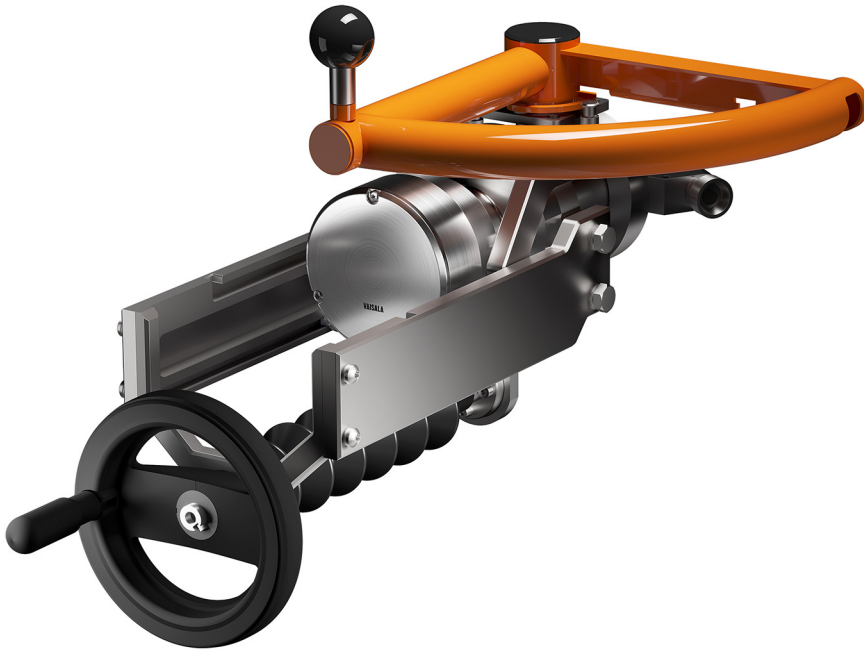


Polaris™ PR53SD Safe-Drive Process Refractometer



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 and Indigo80 compatible
- Built-in 4–20 mA, HART, 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
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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⁾

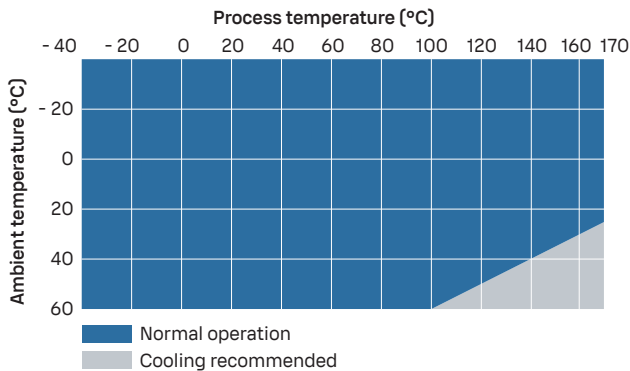
Sensor class F0.15 IEC 60751

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

Maximum load 600 Ω

Accuracy of analog outputs at +20 °C ±0.1 % of full scale (±0.00002 RI)

Supported protocol HART 7

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 7
2 × M16×1.5 cable gland, Cable D 5–10 mm / 2 × adapter for conduit entry M16×1.5 ²⁾ / NPT ½"

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

²⁾ Thread adapter is not compatible with SD15 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 1.4462 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

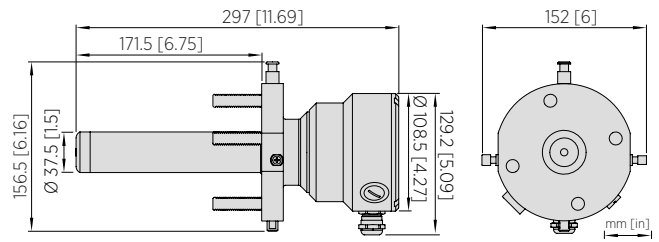
Item	Item code
Blind flanges for SDI5, spare kit	278299SP

Calibration accessories

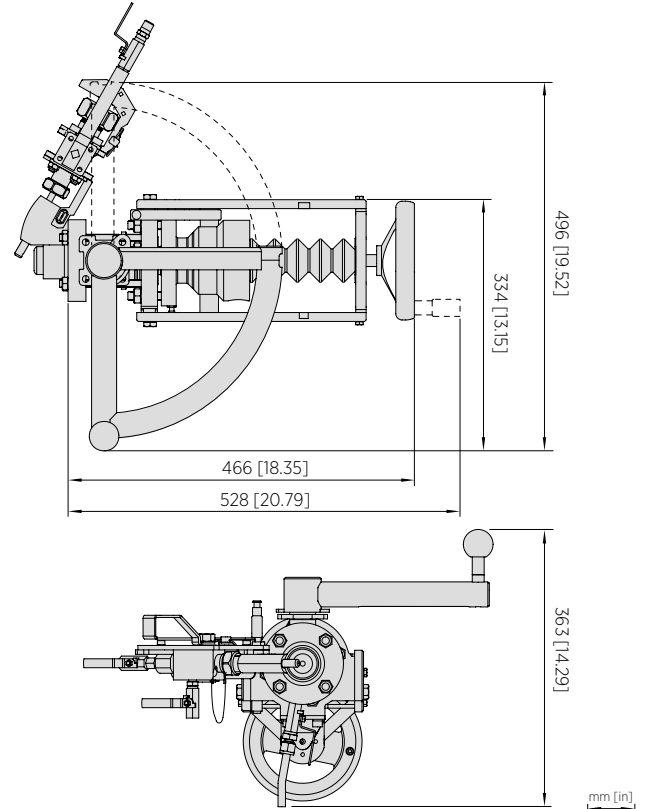
Item	Item code
Verification kit 1.33, 1.37, 1.42, 1.47, 1.52	280380SP
Calibration kit 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.40, 1.42, 1.45, 1.47, 1.50, 1.52, 1.53, 1.57	278292SP
High-range special kit 1.42, 1.47, 1.53, 1.57, 1.60, 1.62, 1.67, 1.72	278293SP
Sample holder and cover	278295SP

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

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