

Instruction Manual

Vaisala K-PATENTS® Process Refractometer
PR-43-GC/GP



VAISALA

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General safety considerations

The process medium may be hot or otherwise hazardous. Use **shields and protective clothing** adequate for the process medium - do not rely on avoidance of contact with the process medium.

Manufacturer recommends to wear:

- long-sleeved safety clothing
- protective gloves
- safety glasses and/or goggles
- visor
- hard hat or helmet
- hard-cap safety boots

Precautions when removing a refractometer from the process line :

- Check first that the process line is depressurized and drained.
- Ensure you stay clear of any possible spillage and you have a clear emergency escape path.
- locate the nearest emergency shower and eye wash before starting work

Please note that it is the user's responsibility to follow manufacturer's safety and operating instructions. The client's organization has the responsibility to develop and maintain occupational safety and create a safe working environment and a safety culture where individuals are expected to follow safety instructions at all times. Any negligence towards safety instructions or failure to comply with safe practices should not be tolerated.

Disposal

When wishing to dispose of an obsolete refractometer or any parts of a refractometer, please observe local and national regulations and requirements for the disposal of electrical and electronic equipment.



Symbols and terms used in this manual:



This indicates a **warning**. It provides safety precaution information needed to avoid injury while operating the refractometer system.



This indicates that something is **important** for the operation of the refractometer system.

Note. Notes contain additional information and hints.

This product manual is delivered to the end user with a Vaisala product. Information in this manual is subject to change without notice. When the manual is changed, a revised copy is published at <http://www.vaisala.com/>

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

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1 Refractometer

Compact process refractometer PR-43-GC is designed for the general industry small pipeline and bypass line applications, e.g. in chemical, oil, gas, petrochemical and kraft pulping process. Probe process refractometer PR-43-GP is a general industry model that is typically installed in large pipes and vessels.

The PR-43-GC and PR-43-GP measure the refractive index n_D and the temperature of the process medium. The concentration of the process liquid is calculated from these values when the composition of the process medium is known.

The output values of the refractometer are transmitted through mA output and digitally through an Ethernet connection by using a UDP/IP protocol (see the general manual for specifications). mA output is available with mA output cable (mA only) or with a split cable (mA and Ethernet).



PR-43-GC

PR-43-GP

Figure 1.1 Refractometer models

2 Mounting

The refractometer mounting location should be chosen with care to ensure reliable readings from the process.

2.1 Choosing the mounting location

Select a mounting location where sediments or gas bubbles cannot accumulate by the refractometer, such as in an outer corner of a pipe bend.



Important: If the process pipe vibrates, support the pipe. A vibrating pipe might damage the in-line refractometer mounted on it.

A Vaisala K-PATENTS® inline refractometer can be located either indoors or outdoors in most climates. However, when a refractometer is located outdoors, some basic protection against direct exposure to sunlight and rain should be provided. Special care should be taken if the pipe wall is translucent (e.g. of fiberglass), as light from outside reaching the prism through the pipe wall may disturb the measurement.

The refractometer cover should not be exposed to high temperature radiation. In most cases, draft and natural convection provide sufficient air cooling if the air gets to flow freely around the refractometer head.

Additional cooling is necessary when the ambient temperature is higher than 45 °C (113 °F) or when the process temperature is above 110 °C (230 °F) and the ambient temperature is above 35 °C (95 °F). The air cooling is improved by blowing pressurized air against the refractometer cover. The pressurized air can be supplied by the ventilation system. Another option is to install a water-cooled cooling cover PR-14038.

2.2 Electrical connections

The refractometer has an M12 connector in the refractometer for power supply, mA output and Ethernet connections.

PR-43 refractometers are powered with 24 VDC. For connecting the refractometer to Multichannel user interface MI, see the manual for Multichannel user interface. For connecting the refractometer to Compact user interface CI, see the manual for Compact



Figure 2.1 The M12 connector

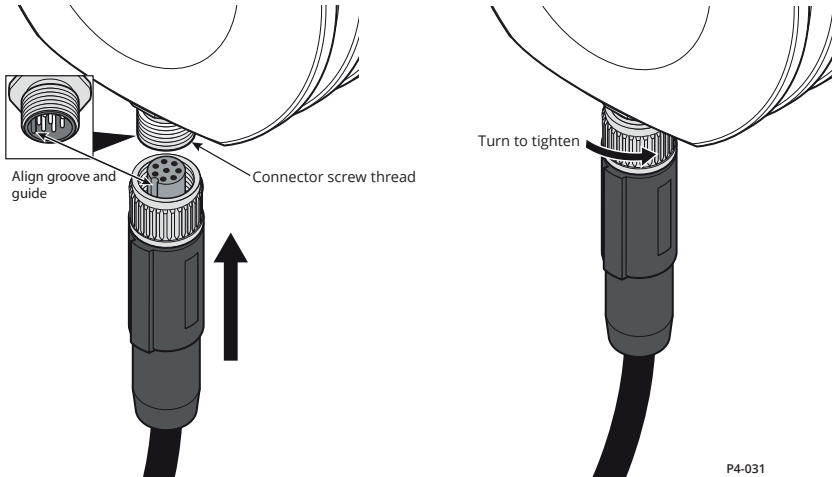


Figure 2.2 Connecting the refractometer cable to the refractometer

user interface. See Figure 2.2 for instruction how to connect the M12 refractometer cable.

2.2.1 Wiring options

The PR-43 refractometer provides both analogue (mA) and digital output signals. See Figure 2.3 for the wiring when only analogue output is used.

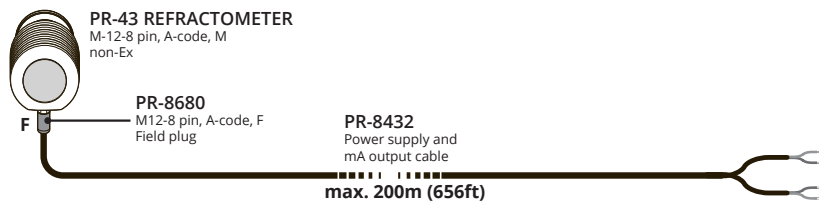


Figure 2.3 Wiring with analogue output only

Options for connecting the refractometer with both analogue and digital outputs are shown in Figure 2.4. Both Compact user interface CI and Multichannel user interface MI use the digital output signal.

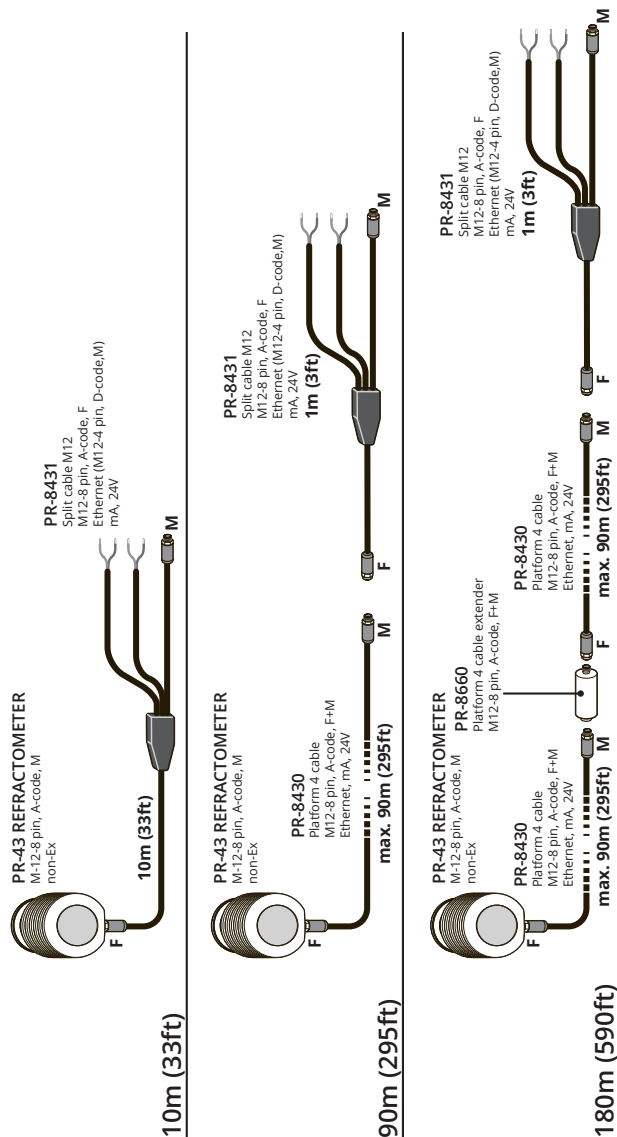


Figure 2.4 Wiring options when both analogue and digital outputs are used, with M12 ethernet connector

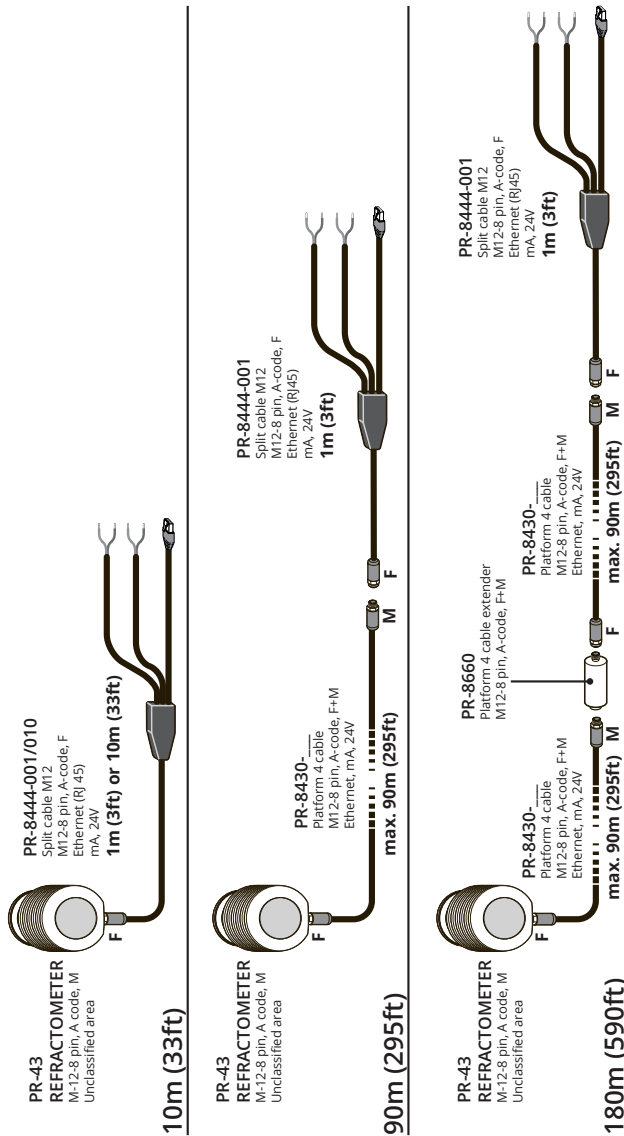


Figure 2.5 Wiring options when both analogue and digital outputs are used, with RJ45 ethernet connector

RJ45				M12			
Pairs				Pairs			
1	2	Pin	Colour	1	2	3	4
x		1	wh/og	x			6
x		2	og	x			4
					x		1
					x		7
x		3	wh/gn		x		5
x		6	gn		x		8
						x	2
						x	3
							Signal
							Eth TX+
							Eth TX-
							mA+
							mA-
							Eth RX+
							Eth RX-
							VDD
							GND

Figure 2.6 Connections in M12 and RJ-45 connectors

In split cables the power cable and the mA output cable are marked near the end of the cable.

Power cable:

- white: +24 DC
- brown: GND

mA output cable:

- white: mA+
- brown: mA-

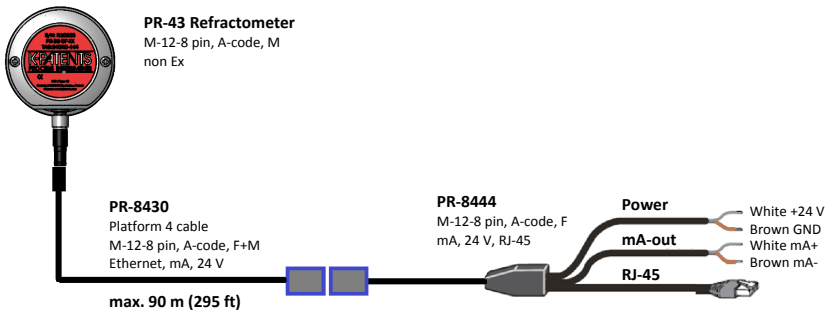


Figure 2.7 PR-8444 connections

2.3 Insulation solutions

The process refractometer benefits from low ambient and high process temperatures with as little heat transfer as possible between the environment and the process. In good thermal conditions the hot prism surface is less susceptible to fouling, requiring less washing and saving the refractometer prism. Furthermore, insulation prevents heat transfer from the process to the electronics, ensuring error-free operation and longer lifetime for the electronics. Vaisala has developed custom-made removable insulation solutions for PR-43-GP.

2.3.1 Thermal insulator for PR-43-GP

The thermal insulator is installed in the manufacturing phase between the flange and the wash nozzle (if nozzle is present). If there is no wash nozzle, the thermal insulator can be installed at any time. It is made of PTFE and is water and chemical resistant. The thermal insulator keeps the electronics in an optimal and stable temperature of under 65 °C (150 °F). With the thermal insulator process temperatures can reach up to 180 °C (355 °F) without harming the refractometer electronics.

PR-7056-NC	Thermal insulator for PR-43-GP-A20/D50/J50
PR-7057-NC	Thermal insulator for PR-43-GP-A30/D80/J80

Table 2.1 Thermal insulator product models



Warning! If a PR-43-GP refractometer with insulator is installed in an explosive atmosphere, explosion hazard can be caused by an electrostatic charge generated in the insulator. In the presence of an explosive atmosphere, a PR-43-GP refractometer with thermal insulator shall only be used for measuring liquids with high conductivity (> 10000 pS/m).

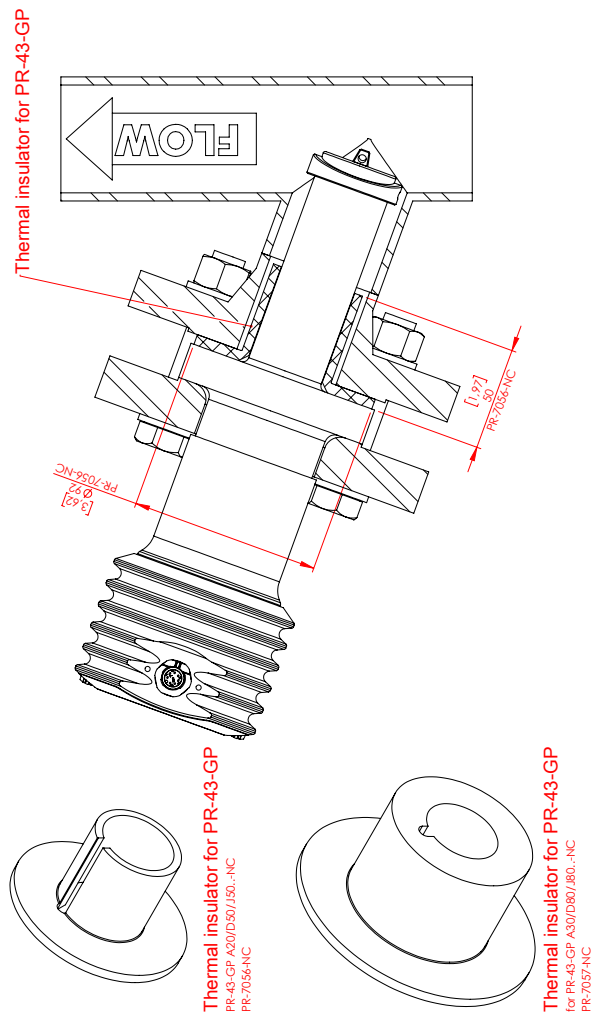


Figure 2.8 Thermal insulator

2.3.2 Flange thermal cover for PR-43-GP

The flange thermal cover is an option recommended when process temperature is 30 °C (86 °F) or more above the ambient temperature. The cover minimizes heat transfer between the environment and the process, keeping the prism hot and the refractometer electronics cool. The cover is easy to install, remove and reinstall and is made from chemically and water resistant materials.

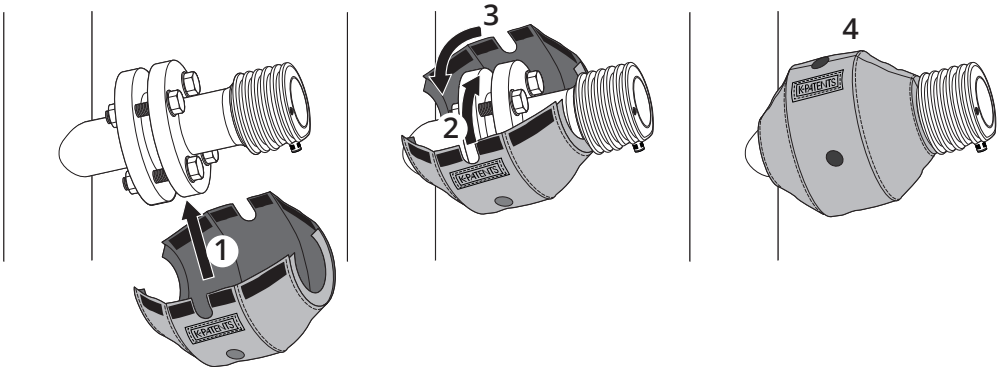


Figure 2.9 Mounting the thermal cover

- 1. Bring the cover up from beneath the flange
- 2. Bring the left-hand side to the middle
- 3. Bring the right-hand side to the middle and stick the velcro fasteners together

The hole in the middle of the velcro fasteners is for wash option.

PR-7061	Flange thermal cover for GP A20/D50/J50
PR-7062	Flange thermal cover for GP A30/D80/J80

Table 2.2 Thermal cover models

Cover fabric	Silicon coated polyester
Velcro strip	Polyphenylene sulphide (PPS)
Sewing thread	Aramid

Table 2.3 Thermal cover materials

3 Specifications

3.1 Compatibility

Electrically: The PR-43 refractometers are *not* interchangeable with any other refractometer model. All PR-43-GC/GP refractometers are however interchangeable with each other as long as they have the same prism. The PR-43-GC/GP refractometers are *not* compatible with the Indicating transmitters DTR, STR or IT-R.

Mechanically: Compact process refractometer PR-43-GC with 76.1 mm Sandvik coupling fits the same process connection as PR-23-GC and PR-03-D. PR-43-GP fits same process connection as PR-23-GP 3" and 4" refractometers and PR-01-S-GP refractometer.

3.2 PR-43-GC specifications

3.2.1 Model code

COMPACT REFRACTOMETER

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-GC = Compact type for pipeline installations	-GC
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D Sapphire prism	-73
-74 = R.I. 1.260-1.470 n_D Sapphire prism	-74
-82 = R.I. 1.410-1.620, YAG prism	-82
-92 = R.I. 1.520-1.730, GGG prism	-92
Connection type and size	
-K76-P25 = Sandvik L coupling, 76.1 mm, 25 bar, insertion length 14 mm	-K76-P25
-K60-P40 = Sandvik L coupling, 60.3 mm, 40 bar, insertion length 14 mm (A)	-K60-P40
Refractometer wetted parts material	
-SS = AISI 316 L	-SS
-HA = Alloy 20	-HA
-HC = Alloy C276	-HC
-NI = Nickel 200	-NI
-TI = Titanium ASTM B348 GR 2	-TI
-XS = SAF2205	-XS
-SU = AISI 904L	-SU
Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T_{amb} -40...+65°C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T_{amb} -40 ... +65°C)	-IA

(A) SS, AISI 316 L only

GENERAL FLOW CELL GFC FOR SANDVIK L COUPLING 60.3MM

GFC	Flanges	ANSI	150	0.5" GFC-K60-P40-XX-A05-P150-SN/WP/WN-PG	DIM:4871 MTG:4861
			300	1" GFC-K60-P40-XX-A10-P150-SN/WP/WN-PG	DIM:4878 MTG:4862
		DIN	PN40	0.5" GFC-K60-P40-XX-A05-P300-SN/WP/WN-PG	DIM:4871 MTG:4861
			PN40	1" GFC-K60-P40-XX-A10-P300-SN/WP/WN-PG	DIM:4878 MTG:4862
		JIS	10K	DN15 GFC-K60-P40-XX-D15-P40-SN/WP/WN-PG	DIM:5031 MTG:5033
			10K	DN25 GFC-K60-P40-XX-D25-P40-SN/WP/WN-PG	DIM:5032 MTG:5035
	Threads	R 7/1	-	15 GFC-K60-P40-XX-J15-P10-SN/WP/WN-PG	DIM:5008 MTG:5037
			-	25 GFC-K60-P40-XX-J25-P10-SN/WP/WN-PG	DIM:5023 MTG:5036
		NPT	-	0.5" GFC-K60-P40-XX-R05-SN/WP/WN-PG	DIM:4880 MTG:4883
			-	1" GFC-K60-P40-XX-R10-SN/WP/WN-PG	DIM:4881 MTG:4884
		NPT	-	0.5" GFC-K60-P40-XX-N05-SN/WP/WN-PG	DIM:4880 MTG:4883
			-	1" GFC-K60-P40-XX-N10-SN/WP/WN-PG	DIM:4881 MTG:4884

XX indicates flow cell material. The options are listed in Table 3.1 below.

Material	Code
AISI 316 L	SS

Table 3.1 General flow cell materials

3.2.2 Specifications

	Standard	Optional
REFRACTOMETER PR-43-GC Models	PR-43-GC Compact model for small pipelines	
Refractive Index range	Full range, $n_D = 1.3200...1.5300$ corresponds to hot water...100 % by weight.	n_D 1.260-1.470, Sapphire prism n_D 1.410-1.620, YAG prism n_D 1.520-1.730, GGG prism
Accuracy	Across the full range: Refractive Index $n_D \pm 0.0002$ corresponds typically to ± 0.1 % by weight	
Repeatability	Across the full range: $n_D \pm 0.00004$ (corresponds typically to ± 0.02 % by weight).	
Speed of response	1 s undamped, damping time selectable up to 5 min	
Calibration	With NIST traceable Cargille standard R.I. liquids over full range	

	Standard	Optional
Patented CORE-Optics	No mechanical adjustments and digital measurement with 3648 pixel CCD element, sodium D-line light emitting diode (LED) built-in Pt-1000 temperature sensor (linearization according to IEC 751).	
Temperature compensation	Automatic, digital compensation.	
Instrument verification	With NIST traceable Cargille standard R.I. liquids and guided procedure, including a printable verification report	
Process connection	By Sandvik coupling L 76.1 (2.5 inch) for pipeline sizes of 2.5 inch and larger; via reducing ferrule PR-9283 for 2 inch pipes; via Wafer flow cell WFC for pipeline sizes 15 mm (0.5 inch), 25 mm (1 inch) and 40 mm (1.5 inch); Wafer flow cell body mounts between ANSI 150 psi, DIN PN 25 or JIS By Sandvik L 60.3 (2 inch) for pipeline sizes 1.5 inch and larger via reducing ferrule PR-9285	
Process pressure	For Sandvik 76.1 up to 25 bar (350 psi) at 20 °C (70 °F) For Sandvik L 60.3 up to 40 bar (580 psi) at 20 °C (70 °F)	
Process temperature	-40°C...130°C (-40°F...266°F)	
Ambient temperature	Min. -40°C (-40°F), max. 45°C (113°F)	
Process wetted parts	AISI 316L stainless steel, prism sapphire, prism gasket modified PTFE (Teflon)	Alloy 20 Alloy C276 Nickel 200 Titanium ASTM B348 GR 2 SAF2205 AISI 904L
Refractometer protection class	IP67, Type 4X	
Refractometer weight	1.6 kg (3.5 lbs)	
Current output	Isolated 4-20 mA, max. load 1000 Ohm, galvanic isolation 1000 VDC or AC (peak)	
Remote and Ethernet connections	10/100BaseT Ethernet, web server for configuration and diagnostics, UDP/IP Protocol connection for data acquisition.	
Power supply	+24 VDC ±10%, max. 2 VA	
INTERCONNECTING CABLES	Standard length 10 m. Single cable maximum length 90 meters, with cable extender PR-8660 maximum length 90+90 meters.	

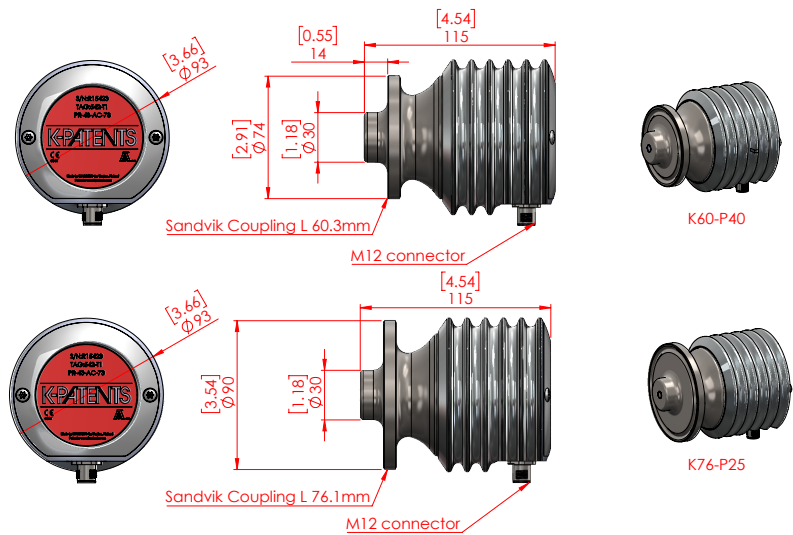


Figure 3.1 PR-43-GC dimensions

3.2.3 Mounting specifics

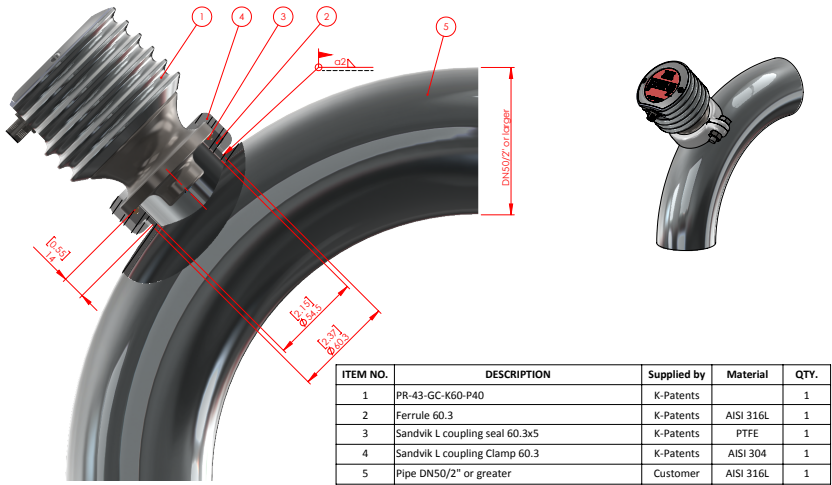


Figure 3.2 Mounting PR-43-GC-K60

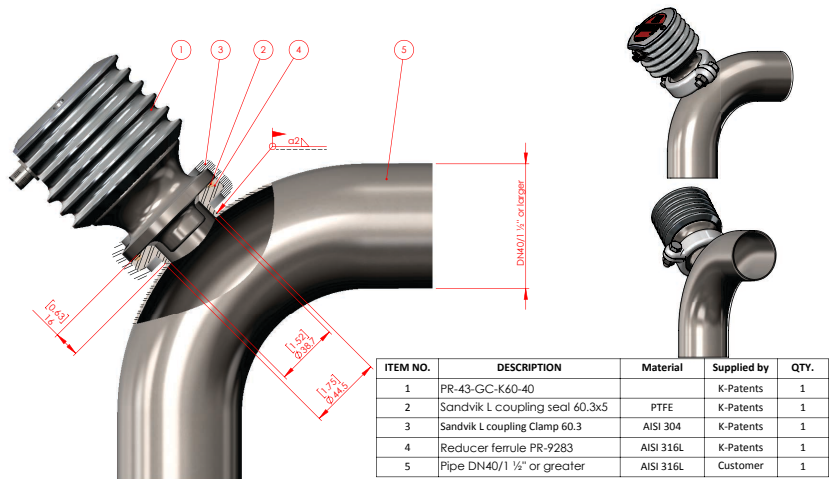


Figure 3.3 Mounting PR-43-GC-K60 with reducer ferrule

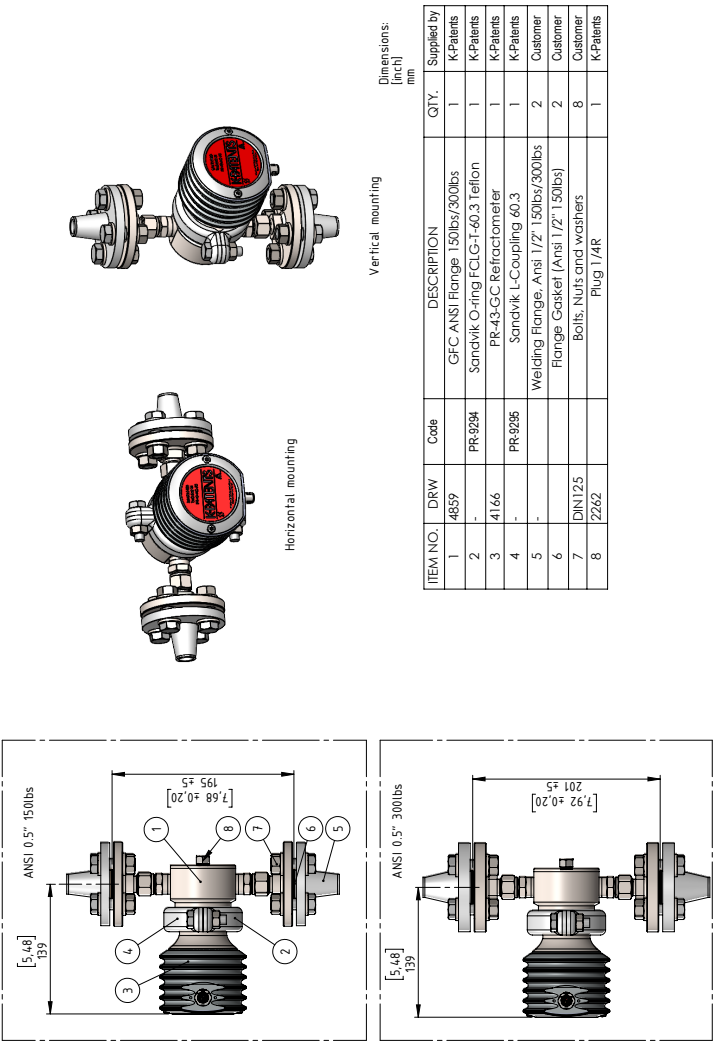


Figure 3.4 Mounting a General Flow Cell with flange connection

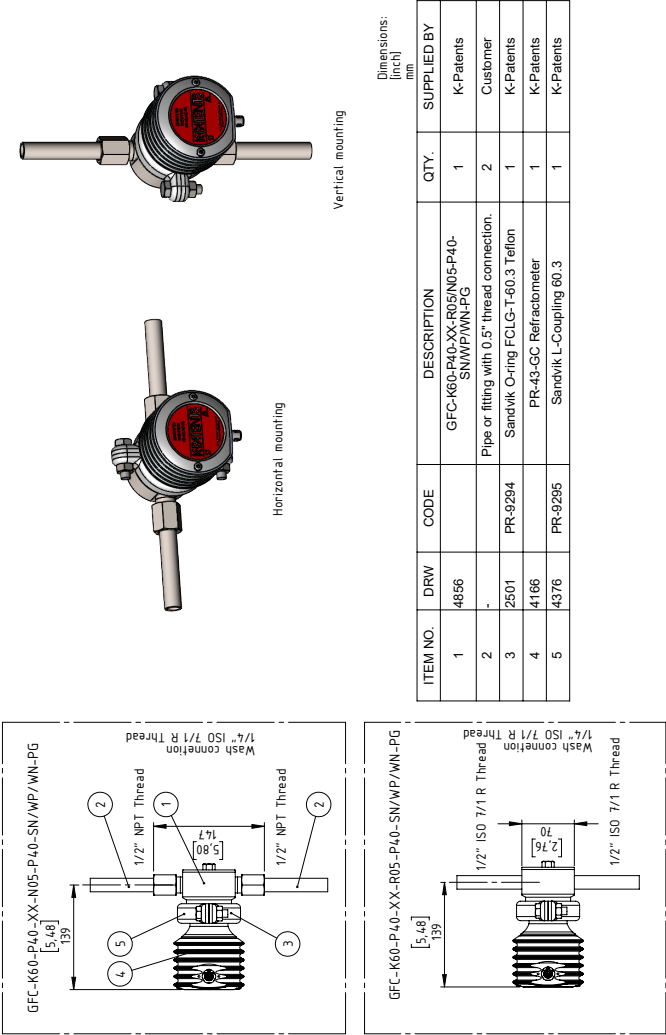


Figure 3.5 Mounting a General Flow Cell with threaded connection

3.3 PR-43-GP specifications

3.3.1 Model code

GENERAL PROCESS REFRACTOMETER, 2" flanged version, for large pipelines and vessels

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-GP = General Process Refractometer, probe	-GP
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D Sapphire prism	-73
-74 = R.I. 1.260-1.470 n_D Sapphire prism	-74
-82 = R.I. 1.410-1.620, YAG prism	-82
-92 = R.I. 1.520-1.730, GGG prism	-92
Connection type and size	
-A20-P150 = ANSI 2" flange, 150 lbs	-A20-150
-A20-P300 = ANSI 2" flange, 300 lbs	-A20-P300
-D50-P25 = DIN flange DN50, PN25	-D50-P25
-J50-P10 = JIS flange 10k 50A	-J50-P10
Insertion length	
-L110 = Insertion length 110 mm	-L110
Refractometer wetted parts material	
-SS = AISI 316 L	-SS
-HA = Alloy 20	-HA
-HC = Alloy C276	-HC
-NI = Nickel 200	-NI
-TI = Titanium ASTM B348 GR 2	-TI

Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T_{amb} -40...+65°C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T_{amb} -40 ... +65°C)	-IA
Wash nozzle connection	
-NC = Integral nozzle connection	-NC
-SN = Integral steam nozzle, AISI 316L	-SN
-WP = Integral pressurised water nozzle, AISI 316L	-WP
-WN = Integral water nozzle, AISI 316L	-WN
-YC = No integral nozzle connection	-YC

GENERAL PROCESS REFRACTOMETER, 3" and 4" flange or Sandvik L coupling, for large pipelines and vessels

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-GP = General Process Refractometer, probe	-GP
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D Sapphire prism	-73
-74 = R.I. 1.260-1.470 n_D Sapphire prism	-74
-82 = R.I. 1.410-1.620, YAG prism	-82
-92 = R.I. 1.520-1.730, GGG prism	-92
Connection type and size	
-A30-P150 = ANSI 3" flange, 150 lbs	-A30-150
-A30-P300 = ANSI 3" flange, 300 lbs	-A30-P300
-A40-P150 = ANSI 4" flange, 150 lbs	-A40-150
-A40-P300 = ANSI 4" flange, 300 lbs	-A40-P300
-D80-P25 = DIN flange DN80, PN25	-D80-P25
-D100-P25 = DIN flange DN100, PN25	-D100-P25

-J80-P10 = JIS flange 10k 80A	-J80-P10
-J100-P10 = JIS flange 10k 100A	-J100-P10
-K88-P25 = Sandvik L coupling 88.9 mm, 25 bar	-K88-P25
Insertion length	
-L130 = Insertion length 130 mm	-L130
Refractometer wetted parts material	
-SS = AISI 316 L	-SS
-HA = Alloy 20	-HA
-HC = Alloy C276	-HC
-NI = Nickel 200	-NI
-TI = Titanium ASTM B348 GR 2	-TI
Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T_{amb} -40...+65°C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T_{amb} -40 ... +65°C)	-IA
Wash nozzle connection	
-NC = Integral nozzle connection	-NC
-SN = Integral steam nozzle, AISI 316L	-SN
-WP = Integral pressurised water nozzle, AISI 316L	-WP
-WN = Integral water nozzle, AISI 316L	-WN
-YC = No integral nozzle connection	-YC

GENERAL PROCESS REFRACTOMETER, Sandvik L 76.1 mm, insertion length 12 mm

Model and description	Model
PR-43 = Refractometer	PR-43
Refractometer model	
-GP = General Process Refractometer, probe	-GP
Prism material and Refractive Index range limit	
-73 = R.I. 1.320-1.530 n_D Sapphire prism	-73
-74 = R.I. 1.260-1.470 n_D Sapphire prism	-74
-82 = R.I. 1.410-1.620, YAG prism	-82
-92 = R.I. 1.520-1.730, GGG prism	-92
Connection type and size	
-K76-P25 = Sandvik L coupling, 76.1 mm, 25 bar	-K76-P25
Insertion length	
-L12 = Insertion length 12 mm	-L12
Refractometer wetted parts material	
-SS = AISI 316 L	-SS
Electrical classification	
-UN = Unclassified area, general purpose, ordinary location	-UN
-AX = EX and IECEx certified Ex II 3G, Ex nA IIC T4 Gc (up to zone 2) (T_{amb} -40...+65°C)	-AX
-IA = ATEX and IECEx certified Ex II 1G, Ex ia IIC T4 Ga (up to zone 0) (T_{amb} -40 ... +65°C)	-IA

FLOW THROUGH CELLS FTC

FTC		Flange connection					
ANSI		150lbs		0.5"	FTC-A20-P150-XX-A05	DIM:5047	MTG:5049
				1"	FTC-A20-P150-XX-A10	DIM:4394	MTG:4123
				1.5"	FTC-A20-P150-XX-A15	DIM:5045	MTG:5048
				2"	FTC-A20-P150-XX-A20	DIM:4392	MTG:4269
				welding	FTC-A20-P150-XX-Y05	DIM:4397	MTG:4391
300lbs		0.5"	FTC-A20-P300-XX-A05	DIM:5047	MTG:5049		
		1"	FTC-A20-P300-XX-A10	DIM:4394	MTG:4123		
		1.5"	FTC-A20-P300-XX-A15	DIM:5045	MTG:5048		
		2"	FTC-A20-P300-XX-A20	DIM:4392	MTG:4269		
		2"	FTC-A20-P300-SS-A20-NC-PG/FN	DIM:4849	MTG:4851		
		welding	FTC-A20-P300-XX-Y05	DIM:4397	MTG:4391		
DIN		PN25		DN10	FTC-D50-P25-XX-D10	DIM:5059	MTG:5079
				DN25	FTC-D50-P25-XX-D25	DIM:4395	MTG:4267
				DN40	FTC-D50-P25-XX-D40	DIM:5057	MTG:5069
				DN50	FTC-D50-P25-XX-D50	DIM:4393	MTG:4273
				welding	FTC-D50-P25-XX-Y05	DIM:4398	MTG:4390
JIS		10K		10A	FTC-J50-P10-XX-J10	DIM:5060	MTG:5080
				25A	FTC-J50-P10-XX-J25	DIM:4442	MTG:4443
				40A	FTC-J50-P10-XX-J40	DIM:5058	MTG:5076
				50A	FTC -J50-P10-XX-J50	DIM:4446	MTG:4447
				welding	FTC-J50-P10-XX-Y05	DIM:4439	MTG:4440

XX indicates flow cell material. The options are listed in Table 3.2 below.

Material	Code
AISI 316 L	SS
Alloy 20	HA
Alloy C276	HC
Nickel 200	NI
Titanium ASTM B348 GR 2	TI

Table 3.2 Flow through cell materials

3.3.2 Specifications

	Standard	Optional
REFRACTOMETER PR-43-GP Models	PR-43-GP, general process refractometer, 2", 3", 4" and flange and L coupling versions probe, for large pipelines and vessels	
Refractive Index range	Full range, $n_D = 1.3200 \dots 1.5300$ corresponds to hot water...100 % by weight.	n_D 1.260-1.470, Sapphire prism n_D 1.410-1.620, YAG prism n_D 1.520-1.730, GGG prism
Accuracy	Across the full range: Refractive Index $n_D \pm 0.0002$ corresponds typically to ± 0.1 % by weight	
Repeatability	Across the full range: $n_D \pm 0.00004$ (corresponds typically to ± 0.02 % by weight).	
Speed of response	1 s undamped, damping time selectable up to 5 min	
Calibration	With NIST traceable Cargille standard R.I. liquids over full range	
Patented CORE-Optics	No mechanical adjustments and digital measurement with 3648 pixel CCD element, sodium D-line light emitting diode (LED) built-in Pt-1000 temperature sensor (linearization according to IEC 751).	
Temperature compensation	Automatic, digital compensation.	
Instrument verification	With NIST traceable Cargille standard R.I. liquids and guided procedure, including a printable verification report	
Process connection	Flanges: ANSI 2", 3" or 4" with 150 lbs or 300 lbs, DIN 80 or DIN 100 PN25, JIS 50A, 80A or 100A with 10k; Sandvik L coupling 88 mm	
Process pressure	Flange connections up to 25 bar (350 psi)	
Process temperature	$-40^{\circ}\text{C} \dots 150^{\circ}\text{C}$ ($-40^{\circ}\text{F} \dots 300^{\circ}\text{F}$)	
Ambient temperature	Min. -40°C (-40°F), max. 45°C (113°F)	
Process wetted parts	AISI 316L stainless steel, prism sapphire, prism gasket modified PTFE (Teflon)	Alloy 20 Alloy C276 Nickel 200 Titanium ASTM B348 GR 2
Refractometer protection class	IP67, Type 4X	
Refractometer weight	PR-43-GP-DN50 without wash 6.7 kg (14.7 lbs)	
Current output	Isolated 4-20 mA, max. load 1000 Ohm, galvanic isolation 1000 VDC or AC (peak)	

	Standard	Optional
Remote and Ethernet connections	10/100BaseT Ethernet, web server for configuration and diagnostics, UDP/IP Protocol connection for data acquisition.	
Power supply	+24 VDC ±10%, max. 2 VA	
INTERCONNECTING CABLES	Standard length 10 m. Single cable maximum length 90 meters, with cable extender PR-8660 maximum length 90+90 meters.	

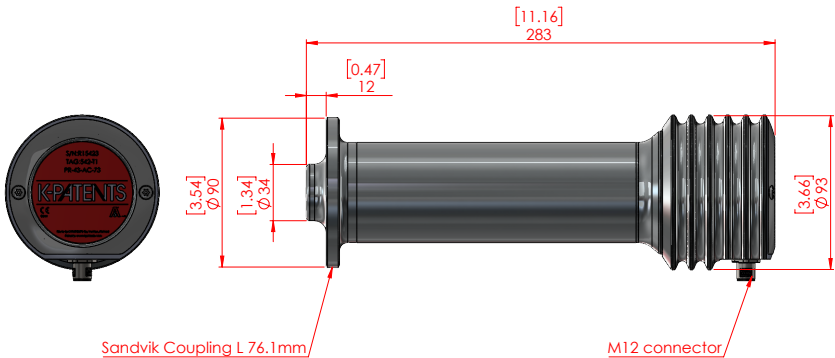


Figure 3.6 PR-43-GP-73-K76-P25-L12-SS-... dimensions

3.3.3 Mounting specifics

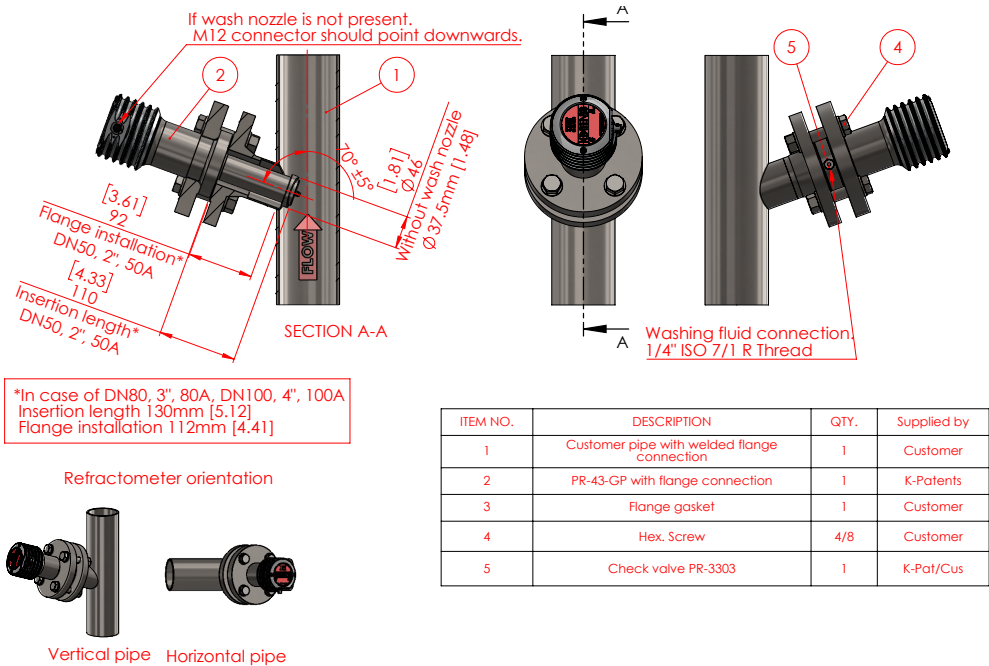


Figure 3.7 Mounting PR-43-GP with flange connection

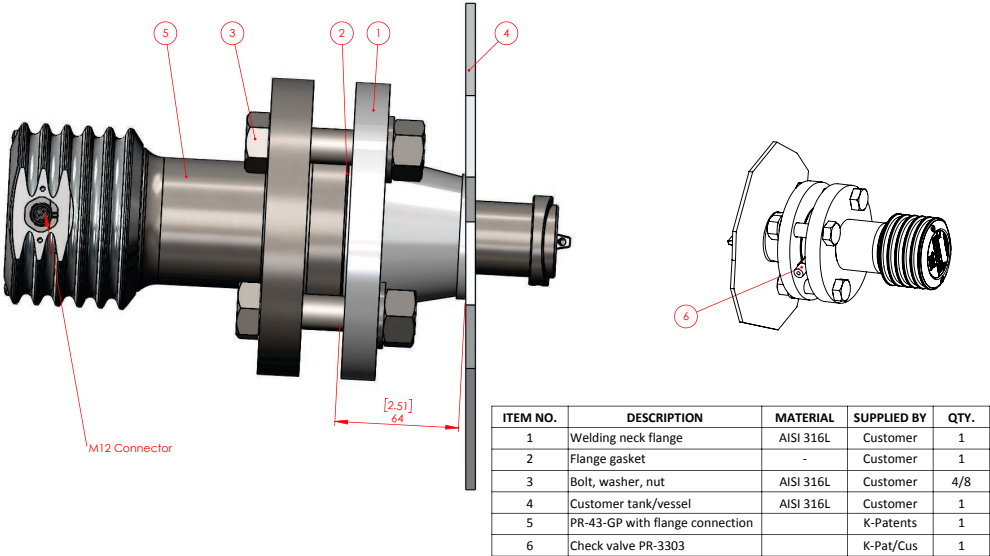


Figure 3.8 Mounting PR-43-GP to a tank or vessel

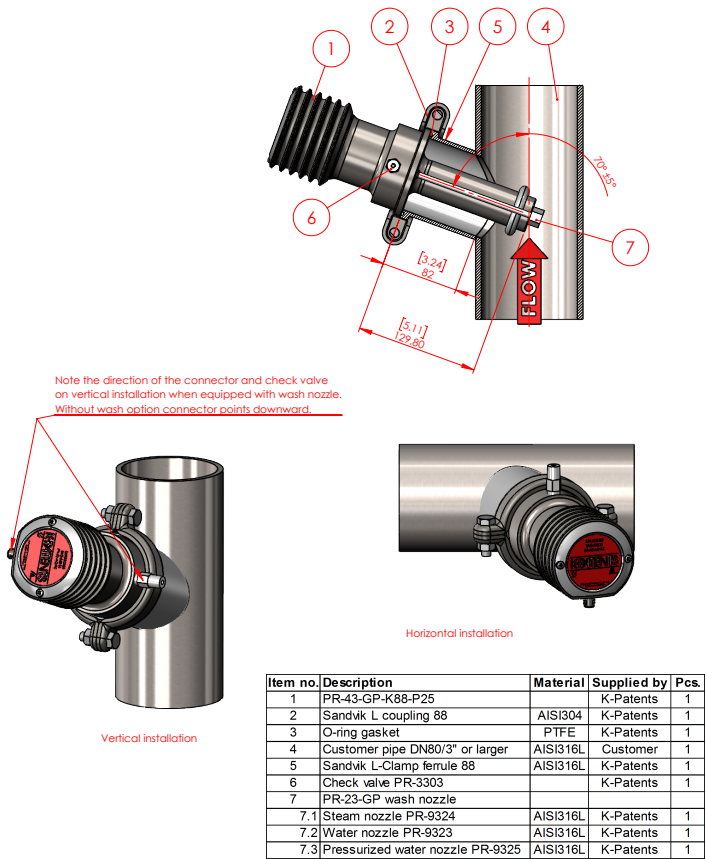
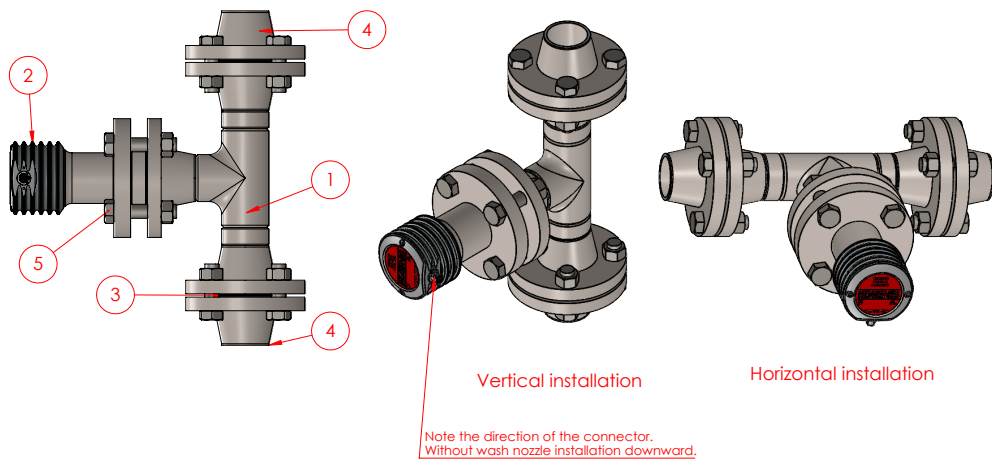


Figure 3.9 Mounting PR-43-GP-K88



ITEM NO.	PART NO.	DESCRIPTION	MATERIAL	SUPPLIED BY	QTY.
1	4392	FTC-A20-P150/300-SS-A20	AISI 316L	K-Patents	1
2	4293	PR-43-GP-A20		K-Patents	1
3		Flange gasket	as requested	Customer	3
4		2" ANSI 150/300 lbs welding neck flange	AISI 316L	Customer	2
5		Bolt, washer, nut	A4	Customer	12/24

Figure 3.10 Mounting with Flow Through Cell
Ansi 2 inch flange (FTC A20-P150/300-A20)

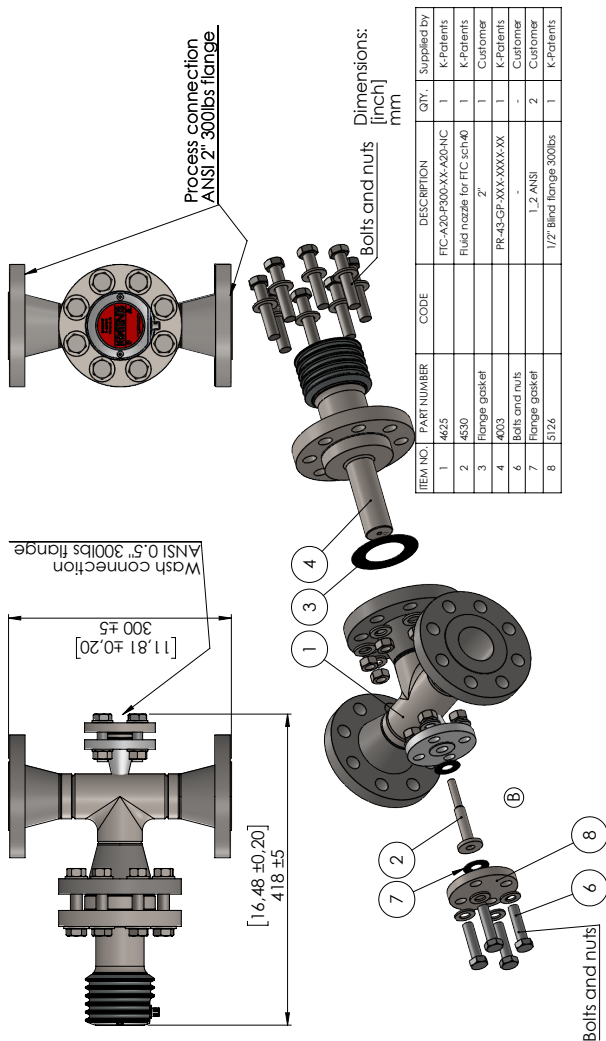


Figure 3.11 Mounting with Flow Through Cell Ansi 2 inch flange with wash connection (FTC-A20-P300-XX-A20-NC)

4 Prism wash

Prism wash requires a system for wash control and diagnostics. This can be achieved with Multichannel user interface (MI) with a relay module.

4.1 Prism coating

Deposit build-up on the prism surface disturbs the measurement. *An abnormally high concentration reading, an upward concentration (CONC) drift, decreased QF value or increased LED value* may indicate coating.

In most applications the prism will keep clean due to the self-cleaning effect. If coating occurs, check the following:

- Sufficient flow velocity
- A temperature difference between process fluid and refractometer probe may cause coating. This may happen with small flows if the thermal insulation is inadequate. In some cases it helps to also insulate the clamp connector.

In case of a coating problem, the preferred solution is to try to increase the flow velocity, e.g. by installing a pipe portion with smaller diameter.

Installing a wash nozzle can be considered, if increasing the velocity does not provide a solution (Section 4.2).

4.2 Prism wash

Three alternative wash media can be used for prism wash: *steam, water, high pressure water*. Relay modules in a Multichannel user interface MI can be configured to control the prism wash cycle, see MI manual, Chapter 6, "Module cards" and Chapter 7, "Prism wash".

4.2.1 Recommended wash pressures and times

The recommended wash pressures and times are given in the table below.

Wash medium parameters for PR-43-GC/GP					
	Minimum <i>above process pressure</i>	Maximum <i>above process pressure</i>	Wash time	Recovery	Interval
Steam (SN)	2 bar (30 psi)	4 bar (60 psi)	3 s	20–30 s	20–30 min
Water (WN)	2 bar (30 psi)	4 bar (60 psi)	10 s	20–30 s	10–20 min
High pressure water (WP)	15 bar (220 psi)	40 bar (60 psi)	10 s	20–30 s	10–20 min



Important: In steam wash, do not exceed the recommended wash times, because some process media may burn to the prism surface if steamed for longer time. In case of coating, shorten the wash interval.

Note: In water wash, water temperature should be above the process temperature.

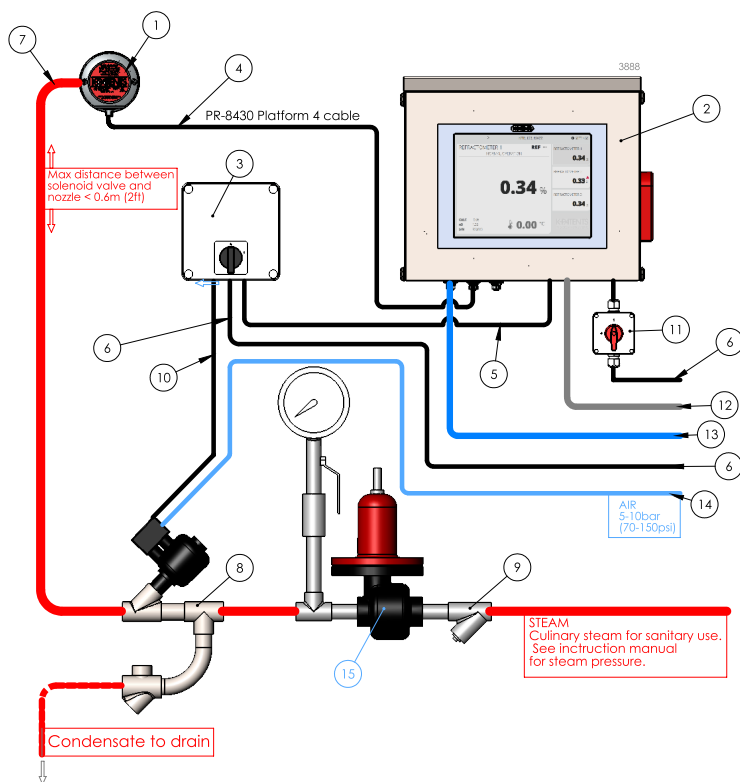
Note: The check valve pressure drop is 0.7 bar (10 psi).

4.2.2 Prism wash systems

The prism wash system for steam is described in Figure 4.1. The prism wash system for high pressure water is described by Figure 4.3.



Warning! In high pressure wash systems, pressure increase can occur in a closed pipe section when the high pressure pump is operated. It is recommended to mount a pressure relief valve in the pipe section. Relief pressure should be according to pipe pressure rating.



No.	Description	Supplied by	Qty
1	PR-43 refractometer	K-Patents	1
2	Multichannel User Interface MI	K-Patents	1
3	Safety switch PR-7060	K-Patents	1
4	Platform 4 Cable PR-8430	K-Patents	1
5	Relay cable 2x1 (AWG 17)	Customer	1
6	Power Supply	Customer	1
6.1	100-240 VAC/50-60Hz		
6.2	24VDC		
7	Flexible steam pipe 1/4" x 24", PR-3515	K-Patents	1
8	Shut-off valve & Steam trap PR-3340-230/110/24VDC	K-Patents	1
9	Strainer PR-3342	K-Patents	1
10	Solenoid cable 3x1 (AWG 17)	Customer	1
11	Mains Power Switch PR-10900	K-Patents	1
12	mA-output cable	Customer	1
13	Ethernet cable for interfaces PR-8440	K-Patents	1
14	Instrument airline	Customer	1
15	Pressure reducer and gauge PR-3341-J	K-Patents	1

Figure 4.1 A prism wash system for steam

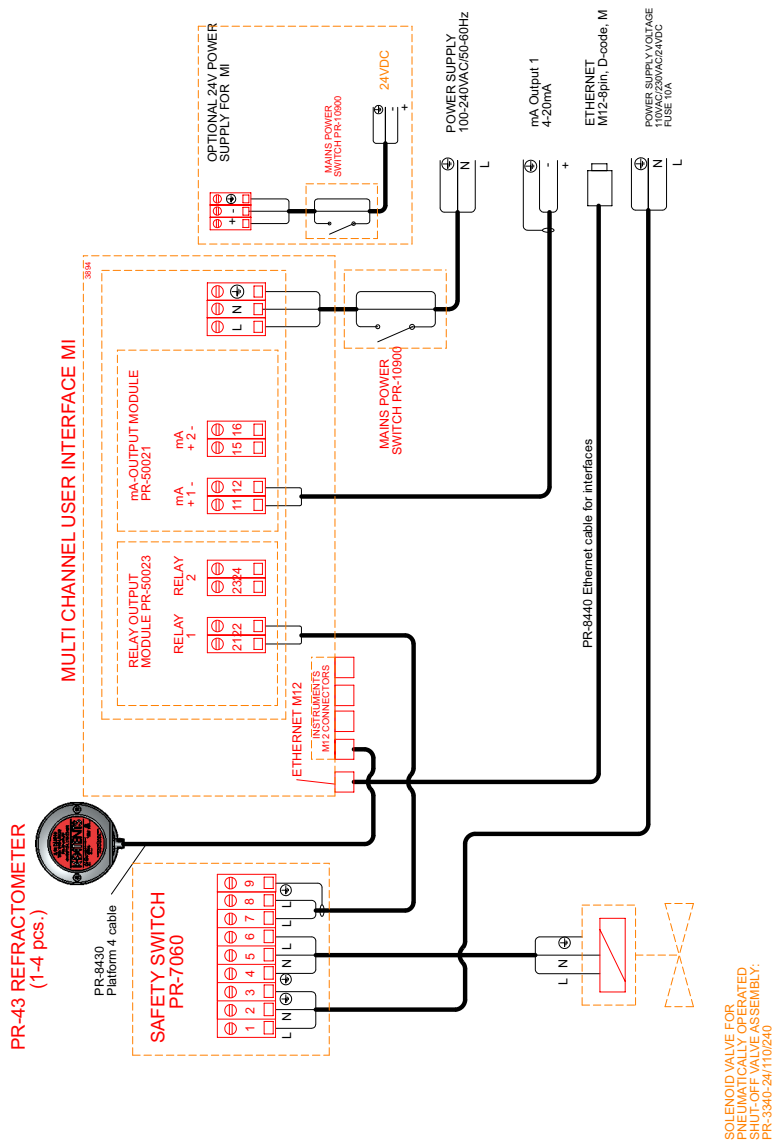
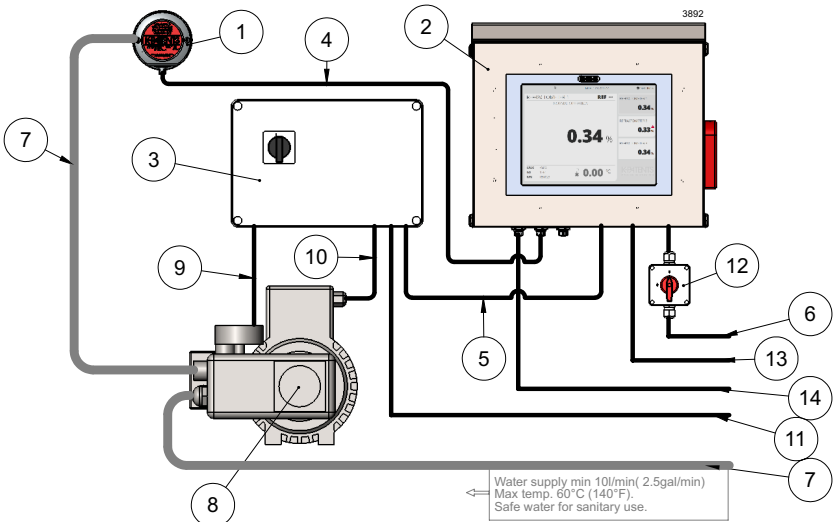
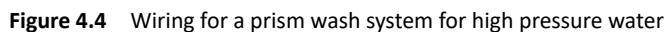


Figure 4.2 Wiring for a prism wash system for steam



No.	Description	Supplied by	Qty
1	PR-43 refractometer	K-Patents	1
2	Multichannel user interface	K-Patents	1
3	Power relay unit PR_3603-300-U/M-230/110	K-Patents	1
4	Platform 4 cable PR-8430	K-Patents	1
5	Relay cable 3x1 (AWG 17)	Customer	1
6	Power supply for MI	Customer	1
6.1	Power supply 100-240 VAC/50-60 Hz		
6.2	Power supply 24V DC		
7	Water supply line min. 12 mm (1/2")	Customer	1
8	High pressure pump PR-3602-XXX	K-Patents	1
9	Solenoid cable 3x1 (AWG 17)	Customer	1
10	Power cable 4x2.5 (AWG 12)	Customer	1
11	Power supply 400-575 VAC/50-60 Hz	Customer	1
12	Mains power switchy PR-10900	K-Patents	1
13	mA output cable	Customer	1
14	Ethernet cable for interface PR-8840	Customer	1

Figure 4.3 A prism wash system for high pressure water



PR-43 refractometer verification form

Fill in this form and email (or fax) it to your local service representative.

Refractometer serial no: _____

Customer: _____

Address: _____

Fax: _____

Email: _____

Date: _____

Verification made by: _____

VERIFICATION RESULTS DISPLAY				
Sample no	Nominal n_D	Measured n_D	CCD	Temp
1	1.3300			
2	1.3700			
3	1.4200			
4	1.4700			
5	1.5200			

EU declaration of conformity



2019-09-01/JJAMO

1 (1)

EU DECLARATION OF CONFORMITY

Manufacturer: Vaisala Oyj
Mail address: P.O. Box 26, FI-00421 Helsinki, Finland
Street Address: Vanha Nurmijärventie 21, Vantaa, Finland

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration:

K-Patents Process Refractometer PR-43 series

The object of the declaration described above is in conformity with Directives:

RoHS Directive (2011/65/EU)
EMC Directive (2014/30/EU)

The conformity is declared using the following standards:

EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements

EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use – EMC requirements – intended for use in industrial locations

Signed for and on behalf of Vaisala Oyj, in Vantaa, on 1st September 2019

Jukka Lyömiö
Standards and Approvals Manager

VAISALA