Product Data Sheet
PDS-658
2021-01-09

TigermagEP
Obstructionless
Electromagnetic Flowmeter

Description
The TigermagEP is a microprocessor based electromagnetic flowmeter designed to measure the flow of conductive liquids in full pipes. The sensor and transmitter are integral and enclosed in a NEMA 7 explosion-proof housing. The sensor housing is made of steel.

A wide variety of liner and electrodes are available to tailor the meter to operate in many processes.

The Tigermag's nonvolatile EEPROM memory and circuitry eliminates the need for a microprocessor backup battery. It is not necessary to reprogram if the electronic module is replaced or exchanged with electronics from another size flowmeter.

Certified Accuracy
Each FM658 is 'wet-flow' calibrated in Sparling's Primary Flow Lab traceable to the National Institute of Standards and Technology (NIST).

Principle of Operation
Sparling magnetic flowmeters are based on Faraday's Law which states that the voltage induced in a conductor moving through a magnetic field is proportional to the velocity of that conductor. Accuracy is minimally affected by changes in temperature, pressure, viscosity, or conductivity.

Applications
The Model FM658's high signal frequency makes it ideally suited to applications with high levels of inherent noise including: Process Chemicals, Heavy Slurries, Polymers, Acids, Alkalies, Sewage, Cooling Water. Nearly any conductive liquid can be measured.

Features
- Sampling frequency up to 100Hz for accurate measurement of fluids with high levels of inherent noise.
- Forward & Reverse Totalization
- Programmable high and low flow alarms
- Nonvolatile EEPROM Memory
- Universal electronics module compatability
- Low Flow Cutoff
- NEMA 4X/NEMA 7 explosion proof enclosure
- Accidental Submergence (NEMA 6/IP67), Permanent Submergence (NEMA 6P/IP68) and Direct Burial Sensors available
- Approvals Include: FM, CSA and NSF 61
- Empty pipe detection
- PZR - Positive Zero Return
- Standard 0.5% Accuracy
- Sizes available from 0.1" - 72"

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Installation

The meter must be mounted at a point in the line which is always full of process liquid under flowing conditions.

A minimum of three diameters of straight pipe length are required from the center of the meter to normal obstructions to obtain specified accuracies.

The meter may be equipped with the following flanges: ANSI 150 or 300#, AWWA, DIN, PN 10 or 16, JIS or British Standard.

Nonvolatile EEPROM Memory

A backup battery is not required and there is no need to reprogram if the electronics module is replaced or exchanged. Meter identification (tube ID, serial number, K, offeset, etc.) is stored on an EEPROM chip independent of transmitter electronics. The EEPROM chip has lifetime data retention.

Empty pipe detection

The Sparling TigermagEP is designed to detect absence or inadequate volume of process fluid in the pipe and will hold the output signal to 4mA or zero. This feature does not require any hard wiring as it is a software selection. One of the most important values of this feature is that it prevents false totalization possible with other meters under partially filled pipe conditions

Ease of Communications

The TigermagEP is programmable with Mag-Command, Modbus or Hart Protocol. 4-20mA, RS-232 or RS-485 outputs give you flexibility when interfacing with your distrubuted control system.

Hi-Z Circuitry

The Sparling TigermagEP provides superior performance in liquids which tend to deposit nonconductive coatings. Hi-Z circuitry produces a high input impedance to the transmitter's preamplifier ($1x10^{12}$ Ohms). The impedance of the coating is negligible as compared to the impedance of the receiving instrument. The voltage drop across the electrode coating is also negligible eliminating the need for electrode cleaners.

Remote Mounted Transmitter

Remote mounting of the transmitter is required when pipe vibration is excessive, when flooding is possible or where high termperature conditions exist (over 100°F).

The TigermagEP remote transmitter is housed in a NEMA-4X enclosure and features a larger sized (8mm) 16 digit 2-line backlit display. All power, coil, and elctrode connections are made within the transmitter enclosure and junction box. The meter is programmed using Mag-Command. Hall-effect switches which are energized from outside the enclosure. The enclosure can be wall mounted. An optional bracket for pipe mounting is available.

Two flow alarms

Fault alarms can be configured with alarm set points between 0-99% of flow for each alarm. Open collector output turns on above programmed set point.

Grounding

The use of grounding rings is recommended to ensure accuracy. Grounding rings are required if adjacent piping is lined or nonconductive. Pump noise or excessive RF should be minimized to achieve highest accuracy.


Grounding Rings
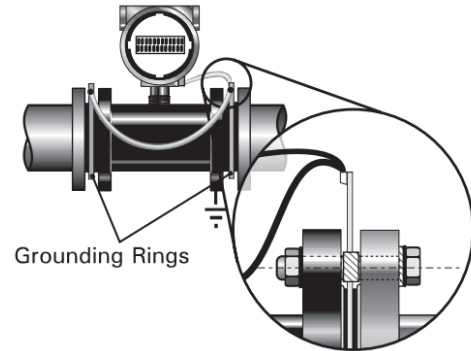
PZR - Positive Zero Return

An electronic circuit is activated by an external contact closure when lines go empty or when a pump or valve is shut down, indicating to the meter that it should drive the output signal to 4mA or 0.

Removable Electrodes

Two configurations of removable electrodes are available in sizes of 6" or greater for all FM656 meters. The first configuration allows removal of the electrode after the line has been depressurized and drained. Removal is performed with an 11/32" nut driver and a 3/4" socket wrench.

Electrode Cable

Thumbscrew

Shut-off Valve Handle
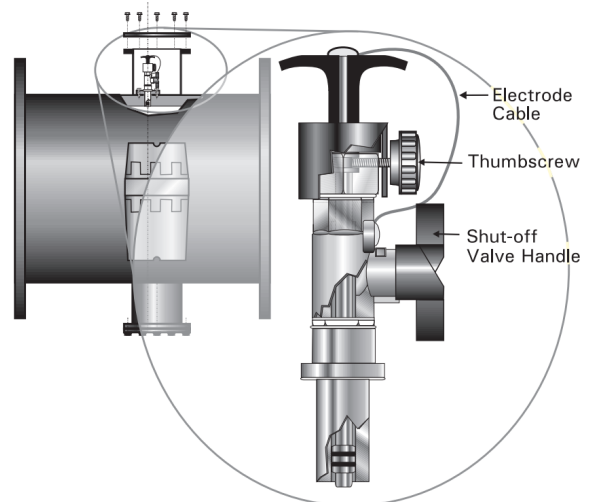
The second is the "hot-tap" electrode which allows electrode replacement while the system is still under pressure without disturbing the process flow. Removal can be easily performed with a phillips screwdriver and a crescent wrench. Special locking catches were designed to prevent high pressure accidents during electrode removal. The shut-off valve must be closed before the electrode may be removed.

Flow Rates & Dimensions

Meter Size (in)	Dimensions (in)								Flow Rates (GPM)		
	A		B		C		D		1 fps	3 fps	33 fps
	150#	300#	150#	300#	150#	300#	150#	300#			
0.100	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	*	*	*
0.250	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	0.153	0.459	5.05
0.375	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	0.342	1.03	11.3
0.500	4.00	4.00	3.50	3.75	9.50	9.62	9.25	9.30	0.568	1.71	18.8
1.00	4.00	4.00	4.25	4.88	10.2	10.5	9.94	10.3	2.02	6.07	66.7
1.50	4.00	4.00	5.00	5.12	10.9	11.4	10.6	11.2	5.29	15.9	174
2.00	4.00	4.00	6.00	6.50	11.7	11.9	11.4	11.6	9.18	27.5	303
2.50	6.00	6.00	7.00	7.50	12.6	12.9	11.6	11.9	13.1	39.2	431
3.00	6.00	6.00	7.50	8.25	13.0	13.4	12.8	13.2	20.1	60.4	664
4.00	6.00	6.00	9.00	10.0	14.4	14.9	14.1	14.6	35.8	107	1180
6.00	13.4	14.9	11.0	12.5	17.0	17.8	16.8	17.5	88.1	264	2910
8.00	13.4	15.4	13.5	14.3	19.4	19.8	19.1	19.5	157	470	5170
10.0	18.2	20.6	16.0	17.5	22.6	23.3	22.3	23.1	245	734	8070
12.0	19.4	21.8	19.0	20.5	25.0	25.8	24.8	25.5	352	1060	11600
14.0	21.4	23.8	21.0	23.0	26.7	27.7	26.4	27.4	430	1290	14200
16.0	23.4	25.9	23.5	25.5	29.0	30.0	28.7	29.7	569	1710	18800
18.0	27.3	29.9	25.0	28.0	31.1	32.6	34.9	32.4	728	2180	24000
20.0	27.6	30.4	27.5	30.5	33.4	34.9	33.1	34.6	907	2720	29900
24.0	32.8	35.8	32.0	36.0	37.4	39.4	37.2	39.2	1310	3920	43100
30.0	43.5	46.6	38.8	43.0	43.7	45.9	43.5	45.6	2070	6220	68400
36.0	47.8	50.9	46.0	50.0	50.2	52.2	50.0	52.0	3010	9040	99500
42.0	51.8	55.1	53.0	57.0	56.9	58.9	56.7	58.7	4110	12300	136000
48.0	51.8	55.4	59.5	65.0	63.1	65.8	62.8	65.6	5400	16200	178000
54.0	53.5	*	66.3	*	69.9	*	69.6	*	6810	20400	225000
60.0	65.5	*	73.0	*	76.8	*	76.5	*	8810	26400	291000
66.0	65.5	*	80.0	*	83.8	*	83.5	*	10700	32000	352000
72.0	72.8	*	86.5	*	90.0	*	89.8	*	12700	38100	419000

Dimensions for flanges. Allow 0.125" to 0.25" for lining thickness/Dimensions C & D ±0.125"

Flow Rates: 0.25" - 4" flow rates are for FEP/PTFE, Poly, and HR liners. Ceramic sensor flow rates differ slightly. Please see [PDS-626](#) for ceramic sensor flow rates for 0.25" - 4"

How to Order a TigermagEP

Table 1: Base Model Number
FM658 - Flanged, Blind, Magnetic Flowmeter

Table 2: Size

AA - 0.1"	**OA** - 0.25"	**OB** - 0.375"	**OD** - 0.5"	**OF** - 1"	**OG** - 1.5"	**02** - 2"
OH - 2.5"	**03** - 3"	**04** - 4"	**06** - 6"	**08** - 8"	**10** - 10"	**12** - 12"
14 - 14"	**16** - 16"	**18** - 18"	**20** - 20"	**24** - 24"	**30** - 30"	etc.

Table 3: Liner Material
1 - Hard Rubber (1-72")
6 - Ceramic[1] (0.1-4")
A - Polyurethane for potable water (2-72")
5 - Polyurethane (2-72")
8 - FEP (0.25-48")

Table 4: Electrode Material
1 - 316 SS	**2** - Hastelloy C	**3** - 316 SS BN
4 - Titanium	**5** - Tantalum	**6** - Fused Pt: Ceramic Liners
7 - Platinum: Other Liners	**8** - Zirconium	**9** - Monel
0 - Tungsten Carbide	**B** - HastC BN	**D** - Titanium BN
E - Tantalum BN	**G** - Platinum BN	**H** - Zirconium BN
I - Monel BN		

Table 5: Flange Rating
1 - AWWA Cl D (150#)	**3** - AWWA Cl F (300#)	**A** - ANSI B16.5 Cl 150
B - ANSI B16.5 Cl 300	**C** - ANSI B16.5 Cl 400	**D** - ANSI B16.5 Cl 500
S - Tri-Clamp (Sanitary)		

Table 6: Transmitter
F - Integral NEMA 4X encl.
G - Integral NEMA 4X encl. Battery Operated
0 - Integral NEMA 7 encl.
1 - Remote NEMA 7 encl. encl., 15ft Cable
2 - Remote NEMA 7 encl. encl., 15ft Cable, Perm. Sub
3 - Remote NEMA 7 encl. encl., 15ft Cable, Acc. Sub
4 - Remote NEMA 7 encl. encl., 15ft Cable, Direct Burial
5 - Remote NEMA 4X encl. encl., 15ft Cable
6 - Remote NEMA 4X encl. encl., 15ft Cable, Acc. Sub
7 - Remote NEMA 4X encl. encl., 15ft Cable, Direct Burial
8 - Remote NEMA 4X encl. encl., 15ft Cable, Perm. Sub

Table 7: Power[3]
0 - 77-265 VAC   **1** - 12-60 VDC

Table 8: Options
HART, Modbus, RS485, RS232
High Temperature Coils (Req Over 266°F)
Hot Tap Removable Electrodes (4"+)
Removable Electrodes (4"+)
Add Cable (15ft - 300ft)
Relay for Fault and Flow Alarms

Model	Size	Liner	Electrode	Flange	Transmitter	Power
FM658	24	8	7	A	5	1

1. Ceramic Liner not available in the following sizes: 0.375" or 2.5"   *3. FM approval is up to 120V*

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Standard Specifications

Accuracy: 0.1" - 0.25": $\pm$1% of flow (1fps - 33fps)
0.5" - 8": $\pm$0.5% of flow (1fps - 33fps)

Temp Effect $\pm$0.025% FS/°C

Full Scale Ranges: From 0fps - 3fps to 0fps - 33fps

Repeatability: $\pm$0.1% of full scale

Electrodes: 316 SS Standard (others available)

Liner: Hard Rubber, Polyurethane, Ceramic, FEP/PTFE, Polyurethane- liner for potable water certified to NSF61

Outputs:
1) Isolated analog 4mA - 20mA DC into 800 Ohms
2) Scaled Pulse 24VDC with selectable 12.5/25/50/100 ms on time, max.freq. 60Hz
3) 0Hz - 1000Hz Freq., for 0%-100% of flow rate, 15VDC
4) Two flow alarms
5) Fault, with open collector
6) RS232 communication
7) Flow direction with open collector
8) Positive Zero Return (PZR) for external relay contacts. Outputs 2 and 3 can be open collector if required.
9) HART Protocol Available
10) Modbus Protocol Available

Min Velocity[1]:   0.3fps

Power Requirements: 77-265VAC/12-60VDC

Power Consumption: Less than 20 W

Enclosures: Cast alumnium epoxy coated. Integral NEMA 7 encl. or Remote NEMA 4X encl.

Sensor Housing: Fabricated steel, epoxy coated

Preamp Impedance: 1×10^{12} Ohms minimum

Amb. Temp: -20°F - 140°F (-29°C - 60°C) Display darkens over 158°F (70°C)

End Connections: 150# or 300#

Sensor Tube: 304 Stainless Steel

Process Temp:
Integral Mount:
- Hard Rubber, Neoprene, Polyurethane, Food Grade Polyurethane: -40°F - 180°F
- TEF, Ceramic: -40°F - 212°F

Remote Mount (opt):
- TEF, Ceramic: -40°F - 266°F

High Temperature Coils (opt):
- TEF: -40°F - 300°F
- Ceramic: -40°F - 420°F

Selectable Damping: 0-99 seconds

Minimum Conductivity: 5 µsiemens

Low Flow Cutoff: Selectable 0-9% of full scale

[1] *Minimum Velocity is the lowest velocity the meter will show a reading. Accuracy, however, is subject to the limits above.*

Model FM658 Specification available on request