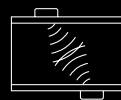
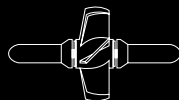
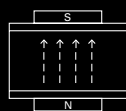
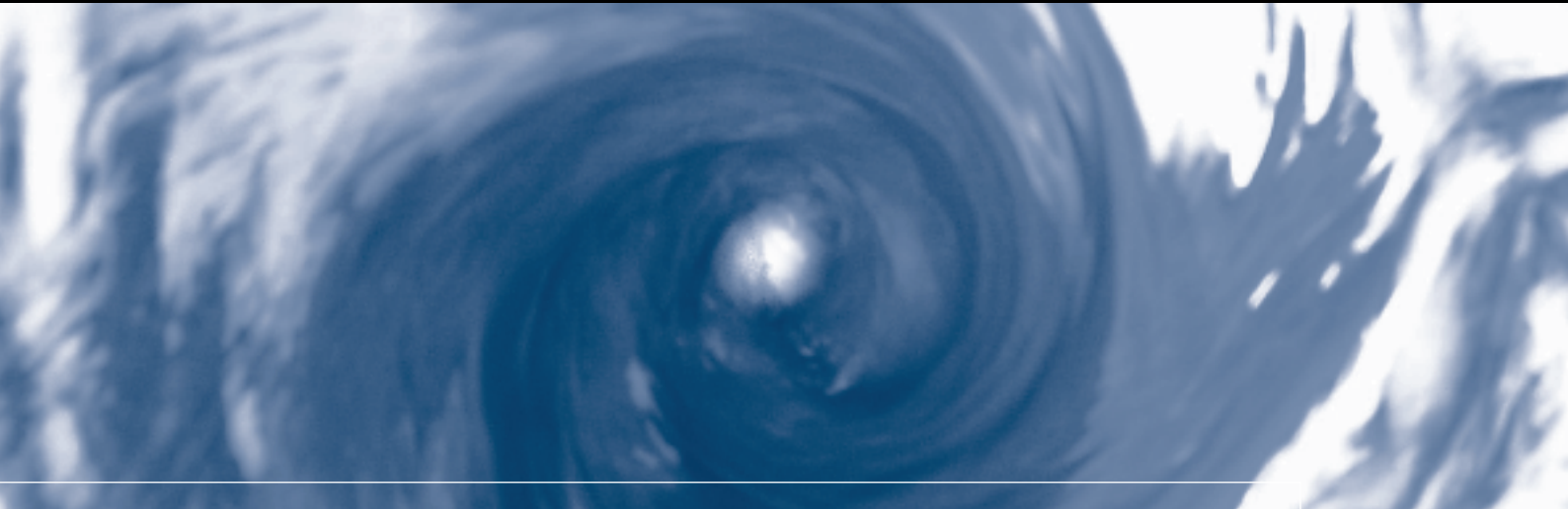


Flow measurement technology

Flow measuring, batching, controlling



You can build on our experience



Badger Meter Europa

“Nothing in the world is as powerful as an idea whose time has come.”

Victor Hugo



Badger Meter Europa GmbH in Beuren, Germany



Badger Meter, Inc., Milwaukee, USA

The company

Badger Meter Europa GmbH is a wholly owned subsidiary of Badger Meter, Inc., USA, based in Milwaukee, Wisconsin. With sales of more than 220 million Euro and the dedication of nearly 1000 employees all around the world, Badger Meter is a leading marketer and manufacturer of flow measurement and control devices since 1905. Badger Meter was a pioneer in flow measurement and can look back today at many patents in that field.

Badger Meter Europa GmbH is responsible for the international operations worldwide, except for the United States, Mexico and Canada which are operated from Badger Meter, Inc., USA. Highly qualified people as well as state-of-the-art production and test facilities ensure the best sales support and service for our customers. Badger Meter Europa GmbH is DIN ISO 9001:2000 certified and, since 1997, one of the test stands is officially PTB-approved and certified from the Office of Weight and Measures as test equipment according to the OIML R 117.

Long-term service and competence

We help you in a timely manner to solve your measurement problems, advise you and optimize your measurement solution, technology and site location before you make a decision. An extensive distributor and service network assures the best service all around the world. Local representatives are a big advantage for our customers. The short distance and the language make the assistance more efficient. Our distributors are trained on Badger Meter products in their own office or in our training center.

You can compare – we can't!

Our name assures you that our products have been manufactured with the best care and in conformity with all DIN ISO 9001:2000 directives.

Quality is a tradition

A company which has successfully been providing the industry with flow meters for more than 100 years is always aware of the importance of quality in its products. However, quality is an on-going process which we, as a company, embrace every day. At Badger Meter Europa GmbH, we consider quality as of the whole. It is the quality of our work, which you, as a customer, are entitled to expect from us. Quality begins with the individual, our employees, and requires a company philosophy which fits accordingly. Our quality should accompany you throughout the process: from the inquiry, to the order and the product up to the service.

“Quality is not a coincidence; it is the result of our company philosophy.”



Test stand and innovation center of Badger Meter

Flow measuring, batching, controlling

We can measure the flow of all liquids in almost all branches of the industry, and in small and large applications including pressure pipes, semi-filled pipes and open channels with a great variety of measurement principles.

A large product range of electromagnetic flow meters, nutating disc/positive displacement meters, turbine meters, oval gear meters, oscillating piston meters and ultrasonic flow meters provide a solution for almost any of your measurement applications in the water and waste water industry, sewage plant, water conditioning, water supply, water discharge, chemical industry, process industry, heat transfer, pharmaceutical industry, concrete industry, food and beverage industry, shipyard industry, power plants, refineries, paper industry, metallurgical industry, automotive industry, photography industry, textile industry...

Our flow meters

Electromagnetic flow meters	4
Detector type II	6
Sanitary detector for food	8
Detector type III	10
Amplifier type Primo® Advanced	11
Amplifier type ModMAG™ M 1000	12
Amplifier type ModMAG™ M 3000 / 4000	13
Turbine meters	14
Precision turbine meter type TP	16
Turbine meter type VISION	18
Turbo Meter	19
Oval gear meters	20
Precision oval gear meter type LM OG-I and LM OG-TI 100	22
Precision oval gear meter type MN D 100, MN 75-HG 100 and MN HG 100	23
Oval gear meter type MN 05, MN 1 and MN 2	24
Oval gear meter type MN 4 and MN 7	25
Oval gear meter type MN 10, MN 40, MN 50, MN 80 and MN 100	26
Nutating disc meters	28
Fluid meter type Recordall®	30
Impeller meters	32
Flow sensors	34
Monitors and transmitters	35
Ultrasonic flow meters	36
Type MoniSonic 4500 / 4600 and type PortaSonic 7000	38
Type iSonic 2000, DataControl 2500 and L2 xx	40
Type VHQ 500-SPS and type VHQ 500-SP	42
Type Compound® UF 5000 (transit time)	44
Further devices for system solutions	46



Badger Meter, Inc.

1905 TO 2005 ~ A CENTURY OF



FLOW MEASUREMENT SOLUTIONS

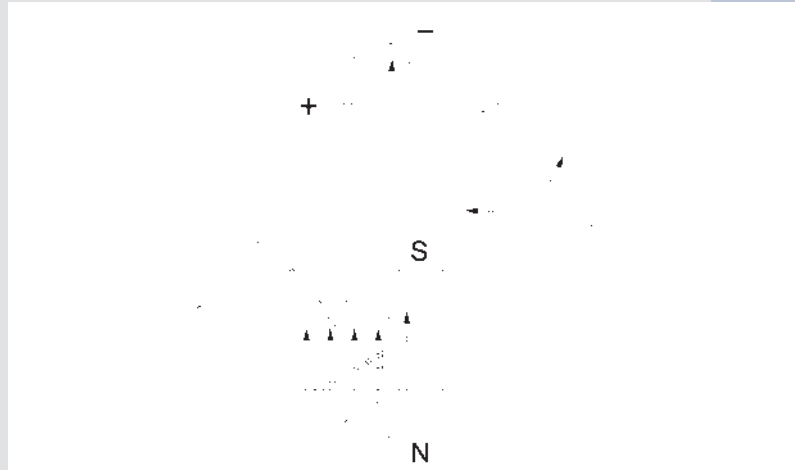
The meters for conductive fluids

Electromagnetic flow meters

The electromagnetic flow meters are ideally suited for flow measurement of all liquids with a minimum conductivity of $5 \mu\text{S}/\text{cm}$.

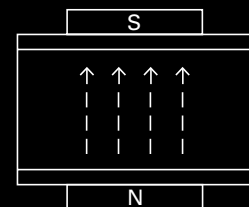
These meters are very accurate and the flow measurement is independent of density, temperature and pressure of the medium.





Measuring principle

The operating principle of the electromagnetic flow meter is based on Faraday's law of magnetic induction: The voltage induced across any conductor, as it moves at right angles through a magnetic field, is proportional to the velocity of that conductor. The voltage induced within the fluid is measured by two diametrically opposed internally mounted electrodes. The induced signal voltage is proportional to the product of the magnetic flux density, the distance between the electrodes and the average flow velocity of the fluid.



Detector type II

Flange process connection



DN 6 – 1400
Nominal pressure up
to PN 100

The electromagnetic detector type II is not only available in a number of different flange process connections (DIN, ANSI, JIS, AWWA, etc.) but also in a number of liners like hard rubber, soft rubber, PTFE, PFA or Halar.

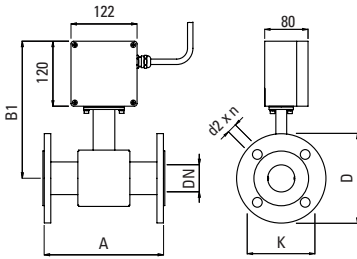
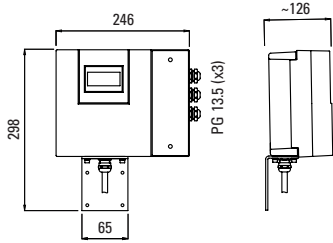
Available in sizes from DN 6 to DN 1400 and nominal pressures up to PN 100, the detector type II is best suited for a variety of applications in the industry and the water/waste water industry.

Technical data

Size	DN 6 – 1400 (1/4" ...56")		
Process connections	Flange: DIN, ANSI, JIS, AWWA, etc.		
Nominal pressure	Up to PN 100		
Protection class	IP 65, optional IP 68		
Min. conductivity	5 µS/cm		
Liner materials	Hard/soft rubber	from DN 25	0 up to +80 °C
	PTFE	DN 6 – 600	-40 up to +150 °C
	Halar (ECTFE)	from DN 300	-40 up to +150 °C
Electrodes materials	Hastelloy C (standard)		
	Tantal		
	Platinum/Gold plated		
	Platinum/Rhodium		
Housing	Carbon steel / Optional stainless steel		
Lay length	DN 6 – 20	170 mm	
	DN 25 – 50	225 mm	
	DN 65 – 100	280 mm	
	DN 125 – 200	400 mm	
	DN 250 – 350	500 mm	
	DN 400 – 750	600 mm	
	DN 800 – 1000	800 mm	
	DN 1200 – 1400	1000 mm	

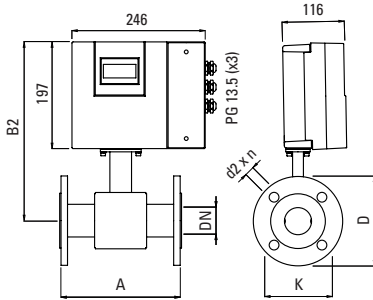
Flange process connection

Primo® wall mounted



Flange process connection

Primo® meter mounted



Dimensions (mm)

DN		A Std*	A ISO**	B 1	B 2	with ANSI flanges			with DIN flanges		
						Ø D	Ø K	Ø d2 x n	Ø D	Ø K	Ø d2 x n
6	1/4"	170	–	228	305	88,9	60,3	15,9 x 4	90	60	14 x 4
8	3/10"	170	–	228	305	88,9	60,3	15,9 x 4	90	60	14 x 4
10	3/8"	170	–	228	305	88,9	60,3	15,9 x 4	90	60	14 x 4
15	1/2"	170	200	238	315	88,9	60,3	15,9 x 4	95	65	14 x 4
20	3/4"	170	200	238	315	98,4	69,8	15,9 x 4	105	75	14 x 4
25	1"	225	200	238	315	107,9	79,4	15,9 x 4	115	85	14 x 4
32	1 1/4"	225	200	253	330	117,5	88,9	15,9 x 4	140	100	18 x 4
40	1 1/2"	225	200	253	330	127	98,4	15,9 x 4	150	110	18 x 4
50	2"	225	200	253	330	152,4	120,6	19 x 4	165	125	18 x 4
65	2 1/2"	280	200	271	348	177,8	139,7	19 x 4	185	145	18 x 4
80	3"	280	200	271	348	190,5	152,4	19 x 4	200	160	18 x 8
100	4"	280	250	278	355	228,6	190,5	19 x 8	220	180	18 x 8
125	5"	400	250	298	375	254	215,9	22,2 x 8	250	210	18 x 8
150	6"	400	300	310	387	279,4	241,3	22,2 x 8	285	240	22 x 8
200	8"	400	350	338	415	342,9	298,4	22,2 x 8	340	295	22 x 12
250	10"	500	450	362	439	406,4	361,9	25,4 x 12	395	350	22 x 12
300	12"	500	500	425	502	482,6	431,8	25,4 x 12	445	400	22 x 12
350	14"	500	550	450	527	533,4	476,2	28,6 x 12	505	460	22 x 16
400	16"	600	600	475	552	596,9	539,7	28,6 x 16	565	515	26 x 16
450	18"	600	–	500	577	635,0	577,8	31,7 x 16	–	–	–
500	20"	600	–	525	602	698,5	635,0	31,7 x 20	670	620	26 x 20
550	22"	600	–	550	627	749,3	692,1	34,9 x 20	–	–	–
600	24"	600	–	588	665	812,8	749,3	34,9 x 20	780	725	30 x 20
650	26"	600	–	613	690	869,9	806,4	34,9 x 24	–	–	–
700	28"	600	–	625	702	927,1	863,6	35,1 x 28	895	840	30 x 24
750	30"	800	–	650	727	984,2	914,4	34,9 x 28	–	–	–
800	32"	800	–	683	760	1060,5	977,9	41,3 x 28	1015	950	33 x 24
850	34"	800	–	708	785	1111,2	1028,7	41,3 x 32	–	–	–
900	36"	800	–	725	802	1168,4	1085,8	41,3 x 32	1115	1050	33 x 28
950	38"	800	–	750	827	1238,3	1149,4	41,3 x 32	–	–	–
1000	40"	800	–	790	867	1346,2	1257,3	41,3 x 36	1230	1160	36 x 28
1200	48"	1000	–	900	977	1511,5	1422,4	41,3 x 44	1455	1380	39 x 32
1350	54"	1000	–	975	1052	1682,8	1593,9	47,8 x 44	–	–	–
1400	56"	1000	–	1000	1077	–	–	–	1675	1590	42 x 36

Standard

with ANSI flanges	from DN 6 to 1400	Lbs 150
with DIN flanges	from DN 6 to 200	PN 16
	from DN 250 to 1400	PN 10

*Standard **ISO 13359

Sanitary detector for food

Process connections Tri-Clamp®, DIN 11851, ISO 2852, etc.



DN 10 – 100
Nominal pressure PN 10

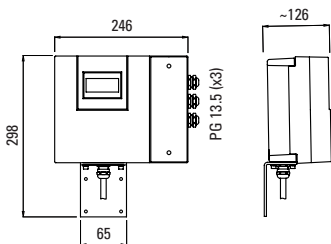
The sanitary detector was developed for the flow measurement of liquid food. This model is available with Tri-Clamp®, DIN 11851, ISO 2852 process connections and also with any special connections (customer specifications). The sanitary detector is delivered in a stainless steel housing and with PTFE lining.

Technical data

Size	DN 10 – 100 (3/8" ... 4")		
Process connections	Tri-Clamp®, DIN 11851, ISO 2852, etc.		
Nominal pressure	PN 10		
Protection class	IP 65, optional IP 68		
Min. conductivity	5 µS/cm		
Liner materials	PTFE	-40 up to +150 °C	
Electrodes materials	Hastelloy C (standard) Tantal Platinum / Gold plated Platinum / Rhodium		
Housing	Stainless steel		
Lay length	Tri-Clamp® connection	DN 10 – 50	145 mm
		DN 65 – 100	200 mm
	DIN 11851 connection	DN 10 – 20	170 mm
		DN 25 – 50	225 mm
		DN 65 – 100	280 mm

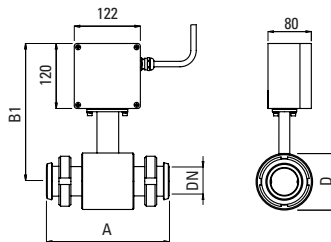
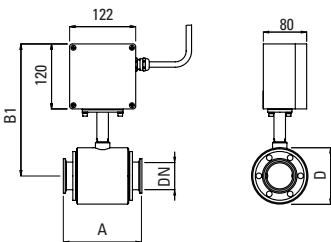
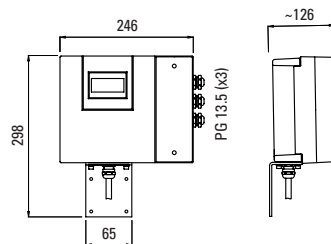
Tri-Clamp® process connection

Primo® wall mounted



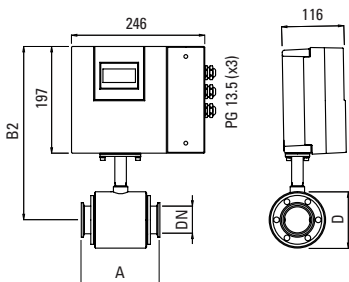
DIN 11851 process connection

Primo® wall mounted



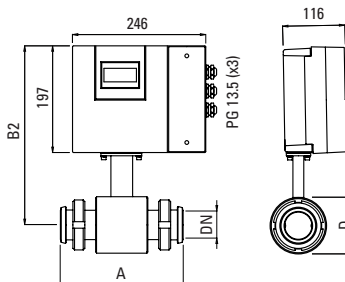
Tri-Clamp® process connection

Primo® meter mounted



DIN 11851 process connection

Primo® meter mounted



Dimensions (mm) type Food Tri-Clamp®

DN		A	B 1	B 2	D
10	3/8"	145	228	305	74
15	1/2"	145	228	305	74
20	3/4"	145	228	305	74
25	1"	145	228	305	74
40	1 1/2"	145	238	315	94
50	2"	145	243	320	104
65	2 1/2"	200	256	333	129
80	3"	200	261	338	140
100	4"	200	269	346	156

PN 10

Dimensions (mm) type Food DIN 11851

DN		A	B 1	B 2	D
10	3/8"	170	238	315	74
15	1/2"	170	238	315	74
20	3/4"	170	238	315	74
25	1"	225	238	315	74
32	1 1/4"	225	243	320	84
40	1 1/2"	225	248	325	94
50	2"	225	253	330	104
65	2 1/2"	280	266	343	129
80	3"	280	271	348	140
100	4"	280	279	356	156

PN 10

Detector type III

Wafer connection



DN 25 – 100
PN 40

Technical data

Size	DN 25 – 100 (1"…4")	
Process connection	Wafer connection, (in-between flange mounting)	
Nominal pressure	PN 40	
Protection class	IP 65, optional IP 68	
Min. conductivity	5 µS/cm	
Liner materials	PTFE	-40 up to +150 °C
Electrodes materials	Hastelloy C (standard) Tantal Platinum / Gold plated Platinum / Rhodium	
Housing	Carbon steel/optional stainless steel	
Lay length	DN 25 – 50	100 mm
	DN 65 – 100	150 mm

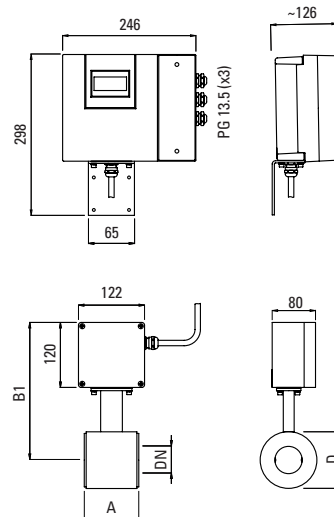
Dimensions (mm)

DN	A	B 1	B 2	D
25	100	238	315	74
32	100	243	320	84
40	100	248	325	94
50	100	253	330	104
65	150	266	343	129
80	150	271	348	140
100	150	279	356	156

Thanks to its very short lay length, the detector type III is often the right alternative to a lot of applications. Delivered with a PTFE liner, the detector type III has a standard nominal pressure of PN 40.

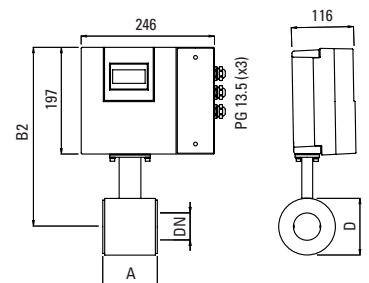
Wafer connection

Primo® wall mounted



Wafer connection

Primo® meter mounted



Amplifier type Primo® Advanced

for all detectors



Accuracy $\pm 0,25\%$
Flow range 0,03 – 12 m/s
LCD-display

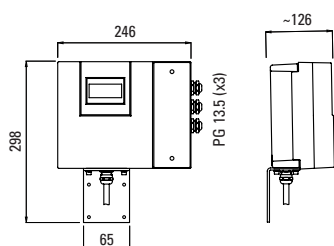
The amplifier type Primo® Advanced is time-proven in all flow applications. This series is extremely accurate and very simple to use. Standard models have a RS 232 interface, thus allowing an easy programming of the devices. The backlit, four-line display shows all actual flow measuring data, daily and complete information, including alarm messages.

Further functions like the entry of upper and lower flow set points and preselection for batch applications make the series flexible for a large variety of applications. Integrated tools make it easy to install and to maintain. The model Primo® Advanced includes HART protocol communication.



Dimensions

Primo® Advanced



Technical data

Power	85 – 265 VAC, 45 – 65 Hz, < 20 VA
Analog output	0/4 – 20 mA, ≤ 800 ohms, flow direction is displayed through a separate status output
Pulse output	24 V active, 250 mA 30 V passive, 250 mA (open collector) max. 10 kHz
Status output	1 min./max. alarm or preselection meter, 1 flow direction, 1 error message
Medium control	Separate electrode
Programming	3 keys, RS 232, HART
Interface	RS 232 for measuring values and programming Optional: HART
Flow range	0,03 – 12 m/s
Accuracy	$\geq 0,5$ m/s better $\pm 0,25\%$ of actual flow $< 0,5$ m/s $\pm 1,25$ mm/s of actual flow
Repeatability	0,1 %
Flow direction	Bi-directional
Pulse length	Programmable up to 500 ms
Outputs	Short circuit safe up to min. 500 V
Low flow cut off	0 – 10 %
Display	LCD, 4-lines / 16 characters, backlight Actual flow, 2 totalizers, status display
Housing	Powder coated aluminium die cast
Protection class	IP 65
Cable insertion	Power and signal cable (outputs) 3 x PG 13.5
Signal cable	From detector PG 11
Ambient temperature	-20 up to +60 °C

Amplifier type ModMAG™ M 1000

for all detectors

The low cost alternative

Accuracy $\pm 0,5\%$ of actual flow

Flow range 0,03 – 12 m/s

Power supply 24 VDC / 115 VAC / 230 VAC



Technical data

Power supply	24 VDC optional 115 / 230 VAC (50 / 60 Hz), 10 VA
Accuracy	$\pm 0,5\%$ of actual flow, $\geq 0,5$ m/s $\pm 2,5$ mm/s of actual flow, $< 0,5$ m/s
Repeatability	$< 0,1\%$ of full scale
Flow range	0,03 – 12 m/s
Conductivity	Min. 5 μ S/cm
Flow direction	Bi-directional
Display	Optional with LCD, 4 lines / 16 characters, backlit Actual flow, 3 totalizers, status display
Programming	Handheld, RS 232 or optional via 3 buttons
Interface	RS 232 for measuring values and programming
Analog output	0/4 – 20 mA passive, optional active Flow direction is displayed upon a separate status output
Pulse output	Passive, optional active 2 open collectors Passive 24 VDC, 50 mA, max. 10 kHz
Frequency output	Max. 10 kHz (open collector)
Status output	Min./max. alarm, preselection, flow direction, error message, free configurable
Empty pipe detection	Separate electrode
Low flow cut off	0 – 10 %
Housing	Powder coated aluminium die cast
Protection class	IP 65
Cable insertion	2 x M 20
Ambient temperature	-20 up to 60 °C

M 1000 has been designed to fit into the MAG meter series and especially for applications in machinery plants, vehicles and batching processes.

The applications range from DN 6 to DN 200 with the most various process connections like DIN flanges, dairy pipe connections, TriClamp®, etc.

The basic line of M 1000 is provided with 24 VDC power supply, without display, with passive outputs and can be programmed via a serial port RS 232 or separate handheld. The device can also, upon request, be factory preconfigured and then just needs to be electrically connected on site.

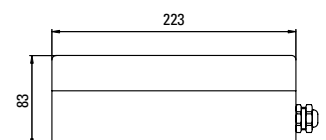
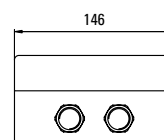
The M 1000 is encased into a powder-coated aluminium diecast housing IP 65 and has two M 20 screws. The basic line can be, upon request, provided with a four-line LC display, a 115/230 VAC power supply and active pulse and analog outputs.

The standard model M 1000 is supplied with an analog output, two digital outputs for pulse and frequency as well as a digital input.

With an accuracy of $\pm 0,5\%$ of actual flow ($> 0,5$ m/s) and flow measurements ranging between 0,03 and 12 m/s in both directions, the flow meter covers a great variety of applications.

Dimensions

ModMAG™ M 1000



Amplifier type ModMAG™ M 3000 / 4000

for all detectors



Ex-proof
Protection class IP 67
Accuracy ±0,25 % of actual flow
Flow range 0,03 – 12 m/s

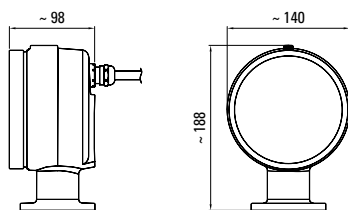
The new amplifier with modular design allows flow measurements in ex-zones 1 and 2, in either the mounted or remote version.

The amplifier housing, made of powder-coated aluminium, is available in protection class IP 67 and with a separate connection space. Programming can be done either with closed housing thanks to a magnetic pen or with open housing via three buttons. The four-line display shows all necessary data like actual flow, totalizer and status messages.

The programmable excitation frequency even enables the amplifier to be adjusted for difficult metering applications. The new developed process for amplifier compensation enables a high accuracy, especially in the lower flow range.

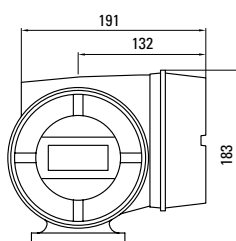
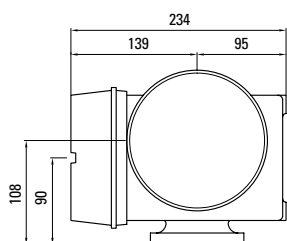
The ModMAG™ is especially suited for flow measurements in the chemical and pharmaceutical industry, as well as water and waste water plants with explosion-proof zones.

Dimensions Junction box



Dimensions

ModMAG™ M 3000 / 4000



Technical data

Power supply	85 – 265 VAC, 45 – 65 Hz < 20 VA
Accuracy	±0,25 % of actual flow, ≥ 0,5 m/s ±1,25 mm/s of actual flow, < 0,5 m/s
Repeatability	< 0,1 % of full scale
Flow range	0,03 – 12 m/s
Conductivity	Min. 5 µS/cm
Flow direction	Bi-directional
Display	LCD, 4 lines / 16 characters, backlit Actual flow, 3 totalizers, status display
Programming	3 buttons or via magnetic pen
Interface	RS 232 for measuring values and programming
Analog output	0/4 – 20 mA ≤ 750 ohms Flow direction is displayed upon a separate status output
Pulse output	Active / passive selectable 2 open collectors and 2 solid state relays Open collector Active 18 VDC, 25 mA Passive 24 VDC, 20 mA (max. 0,5 W) AC solid state relay: max. 24 VAC, 500 mA
Frequency output	Max. 10 kHz (open collector)
Status output	Min./max. alarm, preselection, flow direction, error message, free configurable
Empty pipe detection	Separate electrode
Low flow cut off	0 – 10 %
Housing	Powder coated aluminium die cast
Protection class	IP 67
Cable insertion	3 x M 20
Ambient temperature	-20 up to +60 °C
Ex proof version	FM/CSA class I, div. 1 / div. 2 ATEX EEx de [ia] IIC T4 (in process)

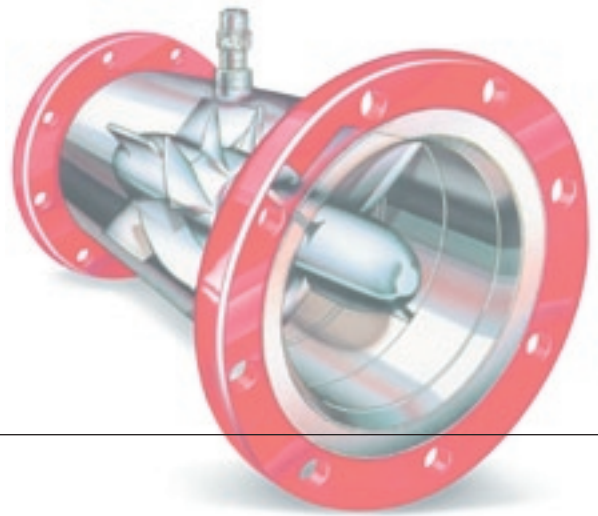
The meters for fluids with

low viscosity

Turbine meters

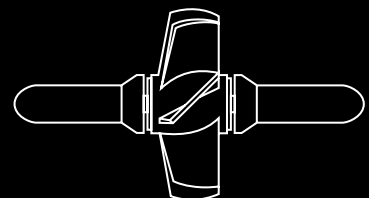
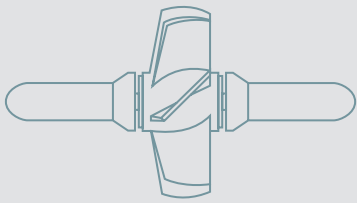
Turbine meters are only meant for applications with low viscosity and non-aggressive fluids and gases.





Measuring principle

Turbine meters are volumetric meters. When the fluid passes through, a rotor is activated and the movement is either electronically or mechanically transmitted outside.



Precision turbine meter type TP

for low viscosity, non-aggressive fluids and gases

Very good accuracy
Extremely high operation
Large temperature range
High resolution



The turbine meters of the TP series are ideally suited for precision flow and volume measurement of low viscosity and non-aggressive fluids and gases.

Since all turbine meters have an unscaled pulse output, a pulse scaler must be utilized in order to get a scaled pulse value.

Technical data

Housing material	Stainless steel 316
Rotor material	Stainless steel Sandvic 1802, or BS 3146
Bearing material	Stainless steel 316, or WC / Stellite
Pulse pick-up	Standard, intrinsic safe and high temperature
Response time	5 – 200 ms
Max. viscosity	Ca. 20 mPas, depending on meter size
Linearity	± 0,5 % of value for liquids, ± 1 % for gases, if $p \geq 10$ bars
Repeatability	± 0,5 %
Output frequency	0 – 1000 Hz
Pressure drop	0,25 bar for liquids, ca. 50 mbar for gases
Operating pressure	max. 350 bars
Operating temperature	-200 up to +450 °C
Process connections	BSP and NPT threads, flanges DIN, ANSI, 11851, Ermeto
Electrical connection	2-pin Cannon connector

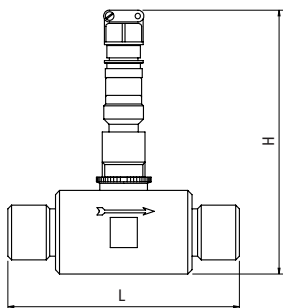
Specifications

Type		DN	Flow range in m ³ /h		K factors** Pulses / Liter
Threaded	Flanged		Liquids	Gases*	
TP-R-1	TP-F-1	6	0,028 – 0,275	–	17000
TP-R-2	TP-F-2	6	0,055 – 0,55	–	9000
TP-R-4	TP-F-4	13	0,11 – 1,1	–	3000
TP-R-8	TP-F-8	15	0,22 – 2,2	0,88- 6,6	1700
TP-R-15	TP-F-15	15	0,4 – 4	1,6 – 12	1100
TP-R-30	TP-F-30	20	0,8 – 8	3,4 – 24	500
TP-R-60	TP-F-60	25	1,6 – 16	6,4 – 48	190
TP-R-125	TP-F-125	40	3,4 – 34	10 – 100	51
TP-R-250	TP-F-250	50	6,8 – 68	20 – 200	24
–	TP-F-500	65	13,5 – 135	40 – 400	14
–	TP-F-1000	100	27 – 270	80 – 800	6,5
–	TP-F-2000	150	55 – 550	160 – 1600	2,4
–	TP-F-4000	200	110 – 1100	320 – 3200	1,73
–	TP-F-7000	250	190 – 1900	500 – 5000	1,7
–	TP-F-10000	300	270 – 2700	800 – 8000	1,1
–	TP-F-15000	400	400 – 4000	1200 – 12000	–
–	TP-F-25000	500	700 – 7000	1700 – 17000	–

* Actual m³/h ** Average values

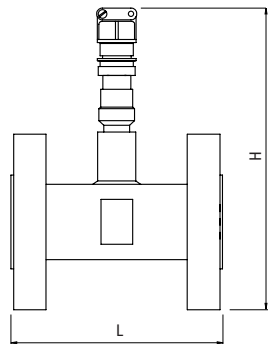
Dimensions type TP

Threaded connection (R)



Dimensions type TP

Flanged connection (F)



Dimensions type TP

DN	Connections		Dimensions (mm)			
	Threaded (R)	Flanged (F)	Length L		Height H	
			R	F	R	F
6	R 3/8"	DN 10	51	114	143	175
13	R 1/2"	DN 15	64	127	143	175
15	R 3/4"	DN 15	64	127	144	186
20	R 3/4"	DN 20	83	140	153	193
25	R 1"	DN 25	89	152	164	204
40	R 1 1/2"	DN 40	114	178	182	227
50	R 2"	DN 50	133	197	200	248
65	–	DN 80	–	254	–	271
100	–	DN 100	–	356	–	364
150	–	DN 150	–	368	–	422
200	–	DN 200	–	457	–	481
250	–	DN 250	–	457	–	539
300	–	DN 300	–	457	–	592
400	–	DN 400	–	610	–	709
500	–	DN 500	–	610	–	828

Turbine meter type VISION

for low viscosity, non-aggressive liquids, for very low flows

Good price/performance ratio

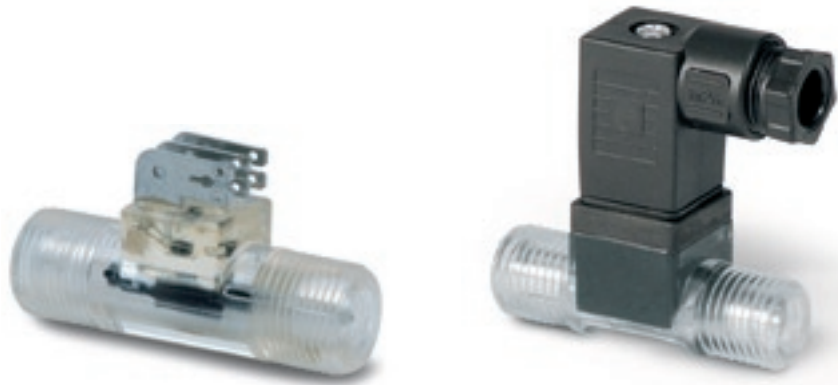
Compact construction

Easy installation

No maintenance

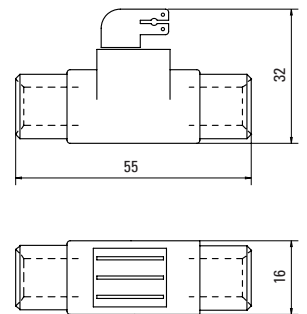
High operating pressure

Operates in any mounting position



Technical data		
Type	1000 2F 66	all other models
Material	Grilamid TR 55 (PA 12)	
Viscosity range	0,8 – 16 mm ² /sec	
Accuracy	±3 % of value	
Repeatability	0,50 %	
Temperature range	-20 up to +100 °C	
Operating pressure	Max. 25 bars	
Burst pressure	200 bars	
Electrical connection	–	AMP Faston 2,8 / 6,3 x 0,8 mm
Power supply	5 – 24 VDC	
Current consumption	Ca. 8 mA	
Output signal	Open collector NPN pulse	
Pull-down resistor	1 – 2,2 kOhms	
Process connections	G 1/4", NPT 1/4"	G 3/8", NPT 3/8"

Dimensions



Specifications								
Type	1000 2F 66	2006 4F 44	2006 2F 66	2008 4F 16,5	2008 4F 22	2008 4F 23	2008 4F 44	2008 2F 66
Measuring range l/min	0,1 – 2	1 – 10	0,5 – 5	2 – 35	1 – 25	1,5 – 25	1 – 15	0,5 – 7,5
K factor PPL*	25.000	3300	6900	700	1000	1000	2200	4600
Size DN (mm)	5	6	6	8	8	8	8	8

* PPL = pulses / liter

Also available with cable connection.

Pressure drop in bars for water								
Type	1000 2F 66	2006 4F 44	2006 2F 66	2008 4F 16,5	2008 4F 22	2008 4F 23	2008 4F 44	2008 2F 66
0,5 l/min	0,02	–	–	–	–	–	–	–
1 l/min	0,05	~ 0	~ 0	~ 0	~ 0	~ 0	~ 0	~ 0
1,5 l/min	0,15	–	–	–	–	–	–	–
2 l/min	0,25	0,06	~ 0	~ 0	~ 0	~ 0	0,05	~ 0
5 l/min	–	0,2	0,12	~ 0	0,05	0,05	0,2	0,05
10 l/min	–	0,7	0,4	~ 0,12	0,17	0,17	0,4	0,2
15 l/min	–	–	0,9	~ 0,25	0,27	0,27	–	0,4
20 l/min	–	–	1,3	~ 0,45	0,48	0,48	–	0,7
25 l/min	–	–	–	~ 0,60	0,65	0,65	–	–
30 l/min	–	–	–	~ 0,92	0,97	0,97	–	–

Turbo Meter

for liquids without entrained air



High accuracy
Compact construction
Light weight
Flow range of ca. 1:30

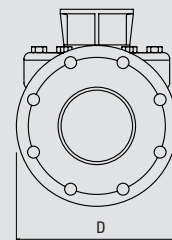
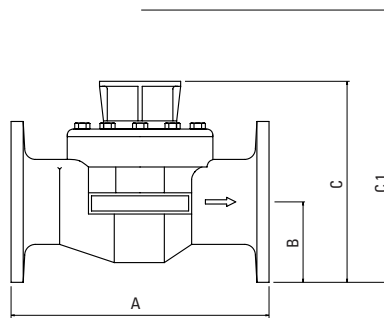
The Turbo Meter is used in a wide range of fluid applications ranging from water to oils, solvents to acids. The meter has been used in water treatment systems, loading and unloading of tankers or rail cars, batching systems, or simple inventory control of a process fluid. Anywhere high volume and/or high flow rates are required in the application, the Turbo Meter is likely the right choice.

Technical data

Size DN (mm)	DN 50	DN 80	DN 100	DN 150
Normal flow range (l/min.)	30 – 600	38 – 1320	95 – 3780	150 – 7600
Max. continuous flow (l/min.)	600	1320	3780	7600
Accuracy in complete flow range	±1,5 %	±1,5 %	±1,5 %	±1,5 %
Accuracy in flow range 10:1	±0,5 %	±0,5 %	±0,5 %	±0,5 %
Pressure drop at max. flow (bar)	0,3	0,4	0,35	0,35
Max. operating temperature	120 °C	120 °C	120 °C	120 °C
Nominal pressure PN (bar)	10/20	10/20	10/20	10/20
Weight (kp)	14	18	35	60

Dimensions (mm)

Size	DN 50	DN 80	DN 100	DN 150
A	250	300	355	460
B	70	89	108	133
C	200	230	250	300
D	155	190	230	280



Total height C1 (mm) with various accessories

Size	DN 50	DN 80	DN 100	DN 150
Accessories				
MS-E 1	276	300	320	380
MS-ER 1	335	360	385	437
Register	280	310	335	385
PC 100 / VZ-150	430	460	480	530
PFT	245	270	295	345

Materials

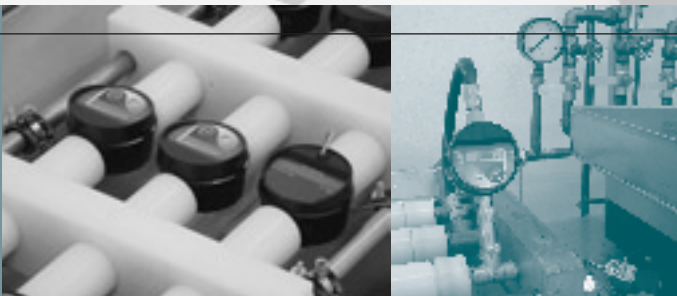
Housing	Cast iron / bronze / 316 SS
Rotor and nose cone	Ryton (polyphenylene sulfide)
Bearings	Ceramic
Drop pipe	316 SS
Straightening vanes	316 SS
Bypass valve	316 SS
Head gasket	Buna-N or EPDM / Viton
O-rings	EPDM / Buna-N / Viton-A

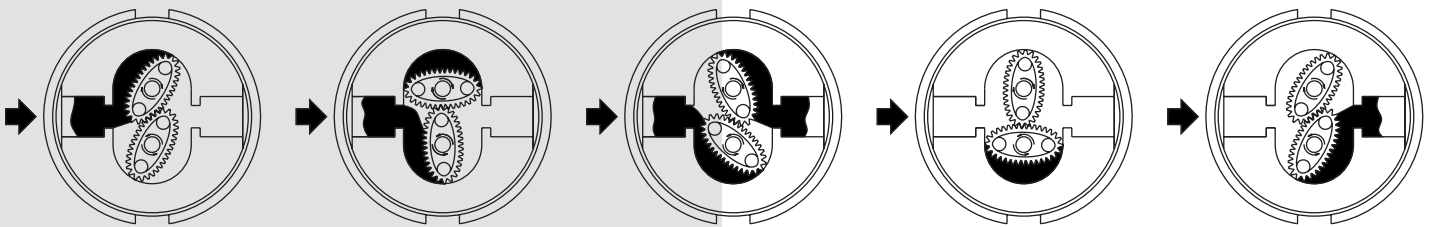
The meters for liquids

with middle and high **viscosity**

Oval gear meters

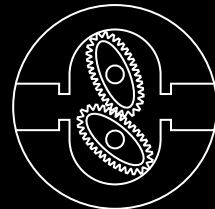
Oval gear meters are volumetric meters and are best suited for liquids with a viscosity up to 1.000 mPas. (special models up to 1.000.000 mPas.). Typical applications are mineral oils, hydraulic oils, solvents, brake fluids, coolants, transmission oils, etc.





Measuring principle

As fluid passes through the metering chamber by entering the inlet port, it forces the internal gears to rotate and exits through the outlet port. Each rotation of the gear displaces a given volume of fluid. Controlled clearances between the gears and chamber wall insure minimum leakage. As the gears rotate, a magnet on each end of the gear activates the microprocessor in the register.



Precision oval gear meter type LM OG-I and LM OG-TI 100

for industrial applications

Leakproof, magnetic drive

Large LCD display

**Only two moving parts to reduce
maintenance costs**

Up to 7 years battery life

Low battery signal

Replaceable battery



Specifications LM OG-TI 100

	ANSI	Metric
Flow range	0,25 – 8 gpm	1 – 35 l/min
Max. operating pressure	1500 psi	103 bars
Min. operating pressure	5 psi	0,35 bar
Max. operating temperature	-10 to +110 °F	-20 to +45 °C
Accuracy	±0,75 %	±0,75 %
Pulse rate	380 pulses per gallon	100 pulses per liter
Max. reedswitch resistance	150 VAC @ 10 Watt	150 VAC @ 10 Watt
Weight	2,0 lbs	0,9 kg
Inlet & outlet connections	1/2" NPTF	1/2" BSPP

The powder-coated universal meter with electronic register contains a microprocessor board powered by a lithium battery with an expected life of five years or more depending on use. It can be programmed to dispense in pints, quarts, liters or gallons and will totalize in liters or gallons.

A calibration factor and unit of measure are programmed during factory test. Unlike mechanic meters, these units can be electronically recalibrated in the field when necessary. A 5-digit

liquid crystal display, accurate to the second decimal place, shows the exact amount of fluid dispensed.

The entire register module is protected from the wear and tear of normal shop use by a rugged, glass filled, shock resistant, nylon housing.

The Badger Meter oval gear meter with pulse transmitter, model LM OG-TI, is an economical, rugged yet accurate meter.

The transmitter, mounted on the meter, can be wired to batch controllers, remote counters and other electronically operated instruments that can accept pulses from a reed switch, and have scaling capabilities.

The oval gear transmitter is contained in a glass filled plastic housing with a NEMA 4X rating and has a 100 PPL isolated reedswitch as output.

Specifications LM OG-I

	Coolant/windshield liquid*		Brake fluid/waste oil**	
	ANSI	Metric	ANSI	Metric
Maximum flow*	6 gpm	23 l/min	8 gpm	35 l/min
Minimum flow*	1,0 gpm	3,8 l/min	0,25 gpm	1,0 l/min
Max. operating pressure	1500 psi	103 bars	1500 psi	103 bars
Min. operating pressure	5 psi	0,35 bar	5 psi	0,35 bar
Max. operating temperature	110 °F	45 °C	110 °F	45 °C
Min. operating temperature	-10 °F	-20 °C	-10 °F	-20 °C
Accuracy (non-approved version)	±1,0 %	±1,0 %	±0,5 %	±0,5 %
Weight without handle	2,5 lbs / 3,0 lbs	1,0 kg / 1,4 kg	2,5 lbs / 3,0 lbs	1,0 kg / 1,4 kg
5-digit LCD display, 5/16" high (8 mm)	Pints / Quarts / Gallons	Liters	Pints / Quarts / Gallons	Liters
Inlet & outlet connections	1/2" NPTF	1/2" BSPP	1/2" NPTF	1/2" BSPP

*Tested with water at ambient temperature.

**Tested with Mobil DTE-25 motor oil at ambient temperature.
Min./max. flow rates will vary with fluid viscosity.

Precision oval gear meter type MN D 100, MN 75-HG 100 and MN HG 100

for oils and fuel



Lower pressure drop
Ideal for gravity and pump
(in-line) applications
Rugged construction

The flow meter type MN D 100 has been designed to measure diesel, kerosene, petrol and oil up to 1000 mPas. The meter is made from corrosion-resistant aluminium with easy-to-read mechanical registers.

The MN 75-HG 100 has been designed specifically to dispense lubricating oils, diesel and kerosene. This high pressure, positive displacement type meter is suitable for all end-of-line applications and features a rugged and robust register with integrated electronics and large LC display.

The MN HG 100 is a feature packed non-metered high-flow pistol grip designed to shift large volumes of fluid quickly and easily. The pistol grip is also available in zinc for use in the mining industry.

Specifications			
Type	MN D 100	MN 75-HG 100	MN HG 100
Accuracy	±1 % of flow	0,5 % of flow	–
Flow range	3 – 80 l/min	3 – 60 l/min	Up to 57 l/min
Max. pressure	10 bars	103 bars	105 bars
Max. temperature	80 °C	55 °C	70 °C

Oval gear meter type MN 05, MN 1 and MN 2

for industrial fluids

Large viscosity range
Pressure up to 550 bars
Low flow

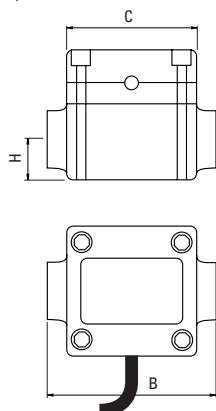


Technical data

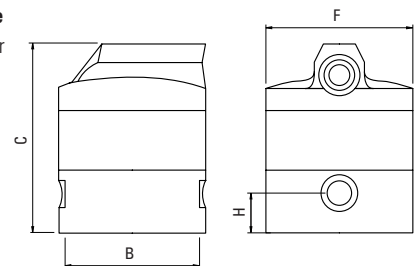
Type	MN 05		MN 1				MN 2			
Model	Stainless steel	Aluminium	Plastic	Stainless steel	Aluminium	High pressure	Plastic	Stainless steel	Aluminium	High pressure
Size	DN 3		DN 6				DN 6			
Flow range	under 1 mPas: 1 – 50 l/h		under 5 mPas: 5 – 100 l/h				under 5 mPas: 25 – 500 l/h			
	over 1 mPas: 0,5 – 50 l/h		over 5 mPas: 2 – 100 l/h				over 5 mPas: 15 – 500 l/h			
Accuracy	±1 % of value		±1 % of value				±1 % of value			
Repeatability	0,03 %		0,03 %				0,03 %			
Max. viscosity	1000 mPas		1000 mPas				1000 mPas*			
Max. pressure	10 bars	5 bars	5 bars	10 bars	5 bars	551 bars	5 bars	10 bars	5 bars	551 bars
	55 bars		55 bars				55 bars			
Max. temperature	80 °C / 120 °C		80 °C / 120 °C				80 °C / 120 °C			
Pulse rate	1552 PPL		1000 PPL				400 PPL			
Pulse transmitter	Reedswitch		Reedswitch				Reedswitch			
Recommended filter	0,05 mm		0,05 mm				0,05 mm			
Register	without		without				without			
Process connections	R 1/8"		R 1/4"				R 1/4"			
Housing material	316 SS	Alu	PPS	316 SS	Alu	316 SS	PPS	316 SS	Alu	316 SS
Oval gear material	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS	316 SS
Option	Pulse transmitter with hall effect sensor		Pulse transmitter with hall effect sensor				Pulse transmitter with hall effect sensor			

* with special oval gears up to 1.000.000 mPas as an option

MN 05 / MN 1 / MN 2 standard
with pulse transmitter



MN 2 high pressure
with pulse transmitter



Dimensions (mm)

	B	C	F	H
MN 05 / MN 1 / MN 2 standard	65	50	–	18
MN 1 / MN 2 high pressure	83	110	86	23

Oval gear meter type MN 4 and MN 7

for industrial fluids



Large LCD display
Large flow range
Good accuracy

The type MN 4 is available in various models: Aluminium or stainless steel housing with pulse transmitter or mechanic register. This meter is best suited for fluids with a maximum viscosity of 1000 mPas and a maximum pressure of 55 bars.

The type MN 7 is also meant for fluids with a maximum viscosity of 1000 mPas but with a maximum pressure of 10 bars. Accessories like pulse transmitters with hall effect sensor, electronic LCD display as well as Ex-proof display for applications in zone 1, can be mounted on the meter.

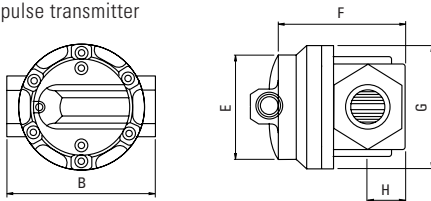
Technical data

Type	MN 4			MN 7	
Model	with pulse transmitter	with electronic display	with mechanic display	with pulse transmitter	with electronic display
Size	DN 15			DN 25	
Flow range	under 5 mPas: 180 – 1500 l/h			under 5 mPas: 480 – 4200 l/h	
	over 5 mPas: 60 – 1800 l/h			over 5 mPas: 180 – 4500 l/h	
Accuracy	±0,5% of value		±1% of value	±0,5% of value	
Repeatability	0,03 %			0,03 %	
Max. viscosity	1000 mPas*			1000 mPas	
Max. pressure	55 bars	55 bars	34 bars	10 bars	
Max. temperature	80 °C / 120 °C			80 °C	
Pulse rate	112 PPL			52 PPL	
Pulse transmitter	Reedswitch			Reedswitch	
Recommended filter	0,1 mm			0,1 mm	
Register	without	electronic	mechanical**	without	electronic
Process connections	R 1/2"			R 1"	
Housing material	Alu/316 SS			PPS	
Oval gear material	PPS/316 SS		PPS	PPS	
Option	Pulse transmitter with hall effect sensor				
	Standard LCD display / Option with EEx-i				
	Deluxe LCD preset meter / Option with EEx-i				

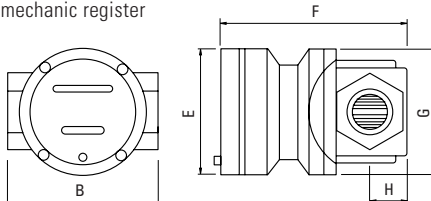
* with special oval gears up to 1.000.000 mPas

** no pulse transmitter in connection with mechanical register

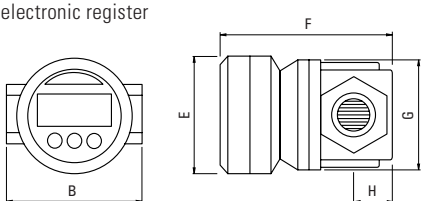
MN 4 with pulse transmitter



MN 4 with mechanic register



MN 7 with electronic register



Dimensions (mm)

	B	E	F	G	H
MN 4 p	100	70	105	100	20
MN 4 e	100	115	125	96	20
MN 4 g	100	115	125	96	20
MN 4 m	100	115	125	96	20
MN 7 p	108	70	120	100	30
MN 7 e	108	137	137	100	30
MN 7 g	108	137	137	100	30

e: electronic display g: LCD standard display

m: mechanic display p: pulse transmitter

Oval gear meter type MN 10, MN 40, MN 50, MN 80 and MN 100 for industrial fluids

Large LCD display
Large flow range
Good accuracy



The models are available with either aluminium, bronze or stainless steel housing; models MN 80 and MN 100 are available in aluminium only. Mechanic as well as electronic registers, ex-proof, can be mounted upon

request. The maximum operating pressure for the type MN 10 is 55 bars while 18 bars for the MN 40/MN 50 and 10 bars for the MN 80/MN 100 models. These meters differ themselves in their size and their flow range.

Technical data

Type	MN 10			MN 40			MN 50		
Model	with pulse transmitter	with electron. display	with mechanic display	with pulse transmitter	with electron. display	with mechanic display	with pulse transmitter	with electron. display	with mechanic display
Size	DN 25			DN 40			DN 50		
Flow range	under 5 mPas: 600 – 6000 l/h			under 5 mPas: 900 – 14100 l/h			under 5 mPas: 1800 – 18000 l/h		
	over 5 mPas: 360 – 7200 l/h			over 5 mPas: 600 – 15000 l/h			over 5 mPas: 900 – 21000 l/h		
Accuracy	±0,5 % of value		±1 % of value	±0,5 % of value		±1 % of value	±0,5 % of value		±1 % of value
Repeatability	0,03 %			0,03 %			0,03 %		
Max. viscosity	1000 mPas*			1000 mPas*			1000 mPas*		
Max. pressure or acc. to flange norm PN 16	16/55 bars	16/55 bars	16/34 bars	18 bars	18 bars	18 bars	18 bars	18 bars	18 bars
Max. temperature	80 °C / 120 °C			80 °C / 120 °C			80 °C / 120 °C		
Pulse rate	36 or 72 PPL		–	14,5 PPL		–	6,68 PPL		–
Pulse transmitter	Reedswitch			Reedswitch			Reedswitch		
Pulse type	–			–			–		
Recommended filter	0,1 mm			0,1 mm			0,1 mm		
Register	without	electronic	mechanical**	without	electronic	mechanical**	without	electronic	mechanical**
Process connections	BSP/NPT R 1" / DN 25 / ANSI 1" / Triclamp			R 1 1/2" / DN 40 / ANSI 1 1/2" / Triclamp			R 2" / DN 50 / ANSI 2" / Triclamp		
Housing material	Alu / 316 SS / Bronze			Alu / 316 SS / Bronze			Alu / 316 SS / Bronze		
Oval gear material	PPS / 316 SS			PPS / 316 SS			PPS / 316 SS		
Option	Pulse transmitter with hall effect sensor			Pulse transmitter with hall effect sensor			Pulse transmitter with hall effect sensor		
	Standard LCD display / Option with EEx-i			Standard LCD display / Option with EEx-i			Standard LCD display / Option with EEx-i		
	Deluxe LCD preset meter / Option with EEx-i			Deluxe LCD preset meter / Option with EEx-i			Deluxe LCD preset meter / Option with EEx-i		

* With special oval gears up to 1.000.000 mPas

** No pulse transmitter in connection with mechanical register



Dimensions (mm)

	A	B ^{alu/st. steel}	C DIN/ANSI	D	E	F	G	H
MN 10 p	170	133/143	115/108	165	86	138	112	35
MN 10 e	170	133/143	115/108	162	115	135	112	35
MN 10 g	170	133/143	115/108	154	137	181	112	35
MN 10 m	170	133/143	115/108	185	115	157	112	35
MN 10 a	170	133/143	115/108	225	155	213	112	35
MN 40 p	212/150		150/127	163	86	190	144	40
MN 40 e	212/150		150/127	180	137	207	144	40
MN 40 g	212/150		150/127	180	140	207	144	40
MN 40 m	212/150		150/127	177	115	211	144	40
MN 40 a	212/150		150/127	228	155	260	144	40
MN 50 p	270/210		165/152	198	86	223	178	55
MN 50 e	270/210		165/152	210	137	235	178	55
MN 50 g	270/210		165/152	185	140	210	178	55
MN 50 m	270/210		165/152	208	115	230	178	55
MN 50 a	270/210		165/152	263	155	288	178	55
MN 80 p	344/256		200/191	240	86	260	220	77
MN 80 e	344/256		200/191	255	137	275	220	77
MN 80 g	344/256		200/191	255	140	275	220	77
MN 80 a	344/256		200/191	305	155	325	220	77
MN 100 a	385/300		220/229	310	156	357	290	67
MN 100 m	385/300		220/229	310	156	357	290	67
MN 100 p	385/300		220/229	252	86	293	290	67

a: analog register e: electronic display g: LCD standard display
m: mechanic display p: pulse transmitter

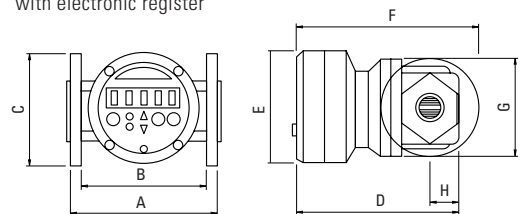
MN 80			MN 100		
with pulse transmitter	with electron. display	with mechanic display	with pulse transmitter	with standard display	with Deluxe display
DN 80			DN 100		
under 5 mPas: 1200 – 43980 l/h			under 5 mPas: 300 – 1200 l/min		
over 5 mPas: 3960 – 36960 l/h			over 5 mPas: 120 – 1200 l/min		
±0,5 % of value		±1 % o. v.	±0,5 % of value		
0,03 %			0,03 %		
1000 mPas			1000 mPas		
12 bars	12 bars	12 bars	10 bars***		
80 °C / 120 °C			80 °C	70 °C	60 °C
2,61 PPL		10 PPL	2.315 PPL		
Reedswitch			Reedswitch / Hall effect or Reed / Hall		
–			Two Reedswitches****		
0,1 mm			0,1 mm		
without	electronic	mechanical**			
3" BSP/NPT / DIN DN 80 / ANSI 3"			ANSI 150 lb	JIS 10 K or DN 100 PN 16	
Aluminium			Aluminium		
Aluminium			Aluminium		
Pulse transmitter with hall effect sensor			Standard display ex-proof		
Standard LCD display / Option with EEx-i			Deluxe display ex-proof		
Deluxe LCD preset meter / Option with EEx-i			Mechanical display with pulse transm. / Option P 500		

*** As per PED 97/23/EC

**** Reedswitch necessary for standard and Deluxe LC displays

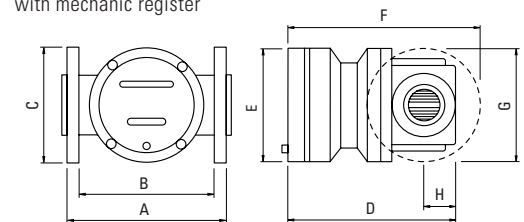
MN 10 up to MN 100

with electronic register



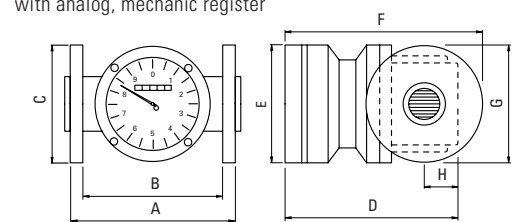
MN 10 up to MN 100

with mechanic register



MN 10 up to MN 100

with analog, mechanic register



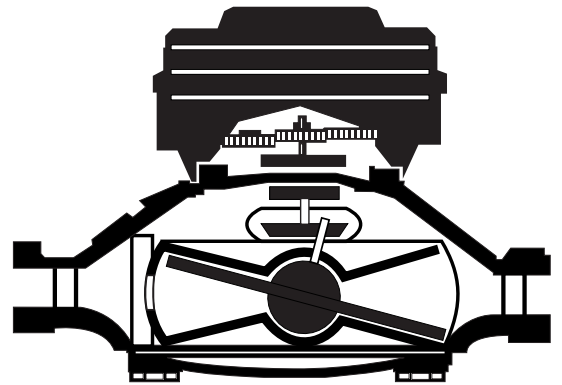
The meters for a great variety

of industrial fluids

Nutating disc meters

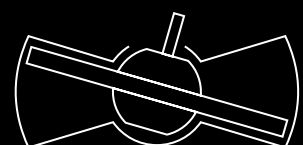
Nutating disc meters are best suited to measure flow and volume of low and medium viscosity fluids.





Measuring principle

Nutating disc meters are positive displacement meters. The top and lower part of the meter chamber are cone shaped. A ball bearing centralizes the disc between the two cones. A nutating motion of the disc is generated when flow enters the meter chamber. Complete separation between inlet and outlet chamber volumes is always achieved by one dedicated disc diameter line. The inlet and outlet parts of the meter chamber are separated by a partition plate. The positioning bar forces the disc to nutate around the center axis of the chamber, driving the transmission magnet.



Recordall® fluid meter

for clean and moderately dirty fluids



- Magnetic coupling**
- Compatible with many liquids**
- Wide flow range**
- Low pressure loss**
- Light weight**

The Recordall® series is a positive displacement meter. The series is best suited for metering fluids up to a viscosity of 700 mPas and at an operating temperature of 50 °C up to 120 °C.

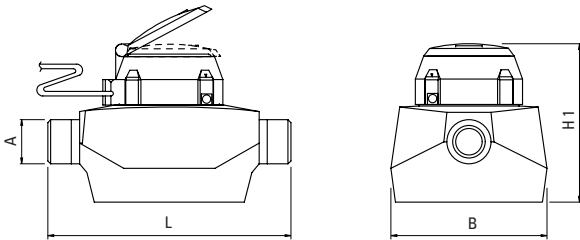
Typical applications are: Clean and moderately dirty liquids, hard and soft water, oils, fuel, solvents, etc.

The metering chamber includes disc, positioning bar and transmission magnet. The chamber is inserted into the meter body. A screen in the inlet side of the body protects the chamber against penetration of larger solid particles.

The meter system is modular and enables the combination of mechanical or electronic displays with any meter size.

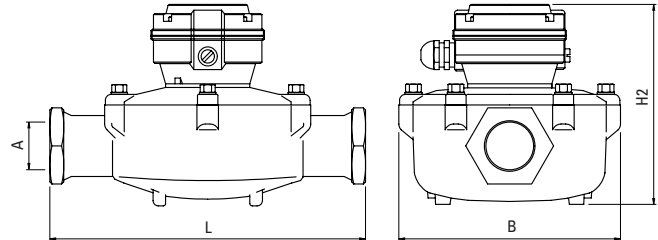
Dimensions

Plastic model



Dimensions

Bronze model



Dimensions (mm)

Type	M 25			M 35	M 40		M 70	M 120	M 170
	Plastic	Bronze Nickel coated	Stainless steel	Bronze Nickel coated	Plastic	Stainless steel	Bronze Nickel coated	Bronze Nickel coated	Bronze Nickel coated
Connection A	R 3/4", 1"	R 3/4", 1"	R 3/4", 1"	R 1"	R 1 - 1/4"	R 1 1/4"	R 1 - 1/4"	1 - 1/2" NPT	2" NPT
Lay length L	190	190	190	230	270	230	270	321	387
Width B	122	122	110	133	151	135	184	223	240
Height register H 1	125	125	130	132	150	130	165	178	204
Height transmitter H 2	128	128	155	168	180	160	200	213	239

Technical data

Type	M 25			M 35	M 40		M 70	M 120	M 170
	Plastic	Bronze Nickel coated	Stainless steel	Bronze Nickel coated	Plastic	Stainless steel	Bronze Nickel coated	Bronze Nickel coated	Bronze Nickel coated
Size DN	15, 20	15, 20	20	20	25	25	25	40	50
Nominal pressure PN	16	16	16	16	16	16	16	16	16
Max. temperature (PPO)	50 °C	50 °C	50 °C	50 °C	50 °C	50 °C	50 °C	50 °C	50 °C
Max. temperature (Vectra)	–	120 °C	120 °C	–	–	–	120 °C	120 °C	–
Flow range l/min (PPO)	1 – 100	1 – 100	1 – 100	2 – 132	2 – 160	2 – 160	4 – 265	8 – 454	8 – 643
Flow range l/min (Vectra)	–	3 – 100	3 – 100	–	–	–	19 – 265	18 – 454	–
Accuracy (1:10)	±0,5 %	±0,5 %	±0,5 %	±0,5 %	±0,5 %	±0,5 %	±0,5 %	±0,5 %	±0,5 %
Accuracy (total range)	±1,5 %	±1,5 %	±1,5 %	±1,5 %	±1,5 %	±1,5 %	±1,5 %	±1,5 %	±1,5 %
Weight	1,2 kg	1,8 kg	5,8 kg	2,7 kg	1,8 kg	7 kg	5,5 kg	10,5 kg	13,6 kg

Materials

Type	M 25			M 35	M 40		M 70	M 120	M 170
Housing	Nylon	Bronze	Stainl. steel	Bronze Nickel coated	Polycarbon- ate	Stainl. steel 1.4571	Bronze Nickel coated	Bronze Nickel coated	Bronze Nickel coated
		Nickel coated	1.4571						
Measuring chamber	PPO	PPO / Vectra	PPO / Vectra	PPO	PPO	PPO	PPO / Vectra	PPO / Vectra	PPO
O-rings	Buna	Buna / Viton	Buna / Viton	Buna	Buna	Buna	Buna / Viton	Buna / Viton	Buna
Retainer strap (PPO)	Nylon								
Retainer strap (Vectra)	Stainless steel 316 / 316 S/S								
Screen	PPO								
Bottom (PPO)	Nylon	Cast iron	Stainl. steel	Cast iron C Nickel coat.	Polycarbonate	Stainl. steel	Cast iron C Nickel coat.	Cast iron C Nickel coat.	Cast iron C Nickel coat.
		C Nickel coat.	1.4571						
Bottom (Vectra)	–	Bronze	Stainl. steel	– B Nickel coat.	–	Stainl. steel	Bronze B Nickel coat.	Bronze B Nickel coat.	– B Nickel coat.
		B Nickel coat.	1.4571						
Retainer ring	Nylon	–	–	–	Polycarbonate	–	–	–	–
Magnet	Barium/Ferrite								
Crossbar	Nylon								
Thrust roller	Nylon								
Roller insert	Stainless steel 316 / 316 S/S								

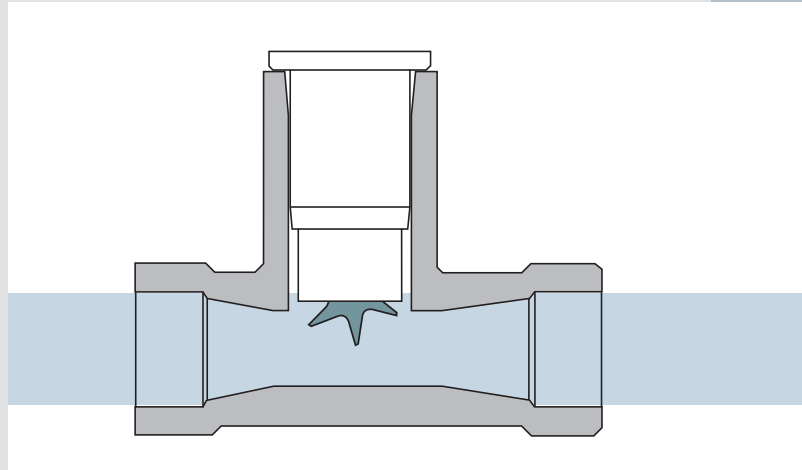
The meters for irrigation systems, building management

and the general industry

Impeller meters

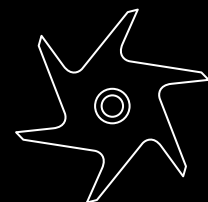
Impeller meters are a low cost alternative in irrigation systems (sprinklers, chemical injection processes in water treatment, water management, etc.), in municipalities (fluoridation, pump control, etc.) in the energy management (HVAC, building management, energy consumption monitoring, outdoor lighting control, etc.) and in the general industry (batch processes for bakeries, adding color dye to water for textile, food processing, inks, and other color additive mixtures, adding liquid vitamins and nutrients to feed water for livestock, automatization in the film industry, etc.).





Measuring principle

The series feature a six-bladed impeller design with a proprietary, non-magnetic sensing mechanism. The impeller shape coupled with the absence of magnetic drag provides accuracy and repeatability throughout the flow range of the sensors. As the liquid flow turns the impeller, a low impedance square wave signal is transmitted with a frequency proportional to the flow rate.



Flow sensors

a great versatility



2" up to 48"

Special models up to 120"

Large temperature range and pressure rates

Bidirectional measurements possible

Very good price / performance ratio

Technical data I: Flow sensors

Type	200			225		226	250		228			4000		SDI	
Material															
Brass	X			X		X			X					X	
Bronze							X								
Stainless steel		X			X	X			X					X	
PVC			X								X	X			
PVDF													X		
PVCS				X											
Carbon steel									X						
Max. temperature in °C	105	150	60	105	150		105	105	150	105	60	60	104	135	150
Potted version (up to 66 °C)	X	X		X	X		X	X	X	X	X				
Max. pressure in bar															
60 °C / 3 bar				X								X			
7 bar / 20 °C				X											
7 bar / 25 °C												X			
7 bar / 38 °C			X												
9,5 bar / 150 °C										X					
11 bar / 150 °C									X						
12 bar / 38 °C										X					
14 bar / 38 °C									X						
17 bar / 150 °C						X	X								
20 bar / 38 °C				X											
14 bar / 150 °C				X	X										
22 bar / 150 °C	X	X							X						
24 bar / 22 °C												X			
19 bar / 18 °C													X		
27 bar / 38 °C	X	X				X	X		X						
41 bar / 60 °C														X	
68 bar / 150 °C															X

The series 200 flow sensor is an insertion style flow sensor constructed of metallic and non-metallic materials. These sensors are designed for service in corrosive and non-corrosive liquids. The series can be installed in pipe sizes of 3" up to 40" (special models up to 120") and includes a special potted version (IR models) for irrigation applications (enabling direct mounting in the earth).

T-type sensors offer another model variation. These models have been designed for indoor or protected area applications such as HVAC, heat/energy monitoring, water cooling systems, pump control and industrial process monitoring.

The 4000 series flow sensor is an inline, flow-through design using a tangential six-bladed impeller. The series is available in 1/2", 3/4", 1" pipe sizes and is molded of PVC or PVDF materials. The compact design allows the 4000 series be used in a wide range of industrial applications, among them the flow measurement of ultra pure water in the semiconductor industry.

The SDI series flow sensor offers unparalleled performance for liquid flow measurement in closed pipe systems. The impeller sensor is well suited for flow control, flow monitoring and batch type applications. The flow meter can be mounted in pipe sizes of 1,5" up to 48". This sensor can be used for water applications or as stainless steel version for corrosive fluids at high temperatures and pressure rates. Bidirectional flow measurement or battery driven systems are available as option.

Monitors and transmitters

for all flow sensor series



Universal
Energy monitoring systems
Batch controllers
Various output options

The series 1500 and 2100 are versatile flow monitors with alphanumeric LC display. They can be configured by the user to display actual flow, total flow or other parameters like optional relay status.

The batch controller type 2200 enables a large variety of flow batch processes which require volumetric or time based measurements.

Models 1500 and 2300 together with flow sensors of series 200 or SDI series offer an excellent unit for energy consumption monitoring in many buildings which are centrally controlled. HVAC processes in residential or large complexes as well as big industrial processes can be monitored.

All flow sensors can be combined with transmitters of the series 300 and 500 thus enabling the connection to overriding plotting systems like SPS or simple monitors.

Technical data: Transmitters

Type	310	320	330	340	340 LW - LonWorks®	340 N2
	Analog output, programmable	Pulse output, programmable	Relay output, programmable	BTU	BTU	BTU

Technical data: Monitors

Type	1500	1520	1550	2100	2200	2300
	Wall mounted / Control panel mounted	Portable device	BTU	Wall mounted / Control panel mounted	Batch controller	BTU

Can be extended with signal outputs.

Technical data II: Flow sensors

Type	200	225 / 226	250	228		4000	SDI
					PVC		
Mounting in pipe sizes DN	80 – 1000	80 – 1200*	6 – 32	50 – 65	32 – 100	6 – 25	32 – 900**
	3 – 40"	3 – 48"	0,5 – 1,5"	2 – 2,5"	1,5 – 4"	0,5 – 1"	1,5 – 36"
Flow range in m/s (standard)	0,15 – 9	0,15 – 9	0,1 – 4,5	0,15 – 9		0,6 – 6	0,1 – 6
Flow range in m/s (low flow)						0,09 – 2,5	
Accuracy (full scale / Qmax.)	±1 %	±1 %	±1 % v. M.	±1 %		< 1 %	±1 %
Accuracy (of reading)	±4 %	±4 %					
Repeatability (full scale / Qmax.)	±0,3 %	±0,3 %	±0,7 %	±0,3 %		±0,5 %	±0,5 %

*Special models up to DN 3000 / 120"

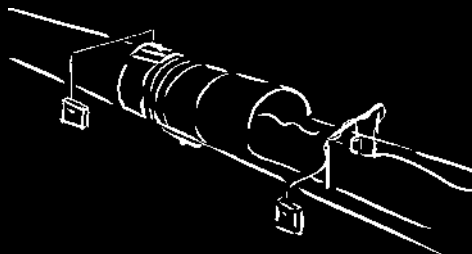
**or larger upon request

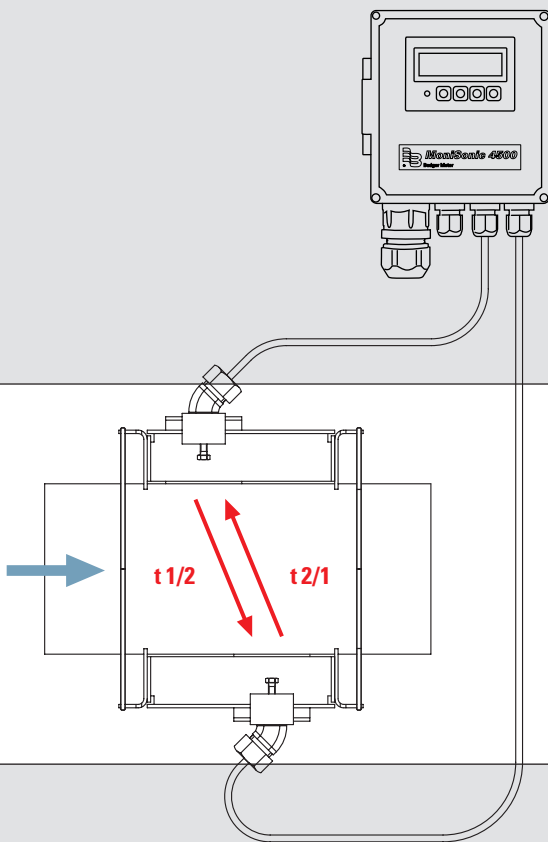
The meters for water and wastewater

and other fluids

Ultrasonic flow meters

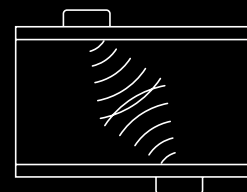
Ultrasonic flow meters are best suited for flow measurement of fluids in pressure pipes as well as in channels and semi-filled pipes.





Measuring principle (transit time)

Ultrasonic signals are alternately sent in and against the flow direction. Ultrasonic energy bursts are transmitted and received via well-defined paths across the flow stream. The velocity of the flow is accurately measured by the difference in the arrival times of signals from the upstream and downstream transducers. The transit time difference ($\Delta t = t_{2/1} - t_{1/2}$) determines the average flow velocity.



Type MoniSonic 4500 / 4600 (stationary) and type PortaSonic 7000 (portable)

for flow measurement in full pipes

- Transit time**
- Non intrusive measurement**
- No pressure drop**
- Easy installation**
- High accuracy**



Technical data: Type MoniSonic 4500

Housing material	Plastic		
Mounting	Wall mount, pipe mount optional		
Dimensions H x L x W	197 x 130 x 68 mm		
Protection class	IP 65		
Operating temperature range	-20 °C to +50 °C		
Outputs	4–20 mA, max. load 600 Ω RS 232 or RS 485 optional, synchronization optional Open collector, 1 relay output		
Display functions	Act. Q and V, total for- and backward, alarms		
Display language	German, English, French, Spanish		
Supply voltage	100–120 VAC, 50/60 Hz, or 200–240 VAC, or 20–30 VDC, 5 W		
Programming	Via front keypad		
Measuring accuracy	Pipe-Ø	V	Accuracy
		<50 mm	2–10 m/s
	>50 mm	0–2 m/s	0,06 m/s
		2–10 m/s	±2 % of act. Q
		0–2 m/s	0,04 m/s

Strap-on sensors Type MoniSonic 4500

Type	FLSE 1	FLSE 2
Size	DN 25, DN 100	DN 50–225
Sensor material	ABS	
Cable lengths	5–30 m	
Sensor cable	RF co-axial	
Temperature range	-20 °C to +60 °C, cable -20 °C to +100 °C	
Protection class	IP 65	

The series has been designed for exact and reliable non-intrusive flow measurement of supply and discharge water as well as other fluids. These meters are working on the transit time difference measuring principle and are best suited for flow measurement in pressure pipes DN 13 to DN 6000.

Suitable strap-on sensors are available for the different pipe diameters. Advantage of the strap-on sensors is that the sensors are mounted on the pipeline from the outside, which means there is no need to cut the pipe nor to interrupt the process during the installation.

The microprocessor-based meters are equipped with a multiple line alphanumeric display showing flow, quantity and status.

The sensors can be mounted on horizontal or vertical pipes. The best condition for an exact flow measurement is a well-developed velocity profile. Experience has shown that a pressure pipe with an adequate inlet/outlet distance for a good velocity profile is adequate.

These ultrasonic transit time flow meters do not measure the average flow velocity in the pipe cross section, but the average flow velocity in a chordal path, through which the ultrasonic beam passes in the wetted cross section. The relationship between this velocity measured inside of the chordal path and the actual average flow velocity is calculated with a correction factor k (calibration factor), which depends on the Reynold's number.

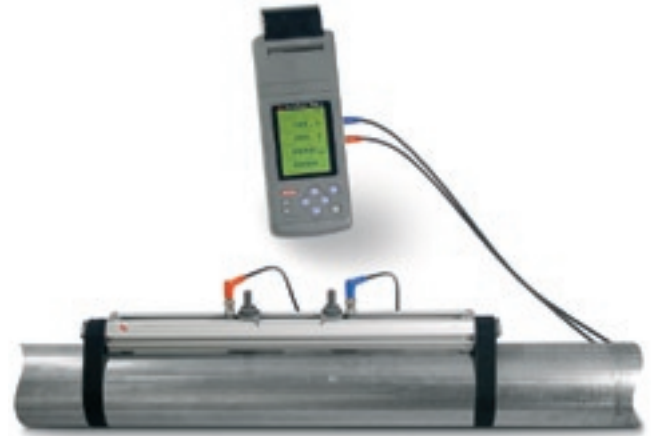


Technical data: Type MoniSonic 4600

Measuring principle	Transit-time 1-path		
Housing material	Aluminium		
Mounting style	Wall- or pipe mount		
Dimensions H x L x W	312 x 244 x 95 mm		
Protection class	IP 65		
Operating temperature range	-10 °C to +60 °C		
Outputs	4–20 mA, max. load 1 kΩ 2 x open collector, 30 VDC / 0,1 A RS 232 (optional)		
Display functions	Act. Q and V, total for- and backward, alarms		
Display language	German, English, French		
Supply voltage	100–240 VAC, 50/60 Hz or 20–30 VDC		
Programming	Via front keypad		
Measuring accuracy	Pipe-Ø	V	Accuracy
	DN 13–50	2–32 m/s	±0,75–15 % of act. Q
		0–2 m/s	0,03 m/s
	DN 50–300	2–32 m/s	±0,5–1 % of act. Q
		0–2 m/s	0,02 m/s
	DN 300–6000	1–32 m/s	±0,5–1 % of act. Q
		0–1 m/s	0,01 m/s

Strap-on sensors Type MoniSonic 4600

Type	FLD 22	FLW 12	FLW 41	FLW 51	FLD 32
Size DN	13–100	50–400	200–1200	200–6000	50–400
Max. temperature	100 °C	80 °C, Ex protection optional			200 °C
Sensor material	Plastic, stainless steel, aluminium				
Cable lengths	5–150 m				
Temperature range	-40 °C to +200 °C				
Protection class	IP 52	IP 67 (IP 68 optional)			IP 52



Technical data: Type PortaSonic 7000

Measuring principle	Transit-time 1-path		
Housing material	Plastic		
Dimensions H x L x W	240 x 127 x 70 mm (without printer) 359 x 127 x 70 mm (with printer)		
Protection class	IP 50		
Operating temperature range	-10 °C to +55 °C (without printer) -10 °C to +45 °C (with printer)		
Outputs	RS 232		
Inputs	DC voltage input, 4–20 mA		
Printer	Optional		
Display functions	Act. Q and V, total for- and backward, trend, stored logger data		
Display language	German, English, French		
Supply voltage	Internal Ni-Cd battery, service life appr. 5 hours or with adapter 90–264 VAC, 47–63 Hz		
Programming	Via front keypad		
Measuring accuracy	Pipe-Ø	V	Accuracy
	DN 13–50	2–32 m/s	±1,5 % of act. Q
		0–2 m/s	0,03 m/s
	DN 50–300	2–32 m/s	±1 % of act. Q
		0–2 m/s	0,02 m/s
	DN 300–600	1–32 m/s	±1 % of act. Q
		0–1 m/s	0,01 m/s

Data logger: 40 000 data, time, act. Q, act. V, totalizer, analog input and status

Strap-on sensors Type PortaSonic 7000

Type	FLD 22	FLD 12	FLD 41	FLD 51	FLD 32
Size DN	13–100	50–400	200–1200	200–6000	50–400
Max. temperature	100 °C	100 °C	80 °C	80 °C	200 °C
Sensor material	Plastic, stainless steel				
Cable lengths	5 m				
Temperature range	-20 °C to +200 °C				
Protection class	IP 52	IP 52	IP 52	IP 67	IP 52

Type iSonic 2000, DataControl 2500 and L2xx

for flow and level measurement in open channels, semi-filled pipes and tanks/reservoirs



Flow / Quantity
Level and volume measurement
Differential measurement
Pump monitoring
Data collection
High accuracy

The iSonic 2000 is a versatile ultrasonic flow meter. The microprocessor-based meter was designed to measure levels/volumes in tanks or flows in open channels in combination with venturi channels or effluent weirs.

The meter works according to the Echolot principle, which means that a free outlet in the channel/pipe is required for this measuring principle. Some Q/H relations are already stored in the memory. A 15 point graph can be programmed for unknown Q/H conversions.

When 2 sensors are in operation, the meter can be used for 2 channel measurements with separated totalizers or for differential measurement. The configuration of the flow meter is done via the front keypad or a PC. A data logger is integrated for recording measuring data. The memory has a capacity of approx. 44 000 records.

The DataControl 2500 is an evaluation device which can be connected to further equipments with analog or digital outputs. It is used for applications as already described for iSonic 2000. The features and functions are also similar to the iSonic 2000.

The L2xx series is a 2-wire ultrasonic level sensor designed for continuous level measurement of liquids or viscous fluids. The maximum flow ranges are 6, 8, 10 and 15 meters depending on type at a bloc distance of ≥ 250 mm.

Technical data: Type iSonic 2000 (2-channel measurement)	
Housing material	Plastic, UV-resistant
Dimensions H x L x W	240 x 270 x 76 mm
Protection class	IP 65
Operating temperature range	-20 °C to +60 °C
Outputs	2 analog outputs 4–20 mA or 0–5 V, isolated 5 relays, max. 250 VAC / 6 A 2 digital outputs max. 80 VDC / 30 mA RS 232 or RS 485 Voltage output 24 VDC / 50 mA and 12 VDC
Inputs	2 analog inputs 4–20 mA, isolated 4 digital inputs 1,3 VDC / 2 mA, optically separated
Display function	8-lines for level, flow rate, total, volume and distance
Display language	English
Supply voltage	90–230 VAC or 12–14 VDC
Programming	Via front keypad or PC with software (password protected)
Measuring accuracy	BAT 1 ±1,2 mm BAT 2 ±4 mm BAT 3 ±24 mm BAT 4 ±60 mm
Data logger	2 MB flash, programmable time intervals, Capacity for approx. 44 000 records, Records available as table or graphics

Technical data: Sensors for iSonic 2000

Type	BAT 1	BAT 2	BAT 3	BAT 4
Measuring range	4 m	8 m	16 m	24 m
Offset	0,15 m	0,2 m	0,2 m	1 m
Beam angle	7°	8°	9°	10°
Material	Tefzel	Tefzel	PVC	PVC + Teflon
Temperature compensation	Integrated			
Cable lengths	Max. 1000 m			
Protection class	IP 68			

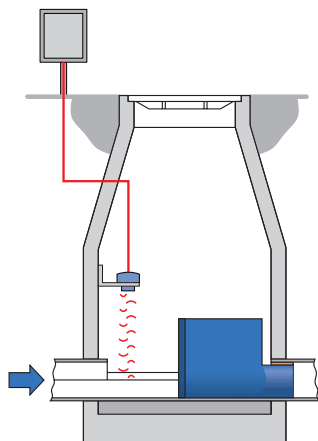
Technical data: Type DataControl 2500 (4-channel measurement)	
Housing material	Plastic, UV-resistant
Dimensions H x L x W	240 x 270 x 76 mm
Protection class	IP 65
Operating temperature range	-20 °C to +60 °C
Outputs	2 analog outputs 4–20 mA or 0–5 V, isolated 2 digital outputs max. 80 VDC / 30 mA 6 relays, max. 250 VAC / 6 A RS 232 or RS 485 Voltage output 24 VDC / 50 mA and 12 VDC
Inputs	4 analog inputs 4–20 mA, isolated 4 digital inputs 1,3 VDC / 2 mA, optically separated
Display function	8-lines for level, flow rate, total, volume, distance, temperature, pH or pressure
Display language	English
Supply voltage	90–230 VAC / 10 W
Programming	Via front keypad or PC with software (password protected)
Data logger	2 MB flash, programmable time intervals, Capacity for approx. 44 000 records, Table and graphics

Technical data: Sensors L2 xx

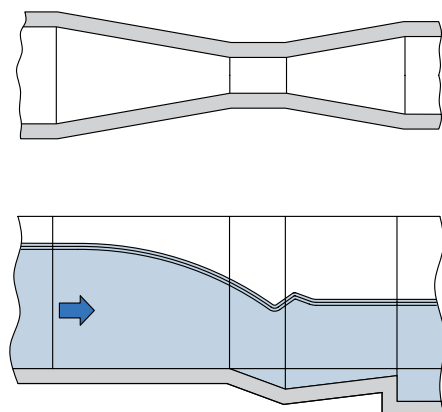
Type	L206	L208	L210	L215
Range	0,25–6,00 m	0,3–8,00 m	0,4–10,00 m	0,5–15,00 m
Current output	4–20 mA			
Accuracy	±0,25 % of maximum span			
Resolution	3 mm			
Point setting	With magnetic key			
Beam angle	8°	11°	11°	11°
Operating temperature	-20 °C to 60 °C			
	The sensor has internal temperature compensation			
Enclosure rating	IP 68			
Housing	ABS / Tefzel™, UV resistant		ABS / PVC, UV resistant	
Supply voltage	17 V to 30 VDC (max.), 24 VDC typical operating voltage			

Typical applications

Manhole flume



Parshall flume



Type VHQ 500-SPS (stationary) and type VHQ 500-SP (portable)

for small channels and semi-filled pipes



Channel dimensions < 1 m
Programmable channel profiles
Volume proportional output
Easy installation

The VHQ 500 series has been designed to measure flow in sewage channels.

Typical applications for the stationary model are inflow and discharge in sewage plants, infiltration and inflow analysis, sewer infiltration monitoring and industrial discharge monitoring.

Typical applications for the portable model are infiltration and inflow analysis, sewer infiltration monitoring, measurements for channel calculation, industrial discharge monitoring, determination of data for sewer with storage capacity.

Channel sizes vary between DN 150 and DN 1000. A data memory collects flow velocity, level, flow, quantity with date and time.

Measuring data can be read out using a RS 232 interface. The actual values are shown on a LCD-display along with additional graph functions. The programming is menu-driven and the front panel is easy to use. The flow meters are easy to install, require minimum maintenance and are equipped with the utmost modern upgradeable electronics. All signal components, memory and evaluation electronics are encased in a stable, waterproof housing (IP 66).

The various channel profiles and memory intervals can be selected (menu-driven) using the keypad. The user can choose the setpoints for flow velocity, the level and flow.

Technical data: Flow meter

Type	VHQ 500-SPS (stationary)	VHQ 500-SP (portable)
Housing material	Casting aluminium	Aluminium housing
Dimensions L x H x W	230 x 110 x 280 mm	250 x 200 x 320 mm
Protection class	IP 66	IP 66
Power supply	90 – 240 VAC or 18 – 32 VDC	Battery with 12V/17 Ah (rechargeable), battery life time: about 7 days or 230 VAC
Temperature range	0 up to 50 °C -30 up to +50 °C (optional)	0 up to 50 °C
Data and programming display	Alphanumeric and graph LCD display, backlit, for V, H, Q and quantity	
Outputs	2 analog outputs 0 – 20 mA or 4 – 20 mA, isolated (max. 500 Ω) for V, H and Q Grounded, 3 relay contacts for V, H, Q and quantity pulse, contact load max. 230 V, 1 A.	
Memory capacity	256 kB RAM ≈ about 25.000 measuring values	
Interface	RS 232	
Data evaluation software	Reports and graphs	
Meter programming	Upon 3 x 4 keypad Protection against unauthorized access using code number	

Technical data: Sensors (for stationary and portable models)

Sensor housing	Streamlined PVC sensor housing Standard sensor cable length 10 m Larger distances between sensors and electronics upon request	
Dimensions L x H x W	220 x 37 x 35 mm	
Temperature range	0 – 65 °C	
Flow velocity	Measuring principle	Ultrasonic Doppler
	Flow range	0,1 – 9 m/s
	Accuracy	±2 % of flow range
	Resolution	0,01 m/s
Level	Measuring principle	Differential pressure
	Flow range	12 – 2540 mm
	Accuracy	±0,25 % of flow range
	Housing material	Stainless steel 1.4435

Type Compound® UF 5000 (transit time)

for large channels and semi-filled pipes



300 up to 6000 mm channels
Easily programmable channel profiles
Quantity proportional output
High accuracy
Bidirectional measurement

The model UF 5000 is used for flow measurements in open channels and partially filled pipes. Successful applications are made in sewer flow, storm water flow, irrigation, plant influents/effluents, aqueducts and other in-plant measurements in the water and wastewater industry.

Wide flow range, no pressure drop, level and flow velocity measurements are determined using the continuity equation to calculate the flow rate electronically.

The flow velocity sensors are mounted laterally on the channel sides over the channel bottom; the level sensor is mounted over the maximum filling height. For low filling height applications, one can install a Doppler sensor on the channel bottom (optional).

The Compound® series is best suited for flow measurements requiring high accuracy and wide flow ranges. The average flow velocity is measured by the flow velocity sensors mounted at the channel sides using the ultrasonic transit time principle. The level sensor measures the flow level.

The wetted area is multiplied by the flow velocity and generates the flow rate as well as the quantity.

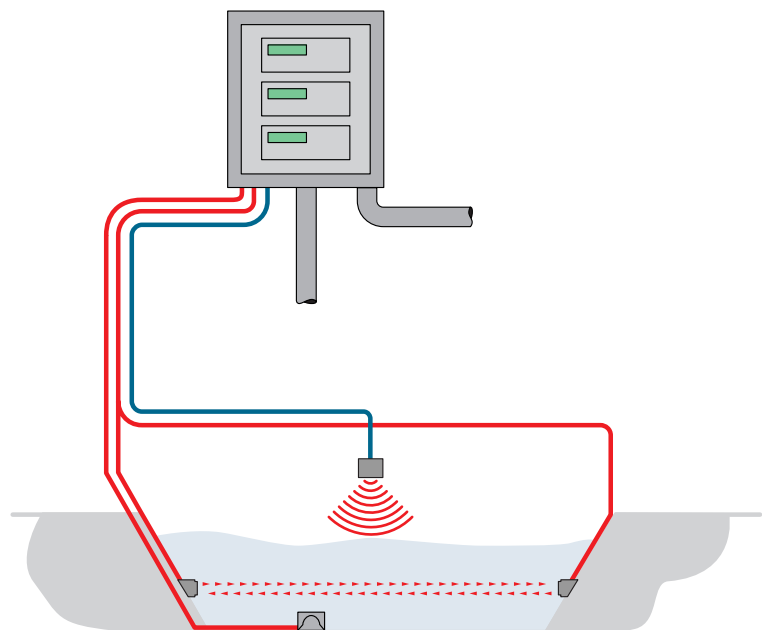
Since level and flow velocity are measured directly, the measurement is independent of overflow or backflow.

To assure a reliable measurement, an undisturbed flow past the sensors is necessary. A straight inlet of about 15 D and an outlet run of 1 to 2 D behind the measurement site is required.

For channel measurements, one should make sure that the side and bottom conditions of the channel are stable at the measurement points.

Technical data	
Electronics	Microprocessor based, max. distance to sensor 300 m
Measuring data on LCD	Flow, quantity, flow velocity, level
Meter accuracy	±4 % of actual value, above 30 % of H max.
Ambient temperature	-40 up to +65 °C for meters installed outside (canopy top)
Power supply	110 V / 230 V / ±10 % / 50/60 Hz
Power draw	200 VA with heating facilities
Housing	
Material	Reinforced Polyester fiber glass
Protection class	IP 65
Dimensions L x H x W	400 x 600 x 200 mm
Weight	20 kg
Level measurement (ultrasonic)	
Accuracy	±2 mm or 0,1 % of the target distance
Flow range	min. 0 – 100 mm, max. 0 – 7620 mm
Repeatability	±0,25 %
Offset	305 mm min.
Flow velocity measurement (transit time)	
Accuracy	±0,005 m/s
Repeatability	±0,25 %
Measurement sensitivity	±0,0016 m/s
Signal outputs	
Display	LCD, 2 lines for V, H, Q and quantity
Analog outputs	4 – 20 mA / 800 Ω load, isolated Choice between 3 outputs for flow, flow velocity, level
Alarm/Setpoints	2 setpoints, programmable (level)
Sampler	230 V Triac, programmable
Totalizer	Open collector, programmable

Typical installation



Further devices for system solutions upon request

Count and batch meters



PC 100

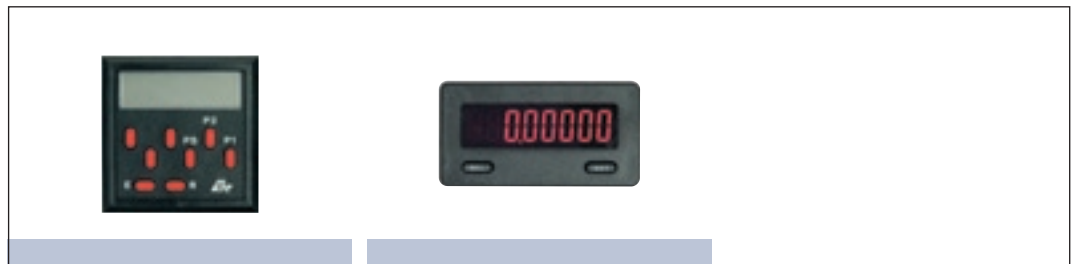
High quality batch system for all batch applications

VZ 150

Electronic batch system, ex-proof, for applications in zone 1

ER-8 and ER-9

Totalizer, reversible to flow display with pulse output



BC 2

Preselection meter with two relay outputs

CUB 5

Multifunction register with two counters and flow displays

Fluid management systems



LMS Baby System

For control and management of fluids

Flow measurement principles: Q/h relationship and/or differential pressure



Venturi channels

For flow measurements in open channels and partially filled pipes in the water and wastewater industry (Q/h relationship)



Product line overview

Electromagnetic flow meters
Ultrasonic flow meters
Venturi tubes
Turbine meters
Nutating disc meters
Oscillating piston meters
Impeller meters
Lubrication meters
Oil management systems
Tank level systems
Control valves

For worldwide operations
Badger Meter Europa GmbH
Karlstrasse 11
72660 Beuren
Germany
Tel. +49-70 25-92 08-0
Fax +49-70 25-92 08-15
badger@badgermeter.de
www.badgermeter.de

For Mexico
Badger Meter de las Americas
S. A. de C. V.
Insurgentes Sur 1862 Piso 8
Colonia Florida De Las Americas
01030 Mexico, D. F.
Mexico
Tel. +11-52-55-56 62-65 88
Fax +11-52-55-56 62-66 31
porterra@badgermeter.com.mx

For Slovakia
Badger Meter Slovakia s. r. o.
Racianska 109/B
83105 Bratislava
Slovakia
Tel. +421-2-44 63 83 01
Fax +421-2-44 63 83 77
badger@badgermeter.sk
www.badgermeter.sk

For the USA, Canada and
Latin America
Badger Meter, Inc.
P.O. Box 245036
Milwaukee, WI 53224-9536
USA
Tel. +1-414-355-04 00
Fax +1-414-355-74 99
international@badgermeter.com
www.badgermeter.com

For Asia
Badger Meter Asia
Singapore Representative Office
80 Marine Parade Road
#21-04 Parkway Parade
Singapore 449269
Singapore
Tel. +65-63 46 48 36
Fax +65-63 46 48 37
awang@badgermeter.com

For the Czech Republic
Badger Meter Czech
Republic s. r. o.
Marikova 2082/26
62100 Brno
Czech Republic
Tel. +420-5-41 42 04 11
Fax +420-5-41 22 97 24
itomas@badgermeter.cz
www.badgermeter.cz



Badger Meter Europa