



## PD 940 DIPSTICK

- Compact sanitary design - designed for the food industry
- Level, conductivity and temperature sensor in a single unit
- Handles foam in liquid - only the equivalent liquid of the foam is included
- Reliable continuous level measurement
- Designed for top mounting in vessel
- Flexible configurations to suit your specific application
- Conductivity sensor
- Temperature sensor, process temperature range 0 °C to 100 °C
- Analogue current output: 4-20 mA
- Digital I/O
- Programmable in COPP
- P-NET via RS485

### APPLICATION

The PD 940 Dipstick is a hygienic electronic level, conductivity and temperature sensor for electrically conductive liquids in a metal tank. A special flange welded onto the tank provides for easy clamp mounting of the Dipstick.

The Dipstick has a hygienic and robust design suitable for food industry and performs very fast measurements making it ideal for inline process control.

Level measurement is independent of conductivity and works with different liquids without any calibration. Foam on top of liquids, like in a milk air eliminator, contributes to level with the equivalent liquid content in the foam. Level output is measured in meters starting from the isolation between the tip and stick.

Conductivity measurement is level independent and is factory calibrated with a cell constant that fits most applications. It is useful to detect water, milk or CIP liquids in the tank without further calibration.

For precise conductivity measurement, it is possible to adjust the cell constant according to the actual tank diameter or to conductivity measured with a reference instrument.

The module also includes an analog source output (4-20 mA) and a Digital I/O that can source 1 A to ground.

The Dipstick is programmable in COPP, which means that part of or all of an automation application can run in the Dipstick. The program can make use of ready-made components to control and monitor any process or machine application, locally in the Dipstick as well as via the network, interacting with other devices.

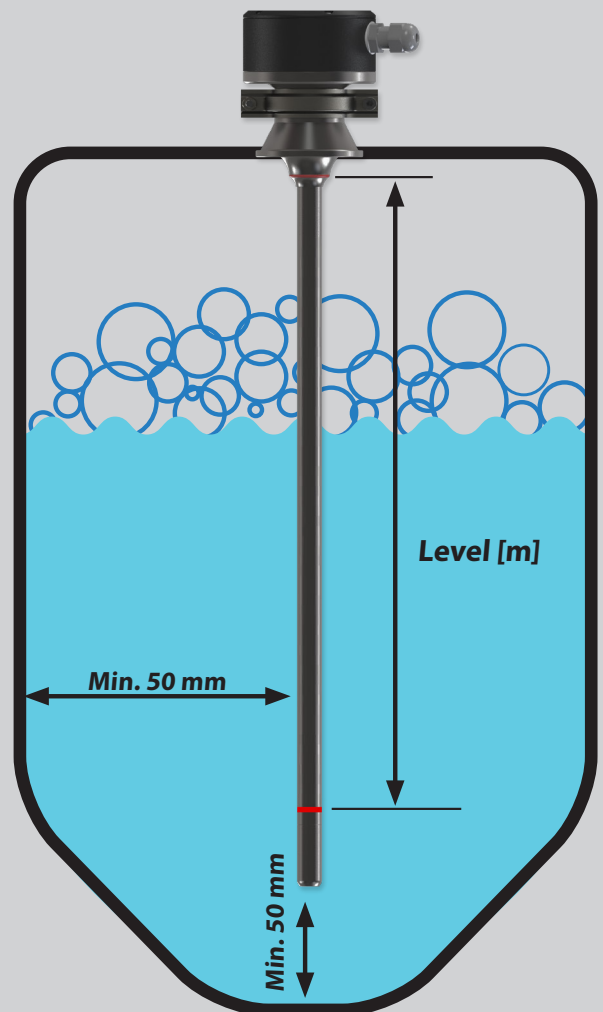
#### Programming examples

Analogue output current (4-20 mA) can indicate actual level or conductivity.

The cabled P-NET RS485 interface can communicate all the measured variables in the module.

The digital output can control for example a pump depending on the measured level.

A program can convert level to volume using a strapping table to fit irregular tank shapes.



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**Measurement principles:**

- The isolated tip part measures resistance to tank.  
It is converted to conductance and scaled with the cell constant to show specific conductivity for the liquid
- The stick part measures resistance to tank  
Level is calculated as the ratio between stick and tip resistance scaled with the tip length.
- The accurate Pt1000 sensor in the tip use a speed up algorithm to calculate the final tip temperature in advance.

**Accurate and reliable measurement conditions:**

- The tip is always completely covered with liquid
- Measurements assume constant vertical tank area (e.g. a cylinder)
- Liquid conductance is within specified limits for the module
- Tank, stick and tip is clean and without isolating layers
- Distance from stick and tip to tank is more than 50 mm

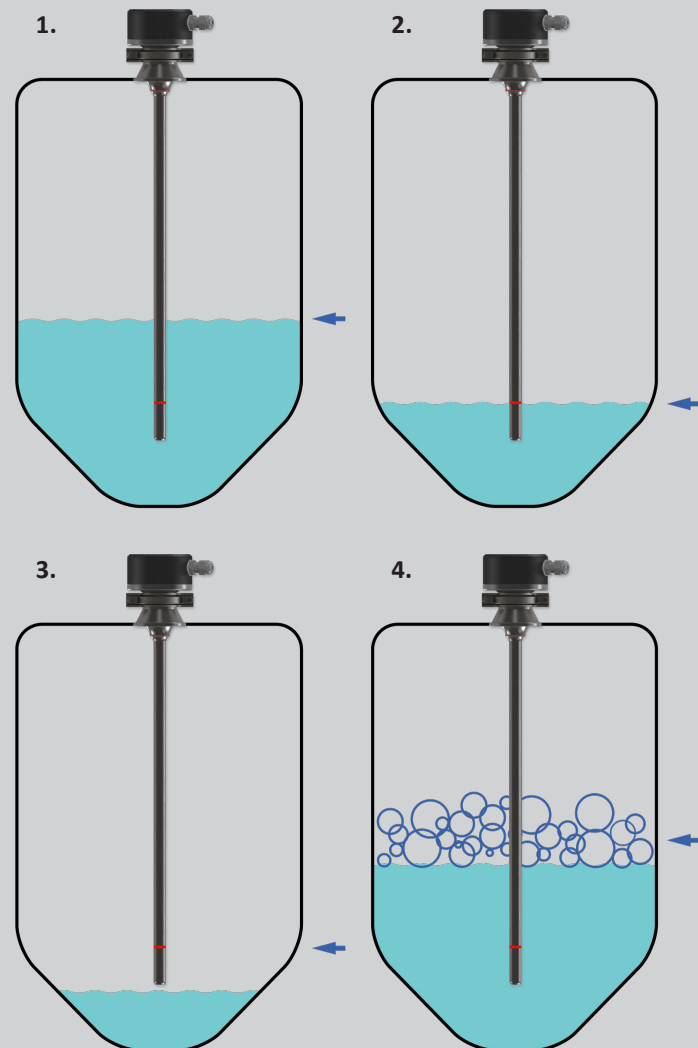
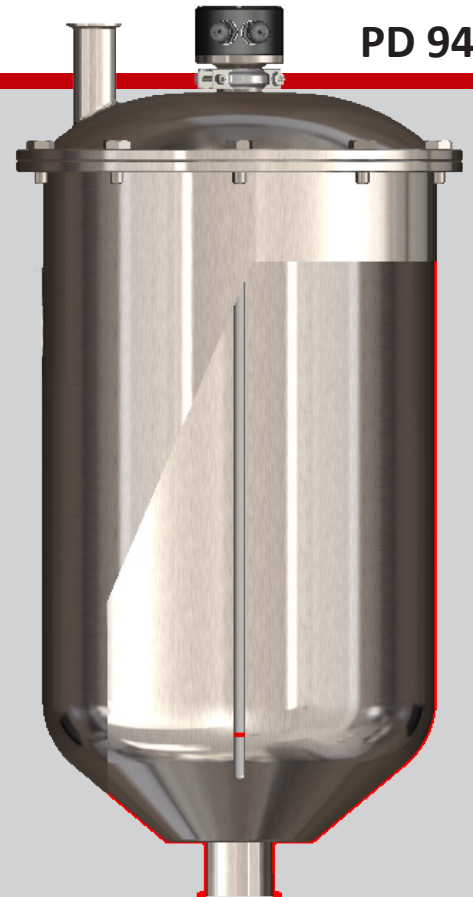
Note that the conductivity of liquids are temperature dependent.  
For absolute conductivity measurement, the cell constant must fit the tank diameter.

**Calculation example:**

$$k_{cell} = \ln(D_{tank}/D_{stick}) \times 10/\pi = \ln(0.300/0.015) \times 10/3.14 = 9.536$$

**Typical conductivity examples**

- Fresh cow milk: 4-5 mS/cm
- Tap water: 0.005 to 0.5 mS/cm (soft to hard water)
- CIP liquid: 100 mS/cm (water with 2% NaOH or HNO3)



**Different measurement situations with and without foam**

**Without foam**

1. Valid liquid level and conductivity.
2. Valid zero liquid level and conductivity.
3. Invalid zero liquid level. Conductivity out of range.  
Tip must be covered by liquid.

**With foam**

4. Valid equivalent liquid level of foam and conductivity.
5. Valid equivalent liquid level of foam and conductivity.
6. Invalid foam level.  
Zero level if foam conductivity is out of range.  
Tip must be covered by liquid.

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**SPECIFICATIONS**

**Analogue Current Output**

Signal range (source) ..... 0 - 22 mA  
 Calibration error @ Tamb. 20 °C .... Max. +/- 0.1 % of full scale  
 Temperature coefficient Tc ..... Max. +/- 150 ppm / °C  
 Resolution: ..... 0.06 % of full scale

**Digital Input (referenced to -24 Vin)**

Frequency..... Max. 1 kHz @ 50 % duty cycle  
 Input On: ..... Vin < 4.5 V, Off: Vin > 6.5 V  
 Hysteresis: ..... Typ. 1 V  
 Line check: (\*  
     Line open voltage: ..... >0.75 \* Vin  
     Line short circuit voltage: ..... < 2 V  
 Input pull down resistance: ..... 6.8 kΩ  
 Input active pull up (configurable) ..... 3 mA

**Digital Output (source)**

Oneshot and Dutycycle time resolution ..... 417 μs  
 Internal resistance..... Typ. 0.5 Ω  
 Output start current (duration max 200 ms) ..... Typ. 5 A  
 Load current at ON (Source only)..... Max. 0.5 A  
 Short circuit cutoff delay time (current > 5A) ..... 104 μs  
 Leak current at OFF ..... Max. 500 μA

(\* Use shielded cable

**Level Measurement**

Range - lenght of Dipstick ..... fx. 0.700 m  
 Accuracy ..... 0.005 m  
 Resolution ..... 0,0001 m  
 Update frequency ..... 100 ms

**Conductivity Measurement**

Range..... 0.001 mS/cm to 100 mS/cm  
 Accuracy (uncalibrated) ..... +/-30 %  
 Resolution ..... 0,1 mS/cm  
 Update frequency ..... 100 ms

**Temperature Measurement**

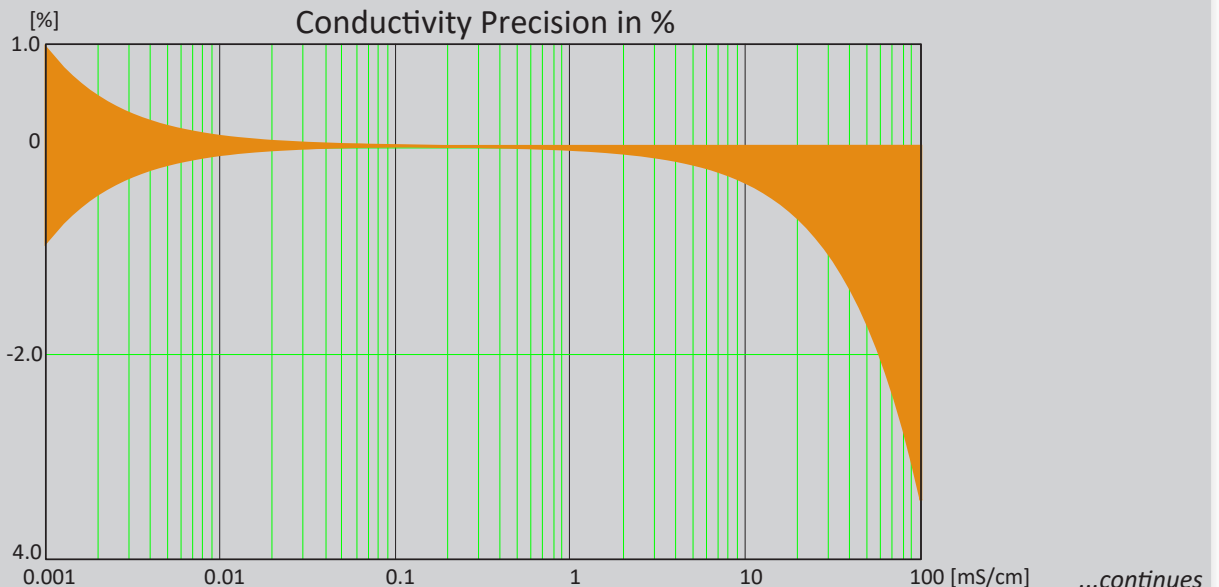
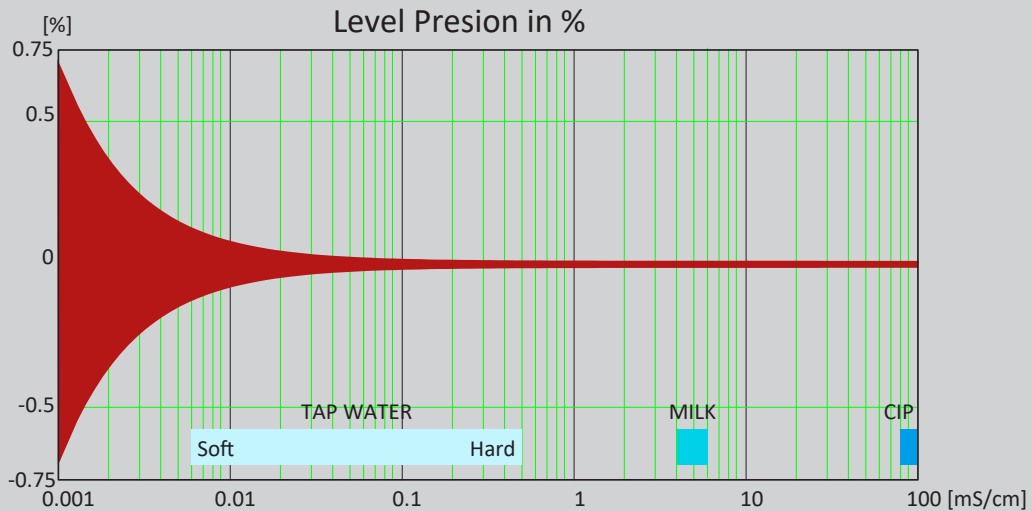
Process temperature range..... 0-100 °C  
 Calibration error @ 20 °C ..... +/-0.6 °C  
 Resolution ..... 0,1 °C  
 Update frequency ..... 200 ms

**Power Specifications**

Supply voltage nominal ..... 24 VDC  
 Supply voltage ..... 12 - 32 VDC  
 Typ. internal power consumption (@ 24 VDC) ..... 0.5 W

**Environmental Conditions**

Operation temperature..... -25 °C to +70 °C  
 Storage temperature..... -40 °C to +85 °C  
 Liquid pressure: ..... Max. 5 bar  
 Protection class ..... IP67

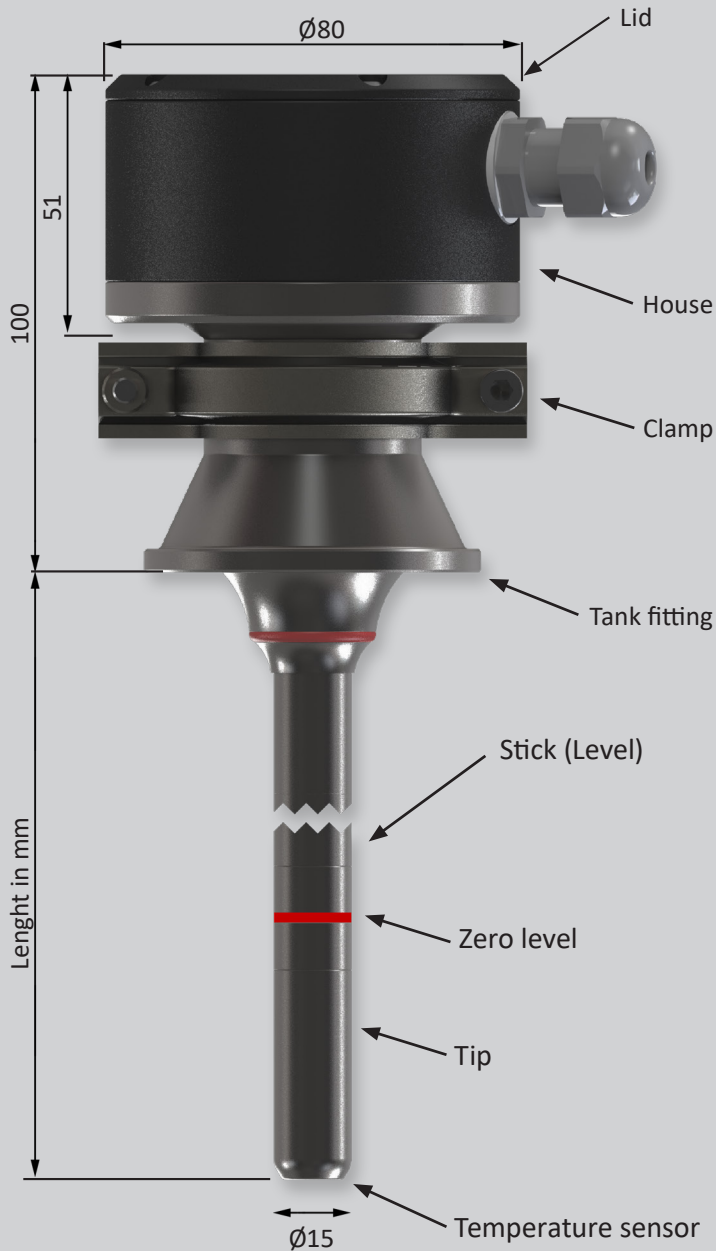




### MECHANICAL (mm)

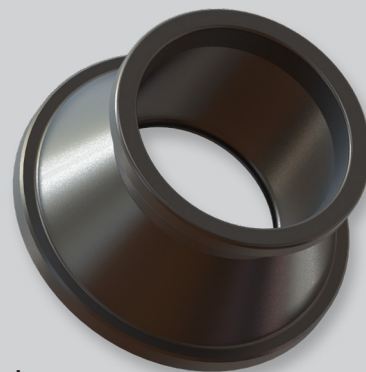
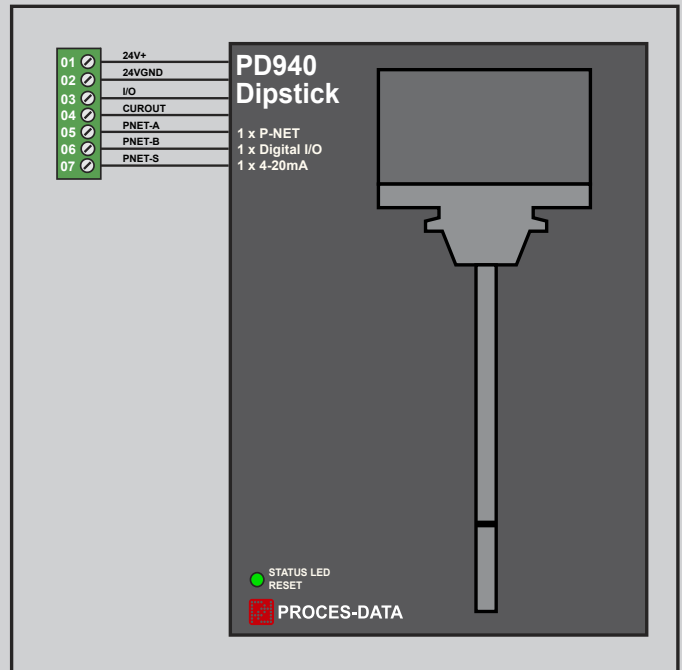
#### Mechanical Specifications

Weight approx (length 500 mm).....1600 g  
 Vibration..... IEC 60068-2-6 : 2007



### Connections

A terminal block is available under the lid for connections to P-NET RS485, power supply and process signals. All cables must be mounted through the glands.



Tank part

