ti)	EAL-706-1
Single-blade 90°, 130 mm (5.1") / 1.4571 (316Ti)	EAL-707-1
3-blade extended, 268 mm (10.5") / 1.4571 (316Ti)(1)	EAL-708-1
3-blade standard, 120 mm (4.7") / 1.4571 (316Ti)(1)	EAL-709-1
Mounting sleeve (3x20)	4cesp3x20ykoy

Mounting plate

Type / material	Code
1" female nut / 1.4571 (316Ti)	EAM-701-0
1½" female nut / 1.4571 (316Ti)	EAM-702-0
Sliding sleeve for rod extended version / 1.4571 (316Ti)	EAM-703-0
Mounting plate, 1" hole / 1.4571 (316Ti)	EAM-704-0
Mounting plate, 1" hole / carbon steel	EAM-705-0
Mounting plate, 1½" hole / 1.4571 (316Ti)	EAM-706-0
Mounting plate, 1½" hole / carbon steel	EAM-707-0
Mounting plate seal	EAM-704-0M-003

Accessories

Type / material	Code
Weight / 1.4571 (316Ti)	EAW-701-0
Flexible Coupling / 1.4571 (316Ti)	EAS-701-0
Rigid pipe for cable extended version (0.1…3.0 m [0.3…3 ft])	EAK-7□□-1 (2)
Pipe extension Ø10x1 (0.1…0.5 m [0.3…1.6 ft])	EAR-70□-1 (2)

Adapters

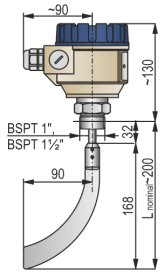
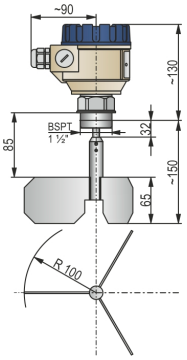
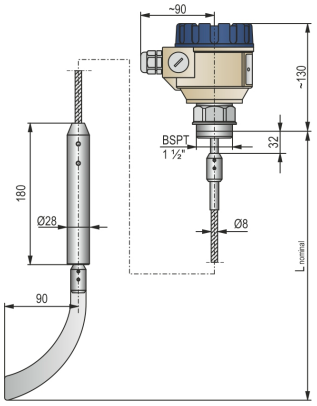
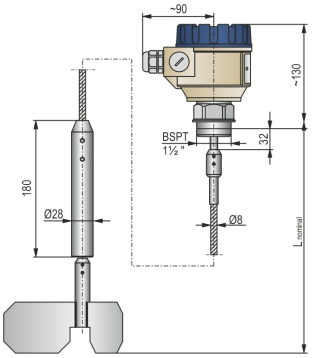
1" BSP – 1½" BSP / 1.4571 (316Ti)	EAA-601-0
1" BSP – 1½" NPT / 1.4571 (316Ti)	EAA-602-0
1½" BSP – 2" BSP / 1.4571 (316Ti)	EAA-603-0
1½" BSP – 3" BSP / 1.4571 (316Ti)	EAA-609-0
1½" BSP – 1¼" NPT / 1.4571 (316Ti)	EKH-402-1M-000-01
1½" BSP – 2" NPT / 1.4571 (316Ti)	EKN-402-1M-000-02

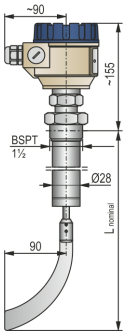
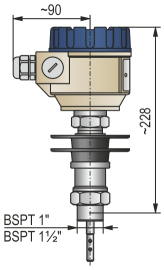
(1) With a mounting plate

(2) Coding of length in accordance with the "insertion length" column of the order code table.

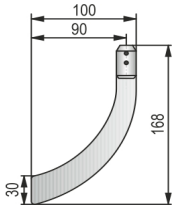
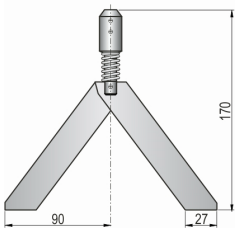
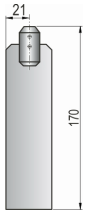
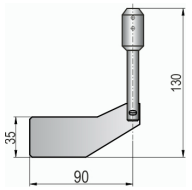
2.5. DIMENSIONS

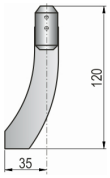
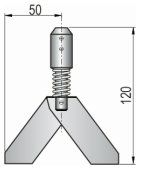
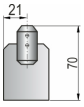
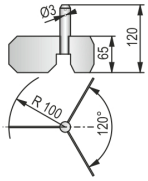
2.5.1 UNITS

STANDARD VERSION		CABLE EXTENDED VERSION WITH COUNTERWEIGHT	
Single-blade paddle EL□–, EK□–□02–□	**3-blade paddle ELF–, EKF–□02–□**	**Single-blade paddle EKK–, ELK–□□□–□**	**3-blade paddle EKL–, ELL–□□□–□**
			

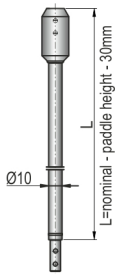
ROD EXTENDED VERSION	HIGH-TEMPERATURE VERSION
Single-blade paddle ELR–, EKR–□□□–□ **Insertion length** (L): 0.3…3.0 m (1…10 ft)	**EM□–, EH□–7□□–□**
	 Standard 1 or 3-blade paddle, rod or cable version

2.5.2 ACCESSORIES

Single-blade curved paddle (168 mm, 6.6") EAL–701–1	2-blade flexible paddle (170 mm, 6.7") EAL–703–1	Single-blade straight paddle (170 mm, 6.7") EAL–705–1	Single-blade 90° paddle (130 mm, 5.1") EAL–707–1
			
• Inserted through a 1", 45 mm (1.75") long process connection. • Default blade, for most applications • Paddle pressure*: 1.4 kPa (0.203 psi)	• 1" variant, it can be inserted through a 80 mm (3.15") process connection. The length of the device must be determined so the blades can open freely before the threads meet. Variants with extension pipe or rod are available. • Paddle cannot be used with sticky materials, as they may prevent the blades from closing when removing. • The blades must be closed by pressing the blade tips together when the unit is installed. • For lighter materials. • Paddle pressure*: 0.8 kPa (0.116 psi)	• Inserted through a 1½" process connection. • For coarse or sticky materials. The material stuck to the blade tends to affect the operation of the unit less. • Paddle pressure*: 3 kPa (0.435 psi)	• Inserted through a 1½", 50 mm (2") long process connection. • Shorter insertion length • Fit for most applications • Paddle pressure*: 1.5 kPa (0.216 psi)

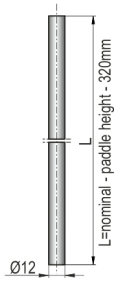
Single-blade curved paddle (120 mm, 4.7") EAL–702–1	2-blade flexible paddle (120 mm, 4.7") EAL–704–1	Single-blade straight paddle (70 mm, 2.75") EAL–706–1	3-blade standard paddle (120 mm, 4.7") EAL–709–1
			
• Inserted through a 1", 45 mm (1.75") long process connection. • For coarse or sticky materials. The material stuck to the blade tends to affect the operation of the unit less. • More robust due to the blade's small area and insertion length. • Paddle pressure*: 10.5 kPa (1.52 psi)	• 1" variant, it can be inserted through a 80 mm (3.15") process connection. The length of the device must be determined so the blades can open freely before the threads meet. Variants with extension pipe or rod are available. • Paddle cannot be used with sticky materials, as they may prevent the blades from closing when removing. • The blades must be closed by pressing the blade tips together when the unit is installed. • For materials with a larger specific weight. • Paddle pressure*: 2.9 kPa (0.42 psi)	• Inserted through a 1½" process connection. • For dense materials. • More robust due to the blade's small area and insertion length. • Paddle pressure*: 8.7 kPa (1.26 psi)	• Use a mounting plate to insert paddle into the tank! • Primarily for light materials due to its large blade. • Paddle pressure*: 0.3 kPa (0.044 psi)

Pipe extension Ø10x1
EAR–70☐–1



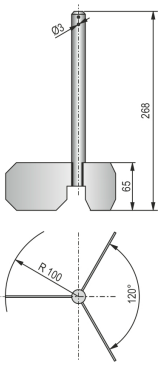
- The extension can only be used with a standard model.
- It is crucial it the paddle of pipe-extended models is not exposed to strong lateral forces, for they may damage the pipe!
- If the required "L" length is different than the one in the order code, it must be specified.

Rigid pipe for cable extended version
EAK–7☐☐–1



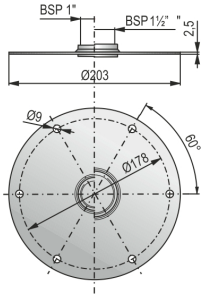
- By pulling it over the cable rope, it makes units with cable rope extension stiffer.
- Caution! If the cable rope is shortened, the tube must be cut to a matching length.
- The length of the exposed cable rope section must be at least 30 mm (1.2").

3- blade extended paddle (268 mm, 10.5")
EAL–708–1



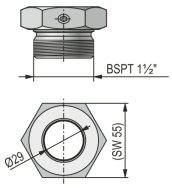
- Use a mounting plate to insert paddle into the tank!
- Primarily for light materials due to its large blade.
- Extended variant.
- Paddle pressure*: 0.3 kPa (0.044 psi)

Mounting plate
EAM–70☐–0



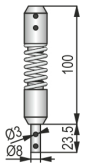
- Stainless steel and carbon steel variant available. The latter is electrostatic powder-coated to prevent rusting.

Sliding sleeve for rod extended version
EAM–703–0



- Only for the E☐R–7☐☐ variant, for changing the insertion length.

Flexible Coupling
EAS–701–0



- To protect the paddle from strong dynamical effects that may occur during operation.

* The paddle pressure value is understood for 0.2 Nm (0.148 ft-lb) torque in the case of complete immersion. The specified values are for comparing the paddles. Paddles with lower paddle pressure are for lighter materials, while paddles with higher paddle pressure are recommended for heavier materials.

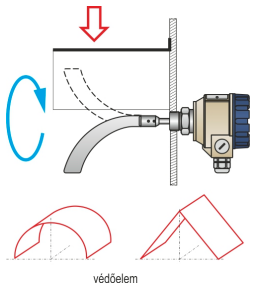
3. INSTALLATION

The device can be installed in several ways, depending on the design (vertical, horizontal, angle), with threaded connections, mounting plates, adapters, adjusting units, etc. The unit must be protected against steady material influx by selecting the appropriate mounting position or using an overhead protective shield. When the device is mounted onto the side of the tank, coning or arching of the material must be taken into consideration. The preferred location for the unit is the one with the least amount of vibration. It is important that the device is installed so that the cable glands are in the correct position.

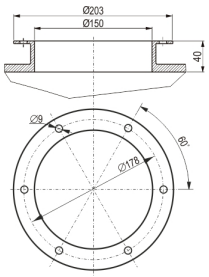
If the device is mounted onto the side of the tank, deposits may clog the connection point and block the movement of the paddle; therefore, they must be prevented.

If a 3-blade unit is on a mounting plate, the insertion hole must be at least ∅110 mm (4.3") for the paddle to pass safely. Do not forget to use the mounting plate seal! When mounted on a bracket or mounting plate, a 1" or 1½" flat nut can be ordered to fasten the unit. Mounting plates thinner than 9 mm (0.35") requires spacers. Attaching rod extensions longer than 0.5 m (20") to the tank wall is recommended. For upper-level switching, using a standard model with the appropriate paddle between the process connection and the measured medium standard is recommended, and if necessary, it must be equipped with a flexible coupling or a rod extension to reach the required detection level. When using the unit for low fail-safe indication, it is necessary to install a deflector element. A cable-extended version recommended for low-level switching, with a suitably-sized rigid tube, if necessary. It must be installed vertically. It will not work correctly if it is slanted or horizontal. A rigid tube is recommended if the measured medium forms a steep cone or the surface is so rigid that the paddle cannot penetrate the material, and the level tends to deviate significantly from its vertical position. If so, it is recommended to use a rigid tube for proper operation.
Besides, there are countless ways to use the device, but you should always be careful about choosing the right process connection and protection of the device.

Protection with a protective shield

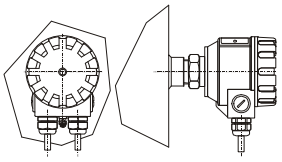


Connection for mounting plate (recommended)

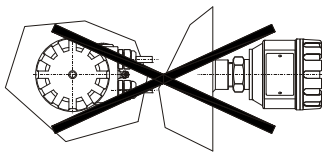


Side mounting

Correct

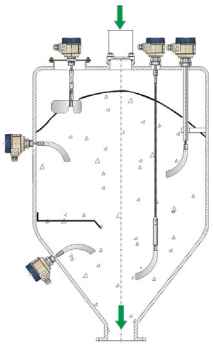


Incorrect

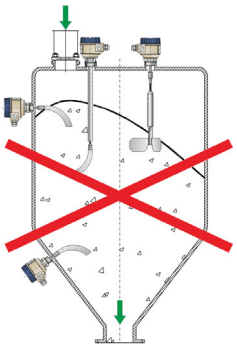


Mounting

Correct



Incorrect



In case of side-mounted units, the cable glands should face down!

4. MOUNTING

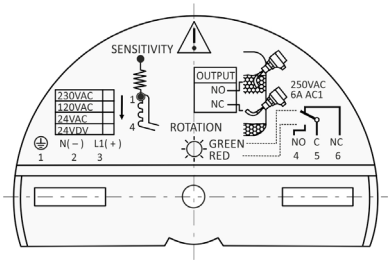
The paddle must be fixed to the device by inserting the two attached pins before the installation. When using a mounting plate, it must be mounted first, followed by the paddle. The cable of cable-extended units can be secured the same way as the pins.

To customize the cable extension's length, cut the cable starting from the lower end. First, remove the grub screws from the lower cable holder. Then cut the cable to the required length. It is recommended to wrap adhesive tape around the wires of the cable when cutting to prevent them from fanning out. After cutting the cable, the holder must be assembled with the probe. If a rigid tube is attached to the unit, it must be cut for the appropriate length before re-assembling!

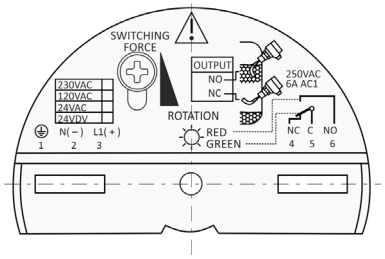
Modifying the insertion length of an extended rod version is possible with the optional sliding sleeve. It needs a 1½" BSP / NPT nozzle. The BSPT thread can be screwed into a suitable BSP or an NPT threaded nozzle with a hex neck.

5. WIRING

EK☐–, EH☐–☐☐☐–☐☐ devices:



EL☐–, EM☐–☐☐☐–☐☐ devices:



6. OPERATION

The device must be connected to the protective grounding with its internal or external grounding screw! After energizing the supply terminals, the unit is fully operational.

- If the paddle is rotating freely (not immersed in the medium), the status LED is green. When the medium reaches the paddle and stops it from rotating, the output microswitch changes its state, the motor stops, and the status LED turns red.
- If the LED of the device is blinking, the supply voltage is too low for the device to operate **(EL☐–, EM☐–☐☐☐–4M, –8M** devices).

To adjust the sensitivity of **EK☐ / EH☐** devices, the following must be considered:

The spring provides reliable operation with mediums of different densities. The default state of the sensitivity adjustment of the spring is position 1. This setting is suitable for almost all applications. However, if the medium is wet, sticky, and prone to form deposits on the paddle, it alters the sensitivity of the device substantially, especially in horizontal or inclined positions. By adjusting the spring tension (**SENSITIVITY 1–4**), the sensitivity of the device can be adjusted to the desired level. Remember to clean the device regularly.

The sensitivity of **EL☐ / EM☐** devices can be adjusted by loosening the **SWITCHING FORCE** adjustment screw, moving the sensitivity adjustment spring, then retightening the switching force screw.

The purpose of the switching force screw is to ensure the proper operation with a great variety of materials. The default setting for the screw is the weakest.

This setting may be used for all applications. However, if the medium is wet, sticky, and prone to form deposits on the paddle, it alters the sensitivity of the device substantially, especially in horizontal or inclined positions. By adjusting the **SWITCHING FORCE**, the sensitivity of the device can be adjusted better to suit the application, device variant, and medium.

When the medium's density or the grain size is not appropriate for the number of blades, the medium may not be able to stop the rotation of the paddle. Therefore, the output switch will not change its state despite the medium reaching the paddle. By choosing the right paddle type and **SENSITIVITY** settings and **SWITCHING FORCE** according to the density of the medium, reliable switching can be ensured in most cases. A custom-sized paddle is required for very low-density materials.

Remember to clean the paddle regularly and occasionally the housing as well!

Operation Status

Power Supply	Status LED	Paddle	Output
ON*	Green	Rotates	NC
	Red	Does not rotate	NO
OFF	Dark	Does not rotate	NC**

*EL☐–, EM☐–☐☐☐–4M, –8M devices indicate low supply voltages by blinking the LED!
** The output of EK☐ / EH☐ devices are not defined!

7. SPECIAL CONDITIONS OF SAFE USE

- The device housing must be protected against dust!
- The housing cover may only be removed only in a de-energized state and only after the necessary waiting time!
  (See: 2.2.1 Temperature data for ex certified models)
- The power supply and the output terminals may only be connected to electrical circuits with short-circuit protection.
- The device may only be operated with a power supply specified in 2.2 Explosion Protection Data!

8. MAINTENANCE, REPAIR

The instrument does not require regular maintenance. If necessary possible dirt deposited should be cleaned off. The warranty conditions are included in the warranty card.

Before returning the device for repairs, it must be cleaned carefully, the parts in contact with the medium that might contain harmful substances must be decontaminated. Our official form (Returned Equipment Handling Form) must be enclosed. Download it from our website www.nivelco.com. The device must be sent with a declaration of decontamination. Please provide a statement in the declaration that the decontamination process is completed, the device is clean and free from harmful materials, and there are no hazardous substances on it.

9. STORAGE CONDITIONS

Ambient temperature: −30…+60 °C (−22…+140 °F)
Relative humidity: max. 98%

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NIVELCO reserves the right to change technical data without notice!