# Tantalum density sensor for accurate online concentration measurement of corrosive acids

**Relevant for:**

Online concentration measurement of acids like HCl, $HNO_3$, $H_3PO_4$ and $H_2SO_4$

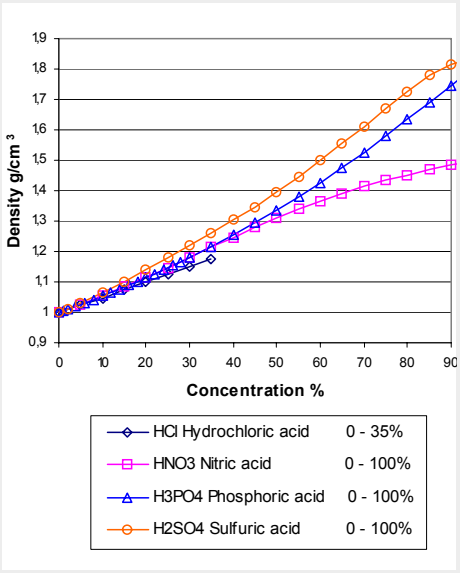
## 1 Introduction

Inorganic acids like HCl, $HNO_3$, $H_3PO_4$ and $H_2SO_4$ are used in vast amounts in many chemical processes. Accurate online concentration measurement helps to make the process more efficient, and to optimize yields.

For most acids, there is a strong correlation between concentration and density, making density measurement ideal for accurate concentration measurement.

The corrosive nature of these acids requires special materials and instruments. The Tantalum density sensor from Anton Paar has been designed for such demanding applications. The sensor tube is made from a single, seamless piece of Tantalum.

Performance by far exceeds traditional methods like conductivity, refractive index or titration.




*Graph. 1 Relationship between density and concentration at 20°C*

## 2 Measuring principle

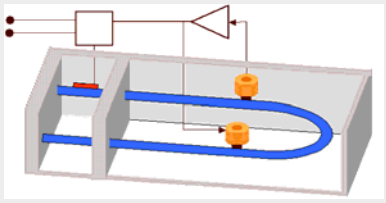


*Fig. 1 Measuring principle*

The U-tube, a mechanical oscillator system, is vibrating at its resonant frequency. The frequency depends on the density of the liquid flowing through, and hence on its concentration. Oscillation period and sample temperature are measured and transferred to an mPDS evaluation unit for data processing and control purposes.

The accuracy of the DPRn density sensor amounts to ± 1 x $10^{-4}$ g/cm$^3$, typically corresponding to <0.05% acid concentration.

Tantalum is fully resistant to HCl, $HNO_3$, $H_3PO_4$ and $H_2SO_4$ solutions at all concentrations and temperatures.

*Fig. 2 DPRn 427 tantalum density sensor*

## 3 Typical installation

The DPRn density sensor has an inner diameter of 7mm and is mounted in a bypass to the main line.

A constant flow through the density sensor of 100 – 500 liters/hour is required.

## 4 Configuration:

- **mPDS 1000 evaluation unit**
- **DPRn 427 tantalum sensor**
- **Concentration formula**

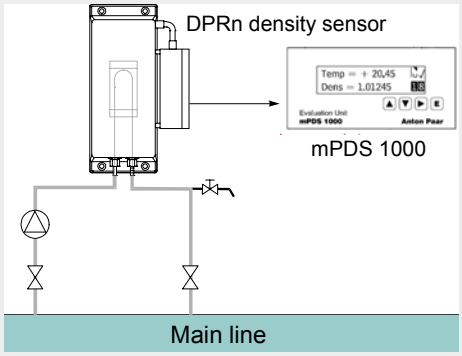



*Fig. 3 Bypass installation of the DPRn*

Density and temperature are transferred to the mPDS evaluation unit by a two-wire cable. The same cable powers the sensor.

## 5 Benefits

- Highly accurate measurement, direct concentration display
- Drift-free, no calibration required
- Automatic temperature compensation
- Maintenance-free
- Easy operation
- Continuous data recording software optional

## 6 Summary

Online density measurements provide accurate concentration determination at important stages of production processes.

The instrumentation is robust and very accurate.