



ELECTROMAGNETIC FLOWMETER

MAG-OVAL III

GENERAL SPECIFICATION
GS.No.GBH021E-2

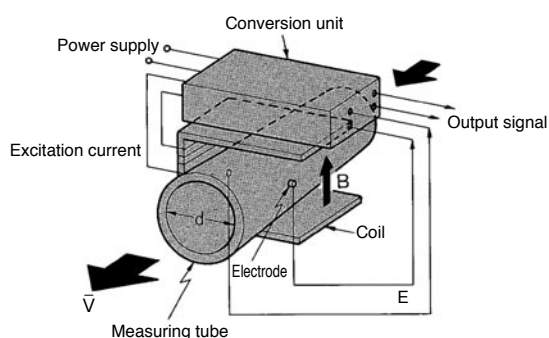
■ GENERAL

Characterized by outstanding accuracy and reliability, a new electromagnetic flowmeter is released from OVAL: the MAG-OVAL III can measure not only water but also various kinds of highly corrosive liquids including chemical solutions. Equipped with RS-485 communication and self-diagnostic functions, conventional MAG-OVAL series have become more user-friendly products.

■ FEATURES

1. Easy-to-use design and low pressure loss feature contribute to low installation and transporting cost and excellent performance per cost of a flowmeter.
2. Four kinds of electrode lineup are available for wetted part and applicable to highly corrosive liquids.
3. In addition to the magnet operation in the field, monitoring, various kinds of setting change, logging, loop test, and self-diagnosis are possible through RS-485 communication.
4. Wide range of metering ability starting from zero point.

■ PRINCIPLE OF OPERATION



The operating principle of this flowmeter is based on Faraday's law of electromagnetic induction. When a conductive liquid passes through magnetic field, a voltage (electromotive force) is produced at a right angle to the magnetic field and the flow of the liquid. Here, the voltage is proportionate to the average flow speed of the liquid. The equation of Faraday's law is given as

$$E = B \times d \times \bar{V}$$



Wafer Type
(Nom. Size 25 to 150mm)



Screw Type
(Nom. Size 3 to 15mm)

Voltage E produced in the fluid is measured by a pair of electrodes installed opposing to the pipe in magnetic field. The length of a conductor (indicating liquid to be measured) is equivalent to the length between sensor electrodes, or inner diameter d of the pipe. Magnetic flux density is proportional to the product of coil current I and constant k.

Therefore, the formula in the left can be expressed as follows

$$E = I \times k \times B \times d \times \bar{V}$$

$$\bar{V} = \frac{\text{Flow}}{\text{Cross section}} = \frac{Q}{A} = \frac{4Q}{\pi d^2} \quad *A = \frac{\pi d^2}{4}$$

$$E = \frac{Q \times I \times k \times B}{\pi \times d}$$

Here, when I is assumed to be constant, E is proportional to Q. That is, induction voltage is proportional to average velocity \bar{V} .

Therefore, flowrate Q is calculated by the following formula.

$$Q = \frac{\pi}{4} \times \frac{E}{B} \times k \times d$$

Архангельск (8182)63-90-72
Астана +7(7172)727-132
Белгород (4722)40-23-64
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Казань (843)206-01-48

Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41

Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Новосибирск (383)227-86-73
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78

Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Тверь (4822)63-31-35
Томск (3822)98-41-53
Тула (4872)74-02-29
Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Уфа (347)229-48-12
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Ярославль (4852)69-52-93

[illegible]

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■ FLOW RANGE, NOMINAL SIZE SELECTION

Fluid velocity range can be selected freely between 0 to 0.5m/s and 0 to 10m/s on all nominal sizes. Select the nominal diameter that best fits your particular situation by referring to the fluid velocity, flowrate and nominal size selection nomograph. It is recommended that the meter be used at fluid velocities below 2.5m/s with abrasive slurries ; above 2.5m/s with fluids containing sediments.

● Flow range

Nom. Size (mm)	Min. Range (Max. flow velocity 0.5m/s)		Max. Range (Max. flow velocity 10m/s)	
	L/min	m ³ /h	L/min	m ³ /h
3	0 to 0.22	0 to 0.013	0 to 4.24	0 to 0.25
6	0 to 0.85	0 to 0.05	0 to 17	0 to 1
10	0 to 2.4	0 to 0.14	0 to 47	0 to 2.8
15	0 to 5.3	0 to 0.32	0 to 106	0 to 6.3
25	0 to 15	0 to 0.9	0 to 295	0 to 17.7
40	0 to 38	0 to 2.3	0 to 754	0 to 45.2
50	0 to 59	0 to 3.5	0 to 1178	0 to 70.6
80	0 to 150	0 to 9	0 to 3015	0 to 181
100	0 to 236	0 to 14	0 to 4710	0 to 283
150	0 to 533	0 to 32	0 to 10667	0 to 640

Note: Accuracy is different depending on Full scale velocity and Nominal bore size.

■ PULSE OUTPUT

Two kinds of pulse outputs are selectable with this flowmeter. Choose your flowmeter from the following to meet your requirement.

(1) Factored pulse output

Unitized pulse output is generated (IL/P, etc.)

● Pulse weight

The pulse weight of a factored pulse output can be set as required in the range of the following output frequencies.

Output frequency range: 0.01 to 10,000Hz

Example) Pulse weight settable at maximum flowrate of 360m³/h

Min.: 0.01L/P * Calculation formula: 100L/s (360m³/h) ÷ 10,000Hz = 0.01L/P

● Pulse width

The pulse width of a factored pulse output changes timely in accordance with the output frequency.

When pulse frequency > 1Hz: Pulse ON/OFF duty ratio 50 : 50

When pulse frequency ≤ 1Hz: Pulse ON width fixed at 500ms

(2) Frequency pulse output

Non-unitized pulse output whose output frequency varies linearly against the preset flow range is produced. (0.01389L/P, etc.)

Settable output upper limit frequency: 10,000Hz

Example) When set to maximum flowrate 500m³/h and upper limit frequency 10,000Hz

● Output frequency: 0m³/h (0%) : 0Hz

125m³/h (25%) : 2,500Hz

250m³/h (50%) : 5,000Hz

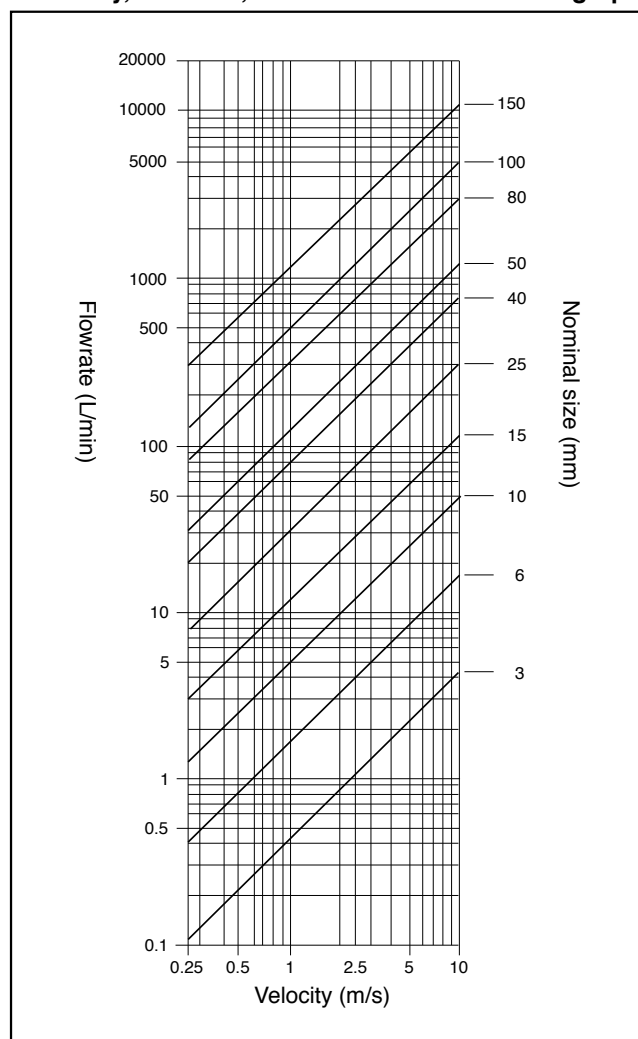
375m³/h (75%) : 7,500Hz

500m³/h (100%) : 10,000Hz

● Pulse weight: 0.01389 L/P * Calculation formula: 138.9L/s (500m³/h) ÷ 10,000Hz

(Frequency upper limit frequency) = 0.01389L/P

● Velocity, Flowrate, Nom. Size Selection Nomograph



■ INSTALLATION

1. Straight tube

At upstream of a meter, it is requested to install a straight tube longer than 5 times of the meter's nominal bore size. However the dimensions from meter inlet to outlet of 3 to 15mm are relatively long to their bore sizes, thus upstream straight tube is not needed.

2. Installation

A meter shall be installed so that the measuring chamber could be fulfilled enough with a liquid to be measured.

3. Installation positioning

Free positioning is acceptable. However, in case of horizontal piping, keep the electrode axis direction also to be horizontal in order to avoid accidental insulation due to passing of floating bubbles. In a vertical run, avoid physical orientation where cable entry points upward to prevent water from entering the transmitter. To prevent the state not completely filled with fluid, the flow direction from bottom to

top is recommended.

If the fluid contains suspended solids, a vertical run to minimize solids deposition and wear is recommended.

4. Grounding

The detector requires the earth connection higher than the 3rd class. (class C)

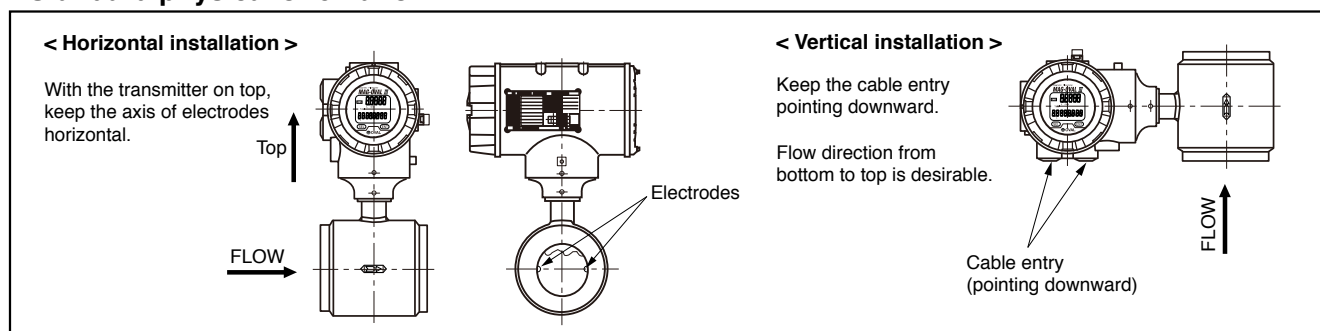
5. Bypass piping

It is recommended to provide a bypass piping for ease of maintenance for the meter in the main line.

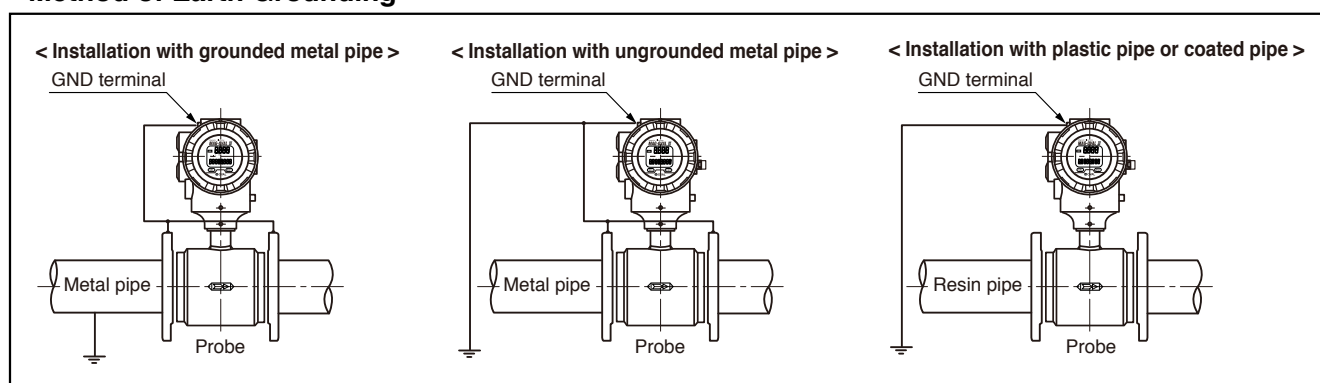
6. Avoid meter installation in those locations listed below

- Close to those electric instruments with strong current such as induction motors and transformers.
- Locations where difficult for maintenance work on the meter.
- Where temperature varies drastically and vibration could be generated.

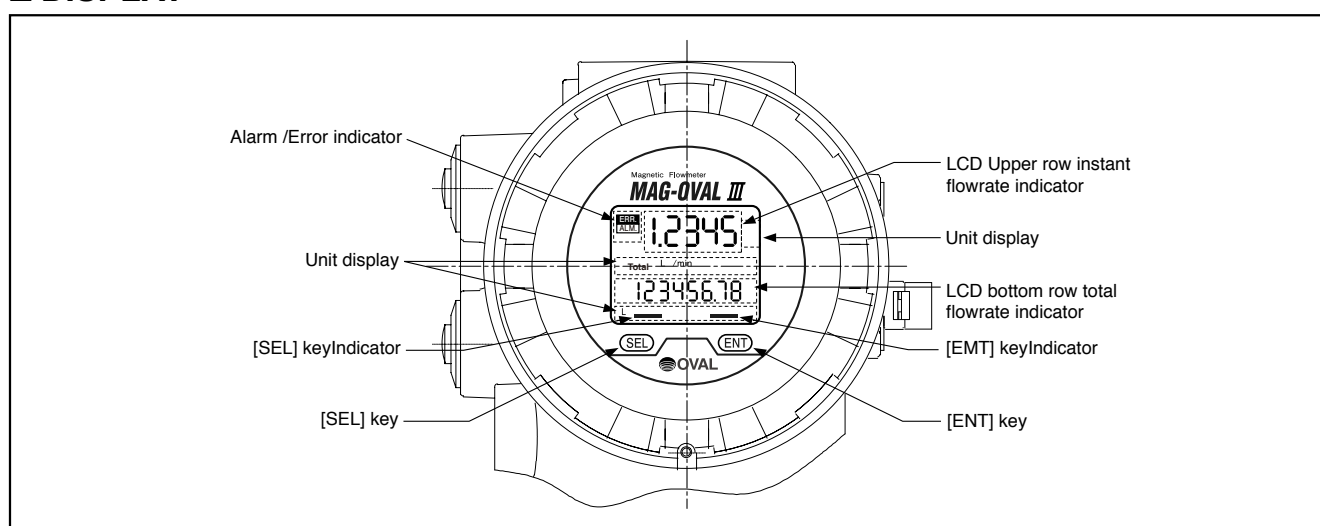
● Standard physical orientation



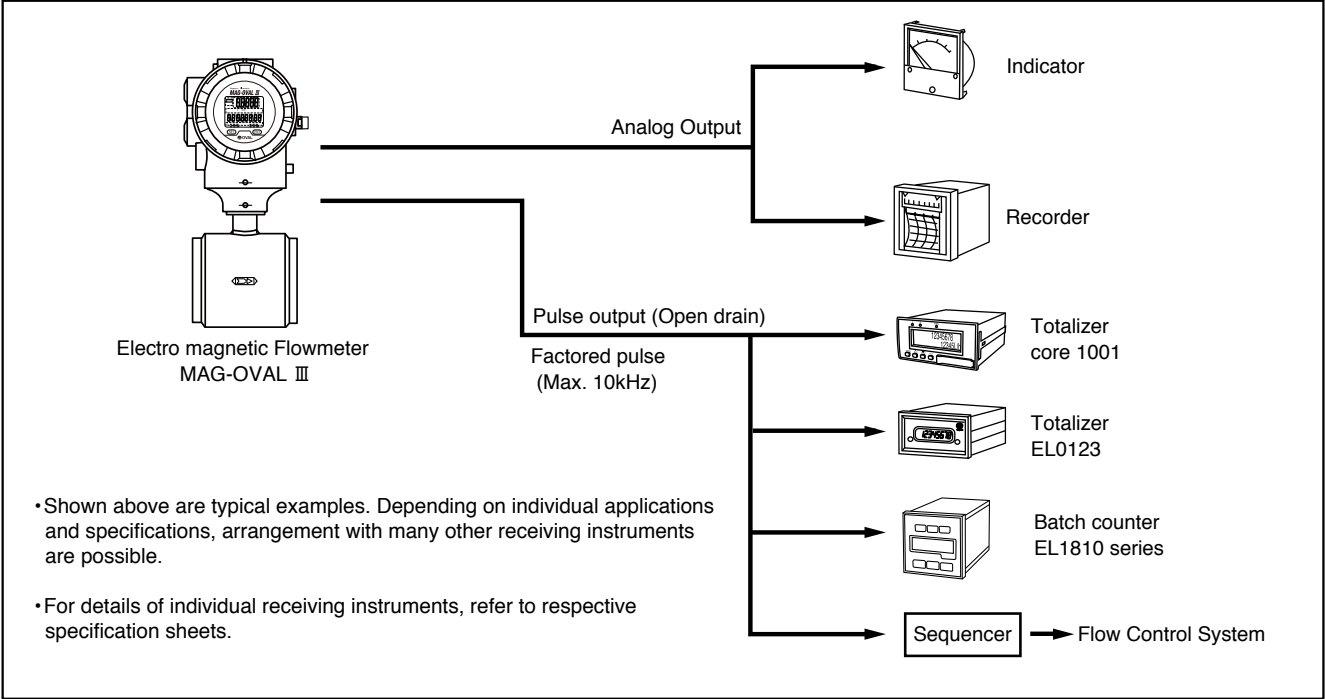
● Method of Earth Grounding



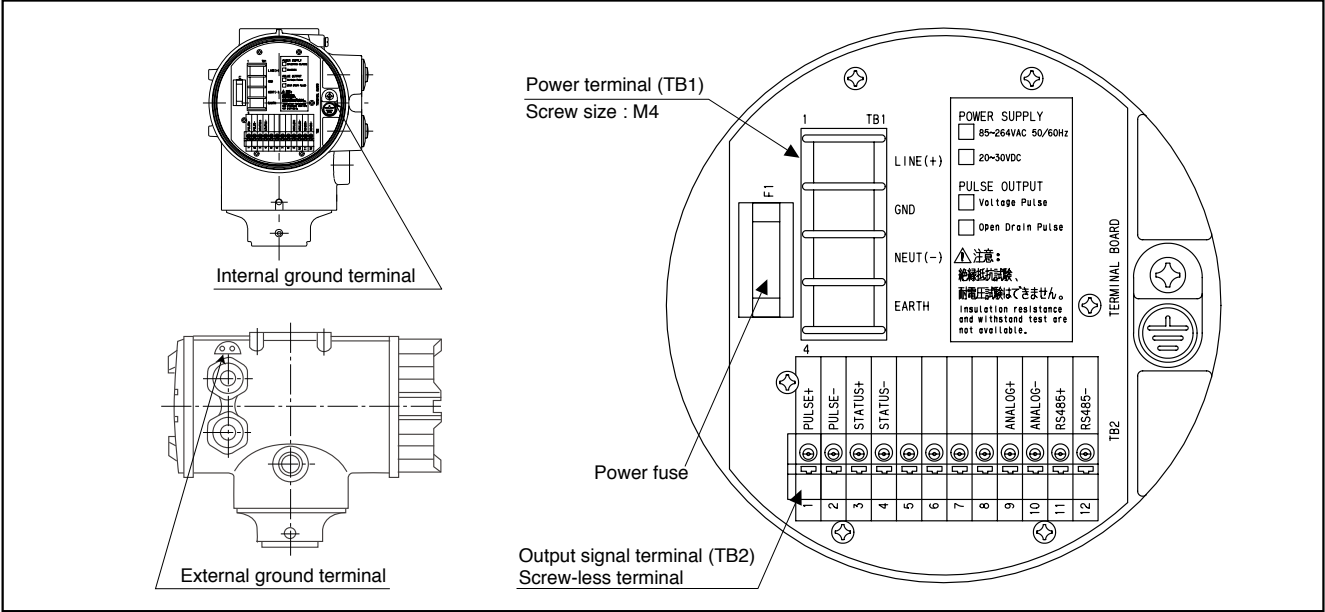
■ DISPLAY



RECEIVING INSTRUMENTS



TERMINAL CONNECTIONS

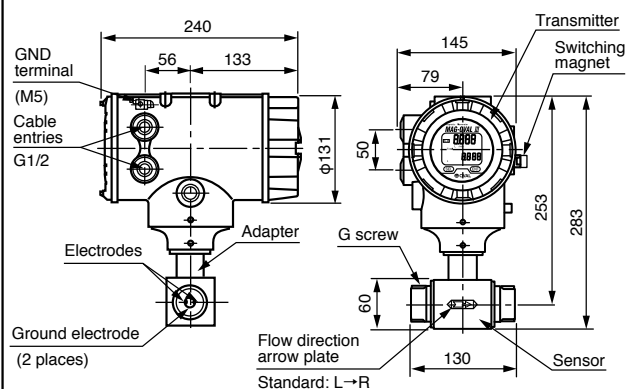


Item	Terminal No.	Label	Description
Output signal	TB2	1	PULSE +
		2	PULSE -
		3	STATUS +
		4	STATUS -
		5	Unused
		6	Unused
		7	Unused
		8	Unused
		9	ANALOG +
		10	ANALOG -
		11	RS485 +
		12	RS485 -
Power	TB1	1	LINE (+)
		2	GND
		3	NEUT (-)
		4	EARTH

Note: Ground terminal “EARTH” shall be used for grounding. (Ground terminal “EARTH” of this flowmeter is internally connected to “GND”).

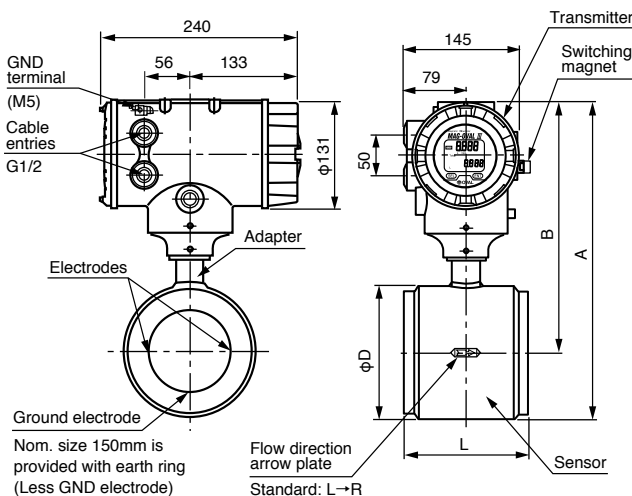
■ DIMENSIONS (Unit in mm)

● Nominal sizes 3 to 15mm (Screw type)



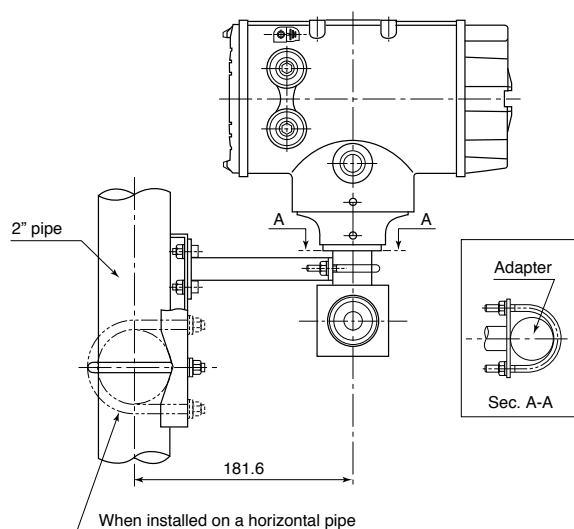
Nom. Size mm	Screw G	Weight kg
3	G1	5.7
6	G1	5.7
10	G1	5.7
15	G1 1/4	5.8

● Nominal sizes 25 to 150mm (Wafer type)

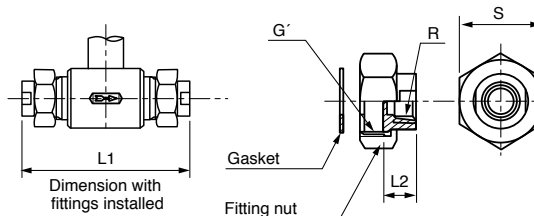


Nom. Size mm	L	A	B	φD	Weight kg
25	100	293	258	70	5.8
40	100	309	266	80	6.5
50	100	323	273	100	7.1
80	150	353	288	130	9.8
100	150	374	303.5	161	12.4
150	210	441	332	218	21.9

● Nominal sizes 3 to 6mm Transmitter hold-down hardware



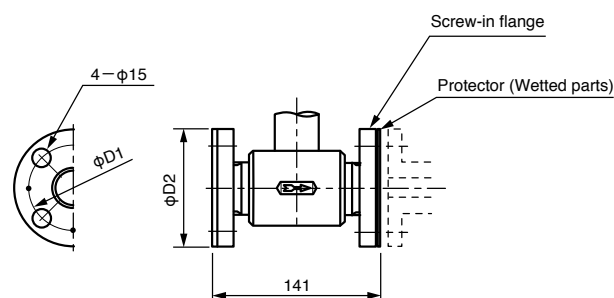
● Pipe union for nom. sizes 3 to 15mm piping (std. Accessory) Wetted parts : SUS316 (Standard)



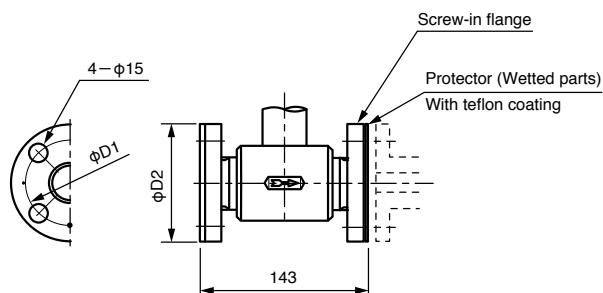
Nom. Size mm	L1	L2	S	G'	R
3, 6	172	20	41	G1	Rc 1/8
10					Rc 3/8
15			50	G1 1/4	Rc 1/2

● Screw-in flange for nom. sizes 3 to 15mm piping (Option)

Wetted parts : SUS316



Wetted part: Fluorine resin



Nom. Size mm	D1	L2	Remarks
3, 6	65	90	Nom. Size 10mm JIS 10K equivalent
10			Nom. Size 10mm JIS 10K equivalent
15	70	95	Nom. Size 10mm JIS 10K equivalent

■ PRODUCT CODE EXPLANATION

Item	Model															Description	Combination																
	①	②	③	④	—	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	—	⑬		⑭	⑮	Screw type 3 to 15A	Wafer type 25 to 100A	Wafer type 150A												
Type	M	G																Electro magnetic flowmeter MAG-OVAL Ⅲ	○	○	○												
Meter style			S															Screw type	○	×	×												
			W															Wafer type	×	○	○												
Construction			1	—														Integral with transmitter	○	○	○												
Nominal size						0	0	3										3mm	Screw type G1	○	×	×											
						0	0	6															6mm	○	×	×							
						0	1	0															10mm	○	×	×							
						0	1	5														15mm	crew type G1 1/4	○	×	×							
						0	2	5														25mm	Wafer type	×	○	×							
						0	4	0														40mm		×	○	×							
						0	5	0														50mm		×	○	×							
						0	8	0														80mm		×	○	×							
						1	0	0														100mm		×	○	×							
						1	5	0														150mm		×	×	○							
Connection (Pressure category)									0									MGS type always “0”	○	×	×												
									1															JIS 10K	×	○	○						
									2																JIS 20K	×	○	○					
									3																	JIS 30K	×	○	○				
									4																	ASME 150, JPI 150	×	○	○				
									5																	ASME 300, JPI 300	×	○	○				
									9																	Other than above	○	○	○				
Lining material									T								Teflon	○	○	○													
Electrode materials									1									SUS316L	○	○	○												
									2															Alloy C 276 (equiv. Hasteloy C)	○	○	○						
									5																Tantalum	○	○	○					
									7																	Platinum	○	○	○				
Power supply									6									20 to 30VDC	○	○	○												
									7															85 to 264VAC 50Hz	○	○	○						
									8																85 to 264VAC 60Hz	○	○	○					
Transmitter type												E	—					Always “E” (PA28)	○	○	○												
Ground electrode materials (Same as electrode material)														1								SUS316L	○	○	○ (*1)								
														2															Alloy C 276 (equiv. Hasteloy C)	○	○	×	
														5																Tantalum	○	○	×
														7																	Platinum	○	○
Additional specification (※2)														1						RS-485 communication	○	○	○										
Version														A								○	○	○									

(*1) For nominal size 150mm, earth ring (SUS316) is applied to the place that contacts a flange in place of earth electrode.

(*2) Special product applicable to Bell 202 communication. If desired, contact OVAL.

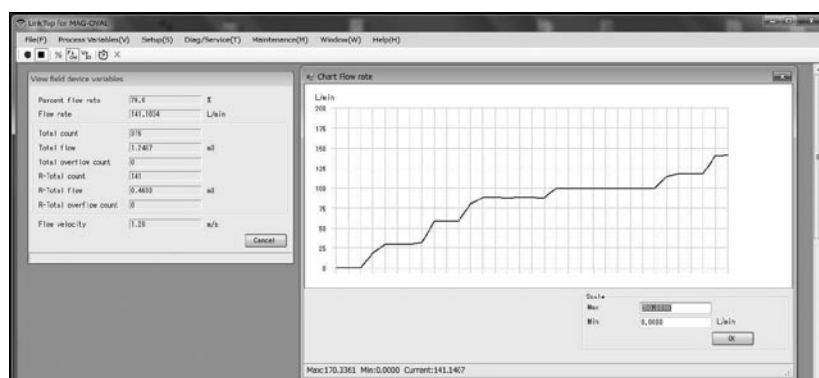
About Communication Software “LinkTop for MAG-OVAL”

■ GENERAL

Communication software for MAG-OVAL III, “LinkTop for MAG-OVAL”, used in combination with electromagnetic flowmeter MAG-OVAL III, provides functions such as monitoring the measured value, logging and saving in CSV format the instantaneous flowrate, changing and saving parameters on site and remotely.

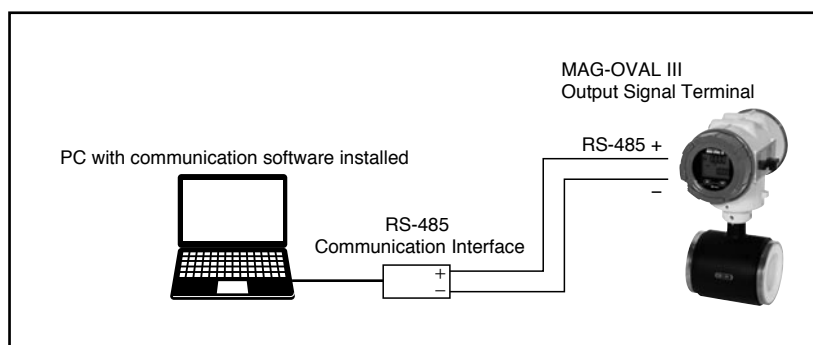
※ This software is available separately at your option.

(Example of screen display)



■ CONNECTION

(Connection with PC)



■ CONNECTION (Communication software “LinkTop for MAG-OVAL”)

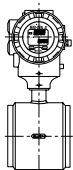
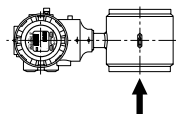
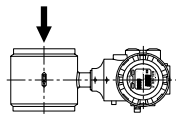
Item	Specifications		
Physical layer	RS-485 or Bell 202 (※2)		
Communication system	Master slave system		
Communication baud rate	<ul style="list-style-type: none"> In case of RS-485 communication : 9600, 19200, 38400 bps In case of Bell 202 : 1200 bps fixed 		
Operating environment	Supported OS	Memory (RAM)	Hard disk
	Windows XP, Windows Vista, Windows 7	256MB or more	Idle capacity of 10MB or more
Functions	<ul style="list-style-type: none"> Monitoring of measurement value (digital display, graphic display) Logging and saving instantaneous flowrate, % flow, and flow speed (Saving system: CSV file, Logging period: 0.2 second to 1 hour) (※3) Reading, changing set value, and saving parameters 		

(※1) RS-485 communication interface is not supplied. Prepare RS485-USB conversion adapter, etc. available commercially.

(※2) Bell 202 communication specification for MAG-OVAL III is supported specifically. If desired, contact OVAL.

(※3) In case of Bell 202 communication, communication baud rate is low. Therefore, the logging period will be 1s minimum.

■ PLEASE SUPPLY THE FOLLOWING INFORMATION WHEN YOU INQUIRE.

Item		Description																
1. Model		_____																
2. Applicable fluid	Liquid Name	_____																
	Flow Ranges	_____ to _____ <input type="checkbox"/> m ³ /h <input type="checkbox"/> L/min <input type="checkbox"/> Other _____																
	Conductivity	_____ to _____ μS/cm																
	Temperature Range	_____ to _____ °C																
	Pressure Range	_____ to _____ MPa																
	Slurry	<input type="checkbox"/> Abrasive <input type="checkbox"/> Adhesive <input type="checkbox"/> No slurry content																
3. Power Supply		<input type="checkbox"/> _____ VAC 50Hz <input type="checkbox"/> _____ VAC 60Hz <input type="checkbox"/> _____ VDC																
4. Full Scale flowrate		_____ <input type="checkbox"/> m ³ /h <input type="checkbox"/> L/min <input type="checkbox"/> Other _____																
5. Physical Orientation		<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <input type="checkbox"/> Horizontal (Left → Right) * Standard <input type="checkbox"/> Horizontal (Right → Left) </div> <div style="text-align: center;">  </div> <div style="text-align: center;"> <input type="checkbox"/> Vertical (Bottom → Top) </div> <div style="text-align: center;">  </div> <div style="text-align: center;"> <input type="checkbox"/> Vertical (Top → Bottom) (Selectable only for indoor use) </div> <div style="text-align: center;">  </div> </div>																
6. Material Specified		Electrode: (Ground Electrode) <input type="checkbox"/> SUS316L <input type="checkbox"/> Alloy C276 (Equiv. to Hasteloy C) <input type="checkbox"/> Tantalum <input type="checkbox"/> Platinum																
7. Pipe Fittings and Gaskets		• MGS Type <input type="checkbox"/> Union fitting (Std.) <input type="checkbox"/> Screw-in flange Connecting flange rating: _____ • MGW Type Connecting flange rating: _____																
8. Output signal		1) Analog output <input type="checkbox"/> 4 to 20mA * The flowrate at 20mA is equivalent to the flowrate you specified. 2) Pulse output (Select whichever) Signal type (*1): <input type="checkbox"/> Open drain pulse output (Standard) <input type="checkbox"/> Voltage pulse output <input type="checkbox"/> Factored pulse Pulse weight: _____ <input type="checkbox"/> m ³ /P <input type="checkbox"/> L/P <input type="checkbox"/> Other _____ <input type="checkbox"/> Frequency pulse Upper limit frequency: _____ Hz 3) Status output (Select whichever) Signal type: Open collector output Logic of status output signal (Select): <input type="checkbox"/> OFF active <input type="checkbox"/> ON active <input type="checkbox"/> Without assignment <input type="checkbox"/> Error / Alarm / Status output (When used, select any of the following. Multiple choices are permitted.) <table style="width: 100%; border: none;"> <tr> <td>• Overflow error (Flow exceeding range set value detected)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Hardware abnormal error (Hardware abnormality detected)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Parameter alarm (Abnormal setting detected)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Output saturation alarm (Output value outside setting range detected)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Measurement signal abnormal alarm (Noise superimpose on electrode detected)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Empty pipe detection alarm (Unwetted electrode detected)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Fixed output state (Output in simulating output operation)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> <tr> <td>• Self-diagnosis state (Output in self-diagnosis operation)</td><td><input type="checkbox"/> Used <input type="checkbox"/> Unused</td></tr> </table> <input type="checkbox"/> Upper and lower limit alarm output Upper limit alarm: _____ <input type="checkbox"/> m ³ /h <input type="checkbox"/> L/min <input type="checkbox"/> Other () Lower limit alarm: _____ <input type="checkbox"/> m ³ /h <input type="checkbox"/> L/min <input type="checkbox"/> Other () <input type="checkbox"/> Judgment of flow direction Logic is inverted at the reverse flow.	• Overflow error (Flow exceeding range set value detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Hardware abnormal error (Hardware abnormality detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Parameter alarm (Abnormal setting detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Output saturation alarm (Output value outside setting range detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Measurement signal abnormal alarm (Noise superimpose on electrode detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Empty pipe detection alarm (Unwetted electrode detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Fixed output state (Output in simulating output operation)	<input type="checkbox"/> Used <input type="checkbox"/> Unused	• Self-diagnosis state (Output in self-diagnosis operation)	<input type="checkbox"/> Used <input type="checkbox"/> Unused
• Overflow error (Flow exceeding range set value detected)	<input type="checkbox"/> Used <input type="checkbox"/> Unused																	
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• Fixed output state (Output in simulating output operation)	<input type="checkbox"/> Used <input type="checkbox"/> Unused																	
• Self-diagnosis state (Output in self-diagnosis operation)	<input type="checkbox"/> Used <input type="checkbox"/> Unused																	
9. Special Notes		_____																

*1: "Open drain pulse" is the standard signal setting. If voltage pulse is desired, please make sure to specify so in your inquiry.

■ PRODUCT CODE EXPLANATION (Communication software “LinkTop for MAG-OVAL”)

Item	Model												Description	
	①	②	③	④	⑤	⑥	—	⑦	⑧	⑨	⑩	⑪		⑫
Type	E	L	2	3	1	0	—							Smart communication unit
Power supply								0						Always “0”
Flowmeter applied									B					Electromagnetic flowmeter MAG-OVAL III
Language									J					Japanese (Conform to Japanese version OS)
									E					(Conform to English version OS)
Interface									0					No interface (Only with application software)
									1					With Bell 202-USB conversion interface (※)
Media (Application software)									1					CD-ROM
									9					Other than above
												0	Always “0”	

(*) Bell 202 communication specifications for MAG-OVAL III are supported specifically.

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 Ижевск (3412)26-03-58
 Казань (843)206-01-48

Калининград (4012)72-03-81
 Калуга (4842)92-23-67
 Кемерово (3842)65-04-62
 Киров (8332)68-02-04
 Краснодар (861)203-40-90
 Красноярск (391)204-63-61
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 Ставрополь (8652)20-65-13
 Тверь (4822)63-31-35
 Томск (3822)98-41-53
 Тула (4872)74-02-29
 Тюмень (3452)66-21-18
 Ульяновск (8422)24-23-59
 Уфа (347)229-48-12
 Челябинск (351)202-03-61
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