

COMPACT ELECTROMAGNETIC FLOWMETER (COMPACT FLOW, SEPARATE TYPE)

DATA SHEET

FMS, FMT

The electromagnetic flowmeter is an instrument used to measure the volumetric flow rate of fluid 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 a voltage to be induced in proportion to the velocity, which is known as Faraday's law.

This flowmeter which utilizes the latest electronics technology is compact and lightweight with a separate detector and converter. Being completely different in configuration from conventional electromagnetic flowmeters, this unit has its own built-in microcomputer to provide a self-diagnosis function and a communication function in addition to the usual flowmeter functions, and additionally features ease of handling and a high cost-performance.

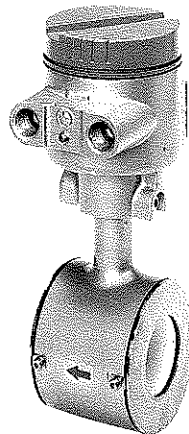
FEATURES

1. **Compact wafer-type detector (meter sizes 2.5A to 200A)**
The compact and lightweight design facilitates piping work by connecting an orifice between flanges and permits easy pipe centering.
2. **Easy adjustment**
Measuring range, etc. can easily be changed by manipulating key switches. Zero point is automatically calibrated at the push of a key without opening the cover.
3. **Self-diagnosis function**
Various self-diagnostic functions can be achieved by the built-in microcomputer.
4. **High reliability structure**
The use of a ceramic measuring tube (meter sizes 2.5A to 200A) provides an excellent resistance to chemicals and wearing.
5. **Communication function**
The addition of a communication module makes the flowmeter a "Smart type". The use of a hand-held communicator enables indication and setting via remote operation.
6. **Power source is selectable**
The flowmeter is connectable to either 100V or 200V power source of 50 or 60Hz.

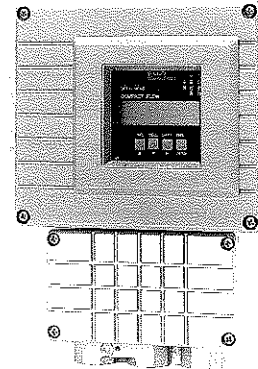
SPECIFICATIONS

Detector (type FMS)

Measured fluid: General industrial water, service water, drainage, sludge, chemical liquid, slurry, and other liquids with conductivity of more than $5\mu S/cm$



Detector
(FMS)



Converter
(FMT)

Process fluid pressure:

- 100 to 4000 kPa { - 1 to 40 kgf/cm² }
... meter sizes 2.5A to 80A
- 100 to 2000 kPa { - 1 to 20 kgf/cm² }
... meter sizes 100A, 150A
- 100 to 1000 kPa { - 1 to 10 kgf/cm² }
... meter sizes 200A to 300A

Process fluid temperature:

- 10 to 120°C
... ceramics and teflon liner
- 10 to 50°C
... polyurethane rubber liner

Note: Allowable fluid temperature is from - 10 to 60°C in case of negative pressure (- 100 kPa) with teflon liner.

Enclosure:

Meets JIS C 0920 immersion-proof (IP67)
JIS C 0903 flameproof (patent pending)

Mounting method:

- Detector body inserted between adjacent pipe flanges (wafer type) or mounted on flange with short pipe
... meter sizes 2.5A to 200A
- Mounted on flange
... meter sizes 250A, 300A

Meter size and measuring range:

Measuring range 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 0.0054	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
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
250A	0 to 53.1	0 to 1767
300A	0 to 76.4	0 to 2544

Structural materials

Measuring tube:

Ceramics (Al₂O₃) (meter sizes 2.5A to 200A)

Teflon or polyurethane rubber liner (meter sizes 250A, 300A)

Electrode: Platinum (for ceramic type), platinum-iridium (for teflon liner), SUS316L (for teflon or polyurethane rubber liner)

Ground ring: SUS316, Hastelloy C or tantalum

Flange short pipe (option):

SUS304

Finish color: Silver (terminal box cover is blue)

Other optional specifications

Contact Fuji for specifications on sanitary type, special immersion-proof type, etc.

Converter (type FMT)

Input/output signal

Current output:

4 to 20mA DC (load resistance 0 to 600Ω)

Pulse output: Open collector (capacity 30V, 0.2A DC)

Status output: Same as above

Status input: No-voltage contact

Note: Either input or output alone is available for status signal.

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

Distance from power lines;

15cm or more

Span setting function:

Volumetric flow rate is settable according to setting of flow unit, flow numerics and meter size (flow velocity also settable).

Flow rate, flow velocity unit;

m³/h, l/h, m/s

Detector meter size;

mm

Multi-range function:

Automatic two-range changeover via two-range changeover mode, and two-range (large/small) changeover via status input

Forward/reverse flow measurement function:

Reverse flow selectable via flow direction mode

Flow rate indication:

Actual flow rate or % indication

Integral indication:

Integrated flow indicated by setting of integration factor

Pulse output:

Provided by setting a pulse factor

Pulse width; 30ms or 100ms

Fault diagnosis function:

Converter fault and process fault (overflow, underflow) are diagnosed and indicated

Zero adjust function:

Zero point automatically calibrated by one push of ZERO switch (inside or outside transmitter)

Output low cutoff, integration low cutoff function:

Output can be cut off (zeroed) when flow rate is below set cutoff point.

Flow noise cutoff function:

Flow noise (spike noise) can be cut off by setting a rate limit.

0% signal lock function:

Indication and output are locked at 0 (zero) by means of status input.

Empty detect function:

Lack of fluid is detected and alarm is given.

Flow switch function:

Contact output is given via status output by setting a lower limit of flow rate.

Damping time constant:

Settable from 0 to 60 seconds.

Arrester:

Built in, for power source and current output

Wiring connection:

G1/2 internal thread

Finish color:

Silver (housing cover is blue)

Structure:

Conforms to JIS C 0920 immersion-proof (IP67)

Material:

Casing; aluminum alloy

Excitation system: Low frequency excitation

Mounting method:

Mounted on wall or pipe

Grounding:

100Ω or less

Exclusive signal cable length:

150m or less (see Fig. 3)

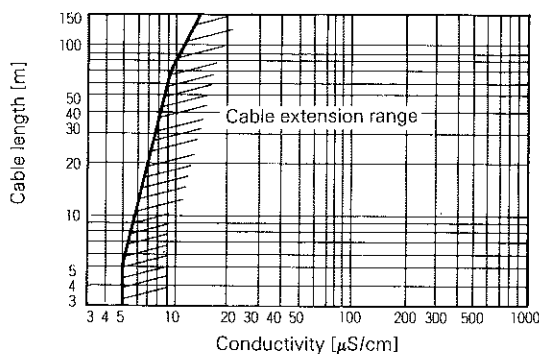


Fig. 3 Allowable length of exclusive signal cable

Standard Performance

Accuracy rating: Within $\pm 0.5\%$ full scale (FS) at flow velocity 1m/s or more
 Within $\pm 1\%$ FS at flow velocity less than 1m/s

Power consumption:
 10W or less

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

Fluid thermal shock:
 $\Delta T \leq 100^\circ\text{C}/1 \text{ sec}$

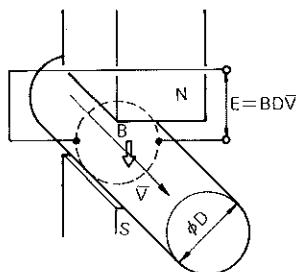
OPERATING PRINCIPLE

Flowmeter design is based on Faraday's law which states that "When an electric conductor moves in a magnetic field, an electromotive force proportional to the velocity is generated in the electric conductor".

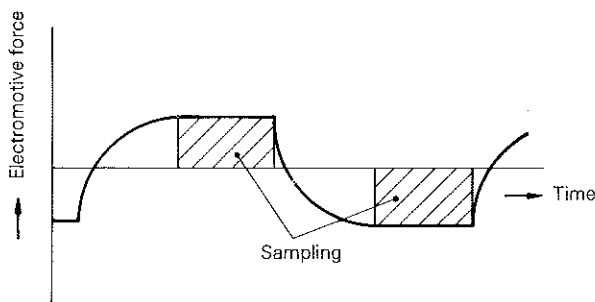
Assuming that a magnetic field with magnetic flux density "B" exists in a pipe of inside diameter "D" with a pair of electrodes placed at right angles to the pipe, and that the mean fluid velocity is " \bar{V} ", then an electromotive force "E" is induced between the electrodes.

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

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 conditions.



Measuring principle



OPTIONAL SPECIFICATIONS

Ground ring: SUS316, Hastelloy C or tantalum (7th digit of detector code)

Centering guide: JIS 10K, 20K, 30K, 40K or 75M (9th digit of detector code)

Communication function:
 Communication module (built in converter), (4th digit of converter code)
 An example of remote setting and adjusting functions using the separately available hand-held communicator (HHC) is shown in Table 1.

ACCESSORIES

Fuse (0.5A) . . . 1

Centering guide (option) . . . 1 set

Exclusive signal cable (option) . . . 1 (Specify the length)

Table 1 Example of remote functions (operation from HHC)

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

CODE SYMBOLS

Converter (type FMT)

1	2	3	4	5	6	7	8	Description
F	M	T						Communication function Not provided Provided
			Y					
			E					Power source 90 to 264V AC, 50/60Hz
			N					
				A				Mounting Pipe mounting Wall mounting
				B				
								Exclusive signal cable length (between detector and transmitter)
						0	0m	
						9	5m	
						1	10m	
						2	20m	
						3	30m	
						4	40m	
						6	60m	
						8	80m	
						Z	Other (up to 150m possible)	

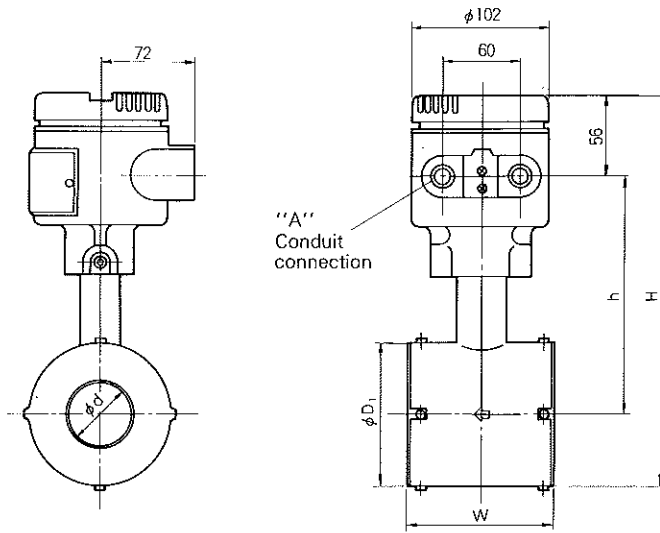
Detector (type FMS)

1 2 3 4 5 6 7 8 9 10 11 12 13

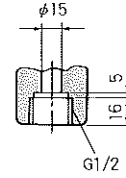
FMS		1		Y Y		Description
0						Flange None (wafer type) . . . meter sizes 2.5A to 200A
1						With flange, JIS 10K RF equivalent
7						With flange, JIS 75M service water-normal pressure or equivalent } meter sizes 250A, 300A
2						With flange short pipe, JIS 10K RF equivalent . . . possible for meter sizes 2.5A to 200A
3						With flange short pipe, JIS 75M service water-normal pressure or equivalent . . . possible for meter sizes 80A to 200A
Z						With flange short pipe, for other pressures
S						Meter size 2.5A
A						6A
C						15A
D						25A
E						50A
F						80A
G						100A
H						150A
J						200A
K						250A
L						300A } With flange and liner
C						Measuring pipe, liner material Ceramics . . . meter sizes 2.5A to 200A
T						Teflon
U						Polyurethane rubber } meter sizes 250A, 300A
0						Ground ring None (with 2, 3, Z in 4th digit of code)
1						SUS316
2						Hastelloy C
3						Tantalum
Y						Centering guide None . . . with 1, 7, 2, 3, Z in 4th digit of code
A						For JIS 10K flanges
B						For JIS 20K flanges (unavailable for meter size 200A)
C						For JIS 30K flanges (unavailable for meter sizes 100A to 200A)
D						For JIS 40K flanges (unavailable for meter sizes 100A to 200A)
E						For JIS 75M flanges (unavailable for meter sizes 2.5A to 50A)
P						Electrode material Platinum (ceramic type), platinum-iridium (for teflon liner)
W						SUS316L (impossible with C in 6th digit of code)
1						Structure Non-explosionproof, immersion-proof case
3						Flameproof (conduit flameproof screw coupling type) } Patent pending (impossible for meter sizes 250A, 300A)
4						Flameproof (flameproof packing type)

OUTLINE DIAGRAM (Unit:mm)

Detector (meter sizes 2.5A to 200A)

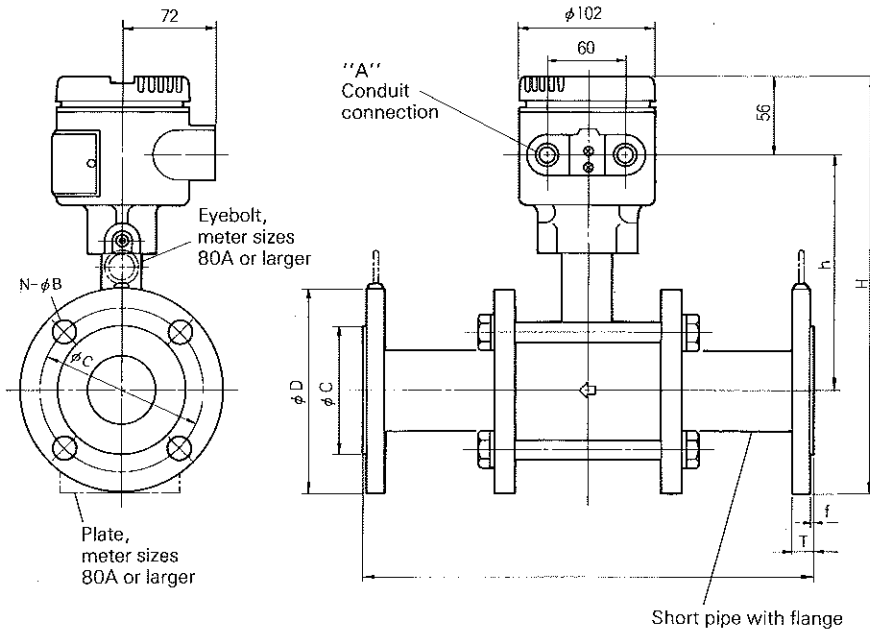


Details of "A"



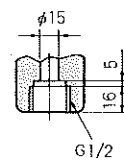
Meter size	W	φd	φD ₁	h	H	Mass [kg]
2.5A	85	2.5	50	145	226	2.5
6A	85	6	50	145	226	2.5
15A	85	12	50	145	226	3.0
25A	93	21	69	155	246	3.0
50A	105	49	104	168	276	4.0
80A	150	78	135	184	308	4.5
100A	160	100	161	198	335	7.0
150A	180	150	220	223	389	10.5
200A	205	200	270	253	444	18.5

Detector (meter sizes 2.5A to 200A, with flange short pipe)

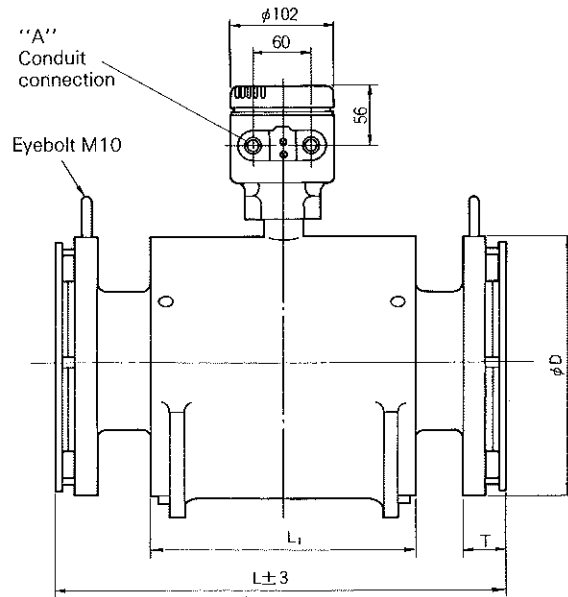
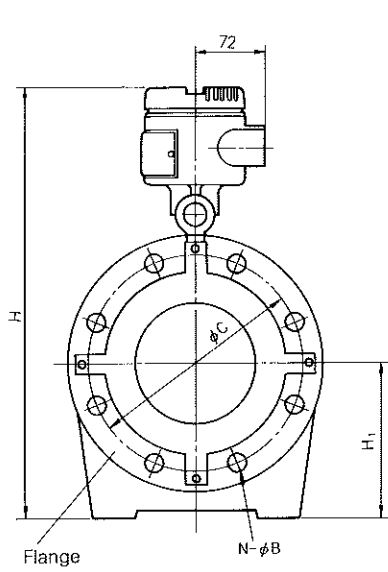


Meter size	2.5A	6A	15A	25A	50A	80A	100A	150A	200A
L	300	300	300	300	330	380	380	507	507
h	145	145	145	155	168	184	198	223	253
JIS10K Flange	φD	95	95	95	125	155	185	210	280
	φC	70	70	70	90	120	150	175	240
	N-φB	4-15	4-15	4-15	4-19	4-19	8-19	8-19	8-23
	T	12	12	12	14	16	18	18	22
	f	1	1	1	1	2	2	2	2
	φG	51	51	51	67	96	126	151	212
	H	249	249	249	274	302	333	359	419
	Mass [kg]	6.0	6.0	6.5	9.5	14.5	21.0	26.5	50.5
	JIS75M Flange	φD					211	238	290
		φC					168	195	247
N-φB						4-19	4-19	6-19	
T						18	18	22	
f						2	2	2	
φG						125	152	204	
H						346	373	424	
Mass [kg]					23.5	29.0	52.0		

Details of "A"

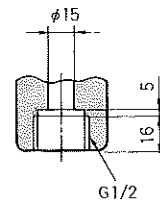


Detector (meter sizes 250A, 300A)

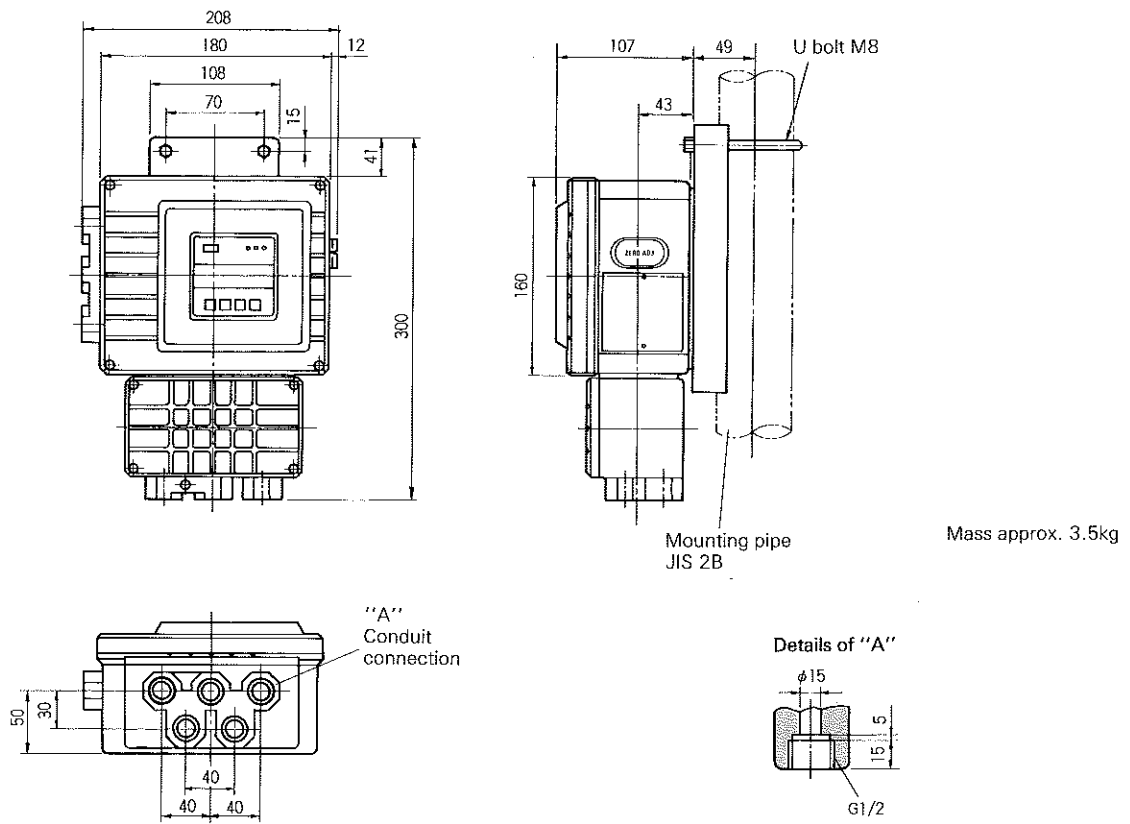


Meter size	250A	300A
L	589	589
L ₁	320	360
H	550	605
H ₁	210	240
T	33	35
JIS10K	φD	400 445
	φC	355 400
	N-φB	12-25 16-25
JIS75M	φD	410 464
	φC	360 414
	N-φB	8-23 10-23
Mass [kg]	95	113

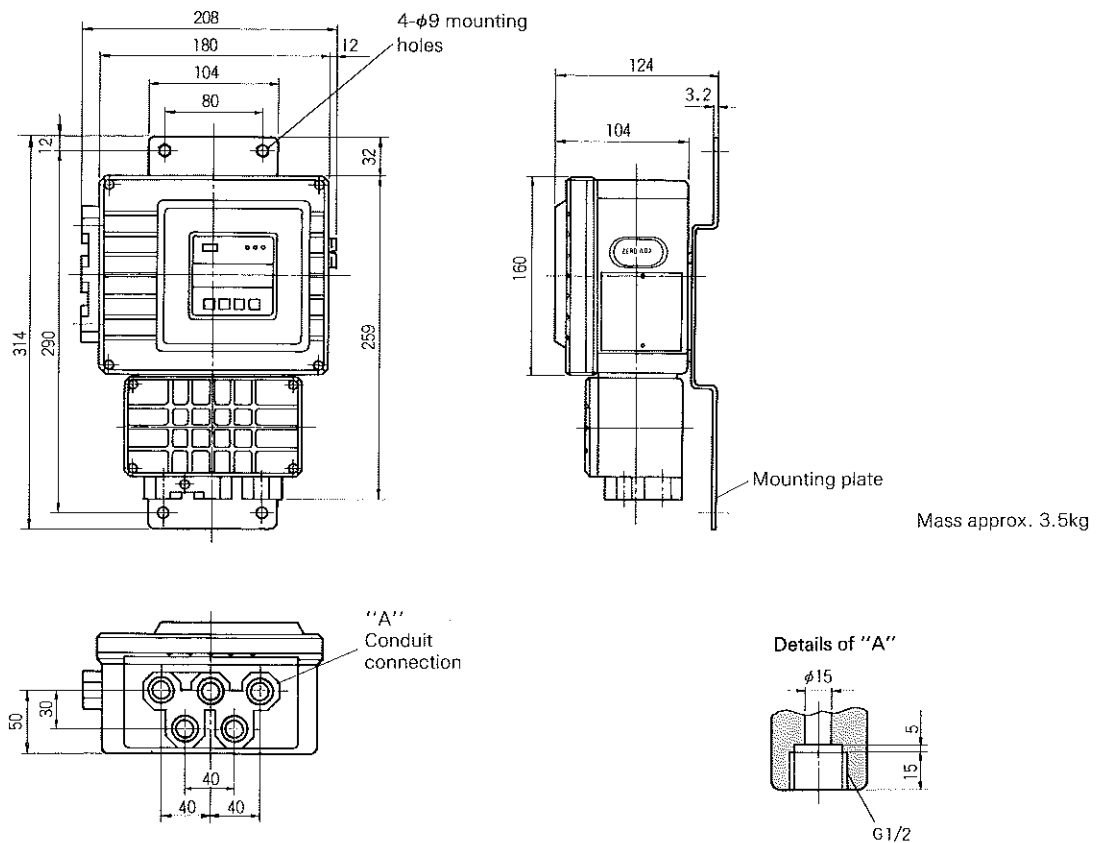
Details of "A"



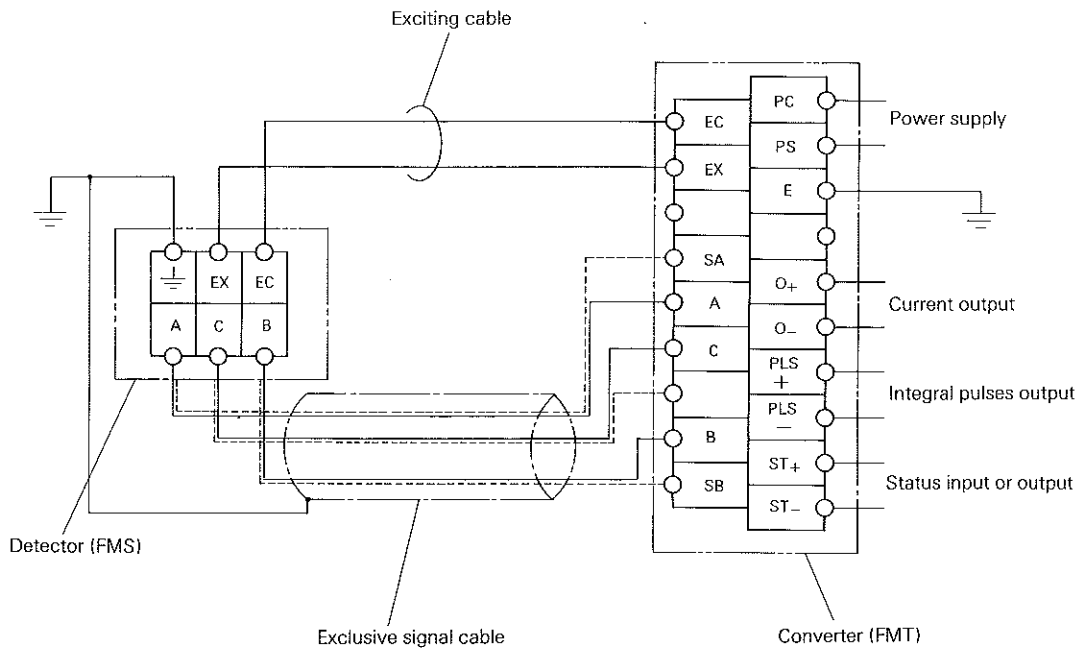
Converter (pipe mounting)



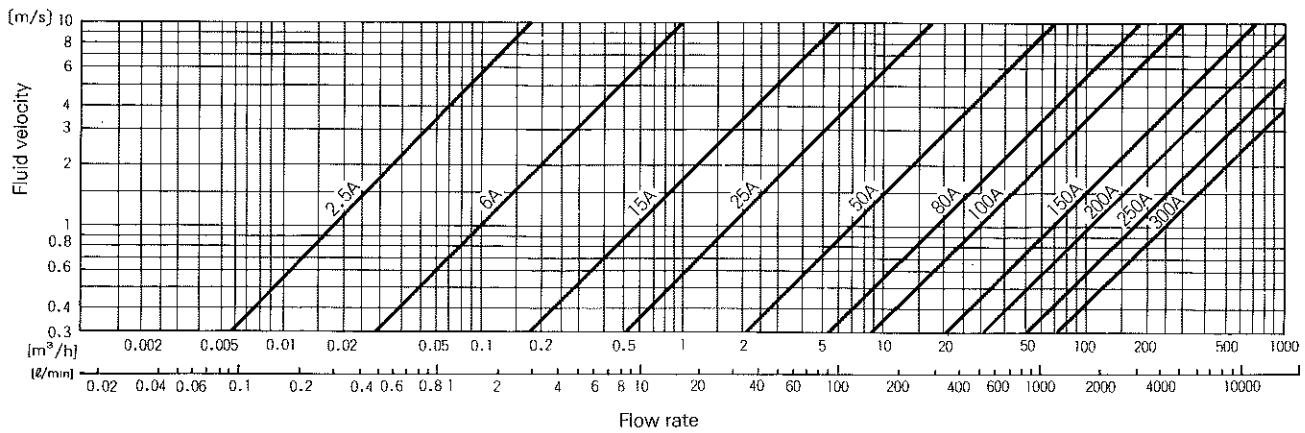
Converter (wall mounting)



CONNECTION DIAGRAM



Flow rate vs. fluid velocity conversion diagram



SCOPE OF DELIVERY

- Detector × 1 (prepare mounting bolts and packings separately)
- Converter × 1 (with pipe or wall mounting bracket)
- Exclusive signal cable × 1 (non-terminated), when specified

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