FUJI ELECTRIC

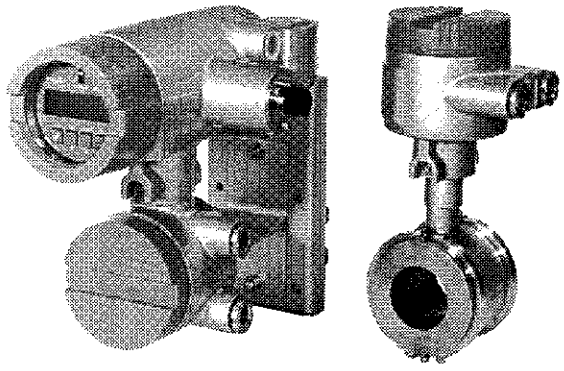
FFI SYSTEM

COMPACT ELECTROMAGNETIC FLOWMETER
(COMPACT FLOW, SEPARATE TYPE)

DATA SHEET FML,FMN1

The electromagnetic flowmeter is an instrument used to measure the volumetric flow rate of fluids 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 has a transmitter equipped with a microcomputer for digital processing of signals to realize high accuracy and intelligent measurements. The adoption of optical fiber cable in the signal transmission unit configures an optical field instrumentation system with an optical star coupler and master station.



Transmitter **Detector**

FEATURES

1. **Compact water-type detector**
   The compact and lightweight design facilitates piping work by connecting an orifice between flanges and permits easy pipe centering.
2. **Bidirectional transmission system**
   One-fiber bidirectional transmission system is used to transmit measurement/diagnosis data to host equipment and to receive remote setting data from the same equipment.
3. **Simple adjustment**
   Measuring range can easily be changed by manipulating key switches with field indicator and setting unit (optional items), addition to remote adjustment with host equipment.
4. **Self-diagnosis function**
   Various self-diagnostic functions can be achieved by the built-in microcomputer.
5. **High reliability**
   The detector casing is fully welded and the electrode unit is double sealed. The circuit unit and the external terminal section of the transmitter are housed in a triple sealed structure.
6. **Field indicator with digital display (option)**
7. **Flameproofing**
   A safety barrier is self-contained.
8. **Dual output signal**
   A change-over switch is provided for 4 to 20mA single output.
   In optical output mode, 4 to 20mA electrical output is given simultaneously to provide flexible application capability.

SPECIFICATIONS

Detector (type FML)

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

Measuring range and accuracy:
Fluid velocity 0 to 1 ... 10 m/s: ±0.5% FS (corresponding to JIS B 7554 class 0.5)
Fluid velocity 0 to 0.3 ... less than 1 m/s: ±1% FS

Operating pressure limits:
−1 to 20 kgf/cm^2 (see Fig. 1)

Process fluid temperature limits:
Teflon liner ... −10 to 120°C
Polyurethane rubber line ... −10 to 50°C

Enclosure: Meets JIS C 0920 immersion-proof IEC IP65 and NEMA4

Explosion-proof: Meets JIS C 0903 flameproof ids2G4 (excluding 2.5A)

Meter size, measuring range and structural materials:

Meter size			2.5A	6A	15A	25A	50A	80A	100A	150A
Measuring range			0 to 0.3 ... 10 m/s							
Wet parts material	Meter liner		Teflon (PFA mold), Polyurethane rubber (excluding meter size 2.5A, 6A)							
	O ring (for use with Teflon liner)		Fluoro-rubber (excluding meter size 2.5A)							
	Electrode	For use with Teflon liner	Platinum-iridium, Tantalum, 316L SS							
		For use with polyurethane rubber liner	316L SS							
	Ground ring	For use with Teflon liner	Tantalum, 316 SS							
		For use with polyurethane rubber liner	316 SS							
Detector body material			Measuring pipe: 304 SS Case: carbon steel							
Electronics housing material			Aluminum casting							
Guide ring material			304 SS							

Mounting method:
Detector body inserted between adjacent pipe flanges

Conduit connection:
JIS G1/2 (M4 screw terminals)
Marine watertight cable gland

Ambient temperature:
–20 to 60°C

Ambient humidity: 95% RH or less

Finish color: Silver (housing cover is blue)

Weight and external dimensions:
See outline diagram

Transmitter (type FMN 1)

Output signal: Optical digital signal
(4 to 20 mA DC is available: Allowable load resistance is 0 to 700Ω)

Power consumption:
Approx. 10VA

Power source: AC 100, 115, 220V (±10%), 50/60 Hz (±2 Hz), according to specification

Functions:
(flowmeter with field indicator and setting unit)

Field indication: LCD 6-digit display
Display of instantaneous flow rate (0 to 100%), symbols of setting items and setting value, and symbols of self-diagnostic items.

Setting items: Direct setting is effected by manipulating toggle and key switches. Remote setting by master station is available.(Asterisked * item is not acceptable)
* Current output calibration (0%, 100%)
Fluid velocity full scale setting range: 0.3 to 10 m/s
Damping constant: 0 to 51 sec
Interchangeability constants of detector and converter

Self-diagnosis: (Following items are displayed on the indicator and transmitted to master station).
Micro-computer abnormal (Note)
RAM backup battery abnormal
Current output D/A converter abnormal
Input overflow (120% FS or more)
Input underflow (–20% FS or less)

(Note) Abnormal micro-computer is normalized by auto-reset.
(No display and transmission of abnormality)

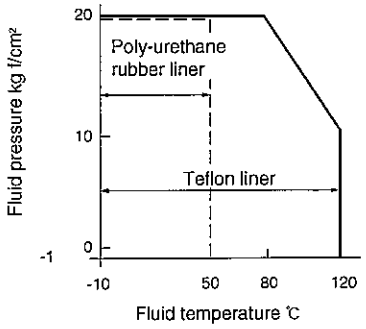


Fig. 1 Fluid temperature vs allowable fluid pressure

Built-in arrester (option):
For power source and current output

Excitation system: Low frequency excitation

Mounting method:
Mounted on wall or pipe

Exclusive signal cable length:
150m max. (see Fig. 2)

Conduit connection:
G1/2 (M4 screw terminal)
Optical signal transmission unit; Fuji's specified cable and connector

Enclosure: Meets JIS C 0920 immersion-proof, IEC IP65 and NEMA4

Ambient temperature:
–20 to 60°

Ambient humidity:
95% RH or less

Finish color: Silver (housing cover is blue)

External dimensions:
See outline diagram

Weight: Approx. 6 kg

OTHER OPTIONAL SPECIFICATIONS
(non-standard; contact Fuji for details)
- Output low cutoff function
- Non-fluid detecting function
- DC 24V power supply (when using exclusive inverter)

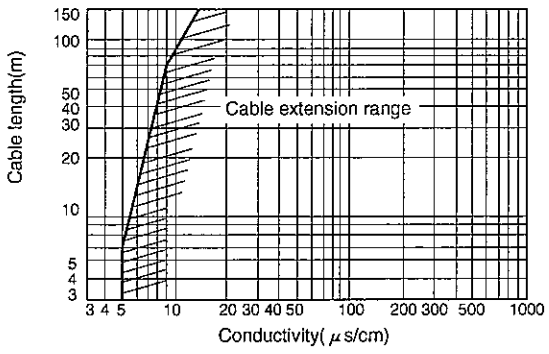


Fig. 2 Exclusive signal cable allowable length

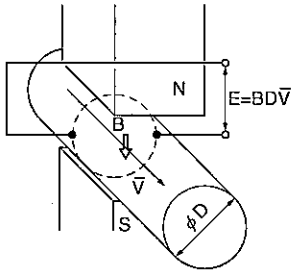
OPERATING PRINCIPLE

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

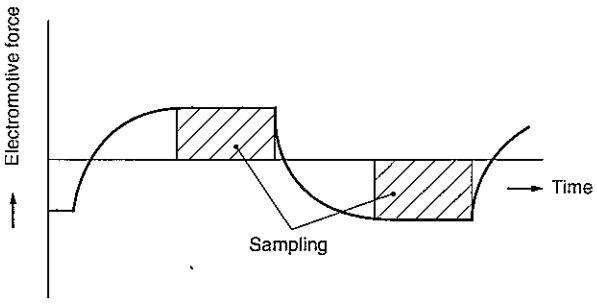
Assuming that a magnetic field with magnetic flux density "B" exists in a pipe of inside diameter "D" with a pair of electrodes placed at right angles to the pipe, and that the mean fluid velocity is "$\bar{V}$", then an electromotive force "E" is induced between the electrodes.

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

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.



Operating principle



CODE SYMBOLS

Detector: FML

FML O	1 -	Y	Description
			Flange
0			Non-flanged insert
			Meter size
S			2.5A
A			6A
C			15A
D			25A
E			50A
F			80A
G			100A
H			150A
			Meter liner
P			Teflon (PFA mold)
U			Polyurethane rubber (not used with S and A in 5th digit)
			Ground ring material
T			Tantalum (not used with U in 6th digit)
W			316 SS
			Guide ring
1			For JIS 10K flanges
2			For JIS 20K flanges
7			For JIS 75M flanges (not used with S, or A to E in 5th digit)
			Electrode material
P			Platinum-iridium } Not used with U in 6th digit
T			Tantalum }
W			316L SS
			Power source and arrester
A			Supplied from transmitter (FMN), 50 Hz
B			Supplied from transmitter (FMN), 60 Hz
			Structure
1			Non-explosion-proof, immersion-proof case
3			Flameproof (conduit flameproof screw coupling type) } Not used with S in 5th digit
4			Flameproof (flameproof Packing type) }

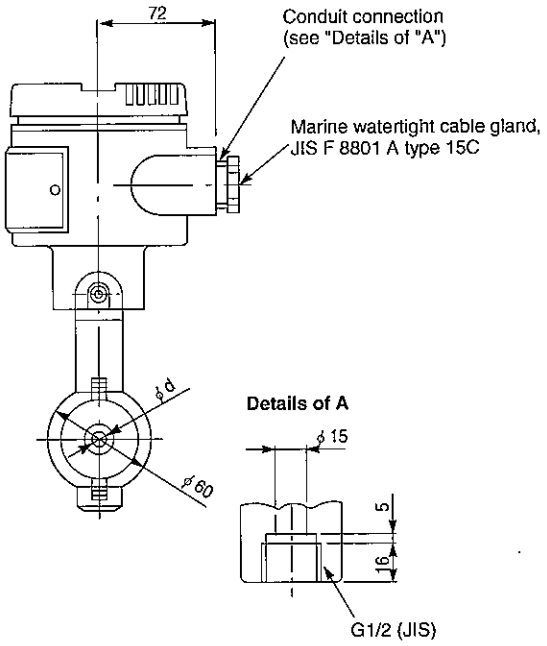
Note 1) Power source, exciting cable, output-optical fiber cable and optical connector should be prepared separately.

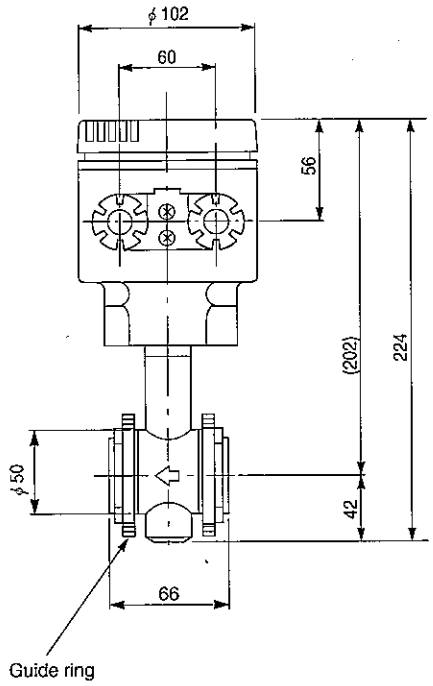
Note 2) Plica tube No. 17 with receptacle adapter can be supplied for the conduit connection.

Transmitter: FMN 1

FMN 1	1	Description
		Output signal and field indicator/setting unit
D		Optical signal/field indicator and setting unit: without
E		Optical signal/field indicator and setting unit: with
		Power source and arrester
A		AC 100V 50 Hz, without arrester
B		AC 100V 60 Hz, without arrester
C		AC 100V 50 Hz, with arrester
D		AC 100V 60 Hz, with arrester
E		AC 115V 50 Hz, without arrester
F		AC 115V 60 Hz, without arrester
G		AC 115V 50 Hz, with arrester
H		AC 115V 60 Hz, with arrester
J		AC 220V 50 Hz, without arrester
K		AC 220V 60 Hz, without arrester
L		AC 220V 50 Hz, with arrester
M		AC 220V 60 Hz, with arrester
		Mounting
A		Pipe mounting
B		Wall mounting
		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)

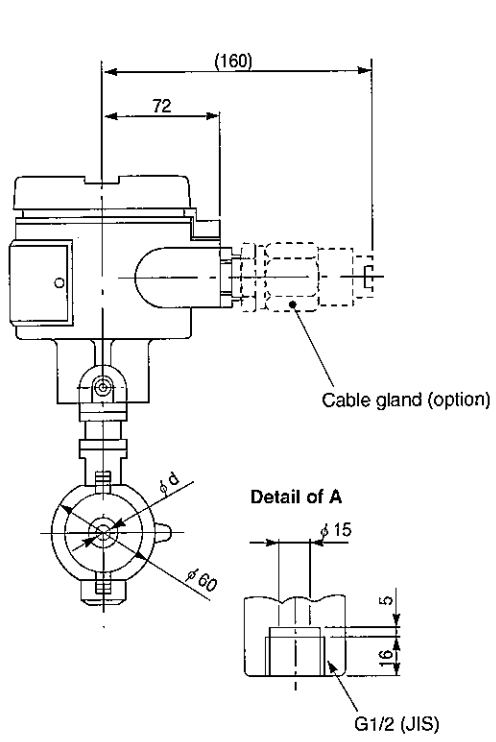
OUTLINE DIAGRAM (Unit: mm)

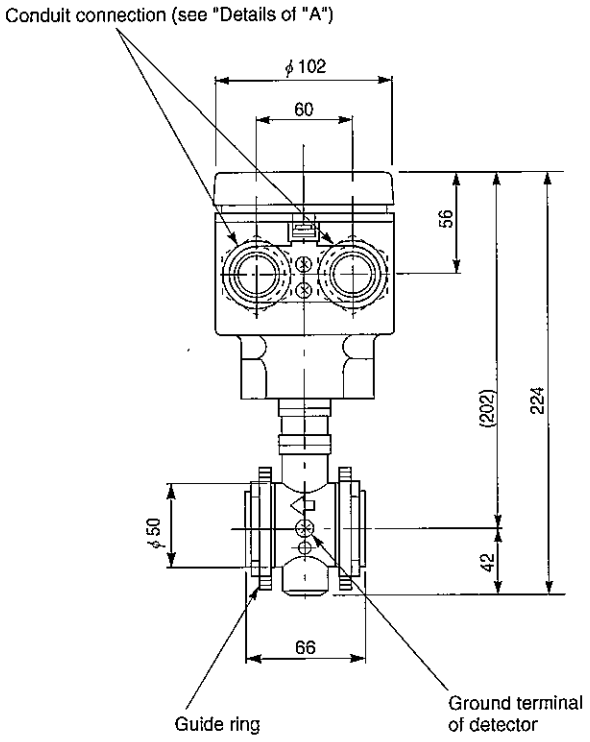




Meter size	φd	Weight [kg]
2.5A	2.5	2.5
6A	6	3
15A	12	3

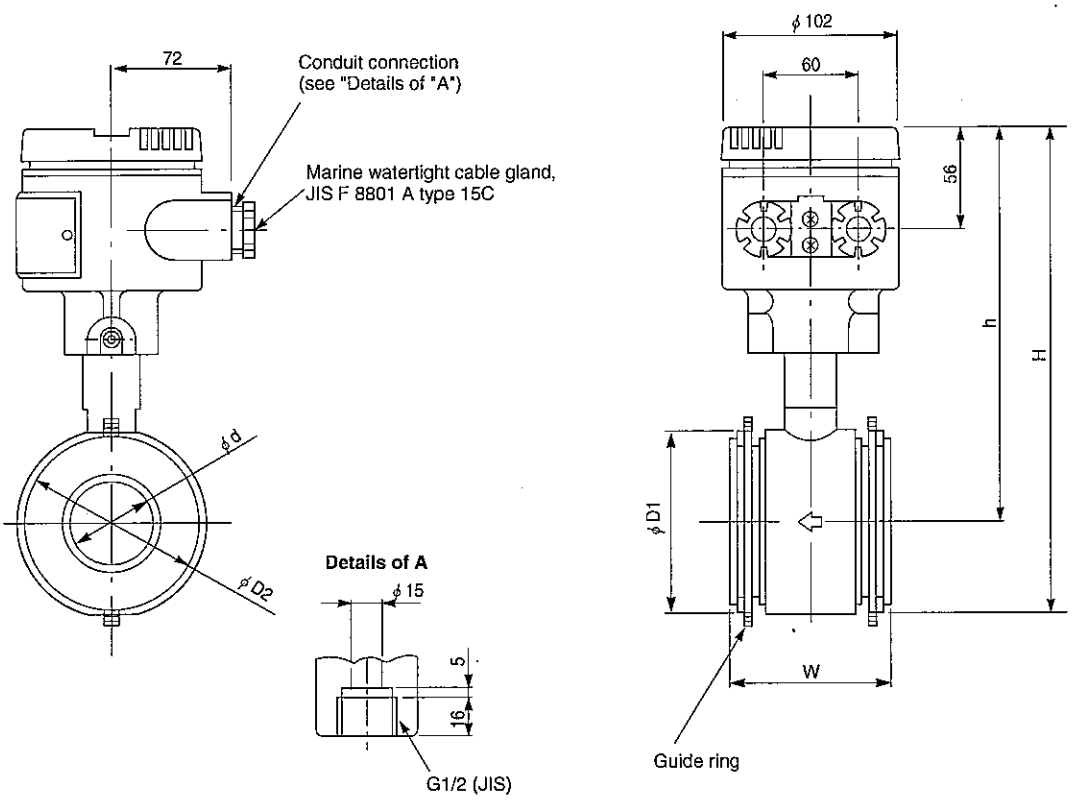
Non-explosion-proof detector (2.5A, 6A, 15A)



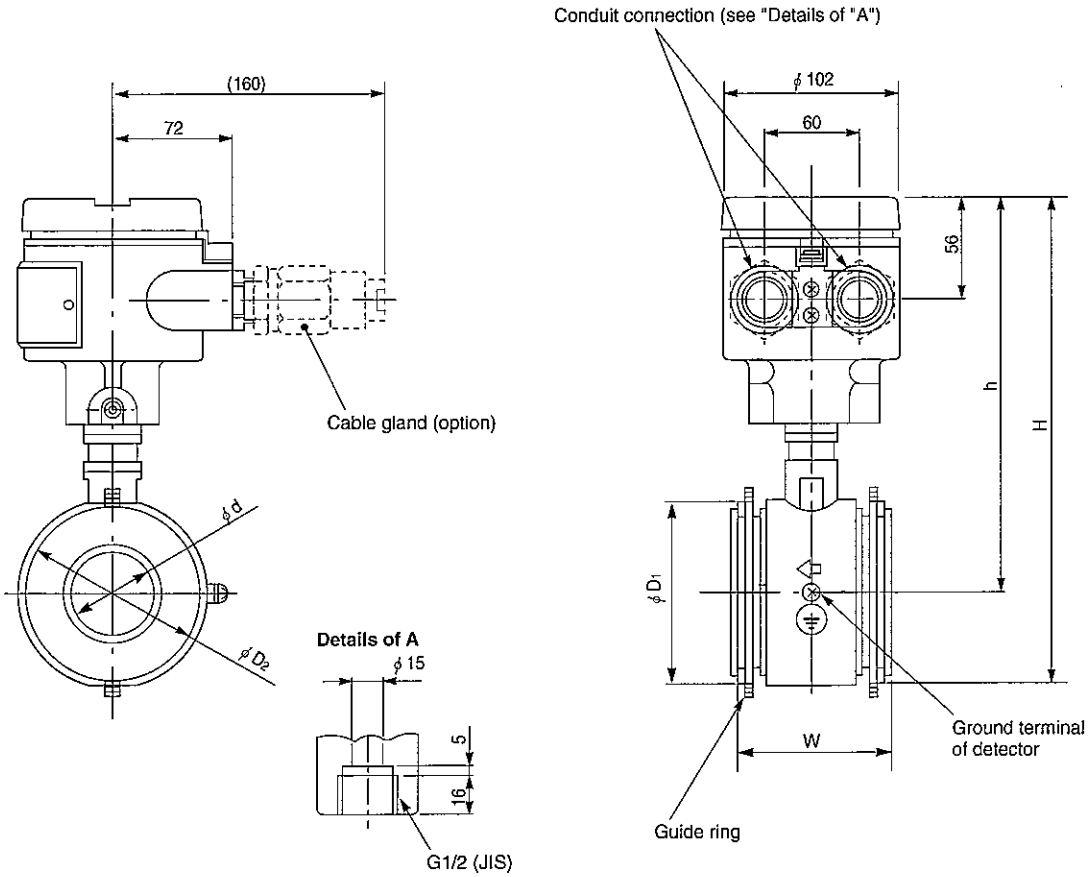


Meter size	φd	Weight [kg]
6A	6	3
15A	12	3

Explosion-proof detector (6A, 15A)



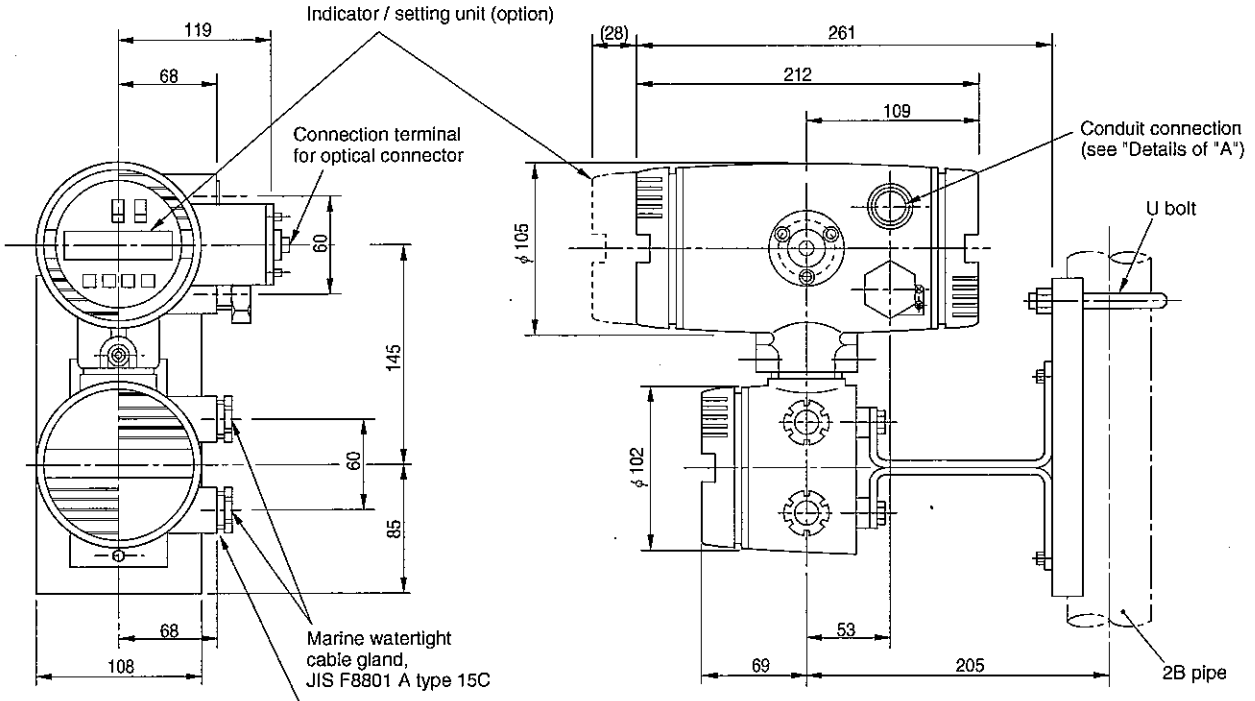
Non-explosion-proof detector (25A, 50A, 80A, 100A, 150A)



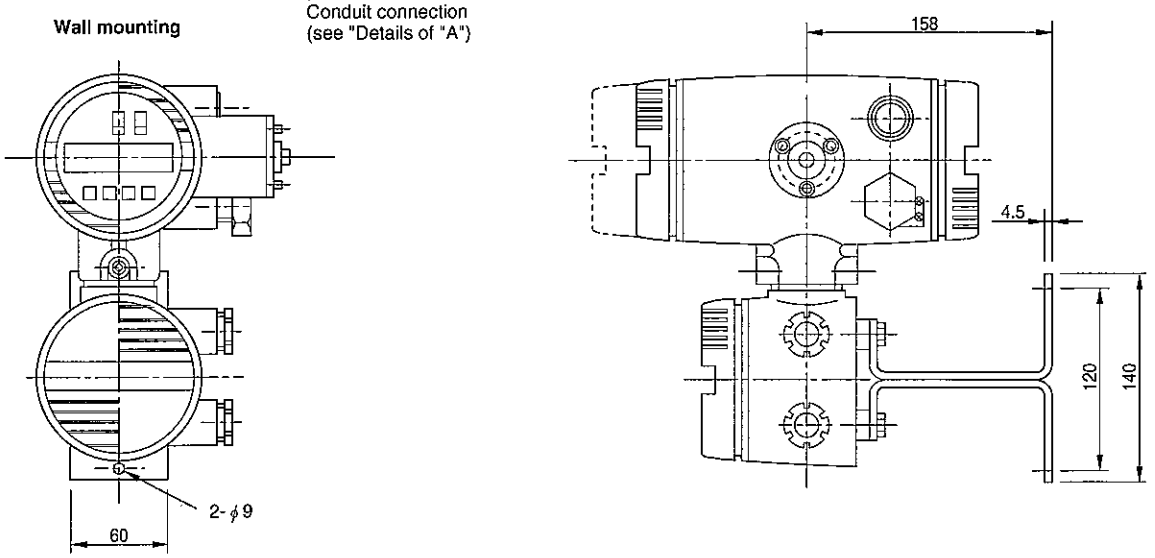
Explosion-proof detector (25A, 50A, 80A, 100A, 150A)

Meter size	W	ϕd	ϕD1	Guide ring ϕD2			h	H	Weight [kg]
				JIS10K	JIS20K	JIS75M			
25A	65	21	70	76	76		212	247	3
50A	80	48	96	106	106		225	273	4
80A	100	76	128	136	142	154	241	305	4.5
100A	120	100	156	161	167	181	255	333	6.5
150A	165	150	206	222	240	233	280	383	10.5

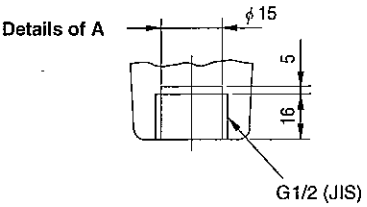
Pipe mounting



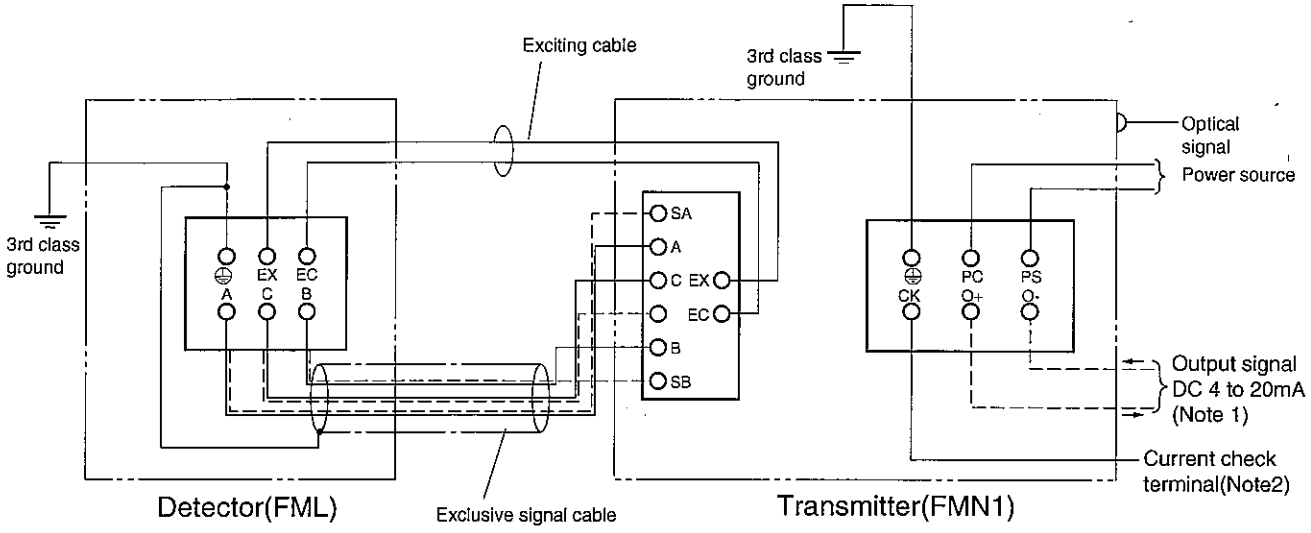
Wall mounting



Transmitter



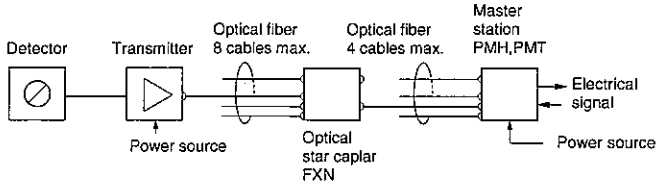
CONNECTION DIAGRAM

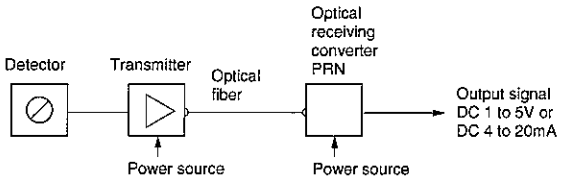


Note 1. When transmitting current output,connect lead wires to "0+"and"0-".

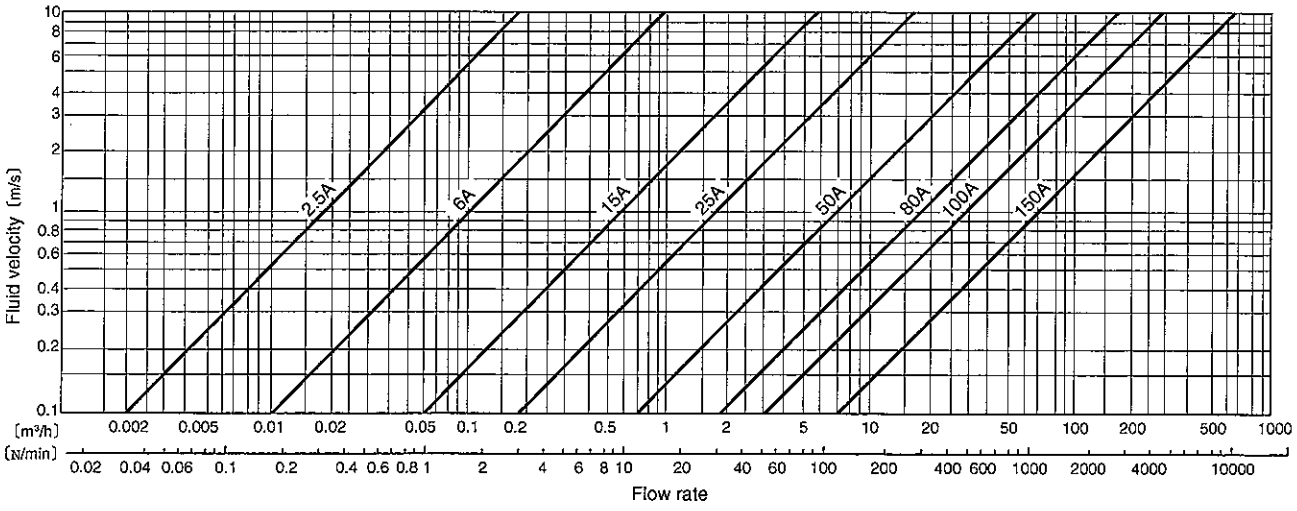
2. Current output being transmitted can be checkd at the CK (check) terminal and "0+" terminal
Connect the "+" side of the check current ammeter (internal resistance : less than 10Ω) to CK and the "-" side to "0+".

SYSTEM BLOCK DIAGRAM





FLOW RATE vs. FLUID VELOCITY CONVERSION DIAGRAM



SCOPE OF DELIVERY

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

RELATED DEVICES

- Master station (Date sheet No. EDS11–86)
- Optical receiving converter (Data sheet No. EDS9–43)
- Optical star caplar (Data sheet No. EDS8–43)
- Optical connector
- Assembling tool for optical connector
- Optical cable

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