

Thank you for choosing a NIVELCO instrument
We are sure that you will be satisfied with it throughout its use



Vibrating fork level switches
Series:
R-400-1, R-400-2
R-400-3, R-400-4
R-400-6, R-400-7

1. OPERATION

The NIVOSWITCH is a mechanical resonance system excited, and kept in resonance by an electronic circuitry. The process medium, when reaching the tines of vibration fork, modifies the vibration. An electronic circuit senses this variation; which, on the elapse of the delay time, actuates the output circuit. The NIVOSWITCH can cover the majority of industrial level detecting applications. Overfill or dry run protection as well as pump control is made possible with the versatile level switch.

2. TECHNICAL DATA

GENERAL DATA

R 400 / R 400 Ex		
Maximum pressure	40 bar, PP flange: 6 bar, for Derating see diagrams	
Probe length	0.69 ... 3 m	
Material of the wetted parts	DIN 1.4571, Halar (ECTFE) coated	
Medium temperature range	-40°C to +130°C, for Derating see Derating diagrams	
Ambient temperature range	-40°C to +70°C, for Derating see Derating diagrams	
Medium density	Liquids	≥ 0.7 kg/dm ³
	Solids*	≥ 0.05 kg/dm ³
Liquid viscosity	≤ 10000 mm ² /s (cSt)	
Response time	When immersed	0.5 sec
	When free	≤ 1 sec at high density setting (ρ ≥ 0.5 kg/dm ³) ≤ 2 sec at low density setting (ρ < 0.5 kg/dm ³)
Output mode indication	Bicolour (LED)	
Operation test	Output can be changed by test magnet	

2-WIRE DC, NORMAL AND Ex APPROVED VERSION

Version	2-wire DC	
	R□□-4□□-6 R□□-4□□-8 Ex	R□□-4□□-7 R□□-4□□-9 Ex
Electric connections (wire cross section)	Connector	Integral cable (2 x 0.5 mm ²)
Mech. Protection	IP 65	IP 68
Output	DC current change: When free: 9 ± 1 mA; When immersed: 14 ± 1 mA	
Consumption	< 0.5 W	
Power supply (U)	15 ... 27 V DC Provided by the JDT 131 N-ExR remote switching unit for the Ex version	
Setting operating mode	By switch on the remote switching unit (low fail-safe, high fail-safe)	
Setting Sensitivity	Wire selectable	
Electrical protection	Class III	
Ex protection mark	EEx ia IIC T4 ... T6	
Intrinsically safe data	U < 28,4 V, I < 100 mA P < 1,4 W, Ceq < 7 nF Leq ≈ 0 For temperature classes see 5.1.	

USER'S MANUAL



Manufacturer:
NIVELCO Process Control Co.
H-1043 Budapest, Dugonics U. 11.
Phone: (36-1) 369-7575 Fax: (36-1) 369-8585
E-mail: sales@nivelco.com http://www.nivelco.com

2-WIRE AC AND 3-WIRE DC VERSIONS, TO DRIVE RELAYS, PLC-S

Version	2 wire AC		3 wire DC	
	R□□-4□□-1	R□□-4□□-2	R□□-4□□-3	R□□-4□□-4
Electric connections (wire cross section)	Connector	Integral cable (4 x 0.75 mm ²)	Connector	Integral cable (5 x 0.5 mm ²)
Mechanical protection	IP 65	IP 68	IP 65	IP 68
High/low mode setting	Connection within connector	Wire selectable	switch selectable	Wire selectable
Density programming	Not available, fixed to: Liquids: ρ ≥ 0.7 kg/dm ³ Solids: ρ ≥ 0.5 kg/dm ³ *		switch selectable	Wire selectable
Output	2-wire AC, for serial connection		Field selectable, PNP/NPN transistor	Field selectable, galvanically isolated PNP/NPN transistor
Output protection	—		Reverse polarity, overcurrent and short circuit protection	
Supply voltage	20 ... 255 V AC, 50/60 Hz		12 ... 55 V DC	
Consumption	Depending on load		< 0,6 W	
Voltage drop in switched-on state	< 10,5 V		< 4,5 V	
Electrical protection	Class I		Class III	
Current load	max. continuous	350 mA AC 13	I _{max} = 350 mA DC / U _{max} = 55 V DC	
	min. continuous	10 mA / 255 V, 25 mA / 24 V	—	
	max. impulse	1,5 A / 40 ms	—	
Residual current (in switched off state)	< 6 mA		< 100 μA	

2.1. ACCESSORIES

User's manual, Guarantee sheet, Magnetic screw driver RPS-101 (optional). Sealing ring (2 mm thick KLINGER OILIT). Sliding sleeve RPH-112 (optional).

2.2. ORDER CODES

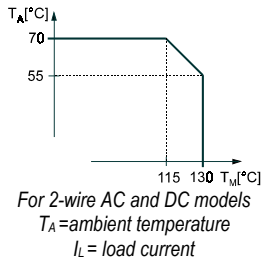
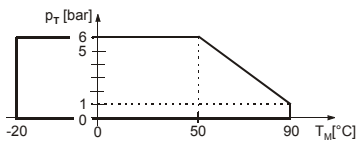
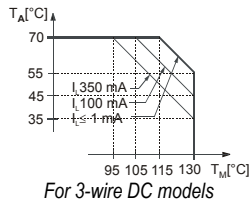
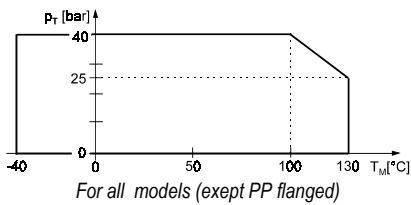
NIVOSWITCH R □ □ - 4 □ □ - □

Fork	Code	Connections	Code	Length	Code	Output	Code
ECTFE coated	A	1" BSP thread	M	SHORTY (69 mm)*	00	2-wire AC with connector	1
Standard	C	1" NPT thread	P	Standard (125 mm)	01	2-wire AC with cable	2
Highly polished	G	DIN DN50PN40 st.st flange **	G	0.2 to 3 m	02...30	2-wire PNP / NPN with connector	3
		2" ANSI st.st. flange**	B			2-wire PNP / NPN with cable	4
		50A JIS st.st. flange**	K			2-wire DC with connector	6
		DIN DN50 PN16 PP flange **	F			2-wire DC with cable	7
		2" ANSI PP flange **	A			2-wire Ex with connector	8
		50A JIS PP flange **	J			2-wire Ex with cable	9
		1 1/2" Triclamp (ISO2852)	T				
		2" Triclamp (ISO2852)	R				
		DN40 Pipe coupling (DIN11851)	D				
		DN50 Pipe coupling (DIN11851)	E				

* The "SHORTY" models are not applicable for solids.

** Flanged versions as standard come with flanges screwed on the 1" process connection.

2.3. DERATING DIAGRAMS



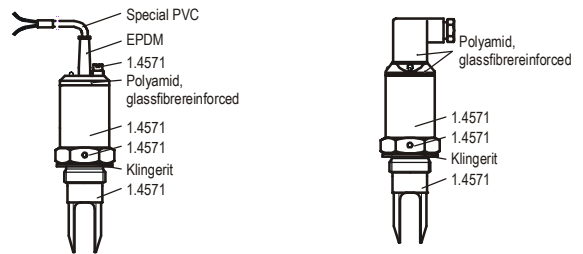
p_T = process pressure
 T_M = medium temperature

T_A = ambient temperature
 I_L = load current

2.4 DIMENSIONS

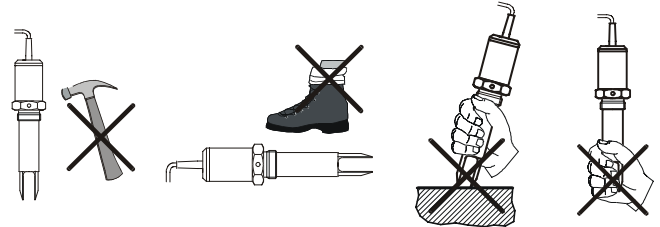
R □ □ - 4 0 0 - □ "SHORTY"	R □ □ - 4 □ □ - □
<p>Sliding Sleeve</p>	<p>Version with flange</p>
<p>TRICLAMP (ISO 2852)</p>	<p>Pipe Coupling</p>
<p>"SHORTY"</p>	<p>"SHORTY"</p>

2.5 MATERIALS

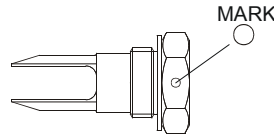


3. INSTALLATION

Prevent the device from any mechanical damage.



For positioning the fork-tines, use the marking on the hexagonal neck.



- Use a TEFLON (PTFE) tape to aid the positioning of the fork-tine
- If the fork-tine position is irrelevant, use the sealing ring provided

3.1. INSTALLATION ON LIQUIDS

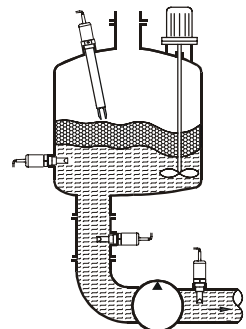
Always use the **HIGH density mode** (LOW sensitivity)!

Low viscosity liquids

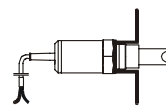
On applications, where the fork-tines are easily freed from the process medium, any of the mountings shown to the right is possible.

High viscosity liquids

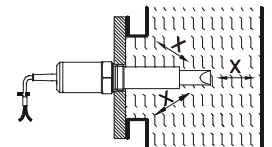
On applications, where the fork-tines are not freed easily from the process medium, only a vertical (top) mounting is recommended.



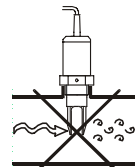
Installation options



Threaded version



Critical distances ($x_{min} > 5 \text{ mm}$)



For pipe mounting, fork-tines must be parallel to the direction of flow

3.2 INSTALLATION ON LIGHT, FREE FLOWING SOLIDS*

Before mounting the unit, it is advised to program the density (only DC versions) on a small sample of the material to be detected. E.g.: Immerse the unit into a bucket of the material and check for reliable switching.

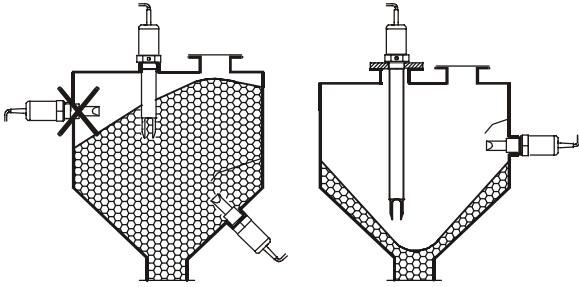
Density	Specific Gravity
HIGH (LOW Sensitivity)	$\rho \geq 0,5 \text{ kg/dm}^3$
LOW (HIGH Sensitivity)	$\rho < 0,5 \text{ kg/dm}^3$

Use the fork with the HIGH Density setting if possible

* The "SHORTY" models are not applicable for solids

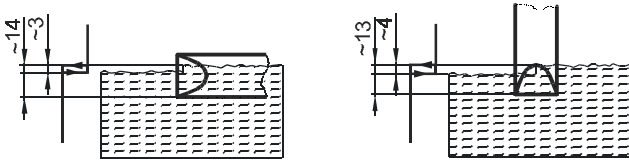
Do not set a lower density than necessary, as this may result in the probe detecting even slight residues of material adhering to it.

The recommended mounting position on light, free flowing solids, is vertical (top) mounting. Side mounting is recommended only where the fork-tines are easily freed from the process medium (ex.: through gravity). For side mounting, the NIVOSWITCH must be mounted with the fork-tines standing vertically (look for the positioning marks).



**Protect the probe from downfalling material!
Fork-tines should not be exposed to mechanical load.**

3.3. SWITCHING POINT, SWITCH DIFFERENTIAL



(Values are for water at 25°C)

Liquids: switching point as well as the switch differential slightly depends on liquid density and mounting position

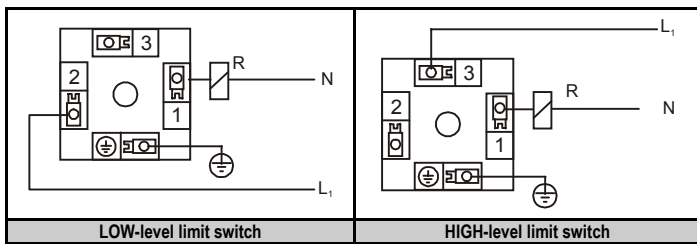
Solids: switching point as well as the switch differential slightly depends on material features and mounting position

4. ELECTRICAL CONNECTIONS

4.1. 2 WIRE AC VERSIONS R □ □ - 4 □ □ - 1 connector R □ □ - 4 □ □ - 2 cable

**DO NOT POWER UP THE DEVICE WITHOUT A LOAD CONNECTED
IN SERIES WITH THE UNIT AND WITHOUT GROUNDING IT**

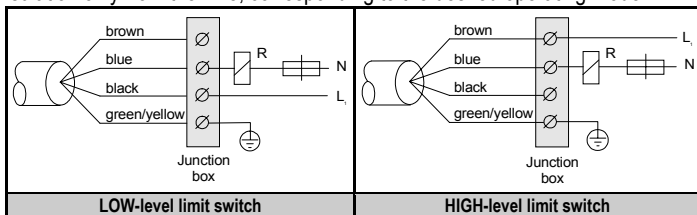
4.1.1. Connector version R □ □ - 4 □ □ - 1



Terminal block cover can be rotated in 90° steps to ensure appropriate cable positioning

4.1.2. Integral cable version R □ □ - 4 □ □ - 2

Two of the signal wires (black and brown) are insulated. Only one of these two wires is used, dependent on the operating mode (High or Low). Remove the insulation only from the wire, corresponding to the desired operating mode.



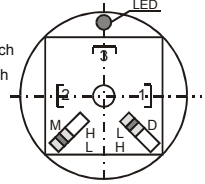
4.2. 3 WIRE DC VERSIONS R □ □ - 4 □ □ - 3 R □ □ - 4 □ □ - 4

In case of overload caused by short circuit, transistor will switch on and off, and LED will start to blink.

4.2.1. Connector version R □ □ - 4 □ □ - 3

All models except the "SHORTY"

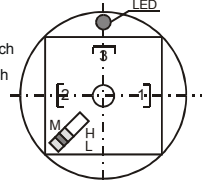
"M" - Operation mode
H= High - level limit switch
L= Low - level limit switch



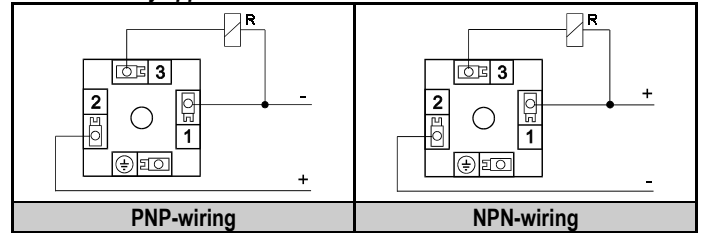
"D" - Density
H= High
L= Low

The "SHORTY" models

"M" - Operation mode
H= High - level limit switch
L= Low - level limit switch

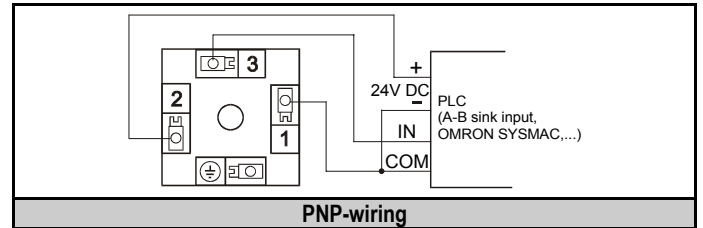


4.2.1.1. Wiring diagram for 3 wire DC version with connector in case of relay application



Terminal block cover can be rotated in 90° steps to ensure appropriate cable positioning

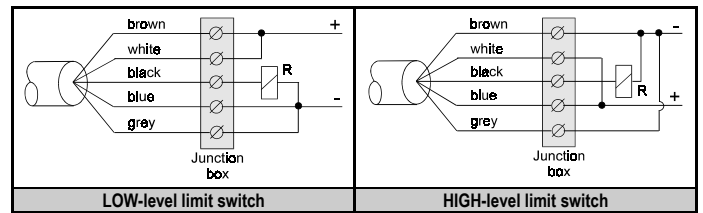
4.2.1.2. Wiring diagram for 3-wire DC version with connector for PLC application



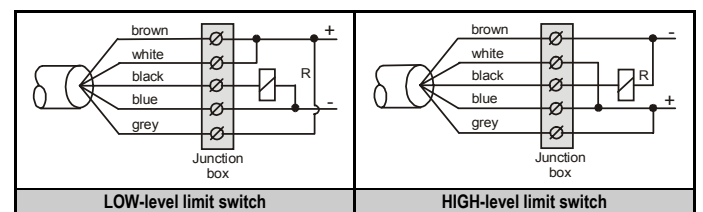
4.2.2. Integral cable version R □ □ - 4 □ □ - 4

4.2.2.1. Relay application

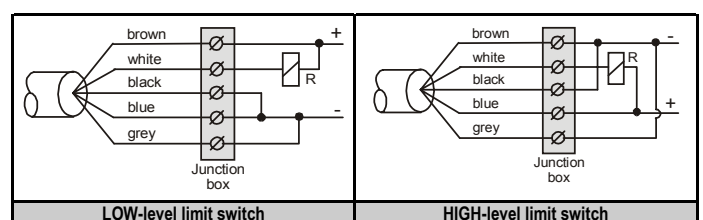
PNP mode HIGH density (Liquids: $\rho \geq 0.7 \text{ kg/dm}^3$; Solids*: $\rho \geq 0.5 \text{ kg/dm}^3$)



PNP mode LOW density (Solids*: $\rho < 0.5 \text{ kg/dm}^3$)

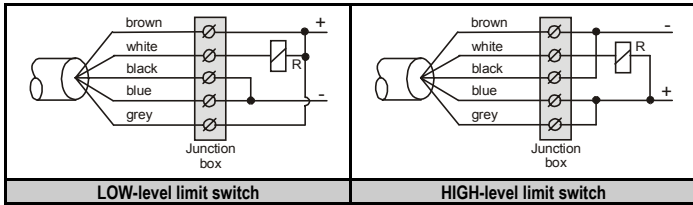


NPN mode HIGH density (Liquids: $\rho \geq 0.7 \text{ kg/dm}^3$; Solids*: $\rho \geq 0.5 \text{ kg/dm}^3$)



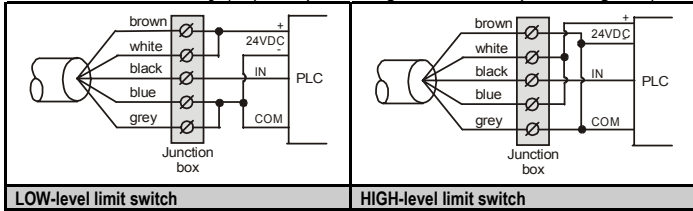
* The "SHORTY" models are not applicable for solids

NPN mode LOW density (Solids*: $\rho < 0.5 \text{ kg/dm}^3$)

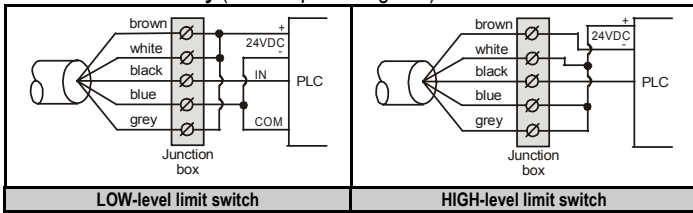


4.2.2.2. PLC applications (A-B sink input, OMRON SYSMAC...)

PNP mode HIGH density (Liquids: $\rho \geq 0.7 \text{ kg/dm}^3$; Solids*: $\rho \geq 0.5 \text{ kg/dm}^3$)



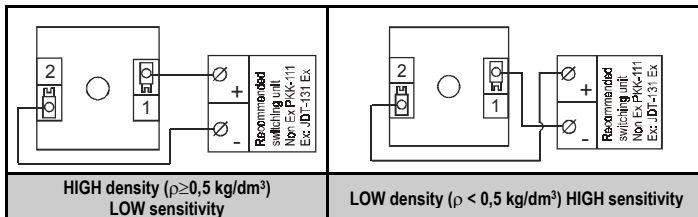
PNP mode LOW density (Solids*: $\rho < 0.5 \text{ kg/dm}^3$)



4.3. 2 wire DC versions STANDARD OR EX

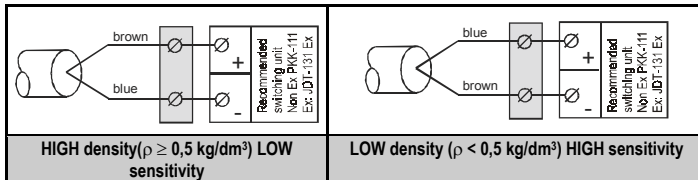
4.3.1. Connector version

R □ □ - 4 □ □ - 6
R □ □ - 4 □ □ - 8 Ex



4.3.2. Integral cable version

R □ □ - 4 □ □ - 7
R □ □ - 4 □ □ - 9 Ex



5. ADJUSTMENT

Check connecting of the wires and position of the switches (if there are any). After connection and power up the tuning fork is operational.

Operating diagram of the NIVOSWITCH (except 2-wire DC versions)

Power supply	Fork	Operating mode	LED	Output
ON	Immersed	HIGH-level limit switch	RED	OFF
		LOW-level limit switch	GREEN	ON
	Free	HIGH-level limit switch	GREEN	ON
		LOW-level limit switch	RED	OFF
FAILS	Free or immersed	HIGH or LOW	NOT LIT	OFF

*The "SHORTY" models are not applicable for solids

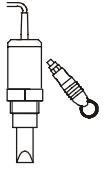
Operating diagram of the 2-wire DC version

Fork	LED	Output
Immersed	RED	$14 \pm 1 \text{ mA}$
Free	GREEN	$9 \pm 1 \text{ mA}$

OPERATION TEST

Correct operation of the switching circuit of an installed device can be tested with the optional test magnet (RPS-101).

Moving the test magnet in front of the marking on the cover of the housing the device must perform a switching (LED changes colour).

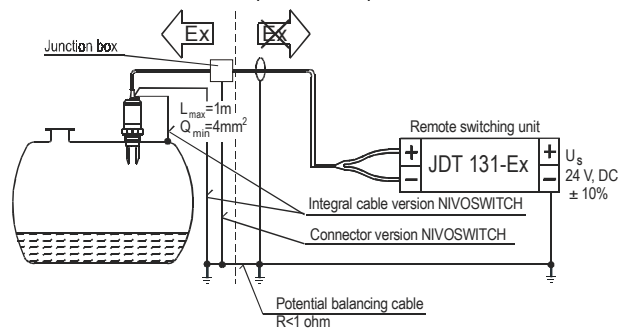


5.1. APPLYING EX APPROVED MODELS

Applying Ex approved models take into consideration the table of allowed temperatures listed below

Temperature classification	T6	T5	T4
T _{Ambient}	60 °C	60 °C	60 °C
T _{Medium}	80 °C	95 °C	130 °C

Table of possible temperatures

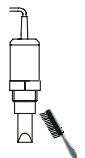


CONDITIONS OF SAFE OPERATION

- The vibration fork level switch has to be supplied by a certified intrinsically safe circuit with maximum parameters only:
 $U_0 = 26.5 \text{ V}$
 $I_0 = 100 \text{ mA}$
 $P_0 = 1.4 \text{ W}$
- For installation of version R □ □ - 4 □ □ - 9 Ex with integrated cable, there has to be a suitable connection box near the level switch.
- It is allowed for the vibration fork to get in contact with the liquid only; the installation has to guarantee that the housing (head) is outside the liquid.
- The level switch has to be connected to the local equipotential bonding.
- To avoid electrostatic ignition danger, the coated version type R □ □ - 4 □ □ - □ Ex is allowed for substances with explosion group IIA or IIB only.

6. MAINTENANCE, REPAIR

The NIVOSWITCH R-400 does not require routine maintenance. In some instances, however, the sensor probe may need occasional cleaning to remove surface deposits. This must be carried out gently, without harming the vibrating section of the vibrating fork.



7. STORAGE CONDITIONS

Ambient temperature: -35 to +60°C
Relative humidity: max. 98 %

8. WARRANTY

All Nivelco products are warranted free of defects in materials or workmanship for a period of two years from the date of purchase. Repairs under guarantee are carried out at the Manufacturer's premises. The Purchaser is liable for costs of dismantling and re-installation as well as transport costs. Nivelco shall not be liable for misapplication, labour claims, direct or consequential damage or expense arising from the installation or use of equipment.