

Detecting liquid levels with conductive Level Rod-Probes

Liquid levels in process and storage tanks need to be measured and monitored, since unwanted variations in these levels (due to evaporation or removal of the process liquids) must be corrected. In this respect, there are two different general tasks:

- control of the level in order to permit automatic execution of process operations (such as dosing of liquids)
- monitoring of the level in order to prevent possible damage (dry-running, heating without sufficient liquid) to the devices (pumps, heaters) installed in the tanks or to prevent an overflow of the process liquid from the tanks.

You can assure the safe control and monitoring of the liquid level in your tank by using level rod-probes. Since these are purely passive devices, suitable electronic controllers are needed.

Level rod-probes operate on the conductive principle, which means that they can be used only in electrically conductive liquids (conductivity $>4 \mu\text{S}$). Encrustation and contamination in the tank normally have no effect on the function of the probes.

Possible deposits of encrustation between the tips of the probe can be avoided by ensuring that the difference between the probe-rod lengths is at least 60 mm.

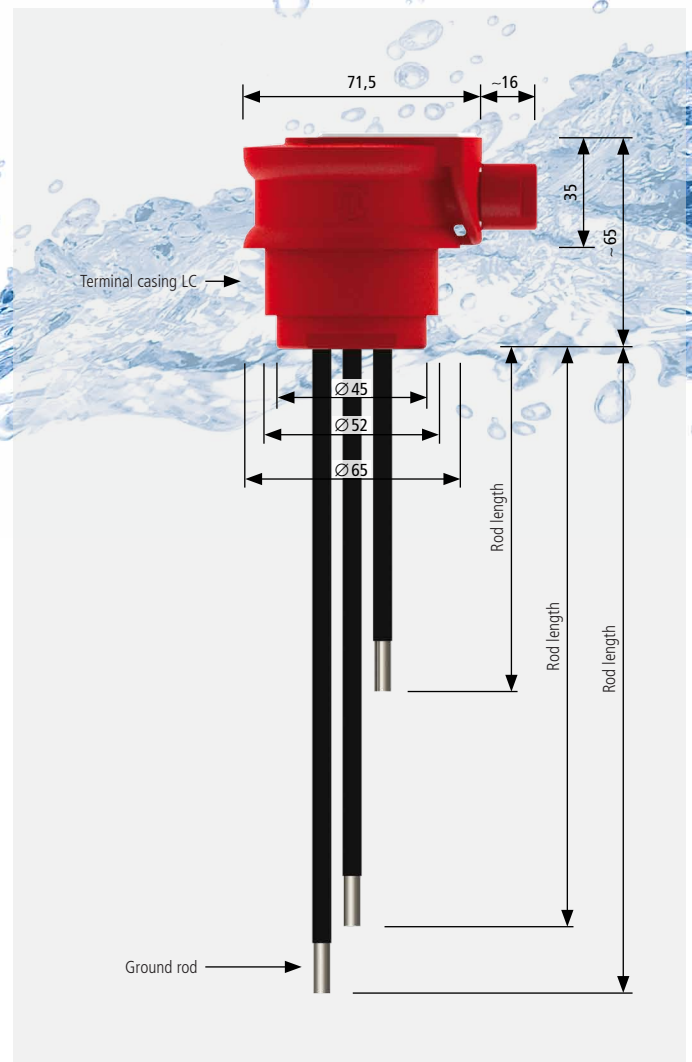
The levels of non-conductive or poorly conducting liquids, in which level rod-probes cannot be used, can be controlled and monitored by our float switches.

The level rod-probes are available in many different versions:

- with two to five rods for detection of one to four different levels and
- with or without an integrated temperature sensor.

A suitable electronic controller applies a low alternating voltage to the probe rods. A current then flows from the electrically conductive tips of the rods and through the conductive liquid to the reference electrode, called the ground rod. The electrical circuit is closed. If the liquid level drops below the tip of a probe rod, the related electrical circuit is opened. The electronic controller detects the two states "current" and "no current".

The ground rod must be at least as long as the longest rod. An additional ground rod must be provided for level rod probes coated with PTFE-Compound, if the distance between the tips of the minimum and maximum rods is more than 1000 mm.



Level rod-probes NS with terminal casing LC

In metallic, electrically conductive tanks, no ground rod is needed if the ground terminal is connected directly to the tank.

In order to prevent the rods from touching each other, PTFE spacers are fitted on probes with rod lengths of 300 mm or more.

The level rod-probes are available with the small terminal casing LC (material PP) or LC/L (material PVDF) and the large terminal casing BC (material PP) or BC/L (material PVDF).

Level rod-probes with terminal casing BC can be mounted onto the edge of the tank by the supports HB (PP) or HB/L (PVDF) or on a cross-beam by means of the mounting sleeve EM or the holding sleeve HM.

Level rod-probes with terminal casing LC are mounted onto the edge of the tank by the supports HL (PP) or HL/L (PVDF), or on crossbeams by means of the holding sleeve ML.



Detecting liquid levels with conductive Level Rod-Probes

In order to ensure optimal chemical and thermal resistance, the level rod-probes are made from a variety of materials.

Specifications of the standard materials

Code letter	Probe rod material	Coating	Max. liquid temperature	
			Temp. Sensor material (in case of NT)	
K	PTFE-Compound	PTFE, pure-white	PFA	100°C
B	Stainless steel (Mat. No. 316Ti)	Polyolefin (PO)	PP	70°C
B/9	Stainless steel (Mat. No. 316Ti)	PTFE, pure-white	PP	90°C
T	Titanium (Mat. No. 3.7035)	PTFE, pure-white	PP	90°C

Overview of available level rod-probes

The switching points are determined by the various lengths of the probe rods and can be changed by the customer by cutting the rods to the desired length (not possible in the case of PTFE probe rods).

Number of levels to be detected	1	2	3	4
Number of probe rods	2	3	4	5
Level rod-probes type	NS2	NS3	NS4	NS5
Level rod-probes with integrated Temperature sensor Pt 100	NT2	NT3	NT4	NT5

BC Version

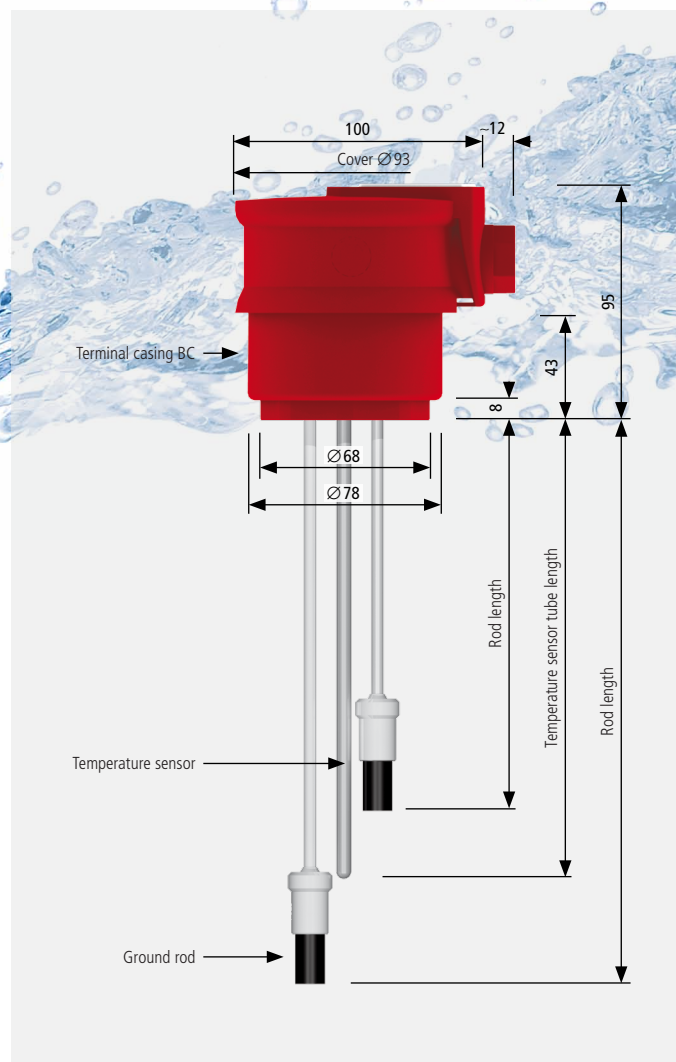
The terminal casing BC made of PP permits the connection of the cable and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529. In cases of high temperatures (liquid temperature >80°C) or strongly oxidizing chemicals (such as chrome electrolyte or HNO₃ solutions), the PVDF terminal casing BC/L should be used.

LC Version

The small terminal casing LC made of PP or LC/L made of PVDF permits the cable connection and has the degree of protection IP 65 (jet waterproof) in accordance with EN 60529.

Cable connection

The covers of the terminal casings can be unscrewed by using the mounting wrench for access to the cable terminals.



Level rod-probes NT with terminal casing BC

Level rod-probes used together with suitable electronic controllers ensure the safe control and monitoring of important process parameters.

Selection table for control and monitoring electronics

	Level rod-probe types							
	NS2	NS3	NS4	NS5	NT2	NT3	NT4	NT5
Monitoring devices								
Level monitor	ETS100	ETS200	-	ETS410	ETS100	ETS200	-	ETS410
Temperature limiter	-	-	-	-	ETB100	ETB100	ETB100	ETB100
Control devices								
Level controller	-	ENR200	ENR300	-	-	ENR200	ENR300	-
Temperature controller	-	-	-	-	MTR	MTR	MTR	MTR

Electronic Fluid Level Control and Monitoring Equipment



Rod-type level probes in conjunction with electronic control units ensure that important process parameters are controlled and monitored safely. Appropriate types of electronic control unit are mandatory because the probes have to be powered with a low probe voltage (pure sinusoidal AC voltage).

The response sensitivity can be set to different levels according to the conductivity of the process fluid.

Level control

The **ENR 200** is equipped with a relay output (MIN/MAX control contact) that can be configured as a break or make contact, according to the application.

As well as the MIN/MAX control contact, the **ENR 300** has an independent switching contact. This switching contact is used for monitoring a MIN/MAX alarm fluid level.

Level monitoring

The **ETS 100** electronic level monitoring system is used for monitoring a fluid level as a MIN or MAX switching contact. The contact switches if the required maximum level is exceeded or the level drops below the defined minimum. The contact is reactivated automatically when the level of the process fluid returns to the „permitted“ range. Run-dry protection for heaters and pumps is a very common type of application for this type of system. The heater or the pump is switched off if the level drops below minimum, and reactivated only when the level rises back above the minimum.

The **ETS 200** is capable of monitoring two fluid levels independently of one another.

The **ETS 410** electronic level monitor offers four separate signal inputs and four relay outputs. This means that four independent fill levels can be detected in one container and evaluated, for instance via an SPS. This facilitates a MIN/MAX control function and two alarm states or alternatively four alarm states. Four LEDs show the status of the outputs on the front.

The electrical connection is made using removable, non-interchangeable plug-in terminals. The LEDs indicate when the electronic control units are ready to operate, as well as the switching status of the outputs.

The electronic control units are installed in the control cabinet, where the relatively small dimensions of their housings permit space-saving installation.



Controlling and Monitoring Fluid Levels

Selection table of the control and monitoring electronics

	Level probes / switches							
	NS2/MTSu	NS3/MTS2u	NS4/MTS3u	NS5	NT2/MTSt	NT3	NT4	NT5
Monitoring technology								
Level monitoring	ETS 100	ETS 200	-	ETS 410	ETS 100	ETS 200	-	ETS 410
Control technology								
Level control	-	ENR 200	ENR 300	-	-	ENR 200	ENR 300	-

Technical data

	ETS100	ETS200	ETS410	ENR200	ENR300
No. of level switching points	1	2	4	2	3
Contacts (potential-free)	1 Changeover switch	2 Changeover switches	2 CO + 1 NO + 1 NC	1 Changeover switch	2 Changeover switches
Switching status display	1 LED	2 LED	4 LED	1 LED	2 LED
Voltage	20...230V AC/DC	20...230V AC/DC	18...32V DC	20...230V AC/DC	20...230V AC/DC
Power consumption approx.	2VA	2VA	3VA	2VA	2VA
Output					
Switching voltage	<250V AC	<250V AC	<60V DC	<250V AC	<250V AC
Switching current	≤5A	≤5A	≤2A	≤5A	≤5A
Test function	yes	yes	no	yes	yes

Input

Switching delay 2 s / 8 s (can be toggled, not on the ETS 410)

Output voltage / current 0,1...6V~ / <5 mA~

Trigger sensitivity 0,05...250 kΩ (4 μS...2.10⁴ μS) adjustable with 32 stages

Mechanical construction

Casing material Polyamide PA6.6

Flammability class housing V0 (UL94)

Mounting on 35 mm mounting rail (acc. to EN50022)

Dimensions w=22,5 mm, h=111 mm, d=115 mm

Index of protection IP20 (acc. to EN 60529)

Climatic stress

Ambient temperature -20...50°C

Transport and storage temp. -40...60°C

Max. humidity <75 % (no dew)