

- **The most stable transmitter in the world**
 - self-calibrating transmitter and ultra-low temperature coefficient for highest accuracy
- **One solution for all your needs**
 - designed for use in all water and waste water applications, from sewage plants to distribution networks
- **Quick transmitter exchange**
 - revolutionary data storage enables transmitter interchange and commissioning without the need for reconfiguration
- **Advanced infrared service port**
 - supports simultaneous and parallel operation of HART, remote HMI, cyclic data output and parameter dump
- **Octagonal full-bore flow measurement sensor**
 - unique inner octagonal bore reduces sensitivity to flow profile disturbances
- **Verification to OIML R49 type 'P' requirements**
 - continuous self checking of the sensor and transmitter to ensure the highest accuracy and long term performance
- **NAMUR compliant diagnostics**
 - comprehensive diagnostics categorized into NAMUR NE107 classifications for clear diagnostic indication



The perfect fit for all water
industry applications

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications. As a part of **ABB**, a world leader in process automation technology, we offer customers application expertise, service and support worldwide. We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support. The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology. Over ten flow calibration plants are operated by the Company, which is indicative of our dedication to quality and accuracy.

Introduction

Setting the Standard

The WaterMaster range, available in sizes 40 to 2200 mm (1½ to 84 in), is designed specifically for use on the many diverse applications encountered in the Water and Waste-water industry.

The specification, features and user benefits offered by this range are based on ABB's worldwide experience in this industry and they are all targeted specifically to the industry's requirements.

Flow Performance

WaterMaster has an operating flow range with ± 0.4 % accuracy as standard (± 0.2 % optional) in both forward and reverse flow directions.

Submersible and Buriable

All WaterMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life under the arduous conditions experienced in the Water and Waste Industry. The sensors are, as standard, inherently submersible (IP68, NEMA 6P), thus ensuring suitability for installation in chambers and metering pits which are liable to flooding.

A unique feature of the WaterMaster sensors is that all sizes are buriable; installation merely involves excavating to the underground pipe, fitting the sensor, cabling back to the transmitter and then backfilling the hole.

Comprehensive Features

A wide range of features and user benefits are built into WaterMaster as standard:

- bi-directional flow
- unique, self-calibrating transmitter (patent approval in progress) for the ultimate in stability and repeatability
- OIML compliant, continuous self-checking, with alarms, ensures both sensor and transmitter accuracy
- true electrode and coil impedance measurement
- comprehensive simulation mode
- universal switch mode power supply (options are available for AC and DC supplies)
- comprehensive self-diagnostics compliant with NAMUR NE107
- programmable multiple alarm capability
- HART protocol over 4 to 20 mA and infrared link
- 3 configurable pulse/frequency and alarm outputs
- advanced infrared service port supports remote HMI, HART, cyclic data out and parameter dump
- NAMUR compliant current output with alarm signalling
- Read-only switch and ultra-secure service password for total security

Assured Quality

WaterMaster is designed and manufactured in accordance with international quality procedures (ISO 9001) and all flowmeters are calibrated on nationally-traceable calibration rigs to provide the end-user with complete assurance of both quality and performance of the meter.



WaterMaster – Electromagnetic Flowmeter

The perfect fit for all water industry applications

Unrivalled in its scope and applications expertise, ABB offers the world's most comprehensive range of flow measurement products. The FlowMaster family of products is unsurpassed in the number of proven measurement techniques, variety of models and scope of application and includes the WaterMaster range of Electromagnetic Flowmeters.

Getting the best levels of efficiency and performance from your production process requires reliable, accurate instrumentation. WaterMaster provides the flexibility to solve your most demanding water applications enabling previously unattainable operational and financial benefits. WaterMaster is the ultimate solution for flow measurement and management in sectors as diverse as water, wastewater, sewage and effluent.

WaterMaster delivers speed, simplicity and ease of use at every stage of the product's lifecycle. In fact, WaterMaster doesn't just plug the gaps left by competitive products, it is simply the best flow metering solution available today.

Superior control through advanced sensor design

Innovative, patented octagonal sensor design improves flow profile and reduces up- and down-stream piping requirements for the most commonly used sizes of 40 to 300 mm (1½ to 12 in).



Octagonal Bore

Using a unique, controlled derivative excitation combined with advanced filtering, WaterMaster improves accuracy by raising zero stability to new levels, resulting in higher accuracy measurements.

Proven in the toughest applications, WaterMaster's rugged, robust and buriable sensors eliminate the need for expensive meter chambers thus providing a long, productive and maintenance-free asset life.

Powerful and flexible transmitter

The backlit, graphical display is rotated easily up to 180 ° (90 ° each way) without any tools, enabling users to position it as best fits their needs. 'Through-the-glass' control allows local operator interface to enable short, quick data entry for all user-specific parameters.



Transmitter Display

ABB's universal Human Machine Interface (HMI) simplifies operation, maintenance and training; thereby reducing cost of ownership and providing one common user experience.

All product versions utilize a common electronics cartridge to simplify installation and reduce the number of spare parts. The same cartridge is used in both integral and remote installations and features active current and passive pulse outputs. Standard HART protocol enables online modification and monitoring of parameters.

Intuitive navigation and configuration

The user-friendly interface allows fast and simple data entry for all parameters. 'Easy Setup' guides the operator step-by-step through the menu to set parameters as quickly as possible, thereby simplifying the commissioning phase.

Improved Performance through Digital Signal Processing (DSP)

Advanced Digital Signal Processing (DSP) gives improved performance and enables real time measurements for maximum reliability.

DSP enables the transmitter to separate the real signal from the noise, therefore providing high quality outputs especially in harsh environments involving vibration, hydraulic noise and temperature fluctuation.

Self-calibration

A unique self-calibration concept developed by ABB (patent pending) has been implemented in WaterMaster. Compliance with OIML R49 Type P (Permanent) checking requirements requires that electromagnetic flowmeters have 'Checking Facilities', where a simulated signal is fed into the input of the flow transmitter and the output is compared and checked within predetermined limits.

WaterMaster has taken this to the next level and uses this signal to not only check the accuracy, but also to perform automatic calibration. This not only meets and exceeds the OIML R49 requirements, it also means the instrument has the following features:

- self-calibrating instrument
- factory calibration no longer necessary
- calibration adjustment is continuous during normal running
- ultra-stable performance with time
- very low temperature coefficient
- the measurement accuracy depends on one precision resistor only
- adjustment % displayed to user for diagnostic use
- alarm limits to trap hardware failures and out-of-range adjustments

Speed, ease and security in the field

'Fit-and-Flow' data storage inside the WaterMaster eliminates the need to match sensor and transmitter in the field. On initial installation, the self-configuration sequence automatically replicates into the transmitter all calibration factors, meter size and serial numbers, as well as customer site-specific settings, eliminating the opportunity for error.

This redundant storage of data in both the sensor and transmitter memory is continually updated during all operations to ensure the integrity of the measurement.

An automatic data self-repair routine corrects any data corruption such as totalizer volume corruption that could occur during a power failure.

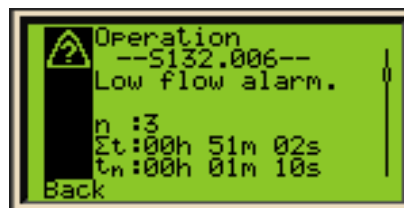


Transmitter with Infrared Communications Device Attached

Detailed diagnostics for rapid decision making

WaterMaster is proven to be robust and reliable, with unmatched diagnostic capabilities providing the correct information to keep your process up and running. In accordance with NAMUR NE107, alarms and warnings are classified with the status of 'maintenance required', 'check function', 'failure' and 'out of specification'.

The following screen shows an alarm history with the number of occurrences for the alarm together with time durations.



Diagnostics Display

Advanced infrared service port

WaterMaster as standard incorporates an infrared service port that enables the meter's configuration to be saved externally.

If a customer alters the configuration and causes the instrument to behave erratically, the infrared service port enables ABB technicians to assist in troubleshooting the problem by allowing easy, remote access to the configuration data.

The infrared service port is used to interrogate HMI menu items automatically and dump the HMI parameter settings and cyclic output measured values (such as flowrate and diagnostic measurement) through the service port to a terminal program. Data can then be downloaded to a PC, saved to a terminal application and output as text or spreadsheet data.

Attention to the smallest technical detail delivers big operational benefits

ABB's WaterMaster sets the standard for flow measurement and management applications in the water, sewage and effluent industries.

Leveraging advanced technology, WaterMaster delivers the power to solve your most demanding applications, enabling previously unattainable operational and financial benefits.

The perfect balance of power, performance, flexibility and control

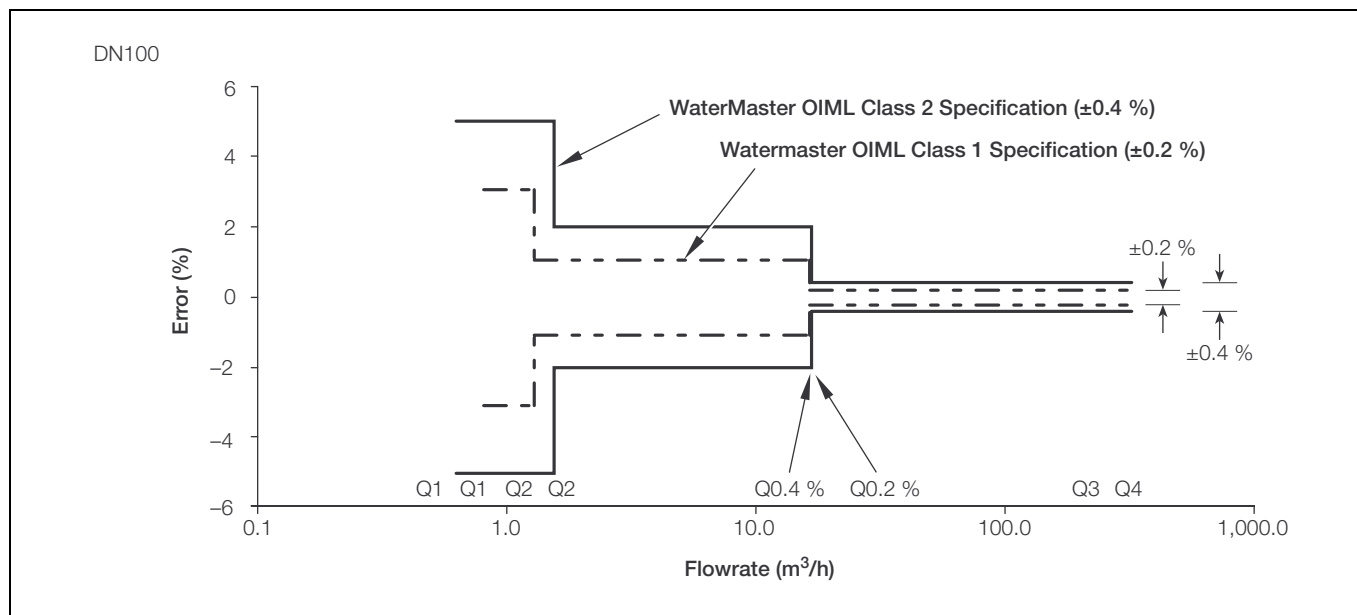
With WaterMaster, flexible doesn't mean complicated. Take advantage of its innovative and versatile attributes to achieve interoperability within a wide range of asset management systems. WaterMaster, the best solution for your flow measurement needs.

Now the best in class is even better!



The WaterMaster Family

WaterMaster Specification to OIML R49



Organization Internationale de Métrologie Légale (OIML)

What is OIML?

OIML is an inter-governmental body, established in 1955. Its main objective is to achieve international harmonization for legal metrology, providing an important basis for measurement credibility, eliminating technical barriers to the trade in measuring instruments and promoting international trade by confidence in measurement capability.

A main output of OIML's work is the production of International Recommendations (such as R49), which are technically based models for legal control of measuring instruments.

OIML R49

Under EU Measuring Instruments Directive (MID) 2004/24/EC, that includes Water Meters for certain applications, conformity can be achieved by various routes. WaterMaster conformity is being sought through the OIML International Recommendation known as R49-1(2006), a Recommendation for cold potable water and hot water meters. The OIML has very similar requirements to the latest ISO4064 and EN14154 standards, but allows the option of a higher accuracy, Class 1 (1%), classification. WaterMaster is designed to meet this very highest accuracy designation with a wide flowrate turndown ratio. A major advance in WaterMaster is the self checking capabilities designed to meet the R49 requirements, with continuous OIML Type 'P' self checking during normal operation (not just at startup) and alarm indication for:

- transmitter and sensor status, with an accuracy alarm
- program ROM and RAM status
- double, independent storage of totalizer values, in both the sensor and transmitter non-volatile memories
- display test

OIML R49 is in 2 parts and can be downloaded from the OIML web site. To download the documents, enter the following addresses in the web browser's address bar:

<http://www.oiml.org/publications/R/R049-1-e06.pdf>

<http://www.oiml.org/publications/R/R049-2-e06.pdf>

WaterMaster Flow Performance

DN	Q4 (m ³ /h)	Q3 (m ³ /h)	Standard Calibration 0.4 % OIML R49 Class 2			High Accuracy Calibration 0.2 % OIML R49 Class 1		
			Q _{0.4%} (m ³ /h)	Q2 (m ³ /h)	Q1 (m ³ /h)	Q _{0.2%} (m ³ /h)	Q2 (m ³ /h)	Q1 (m ³ /h)
40	50	40	4.2	0.25	0.1	6	0.32	0.2
50	79	63	4.2	0.4	0.16	8	0.5	0.32
65	125	100	6.7	0.63	0.25	13	0.8	0.5
80	200	160	11	1	0.4	16	1.3	0.8
100	313	250	17	1.6	0.63	25	2	1.3
125	500	400	27	2.5	1	40	3.2	2
150	788	630	42	4	1.6	63	5	3.2
200	1,250	1,000	67	6.3	2.5	100	8	5
250	2,000	1,600	107	10	4.0	160	13	8
300	3,125	2,500	167	16	6.3	250	20	13
350	5,000	4,000	267	25	10	400	32	20
400	5,000	4,000	267	25	10	400	32	20
450	7,875	6,300	420	39	16	630	50	32
500	7,875	6,300	420	39	16	630	50	32
600	12,500	10,000	667	63	25	1000	80	50
700	20,000	16,000	1067	100	40	1600	160	100
750	20,000	16,000	1067	100	40	1600	160	100
800	20,000	16,000	1067	100	40	1600	160	100
900	31,250	25,000	1667	156	63	2500	250	156
1000	31,250	25,000	1667	156	63	2500	250	156
1050	31,250	25,000	1667	156	63	2500	250	156
1200	50,000	40,000	2667	250	100	4000	400	250
1400	78,750	63,000	4200	394	158	6300	630	394
1500	78,750	63,000	4200	394	158	6300	630	394
1600	78,750	63,000	4200	394	158	6300	630	394
1800	125,000	100,000	6667	625	250	10000	1000	625
2000	125,000	100,000	6667	625	250	10000	1000	625
2200	125,000	100,000	6667	625	250	10000	1000	625

Specification – Sensor

Functional Specification

Pressure limitations

As per flange rating

Temperature limitations

Ambient temperature	
Remote transmitter	–20 to 70 °C (–4 to 158 °F)
Integral transmitter	–20 to 60 °C (–4 to 140 °F)
Process temperature	–6 to 70 °C (21 to 158 °F)

Environmental protection

Rating: IP68 (NEMA 6) to 10m (33 ft) depth with fully-potted terminal box

Conductivity

>5µS cm^{–1}

Transmitter mounting

Integral or remote

Electrical connections

20 mm glands
1/2 in NPT
20 mm armored glands

Sensor cable

ABB WaterMaster cable supplied as standard
Armored version available on request
Maximum length 200 m (660 ft)

Physical Specification

Wetted Parts

Lining material

Polypropylene (sizes DN40 to 200)
Elastomer (sizes DN250 to 2200)
WRAS listed
ACS and NSF61 approved (sizes DN40 to 200 pending)

Electrode material

Stainless steel 316 L
Hasteloy C
(Other electrode materials available on request)

Grounding rings

Not required

Protection plates

Not required

Installation conditions (recommended)

Upstream ≥ 5D
Downstream ≥ 2D

Pressure loss

<0.25 bar at Q3 (sizes DN40 to 200)
Negligible at Q3 (sizes DN250 to 2200)

Non-wetted Parts

Flange material

Carbon steel

Housing material

Carbon steel (sizes DN40 to 200 and DN700 to 2200)
Plastic (sizes DN250 to 600)

Terminal box material

Polycarbonate or aluminium

Cable gland material

Plastic or brass

Specification – Transmitter

Functional Specification

Power supply

Mains	85 to 265 V AC @ <7 VA
Low voltage	24 V AC +10 %/–30 % @ <7 VA
DC	24 V ±30 % @ <0.4 A

Supply voltage fluctuations within the specified range have no effect on accuracy

Pulse/frequency outputs

One dedicated, second configurable output, programmable function:

Maximum output frequency	5,250 Hz
Rating	30 V @ 220 mA open collector
Galvanically isolated	

Alarm/Logic outputs

One dedicated, second configurable output, programmable function:

Rating	30 V @ 220 mA open collector
Galvanically isolated	

Current output

4 to 20 mA or 4 to 12/20 mA
Maximum loop resistance 750 Ω
Galvanically isolated
HART protocol Version 5.7
Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)
Low alarm 3.6 mA
High alarm 21.8 mA

Additional accuracy

±0.1 % of reading	
Temperature coefficient	Typically <±20 ppm/°C

Electrical connections

20 mm glands
1/2 in NPT
20 mm armored glands

Temperature limitations

Ambient temperature	–20 to 60 °C (–4 to 140 °F)
Temperature coefficient	Typically <±10 ppm/°C @ Vel ≥0.5 m/s

Environmental protection

Humidity: 0 to 100 %
Rating: IP67 (NEMA 4X) to 1m (3.3 ft) depth

Tamper-Proof Security

Write access prevented by internal switch combined with external security seals

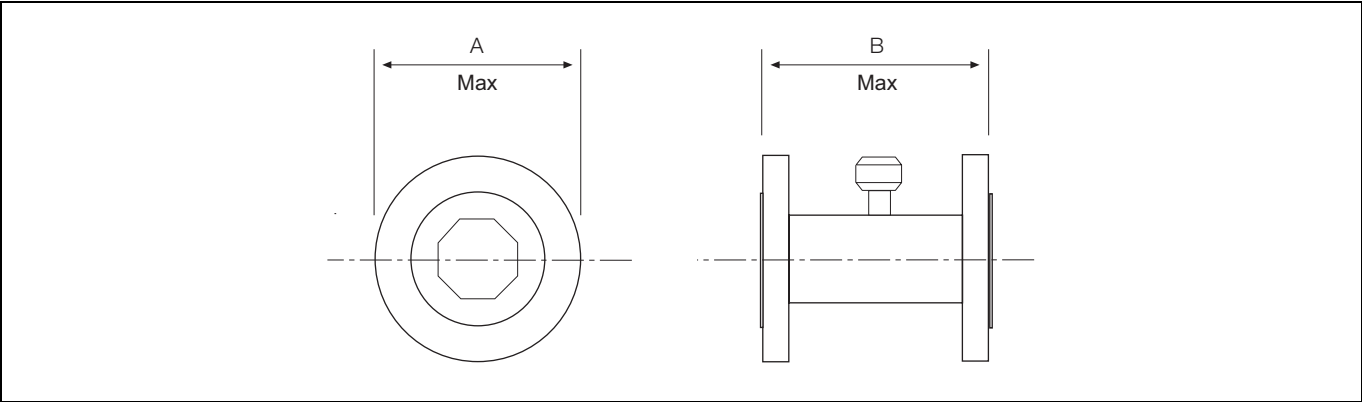
Languages

English
French
German
Italian
Spanish

Infrared Service port

USB adapter (accessory)
USB 1.1. and 2.0 compatible
Driver software for PC only
Windows 2000, XP and Vista compatible

Sensor Dimensions

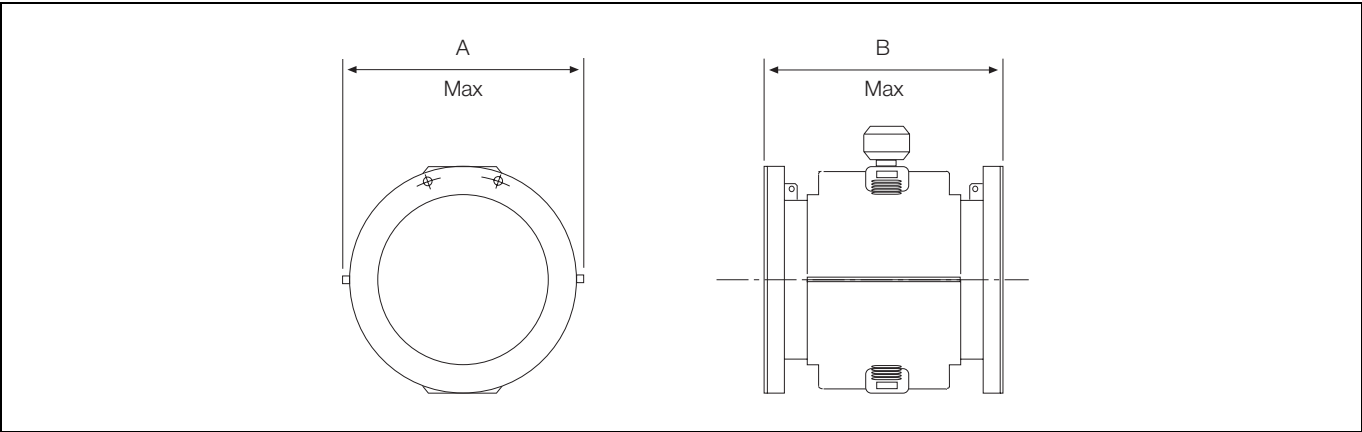


DN 40 to 300 Full-bore

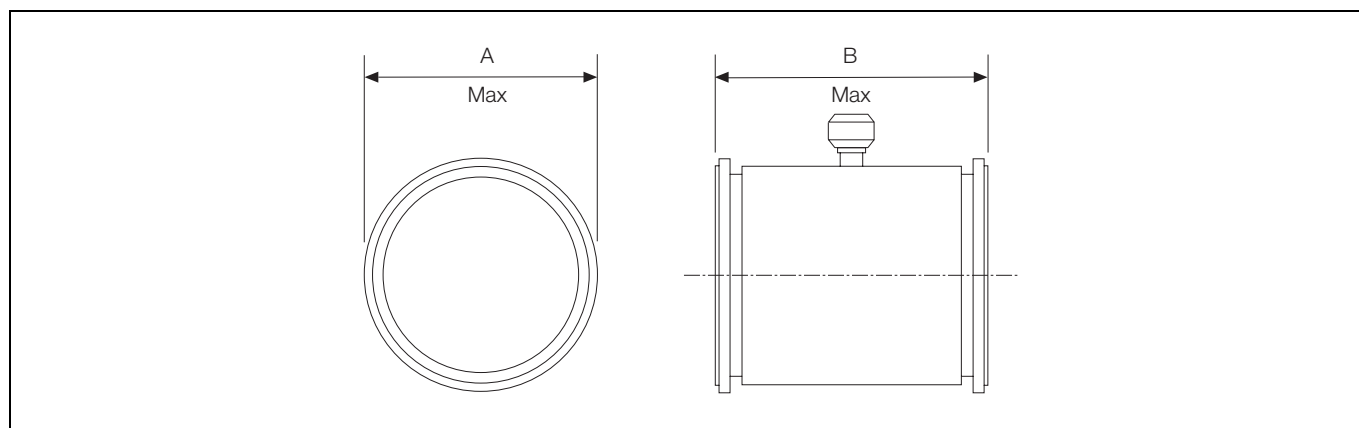
Meter Size		Dimensions mm (in)		Approximate Weight	
DN	NPS/NB	A*	B	kg	lb
40	1½	150 (5.9)	200 (7.9)	11	24
50	2	165 (6.5)	200 (7.9)	12	27
80	3	200 (7.9)	200 (7.9)	15	33
100	4	230 (9.1)	250 (9.8)	18	40
150	6	280 (11.0)	300 (11.8)	31	68
200	8	345 (13.6)	350 (13.8)	48	106
250	10	405 (15.9)	450 (17.7)	75	165
300	12	460 (18.1)	500 (19.7)	112	247

*Dimensions are approximate and vary depending on flange type

DN 40 to 300 Full-bore



DN 350 to 600 Full-bore



DN 700 to 2200 Full-bore

Meter Size		Dimensions in mm (in)		Approximate Weight	
DN	NPS/NB	A	B	kg	lb
350	14	535 (21.1)	550 (21.7)**	100	220
400	16	600 (23.6)	600 (23.6)**	115	253
450	18	640 (25.2)	698 (27.5)**	160	352
500	20	715 (28.1)	768 (30.2)**	217	455
600	24	840 (33.1)	918 (36.1)**	315	693
700	27/28*	927 (36.5)	700 (27.6)***	430	945
750	30	985 (38.8)	762 (30)***	430	945
800	32	1060 (41.7)	800 (31.5)***	430	945
900	36	1170 (46.1)	900 (35.4)***	540	1190
1000	39/40*	1290 (50.8)	1000 (39.4)***	720	1585
1100	42	1405 (55.3)	1067 (42)***	880	1930
1200	48	1511 (59.5)	1200 (47.2)***	1000	2160
1400	54	1745 (68.7)	1400 (55.1)***	1450	3190
1500	60	1855 (73.0)	1524 (59)***	1370	3000
1600	66	2032 (80.0)	1600 (63)***	2000	4400
1800	72	2197 (86.5)	2250 (88.6)***	2400	5280
2000	78	2362 (93.0)	2500 (98.4)***	3200	7040
2200	84	2534 (100.0)	2750 (110)***	4200	9300

* Size is dependent on flange specification

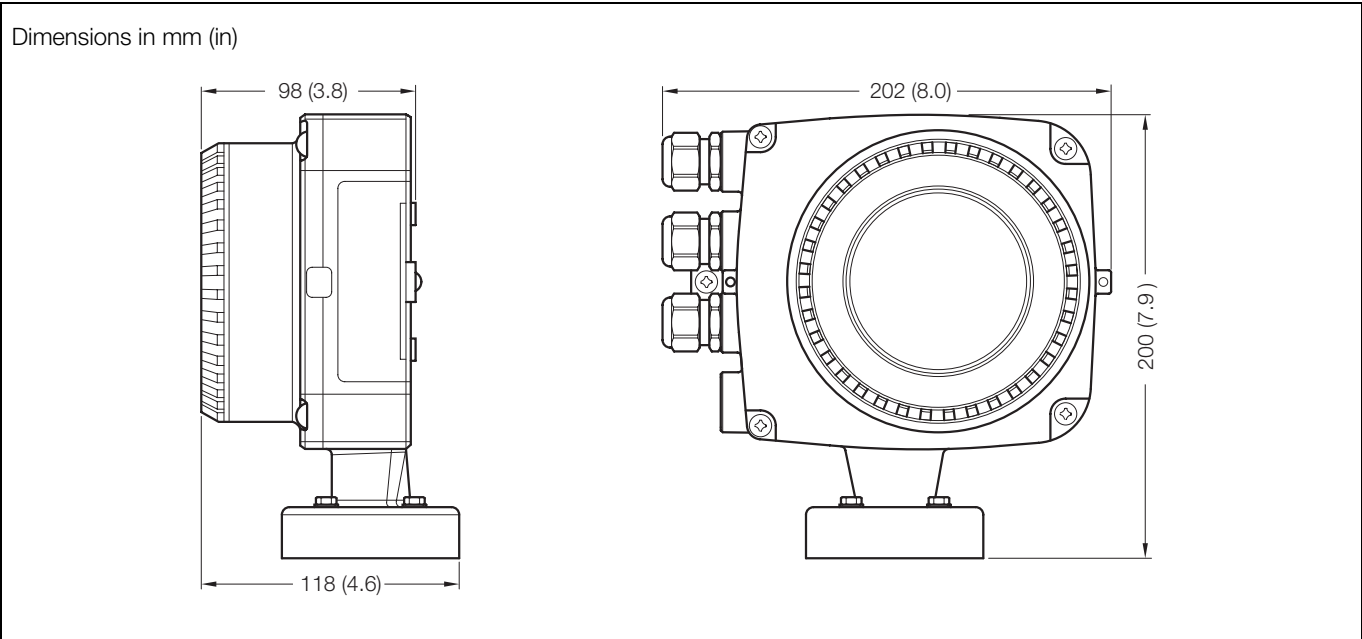
Typical tolerances: **+0/−6 mm (0.24 in); ***+0/−10 mm (0.40 in)

Items **/** DN700 up +0/−25 mm (1.0 in) if using Weld Neck flanges

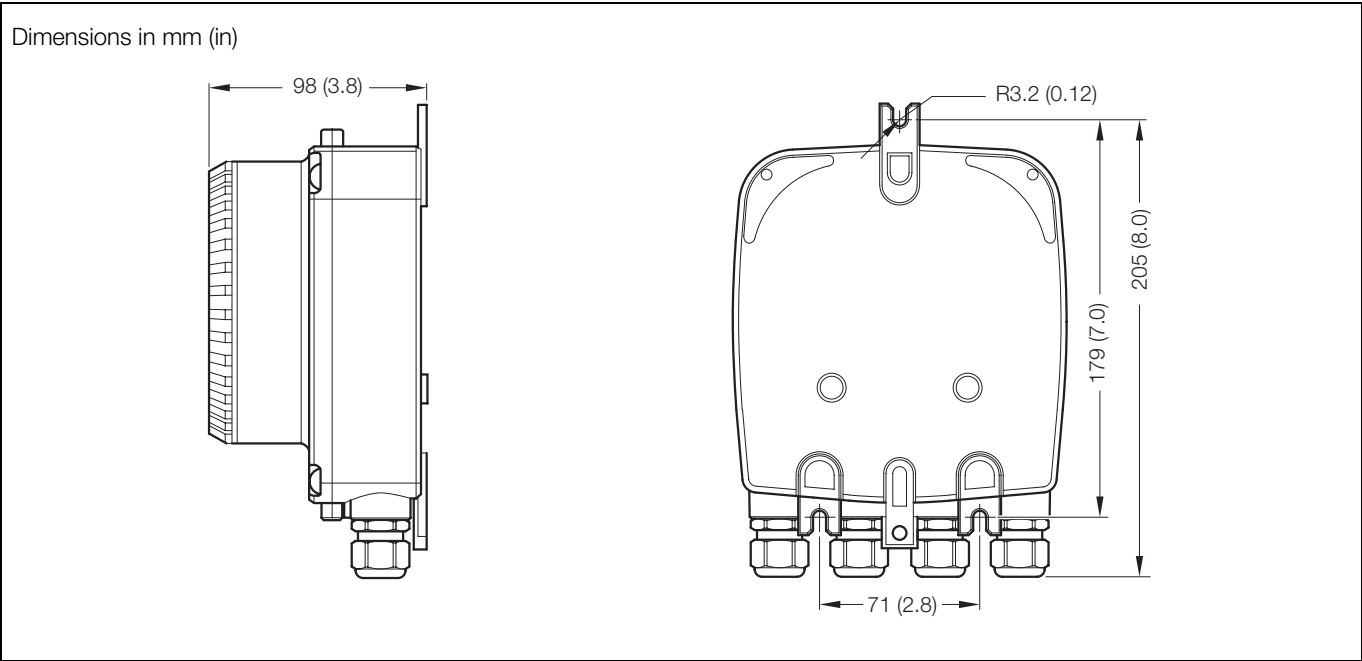
DN 350 to 2200 Full-bore

Transmitter Dimensions

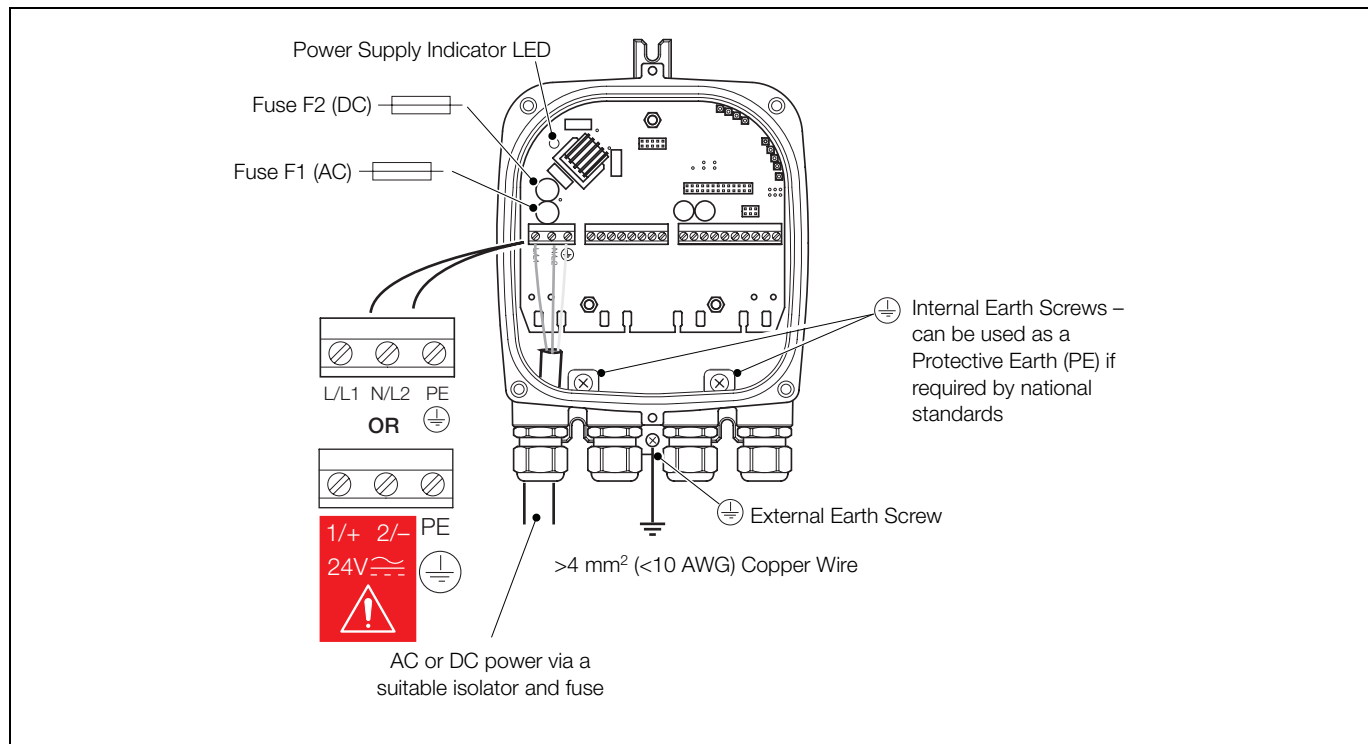
Integral Transmitter



Remote Transmitter



Electrical Connections



AC and DC Power Supply Connections

Ordering Information

WaterMaster Electromagnetic Flowmeter		WaterMaster	FE	X	XX	1	XXX	X	X	10 ... 16
		Code Digits		1	2,3	4	5,6,7	8	9	
Sensor Type				V						
WaterMaster DN 40 ... DN 200 (1½ ... 8 in)				F						
WaterMaster DN 250 ... DN 2200 (10 ... 84 in)				T						
Transmitter Type / Transmitter Housing Type										
Without transmitter					00					
WaterMaster transmitter module					10					
WaterMaster transmitter / integral					11					
WaterMaster transmitter / remote					12					
Sensor only, for use with remote WaterMaster transmitter					18					
Sensor only, for use with integral WaterMaster transmitter					19					
Bore Diameter										
DN 40	(1½ in)						040			
DN 50	(2 in)						050			
DN 80	(3 in)						080			
DN 100	(4 in)						100			
DN 150	(6 in)						150			
DN 200	(8 in)						200			
DN 250	(10 in)						250			
DN 300	(12 in)						300			
DN 350	(14 in)						350			
DN 400	(16 in)						400			
DN 450	(18 in)						450			
DN 500	(20 in)						500			
DN 600	(24 in)						600			
DN 700	(28 in)						700			
DN 750	(30 in)						760			
DN 800	(32 in)						800			
DN 900	(36 in)						900			
DN 1000	(40 in)						001			
DN 1100	(42 in)						101			
DN 1200	(48 in)						201			
DN 1400	(54 in)						401			
DN 1500	(60 in)						501			
DN 1600	(66 in)						601			
DN 1800	(72 in)						801			
DN 2000	(80 in)						002			
DN 2200	(84 in)						202			
Without sensor (replacement transmitter only)							000			
Liner Material										
Elastomer (DN250 ... DN2200)								K		
Elastomer with ACS approval (DN250 ... DN2200)								L		
Elastomer with NSF61 approval (DN250 ... DN2200)								M		
Polypropylene (DN40 ... DN200)								V		
Without (transmitter only)								Y		
Electrode Design										
Without (transmitter only)									0	
Standard									1	

Continued on page 14

WaterMaster Electromagnetic Flowmeter								
Continued from page 13 (Code Digits 1 to 9)								
Measuring Electrodes Material								
Hastelloy C-276 (not DN250 and DN300)	E							
Stainless steel 316	S							
Without (transmitter only)	Y							
Grounding Accessories								
Without		0						
Standard		1						
One ground ring		3						
Two ground rings		4						
Process Connection Type								
Flanges ASME B16.5 class 150 (1½ ... 24 in)			A1					
Flanges AWWA C207 class B (28 ... 84 in)			C1					
Flanges AWWA C207 class D (28 ... 84 in)			C2					
Flanges AS 4087 PN16 (DN50 ... DN600)			E1					
ISO 7005 PN16 EN1092-1 (DN50 ... DN2200), except DN750, DN1100 and DN1500			S2					
ISO 7005 PN16 EN1092-1 (DN40)			S4					
AS2129 Table F (DN40)			E3					
Without			Y0					
Process Connection Material								
Carbon steel flanges			B					
Without (transmitter only)			Y					
Calibration Type								
Standard OIML R49 Class 2 calibration						A		
High accuracy OIML R49 Class 1 calibration						B		
Witnessed OIML R49 Class 1 calibration						M		
Transmitter only						Y		
Continued on page 15								

WaterMaster Electromagnetic Flowmeter			X	X	X	X	X	X	X	X
Continued from page 13	Code Digits 1 to 9	Code Digits 10 to 17	18	19	20	21	22	23	24	25
Continued from page 14										
Language										
English			A							
German			D							
French			G							
Spanish			K							
Italian			N							
Signal Cable Length and Type *										
Without signal cable				0						
5 m (15 ft.) cable				1						
10 m (30 ft.) cable				2						
20 m (60 ft.) cable				3						
30 m (100 ft.) cable				4						
50 m (165 ft.) cable				5						
80 m (260 ft.) cable				6						
100 m (325 ft.) cable				7						
150 m (490 ft.) cable				8						
Special Length > 150 m (> 490 ft.)				9						
Explosion Protection Certification										
General purpose (non-Ex design)					A					
General					Y					
Protection Class Transmitter / Protection Class Sensor										
IP67 (NEMA 4X) Integral						1				
IP67 (NEMA 4X) / IP68 (NEMA 4X) – cable not fitted. Available only with transmitter type / transmitter housing type code 12, 18 (remote transmitter)						2				
IP67 (NEMA 4X) / IP68 (NEMA 4X) – cable fitted and potted. Available only with transmitter type / transmitter housing type code 12, 18 (remote transmitter)						3				
Cable Conduits *										
M20 x 1.5							A			
NPT 1/2 in							B			
M20 SWA armored							D			
M20 SWA armored + M20 x 1.5							F			
Power Supply										
Without (sensor only)								0		
85... 265 V AC, 50 Hz								1		
24 V DC or 24V AC, 50 Hz								2		
85 ... 265 V AC, 60 Hz								3		
24 V DC or 24 V AC, 60 Hz								4		
Input and Output Signal Type										
HART + 20 mA + pulse + contact output									A	
Without (sensor only)									Y	
Configuration Type / Diagnostics Type										
Without (sensor only)										0
Standard diagnostics										1

* The type of cable supplied (standard or armored) depends on the type of cable conduit type (code digit 22) ordered.

ABB has Sales & Customer Support expertise
in over 100 countries worldwide

www.abb.com

The Company's policy is one of continuous product
improvement and the right is reserved to modify the
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Printed in UK (04.08)

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