VAISALA

Polaris™ PR53AP Sanitary Probe Process Refractometer

The Vaisala Polaris PR53AP sanitary probe process refractometer is designed for food and beverage, dairy and brewery industry customers, and OEMs to measure liquid concentrations, such as Brix, in applications such as jam cookers and mixing tanks. 3-A and EHEDG certifications ensure that all hygienic demands and safety requirements are met. The long probe can withstand high process temperatures and its design enables flexible installations directly to kettles, cookers, vessels, and tanks.

Features

- Reliable optical concentration measurements with refractive index
- Brix, Total Solids, Oechsle, Baume, Plato, and more than 500 concentration curves
- 3-A and EHEDG certified
- Sanitary and tank bottom flange couplings
- Measurement not affected by bubbles, particles, suspended solids, or color
- 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. The long probe allows representative measurement in tanks and hot processes, such as jam cooking.

The outstanding long-term stability provides years of accurate, continuous, fast, and stable measurement for concentration of sugar (Brix) and various other chemical concentrations directly in the process stream. Inline process refractometers are easy to install and have no moving parts that require regular maintenance.

The PR53AP continues the success of the Vaisala K-PATENTS® process refractometer series. Based on 40 years of experience and continuous development, the PR53 family is the latest generation of digital process refractometers.

Safe for sanitary applications

The product design welcomes both cleaning-in-place (CIP) and sterilization-in-place (SIP) systems. Stainless-steel wetted parts, PTFE and sapphire, are suitable to be in direct contact with the process, and traceability ensures safety. Stainless steel is easy to maintain and keep clean. The long probe with common tank bottom flanges enables installation depths of up to 170 mm. The flush mount option allows installation in tanks with scrapers or mixers.

Brix and beyond

Brix is a common measurement unit in the food, dairy, and beverage processing industries. Measurements can also be shown in total solids, Oechsle, Baume, or Plato. Other measurement units include concentration of sucrose, gelatin, lactulose, and hydrogen peroxide. The refractometer comes pre-configured with the selected concentration curve.

Wash system

Most applications do not need wash systems due to the self-cleaning effect: the shear force of the process flow keeps the measurement point clean. For the most demanding applications, the powerful wash system ensures correct measurement when process conditions are sticky.

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. The Indigo520 transmitter is required when the application or the installation position requires washing, to control the process. Changing settings, measurement parameters, or other servicing updates can be done directly from the Indigo520, or through a USB cable using Vaisala software.
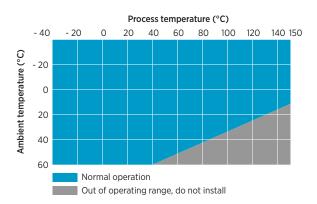
Technical data

Measurement performance

Refractive index

Measurement range	1.32 ... 1.54 nD (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.
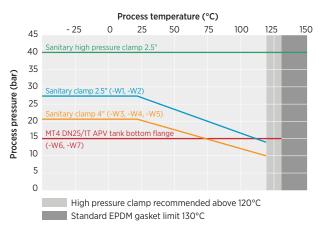3) At standard low-pass filtering.

PR53AP process temperature (indicative)

Operating environment

Process parameters

Process temperature	−40 ... +150 °C (−40 ... +302 °F) [1]
Design temperature	+180 °C (356 °F) [2]
Design pressure	40 bar [3]

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
NEMA rating	NEMA 4X
IP rating	IP66 IP67

1) −40 ... +130 °C (−40 ... 266 °F) EPDM gasket, -40... +150 °C (−40 ... +302 °F) EHEDG gasket
2) Maximum momentary temperature peak.
3) Maximum at +20 °C, operating pressure to the clamp rating pressure.

PR53AP process pressure

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] 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

EMC compatibility	EN 61326-1, industrial environment
Safety	IEC/EN/UL 61010-1
Pressure	CRN all territories, ASME BPVC Sec VIII Div. 1 Ed. 2021
Material compliance	FDA, EC 1935/2004 EC 1935/2004
Compliance marks	CE, China RoHS, RCM, UKCA

Sanitary compliance

Hygienic design	3-A 46-04 EHEDG
Compliance marks	3-A, EHEDG [1]
ADI free (Animal Derived Ingredients)	USP Class VI

1) For EHEDG compliant installation, use 2.5" / 4" sanitary gasket.

Mechanical specifications

Wetted parts

Sensor head	EN 1.4435 (AISI 316L) [1]
Surface roughness	Ra 0.8 µm
Prism	Sapphire monocrystalline, 99.996 % Al_2O_3 [2]
Prism gasket	Modified PTFE [2]
Sanitary gasket 2.5″ / 4″ (-W1, -W2, -W3, -W4, -W5)	EPDM [2] ASME BPE-2019 (DIN 32676-C)
Tank bottom gasket MT4 DN25/1T APV for tank bottom flange (-W6, -W7, -W8, -W9)	EPDM [2]
Welding ferrule	EN 1.4435 (AISI 316L) [1]

Non-wetted parts

Housing	EN 1.4404 (AISI 316L)
Screws, TX20, torque 2.0 Nm	EN 1.4404 (AISI 316L)
Cable gland, dummy plug	EN 1.4305 (AISI 303)
Conduit hub	EN 1.4404 (AISI 316L)
M12 connector	Gland, EN 1.4305 (AISI 303) Contacts, CuZn with Ni/Au plating Carrier, PA 6.6
Sanitary clamp 2.5″ / 4″ (-W1, -W2, -W3, -W4, -W5)	EN 1.4301 (AISI 304)
Cable (-C1)	4×22 AWG PUR, black 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1

Weight	-W1 3.6 kg (7.94 lb)
	-W2 3.7 kg (8.16 lb)
	-W3, -W5 4.1 kg (9.04 lb)
	-W8, -W9 3.9 kg (8.6 lb)
	-W4, -W6, -W7 4.2 kg (9.26 lb)

1) Material certificate included.
2) Manufacturer's declaration included.

Calibration accessories

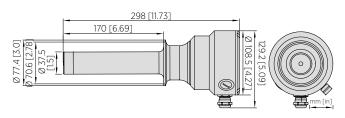| Item |
|---|
| RI liquid kit for RI field calibration, standard 1.33, 1.37, 1.42, 1.47, 1.52 |
| RI liquid kit for RI field calibration, large 1.32, 1.33, 1.35, 1.38, 1.41, 1.44, 1.47, 1.50, 1.52, 1.53 |
| Sample holder and cover |

Accessories

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

Options for PR53AP

PR53AP-W1 dimensions

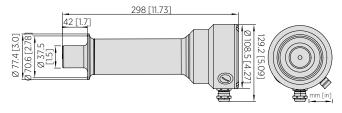## Mounting accessories for option -W1

Item
Welding ferrule, 2.5"
Sanitary clamp 2.5"
Blind flange 2.5"
Sanitary gasket 2.5", EPDM
Sanitary gasket 2.5", PTFE/steel, Combifit VOE-2034 (EHEDG)

PR53AP-W2 dimensions

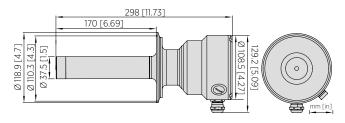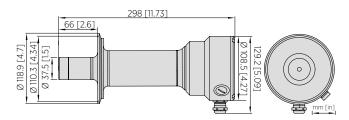## Mounting accessories for option -W2

Item
Welding ferrule, 2.5"
Sanitary clamp 2.5"
Blind flange 2.5"
Sanitary gasket 2.5", EPDM
Sanitary gasket, 2.5", PTFE/steel, Combifit VOE-2034 (EHEDG)

PR53AP-W3 dimensions

Mounting accessories for option -W3

Item
Welding ferrule, 4"
Sanitary clamp 4"
Blind flange 4"
Sanitary gasket 4", EPDM
Sanitary gasket, 4", PTFE/steel, Combifit VOE-2034 (EHEDG)

PR53AP-W4 dimensions
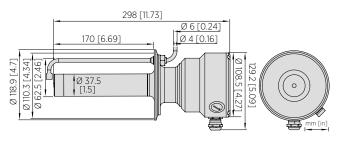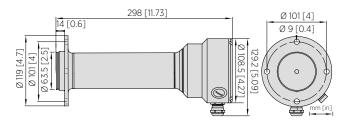
Mounting accessories for option -W4

Item
Welding ferrule, 4"
Sanitary clamp 4"
Blind flange 4"
Sanitary gasket 4", EPDM
Sanitary gasket, 4", PTFE/steel, Combifit VOE-2034 (EHEDG)

PR53AP-W5 dimensions

Mounting accessories for option -W5

Item
Welding ferrule, 4"
Sanitary clamp 4"
Blind flange 4"
Sanitary gasket 4", EPDM
Sanitary gasket, 4", PTFE/steel, Combifit VOE-2034 (EHEDG)

Options for PR53AP

PR53AP-W6 and -W7 dimensions
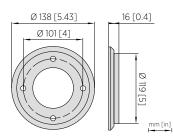

PR53AP-W7 welding flange dimensions

Mounting accessories for option -W6, -W7

Item
Tank bottom welding flange
Tank bottom blind flange
Gasket MT4 DN25/IT EPDM [1]
Blind flange 2.5"
Sanitary gasket 2.5", EPDM
Sanitary gasket, 2.5", PTFE/steel, Combifit VOE-2034 (EHEDG)

[1] Manufacturer's declaration included.