OVAL WHEEL METER SERIES OI

1. IDENTIFICATION

Manufacturer Bopp & Reuther Messtechnik
Am Neuen Rheinhafen 4
67346 Speyer / Germany
Phone: +49 6232 657-0
Telefax: +49 6232 657-505

Product type Direct volumetric meter (positive displacement meter, Version: Single-Case)

Product name Oval Wheel Meter Series OI

2. RANGE OF APPLICATION

The range of application of all oval wheel meters of the series OI comprises measuring of volumes and flowrates in the process, custody transfer, dosage and controlling of liquids. They are used for the measurement of intermediate and final liquid products such as liquefied gases, acids, alkaline solutions, fats, alcohol, solvents, dispersions, polymers, polycondensates, paints, colors, adhesives and other media.

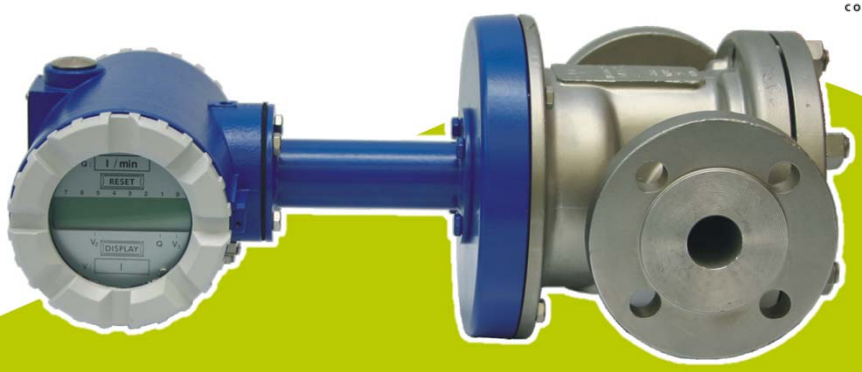
Please not the oval wheel meters capability to measure liquids with very high viscosities with nearly no pressure loss. The high accuracy provided by the oval wheel meters series OI ensure a maximum quality of products being manufactured. Oval wheel meters of the series OI are manufactured with nominal widths of 5 to 100 mm. Depending on the nominal width the can be used up to PN40 with a maximum operating temperature of up to 180°C.

3. MEASURING PRINCIPLE AND SYSTEM CONFIGURATION

3.1 Measuring principle

Oval wheel meters belong to the group of direct volumetric meters for liquids with movable partition walls (displacement flow meters). The oval wheel meter consists of a measuring chamber housing with two pivoted oval wheels, which are toothed and roll off in counter-rotations around each other.

Each revolution of the oval wheels displaces four discrete volumes of fluid (defined by the space between oval wheel and measuring chamber) through the counter. The number of the rotations is a measure for the volume.



3.2 System configuration

Sensor:
Measuring of the volumetric flow and the volume of liquids is performed by the oval wheel meter.

- A magnetic coupling which transmits the rotation of the oval wheel to mechanical roller counters with the decisive advantage of having to work without auxiliary power, optionally with an encoder (e.g. AG19, AG01-08) for connection to flow computers, controls or control systems

or

- Via a direct electronic scanning of the rotation of the oval wheels by means of pulse generators (e.g. AG42, AG43) without further mechanical parts if necessary. With smart transmitter UST combined with the advantages of modern electronic solutions and indirect integration into control systems via 4-20mA / 2-wire technology / HART

For these oval wheel meters is an extensive program of additional equipment available as mechanical, pneumatic, electrical and electronic transducers whose signals for remote counts, flow measurements and controls, as well as for integration in higher-level automation systems can be used. Can also be used for dosing suitable quantity preselection devices with matching valves of different design and operation.

Pulse pick-up AG19 / AG20 see D-EN-17202-00
(attached devices acc. EN 50227 NAMUR)

Pulse pick-up AG42, see D-EN-17201-00
AG43 Wiegand-principle
(attached devices acc. EN 50227 NAMUR)

Pulse pick-up AG01-08 see D-EN-17203-00
(Exd)

Single indicator E and see D-EN-17205-00
Double indicator D

Mechanical resettable see D-EN-17205-00
roller counter M5
M5 with presetting device
M5V
Step switches sp2 , sp22 , se2

Universal Smart Transmitter UST see D-EN-17207-00

The UST dispose by default with a local display, a 4-20 mA 2-wire current output for flow signal and HART-communication (FDT compatible driver available), and a separate pulse output for counting (original pulses or scaled pulses) according to NAMUR.

4. INPUT

4.1 Measured value

Volume and volume flow rate

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4.2 Measuring Range

Measuring ranges for media with Newtonian flow behavior for versions with plain bearings of the oval wheels
OI5, OI10, OI50, OI100, OI200, OI400: 0,3 - 3000 mPa.s (with special toothing: >150mPa.s)

Type	DN	Flow rate [l/min]	Liability at viscosity	< 0,3 mPa·s		0,3 - 1,5 mPa·s		1,5 - 150 mPa·s		to 350 mPa·s		to 1000 mPa·s		to 3000 mPa·s	
				[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]
OI5	25	50	Min	8	0,5	5	0,3	5	0,3	2,5	0,15	1,25	0,075	0,45	0,027
			Max	40	2,4	50	3	50	3	25	1,5	12,5	0,75	4,5	0,27
			continuous operation	16	1	33	2	33	2						
OI10	25	100	Min	16	1	10	0,6	10	0,6	7	0,42	3,5	0,20	1,2	0,072
			Max	80	5	100	6	100	6	70	4,2	35	2	12	0,72
			continuous operation	33	2	66	4	80	4,8						
OI50	50	300	Min	50	3	30	1,8	30	1,8	18	1,08	9,5	0,54	3	0,18
			Max	250	15	300	18	300	18	180	10,8	90	5,4	30	1,8
			continuous operation	100	6	200	12	240	14,4						
OI100	50	660	Min	110	6,6	66	3,9	66	3,9	48	2,9	24	1,45	10	0,6
			Max	550	33	660	39,6	660	39,6	480	29	240	14,5	100	6
			continuous operation	230	13,2	440	26,4	530	31,8						
OI200	80	700	Min	110	6,6	70	4,2	70	4,2	50	3	25	1,5	12	0,72
			Max	560	34	700	42	700	42	500	30	250	15	120	7,2
			continuous operation	230	14	420	25,2	525	31,5						
OI400	100	1200	Min	200	12	120	7,2	120	7,2	100	6	60	3,6	30	1,8
			Max	1000	60	1200	72	1200	72	1000	60	600	36	300	18
			continuous operation	400	24	720	43,2	1000	60						

Measuring ranges for water
Measuring range for cold water:
Column 0,3 - 1,5 mPa·s for continuous liability are 50% and for max. liability 70% of line 2 (max.)

Measuring ranges for hot water:
Column <0,3 mPa·s only min. to permanenty

Measuring ranges for sufuric acid: on request

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Measuring ranges for low and high viscosity media with Newtonian flow behavior with ball bearings for the oval wheels
Meter with ball bearing (instead of carbon bearings), special toothed (OI 5 standard toothed)

Typ	DN	Flow rate Q_{max} [ℓ/min]		1,5 - 20 mPa·s		to 350 mPa·s		to 2000 mPa·s		to 5000 mPa·s		to 10000 mPa·s		to 20000 mPa·s		to 60000 mPa·s	
				[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]
OI5	25	50	Min	15	0,9	5	0,3	2,5	0,15	1,2	0,072	0,6	0,036	0,3	0,018	0,1	0,006
			Max	50	3	50	3	25	1,5	12	0,72	6	0,36	3	0,18	1	0,06
OI10	25	100	Min	30	1,8	10	0,6	8	0,5	4	0,24	2	0,12	1	0,06	0,3	0,018
			Max	100	6	100	6	80	5	40	2,4	20	1,2	10	0,6	3	0,18
OI50	50	300	Min	60	3,6	30	1,8	15	0,9	7,5	0,45	4	0,24	2	0,12	1	0,06
			Max	300	18	300	18	200	12	150	9	80	5	40	2,5	12	0,72
OI200	80	700	Min	140	8,4	70	4,2	30	1,8	15	0,9	10	0,6	4	0,25	3	0,18
			Max	700	42	700	42	700	42	350	20	180	11	80	5	25	1,5
OI400	100	1200	Min	240	14,5	120	7,2	60	3,6	35	2	17	1	10	0,6	4	0,24
			Max	1200	72	1200	72	1200	72	700	42	350	21	180	11	50	3

For Newtonian flow behavior up to 100.000 mPas:
OI 50: 0,6 to 6 l/min
OI 200: 1 to 12 l/min
OI 400: 2 to 25 l/min

Measuring ranges for pseudoplastic substances with non-Newtonian flow behavior, e.g. dispersions in execution with ball bearing of the oval wheels

Typ	DN	Flow rate Q_{max} [ℓ/min]		1,5 - 20 mPa·s		to 300 mPa·s		to 30000 mPa·s		to 60000 mPa·s		to 100000 mPa·s	
				[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]	[ℓ/min]	[m³/h]
OI5	25	50	Min	15	0,9	5	0,3	3,5	0,21	2,5	0,15	1,5	0,09
			Max	50	3	50	3	35	2,1	25	1,5	15	0,9
OI10	25	100	Min	30	1,8	10	0,6	7,5	0,45	5	0,3	3	0,18
			Max	100	6	100	6	75	4,5	50	3	30	1,8
OI50	50	300	Min	60	3,6	30	1,8	12	0,72	7,5	0,45	4,5	0,27
			Max	300	18	300	18	240	14,5	150	9	90	5,4
OI200	80	700	Min	140	8,4	70	4,2	25	1,5	15	0,9	10	0,6
			Max	700	42	700	42	500	30	300	18	200	12
OI400	100	1200	Min	240	14,5	120	7,2	45	2,7	30	1,8	18	1,1
			Max	1200	72	1200	72	900	54	600	36	360	22

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5. CHARACTERISTIC PARAMETER

5.1 Reference conditions

Bopp & Reuther Messtechnik calibration devices are approved by PTB and traceable to national standards

Pressure: 2 to 7 bar. Temp: 20°C to 30°C

5.2 Accuracy

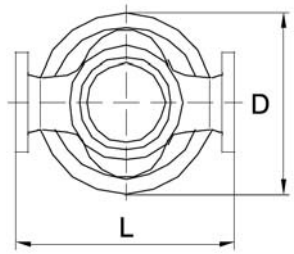
± 0,1% to ± 0,3% of measured value

5.3 Repeatability

< 0,02%

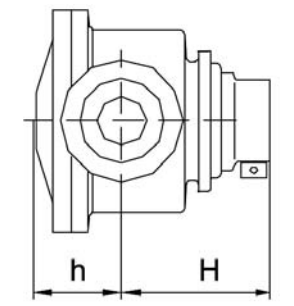
6. CONSTRUCTION DETAILS

6.1 Design / dimensions / weights



Type		OI5	OI10	OI50	OI100	OI200	OI400
Nominal size		DN 25	DN 25	DN 50	DN 50	DN 80	DN 100
D (mm)		135	150	245	290	365	445
Length L (mm)	DIN	220	220	300	370	450	550
	ANSI 150	220	220	330	370	450	550
	ANSI 300	220	220	330	390	470	560

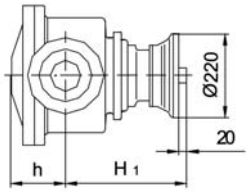
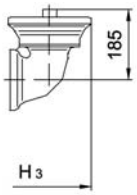
For oval wheel meters series OI only with pulse pick-up AG19, AG20 or AG42, AG43 the following dimensions are valid:



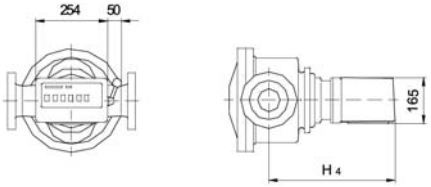
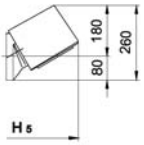
Type		OI5	OI10	OI50	OI100	OI200	OI400
Nominal size		DN 25	DN 25	DN 50	DN 50	DN 80	DN 100
Dimensions (mm)	h	52	65 - 72*	104	146	145	183
	H with pulse pick-up AG19/20	214	217	235	282	299	335
	H with pulse pick-up AG42	180	183	-	-	-	-
	H with pulse pick-up AG43	-	-	201	248	265	301
Weight appr. (kg)		12	15	34	65	74	119

When using a temperature extension, the dimension H is increased by 300 mm and the weight by about 2kg
* Depending on the material version

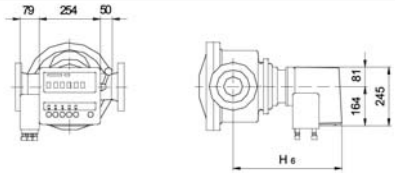
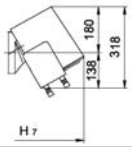
OI5 - OI400 with mechanical indicator E,D or roller counter M5 and optional pulse pick-up AG19, AG20, AG01-08
Version with single indicator E and double indicator D

OI ... E / OI ... D	OI ... Es / OI ... Ds	OI ... wE / OI ... wD
		

Version with roller counter M5

OI ... M5	OI ... M5s
	

Version with roller counter M5V

OI ... M5V (with pneumatic switch)	OI ... M5sV
	

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Type / Nominal size		OI5 DN 25	OI10 DN 25	OI50 DN 50	OI100 DN 50	OI200 DN 80	OI400 DN 100
Dimensions (mm)	H	52	71	106	147	144	183
	H_1	229	231	249	296	313	349
	H_2	312	314	332	379	396	432
	H_3	357	359	377	424	441	477
H_x	H_4	362	364	382	429	446	482
	H_5	392	394	412	459	476	512
	H_6	367	369	387	434	451	487
	H_7	437	439	457	504	521	557
Weight appr. (kg)	E, D	13	16	35	66	75	120
	M 5	17	22	36	72	81	126
	M 5 V	24	29	43	79	88	133

for meters with external regulation,
pulse pick-up AG19 / AG20 or extension the dimensions change as follows:
H1 to H7

External regulation
+ 42 mm

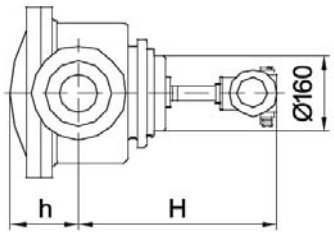
Pulse pick-up AG19 / 20
+ 115 mm

Pulse pick-up AG01-08
+ 67 mm

extension
+ 300 mm

When using a temperature extension
300 mm becomes a weight increased by appr. 2 kg

OI5 - OI400 with UST



Type / Nominal size		**OI5** DN 25	**OI10** DN 25	**OI50** DN 50	**OI100** DN 50	**OI200** DN 80	**OI400** DN 100
Dimen-sions (mm)	h	52	65 - 72*	104	146	145	183
	H USTI/USTX	214	217	235	282	299	335
	H USTD	180	183	-	-	-	-
	H with pulse pick-up AG43	-	-	201	248	265	301
weight app. (kg)		12	15	34	65	74	119

6.2 Material

	G1	G2	F5	F57
Housing	Cast iron	Cast steel	Stainless steel	Stainless steel
Oval wheel	Cast iron	Cast iron	Stainless steel	Stainless steel
Measuring chamber cover	Cast iron (*) + Carbon ring	Cast iron (*) + Carbon ring	Carbon ring	Stainless steel
Sleeve	n.a.	Carbon ring	Carbon ring	n.a.
Bearing	Carbon ring	Carbon ring	Carbon ring	Ball bearing

(*) Measuring chamber cover made of hard carbon at nominal sizes
< DN 50

F528 as execution **F5**, but with encapsulated magnet or magnetic carrier in the wet room and acid resistant carbon stage

Available materials

	Mechanical counters with / without AG19 / AG20 / AG01-08	AG42 / AG43 with / without UST	G1	G2	F5	F57	F528
OI5	•		•	•	•	•	•
		•			•		•
OI10	•		•	•	•	•	•
		•			•		•
OI50	•		•	•	•	•	•
		•	•	•	•		•
OI100	•			•	•		•
		•		•	•		•
OI200	•		•	•	•	•	•
		•	•	•	•		•
OI400	•		•	•	•	•	•
		•		•	•		•

7. OPERATING CONDITIONS

7.1 Degree of protection

	Ambient temperature	Housing	Ex-protection
OI:			Mechanical Ex-protection see certificate of conformity
AG19, AG20:	-25 to +90°C	IP54	II 2G EEx ia IIC T6
AG42, AG43:	-50 to +60/+75/+85°C	IP65	II 2G EEx ib IIC T6/5/4
Indicator E, D:	-20 to +110°C	IP54	
M5:	-20 to +60°C	IP54	
M5 accessories:			see D-EN-17205-00
USTI:	-20 to +70°C	IP65	II 1/2G EEx ia IIC T4
USTX:	-40 to +60°C	IP65	II 2G EEx d [ib] IIC T4
USTD:	-40 to +70°C	IP65	II 2G EEx d [ia] IIC/IIB T6

Degree of protection for enclosures IP acc. to IEC 529 / EN 60529, Ex-approval Directive 2014/34/EU
Caution: The LC-displays of the electronical counters (UST) operates from -10°C to +70°C

7.2 Process pressure / process connection

	PN10 DIN2532	PN16 DIN2533	PN25 DIN2534 / DN2544	PN40 DIN2545	ANSI150[1]	ANSI300[2]
OI5 / OI10			G1	G2 – F5 –F57 – F528	all	all except G1
OI50		G1		G2 – F5 –F57 – F528	all	all except G1
OI100				G2 – F5 – F528	all	all
OI200	G1		G2 – F5 –F57 – F528		all	all except G1
OI400	G1		G2 – F5 –F57 – F528		all	all except G1

7.3 Operating temperature limit

See available materials chapter 6.2

OI5 / OI10	-10 to 60°C	>60 to 90°C	>90 to 110°C	>110 to 170°C	>110 to 180°C
OI5 / OI10 mechanical display	Standard		Extension	Extension and special tolerances	
OI5 / OI10 AG19					
OI5 / OI10 AG42		Extension			
OI5 / OI10 AG01-08				Special tolerances	
OI5 / OI10 AG42 UST					

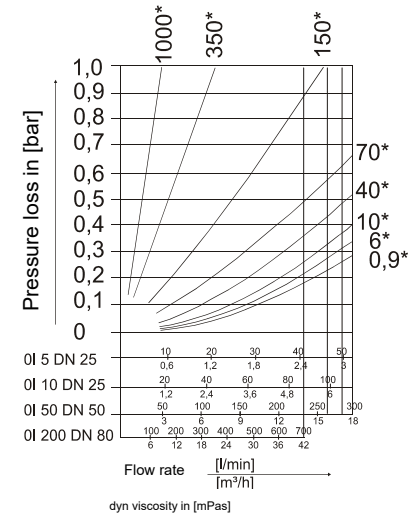
For OI5 / OI10 F57 standard max. 60°C / with special tolerances max. 110°C, but max. 90°C with AG19/AG20. with special tolerances and extensions max. 180°C

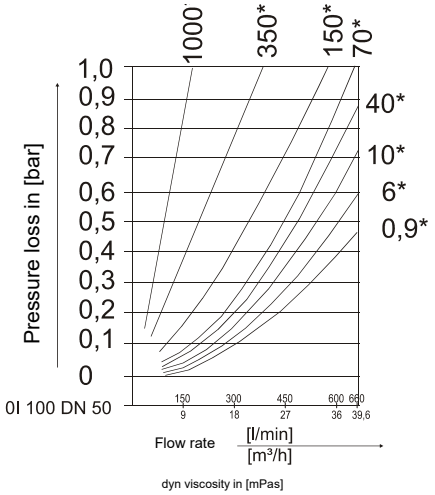
OI50 / OI100 / OI200 / OI400	-10 to 60°C	>60 to 90°C	>90 to 110°C	>110 to 170°C	>110 to 180°C
OI mechanical display	Standard	Special tolerances	Extension and special tolerances		
OI AG19					
OI AG43					
OI AG01-08					
OI AG43 UST		Special tolerances			

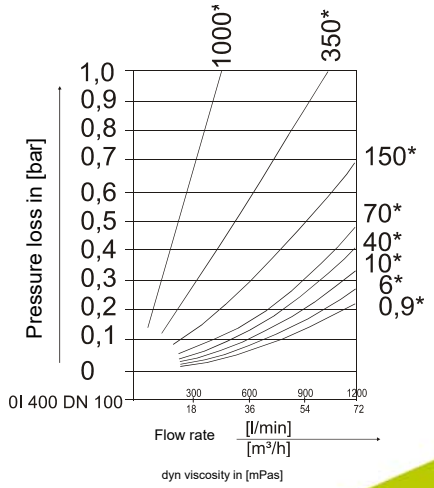
For liquified gases with special tolerances (not suitable for versions G1, F528, F57) max. 20°C.
For OI with mechanical Display or AG19/AG20 with 400 mm extension and 2 magnetic coupling low temperature down to -60°C (note pressure reduction).
For OI AG42/AG43 with or without UST with special bolts and nuts from A4-70 low temperature down to -40°C (note pressure reduction).

7.4 Pressure loss

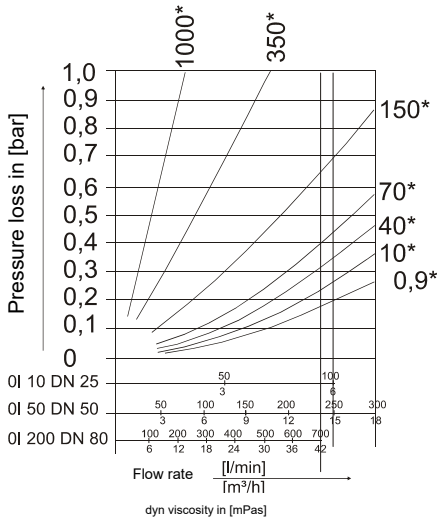
Normal toothed

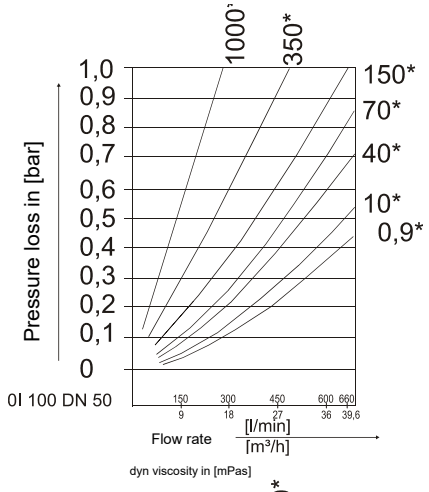


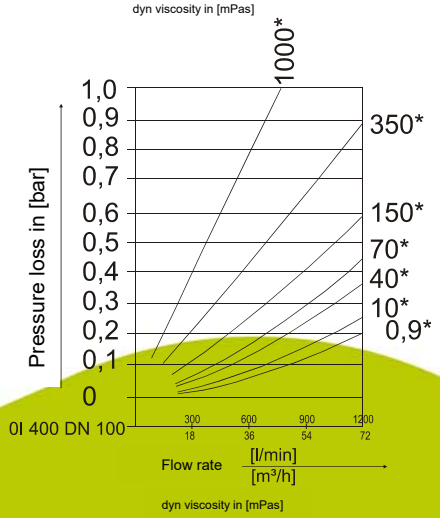




Special toothed







Pressure losses for oval wheels with ball bearings (media with Newtonian flow behavior or pseudoplastic fluids with non-Newtonian flow behavior): on request

8. CERTIFICATE AND APPROVALS

EG-Conformity declaration,
Bopp & Reuther Messtechnik GmbH

EC type examination certificate

Directive 2014/34/EU (Ex-protection), IEC-Ex
EN 13463-1: Non-electrical equipment for use in potentially explosive atmospheres
EN 1127-1: Ex-protection, basic concepts and methodology
EN 60079-0: Explosive atmospheres equipment – General requirements
EN 60079-11: Intrinsically safety „i“
EN 60079-1: Flameproof enclosures „d“

- Universal Smart Transmitter Type UST EExia DMT 99 ATEX E 014 X
- Universal Smart Transmitter Type UST EExd [ia] DMT 00 ATEX E 025 X
- Universal Smart Transmitter Type UST EExd [ib] BVS 04 ATEX E 022 X
- Pulse pick-up AG19, AG2 (proximity switch Types SJ 3,5N) PTB 99 ATEX 2219 X
- Pulse pick-up AG42, AG43 (Wiegand Sensor with preamplifier Type PV11) DMT 00 ATEX E 063 X
- Pulse pick-up AG01-08

Directive 2014/30/EU (EMC - Electromagnetic Compatibility)
- EN 61000-6-2: Generic standards – immunity for industrial environments
- EN 61000-6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments

Directive 2014/68/EU (PED – Pressure Equipment Directive)
- DIN EN 10213
- AD-Pamphlets
- EC-type approvals modul B + C

TYPE-APPROVAL CERTIFICATE UNDER GERMAN LAW MEASURING EQUIPMENT DIRECTIVE - MID
EWC-approval, Measuring Instrument Directive MID 2014/32/EU
OIML R117 test reports

OTHER APPROVALS AND CERTIFICATES (CONSIDERED)
EN 55011: Industrial, scientific and medical (ISM) radio-frequency equipment. Electromagnetic disturbance characteristics. Limits and methods of measurement

NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment

EN 61010-1: safety requirements for electrical equipment for measurement, control and laboratory use. General requirements

EN 60947-5-6: Specification for low-voltage switchgear and controlgear. Control circuit devices and switching elements. DC interface for proximity sensors and switching amplifiers (NAMUR)

Lloyds Register, silicone-free

CE-Zeichen:
The measuring systems complies with the legal requirements of the EC-Directives 2014/30/EU and 2014/34/EU including the amendment and supplements published to date. Bopp & Reuther Messtechnik GmbH confirms the successful testing of the device by affixing the CE-mark.

9. DOCUMENTATION

MANUALS

A-EN-01211-00 Manual OI with pulse pick-up and/or mechanical counters
A-EN-01212-00 Manual OI with Universal Smart Transmitter UST

ACCESSORIES

D-EN-17202-00 Pulse pick-up AG19 and AG20
D-EN-17203-00 Pulse pick-up AG01-08 (Exd)
D-EN-17201-00 Pulse pick-up AG4x
D-EN-17205-00 Single indicator E and double indicator D
D-EN-17205-00 Mechanical resettable roller counter, Series M5
D-EN-17207-00 Universal Smart Transmitter UST