# Polaris™ PR53M PTFE-Body Process Refractometer

The Vaisala Polaris PR53M PTFE-body process refractometer is designed to measure concentrations of aggressive chemicals, such as hydrochloric acid (HCl), sodium hydroxide (NaOH), sodium chloride (NaCl), and sulfuric acid ($H_2SO_4$) in the chemical and semiconductor industries. The integrated ultra-pure PTFE flow cell has no metallic wetted parts, minimizing contamination risk and making it suitable for contact with aggressive chemicals. The PR53M can be mounted to ½ inch process lines with a standard NTP-threaded connection.

## Features

- Non-metallic wetted parts, integrated ultra-pure PTFE and sapphire flow cell for demanding environments
- Reliable optical concentration measurements with refractive index
- Potassium hydroxide, sodium hydroxide, hydrochloric acid, and more than 500 concentration curves
- Measurement not affected by bubbles, particles, suspended solids, or color
- Various fittings and connections available for ½ inch tubing
- Indigo520-compatible
- Built-in 4 ... 20 mA and Modbus RTU outputs

## Benefits

The optical measurement is based on the refractive index (RI). The RI can be measured from practically any liquid, and it responds to dissolved material. Because bubbles, particles, or crystals in the process do not affect measurement, the RI allows accurate measurement for different chemicals, also slurries. Typical applications include different chemical-mixing and monitoring installations in the fine chemical and semiconductor industries. In addition to a wide selection of product options, Vaisala offers the possibility to customize the product for specific needs. The outstanding long-term stability provides years of accurate, continuous, fast, and stable concentration measurement directly in the process stream. Inline process refractometers are easy to install and have no moving parts that require regular maintenance.

The PR53M continues the success of the Vaisala K-PATENTS® process refractometer series. Based on the 40 years of experience and continuous development, the PR53 family is the latest generation of digital process refractometers.

## Accurate and reliable

The optical measurement principle offers accurate and drift-free measurement. Because temperature measurement is incorporated inside the process refractometer, the changing process temperature does not affect the concentration measurement.

## Plug and play to Indigo

The refractometer can be interfaced directly, or it can be connected to a Vaisala Indigo520 transmitter. It provides access to features such as data storage, graphical interface, and analog and digital interface. Changing settings, measurement parameters, or other servicing updates can be done directly from the Indigo520, or through a USB cable using Vaisala software.

# Technical data

## Measurement performance

| | |
|---|---|
| **Refractive index** | |
| Measurement range | 1.32 ... 1.53 nD<br>(Corresponds to 0 ... 100 °Bx) |
| Accuracy | ±0.00014 nD (0.1 °Bx) [1] |
| Repeatability | ±0.00002 nD [2] |
| Resolution | ±0.000015 nD |
| Response time $T_{63}$ with default damping | 10 s [3] |
| Measurement cycle | 1 / s |
| Long-term stability | Max. 0.1 % full scale / a |
| **Temperature** | |
| Accuracy at 20 °C (68 °F) | ±0.3 °C (0.54 °F) [1] |
| Sensor class | F0.15 IEC 60751 |
| Temperature coefficient | ±0.002 °C / C |

1) *Accuracy specified with respect to calibration reference, including non-linearity, hysteresis at +20 °C.*
2) *Repeatability, confidence level k=2, including random noise, at Ta = +20 °C, with standard low-pass filtering.*
3) *With standard low-pass filtering.*

## Operating environment

| | |
|---|---|
| **Process parameters** | |
| Process temperature | –10 ... +130 °C (+14 ... +266 °F) |
| Pressure | 10 bar [1] |
| **Operating environment** | |
| Storage temperature | –40 ... +65 °C (–40 ... +149 °F) |
| Operating temperature | –40 ... +60 °C (–40 ... +140 °F) |
| Maximum operating altitude | 2000 m (approx. 6500 ft) |
| Operating humidity | 0 ... 100 %RH |
| Storage humidity | 0 ... 100 %RH, non-condensing |
| UL 50E (NEMA) rating | Type 4X |
| IP rating | IP66<br>IP67 |

1) *Maximum at +20 °C.*

## Inputs and outputs

| | |
|---|---|
| **Supply** | |
| Operating voltage | 24 V DC nominal (9 ... 30 V DC) |
| Power consumption | Less than 1 W |
| Protection class | 3, PELV |
| **Outputs** | |
| Output parameters | RI, temperature, concentration, quality factor |
| **Analog outputs** | |
| mA | Sourcing, isolated, NAMUR NE 43, configurable |
| mA range | 3.8 ... 20.5 mA |
| Loop impedance | Max. 600 Ω |
| Accuracy of analog outputs at +20°C | ±0.1 % of full scale (±0.00002 RI) |
| **Digital outputs** | |
| Digital output | RS-485, non-isolated |
| Maximum cable run | 300 m (approx. 1000 ft) (digital) |
| Supported protocol | Modbus RTU |
| **Connectors** | |
| External connectors | 1 × M12 F 4 pins, A-coded [1]<br>2 × M16×1.5 cable gland, Cable D 5 ... 10 mm / Adapter for conduit entry M16×1.5 / NPT ½" |

1) *For USB2 adapter and Insight software. See www.vaisala.com/insight.*

## Compliance

| | |
|---|---|
| Electromagnetic compatibility (EMC) | EN 61326-1, industrial environment |
| Safety | IEC/EN/UL 61010-1 |
| Pressure | CRN all territories, ASME BPVC Sec VIII Div. 1 Ed. 2021 |
| Compliance marks | CE, China RoHS, RCM, UKCA |

## Mechanical specifications

| | |
|---|---|
| **Wetted parts** | |
| Prism and sapphire plate | Sapphire monocrystalline, 99.996 % $Al_2O_3$ [1] |
| Flow cell | Ultra pure PTFE [1] |
| Prism gasket | Modified PTFE [1] |
| Process gasket | Kalrez 6375 UP [1] |
| **Non-wetted parts** | |
| Housing | Optional coating |
| Screws TX20, torque 2.0 Nm | EN 1.4404 (AISI 316L) |
| Cable | 4×22 AWG PUR, black 10 m multistrand, with ferrules<br>Flame-retardant acc. to IEC 60332-1-2, FT1, VW1 |

1) *Manufacturer's declaration included.*

## Mounting accessories

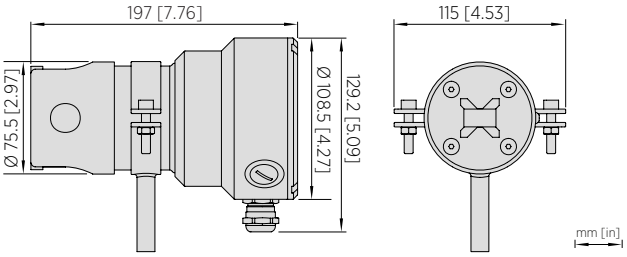
| Item |
|---|
| Support |
| Flare fitting |
| Pillar-type fitting |

## Calibration accessories

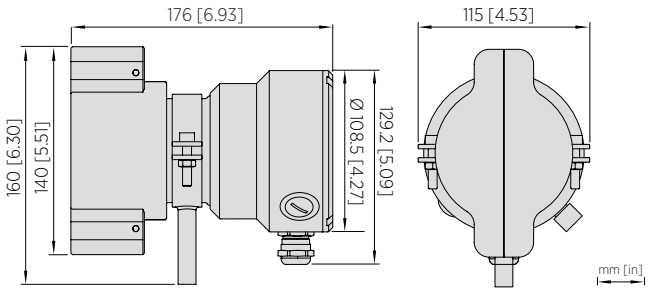
| Item |
|---|
| RI liquid kit for RI field calibration, standard<br>1.33, 1.37, 1.42, 1.47, 1.52 |
| RI liquid kit for RI field calibration, large<br>1.32, 1.33, 1.35, 1.38, 1.41, 1.44, 1.47, 1.50, 1.52, 1.53 |
| Sample holder and cover |

## Accessories

| Item | Code |
|---|---|
| USB adapter for service port, for Insight service software (see www.vaisala.com/insight) | USB2 |
| Fiberglass brush for prism cleaning | |
| Instrument cable, 4×22 AWG, PUR jacket, black, open ends, 10 m<br>Flame-retardant acc. to IEC 60332-1-2, FT1, VW1 | |
| Instrument cable, 4×22 AWG, PUR jacket, black, open ends, 30 m<br>Flame-retardant acc. to IEC 60332-1-2, FT1, VW1 | |
| Instrument cable, 4×22 AWG, PUR jacket, black, open ends, 50 m<br>Flame-retardant acc. to IEC 60332-1-2, FT1, VW1 | |
| Cooling cover | |




Dimensions PR53M NPT 1/2"




Dimensions PR53M tube fitting

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