

Polaris™ PR53AC Sanitary Compact Process Refractometer



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
- 3-A and Type N sanitary couplings
- Measurement not affected by bubbles, particles, suspended solids, or color
- Various flow cells available
- Indigo520-compatible
- Built-in 4–20 mA and Modbus RTU outputs

The Vaisala Polaris PR53AC sanitary compact process refractometer is designed to measure liquid concentrations, such as Brix, inline. Applications include food, beverage, dairy and brewery industry customers, and OEMs. 3-A and EHEDG certifications ensure that all hygienic demands and safety requirements are met. Easy to install directly in pipelines with a sanitary clamp and optional flow cells.

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. Bubbles, particles, or fibers in the process do not affect measurement. 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 PR53AC 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 is compatible with both clean-in-place (CIP) and sterilization-in-place (SIP) systems. The material offering, including stainless-steel wetted parts, PTFE, and sapphire, are all suitable for direct contact with the process with convenient installations directly to process lines with standard sanitary and Type N couplings, or with a sanitary flow cell. Stainless steel is easy to maintain and keep clean, and traceability ensures safety.

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 1.32–1.53 nD
(Corresponds to 0–100 °Bx)

Accuracy ± 0.00014 nD (0.1 °Bx)¹⁾

Repeatability ± 0.00002 nD²⁾

Resolution ± 0.000015 nD

Response time T_{63} with default damping 10 s³⁾

Measurement cycle 1 / s

Long-term stability Max. 0.1 % full scale / a

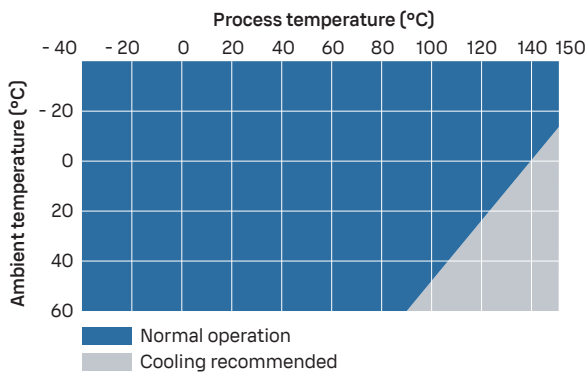
Temperature

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 $T_a = +20$ °C, with standard low-pass filtering.
- 3) With standard low-pass filtering.



PR53AC process temperature, options Sanitary 2.5" and Type N (indicative)

Operating environment

Process parameters

Process temperature -40 ... +150 °C (-40 ... +302 °F)¹⁾

Design temperature +180 °C (356 °F)²⁾

Design pressure 40 bar³⁾

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

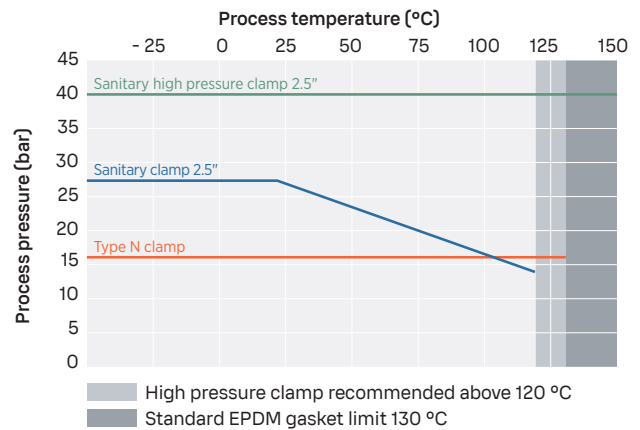
Storage humidity 0–100 %RH, non-condensing

UL 50E/NEMA rating Type 4X

IP rating IP66

IP67

- 1) -40 ... +130 °C (-40 ... 266 °F) EPDM gasket, -40 ... +150 °C (-40 ... +302 °F) PTFE gasket.
- 2) Maximum momentary temperature peak.
- 3) Maximum at +20 °C (68 °F), operating pressure to the clamp rating pressure.



PR53AC 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 M 4 pins, A-coded¹⁾
2 × M16×1.5 cable gland, Cable D 5–10 mm / Adapter for conduit entry M16×1.5²⁾ / NPT 1/2"

- 1) For USB2 adapter and Insight software, see www.vaisala.com/insight.
- 2) Conduit hub is not compatible with SD/IS Safe-Drive system.

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

Material compliance FDA 21 CFR 177.150, 177.2600, 177.1550
EC 1935/2004
EC 2023/2006, GMP
EU 10/2011

Compliance marks CE, China RoHS, RCM, UKCA

Vibration and shock Tested according to IEC 60068-2

Listing marks MET listed (US and Canada)

Sanitary compliance

Hygienic design	3-A 46-04 EHEDG
Compliance marks	3-A, EHEDG (for EHEDG compliant installation, use 2.5" / 4" sanitary gasket)
Biocompatibility	USP Class VI <88>, 70 °C
ADI free (Animal Derived Ingredients)	Yes

Mechanical specifications

Wetted parts	
Sensor head	EN 1.4435 BN2 (AISI 316L) ¹⁾
Surface roughness	Ra 0.8 µm Ra 0.38 µm electropolished ¹⁾
Prism	Sapphire monocrystalline, 99.996 % Al ₂ O ₃ ²⁾
Prism gasket	Modified PTFE ³⁾
Sanitary 2.5" gasket	EPDM ²⁾
Type N gasket	EPDM ²⁾
Welding ferrule	EN 1.4435 (AISI 316L) ^{1) 4)} ASME BPE-2019 (DIN 32676-C)
Non-wetted parts	
Housing	EN 1.4404 (AISI 316L)
Screws TX20, torque 2.0 Nm	EN 1.4404 (AISI 316L)
Cable gland	EN 1.4305 (AISI 303) HUMMEL 1.693.1600.50
Dummy plug	EN 1.4305 (AISI 303) AGRO 8717.96.08.70
Conduit hub	EN 1.4404 (AISI 316L) Vaisala, DRW257718, M16×1.5 / NPT ½ in
M12 connector	Gland, EN 1.4305 (AISI 303) Contacts, CuZn with Ni/Au plating Phoenix Contact, 1405233, M12/4(M), A, 4×0.34 mm ² , TPE, 0.5 m Carrier, PA 6.6
Sanitary 2.5" clamp	EN 1.4301 (AISI 304) ²⁾
Type N Clamp	EN 1.4301 (AISI 304) ²⁾
Cable	2×2×0.5 mm ² (AWG 21), PUR jacket, gray 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1
Weight	2.7 kg (5.95 lb)

1) EN 10204 / 3.1 certificate included.

2) Manufacturer's declaration included.

3) ADI free, FDA 21 C.F.R 177.1550, 3A Sanitary Standard, USP Class VI <88>, 70 °C.

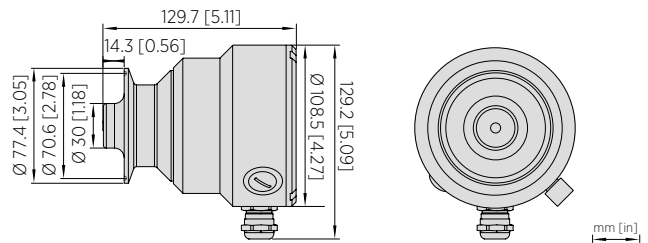
4) 3-A certificate, EHEDG certificate.

Calibration accessories

Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

Accessories

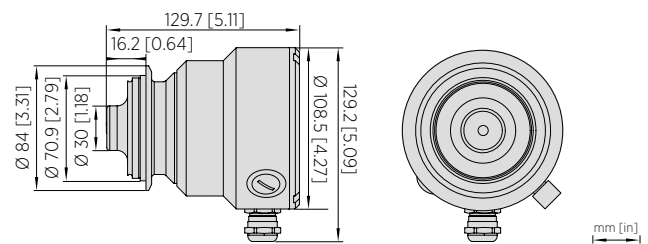
Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-10M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-30M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-50M
Cooling cover	ASM214675SP



Dimensions for PR53AC Sanitary 2.5"

Sanitary 2.5" mounting accessories

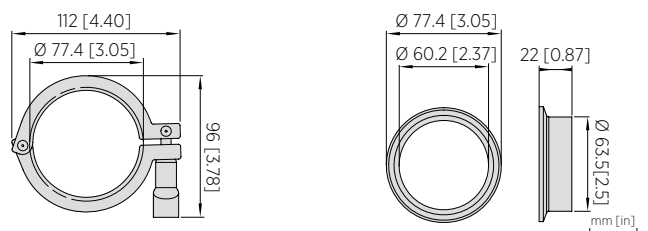
Item
Welding ferrule, 2.5"
Sanitary clamp 2.5"
High-pressure clamp 2.5"
Blind flange 2.5"
Sanitary gasket, 2.5", EPDM
Sanitary gasket, 2.5", EHEDG compliant, PTFE/steel, Combifit VOE-2034 (optional)



Dimensions for PR53AC Type N

Type N mounting accessories

Item
Type N clamp 2.5", DN 50/40
Type N blind flange
Gasket 59.5×3 mm, EPDM



Mounting kit for PR53AC Sanitary 2.5"

Flow cells for PR53AC

Operating pressure

Flow cell model	Max. pressure
SEFC for 1" pipelines	27 bar at 20 °C 13.8 bar at 120 °C
SEFC for 1,5" pipelines	25 bar
SEFC for 2" pipelines	20 bar
SEFC for 2.5" pipelines	15 bar
SEFCL for 3" pipelines	12.5 bar
SEFCL for 4" pipelines	10 bar
MFC	27 bar at 20 °C 13.8 bar at 120 °C

SEFC Sanitary Elbow Flow Cell

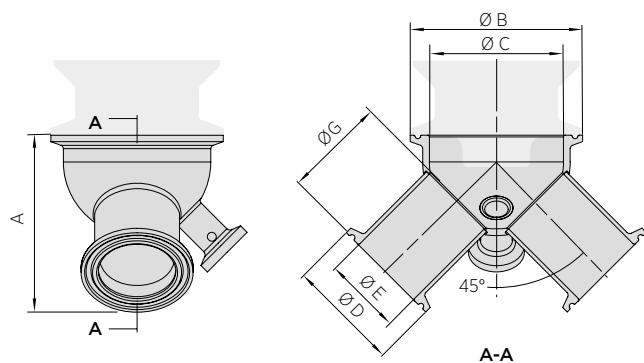
Item
SEFC Sanitary Elbow Flow Cell, DIN 32676-C sanitary coupling
Wetted parts
Sanitary coupling 1", reduced inlet for < 1.5 m/s flow rate
Sanitary coupling 1.5", reduced inlet for < 1.5 m/s flow rate
Sanitary coupling 2.5", reduced inlet for < 1.5 m/s flow rate
Sanitary coupling 1"
Sanitary coupling 1.5"
Sanitary coupling 2.5"
Wash nozzle
No wash nozzle option
Steam wash nozzle
Water wash nozzle
Pressurized water wash nozzle
Documentation
EN 1024 3.1 material certificate included
Material: EN 1.4435
Other variants, surface treatments and special materials available on request

SEFC Sanitary Elbow Flow Cell, dimensions

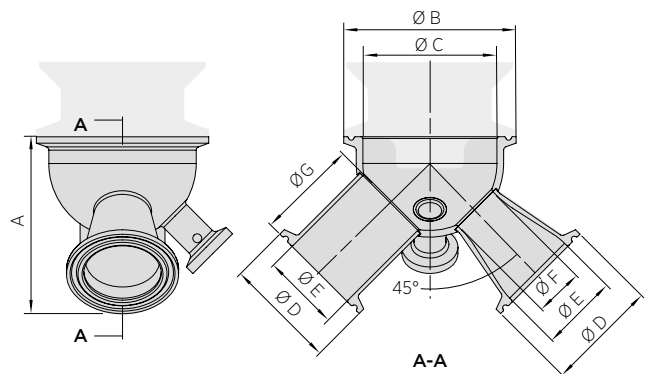
Dimension	1"	1½"	2"	2½"
A	65.7 mm (2.59 in)	79.6 mm (3.13 in)	97.5 mm (3.84 in)	115.7 mm (4.56 in)
ØB	77.4 mm (3.05 in)	77.4 mm (3.05 in)	77.4 mm (3.05 in)	77.4 mm (3.05 in)
ØC	60.2 mm (2.37 in)	60.2 mm (2.37 in)	60.2 mm (2.37 in)	60.2 mm (2.37 in)
ØD	50.4 mm (1.98 in)	50.4 mm (1.98 in)	63.9 mm (2.52 in)	77.4 mm (3.05 in)
ØE	22.1 mm (0.87 in)	34.8 mm (1.37 in)	47.5 mm (1.87 in)	60.2 mm (2.37 in)
ØG	21.7 mm (0.85 in)	44.9 mm (1.77 in)	41.9 mm (1.65 in)	64.8 mm (2.55 in)

SEFC Sanitary Elbow Flow Cell reduced inlet, dimensions

Dimension	1"	1½"	2"
A	65.7 mm (2.59 in)	79.6 mm (3.13 in)	97.5 mm (3.84 in)
ØB	77.4 mm (3.05 in)	77.4 mm (3.05 in)	77.4 mm (3.05 in)
ØC	60.2 mm (2.37 in)	60.2 mm (2.37 in)	60.2 mm (2.37 in)
ØD	50.4 mm (1.98 in)	50.4 mm (1.98 in)	63.9 mm (2.52 in)
ØE	22.1 mm (0.87 in)	34.8 mm (1.37 in)	47.5 mm (1.87 in)
ØF	16 mm (0.63 in)	22.1 mm (0.87 in)	34.8 mm (1.37 in)
ØG	21.7 mm (0.85 in)	44.9 mm (1.77 in)	41.9 mm (1.65 in)



SEFC Sanitary Elbow Flow Cell



SEFC Sanitary Elbow Flow Cell, reduced inlet

SEFCL Sanitary Elbow Flow Cell, for Large Pipelines

Item

SEFCL Sanitary Elbow Flow Cell, for Large Pipelines

Wetted parts

Sanitary coupling 3"

Sanitary coupling 4"

Wash nozzle

No wash nozzle option

Steam wash nozzle

Water wash nozzle

Pressurized water wash nozzle

Documentation

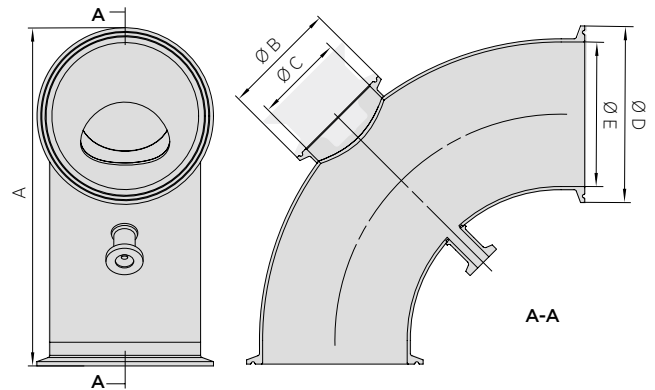
Material certificate included

Material: AISI 316L

Other variants, surface treatments and special materials available on request

SEFCL Sanitary Elbow Flow Cell, for Large Pipelines, dimensions

Dimension	3"	4"
A	172.5 mm (6.79 in)	227.8 mm (8.97 in)
ØB	77.9 mm (3.07 in)	77.9 mm (3.07 in)
ØC	60.2 mm (2.37 in)	60.2 mm (2.37 in)
ØD	90.9 mm (3.58 in)	118.9 mm (4.68 in)
ØE	72.9 mm (2.87 in)	97.4 mm (3.83 in)



SEFCL Sanitary Elbow Flow cell, Large (3 in)

MFC Miniature Flow Cell

Item

MFC Miniature Flow Cell

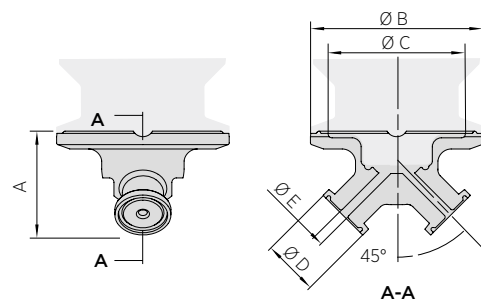
Material: EN 1.4435, EN 1024 3.1 material certificate included

Wetted surface Ra: Electropolished 0.4 um, batch traceable, certificate included

Other variants, surface treatments and special materials available on request

MFC Miniature Flow Cell, dimensions

Dimension	4 mm	5 mm	6 mm
A	46.6 mm (1.83 in)	46.6 mm (1.83 in)	46.6 mm (1.83 in)
ØB	77.5 mm (3.05 in)	77.5 mm (3.05 in)	77.5 mm (3.05 in)
ØC	61.6 mm (2.43 in)	61.6 mm (2.43 in)	61.6 mm (2.43 in)
ØD	25 mm (0.98 in)	25 mm (0.98 in)	25 mm (0.98 in)
ØE	4 mm (0.16 in)	5 mm (0.2 in)	6 mm (0.24 in)



MFC Miniature Flow Cell

Flow cell accessories for MFC

Item

Gasket 22.2×3.0 mm EPDM

Sanitary clamp 0.5"

Polaris™ PR53AP Sanitary Probe Process Refractometer



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

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.

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 1.32-1.53 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 T₆₃ with default damping 10 s ³⁾

Measurement cycle 1 / s

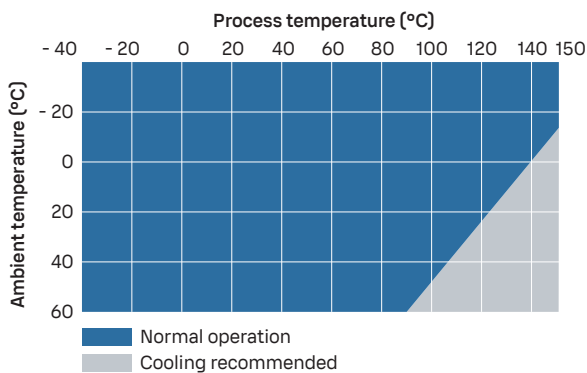
Long-term stability Max. 0.1 % full scale / a

Temperature

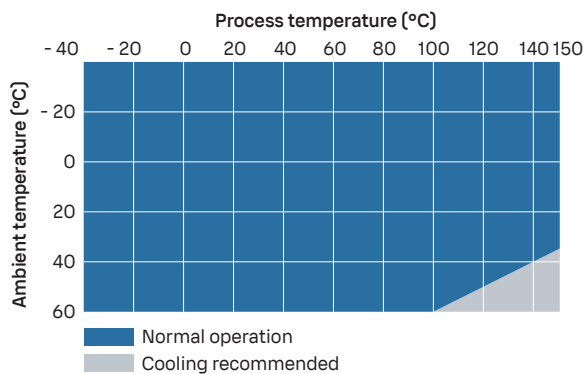
Accuracy at 20 °C (68 °F) ±0.3 °C (0.54 °F) ¹⁾

Sensor class F0.15 IEC 60751

Temperature coefficient ±0.002 °C / C



PR53AP, depth 170 mm process temperature (indicative)



PR53AP, depth 42 mm and 66 mm 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

UL 50E/NEMA rating Type 4X

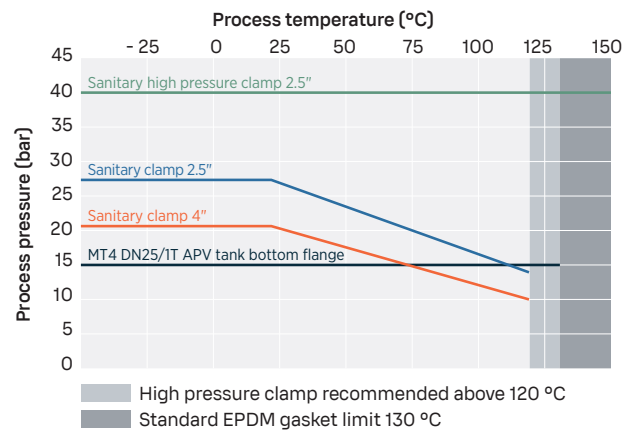
IP rating IP66

IP67

¹⁾ -40 ... +130 °C (-40 ... 266 °F) EPDM gasket, -40... +150 °C (-40 ... +302 °F) PTFE gasket

²⁾ Maximum momentary temperature peak.

³⁾ Maximum at +20 °C (68 °F), 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 M 4 pins, A-coded ¹⁾
2 × M16×1.5 cable gland, Cable D 5-10 mm / Adapter for conduit entry M16×1.5 ²⁾ / NPT ½"

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
Material compliance	FDA 21 CFR 177.150, 177.2600, 177.1550 EC 1935/2004 EC 2023/2006, GMP EU 10/2011
Compliance marks	CE, China RoHS, RCM, UKCA
Vibration and shock	Tested according to IEC 60068-2
Listing marks	MET listed (US and Canada)

Sanitary compliance

Hygienic design	3-A 46-04 EHEDG ¹⁾
Compliance marks	3-A, EHEDG ²⁾
Biocompatibility	USP Class VI <88>, 70 °C
ADI free (Animal Derived Ingredients)	Yes

¹⁾ Excluding tank bottom flange.

²⁾ For EHEDG compliant installation, use 2.5" / 4" sanitary gasket.

Calibration accessories

Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

Mechanical specifications

Wetted parts	
Sensor head	EN 1.4435 BN2 (AISI 316L) ¹⁾
Wash nozzle	EN 1.4404 (AISI316L) ¹⁾ EPDM gasket ²⁾
Surface roughness	Ra 0.8 µm
Prism	Sapphire monocrystalline, 99.996 % Al ₂ O ₃ ²⁾
Prism gasket	Modified PTFE ³⁾
Sanitary gasket 2.5" / 4"	EPDM ²⁾
Tank bottom gasket MT4 DN25/1T for tank bottom flange	EPDM ²⁾
Tank bottom flange	AISI316L ¹⁾
Welding ferrule	EN 1.4435 (AISI 316L) ^{1) 4)}
Non-wetted parts	
Housing	EN 1.4404 (AISI 316L)
Screws, TX20, torque 2.0 Nm	EN 1.4404 (AISI 316L)
Cable gland	EN 1.4305 (AISI 303) HUMMEL 1.693.1600.50
Dummy plug	EN 1.4305 (AISI 303) AGRO 8717.96.08.70
Conduit hub	EN 1.4404 (AISI 316L) Vaisala, DRW257718, M16×1.5 / NPT ½ in
M12 connector	Gland, EN 1.4305 (AISI 303) Contacts, CuZn with Ni/Au plating Phoenix Contact, 1405233, M12/4(M), A, 4×0.34 mm ² , TPE, 0.5 m Carrier, PA 6.6
Sanitary clamp 2.5" / 4"	EN 1.4301 (AISI 304) ²⁾
Cable	2×2×0.5 mm ² (AWG 21), PUR jacket, black 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1
Weight	3.6–4.2 kg (7.94–9.26 lb)

¹⁾ Material certificate included.

²⁾ Manufacturer's declaration included.

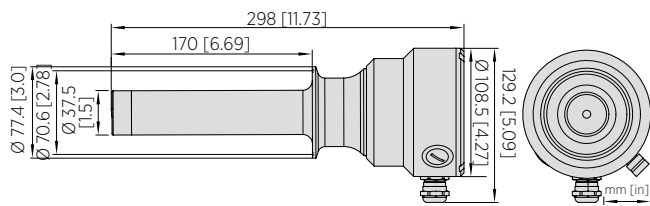
³⁾ ADI free, FDA 21 C.F.R 177.1550, 3A Sanitary Standard, USP Class VI <88>, 70 °C.

⁴⁾ 3-A certificate, EHEDG certificate.

Accessories

Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-10M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-30M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-50M
Cooling cover	ASM214675SP

Options for PR53AP

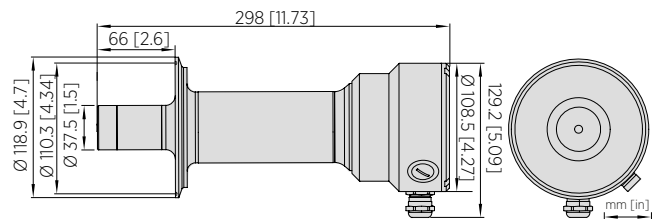


Dimensions of PR53AP Sanitary 2.5", depth 170 mm

Mounting accessories for PR53AP Sanitary 2.5", depth 170 mm

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)

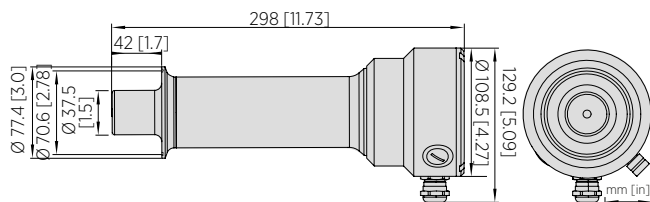


Dimensions of PR53AP Sanitary 4", depth 66 mm

Mounting accessories for PR53AP Sanitary 4", depth 66 mm

Item

- Welding ferrule, 4"
- Sanitary clamp 4"
- Blind flange 4"
- Sanitary gasket 4", EPDM
- Sanitary gasket 4", PTFE/steel, Combifit VOE-2036 (EHEDG)

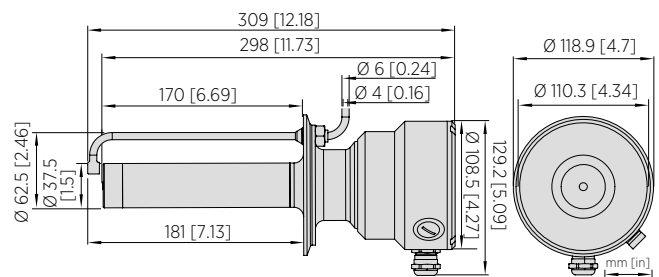


Dimensions of PR53AP Sanitary 2.5", depth 42 mm

Mounting accessories for PR53AP Sanitary 2.5", depth 42 mm

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)

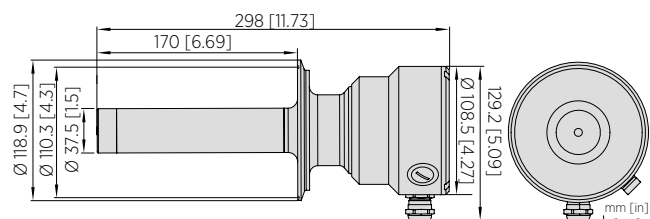


Dimensions of PR53AP Sanitary 4", depth 170 mm, with wash nozzle

Mounting accessories for PR53AP Sanitary 4", depth 170 mm, with wash nozzle

Item

- Welding ferrule, 4"
- Sanitary clamp 4"
- Blind flange 4"
- Sanitary gasket 4", EPDM
- Sanitary gasket 4", PTFE/steel, Combifit VOE-2036 (EHEDG)



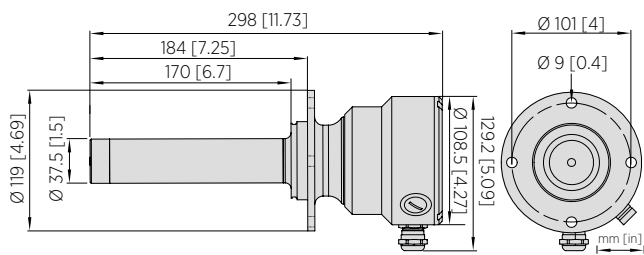
Dimensions of PR53AP Sanitary 4", depth 170 mm

Mounting accessories for PR53AP Sanitary 4", depth 170 mm

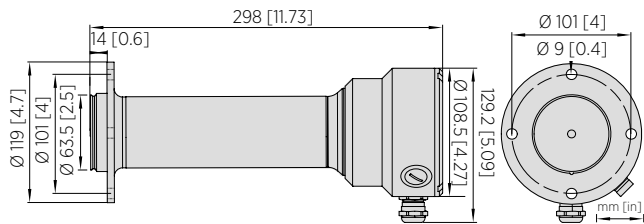
Item

- Welding ferrule, 4"
- Sanitary clamp 4"
- Blind flange 4"
- Sanitary gasket 4", EPDM
- Sanitary gasket 4", PTFE/steel, Combifit VOE-2036 (EHEDG)

Options for PR53AP



Dimensions of PR53AP tank bottom flange, depth 170 mm



Dimensions of PR53AP tank bottom flange, flush mounted

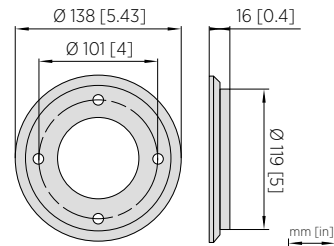
Mounting accessories for PR53AP tank bottom flange, depth 170 mm and tank bottom flange, flush mounted

Item

Tank bottom welding flange

Tank bottom blind flange

Gasket MT4 DN25/1T EPDM



Dimensions of PR53AP tank bottom welding flange

Polaris™ PR53GC Compact Process Refractometer



Features

- Reliable optical concentration measurements with refractive index
- Sulfuric acid, sodium hydroxide, and more than 500 concentration curves
- Special alloy materials available for demanding environments
- Type L coupling
- Measurement not affected by bubbles, particles, suspended solids, or color
- Various flow cells available
- 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 or slurry, and it responds to dissolved material. Bubbles, particles, or fibers in the process do not affect measurement.

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 PR53GC 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 in the 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.

Easy mounting

Type L clamp connections allow easy installation directly into the process line. The unit can also be installed into a flange-mounted flow cell, which enables the use of an additional wash system for applications where prism wash is required.

Selected alloy materials provide durability under challenging process conditions. Other special materials and engineered solutions are available upon request.

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 1.32–1.53 nD
(Corresponds to 0–100 °Bx)

Accuracy ± 0.00014 nD (0.1 °Bx)¹⁾

Repeatability ± 0.00002 nD²⁾

Resolution ± 0.000015 nD

Response time T_{63} with default damping 10 s³⁾

Measurement cycle 1 / s

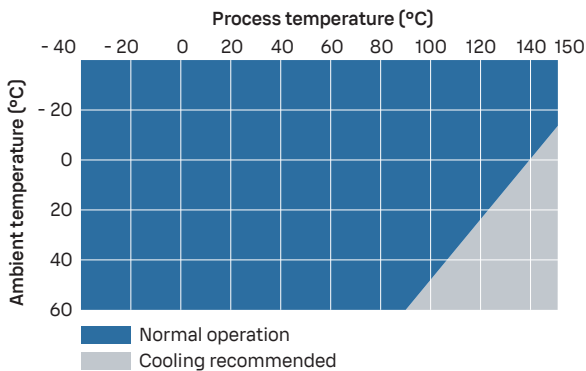
Long-term stability Max. 0.1 % full scale / a

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



PR53GC process temperature (indicative)

Operating environment

Process parameters

Process temperature -40 ... +150 °C (-40 ... +302 °F)

Design temperature +180 °C (356 °F)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

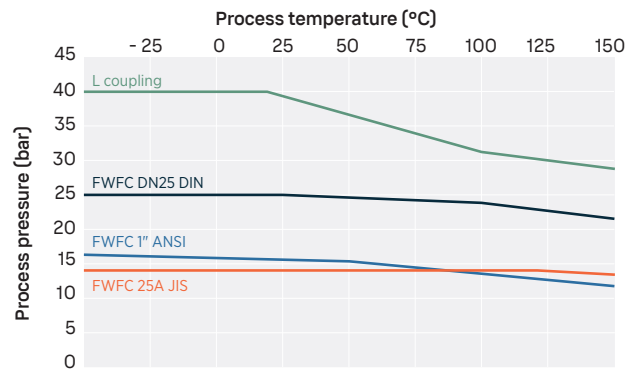
Storage humidity 0–100 %RH, non-condensing

UL 50E/NEMA rating Type 4X

IP rating IP66

IP67

¹⁾ Maximum momentary temperature peak.



PR53GC 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 M 4 pins, A-coded¹⁾
 2 × M16×1.5 cable gland, Cable D 5–10 mm / Adapter for conduit entry M16×1.5²⁾ / NPT ½"

¹⁾ For USB2 adapter and Insight software, see www.valisala.com/insight.

²⁾ Conduit hub is not compatible with SD/IS Safe-Drive system.

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

Vibration and shock Tested according to

IEC 60068-2

Mechanical specifications

Wetted parts	
Sensor head	EN 1.4404 (AISI 316L) EN 2.4660 (Alloy 20) EN 2.4819 (Alloy C276) 1)
Surface roughness	Ra 0.8 µm
Prism	Sapphire monocrystalline, 99.996 % Al ₂ O ₃ 2)
Prism gasket	Modified PTFE 2)
L coupling gasket	PTFE 2)
Welding ferrule	EN 1.4404 (AISI 316L) EN 2.4660 (Alloy 20) EN 2.4819 (Alloy C276) 2)
Non-wetted parts	
Housing	EN 1.4404 (AISI 316L)
Screws, TX20, torque 2.0 Nm	EN 1.4404 (AISI 316L)
Cable gland	EN 1.4305 (AISI 303) HUMMEL 1.693.1600.50
Dummy plug	EN 1.4305 (AISI 303) AGRO 8717.96.08.70
Conduit hub	EN 1.4404 (AISI 316L) Vaisala, DRW257718, M16×1.5 / NPT ½ in
M12 connector	Gland, EN 1.4305 (AISI 303) Contacts, CuZn with Ni/Au plating Phoenix Contact, 1405233, M12/4(M), A, 4×0.34 mm ² , TPE, 0.5 m Carrier, PA 6.6
L coupling clamp (60.3 mm)	EN 1.4301 (AISI 304) 2)
Cable	2×2×0.5 mm ² (AWG 21), PUR jacket, gray 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1
Weight	2.7 kg (5.95 lb)

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

Mounting accessories

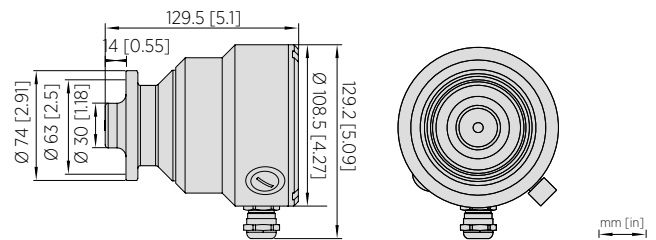
Item
L coupling clamp 60.3 mm (23.7 in)
L coupling ferrule 60.3 mm (23.7 in)
L coupling blind flange 60.3 mm (23.7 in)
L coupling gasket 60.3 mm (23.7 in)

Accessories

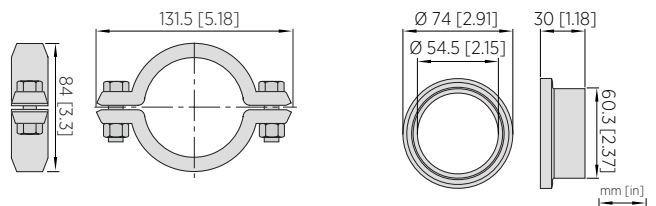
Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-10M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-30M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-50M
Cooling cover	ASM214675SP

Calibration accessories

Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

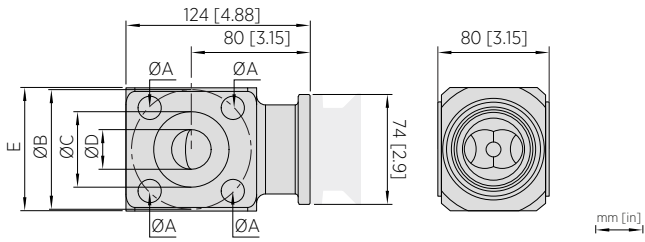


Dimensions of PR53GC



Dimensions of PR53GC L coupling clamp

Flow cells for PR53GC



FWFC Flange Wafer Flow Cell

Dimensions FWFC Flange Wafer Flow Cell

Dimension	ANSI	DIN	JIS
ØA	15.7 mm (0.62 in)	14 mm (0.55 in)	19 mm (0.75 in)
ØB	79.2 mm (3.12 in)	85 mm (3.35 in)	90 mm (3.54 in)
ØC	50.8 mm (2 in)	68 mm (2.68 in)	68 mm (2.68 in)
ØD	26.7 mm (1.05 in)	28.5 mm (1.12 in)	28.5 mm (1.12 in)
E	83 mm (3.27 in)	83 mm (3.27 in)	89 mm (3.50 in)

FWFC Flange Wafer Flow Cell

Item

Wetted parts

DIN flange DN25

ANSI flange 1"

JIS flange DN25

Length

Length 84 mm (3.3 in)

Wash nozzle

No wash nozzle, plugged

Steam wash nozzle

Water wash nozzle

Pressurized water wash nozzle

Documentation

Material EN 1024 3.1 certificate included

Material: EN 1.4404 ¹⁾

Other variants, surface treatments and special materials available on request.

¹⁾ 3.1 material declaration included

Polaris™ PR53GP Probe Process Refractometer



Features

- Reliable optical concentration measurements with refractive index
- Sulfuric acid, sodium hydroxide, and more than 500 concentration curves
- Special alloy materials available for demanding environments
- Clamp and flange connections available
- 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.

Because bubbles, particles, or crystals in the process do not affect measurement, the RI allows accurate measurement for different chemicals. Typical applications include crystallizers, wet scrubbers, reactors, transport pipelines, blending, and distillation operations.

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 PR53GP 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 the 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.

Easy mounting

The PR53GP can be installed in standard flanges, making it easy to mount to process line. With the optional cooling cover accessory, the instrument tolerates

high process pressures and temperatures. The optional flange-mounted pipe flow cell installation accessory allows flange-mounted installation in a wide variety of pipe sizes. Selected alloy materials provide durability under challenging process conditions. Other special materials and engineered solutions are available upon request.

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 1.32–1.53 nD
(Corresponds to 0–100 °Bx)

Accuracy ± 0.00014 nD (0.1 °Bx)^{1) 2)}

Repeatability ± 0.00002 nD³⁾

Resolution ± 0.000015 nD

Response time T_{63} with default damping 10 s⁴⁾

Measurement cycle 1 / s

Long-term stability Max. 0.1 % full scale / a

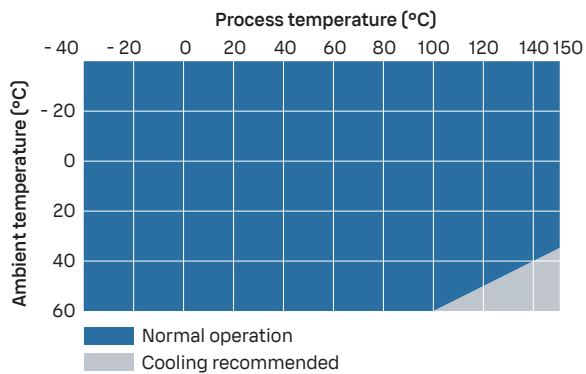
Temperature

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) VD algorithm accuracy is 0.00030.
3) Repeatability, confidence level $k=2$, including random noise, at $T_a = +20$ °C, with standard low-pass filtering.
4) With standard low-pass filtering.



PR53GP process temperature (indicative)

Operating environment

Process parameters

Process temperature -40 ... +150 °C (-40 ... +302 °F)

Design temperature +180 °C (+356 °F)¹⁾

Design pressure 40 bar²⁾

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

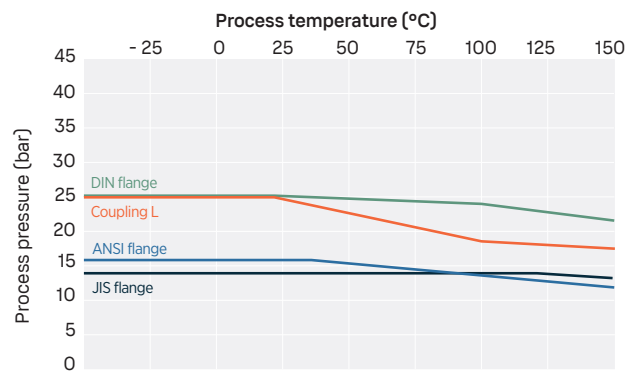
Storage humidity 0–100 %RH, non-condensing

UL 50E/NEMA rating Type 4X

IP rating IP66

IP67

- 1) Maximum momentary temperature peak.
2) Maximum at +20 °C, operating pressure to the process connection rating pressure.



PR53GP 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 M 4 pins, A-coded¹⁾
2 × M16×1.5 cable gland, Cable D 5–10 mm / Adapter for conduit entry M16×1.5²⁾ / NPT ½"

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

Vibration and shock Tested according to

IEC 60068-2

Mechanical specifications

Wetted parts	
Sensor head	EN 1.4404 (AISI 316L) ¹⁾
Surface roughness	Ra 0.8 µm
Prism	Sapphire monocrystalline, 99.996 % Al ₂ O ₃ ²⁾
Prism gasket	Modified PTFE ²⁾
L coupling gasket	PTFE ²⁾
L coupling welding ferrule	EN 1.4404 (AISI 316L) ¹⁾
Wash nozzle parts	EN 1.4404 (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	EN 1.4305 (AISI 303) HUMMEL 1.693.1600.50
Dummy plug	EN 1.4305 (AISI 303) AGRO 8717.96.08.70
Conduit hub	EN 1.4404 (AISI 316L) Vaisala, DRW257718, M16×1.5 / NPT ½ in
M12 connector	Gland, EN 1.4305 (AISI 303) Contacts, CuZn with Ni/Au plating Phoenix Contact, 1405233, M12/4(M), A, 4×0.34 mm ² , TPE, 0.5 m Carrier, PA 6.6
Flange	EN 1.4404 (AISI 316L) Dimensioning and tolerances as per ASME B16.5, DIN 2543, JIS B2220
L coupling clamp, 88.9 mm	EN 1.4301 (AISI 304)
Cable	2×2×0.5 mm ² (21 AWG) PUR jacket, gray 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1
Weight	PR53GP 2" flange 7.2 kg (15.87 lb) - 7.7 kg (16.98 lb) PR53GP 3" flange 10.5 kg (23.15 lb) - 11.7 kg (25.79 lb) PR53 L coupling 5.1 kg (11.24 lb)

1) Material certificate included.

2) Manufacturer's declaration included.

Mounting accessories

Item
L coupling clamp D 88.9 mm
L coupling ferrule 88.9 / 3.6 mm PN25
L coupling blind flange 88.9 mm
L coupling gasket 88.9 / 84 mm

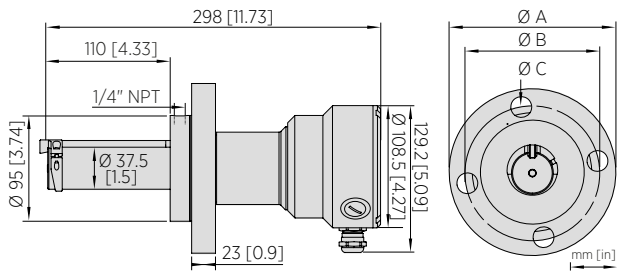
Accessories

Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft)	CBL211266-10M
Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft)	CBL211266-30M
Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft)	CBL211266-50M
Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	
Cooling cover	ASM214675SP

Calibration accessories

Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

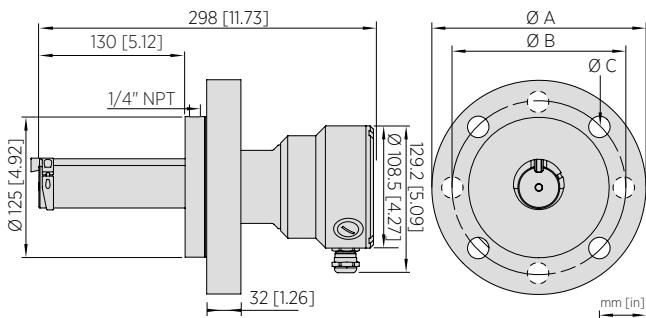
PR53GP technical data



Dimensions of PR53GP 2" flange

Dimensions of 2" flange, depth 110 mm

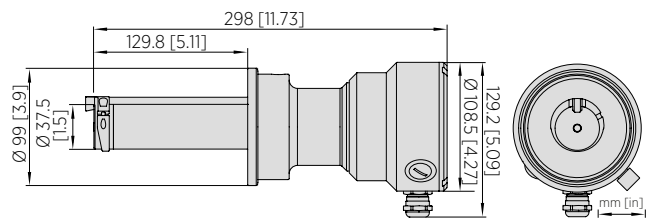
Dimension	ANSI 2"	DIN DN50	JIS 50A
ØA	152.4 mm (6 in)	165 mm (6.5 in)	155 mm (6.1 in)
ØB	120.7 mm (4.75 in)	125 mm (4.92 in)	120 mm (4.72 in)
ØC	19.1 mm (0.75 in)	18 mm (0.71 in)	19 mm (0.75 in)



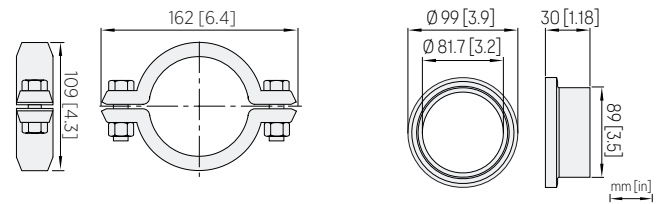
Dimensions of PR53GP 3" flange

Dimensions of 3" flange, depth 130 mm

Dimension	ANSI 3"	DIN DN80	JIS 80A
ØA	190.5 mm (7.5 in)	200 mm (7.87 in)	185 mm (7.28 in)
ØB	152.4 mm (6 in)	160 mm (6.3 in)	150 mm (5.9 in)
ØC	19.1 mm (0.75 in)	18 mm (0.71 in)	19 mm (0.75 in)



Dimensions of PR53GP L coupling 88.9 mm (3.5 in)



Dimensions of PR53GP L coupling clamp

Polaris™ PR53M PTFE-Body Process Refractometer



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 40 years of experience and continuous development, the PR53 family is the latest generation of digital process refractometers.

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 (H₂SO₄) 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.

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
(Corresponds to 0–100 °Bx)

Accuracy ± 0.00014 nD (0.1 °Bx)¹⁾

Repeatability ± 0.00002 nD²⁾

Resolution ± 0.000015 nD

Response time T_{63} with default damping 10 s³⁾

Measurement cycle 1 / s

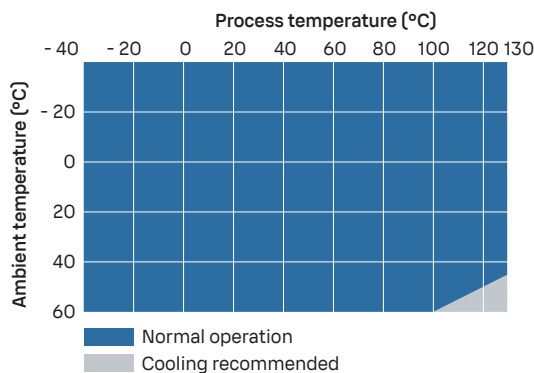
Long-term stability Max. 0.1 % full scale / a

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



PR53M process temperature (indicative)

Operating environment

Process parameters

Process temperature -10 ... +130 °C (+14 ... +266 °F)

Pressure 10 bar at 20 °C, 4.5 bar at 130 °C
(145 psi at 68 °F, 652 psi at 266 °F)

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)

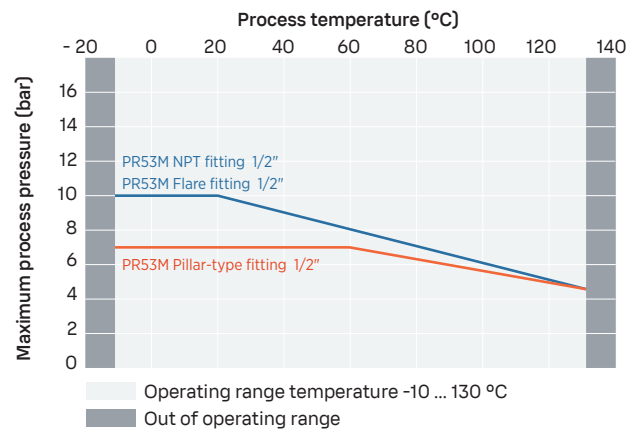
Operating humidity 0–100 %RH

Storage humidity 0–100 %RH, non-condensing

UL 50E/NEMA rating Type 4X

IP rating IP66

IP67



PR53M 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 M 4 pins, A-coded¹⁾
2 × M16×1.5 cable gland, Cable D 5–10 mm / Adapter for conduit entry
M16×1.5²⁾ / NPT 1/2"

¹⁾ For USB2 adapter and Insight software, see www.vaisala.com/insight.

²⁾ Conduit hub is not compatible with SD15 Safe-Drive system.

Compliance

Electromagnetic compatibility (EMC) EN 61326-1, industrial environment

Safety IEC/EN/UL 61010-1

Compliance marks CE, China RoHS, RCM, UKCA

Vibration and shock Tested according to

IEC 60068-2

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 W240UP ¹⁾

Non-wetted parts

Housing	Stainless steel (AISI 316)
Coating	Cerakote, white (PR53M with integrated fittings)
Screws TX20, torque 2.0 Nm	EN 1.4404 (AISI 316L)
Cable	2x2x0.5 mm ² (AWG 21), PUR jacket, gray 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1

¹⁾ Manufacturer's declaration included.

Mounting accessories

Item

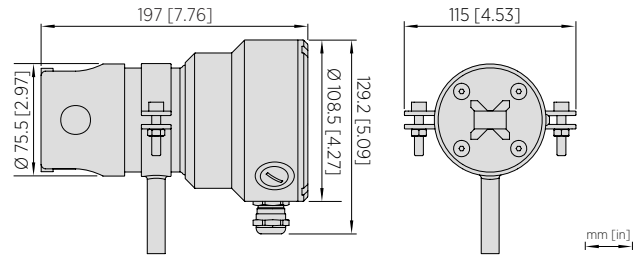
Flare fitting nut
Pillar nut and sleeve

Calibration accessories

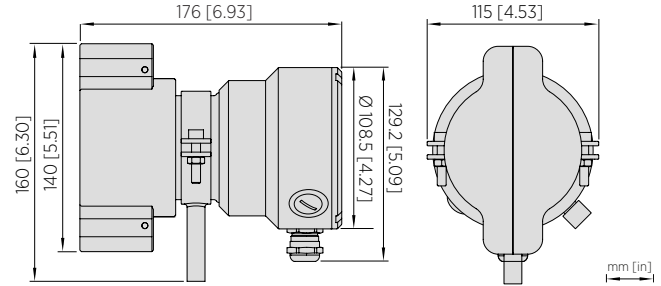
Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

Accessories

Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2x2x0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-10M
Instrument cable, 2x2x0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-30M
Instrument cable, 2x2x0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-50M
Cooling cover	ASM214675SP



Dimensions of PR53M flow cell end plate bolts (NPT fitting)



Dimensions of PR53M flow cell end plate bolts (integrated fittings, Flare and Pillar-type)

Polaris™ PR53W Valve-Body Process Refractometer



Features

- ETFE-lined valve-body flow cell with non-metallic wetted parts, for aggressive chemicals in pressurized pipelines
- Reliable optical concentration measurements with refractive index
- Hydrochloric acid, sulfuric acid, amino acid, potassium hydroxide, and more than 500 concentration curves
- Measurement not affected by bubbles, particles, suspended solids, or color
- ANSI, JIS, and DIN flanges for 2 inch process lines
- Indigo520-compatible
- Built-in 4–20 mA and Modbus RTU outputs

The Vaisala Polaris PR53W valve-body process refractometer is designed to measure concentrations of aggressive chemicals, such as sulfuric acid, hydrochloric acid (HCl), and sodium hydroxide (NaOH) in production pipelines such as in the chemical, biochemical, and pharmaceutical industries. The PR53W is mounted in a membrane-lined valve body that has no metallic wetted parts. This allows convenient flange mounting to 2 inch ANSI, JIS, and DN50 flanges.

Benefits

The optical measurement is based on the refractive index (RI). 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, 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, it is possible 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 PR53W 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.

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.

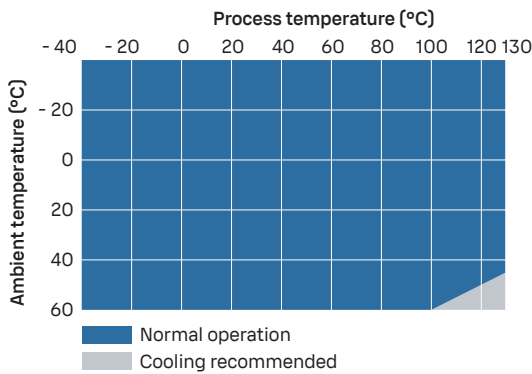
Plug and play to Indigo

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 (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



PR53W process temperature (indicative)

Operating environment

Process parameters	
Process temperature	-10 ... +130 °C (+14 ... +266 °F)
Operating pressure	10 bar (145 psi)
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
	IP67

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 M 4 pins, A-coded ¹⁾ 2 × M16×1.5 cable gland, Cable D 5–10 mm / Adapter for conduit entry M16×1.5 ²⁾ / NPT ½"

Compliance

Electromagnetic compatibility (EMC)	EN 61326-1, industrial environment
Safety	IEC/EN/UL 61010-1
Compliance marks	CE, China RoHS, RCM, UKCA
Vibration and shock	Tested according to IEC 60068-2

Mechanical specifications

Wetted parts	
Prism and sapphire plate	Sapphire monocrystalline, 99.996 % Al ₂ O ₃ ¹⁾
Valve body lining	ETFE ¹⁾
Prism gasket	Modified PTFE ¹⁾
Valve body gasket	PTFE ¹⁾
Process gasket	Kalrez W240UP ¹⁾
Valve body M10 stud	EN 1.4404 (AISI 316L) ¹⁾
Non-wetted parts	
Valve body	Cast iron ¹⁾
Housing	EN 1.4404 (AISI 316L)
Screws TX20, torque 2.0 Nm	EN 1.4404 (AISI 316L)
Cable	2×2×0.5 mm ² (AWG 21), PUR jacket, gray 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1

¹⁾ Manufacturer's declaration included

Calibration accessories

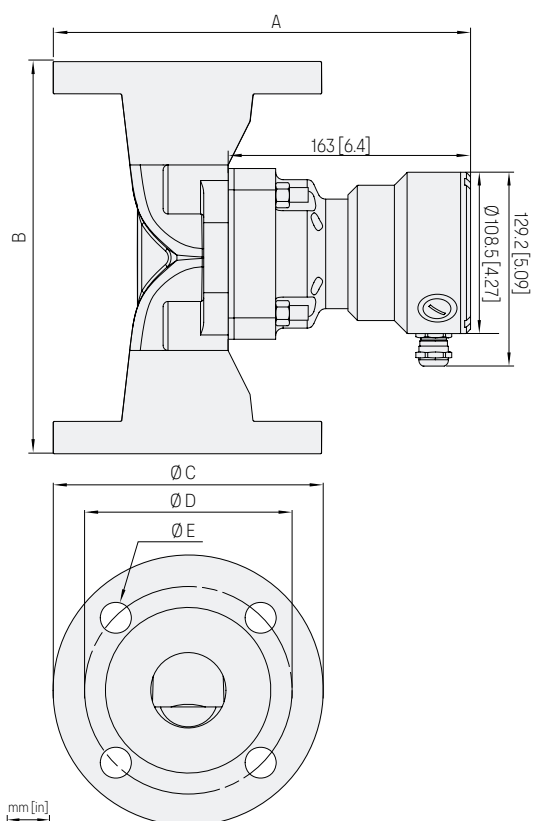
Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

Dimensions

Dimension	ANSI 2"	DIN DN50	JIS 50A
A	268 mm (10.55 in)	275 mm (10.83 in)	270 mm (10.63 in)
B	196 mm (7.7 in)	230 mm (9.1 in)	196 mm (7.7 in)
ØA	152.4 mm (6 in)	165 mm (6.5 in)	155 mm (6.1 in)
ØB	120.7 mm (4.75 in)	125 mm (4.92 in)	120 mm (4.72 in)
ØC	19.1 mm (0.75 in)	18 mm (0.71 in)	19 mm (0.75 in)

Accessories

Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-10M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-30M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-50M
Cooling cover	ASM214675SP



Dimensions of PR53W valve body

Polaris™ PR53SD Safe-Drive Process Refractometer



Features

- Designed for safe and easy retraction from pressurized process lines
- Reliable optical concentration measurements with refractive index
- Black liquor, green liquor, filtrates, and other liquids in chemical recovery line and fiberline
- SAF 2205 material for demanding environments
- Measurement not affected by bubbles, particles, suspended solids, or color
- Indigo520-compatible
- Built-in 4–20 mA and Modbus RTU outputs

The retractable Vaisala Polaris PR53SD Safe-Drive process refractometer is designed for safety-critical measurements in pulp mills, such as firing liquor concentration. The newest design of the Safe-Drive retractor system allows insertion and removal of the measurement instrument when the process is running, ensuring operator safety. Prism wash systems enable reliable measurements in various installation positions, from fiberline to brown stock washing, evaporation, black liquor firing, slaker, and lime operations. The design complies with the **BLRBAC** Recommended Good Practice Safe Firing of Black Liquor in Black Liquor Recovery Boilers.

Benefits

The optical measurement is based on the refractive index (RI). The outstanding long-term stability provides years of accurate, continuous, fast, and stable measurement for total dissolved solids and other concentration measurements, directly in the process stream. The PR53SD is designed for the critical safety measurements in pulp mills. The PR53SD measurement instrument can be retracted for maintenance without requiring process shutdown, minimizing measurement downtime. To ensure operator safety, the PR53SD and retractor prevents inadvertent errors in use: the Safe-Drive retractor tool is built into the isolation valve and ensures that

the isolation valve is always closed when the refractometer is removed from the pressurized line. The PR53SD 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.

True dissolved solids measurement

Weak liquor and black liquor are a mixture of cooking chemicals and dissolved organic material. The RI measurement responds to all dissolved solids. Bubbles, foam, particles, suspended solids, or fibers do not affect

measurement. The measurement enables process optimization through advanced process control: continuous and accurate optical measurement for true dissolved solids allows immediate reaction to process variations.

Fiberline and chemical recovery lines

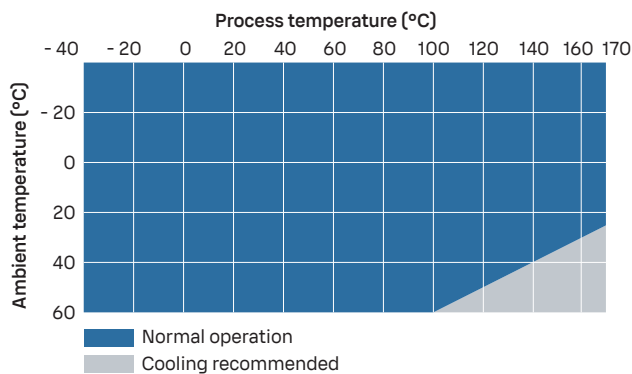
Measurement is suitable for low and medium consistency pulp, filtrates, and process liquids. In black liquor applications, total dissolved solids concentrations up to 90 % can be measured directly inline. Field-proven prism wash systems allow accurate measurement in challenging process media and conditions.

Technical data

Measurement performance

Refractive index	
Measurement range	1.32–1.53 nD (0–90 % total solids), normal-range prism 1.36–1.57 nD (20–100 % total solids), high-range prism
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 T_a = +20 °C, with standard low-pass filtering.
3) At standard low-pass filtering.



PR53SD process temperature (indicative)

Operating environment

Process parameters	
Process temperature	-40 ... +170 °C (-40 ... +338 °F)
Design temperature	+180 °C (+356 °F) ¹⁾
Design pressure / maximum operating pressure	35 bar (507.6 psi)
Maximum retraction pressure	35 bar (507.6 psi)
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 IP67

1) Maximum momentary temperature peak.

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 M 4 pins, A-coded ¹⁾ 2 × M16×1.5 cable gland, Cable D 5–10 mm / Adapter for conduit entry M16×1.5 ²⁾ / NPT ½"

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
Vibration and shock	Tested according to IEC 60068-2

Mechanical specifications

Wetted parts	
Sensor head	EN 1.4462 ¹⁾
Prism	Sapphire monocrystalline, 99.996 % Al ₂ O ₃ ²⁾
Process gasket	Co-Cr-Ni Alloy (AMS 5876) lined PTFE ²⁾
Prism gasket	Modified PTFE ²⁾
SD flange	EN 1.4462 ¹⁾
Wash nozzle	EN 1.4462 ²⁾
Non-wetted parts	
Housing	EN 1.4404
Screws, TX20 torque 2.0 Nm	EN 1.4404 (AISI 316L)
Stud bolts, M12 torque 75 Nm, M10 torque 40 Nm	EN 1.4435 (AISI 316L), grade 8.8
Flanges (3 pcs)	EN 1.4462 (AISI 2205) ASME B16.5, DIN 2543
Cable	2×2×0.5 mm ² (AWG 21), PUR jacket, grey 10 m multistrand, with ferrules Flame-retardant acc. to IEC 60332-1-2, FT1, VW1
Weight	Retractor and wash connection 15 kg (33.07 lb) Refractometer 5.4 kg (11.9 lb)

1) EN 10204 / 3.1 certificate included.
2) Manufacturer's declaration included.

Mounting accessories

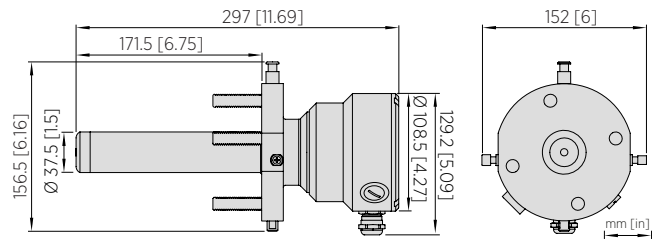
Item	Item code
Blind flanges for SDI5, spare kit	278299SP

Calibration accessories

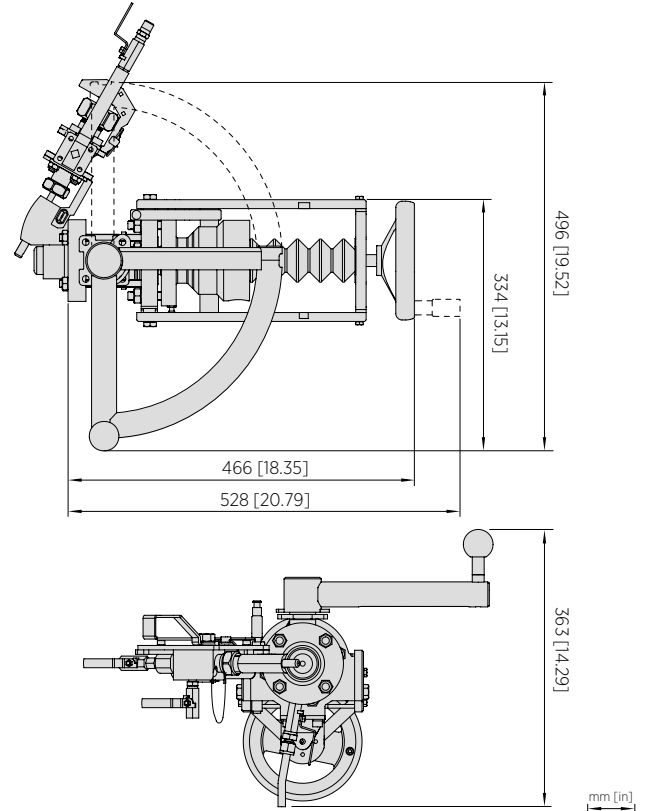
Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

Accessories

Item	Item code
USB adapter for service port, for Insight service software (see www.vaisala.com/insight)	USB2
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 10 m (33 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-10M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 30 m (98 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-30M
Instrument cable, 2×2×0.5 mm ² (AWG 21), PUR jacket, grey, open ends, 50 m (164 ft) Flame-retardant acc. to IEC 60332-1-2, FT1, VW1	CBL211266-50M
Cooling cover	ASM214675SP



Dimensions of PR53SD



Dimensions of PR53 SDI5 Safe-Drive isolation valve and retractor