Data Sheet

DS/WM Issue 4

Electromagnetic Flowmeter

WaterMaster

- **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
- **VeriMaster in situ verification software option**
  - allows the customer to perform in situ verification at the flowmeter

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 ($1^1/_2$ 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-type 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
- VeriMaster in situ verification software available as option
- 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 ($1^1/_2$ 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.

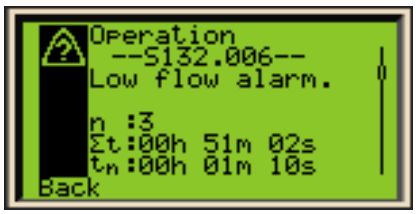
An automatic data self-repair routine corrects any data corruption such as totalizer volume corruption that could occur during a power failure.

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!

In situ verification

WaterMaster is now extended to include VeriMaster for in situ verification. VeriMaster is a PC application, that when coupled to the WaterMaster through the infrared service port, generates a report on the accuracy of the complete flowmeter, both sensor and transmitter. It builds on over 10 years of ABB's experience in the verification field, through its leading CalMaster range. VeriMaster is a quick and easy to use utility, that uses the advanced self-calibration and diagnostic capability of WaterMaster, coupled with fingerprinting technology, to determine the accuracy status of the WaterMaster flowmeter to within +/-1 % of its original factory calibration. VeriMaster also supports printing of calibration verification records for regulatory compliance.

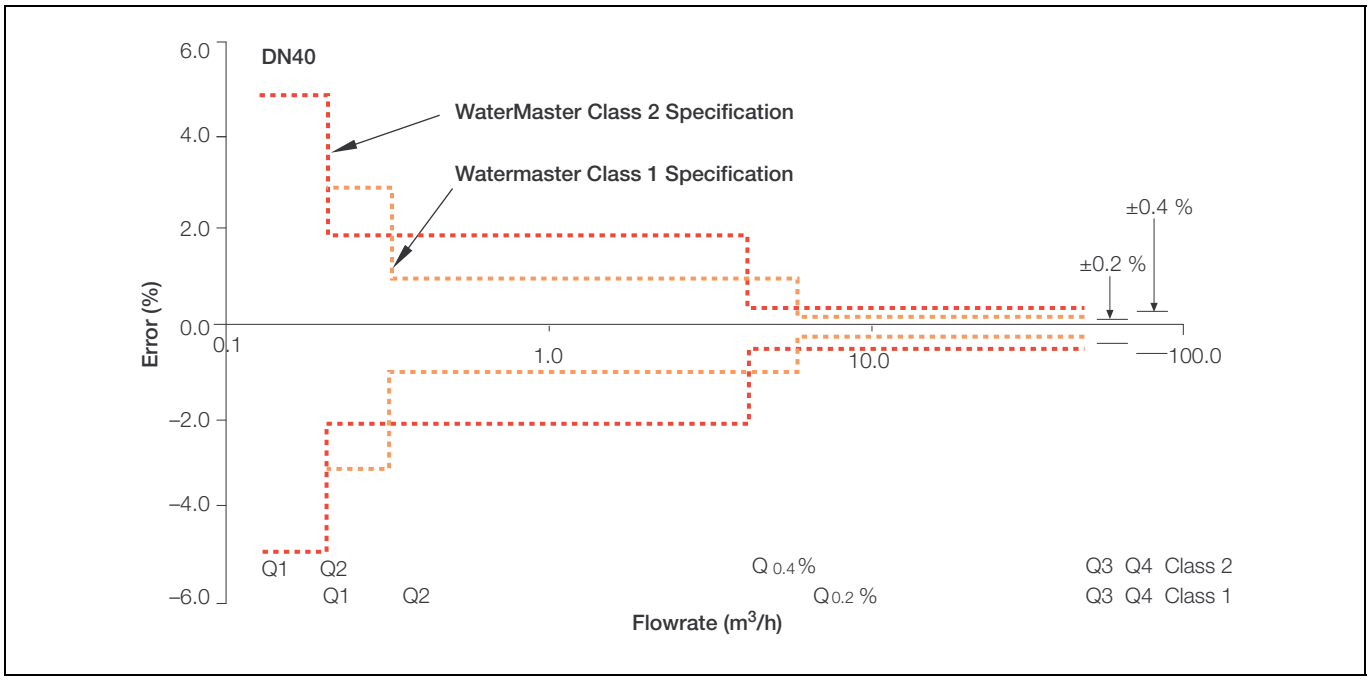
VeriMaster integrates with WaterMaster seamlessly, meaning:

- no interruption to any of the wiring
- no cover removal, with operation through the front glass using the infrared service port
- no interruption to the measurement

If desired, an operator can additionally check and record the accuracy of the current and pulse outputs. VeriMaster is compatible with Microsoft Windows XP and Vista operating systems

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

Calibration Options

A variety of calibration options are available to OIML R49 Class 1 or Class 2 accuracy specifications, optionally available with fingerprinting for the ABB VeriMaster product.

WaterMaster Flow Performance – m^3/h

			Standard Calibration 0.4 % OIML R49 Class 2			High Accuracy Calibration 0.2 % OIML R49 Class 1		
	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
DN	(m^3/h)	(m^3/h)	(m^3/h)	(m^3/h)	(m^3/h)	(m^3/h)	(m^3/h)	(m^3/h)
40	50	40	4.2	0.2	0.13	6	0.32	0.2
50	79	63	4.2	0.32	0.20	7.9	0.5	0.32
65*	125	100	6.7	0.5	0.32	12.5	0.8	0.5
80	200	160	10.7	0.81	0.51	16	1.3	0.8
100	313	250	16.7	1.3	0.79	25	2	1.25
125*	500	400	26.7	2.0	1.3	40	3.2	2
150	788	630	42	3.2	2.0	63	5	3.2
200	1,250	1,000	67	5.1	3.2	100	8	5
250	2,000	1,600	107	8.1	5.1	160	13	8
300	3,125	2,500	167	12.7	7.9	250	20	12.5
350	5,000	4,000	267	20.3	12.7	400	32	20
400	5,000	4,000	267	20.3	12.7	400	32	20
450	7,875	6,300	420	32	20	630	50	32
500	7,875	6,300	420	32	20	630	50	32
600	12,500	10,000	667	51	32	1000	80	50
700	20,000	16,000	1600	102	64	1600	160	100
760	20,000	16,000	1600	102	64	1600	160	100
800	20,000	16,000	1600	102	64	1600	160	100
900	31,250	25,000	2500	160	100	2500	250	156
1000	31,250	25,000	2500	160	100	2500	250	156
1050	31,250	25,000	2500	160	100	2500	250	156
1100	31,250	25,000	2500	160	100	2500	250	156
1200	50,000	40,000	4000	256	160	4000	400	250
1400	78,750	63,000	6300	403	252	6300	630	394
1500	78,750	63,000	6300	403	252	6300	630	394
1600	78,750	63,000	6300	403	252	6300	630	394
1800	125,000	100,000	10000	640	400	10000	1000	625
2000	125,000	100,000	10000	640	400	10000	1000	625

*Future option

WaterMaster Flow Performance – gal/min

			Standard Calibration 0.4 % OIML R49 Class 2			High Accuracy Calibration 0.2 % OIML R49 Class 1		
	Q4	Q3	$Q_{0.4\%}$	Q2	Q1	$Q_{0.2\%}$	Q2	Q1
NPS/NB (DN)	(gal/min)	(gal/min)	(gal/min)	(gal/min)	(gal/min)	(gal/min)	(gal/min)	(gal/min)
1 1/2 (40)	220	176	18.5	0.89	0.56	26.4	1.41	0.88
2 (50)	347	277	18.5	1.41	0.88	34.7	2.22	1.39
2 1/2* (65*)	550	440	29.4	2.24	1.40	55.0	3.52	2.20
3 (80)	881	704	47.0	3.58	2.24	70.4	5.64	3.52
4 (100)	1,376	1,101	73.4	5.59	3.49	110	8.81	5.50
5* (125*)	2,201	1,761	117	8.95	5.59	176	14.1	8.81
6 (150)	3,467	2,774	185	14.1	8.81	277	22.2	13.9
8 (200)	5,504	4,403	294	22.4	14.0	440	35.2	22.0
10 (250)	8,806	7,045	470	35.8	22.4	704	56.4	35.2
12 (300)	13,759	11,007	734	55.9	34.9	1,101	88.1	55.0
14 (350)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
16 (400)	22,014	17,611	1,174	89.5	55.9	1,761	141	88.1
18 (450)	34,673	27,738	1,849	141	88.1	2,774	222	139
20 (500)	34,673	27,738	1,849	141	88.1	2,774	222	139
24 (600)	55,036	44,029	2,935	224	140	4,403	352	220
27/28** (700)	88,057	70,446	7,045	451	282	7,045	704	440
30 (760)	88,057	70,446	7,045	451	282	7,045	704	440
32 (800)	88,057	70,446	7,045	451	282	7,045	704	440
36 (900)	137,590	110,072	11,007	704	440	11,007	1,100	688
39/40** (1000)	137,590	110,072	11,007	704	440	11,007	1,100	688
42 (1050)	137,590	110,072	11,007	704	440	11,007	1,100	688
44 (1100)	137,590	110,072	11,007	704	440	11,007	1,100	688
48 (1200)	220,143	176,115	17,611	1,127	704	17,611	1,761	1,101
54 (1400)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
60 (1500)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
66 (1600)	346,726	277,381	27,738	1,775	1,110	27,738	2,773	1,733
72 (1800)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
78 (2000)	550,358	440,287	44,029	2,818	1,761	44,029	4,403	2,752
84 (2200)	880,573	704,459	70,446	4,509	2,818	70,446	7,045	4,403

*Future option
**Size is dependent on flange specification

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 available in two forms – standard and armored
Maximum length 200 m (660 ft)

Physical Specification

Wetted Parts

Lining material

Polypropylene (sizes DN40 to 200 [1 1/2 to 8 NB])
Elastomer (sizes DN250 to 2200 [10 to 84 NB])
WRAS listed
ACS and NSF61 approved (sizes DN40 to 200 [1 1/2 to 8 NB] pending)

Electrode material

Stainless steel 316 L
Hastelloy 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 [1 1/2 to 8 NB])
Negligible at Q3 (sizes DN250 to 2200 [10 to 84 NB])

Non-wetted Parts

Flange material

Carbon steel

Housing material

Carbon steel (sizes DN40 to 200 [1 1/2 to 8 NB] and DN700 to 2200 [28 to 84 NB])
Plastic (sizes DN250 to 600 [10 to 24 NB])

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

Digital Outputs (3 off)

Rating 30 V @ 220 mA, open collector
Galvanically isolated
Maximum output frequency 5250 Hz

1 off dedicated to Alarm/ Logic, programmable function

2 off configurable to either Pulse/Frequency or Alarm/Logic function

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 mls

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

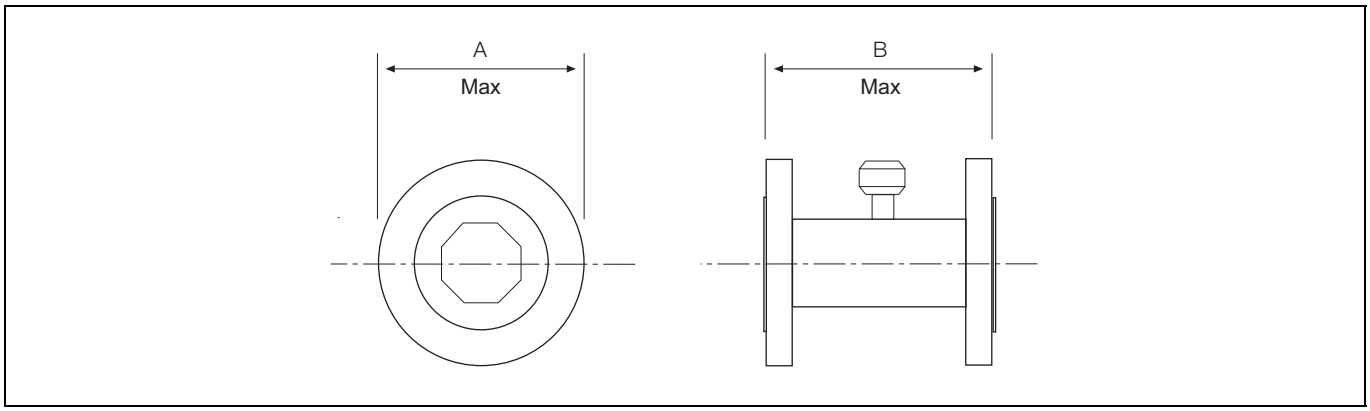
Infrared service port

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

Housing material

Power-coated aluminium glass window

Sensor Dimensions

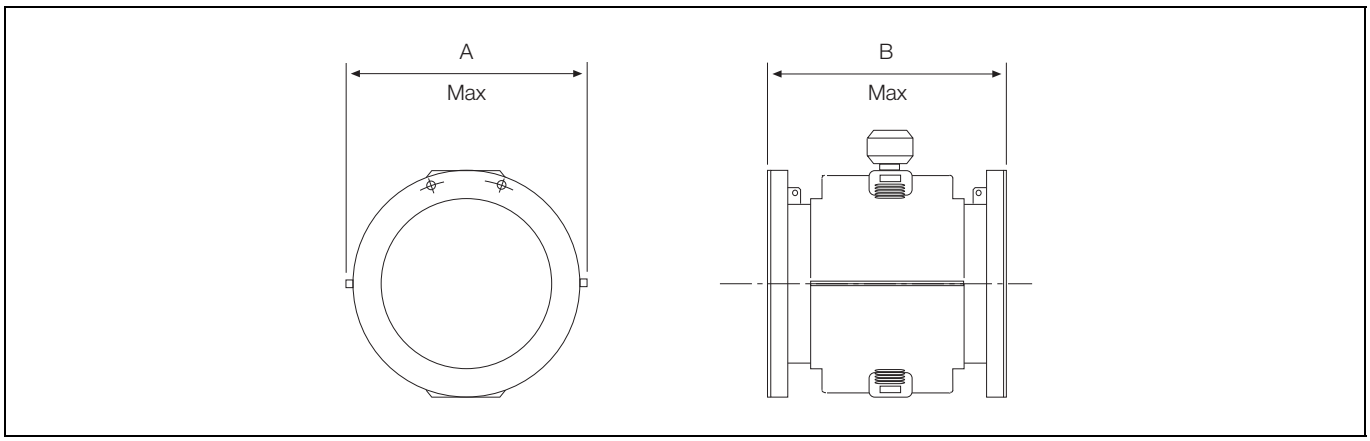


DN 40 to 300 (1 1/2 to 12 NB) Full-bore

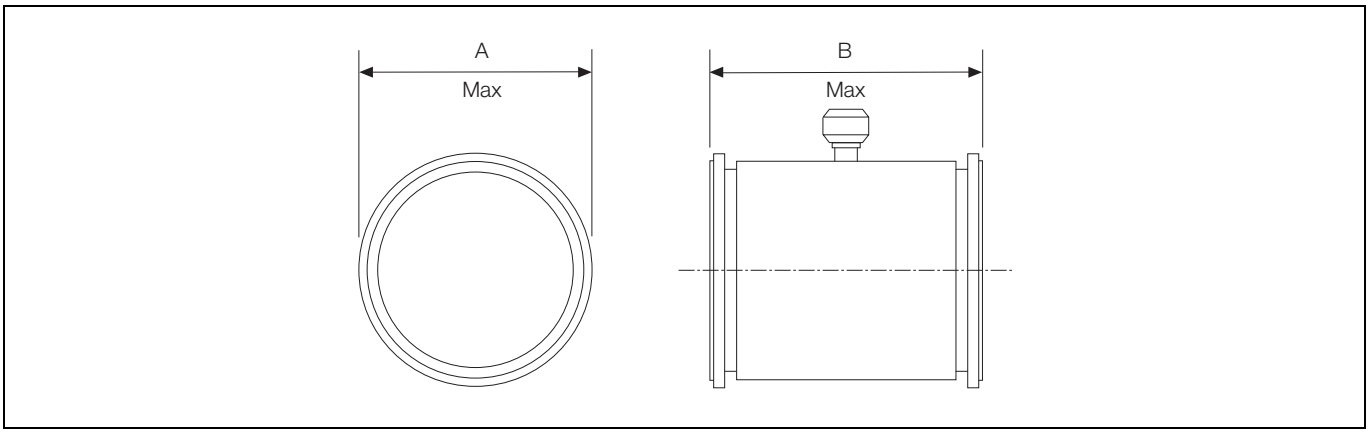
Meter Size		Dimensions mm (in)		Approximate Weight	
DN	**NPS/NB**	**A***	**B**	**kg**	**lb**
40	1 1/2	150 (5.9)	200 (7.9)	11	24
50	2	165 (6.5)	200 (7.9)	12	27
80	3	200 (7.9)	200 (7.9)	15	33
100	4	220 (8.6)	250 (9.8)	18	40
150	6	280 (11.0)	300 (11.8)	31	68
200	8	345 (13.6)	350 (13.8)	48	106
250	10	405 (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 (1 1/2 to 12 NB) Full-bore



DN 350 to 600 (14 to 24 NB) Full-bore



DN 700 to 2200 (28 to 84 NB) 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
760	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
1050	42	1405 (55.3)	1067 (42)***	880	1930
1100	44	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/–10 mm (0.40 in)

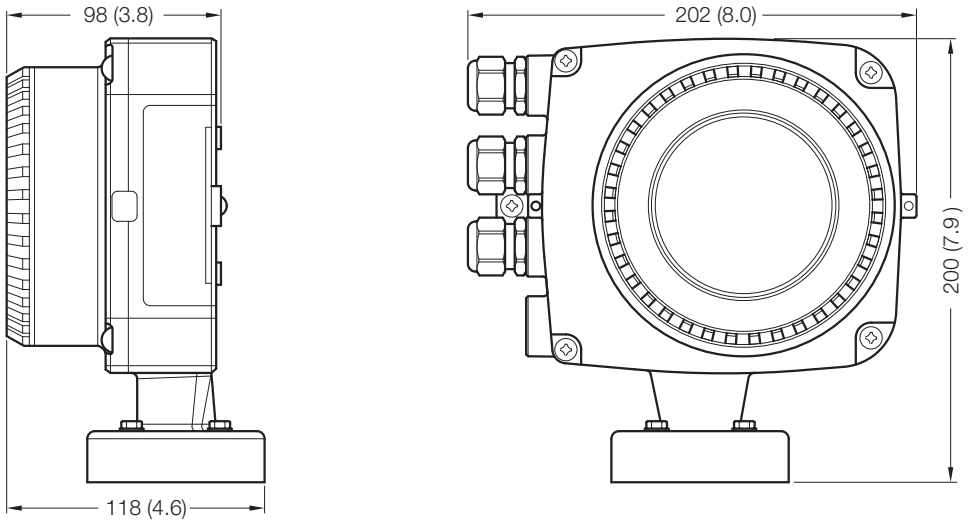
*** +0/–20 mm (1.0 in)

DN 350 to 2200 (14 to 84 NB) Full-bore

Transmitter Dimensions

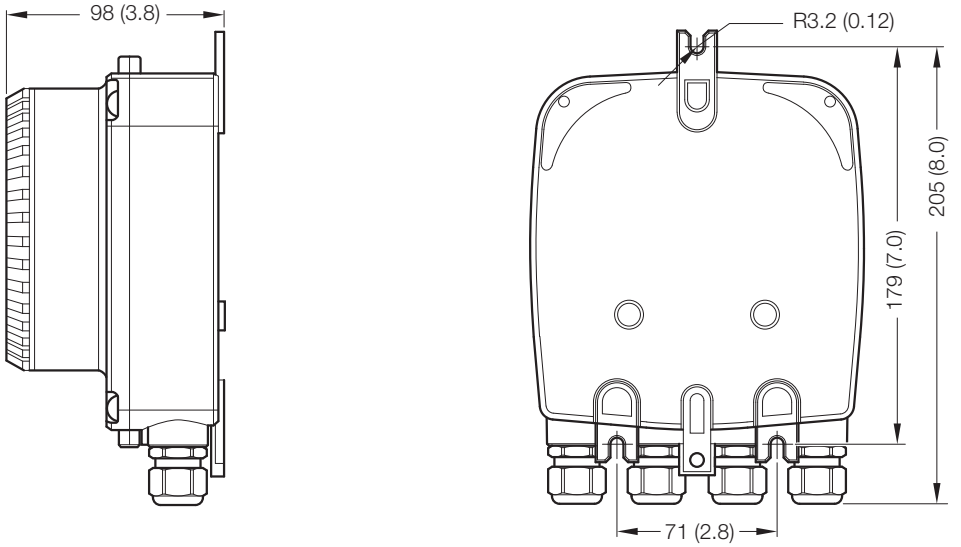
Integral Transmitter

Dimensions in mm (in)

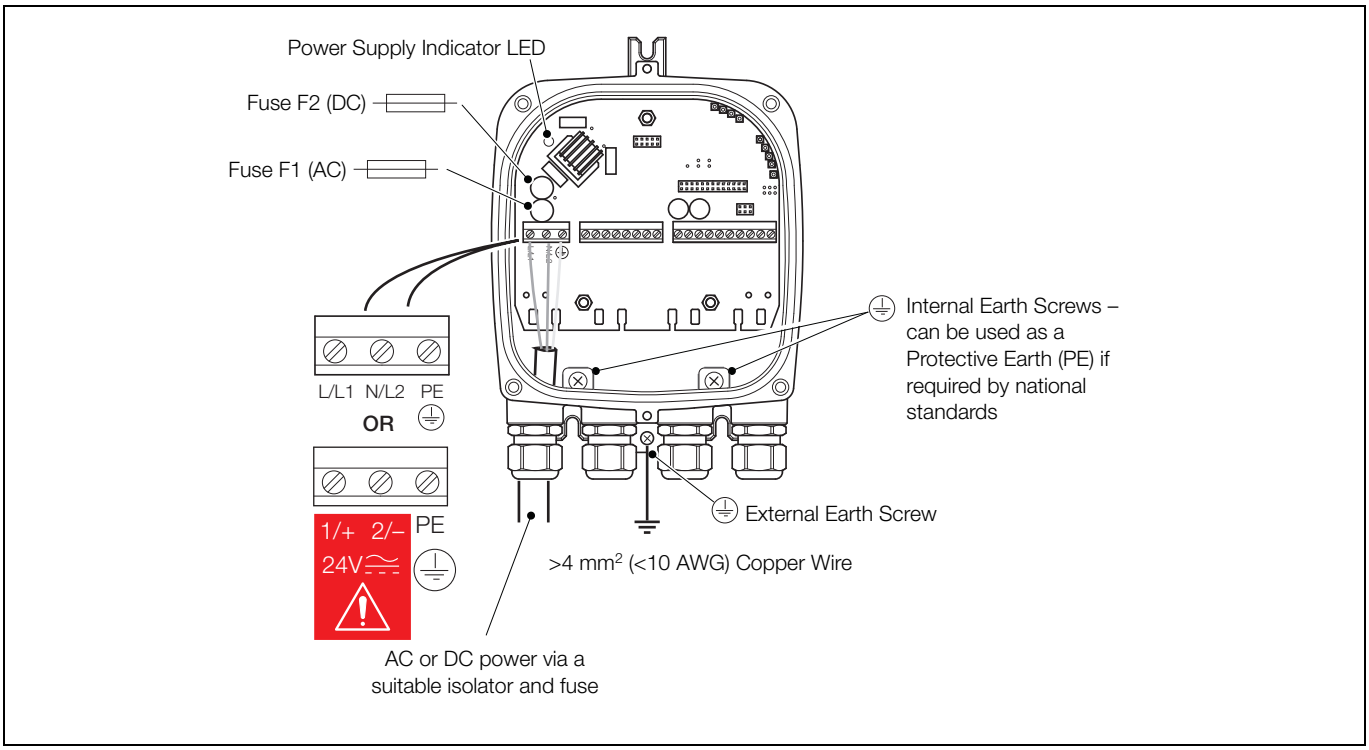


Remote Transmitter

Dimensions in mm (in)



Electrical Connections



AC and DC Power Supply Connections

Ordering Information

Electromagnetic Flowmeter WaterMaster FEF121 and FEF181

Variant digit number	1 … 6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27
Flowmeter system, full bore, remote mount	**FEF121**																		
Full bore sensor only, for use with WaterMaster transmitter / remote	**FEF181**	**XXX**	**X**	**X**	**X**	**X**	**XX**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Bore Diameter																			
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 760 (30 in)		760																	
DN 800 (32 in)		800																	
DN 900 (36 in)		900																	
DN 1000 (40 in)		001																	
DN 1050 (42 in)		051																	
DN 1100 (44 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 (78 in)		002																	
DN 2200 (84 in)		202																	
Others		999																	
Liner Material																			
Elastomer			K																
FEP			B																
Neoprene			C																
Linatex			J																
Polyurethane			U																
Others			Z																
Electrode Design																			
Standard				1															
Others – FEF181 only				9															
Measuring Electrodes Material																			
Stainless steel 316					S														
Hastelloy C-276					E														
Others					Z														
Grounding Accessories																			
Standard						1													
One grounding plate						3													
Two grounding plates						4													
Others						9													

Continued on page 15

Variant digit number	1 … 6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27
Flowmeter system, full bore, remote mount	**FEF121**	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X
Full bore sensor only, for use with WaterMaster transmitter / remote	**FEF181**																		
Process Connection Type																			
Flanges ASME class 150							A1												
Flanges ASME class 300							A3												
Flanges AWWA C207 class B							C1												
Flanges AWWA C207 class D							C2												
Flanges AS 4087 class 16							E1												
Flanges AS 2129 Table F							E3												
Flanges J15 10K							J1												
Flanges J15 5K							J2												
Flanges ISO / EN PN6							S0												
Flanges ISO / EN PN10							S1												
Flanges ISO / EN PN16							S2												
Flanges ISO / EN PN25							S3												
Flanges ISO / EN PN40							S4												
Others							Z9												
Process Connection Material																			
Carbon steel flanges								B											
Others								Z											
Usage Certifications																			
Standard									1										
Calibration Type																			
Class 2 Calibration – standard accuracy 0.4 %										A									
Class 1 Calibration – enhanced accuracy 0.2 %										B									
Class 2 Calibration – standard accuracy 0.4 % with VeriMaster										D									
Class 1 Calibration – enhanced accuracy 0.2 % with VeriMaster										H									
Witnessed Class 1 Calibration										M									
Others										Z									
Temperature Range Installation / Ambient Temperature Range																			
Standard design / –20 … 60 °C (–4 … 140 °F)											1								
Language																			
English												A							
French												G							
German												D							
Spanish												K							
Italian												N							
Signal Cable Length and Type *																			
Without signal cable – FEF181 only													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.) (and/or armored cable – FEF181 only)													9						

Continued on page 16

Variant digit number	1 … 6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27
Flowmeter system, full bore, remote mount	**FEF121**	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X
Full bore sensor only, for use with WaterMaster transmitter / remote	**FEF181**																		
Explosion Protection Certification																			
General purpose (non-Ex design)														A					
Protection Class Transmitter / Protection Class Sensor																			
IP67 (NEMA 4X) / IP68 (NEMA 6X) – cable not fitted and not potted															2				
IP67 (NEMA 4X) / IP68 (NEMA 6X) – cable fitted and potted															3				
Cable Conduits *																			
M20 x 1.5																A			
NPT 1/2 in																B			
M20 SWA armored																D			
Power Supply																			
Without (FEF181 only)																	0		
100... 230 V AC																	1		
24 V AC or 24 V DC																	2		
Input and Output Signal Type																			
HART + 20 mA + pulse + contact output (FEF121 only)																		A	
Without (FEF181 only)																		Y	
Configuration Type / Diagnostics Type																			
Factory defaults/standard diagnostics																			1

* The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered.

Electromagnetic Flowmeter WaterMaster FEV111, FEV121, FEV181 and FEF191

Variant digit number	1 … 6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27
Flowmeter system, optimized full bore, integral mount	**FEV111**	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X
Flowmeter system, optimized full bore, remote mount	**FEV121**																		
Optimized full bore sensor only, for use with WaterMaster transmitter/remote	**FEV181**																		
Optimized full bore sensor only, for use with WaterMaster transmitter/integral	**FEV191**																		
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																	
Liner Material																			
Polypropylene (DN 40 … DN 200 [1½ to 8 NB] only			V																
Electrode Design																			
Standard				1															
Measuring Electrodes Material																			
Stainless steel 316					S														
Grounding Accessories																			
Standard						1													
One grounding plate						3													
Two grounding plates						4													
Process Connection Type																			
Flanges ASME class 150							A1												
Flanges AS 4087 class 16 (DN50 ... DN300 [1½ to 8 NB] only)							E1												
Flanges AS 2129 table F (DN40 [1½ NB] only)							E3												
ISO / EN PN16 (DN50 ... DN300 [2 to 12 NB] only)							S2												
ISO / EN PN40 (DN40 [1½ NB] only) 16 bar rated							S4												
Process Connection Material																			
Carbon steel flanges								B											
Usage Certifications																			
Standard									1										
Calibration Type																			
Class 2 Calibration – standard accuracy 0.4 %										A									
Class 1 Calibration – enhanced accuracy 0.2 %										B									
Class 2 Calibration – standard accuracy 0.4 % with VeriMaster										D									
Class 1 Calibration – enhanced accuracy 0.2 % with VeriMaster										H									
Witnessed Class 1 Calibration										M									
Others										Z									
Temperature Range Installation / Ambient Temperature Range																			
Standard design/ –20 … 60 °C (–4 … 140 °F)											1								

Continued on page 18

Variant digit number	1 … 6	7 … 9	10	11	12	13	14, 15	16	17	18	19	20	21	22	23	24	25	26	27
Flowmeter system, optimized full bore, integral mount	**FEV111**	XXX	X	X	X	X	XX	X	X	X	X	X	X	X	X	X	X	X	X
Flowmeter system, optimized full bore, remote mount	**FEV121**																		
Optimized full bore sensor only, for use with WaterMaster transmitter/remote	**FEV181**																		
Optimized full bore sensor only, for use with WaterMaster transmitter/integral	**FEV191**																		

Language

English	A
French	G
German	D
Spanish	K
Italian	N

Signal Cable Length and Type *

Without signal cable (FEV111 and FEV 191 only)	0
5 m (15 ft.) cable (FEV121 and FEV181 only)	1
10 m (30 ft.) cable (FEV121 and FEV181 only)	2
20 m (60 ft.) cable (FEV121 and FEV181 only)	3
30 m (100 ft.) cable (FEV121 and FEV181 only)	4
50 m (165 ft.) cable (FEV121 and FEV181 only)	5
80 m (260 ft.) cable (FEV121 and FEV181 only)	6
100 m (325 ft.) cable (FEV121 and FEV181 only)	7
150 m (490 ft.) cable (FEV121 and FEV181 only)	8
Special Length > 150 m (> 490 ft.) (FEV121 and FEV181 only)	9

Explosion Protection Certification

General purpose (non-Ex design)	A

Protection Class Transmitter / Protection Class Sensor

IP67 (NEMA 4X) / IP67 (NEMA 4X) – integral (FEV111 and FEV191 only)	1
IP67 (NEMA 4X) / IP68 (NEMA 6X) – cable not fitted and not potted (FEV121 and FEV181 only)	2
IP67 (NEMA 4X) / IP68 (NEMA 6X) – cable fitted and potted (FEV121 and FEV181 only)	3

Cable Conduits *

M20 x 1.5	A
NPT 1/2 in	B
M20 SWA armored (FEV121 and FEV181 only)	D
M20 SWA sensor, output and power connector	F

Power Supply

Without (FEV181 and FEV191 only)	0
100... 230 V AC, 50 Hz (FEV111 and FEV121 only)	1
24 V AC or 24 V DC, 50 Hz (FEV111 and FEV121 only)	2
100... 230 V AC, 60 Hz (FEV111 and FEV121 only)	3
24 V AC or 24 V DC, 60 Hz (FEV111 and FEV121 only)	4
Others (FEV111 only)	9

Input and Output Signal Type

HART + 20 mA + pulse + contact output (FEV111 and FEV121 only)	A
Without (FEV181 and FEV191 only)	Y

Configuration Type / Diagnostics Type

Factory defaults / standard diagnostics	1

* The type of signal cable supplied (standard or armored) depends on the type of cable conduit (variant digit number 24) ordered.

Electromagnetic Flowmeter Transmitter for WaterMaster FET101, FET111 and FET121

Variant digit number	1 … 6	7	8	9	10	11	12	13	14	15
Transmitter cartridge	**FET101**									
Integral transmitter	**FET111**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Remote transmitter	**FET121**									
Temperature Range Installation / Ambient Temperature Range										
Standard design / –20 … 60 °C (–4 … 140 °F)		1								
Language										
English			A							
French			G							
German			D							
Spanish			K							
Italian			N							
Signal Cable Length and Type										
Without signal cable				0						
Explosion Protection Certification										
Without (transmitter only)					Y					
Protection Class Transmitter / Protection Class Sensor										
IP67 (NEMA 4X) / IP67 (NEMA 4X)						1				
Cable Conduits										
Without (FET101 only)							Y			
M20 x 1.5 (FET111 and 121 only)							A			
NPT $^1/_2$ in (FET111 and 121 only)							B			
M20 SWA armored (FET111 and 121 only)							D			
M20 Plastic power/output + M20 SWA armored sensor cable entry							F			
Power Supply										
100... 230 V AC								1		
24 V AC or 24 V DC								2		
Input and Output Signal Type										
HART + 20 mA + pulse + contact output (FEV111 and FEV121 only)									A	
Configuration Type / Diagnostics Type										
Factory defaults/standard diagnostics										1

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