OPTICAL PRESSURE TRANSMITTER REMOTE SEAL TYPE

DATA SHEET **FBM···3**

The Model FBM 3 Optical Pressure Transmitter Remote Seal Type measures pressures of various fluids accurately, converts them into optical digital signals and outputs them. This is an intelligent transmitter providing excellent performance and functions due to incorporation of electrostatic capacitance type silicon sensor and microprocessor.

A fiber optic cable used for the signal transmission line forms an optical field instrumentation system together with an optical star coupler and a master station.

FEATURES

1. Resistive to noise and lightning
   Optical signal ensures a reliable signal transmission, because it is not affected by external noise and inductive lightning. Use of a nonmetallic optical (fiber) cable prevents propagation of inductive lightning through the cable, so a signal transmission immune to lightning can be realized.
2. Reliability due to redundant configuration
   Host system can be duplicated by using two optical cable trunk lines (between an optical star coupler and host system). This enhances reliability of users' systems.
3. Intrinsic safety type explosion-proof
   Each equipment with a built-in battery can be constructed so as to be an intrinsic safety type individually (intrinsic safety type barrier unnecessary).

SPECIFICATIONS

Functional specifications

Fluids measured: Liquid, gas or steam

Measuring range:

Type	Span [kPa]		Range limit [kPa]		Max. allowable over-pressure [MPa]
	Minimum value	Maximum value	Lower range limit	Upper range limit	
FBM□□1	3.25	130	Determined by allowable operating pressure limit of particular fill fluid (See table at right.)	130	1
FBM□□2	12.5	500		500	1.5
FBM□□3	75	3000		3000	4.5
FBM□□4	250	10000		10000	15
FBM□□5	1250	50000		50000	75

Operating pressure: Up to the maximum value of measuring range, provided the maximum operating pressure of flange should not be exceeded.

Process temperature, Allowable pressure limit:

Fill-fluid	13th code digit	Process temperature	Allowable pressure limit
Fluorolube oil	W, A, D	–20 to 120°C	Atmospheric pressure or higher
Silicon oil	H	–15 to 250°C	
Silicon oil	J	85 to 300°C	
Silicon oil	Y, G	–40 to 120°C	2.7 kPa abs or higher See Fig. 1.
Silicon oil	S	–15 to 250°C	
Silicon oil	T	85 to 300°C	
Silicon oil	K	–15 to 200°C	0.13 kPa abs or higher See Fig. 2.

For small bores 40A, 50A, 1-1/2B, 2B:

Fill-fluid	13th code digit	Process temperature	Allowable pressure limit
Fluorolube oil	W, A, D	–20 to 120°C	Atmospheric pressure or higher
Silicon oil	H	0 to 250°C	
Silicon oil	Y, G	–40 to 120°C	2.7 kPa abs or higher See Fig. 1.
Silicon oil	S	0 to 250°C	

Self-diagnosis: Displayed on indication unit (option) and transmitted to master station.

Item	Host system	Indication unit
Measuring range abnormal	○	○
Detecting unit failure	○	○
Amplifier abnormal	○	○
Battery voltage	○	—
Battery voltage low alarm	○	○

Remote control function: See Table 1.

Output signal: Optical digital signal

Power supply: Built-in lithium battery (expected life about 4 years)

Optical cable: Code set type, silica fiber ... core/clad diameter 100/140 μm

Optical connector: FC connector

Transmission distance:
1.5 km max. (when transmission loss of optical cable is 4 dB/km)

Damping: Variable from 0.2 to 32 sec (time constant)

Zero elevation and suppression:
Possible within a range from –0.1 MPa to maximum span.

Explosion-proof: Intrinsic safety type, JIS ib IIC T3

Ambient temperature:
–30 to +70°C
–10 to +60°C for intrinsic safety explosion-proof type
–20 to +70°C when provided with indicator
–10 to +60°C when filled with fluorolube oil
–10 to +70°C for silicone oil codes H, S and K
+20 to +70°C for silicone oil codes J and T

For small bores 40A, 50A, 1-1/2B, 2B:
–15 to +65°C
–10 to +60°C for intrinsic safety explosion-proof type
–15 to +65°C when provided with indicator
–10 to +60°C when filled with fluorolube oil
–10 to +60°C for silicone oil codes H and S.

Storage temperature:
–40 to +80°C

Performance specifications

Accuracy rating (Note)	±0.2% when measuring span is 1/10 or more of maximum span $\pm(0.1 + 0.01\frac{\text{max. span}}{\text{measuring span}})$% when measuring span is less than 1/10 of maximum span.

Note: Percent value with respect to measuring span (including linearity, hysteresis and repeatability in standard 23°C status)

For small bores 40A, 50A, 1-1/2B, 2B:

Accuracy rating (Note)	±0.25% when measuring span is 1/10 or more of maximum span $\pm(0.17 + 0.008\frac{\text{max. span}}{\text{measuring span}})$% when measuring span is less than 1/10 of maximum span.

Ambient temperature effect:
Zero shift: $\pm(0.5\frac{URL}{x})$% / 28°C
Overall shift: $\pm(0.7\frac{URL}{x})$% / 28°C
Where; URL: Maximum span
x: Measuring span
2 times as large as above when the 7th digit (material) is other than V, A, B, C and D.

Remarks: (1) This is an output change when the process pressure receiving unit and the transmitter body are at the same height and temperature.
(2) Error is larger when there is a temperature difference among the process pressure receiving unit, capillary and transmitter body.

Ambient temperature effect:
For small bores 40A, 50A, 1-1/2B, 2B:
Zero shift: ±0.7% / 28°C (x equal to 1/2 URL or more)
Zero shift: $\pm0.7\frac{URL}{2x}$ % / 28°C (x less than 1/2 URL)
Overall shift: ±0.9% / 28°C (x equal to 1/2 URL or more)
Overall shift: $\pm(0.4 + 0.5\frac{URL}{2x})$% / 28°C ($x$ less than 1/2 URL)
Note 1: Condition; Capillary length is limited to max. 3 m. With a capillary of 5 m long, the effect is 1.5 times as large as the above.
Note 2: The effect is 2.5 times as large as the above when the 7th code digit (material) is other than V, A, B, C and D.

Maximum allowable pressure effect:
Zero shift at maximum span
±0.2% / nominal pressure of flange
For small bores 40A, 50A, 1-1/2B, 2B:
±0.2% / (1.5 x URL)
URL: Maximum span

Measurement period:
0.2 sec

Response time: Time constant 0.3 sec (Value at capillary length 1.5 m and 23°C)
Dead time: About 0.2 sec

Physical specifications

Flange material: SUS304
Screw-in design for 10 and 50 MPa specifications (thread material: carbon steel)

Material:

Material code	Seal diaphragm	Other wetted parts
V, A, B, C, D	SUS316L	SUS316
H, F, G, K, L	Hastelloy-C	Hastelloy-C
M	Monel	Monel
T	Tantalum	Tantalum
P	Titanium	Titanium
R	Zirconium	Zirconium

Note 1: Selected according to combination of type codes. Refer to CODE SYMBOLS.

Capillary: Stainless steel pipe coated with PVC

Finish: Epoxy-polyurethane double coat, Color: silver (blue for amplifier case cover)

Environmental protection:
Meets JIS C0920, immersion-proof (equivalent to IEC IP67 or NEMA 6/6P)

External dimensions:
See OUTLINE DIAGRAM.

Mass: 10.5 to 13.5 kg

Optical cable connection:
G1/2 or 1/2 -14NPT (whichever selected by code symbol)

Process connection:
JIS specifications;
10K, 20K, 30K, 63K-40, 50A
10K-80A, 100A
ANSI/JPI specifications;
150LB, 300LB, 600LB, 1-1/2B, 2B
150LB-3B, 4B

Diaphragm extension:
0, 50, 100, 150 or 200 mm (as specified)

Mounting method:
U-bolt mounting to a 50A (2B) pipe. Detection unit is mounted with flange or between flanges (wafer type).

Orientation of transmission unit:
Indicator unit turnable 90° upward/downward relative to detection unit.

Capillary length: Max. 10 m
Max. 5 m for small bore 40A, 50A, 1-1/2B or 2B

Optional specifications

Indication unit: 5-digit LCD indication, % or real scale indication (as specified by code symbol)
Operating temperature range: –20 to +70°C

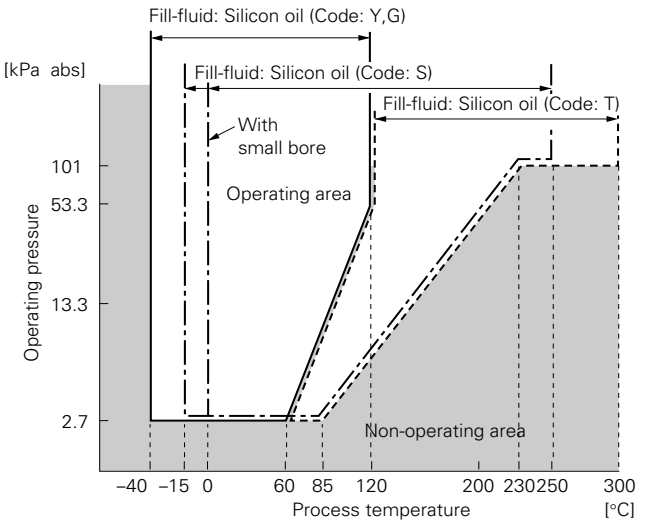
Oxygen oil-proof processing:
Fluorolube filled.
Wetted parts degreased and cleaned.
Chlorine service: Fluorolube oil filled.

} Varies with material. Refer to CODE SYMBOLS.

Table 1 Remote Control Function
(Items readable and setting from hand-held communicator)

Item	Reading	Setting	Description
Maximum range	○	—	Maximum measuring range of equipment
Measuring range	○	○	Actual measuring range
Damping	○	○	Variable within 0.2 to 32 sec.
Real scale indication	○	○	Indication in industrial value
Battery voltage	○	—	Battery voltage of equipment
Error indication	○	—	Errors of detection unit and amplifier
Measured value	○	—	Measured data
Adjustment	○	○	Zero and span adjustment

Note: For operation of the "3" type transmitter ("3" at the 8th digit of product code), a hand-held communicator is required to have a version 1.6 or higher, but a communicator before version 1.6 can be operated with memory data updated. (Refer to the instruction manual of transmitter.)



Note: For use at a vacuum level, the transmitter body should be mounted below the flange section mounting position.

Fig. 1 Relation between process temperature and operating pressure

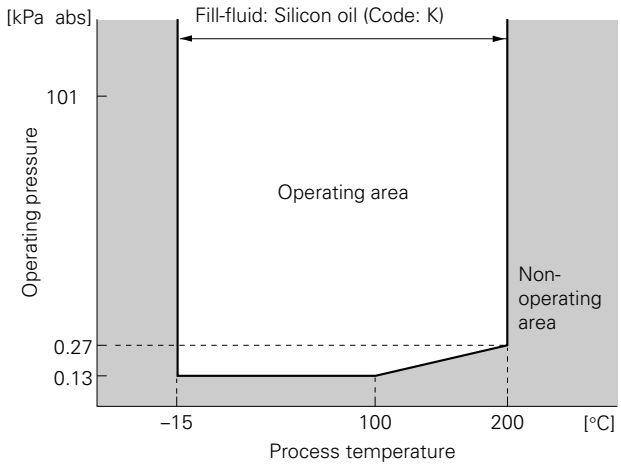
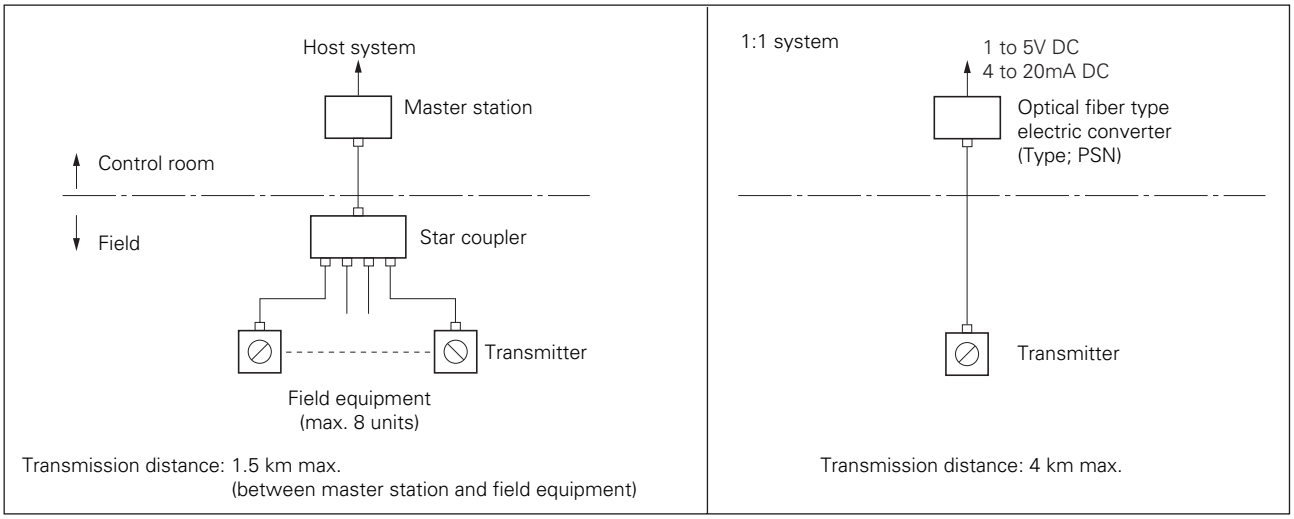
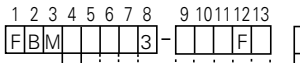


Fig. 2 Relation between process temperature and operating pressure

SYSTEM BLOCK DIAGRAM



CODE SYMBOLS



Description

Cable lead-in port (4th digit)

- S: G1/2
- T: 1/2-14NPT

Flange (5th digit)

	Material	Rating	Code usable at 6th digit	Code usable at 7th digit
0	SUS304	JIS 10K 80A	1,2,3	All codes usable
1		JIS 10K 100A	1,2,3	P and R unusable
3		ANSI/JPI 150LB 3B	1,2,3	All codes usable
4		ANSI/JPI 150LB 4B	1,2,3	P and R unusable
A		JIS 10K 40A	3	V,H,M,T
B		JIS 10K 50A	3	V,A to D,H,M,T
C		JIS 20K 40A	3	V,H,M,T
D		JIS 20K 50A	3	V,A to D,H,M,T
E		JIS 30K 40A	3,4	V,H,M,T
F		JIS 30K 50A	3,4	V,A to D,H,M,T
G		JIS 63K 40A	3,4	V,H,M,T
H		JIS 63K 50A	3,4	V,A to D,H,M,T
J		ANSI/JPI 150LB 1 1/2B	3	V,H,M,T
L		ANSI/JPI 150LB 2B	3	V,A to D,H,M,T
M		ANSI/JPI 300LB 1 1/2B	3	V,H,M,T
N		ANSI/JPI 300LB 2B	3	V,A to D,H,M,T
V		ANSI/JPI 600LB 1 1/2B	3,4	V,H,M,T
W		ANSI/JPI 600LB 2B	3,4	V,A to D,H,M,T
P	Wafer type (without flange)	For JIS 80A, ANSI/JPI 3B	1,2,3	All codes usable
Q		For JIS100A, ANSI/JPI 4B	1,2,3	P and R unusable
R		For JIS 50A, ANSI/JPI 2B	3,4	V,A to D,H,M,T
S		For JIS 40A, ANSI/JPI 1 1/2B	3,4	V,H,M,T
K	Screw-in type	JIS G1 thread	4,5	V

Measuring span (6th digit)

- 1: 3.25.....130kPa
- 2: 12.5..... 500kPa
- 3: 75..... 3000kPa …Selectable when 7th digit is V, A, B, C, D, H, M or T.
- 4: 250..... 10000kPa } Must be specified for 5th code K.
- 5: 1250.... 50000kPa } 7th digit must be V.

Material and diaphragm extension (7th digit)

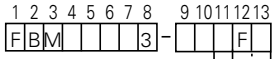
	Seal diaphragm	Other wetted parts	Diaphragm extension (mm)	
V	SUS316L	SUS316	0	
A	SUS316L	SUS316	50	Only 5th codes 1, 4 and Q are selectable when these codes are used in combination with 13th codes S, T or K.
B	SUS316L	SUS316	100	
C	SUS316L	SUS316	150	
D	SUS316L	SUS316	200	
H	Hastelloy-C	Hastelloy-C	0	
F	Hastelloy-C	Hastelloy-C	50	
G	Hastelloy-C	Hastelloy-C	100	
K	Hastelloy-C	Hastelloy-C	150	
L	Hastelloy-C	Hastelloy-C	200	
M	Monel	Monel	0	
T	Tantalum	Tantalum	0	
P	Titanium	Titanium	0	Selectable when 6th digit is 2 and 5th digit is 0, 3 or P.
R	Zirconium	Zirconium	0	

Indicator (9th digit)

- A: Not provided
- L: Digital, % indication
- P: Digital, real scale indication

Explosion-proof (10th digit)

- A: Non-explosion proof
- G: Intrinsic safety, JIS



	Description
	Capillary length (11th digit)
A	1.5m
B	3m
C	5m
G	6m.....Selectable when 5th digit is 0, 1, 3, 4, P or Q.
H	7m } Selectable when 5th digit is 0, 1, 3, 4, P or Q and 13th digit is Y, W, G, A or D.
J	8m } Selectable when 5th digit is 0, 1, 3, 4, P or Q and 13th digit is Y, W, G, A or D.
K	10m } Selectable when 5th digit is 0, 1, 3, 4, P or Q and 13th digit is Y, W, G, A or D.

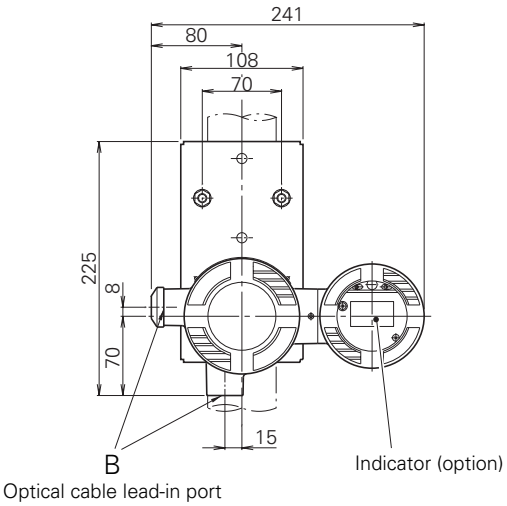
Treatment and fill-fluid (13th digit)

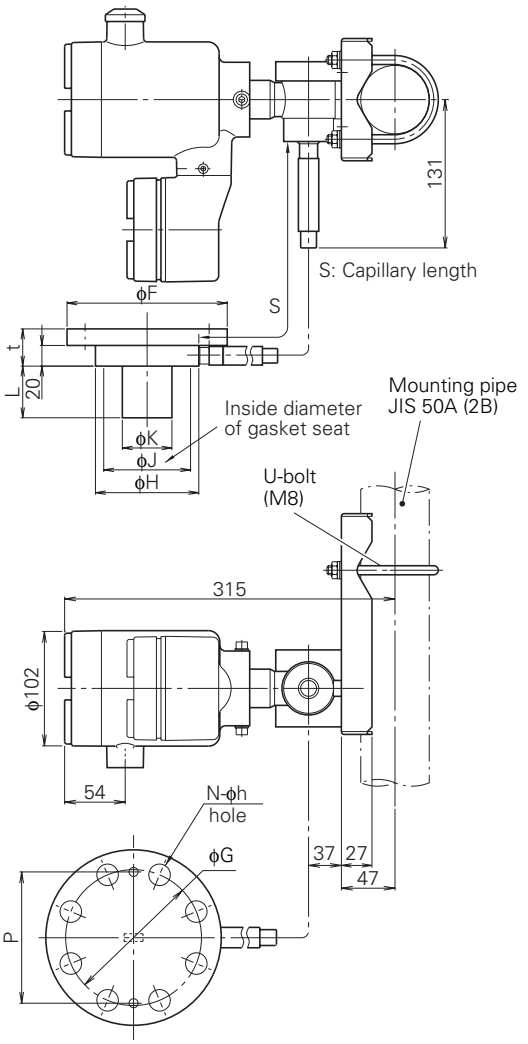
		Treatment	Fill-fluid
	Y	None	Silicon oil
	W	None	Fluorolube oil
	G	Degreasing	Silicon oil
	A	Oxygen oil-proof processing	Fluorolube oil..... when 7th digit is V, A, B, C or D
	D	Chlorine service	Fluorolube oil..... when 7th digit is H, F, G, K, L or T
	H	None	Silicon oil (for high temperature) } when 6th digit is 1, 2, 3, and 7th digit is V, A, B, C or D
Note 1	J	None	Silicon oil (for high temperature) } when 6th digit is 1, 2, 3, and 7th digit is V, A, B, C or D
	S	None	Silicon oil (for high temperature and vacuum) } when 6th digit is 2, and 7th digit is V, A, B, C or D
Note 1	T	None	Silicon oil (for high temperature and vacuum) } when 6th digit is 2, and 7th digit is V, A, B, C or D
Note 1	K	None	Silicon oil (for high temperature and high vacuum) } when 6th digit is 2, and 7th digit is V, A, B, C or D

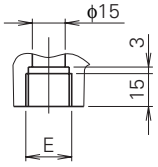
Note 1: Inapplicable for small bores 40A, 50A, 1-1/2B and 2B.

OUTLINE DIAGRAM (Unit : mm)

FBM □ (0 C J / 1 D L / 3 E M / 4 F N / A G V / B HW) (1 2 3 4) □3







Details of "B"

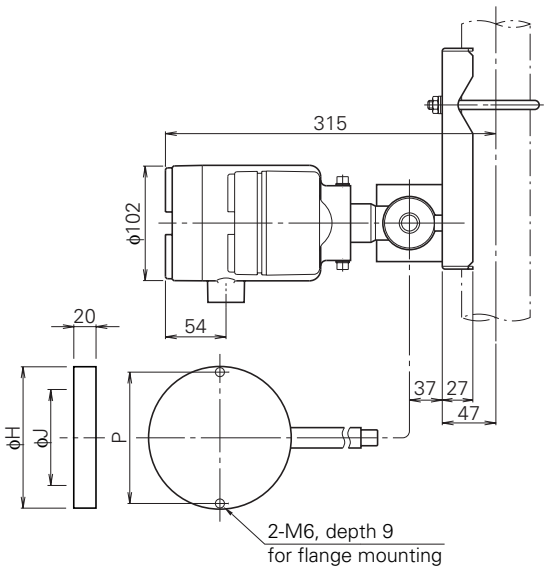
Type	E
FBMS	G1/2
FBMT	1/2-14NPT

Type	L	Mass (kg)
FBM***V3 FBM***H3 FBM***M3 FBM***T3 FBM***P3 FBM***R3	0	10.5
FBM***A3 FBM***F3	50	11.5
FBM***B3 FBM***G3	100	12.5
FBM***C3 FBM***K3	150	13
FBM***D3 FBM***L3	200	13.5

Type	ϕF	ϕG	ϕH	ϕJ	ϕK	t	P	N-ϕh	FLANGE
FBM*0**3	185	150	126	100	73	38	116	8-19	JIS-10K-80A
FBM*1**3	210	175	151	103	96	38	141	8-19	JIS-10K-100A
FBM*3**3	191	152.5	126	100	73	44	116	4-20	ANSI/JPI 150lB 3B
FBM*4**3	229	190.5	151	103	96	44	141	8-20	ANSI/JPI 150lB 4B
FBM*A**3	140	105	84	49	48	36	71	4-19	JIS-10K-40A
FBM*B**3	155	120	84	49	48	36	71	4-19	JIS-10K-50A
FBM*C**3	140	105	84	49	48	38	71	4-19	JIS-20K-40A
FBM*D**3	155	120	84	49	48	38	71	8-19	JIS-20K-50A
FBM*E**3	160	120	84	49	48	42	71	4-23	JIS-30K-40A
FBM*F**3	165	130	84	49	48	42	71	8-19	JIS-30K-50A
FBM*G**3	175	130	84	49	48	52	71	4-25	JIS-63K-40A
FBM*H**3	185	145	84	49	48	54	71	8-23	JIS-63K-50A
FBM*J**3	127	98.4	84	49	48	37.5	71	4-16	ANSI/JPI 150LB 1 1/2B
FBM*L**3	152	120.6	84	49	48	39.5	71	4-20	ANSI/JPI 150LB 2B
FBM*M**3	156	114.3	84	49	48	41	71	4-23	ANSI/JPI 300LB 1 1/2B
FBM*N**3	165	127	84	49	48	42.5	71	8-20	ANSI/JPI 300LB 2B
FBM*V**3	156	114.3	84	49	48	42.5	71	4-23	ANSI/JPI 600LB 1 1/2B
FBM*W**3	165	127	84	49	48	45.5	71	8-20	ANSI/JPI 600LB 2B

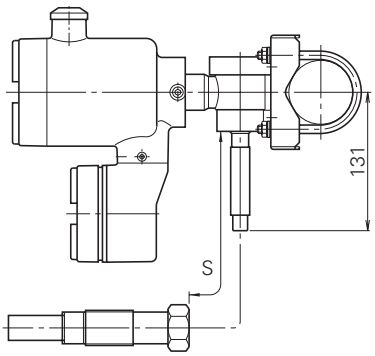
Note) For S (capillary length), refer to CODE SYMBOLS.

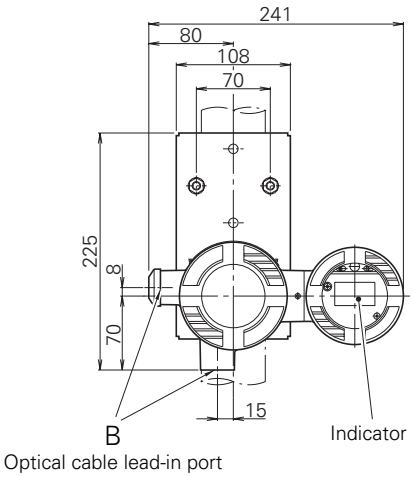
FBM□ P Q R S 1 2 3 4 □3



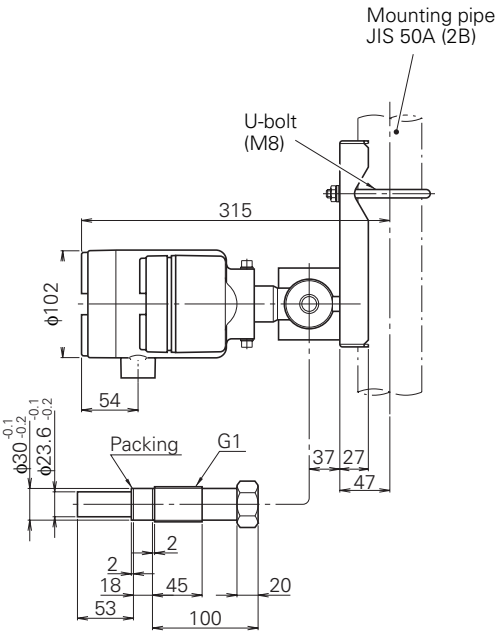
Type	ϕH	ϕJ	P	FLANGE
FBM*P**3	126	100	116	80A, 3B
FBM*Q**3	151	103	141	100A, 4B
FBM*R**3	84	49	71	50A, 2B
FBM*S**3	84	49	71	50A, 1 1/2B

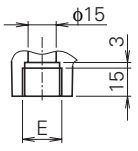
FBM□ K 4 5 V3





Optical cable lead-in port





Details of "B"

Type	E
F B M S	G1/2
F B M T	1/2-14NPT

Note) For S, refer to CODE SYMBOLS.

SCOPE OF DELIVERY

Instrument body and pipe fixture (as specified)

ORDERING INFORMATION

1. Model type
2. Measuring range
3. Indication scale for real scale specification
4. Others

⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.

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