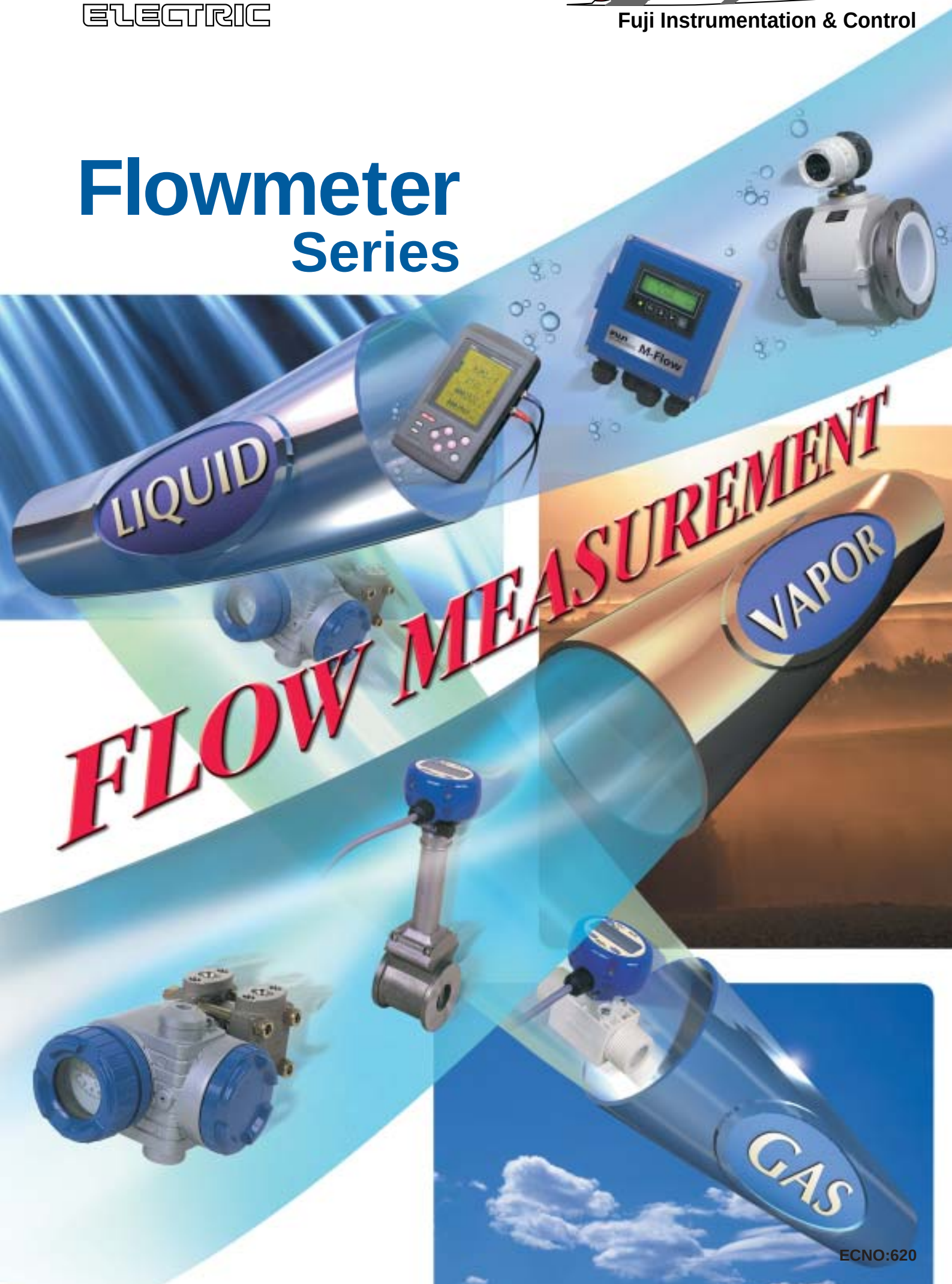
FUJI ELECTRIC

Fuji Instrumentation & Control

Flowmeter
Series



ECNO:620

Wide Selection of Flowmeter

PRODUCT'S CONCEPT

- **Suitable for versatile application among process automation and factory automation.**
- **Liquid, gas, and vapor can be measured.**
- **The most appropriate model for the fluid property can be selected.**

Liquid flow rate measurement

Electromagnetic flowmeter

Ultrasonic flowmeter

Vortex flowmeter

Differential pressure flowmeter

Gas flow rate measurement

Vortex flowmeter

Differential pressure flowmeter

Vapor flow rate measurement

Vortex flowmeter

Differential pressure flowmeter

Connected measuring instrument

Recorder (PHC)

Integrator (FDC-281)

Integrator (FDC-981)

Alarming indicator (PCP)

Distributor (PTL)

Controller (PDA)

Personal computer

Flowmeters with various measuring principle to meet your needs

Simply select to suit the application

			Ultrasonic	Electromagnetic	Differential pressure	Vortex
Object of measurement	Fluid		○	○	○	○
	Gas		×	×	○	○
	Vapor		×	×	○	○
	Slurry		×	○	×	×
Application	Control		○	○	○	○
	Monitor		○	○	○	○
	Supply		×	○	×	×
Operating condition	Temperature		–40 to 200℃	–20 to 120℃	–40 to 600℃	–10 to 200℃
	Pressure		——	–1 to 2MPa	–0.1 to 42MPa	max 5MPa
	Pressure loss		None	None	Large	Large
	Rangeability		Large	Large	Small	Medium
Installing condition	Bore		ϕ13 to ϕ6000	ϕ2.5 to ϕ300	ϕ25 to ϕ3000	ϕ4 to ϕ100
	Straight pipe length	Upstream side	10D	5D	10D	7D
		Downstream side	5D	2D	5D	3D
	Piping work		Not required	Required	Required	Required
	Explosion-proofing		×	×	○	×
Performance	Accuracy		±1% of rate	±0.5% of rate	±2.0% FS	1 to 3% of rate
	Velocity range		–32 to +32m/s (0.3m/s min.)	0 to 15m/s (0.1m/s min.)	——	0.3 to 4m/s

Note: Straight pipe length (D): Represents pipe bore.

Typical applications for flowmeter

Application	Measuring fluid	Oil	Ultra-demineralized water	Chemical	Warm cooling water	Pure water	Drainage	Sludge	Condensed sludge	High purity alcoho	Liquor	Milk / fruit juice	Soy sauce,dip	Air	Vapor
Chemical & petroleum chemical	Crude oil, refined oil, fertilizer, chemical	✔		✔											
Steel	Cooling water				✔										
Water treatment	Pure water, drainage, sludge, condensed sludge, chemical, air			✔		✔	✔	✔	✔					✔	
Semiconductor	Demineralized water, chemical, drainage		✔	✔			✔								
Food & beverage	Water, liquor, milk, fruit juice, sauce, etc.									✔	✔	✔	✔		✔
Pharmaceuticals	Chemical, water			✔		✔									
Building and regional heating / cooling	Chilled water, hot water				✔										
Energy conservation	Air, vapor, water				✔									✔	✔
Assembly plant	Air, vapor, water, oil, chemical	✔		✔	✔	✔								✔	✔
Molding plant	Cooling water				✔										

Applicable flowmeter

Fluid	Ultrasonic	Electromagnetic	Differential pressure	Vortex
Oil	○	×	◎	○
Ultra-demineralized water	◎	×	△	△
Chemical	◎	◎	○	○
Warm cooling water	◎	◎	○	◎
Pure water	◎	◎	○	○
Drainage	○	◎	△	△
Sludge	△	◎	△	△
Condensed sludge	×	○	×	×
High purity alcohol	◎	×	○	○
Liquor	○	○	○	○
Milk, fruit juice	○	○	○	△
Soy sauce, dip	○	○	○	○
Air	×	×	○	○
Vapor	×	×	◎	◎
Gas	×	×	◎	◎

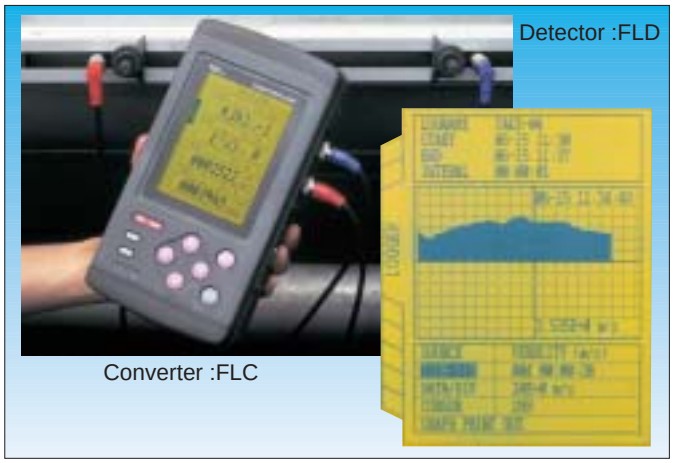
◎ : Optimum
○ : Suitable
△ : May be used (but conditional)
× : Should not be used

Ultrasonic Flowmeter series

Ultrasonic flowmeter for measuring flow rate from outside the pipe

PORTAFLOW-X, offering true mobility

Detector type:FLD Converter type:FLC



Features

- Portable, 1.5kg & 5hours operation
- Superior operability with large graphic display
- Dedicated carrying case for easy carriage
- 40,000 data logging function

Specifications

- Sensor types:
  FLD22: For ϕ13 to ϕ100mm /-40 to 100℃
  FLD12: For ϕ50 to ϕ400mm /-40 to 100℃
  FLD51: For ϕ200 to ϕ6000mm /-40 to 80℃
  FLD32: For ϕ50 to ϕ400mm /-40 to 200℃
- Measurement range: -32 to 0 to 32 m/s (0.3m/s min.)
- Response time: 1s or less
- Output signal: 4 to 20mA DC
- Communication interface: RS 232C
- Accuracy: 1% of rate
- Power supply voltage: 100 to 240V AC, built-in battery
- Printer: Option

Compact M-Flow

Detector type: FLS Converter type: FLR

Features

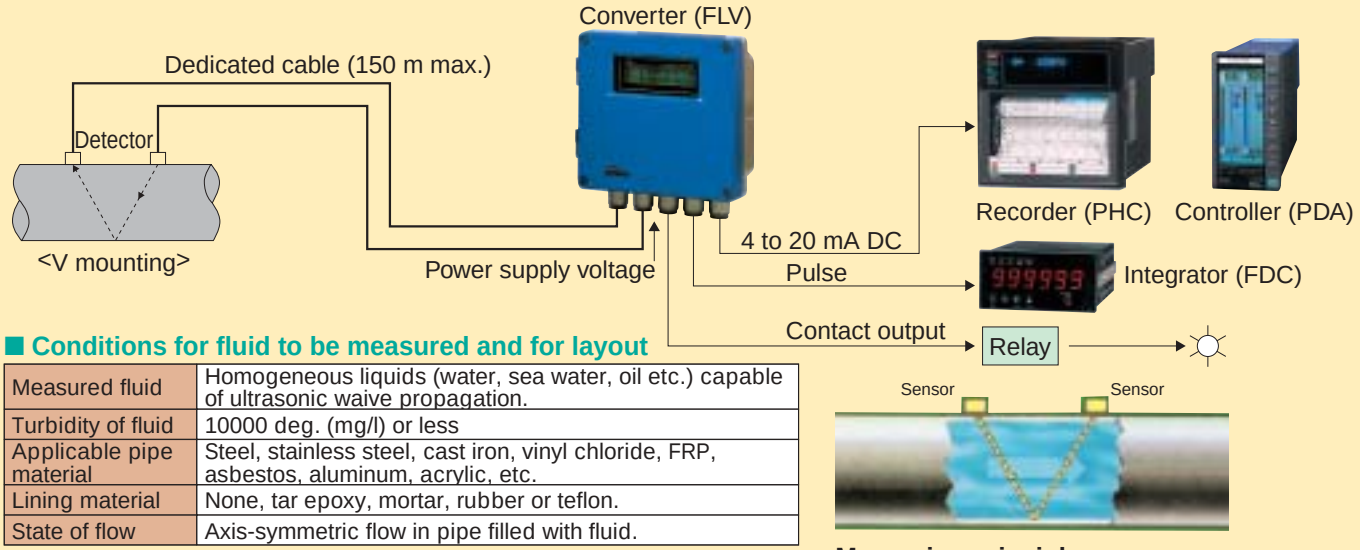
- Small converter, front face of 140×130 mm
- High speed response in 0.2 second
- Almost unaffected by fluid temperature or pressure variations

Specifications

- Sensor types:
  FLSS12: For ϕ25 to ϕ100mm /-20 to 100℃
  FLSS22: For ϕ50 to ϕ225mm /-20 to 100℃
- Measurement range: -10 to 0 to 10 m/s (0.3m/s min.)
- Response time: 0.2s
- Output signal: 4 to 20mA DC, pulse output, alarm output
- Communication interface: RS485 or RS232C
- Accuracy: 2% of rate
- Structure: Both of converter and detector are of IP65 waterproof structure
- Power supply voltage: 100 to 120V AC, 200 to 240V AC or 20 to 30V DC
- Cable length between detector and converter: 30 m max

No troublesome piping work!

Typical system configuration



■ Conditions for fluid to be measured and for layout

Measured fluid	Homogeneous liquids (water, sea water, oil etc.) capable of ultrasonic waive propagation.
Turbidity of fluid	10000 deg. (mg/l) or less
Applicable pipe material	Steel, stainless steel, cast iron, vinyl chloride, FRP, asbestos, aluminum, acrylic, etc.
Lining material	None, tar epoxy, mortar, rubber or teflon.
State of flow	Axis-symmetric flow in pipe filled with fluid.

■ Conditions for measured fluid and layout

(Note) D: pipe diameter

- A straight pipe section of 10D or larger is required on the upstream side and straight pipe section of 5D or larger on the downstream side.
- There must be no pump, valve or the like that disturbs the flow within 30D on the upstream side.
- The pipe interior must be filled with liquid without bubbles or foreign materials.

Measuring principle

All Fuji's Ultrasonic flowmeters measure flow rate by utilizing the Transit-Time Difference Principle.
Simply, two ultrasonic sensors are mounted on the pipe exterior.
Each transmits an ultrasonic pulse to the opposite sensor.
The difference in the transit times of the two waves is used to calculate the flow velocity.

TIME DELTA-S for general use

Detector type: FLW, D Converter type: FLV

Features

- ■ Resistant to bubbles in the liquid
- ■ Accurate measurement: 1.0% of rate
- ■ Various sensors available according to usage
- ■ Almost unaffected by fluid temperature or pressure variations

Specifications

- Sensor types:
  FLD22: For ϕ13 to ϕ100mm /-40 to 100℃
  FLW12: For ϕ50 to ϕ400mm /-40 to 80℃
  FLW51: For ϕ200 to ϕ6000mm /-40 to 80℃
  FLD32: For ϕ50 to ϕ400mm /-40 to 200℃
- Measurement range: -32 to 0 to 32 m/s (0.3m/s min.)
- Response time: 0.5s or less
- Output signal: 4 to 20mA DC, pulse output, alarm output
- Accuracy: 1.0% of rate
- Structure: Converter is of IP65 waterproof structure
- Power supply voltage: 100 to 240V AC
- Cable length between detector and converter: 150 m max

TIME DELTA-F, high-functionality type

Detector type: FLW, Converter type: FLH

Features

- ■ Resistant to bubbles in the liquid
- ■ Simultaneous measurement of two lines or pipes
- ■ Accurate measurement: 1.0% of rate
- ■ Almost unaffected by fluid temperature or pressure variations

Specifications

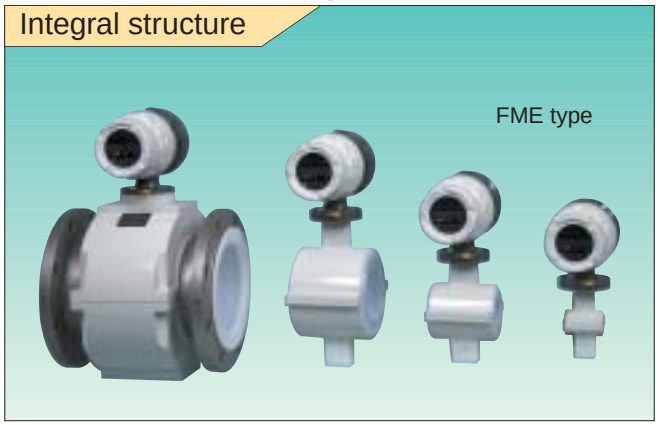
- Sensor types:
  FLW12: For ϕ50 to ϕ400mm /-40 to 80℃
  FLW51: For ϕ200 to ϕ6000mm /-40 to 80℃
  FLD32: For ϕ50 to ϕ400mm /-40 to 200℃
- Measurement range: -32 to 0 to 32 m/s (0.3m/s min.)
- Response time: 1.5s or less
- Output signal: 4 to 20mA DC, pulse output, alarm output, BCD output
- Communication interface: RS485 or RS232C
- Accuracy: 1.0% of rate
- Power supply voltage: 100 to 120V AC or 200 to 240V AC
- Cable length between detector and converter: 150 m max

Electromagnetic flowmeter series

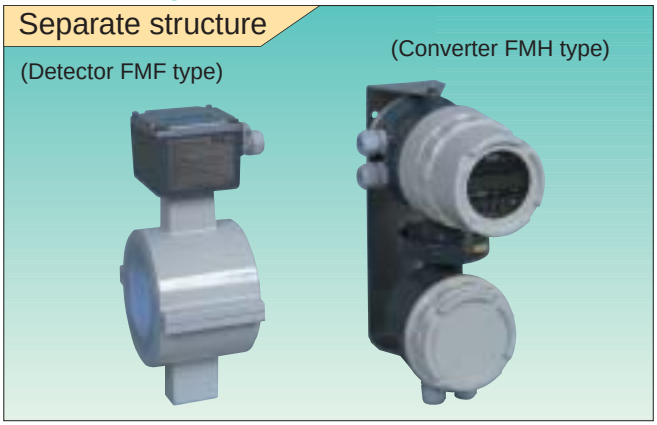
Electromagnetic flowmeters for measuring flow rate of conductive liquids with accuracy

E series electromagnetic flowmeters optimum for general industrial water

Integral structure



Separate structure



Features

- No grounding ring needed, due to built-in grounding electrode of Hastelloy C material.
- Various parameter settings can be changed with a magnet switch from outside of the case cover.
- The direction of the display with backlight can be changed for easy observation.
- Quick delivery thanks to stock system.

Specifications

Measurement item		General-use industrial water and others.
Configuration		Detector/converter integral type or separate type
Bore diameter		Wafer type Flange type
Fluid pressure		0 to 200kPa (flange working pressure in case of flange type)
Fluid temperature		-25 to 130℃
Measurement range		Flow rate that corresponds to flow velocity FS 0.5 to 10 m/s
Material	Lining	Teflon
	Earth electrode Signal electrode	Hasteroy C
	Earth ring	Option (Hasteroy C)
Output signal		4 to 20mA DC, integrated pulse, alarm output
Indicator		LCD of 2-stage/ Air, vapor, water display with back light (upper stage: Momentary flow rate value, lower stage: integrated flow rate value)
Function		Zero adjustment, integration constant setup, low cut point setup, damping adjustment, flow switch, etc.
Accuracy		0.6% of rate
Power supply voltage		100 to 230V AC 50/60Hz
Protection class		IP67 waterproof structure
Exclusive signal cable		Required in case of separate structure (50 m max.)

■ Wide range of menu options according to usage

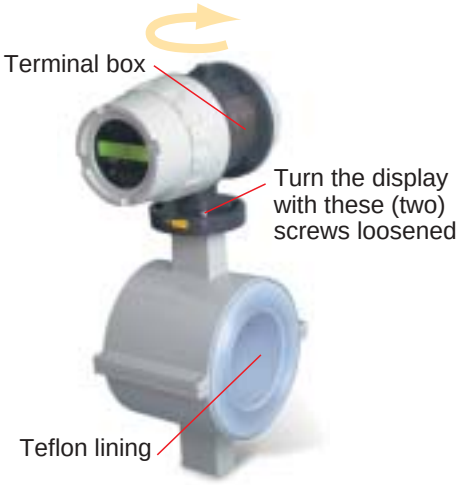
- Separate structure, and integral structure combining detector and converter
- Wafer type (opposed flange clipping type) and flange type
- Bores of 3mm - 300mm supported

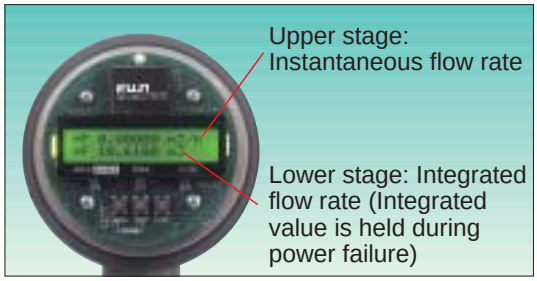
Note: ●: In stock
○: Produced to order
✻: Cannot be produced

	Bore	3mm	6mm	15mm	25mm	40mm	50mm	80mm	100mm	150mm	200mm	250mm	300mm
Integral structure	Wafer type	○	○	●	●	●	●	●	●	✻	✻	✻	✻
	Flange type	✻	✻	○	○	○	○	○	○	●	●	○	○
Separate structure	Wafer type	○	○	●	●	●	●	●	●	✻	✻	✻	✻
	Flange type	✻	✻	○	○	○	○	○	○	●	●	○	○

■ The display can be turned for easy observation.

Can be turned up to 90 degrees.





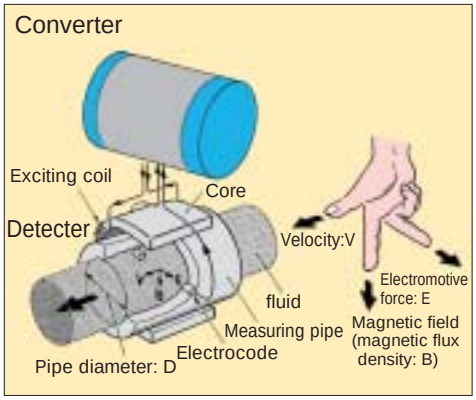
■ Simultaneous display of Instantaneous flow rate and integrated flow rate

LCD dual-stage display with backlight for observation even in the dark

■ Various parameter settings can be changed from outside of the case cover.

The settings can be changed simply by using the provided magnet stick outside the glass face, without opening the case cover.

Measuring principle



Faraday's law of electromagnetic induction, "When a conductor moves in a magnetic field, an electromotive force is generated in the conductor in a direction that is perpendicular to both the magnetic field and moving direction, and its magnitude is proportional to the density and speed of the magnetic flux density".

Material grade

Typical recommended material grades of components that come in contact with typical fluids measured with electromagnetic flowmeters are shown, based on various references and results of use.

■ Feature of lining material grade

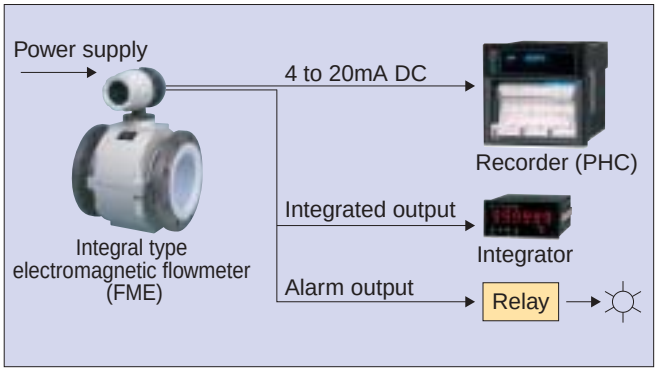
Material grade	Wear resistance	Heat resistance	Corrosion resistance	Adhesion resistance	Remarks
Teflon	×	◎	◎	◎	Optimum for corrosive and adhesive fluid. Not good for wearing fluid (such as slurry).

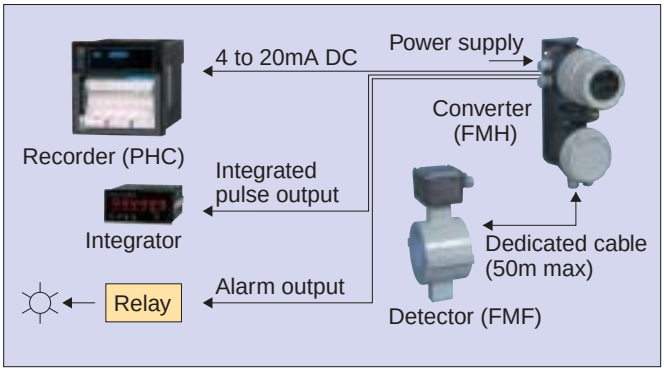
(◎: Particularly superior, ×: Inferior)

■ Features of electrode material grade

Material grade	Recommended use
Hastelloy C	Suitable for medium-degree oxidizability and reducibility, and the working range is broad. But should not be used for chlorides or strong acid.

Typical System configuration





Vortex flowmeter series

Vortex flowmeters for measurement of liquids, gases and vapors

Eggs DELTA Pulse

DELTA FLOWPET

Eggs DELTA

DELTA FLOWPET - A compact and robust body made of stainless steel

Type: FMR

The display can be turned for easy observation.

Features

- Measurement of flow rate of gases, liquids and vapors
- Range of bores, from 10 mm to 100 mm
- Ideal for high-temperature measurement up to 200℃
- 8-digit actual scale display optimum for integrated display

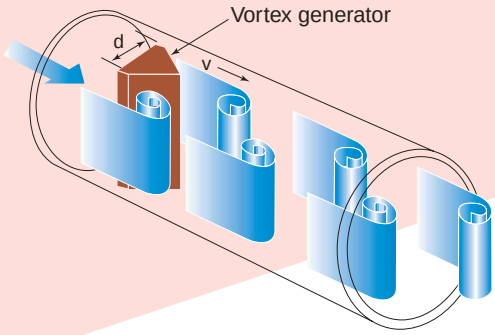
Specifications

Nominal diameter	10, 15, 25, 40, 50, 80, 100mm
Piping connection	Flange clipping type
Applicable fluid	Liquid up to 80℃ Gas up to 80℃ High temperature gas and saturated vapor up to 200℃ High temperature liquid up to 200℃
Flow rate range	(see table below)
Accuracy	±1% of full scale (±2% of full scale in case of nominal diameter 10 mm)
Material	SCS14A
Output signal	4 to 20mA DC or scaled unscaled pulse output. Alarm output (H, L) may also be issued.
Display function	Selective display out of cumulative integration, instantaneous flow rate (every hour), instantaneous flow rate (every minute) and reset integration. Alarm display (H, L).
Power supply voltage	Local display only: Built-in lithium battery unit With output signal: 12 to 45V DC (analog output: 2-wire system, pulse output: 3-wire system, Pulse/alarm output: 5-wire system), provided with 1 m cable

Nominal diameter (mm)	For water (20℃) <Unit: m³/h>		For compressed air (20℃) <When pressure is 0.7 MPa> <Unit: m³/h>		For saturated vapor <When pressure is 0.7 MPa> <Unit: kg/h>	
	Min.	Max.	Min.	Max.	Min.	Max.
10	0.2	2.2	9.4	61	7.0	34
15	0.3	4.7	20	129	15	72
25	0.7	16	49	434	37	246
40	1.2	31	81	864	61	491
50	2.0	53	133	1440	99	816
80	4.6	118	291	5360	217	3030
100	11	205	499	9280	372	5250

Perfect for measuring terminal flow rate of cooling water process and works air

Measuring principle

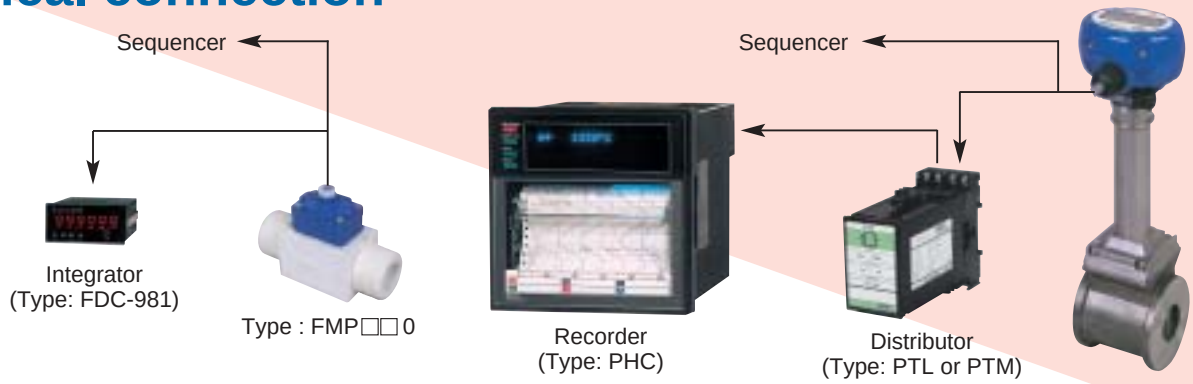


A regular stream of vortexes is generated alternately on the right-hand side and left-hand side under certain conditions downstream of an object located in a flow. These vortexes are called Karman vortexes. Letting the number of vortexes (vortex frequency) generated per unit time be f, the flow velocity in the aperture portion be v, and the width of the object (vortex generator) be d, then the following relation holds:

$f = st \cdot v/d$

where st is a proportional constant called Strouhal number. The Strouhal number is a function of the shape of the vortex generator, and it is a fixed value of about 0.16 over a broad range of Reynolds number. Since the vortex frequency is proportional to the flow velocity in the range in which the Strouhal number is a fixed value, the flow velocity can be deduced by counting this vortex frequency, and the flow rate can be calculated as the area through which the fluid passes is known.

Typical connection



Eggs DELTA - Lightweight and compact
Type: FMP□□1

Features

- Weighs just 285 g (for nominal diameter of 4 mm).
- Compact size of 65×102×83 mm (for nominal diameter of 4 mm)
- 8-digit actual scale display, perfect for display of integrated value
- Battery driven, ideal for display only

Eggs DELTA Pulse
Lightweight and compact
Type: FMP□□0

Features

- For measurement of liquids and gases
- Weighs just 270g (for nominal diameter of 4 mm)
- Compact size of 36×68×80 mm (for nominal diameter of 4 mm)
- Cheaper version of pulse output dedicated model

Specifications

	Eggs DELTA	Eggs DELTA Pulse
Nominal diameter, material	4, 8, 15, 25mm, PPS resin	
Piping connection	Screw-in type (female thread or male thread)	
Applicable fluid	Liquid up to 80℃: Water, alcohol, various aqueous solution, etc. Gas up to 60℃: Air, nitrogen, oxygen, argon, etc.	
Flow rate range	Nominal diameter (mm) / For liquid / For Air 4 / 0.4 to 4L /min / 7.2 to 17L /min 8 / 1.1 to 15L /min / 18 to 90L /min 15 / 2.8 to 45L /min / 55 to 283L /min 25 / 8.3 to 133L /min / 167 to 850L /min	
Accuracy	±3% of full scale	
Output signal	4 to 20mA DC or scaled/unscaled pulse output. Alarm output (H, L) may also be issued.	Unscaled pulse output (open collector)
Display function	Selective display out of cumulative integration, instantaneous flow rate (every hour), instantaneous flow rate (every minute) and reset integration. Alarm display (H, L).	None
Power supply voltage	Local display only: Built-in lithium battery unit With output signal: 12 to 45V DC (analog output: 2-wire system, pulse output: 3-wire system, Pulse/alarm output: 5-wire system), provided with 1 m cable	12 to 24 V DC (pulse output 3-wire system) with 1 m cable

Differential pressure flowmeter series

Differential pressure flowmeters for a broad range of applications

Differential pressure (flow rate) transmitter
<Model: FKC>

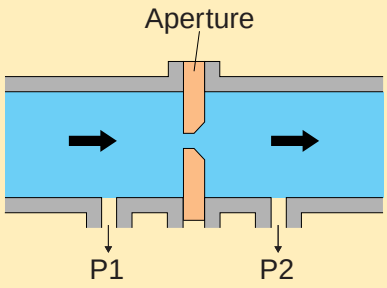
Remote seal type differential pressure (flow rate) transmitter
<Model: FKD, FKX>

Differential pressure (flow rate) transmitter of sanitary specification
<Model: FKD>

Features

- Measurement of flow rate of gases, liquids and vapors
- FCX-AII series capacitance-type transmitter of high accuracy (0.1%) and high reliability
- Pressure diaphragm available in various material grades to suit the application
- Fluid aperture mechanism available in wide range of types and material grades

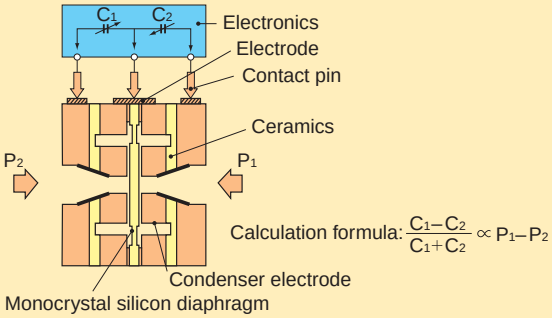
Measuring principle



Q: $K \times \sqrt{P1-P2}$ P1-P2: Differential pressure
Q: Flow rate K: Constant

An aperture is located along the pipeline, the differential pressure produced before and after it is detected, and hence the flow rate is calculated.

<Principle of sensor of differential pressure (flow rate) transmitter>

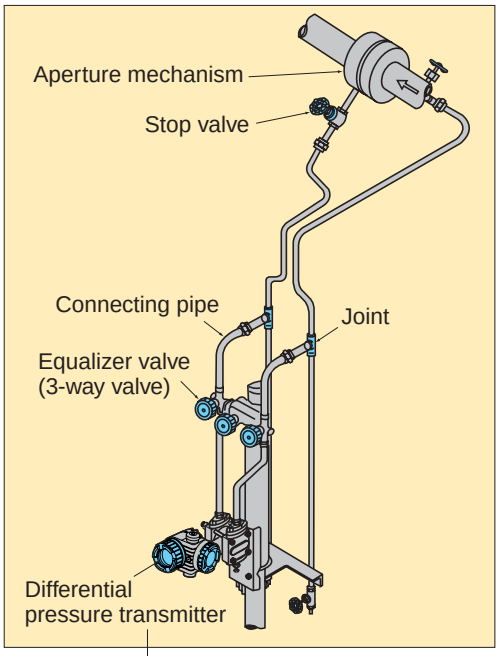


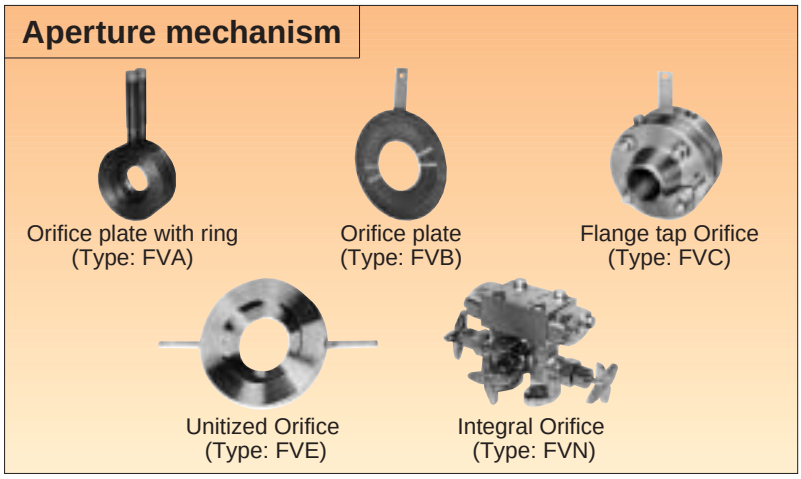
The silicon diaphragm is displaced when pressure is applied from P1 and P2, and the capacitance between the condenser electrode and the silicon diaphragm changes. This change in capacitance is proportional to the differential pressure.

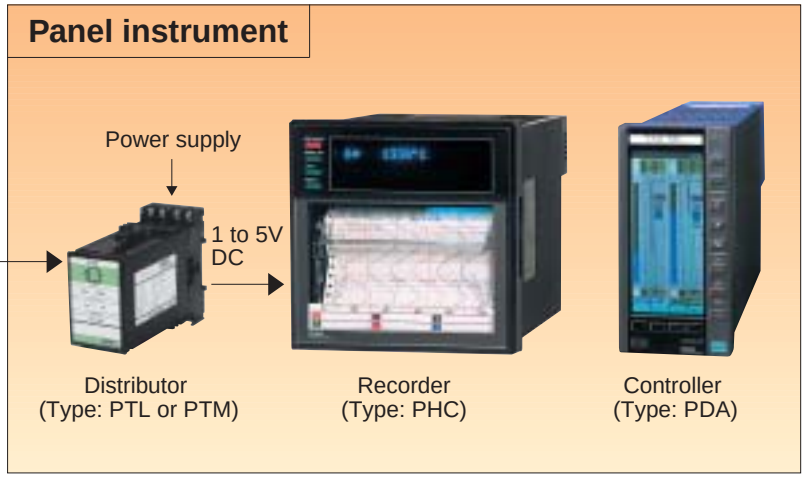
Specifications

Type	Differential pressure (flow rate) gauge <Model: FKC>	Remote seal type differential pressure (flow rate) gauge <Model: FKD, FKX>
Measuring span	1 kPa min., 3,000 kPa max.	32 kPa min., 500 kPa max.
Used pressure	3.2……42MPa	Within flange rating
Accuracy	0.1%	0.2%
Diaphragm material grade	SUS316L, Hastelloy C, Monel, tantalum, gold plated SUS316L, gold, ceramic coating	SUS316L, Hastelloy C, Monel, tantalum, titanium, zirconium, gold plated SUS316L
Process connecting port	Rc1/4 or 1/4-18NPT	Flange (IDF standard for sanitary specification)
Measuring period	120ms (High speed response is also possible (optional 40msec.))	
Working transmission range	-40 to 120℃ (sensing part), -40 to 85℃ (converting part)	
Output signal	4 to 20mA (2-wire system) / Load resistance 600Ω max.	
Power supply voltage	10.5 to 45V DC	
Communication function	HART protocol / Fuji protocol	
Structure	IP67 waterproof structure	
Explosion-proof specification	ATEX, FM, CSA, RIIS, JIS	

System configuration







4 to 20mA DC (2-wire system)

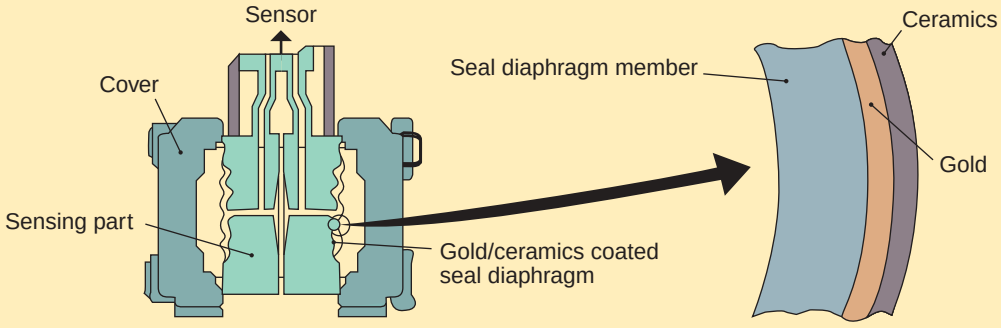
Hand-held communicator
(HHC)

■ Material grade of the pressure diaphragm can be selected to suit the application.

SUS316L (standard), Hastelloy C, Monel, tantalum, titanium, zirconium and Hydro-seal (gold and ceramics coating or gold-plated SUS316L) are available.

Note: Hydro-seal: If hydrogen is contained in the fluid to be measured, hydrogen gas enters the sensing part of the transmitter and may cause deformation of the seal diaphragm and malfunctions such as zero drift. Therefore, the sensing part that is in contact with the fluid is coated with gold and ceramics, thus preventing the transmission of hydrogen more than 100 times better than conventional materials (comparison with our conventional product). (It is superior to gold plating.)

■ Hydrogen transmission treatment



Typical application

Pressure diaphragm material grade	Use	Immeasurable fluid
SUS316L	Tap water, sewage, weak alkali	Inorganic acid, organic acid, chlorides, etc.
Monel	Alkali, hydrofluoric acid	Sulfuric acid, ferric chloride, aqua regia, etc.
Tantalum	Strong sulfuric acid, sulfuric acid, nitric acid, aqua regia	Alkali, fluorides, smoke emitting sulfuric acid, etc.
Hastelloy C	Various organic acids, inorganic acid, alkali	Chlorides, sulfuric acid, valve waste liquid, etc.
Zirconium	Hydrochloric acid, sulfuric acid, caustic soda, bleaching agent	hydrogen fluoride, ferric chloride, etc.
Titanium	Chlorides, sulfides, sulfuric acid compound	Hydrochloric acid, sulfuric acid, nitric acid, etc.
Gold/ceramics coating or gold plates SUS316L	Hydrogen or hydrogen chloride generation plant or measuring environment that permits easy generation of hydrogen in the measuring fluid	

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