FUJI ELECTRIC

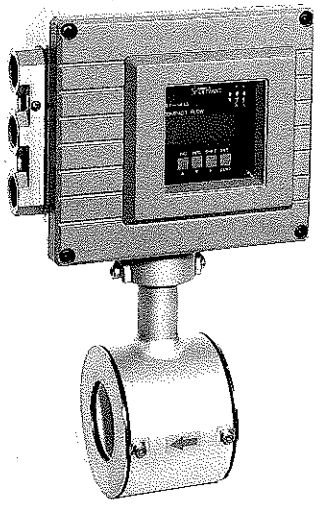
COMPACT ELECTROMAGNETIC FLOWMETER (COMPACT FLOW)

DATA SHEET

FMQ

The electromagnetic flowmeter is an instrument to measure the volumetric flow rate of liquid simply by applying a magnetic field from the outside utilizing the fact that an electric conductor which crosses a magnetic field at a certain velocity causes voltage to be induced in proportion to the velocity, which is known as Faraday's law.

Using the latest electronics technologies, this flowmeter is a compact and lightweight device in which the detector and converter are combined. It is completely different in image from conventional electromagnetic flowmeters. The flowmeter has its own built-in microcomputer to provide self-diagnosis and communication functions as well as easy handling and a high cost-performance.



FEATURES

1. **Compact wafer-type flowmeter in which detector and converter are combined**
   The compact and lightweight design allows the piping work to be accomplished with the ease of installing an orifice and permits easy centering of pipe.
2. **Easy external wiring**
   Special cables are not required for the wiring. The flowmeter can be wired almost in the same way as pressure or differential pressure transmitters.
3. **Simple adjustment**
   Measuring range, etc. can easily be changed by manipulating key switches. Zero point is automatically calibrated at the push of a switch without opening the cover.
4. **High reliabilty**
   The use of a ceramic measuring tube provides an excellent resistance to chemicals and to wear. Teflon lining type is also lined up for fluids which tend to be contaminated with condensed sludge, CWM, mortar, etc.
5. **Communication function**
   The addition of a communication module makes the flowmeter a "smart" type. By using a hand-held communicator, indication and setting can be achieved via remote operation.
6. **Operable on power source ranging from 90 to 264V AC**
   The flowmeter operates on either 100V or 200V AC, 50 or 60Hz, power system.
7. **Variable display direction**
   The direction of the converter case can be changed in 90° steps, while the mounting position of the display unit can also be changed in 90° steps.

SPECIFICATIONS

Measured fluid: Industrial water, service water, drainage, sludge, chemical liquid, slurry and other liquids with conductivity of more than 5μS/cm

Meter size and measuring range:

Measuring range (Flow velocity: Full scale set value) corresponds to fluid velocity of 0.3 to 10 m/s.

Meter size	Min. measuring range [m^3/h]	Max. measuring range [m^3/h]
2.5A	0 to 0.054	0 to 0.176
6A	0 to 0.031	0 to 1.01
15A	0 to 0.2	0 to 6.36
25A	0 to 0.54	0 to 17.6
40A	0 to 1.36	0 to 45.2
50A	0 to 2.13	0 to 70.6
80A	0 to 5.43	0 to 180
100A	0 to 8.49	0 to 282
150A	0 to 19.1	0 to 636
200A	0 to 34.0	0 to 1130

Process fluid pressure range:

– 100 to 4000 kPa { – 1 to 40 kgf/cm^2 }
. . . meter size 2.5A to 80A
– 100 to 2000 kPa { – 1 to 20 kgf/cm^2 }
. . . meter size 100A, 150A
– 100 to 1000 kPa { – 1 to 10 kgf/cm^2 }
. . . meter size 200A

Process fluid temperature range:
−10 to 120°C (see Fig. 1)

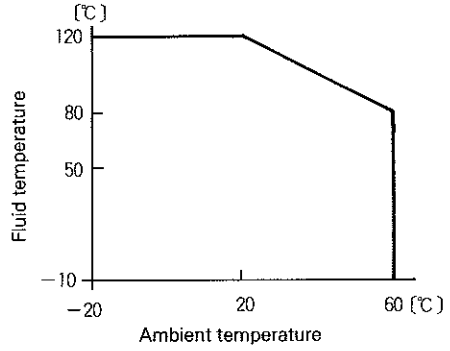


Fig. 1 Ambient temperature vs. allowable fluid temperature

Input/output signal:
Current output; 4 to 20mA DC (load resistance 0 to 600Ω)
Pulse output; open collector (capacity 30V DC, 0.2A)
Status output; open collector (capacity 30V DC, 0.2A)
Status input; no-voltage contact
Note: Either one of input and output is selectable for status signal.

Pulse output: Integral pulse output by setting of pulse factor, pulse width 30 or 100 msec

Communication signal (option):
"Smart" communication signal (superposed on 4 to 20mA DC)
Load resistance; 250 to 600Ω
Load capacity; 0.22μF or less
Load inductance; 3.3mH or less
Spacing from power cables; 15cm or more

Span setting function:
Volumetric flow rate settable according to settings of flow rate unit, flow rate value and meter size (flow velocity also settable)
Flow rate, flow velocity unit; m^3/h, ℓ/h, m/s
Detector meter size; mm

Multi-range function:
Automatic 2-range changeover via 2-range changeover mode, or 2-range changeover by status input (in case of normal/reverse range, normal flow range should be equal to or more than reverse flow range)

Reverse flow measuring function:
Reverse flow selectable via flow direction mode

Flow rate indication:
Actual flow rate or % indication possible

Integral indication:
Integrated volumetric flow indicated by setting of integration factor

Fault diagnosis function:
Diagnosis and indication of converter fault, process fault (overflow, underflow), etc.

Zero adjust function:
Zero point automatically calibrated by a push of ZERO switch (inside or outside converter)

Zero adjust preventing function:
Zero adjust function can be invalidated

Output low cutoff function: (0.0 to 10.0% full scale)
By setting a cutoff point, indication and output can be locked at zero when flow rate is low.

Integral low cutoff function: (0.0 to 10.0% full scale)
Flow rate signal below the set cutoff point will not be integrated.

0% signal lock function:
Indication and output are locked at zero by means of status input.

Flow noise cutoff function: (0.0 to 10.0% full scale, 0 to 60 sec)
Flow noise (spike noise) can be cut off by rate limit setting.

Empty detecting function:
Lack of fluid is detected and an alarm is output.

Flow switch function: (−110 to 110% full scale)
By setting a lower flow rate limit, a contact output will be delivered from the status output terminal.

Damping time constant:
Settable from 0 to 60 seconds

Arrester: Built in for power source and current output

Conduit connection:
G1/2 internal thread

Finish color: Silver; converter cover is blue

Structure: JIS C 0920 immersion-proof (IP67)

Materials:

Converter case	Aluminum alloy	
Detecting unit		
Measuring tube	Alumina 99.7%	Teflon (PFA mold)
Electrode	Platinum	Platinum iridium
		Tantalum
		Titanium
		Hastelloy C
		SUS316L
Earth ring	Tantalum, Titanium, Hastelloy C, SUS316	
Flange short pipe	SUS304	

Excitation system: Low frequency excitation

Mounting method:
Mounted via flange insertion type on opposite side (wafer type) or mounted on flange with flange short pipe.
Note: Flange 15A corresponds to 2.5A or 6A meter size.

Grounding: Resistance 100Ω or less

Other Specifications

Consult with Fuji regarding specifications such as for sanitary type, special immersion-proof type, etc.

STANDARD PERFORMANCE

Accuracy rating:

Meter size	Span [m/s]	Accuracy	
		25% or higher indication	Less than 25% indication
2.5A, 6A	0.3 to 0.99	±1% full scale	
	1 to 10	±0.5% full scale	
15 to 200A	0.3 to 0.99	±1% of rate	±0.25% full scale
	1 to 10	±0.5% of rate	±0.125% full scale

Power consumption:
10W or less

Operating conditions:
Ambient temperature; −20 to 60°C
Ambient humidity; 95%RH or less
Power supply voltage; 90 to 264V AC
Power supply frequency; 50/60Hz

Fluid thermal shock:
$\Delta T \leqq 100$℃/1 sec
(ceramic measuring tube)

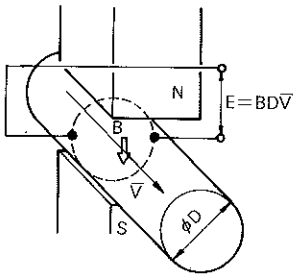
OPERATING PRINCIPLE

The flowmeter is designed utilizing Faraday's law that states "when an electric conductor moves in a magnetic field, an electromotive force proportional to the velocity is generated in the electric conductor".

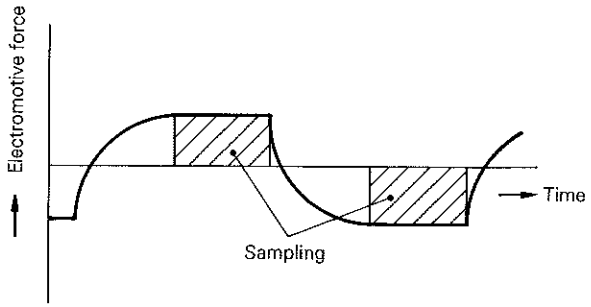
Suppose that there is a magnetic field with magnetic flux density "B" in a pipe of inside diameter "D" and a pair of electrodes are placed at right angles to the pipe, and that the mean fluid velocity is "$\overline{V}$", then an electromotive force "E" is induced between the electrodes.

$$E = B \cdot D \cdot \overline{V}$$

This flowmeter uses a low-frequency rectangular wave exciting system to provide excellent zero point stability and minimum power consumption, thereby allowing an electromotive force to be detected under stabilized condition.



Operating principle



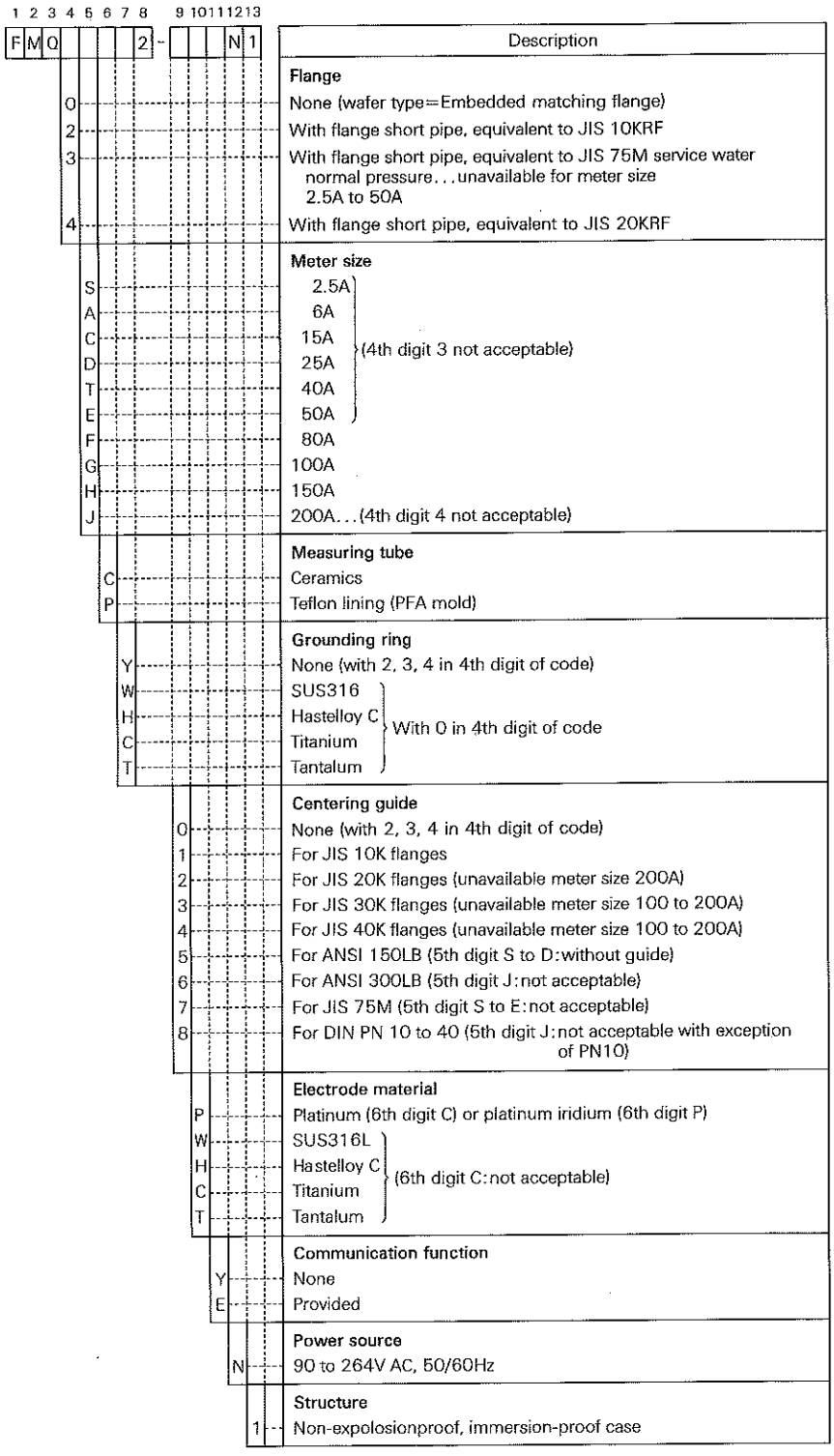
ACCESSORIES

Fuse (0.5A) 1
Centering guide (option) .....1 set

Table 1 Example of remote functions (operation from HHC)

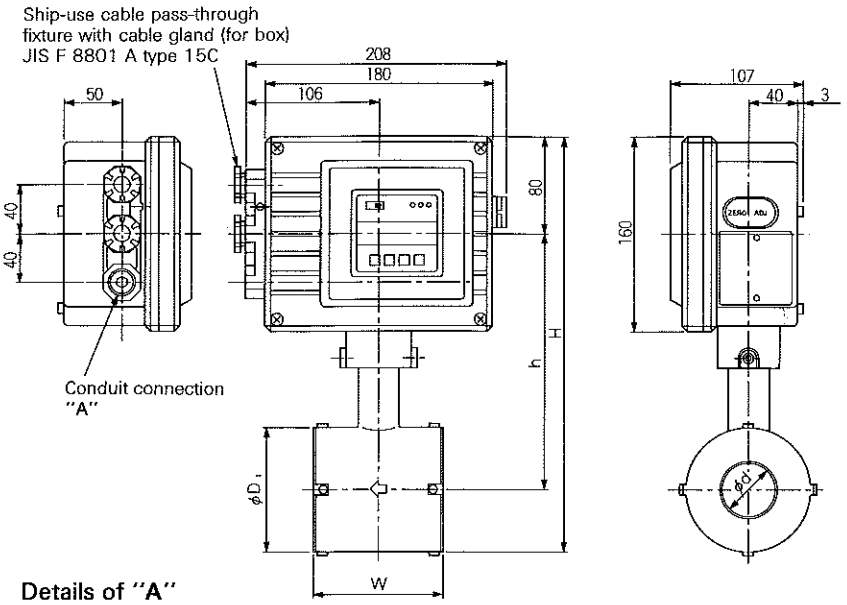
Item	Indication	Setting	Contents
Tag No.	O	O	26 digits alphanumeric
Type	O	O	Instrument type
Serial No.	O	—	Mfg. No. of instrument
Unit	O	O	Engineering unit (flow rate, velocity)
Flow rate (velocity) full scale	O	O	Max. flow rate (velocity) of basic range
Damping	O	O	Setting in range of 0 to 60 seconds
Burnout direction	O	O	Output direction at fault occurrence (−10%, 110%, holding)
Zero adjustment	—	O	Zero point output adjustment
Output circuit adj.	—	O	Output 4mA, 20mA adjustment
Data measurement	O	—	Instantaneous flow, integral flow indication
Self-diagnosis	O	—	Instrument fault diagnosis
Printer function	—	—	Printout

CODE SYMBOLS

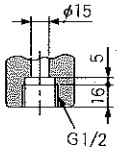


OUTLINE DIAGRAMS (Unit: mm)

<Ceramic type>

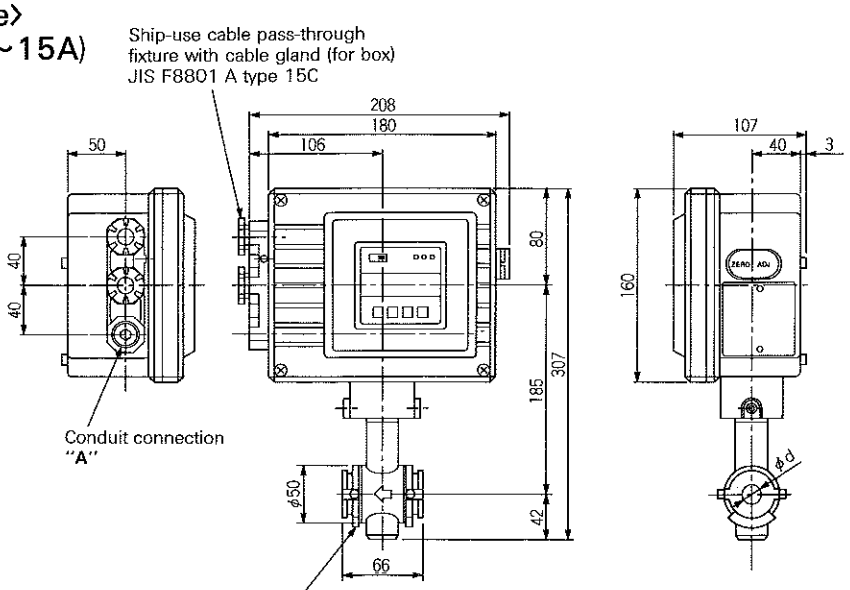


Details of "A"

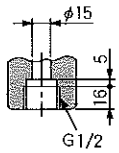


Meter size	W	φd	φD₁	h	H	Mass (kg)
2.5A	85	2.5	49	185	289	3.5
6A	85	6	49	185	289	3.5
15A	85	12	49	185	289	4.0
25A	93	21	69	195	310	4.0
40A	100	40	87	200	323	4.5
50A	105	49	104	208	340	5.0
80A	150	78	135	224	372	5.5
100A	160	100	161	238	399	8.0
150A	190	150	219	263	452	11.5
200A	205	200	270	293	508	19.5

<Teflon lining type> (Meter size 2.5A～15A)

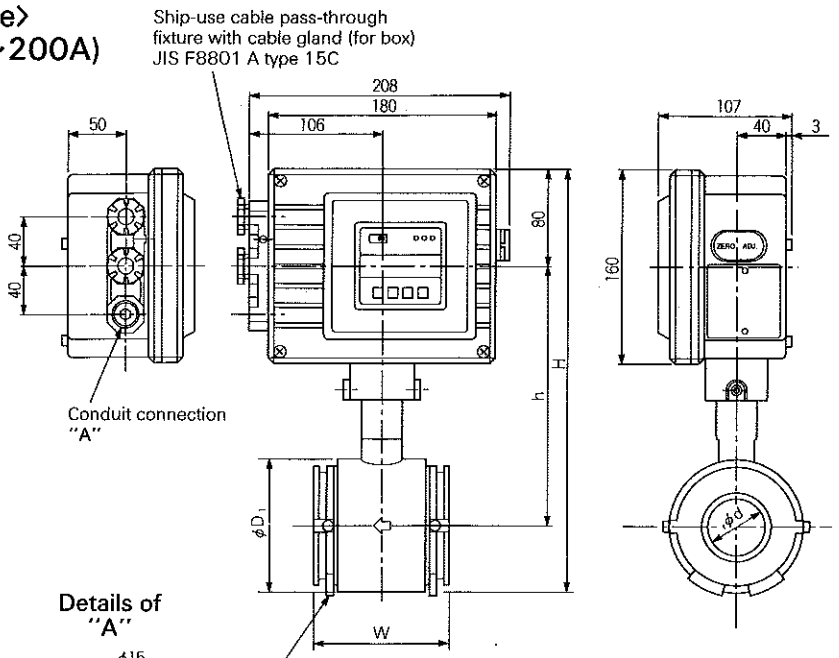


Details of "A"



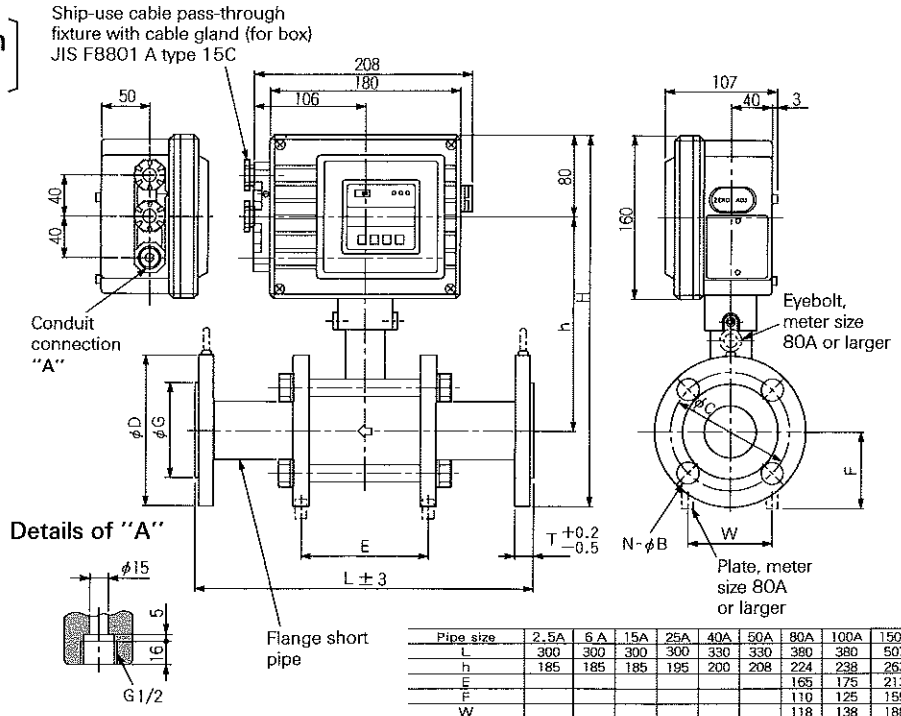
Meter size	φd	Mass (kg)
2.5A	2.5	3.5
6A	6	4.0
15A	12	4.0

<Teflon lining type> (Meter size 25A~200A)



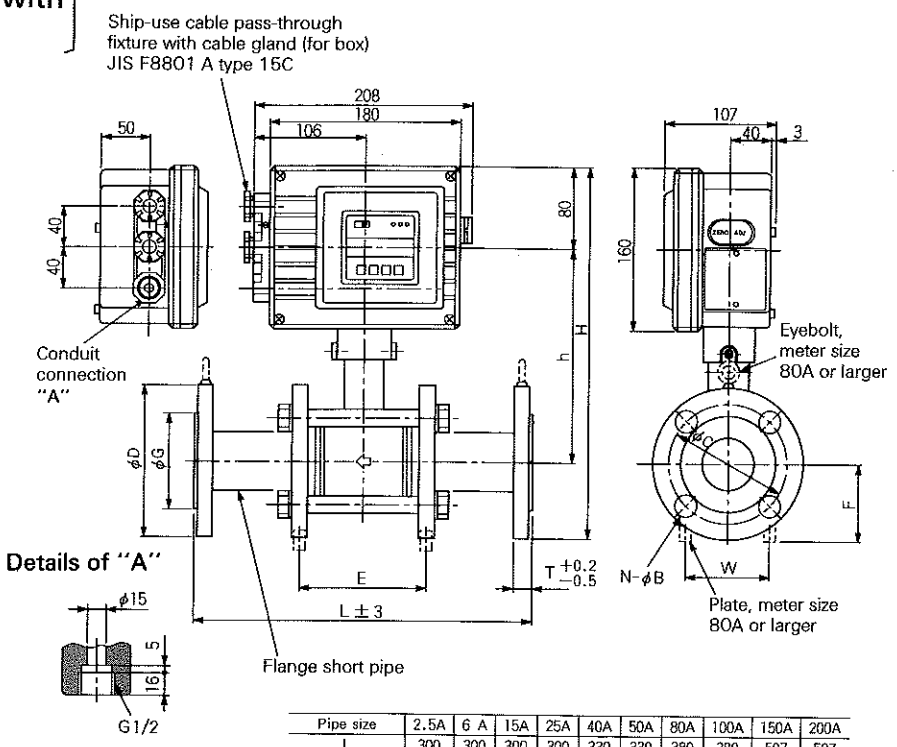
Meter size	W	ϕd	ϕD1	h	H	Mass (kg)
25A	65	21	70	195	310	4.0
40A	80	40	86	203	326	4.5
50A	80	48	96	208	336	5.0
80A	100	76	128	224	368	5.5
100A	120	100	156	238	396	8.0
150A	165	150	206	263	446	11.5
200A	200	200	265	293	505	19.5

[Ceramic type with flange short pipe]



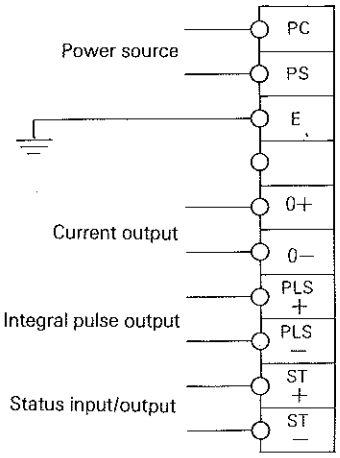
Pipe size		2.5A	5A	15A	25A	40A	50A	80A	100A	150A	200A
L		300	300	300	300	330	330	380	380	507	507
h		185	185	185	195	200	208	224	238	263	293
E								165	175	213	228
F								110	125	155	180
W								118	138	188	218
In case of JIS 10K flange	ϕD	95	95	95	125	140	155	185	210	280	330
	ϕC	70	70	70	90	105	120	150	175	240	290
	N-ϕB	4-15	4-15	4-15	4-19	4-19	4-19	8-19	8-19	8-23	12-23
	T	12	12	12	14	16	16	18	18	22	22
	ϕG	51	51	51	67	81	96	126	151	212	262
	H	312	312	312	338	350	366	397	423	483	538
	Mass (kg)	7.0	7.0	7.5	10.5	14.0	15.5	22.0	27.5	53.0	72.5
In case of JIS 75M flange	ϕD							211	238	290	342
	ϕC							168	195	247	299
	N-ϕB							4-19	4-19	6-19	8-19
	T							18	18	22	22
	ϕG							125	152	204	256
	H							410	437	488	544
	Mass (kg)							24.5	30.0	53.0	76.5
In case of JIS 20K flange	ϕD	95	95	95	125	140	155	200	225	305	
	ϕC	70	70	70	90	105	120	160	185	260	
	N-ϕB	4-15	4-15	4-15	4-19	4-19	8-19	8-23	8-23	12-25	
	T	14	14	14	16	18	18	22	24	28	
	ϕG	51	51	51	67	81	96	132	160	230	
	H	312	312	312	338	350	366	403	430	496	
	Mass (kg)	7.0	7.0	7.5	11.0	14.5	16.0	25.0	31.5	60.0	

Teflon lining type with flange short pipe

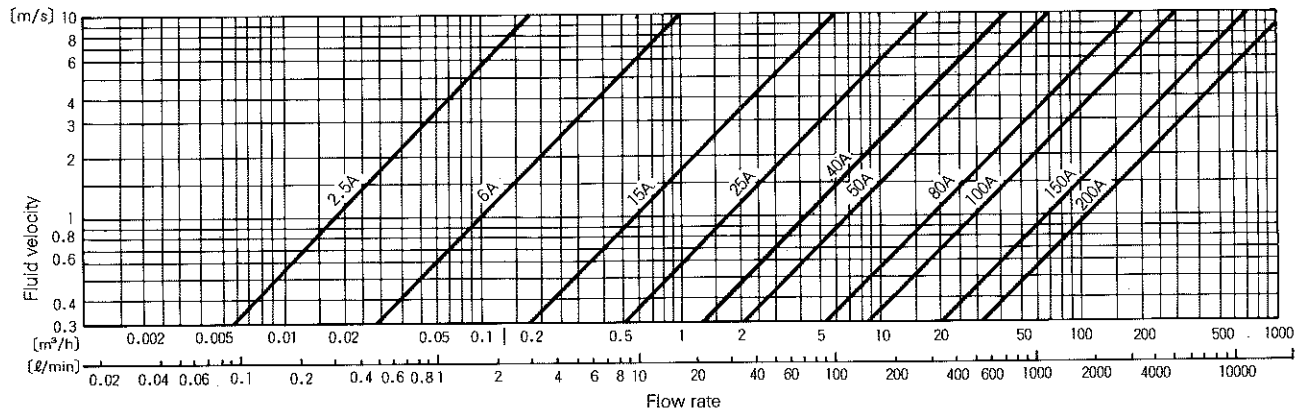


Pipe size		2.5A	6 A	15A	25A	40A	50A	80A	100A	150A	200A
L		300	300	300	300	330	330	380	380	507	507
h		185	185	185	195	203	208	224	238	263	293
E								116	136	189	224
F								110	125	155	180
W								118	138	188	218
In case of JIS 10K flange	φD	95	95	95	125	140	155	185	210	280	330
	φC	70	70	70	90	105	120	150	175	240	290
	N-φB	4-15	4-15	4-15	4-19	4-19	4-19	8-19	8-19	8-23	12-23
	T	12	12	12	14	16	16	18	18	22	22
	φG	51	51	51	67	81	96	126	151	212	262
	H	312	312	312	338	353	364	397	423	483	538
	Mass (kg)	7.0	7.5	7.5	10.5	14.0	15.5	22.5	28.0	52.0	73.0
In case of JIS 75M flange	φD							211	238	290	342
	φC							168	195	247	299
	N-φB							4-19	4-19	6-19	9-19
	T							18	18	22	22
	φG							125	152	204	256
	H							410	437	488	544
	Mass (kg)							25.0	30.5	53.5	77.0
In case of JIS 20K flange	φD	95	95	95	125	140	155	200	225	305	
	φC	70	70	70	90	105	120	160	185	260	
	N-φB	4-15	4-15	4-15	4-19	4-19	8-19	8-23	8-23	12-25	
	T	14	14	14	16	18	18	22	24	28	
	φG	51	51	51	67	81	96	132	160	230	
	H	312	312	312	338	353	366	403	430	496	
	Mass (kg)	7.0	7.5	7.5	11.0	14.5	16.0	25.5	32.0	60.5	

CONNECTION DIAGRAM



Flow rate vs. fluid velocity conversion diagram



SCOPE OF DELIVERY

Flowmeter (mounting bolts and gaskets should be prepared separately)

ITEMS TO BE ORDERED SEPARATELY

Hand-held communicator (type FXW):
Refer to data sheet EDS8-47.

Fuji Electric Co.,Ltd.

Head office
12-1 Yurakucho 1-chome, Chiyoda-ku Tokyo. 100 Japan
Phone: Tokyo 3211-7111
Telex: J22331 FUJIELEA or FUJIELEB

Instrumentation Systems Div.
No. 1, Fuji-machi, Hino-city, Tokyo 191 Japan
Phone: 0425-85-2800
FAX: 0425-85-2810

Printed in Japan 1997-2/10E