TS 1050/2050/3050/4050 Technical Datasheet

Hygienic turbidity meter

- Compact, hygienic design with integrated electronics and parametrisation display
- Elastomer-free sealing with an ingress protection of IP69K in a robust housing
- Fast reacting and comprehensive process monitoring

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1.1 Hygienic turbidity meter for the food and beverage industry

The NIR sensor of the TS x050 series is a 180° see-through sensor measuring absorption or turbidity in fluids in the near infrared range (880 nm wavelength). The sensor is installed in and/or on tanks or pipelines. The optical window of the sensor is submerged in the process medium in order to measure the physical properties by absorbing irradiated light.

The TS 1050 and TS 2050 are simple designed, low cost sensors with a turbidity scale between 0 to 100%. There are 3 OPLs (Optical Path Length) available: 5 mm, 10 mm and 20 mm / 0.2", 0.5" and 0.8", each for a different turbidity range. The TS 2050 additionally is used in manual or automatic quick-change fittings of the SENSOFIT family. There are only 2 OPLs available for the TS 2050: 5 mm and 10 mm / 0.2" and 0.5".

The NIR measuring systems TS 3050 and TS 4050 are used for monitoring the optical density or absorption of fluids in order to watch the process results continuously or to securely indicate changes. A logarithmic amplifier with only one OPL of 5 mm / 0.2" guarantees a very wide measuring range, which is about 4 times the size of the TS 1050 / 2050. The TS 4050 additionally is used in manual or automatic quick-change fittings of the SENSOFIT family.

① TS 1050 / TS 3050
② TS 2050 / TS 4050

Highlights

- 180° transmitted light method according to ISO 7027
- Measuring range (TS 1050 / TS 2050): turbidity scale between 0 to 100% with 3 OPLs
- Measuring range (TS 3050 / TS 4050): 0…6 OD, 0...3 AU, 0…3250 EBC, 0…13000 FAU, 0…13000 TEF or 0…26.650 mg/l
- Analogue output to provide measuring results
- Digital output for setable switching points for enabling / disabling pumps, valves, etc.
- Hygienic approval due to bordered sapphire-glass, conus sealing (without any gaskets) and stainless steel (AISI 316L)
- Robust housing with ingress protection of IP69K
- Compact design with integrated electronics (no transmitter necessary)
- Parametrisation via display or PC / Laptop

Industries

- Water supplier
- Process industry
- Dairies
- Breweries
- Food & Beverages

Applications

- Monitoring of water qualities
- Detection of leakages
- Optimizing of cleaning processes (CIP / SIP)
- Filter monitoring (back washing, performance, etc.)
- Optimising of separating processes (inlet / outlet)
- Phase separation
- Concentration measurement

1.2 Options and variants

There are altogether 4 turbidity meter variants available.

TS 1050

Connection: G1/2 thread

Measuring range OPL 5 mm / 0.2":
0...500 EBC / 0...2000 FAU / 5.0 g/l ~ 0.4% TS*

Measuring range OPL 10 mm / 0.5":
0...250 EBC / 0...1000 FAU / 2.5 g/l ~ 0.2% TS*

Measuring range OPL 20 mm / 0.8":
0...100 EBC / 0...400 FAU / 1.0 g/l ~ 0.1% TS*

TS 2050

Connection: PG 13.5 for retractable assemblies

Measuring range OPL 5 mm / 0.2":
0...500 EBC / 0...2000 FAU / 5.0 g/l ~ 0.4% TS*

Measuring range OPL 10 mm / 0.5":
0...250 EBC / 0...1000 FAU / 2.5 g/l ~ 0.2% TS*

* the values represent about 80% of the display scale

TS 3050

Connection: G1/2 thread

Measuring range OPL 5 mm / 0.2":
0...3 AU, 0...6 OD, 0...13000 FAU, 0...13000 FTU, 0...3250 EBC, 0...26.65 mg/l

TS 4050

Connection: PG 13.5 for retractable assemblies

Measuring range OPL 5 mm / 0.2":
0...3 AU, 0...6 OD, 0...13000 FAU, 0...13000 FTU, 0...3250 EBC, 0...26.65 mg/l

1.3 Measuring principle

Turbidity is an optical property of water based on the amount of light scattered and absorped by colloidal and suspended particles. The turbidity value measured in FNU, FTU, NTU etc. is the quantitative statement of this qualitative phenomenon.
The goal of measuring turbidity is to get an indication for the concentration of scattering particles in a medium. This can be done by determination of the light loss of the transmitted beam or the measurement of the light scattered sideways. Both methods deliver proportional data to particle concentration and are therefore suitable for measuring turbidity. They however differ in application and concentration levels. Scattered light measurement principle is more suitable for the detection of lower concentrations, while transmission (reflection or absorption) measurement is used for higher concentrations.

The advantage of the using NIR as light source as stated in the ISO 7027 is that this sensor is not effected by colour of the medium measured.

The NIR sensor of the TS x050 series is a 180° see-through sensor measuring absorption or turbidity in fluids in the near infrared range (880 nm wavelength). The sensor is installed in and/or on tanks or pipelines. The optical part of the sensor is submerged in the process medium in order to measure the physical properties by absorbing irradiated light.

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	180° transmitted light method
Application	Turbidity or absorption in fluids in the near infrared range (880 nm wavelength)

Design

Variants	4 different types
	TS 1050 Simple designed, low cost sensor with a turbidity scale between 0 to 100%.
	TS 2050 As TS 1050 but additionally this sensor is used in manual or automatic quick-change fittings of the SENSOFIT family.
	TS 3050 Measuring system for monitoring the optical density or absorption of fluids in order to monitor continuous process results or to securely indicate changes. This device has the possibility of calibrate itself to preserve its high accuracy.
	TS 4050 As TS 3050 but additionally this measuring system is used in manual or automatic quick-change fittings of the SENSOFIT family.
Display (option)	Device can be parametrised using the function keys on the display.
Light method specifications	Wavelength: 880 nm
	Light source: LED
Measuring range	
TS 1050/2050	Turbidity scale: 0...100%
	OPL 5 mm / 0.2": 0...500 EBC / 0...2000 FAU / 5.0 g/l ~ 0.4% TS*
	OPL 10 mm / 0.5": 0...250 EBC / 0...1000 FAU / 2.5 g/l ~ 0.2% TS*
	OPL 20 mm / 0.8": 0...100 EBC / 0...400 FAU / 1.0 g/l ~ 0.1% TS*
	* the values represent about 80% of the display scale
TS 3050/4050	0...3 AU (Absorption Units)
	0...6 OD (Optical Density)
	0...13000 FAU (Formazine Absorption Unit)
	0...13000 FTU (Formazine Turbidity Unit)
	0...3250 EBC (European Brewery Convention)
	0...26.65 mg/l (miligrams per litre)

Measuring accuracy

Accuracy	< ± 5% of the maximum value range
Repeatability	< ± 0.5% of the maximum value range

Operating conditions

Process temperature	0...+90°C / +32...+194°F
Transport and storage temperature	-20...+70°C / -4...+158°F
Max. admissible temperature	+90°C / +194°F
Max. admissible sterilisation temperature	+140°C / +284°F, max. 2 hours
Max. pressure	10 bar / 145 psi
Ingress protection	IP69K

Installation conditions

Installation position	Installed in and/or tanks and pipelines.
	Device can be operated in any position but it is recommended with a product flow from bottom to top.
	Optical window of the device is submerged in the process medium
	For flushing and removing device during running process, for types TS 2050/4050 quick-change fittings are optionally available.
Process connection	G1/2; Other process connections are available on request.
Weight	TS 1050/3050: 700 g / 1.5 lb
	TS 2050/4050: 850 g / 1.9 lb

Materials

Sensor body	Stainless steel 1.4435 (316L)
	Surface quality: electro-polished < Ra 0.37 µm
Measuring window	Sapphire

Electrical connection

Power supply	18...30 VDC
Load	≤ (U_b - 4 V)/20 mA (max. 400 Ω at 12 V, 1000 Ω at 24 V, 1300 Ω at 30 V)
Analogue output	4...20 mA
Current demand	Approx. 80 mA (30 VDC and analogue output = 22.5 mA)
Power input	2.4 W max.
Current limit	3.5 mA min.; 22.5 mA max.; adjustable
Switching output	All devices: NO or NC adjustable; PNP- switching; 200 mA max., thermally protected
Teach input (only for TS 1050/2050	Digital input; +12...30 VDC
Cable connection	5-pin M12 connector
Cable length	Standard: 5 m / 16.4 ft
	Option: 10 m / 32.8 ft, 20 m / 65.6 ft or 30 m / 98 ft

Approvals and certifications

CE	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.
Electromagnetic compatibility	Acc. to EN 61326-2: 10-2006 and EN 61326-2-3: 5- 2007
Determination of turbidity	Acc. to DIN/EN 27027 (ISO 7027)

2.2 Dimensions and weight

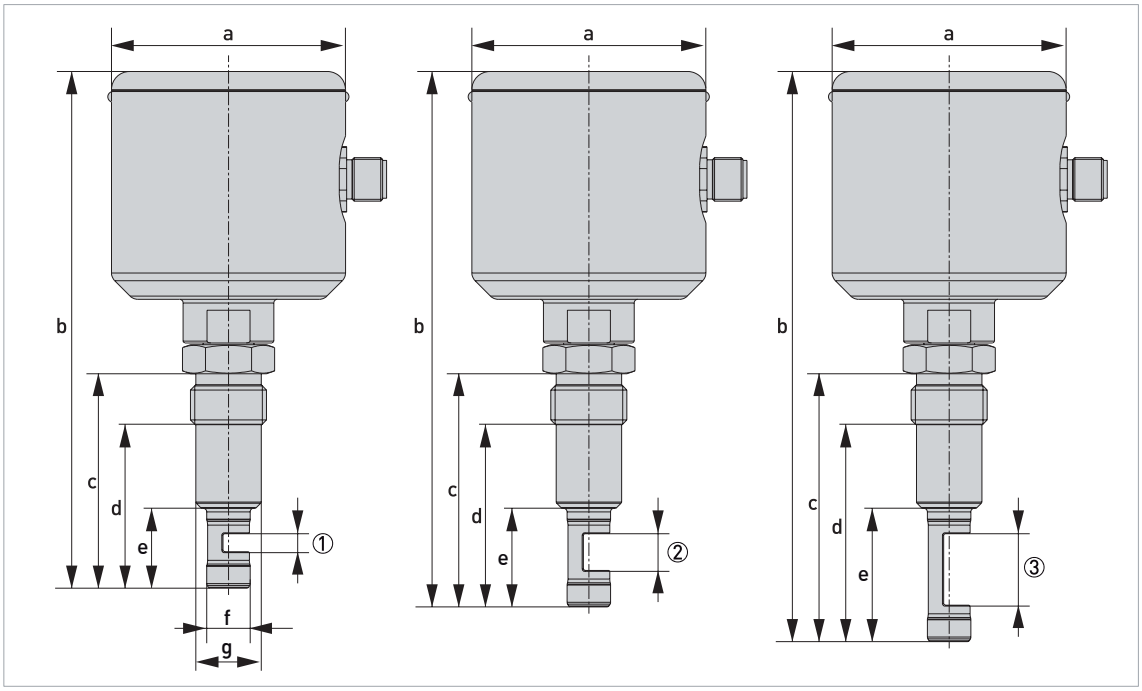

Figure 2-1: Dimensions of TS 1050

① Optical path length 5 mm / 0.2"
② Optical path length 10 mm / 0.4"
③ Optical path length 20 mm / 0.8"

Dimensions in mm

Type	a	b	c	d	e	f	g
①	Ø68	142	59	45	22	Ø12	Ø18
②	Ø68	147	64	50	27	Ø12	Ø18
③	Ø68	157	74	60	37	Ø12	Ø18

Dimensions in inch

Type	a	b	c	d	e	f	g
①	Ø2.7	6.6	2.3	1.8	0.9	Ø0.5	Ø0.7
②	Ø2.7	5.8	2.5	2.0	1.1	Ø0.5	Ø0.7
③	Ø2.7	6.2	2.9	2.4	1.5	Ø0.5	Ø0.7

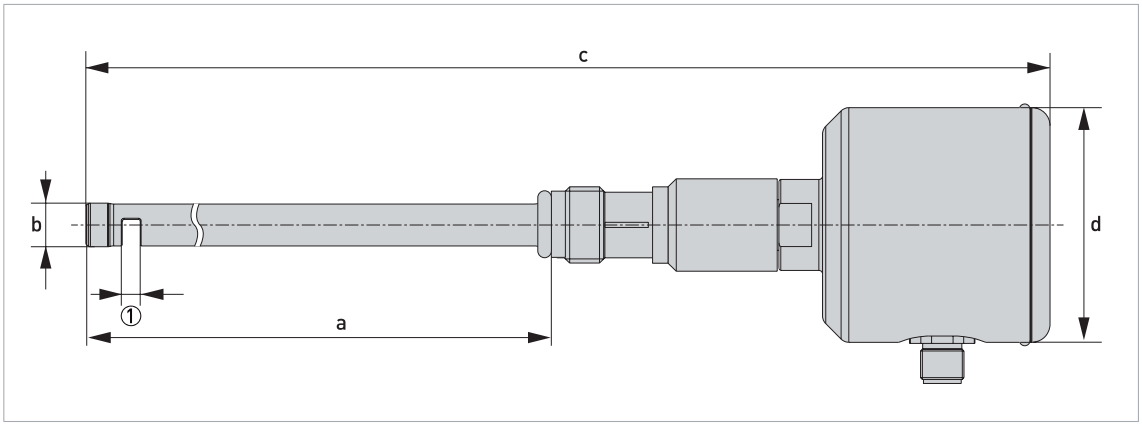

Figure 2-2: Dimensions of TS 2050

① Optical path length 5 mm / 0.2" or 10 mm / 0.4"

a	b	c	d
Dimensions in mm			
225	Ø12	363	Ø68
Dimensions in inch			
8.9	Ø0.5	14.3	Ø2.7

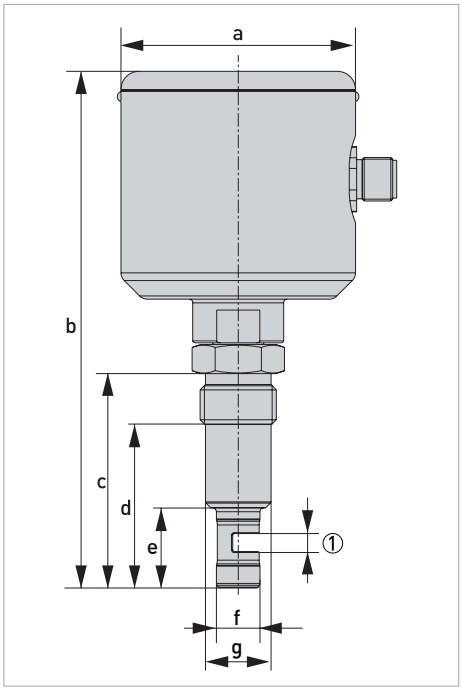

Figure 2-3: Dimensions of TS 3050

① Optical path length 5 mm / 0.2"

a	b	c	d	e	f	g
Dimensions in mm						
Ø68	142	59	45	22	Ø12	Ø18
Dimensions in inch						
Ø2.7	6.6	2.3	1.8	0.9	Ø0.5	Ø0.7

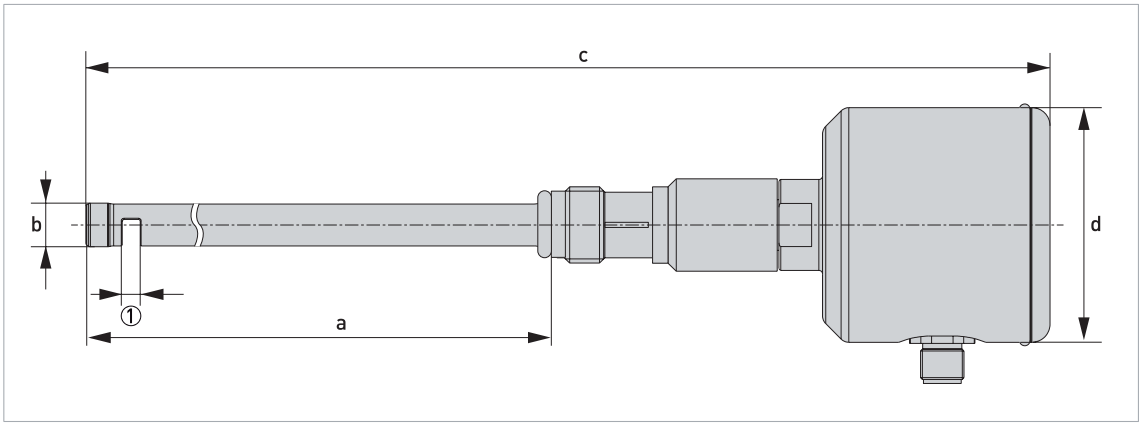

Figure 2-4: Dimensions of TS 4050

① Optical path length

a	b	c	d
Dimensions in mm			
225	Ø12	363	Ø68
Dimensions in inch			
8.9	Ø0.5	14.3	Ø2.7

3.1 General notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Intended use

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The NIR sensor of the TS x050 series is a 180° see-through sensor measuring absorption or turbidity in fluids in the near infrared range (880 nm wavelength). The sensor is installed in and/or on tanks or pipelines. The optical part of the sensor is submerged in the process medium in order to measure the physical properties by absorbing irradiated light.

There are four different types available:

TS 1050

The TS 1050 is a simple designed, low cost sensor with a turbidity scale between 0 to 100%. There are 3 OPLs (Optical Path Length) available: 5 mm, 10 mm and 20 mm / 0.2", 0.5" and 0.8", each for a different turbidity range.

TS 2050

Just like the TS 1050, the NIR sensor TS 2050 is designed for monitoring the turbidity of fluids. This sensor is used in manual or automatic quick-change fittings of the SENSOFIT family. By using quick-change fittings, the sensor can be flushed or removed with the process running, efficiently preventing corrupt results caused by coatings on the measuring windows and allowing for secure long-term monitoring of processes.

TS 3050

The NIR measuring system TS 3050 is a measuring system for monitoring the optical density or absorption of fluids in order to monitor continuous process results or to securely indicate changes. A logarithmic amplifier guarantees a very wide measuring range (0…6 OD, 0...3 AU, 0…3250 EBC, 0…13000 FAU, 0…13000 TEF or 0…26.650 mg/l). This device has the possibility of calibrate itself to preserve its high accuracy.

TS 4050

Just like the TS 3050, the NIR measuring system TS 4050 is designed for monitoring the optical density of fluids. This measuring system is used in manual or automatic quick-change fittings of the SENSOFIT family. By using quick-change fittings, the sensor can be flushed or removed with the process running, efficiently preventing corrupt results caused by coatings on the measuring windows and allowing for secure long-term monitoring of processes.

3.3 Storage and transport

- Store the device in a dry, dust-free location.
- Avoid continuous direct sunlight.
- The original packing is designed to protect the equipment. It has to be used if the device is transported or sent back to the manufacturer.

3.4 Pre-installation requirements

Device type

The TS 1050/3050 is installed into pipelines or tanks by means of his hygienic modular G1/2 process connections directly using a welding sleeve or inserted into existing process connections using the corresponding process adapters.
The TS 2050/4050 is installed into a PG 13.5 quick-change fitting that in turn is connected to the process lines or to the tank.

Installation position

As a matter of principle, the device can be operated in any position. However, we recommend an installation with a product flow from bottom to top. Moreover please observe the good legibility of the indicator and good accessibility and operability.

Measuring window

The measuring windows must be oriented in such a way that no air bubbles or particles may be caught between them. The measuring windows must be kept clean. This can be achieved by an appropriate CIP / SIP cleaning process or you can alternatively use the type with a quick-change fitting.

Make sure before installation that:

- there is enough working space for operating the device.
- the process is shut down.
- tanks or pipelines are depressurised, empty and clean.
- connection nozzle and process connection of the device are matching.

3.5 Mechanical connection

- *Risk of injuries due to escaping process fluid!*
- *Burns or chemical burns depending on the properties of the process fluid.*
- *Wear safety goggles and protective clothing!*
- *Check that the tank or the pipeline, the device is connected to, is depressurised, empty and clean!*

Installation procedure

- Insert the sensor into the matching modular process connection.
- Tighten the pressure screw to a torque of maximum 10 Nm.
- After removal, the optical window must be protected with the original cap immediately.

3.6 Electrical connection

All work on the electrical connections may only be carried out with the power disconnected.

Observe the national regulations for electrical installations!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

The electrical connection is made via a M12 plug connection. Assure to use the original IP69K connecting cable with the proper VA connector.

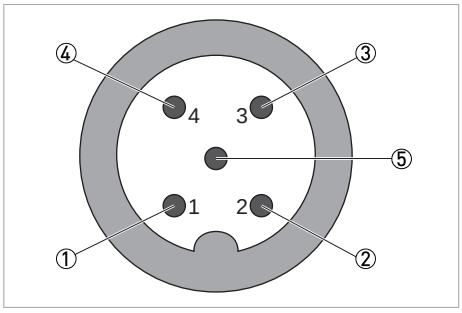

Figure 3-1: Pin designation

Pin	Colour	Designation
①	Brown	(+) supply (24 VDC)
②	White	Switching output
③	Blue	(-) supply
④	Black	4...20 mA analogue output
⑤	Green/yellow or grey	Teach input (+12...30 VDC) (only for TS 1050/20150)

- Connect the connecting cable to the female plug of the device.
- Tighten the retainer nut hand-tight.

The characters of the order code highlighted in light grey describe the standard.

Order number for TS product line									
VGQ	2	(049)	**Turbidity device**						
			0	TS 1050					
			1	TS 2050					
			2	TS 3050					
			3	TS 4050					
				Process adapter					
				0	None				
				1	Cylindrical weld end G1/2				
				2	Adapter sleeve, G1 to G1/2				
				3	Varivent G1/2, DN50 – Type N				
				4	Sanitary connection G1/2, DN50				
				5	Tri-Clamp G1/2				
				6	SENSOFIT RET 5810, DN32, PN16, manual				
				7	SENSOFIT RET 5810, DN40, PN16, manual				
				8	SENSOFIT RET 5810, DN50, PN16, manual				
				9	SENSOFIT RET 5810, 2" ASME, 150 lb, manual				
				B	SENSOFIT RAM 5810, DN32, PN16, pneumatic				
				C	SENSOFIT RAM 5810, DN40, PN16, pneumatic				
				D	SENSOFIT RAM 5810, DN50, PN16, pneumatic				
				E	SENSOFIT RAM 5810, 2" ASME, 150 lb, pneumatic				
				F	SENSOFIT RET 5830 G1/4, manual				
				G	SENSOFIT RAM 5830 G1/4, pneumatic				
					Optical path length				
					0	5 mm			
					1	10 mm			
					2	20 mm			
						PC interface adapter			
						0	None		
						1	USB/M12 + M12/M8		
						2	USB/M12 + M12/M8 + power supply		
							Connection cable		
							0	None	
							1	M12x1.5, 5-pole, 5 m / 16.4 ft, IP69K	
							2	M12x1.5, 5-pole, 10 m / 32.8 ft, IP69K	
							3	M12x1.5, 5-pole, 20 m / 65.6 ft, IP69K	
							4	M12x1.5, 5-pole, 30 m / 98 ft, IP69K	

Order number for TS product line																		
								Closure for process										
								0	None									
								1	Blanking plug G1/2									
								2	Weld in pin G1/2									
									Reference filter									
									0	None								
									1	Reference filter (0.35AU + 2AU)								
										Case								
										0	None							
										1	Demo case for TS1050 / 3050							
											Manual							
											0	None						
											1	English						
											2	German						
											3	French						
VGQ	2	(049)										0	0	0	0	0	0	Order code

KROHNE – Process instrumentation and measurement solutions

- Flow
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