FUJI ELECTRIC

FCX – AX SERIES REMOTE SEAL TYPE PRESSURE TRANSMITTER

DATA SHEET FHB, FKB···3

The FCX – AX pressure transmitter accurately measures gauge pressure and transmits a proportional 4 to 20mA signal.

The transmitter utilizes a unique micromachined capacitance silicon sensor with state-of -the-art microprocessor technology to provide exceptional performance and functionality.

Totally welded construction of the seals assures excellent reliability in high temperature and highly corrosive process conditions.

FEATURES

1. High accuracy
   0.2% accuracy for all calibrated spans is a standard feature for all GP models covering 6.4kPa{0.064bar} range to 50000kPa{500bar} high pressure range. 0.1% accuracy is available as option. Fuji's micro-capacitance silicon sensor assures this accuracy for all elevated or suppressed calibration ranges without additional adjustment.
2. Minimum environmental influence
   The "Advanced Floating Cell" design which protects the pressure sensor against changes in temperature, and overpressure substantially reduces total measurement error in actual field applications.
3. Replaceable Communication Module
   Fuji micro-electronics manufacturing technology offers replaceable communication module that makes FCX – AX transmitter very unique in design. In case of change in communication protocol, all that needs to be done is just to replace the module and the transmitter gets upgraded to the new version.
4. Fuji/HART bilingual communication module
   The communication module is "bilingual" to speak both Fuji proprietary protocol and HART. Any HART compatible devices can communicate with FCX–AX series transmitters.
5. Application flexibility
   Various options that render the FCX – AX suitable for almost any process applications include:
   — Analog indicator at either the electronics side or terminal side
   — Full range of hazardous area approvals
   — Built-in RFI filter and lightning arrester
   — $4\frac{1}{2}$ -digits LCD meter
   — Stainless steel electronics housing
   — Wide selection of materials
   — High temperature, high vacuum seals
6. Burnout current flexibility (Under Scale: 3.2 to 3.8mA, Over Scale: 20.8 to 21.6mA)
   Burnout signal level is adjustable using Model FXW hand Held Communicator (HHC) to comply with NAMUR NE43. (Available for amplifier unit from version 24 and FXW(HHC) version 5.3.)
7. Dry calibration without reference pressure
   Thanks to the best combination of unique construction of mechanical parts (Sensor unit) and high performance electronics circuit (Electronics unit), reliability of dry calibration without reference pressure is at equal level as wet calibration.

SPECIFICATIONS

Functional specifications

Type:
Model FHB: 4 to 20mA
Model FKB: 4 to 20mA with digital signal

Service: Liquid, gas, or vapour

Span, range, and overrange limit:

Type	Span limit [kPa]{bar}			Range limit [kPa]{bar}	Overrange limit [MPa] {bar}
	Min.		Max.		
	FHB	FKB	FHB/FKB		
F□B□□1	6.4 {0.064}	0.64 {0.0064}	64 {0.64}	–64 to +64 {–0.64 to +0.64}	1 {10}
F□B□□2	50 {0.5}	5 {0.05}	500 {5}	–100 to +500 {–1 to +5}	1.5 {15}
F□B□□3	300 {3}	30 {0.3}	3000 {30}	–100 to +3000 {–1 to +30}	9 {90}
F□B□□4	1000 {10}	100 {1}	10000 {100}	–100 to +10000 {–1 to +100}	15 {150}
F□B□□5	5000 {50}	500 {5}	50000 {500}	–100 to +50000 {–1 to +500}	75 {750}

Remark: To minimize environmental influence, span should be greater than 1/40 of the max. span in most applications.

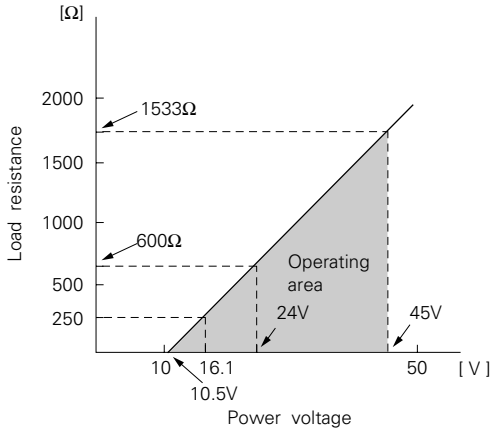
— Lower range limit (vacuum limit) ;
Silicone fill sensor: See Fig. 1
Fluorinated fill sensor: Atmospheric pressure

— Conversion factors to different units;
$1MPa=10^3kPa=10bar=10.19716kgf/cm^2=145.0377psi$
$1kPa=10mbar=101.9716mmH_2O=4.01463inH_2O$

Output signal:
Model FHB: 4 to 20mA DC 2-wire
Model FKB: 4 to 20mA DC with digital signal superimposed on the 4 to 20mA signal.

Power supply: Transmitter operates on 10.5V to 45V DC at transmitter terminals.
10.5V to 32V DC for the units with optional arrester.

Load limitations: see figure below



Note: For communication with HHC (Model: FXW), min. of 250Ω is required.

Hazardous locations: (Approval pending)

Authorities	Flameproof	Intrinsic safety	Type N Nonincendive
BASEEFA Factory Mutual	Ex ds IIC T5, T6 Class I II III Div. 1 Groups B thru. G	EEx ia IIC T4, T5 Class I II III Div. 1 Groups A thru. F	Ex N II T5 Class I II III Div. 2 Groups A thru. G
CSA	Class I II III Div. 1 Groups C thru. G	Class I II III Div. 1 Groups A thru. G	Class I II III Div. 2 Groups A thru. G
RIIS	Ex ds IIB+H_2 T4	—	—
SAA	Ex d II C T5, T6 IP 66/67	Ex ia II C T5, T6 IP 66/67	Ex n II C T5, T6 IP 66/67

Zero/span adjustment:

Model FHB: Zero is adjustable from the external adjustment screw.
The adjustment screw can also function to adjust span when MODE SWITCH (located on the electronics unit) is in the span mode. INHIBIT mode to disable the adjustment screw is also available.

Model FKB: Zero and span are adjustable from the HHC. Zero is also adjustable externally from the adjustment screw.

Damping: Adjustable electrical damping.

Model FHB: The time constant is adjustable to 0, 0.3, 1.2, 4.8, or 19.2 seconds.

Model FKB: The time constant is adjustable between 0 to 38.4 seconds.

Zero elevation/suppression:
Zero can be elevated or suppressed within the specified range limit of each sensor model.

Normal/reverse action:
Selectable by moving a jumper pin located on the electronics unit.

Indication: Analog indicator or $4\frac{1}{2}$-digit LCD meter, as specified.

Burnout direction: If self-diagnostic detect transmitter failure, the analog signal will be driven to either "Output Hold", "Output Overscale" or "Output Underscale" modes.

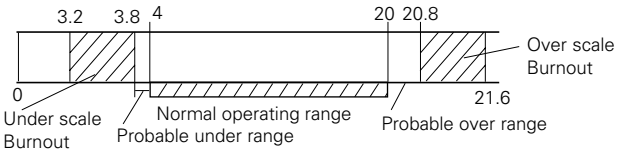
Model FHB: Unless otherwise specified in the order, the transmitter will be shipped in "Output Hold" mode.
(Output signal just before failure happens is maintained.)

Model FKB: Selectable from HHC

"Output Hold":
Output signal is hold as the value just before failure happens.

"Output Overscale":
Approx. 21.6mA
(Adjustable within the range 20.8mA to 21.6mA from HHC)

"Output Underscale":
Approx. 3.8mA
(Adjustable within the range 3.2mA to 3.8mA from HHC)



Loop-check output:

Model FHB: Transmitter can output constant signal of 4mA, 12mA, or 20mA if MODE SWITCH is set to the loop check mode.

Model FKB: Transmitter can be configured to provide constant signal 3.8mA through 21.6mA by HHC.

Temperature limit:

Ambient: –40 to +85°C
(–20 to +80°C for LCD indicator)
(–40 to +60°C for arrester option)
(–10 to +60°C for fluorinated oil fill transmitter)
(–10 to +85°C for silicone oil "H", "S", "K")
(+20 to +85°C for silicone oil "J", "T")
For explosionproof units (flameproof or intrinsic safety), ambient temperature must be within the limits specified by each standard.

Process:

Fill fluid	Code in the 13th digit of "Code symbols"	Process temperature	Lower limit of static press.
Fluorinated oil	W, A and D	–20 to 120°C	Atmospheric pressure
Silicone oil	H	–15 to 250°C	
	J	85 to 300°C	
	Y and G	–40 to 120°C	2.7kPa abs {20mmHg abs}
	S	–15 to 250°C	
	T	85 to 300°C	
	K	–15 to 200°C	0.13kPa abs {1mmHg abs} or more

Storage: –40 to +90°C

Humidity limit: 0 to 100% RH

Communication: (Model FKB only)
With HHC (Model FXW, consult Data Sheet No. EDS8-47), following information can be remotely displayed or reconfigured.

Items	Display	Set
Tag No.	*v*	*v*
Model No.	*v*	*v*
Serial No.	*v*	—
Engineering unit	*v*	*v*
Range limit	*v*	—
Measuring range	*v*	*v*
Damping	*v*	*v*
Output mode	*v*	*v*
Burnout direction	*v*	*v*
Adjustment	*v*	*v*
Output adjust	—	*v*
Data	*v*	—
Self diagnoses	*v*	—
Printer	—	—
External switch lock	*v*	*v*
Transmitter display(*)	*v*	*v*

Note: (*) HHC's version must be more than 5.0 (or FXW □□□□1–□2), to use this function.

Performance specifications

Accuracy rating: (including linearity, hysteresis, and repeatability)

(Standard)
For spans greater than 1/10 of URL: ±0.2% of span
For spans below 1/10 of URL (Model FKB only):

$$\pm \left(0.1+0.1 \frac{0.1 \times \text{URL}}{\text{Span}} \right) \% \text{ of span}$$

(Option) Not available for Max span 50000kPa model.
For spans greater than 1/10 of URL: ±0.1% of span
For spans below 1/10 of URL (Model FKB only):

$$\pm \left(0.05+0.05 \frac{0.1 \times \text{URL}}{\text{Span}} \right) \% \text{ of span}$$

Linearity: 0.1% of calibrated span

Stability: ±0.2% of upper range limit (URL) for 24 months

Temperature effect:
Effect per 28°C change between the limits of –40°C and +85°C
(Standard) Zero shift: ±0.35% of URL
Total effect: ±0.5% of URL
(Option) Zero shift: ±0.25% of URL
Total effect: ±0.275% of URL

Overrange effect: Zero shift; 0.2% of URL for any overrange to maximum limit

Supply voltage effect:
Less than 0.05% of calibrated span per 10V

RFI effect: Less than 0.2% of URL for the frequencies of 20 to 1000MHz and field strength 30 V/m when electronics covers on.
(Classification: 2-abc: 0.2% span per SAMA PMC 33.1)

Step response: Time constant: 0.3s (with 1.5m capillary)
Dead time: approximately 0.3s
(without electrical damping)

Dielectric strength:
500V AC, 50/60Hz 1 min., between circuit and earth.

Insulation resistance:
More than 100MΩ/500V DC.

Turn-on time: 4 sec.

Internal resistance for external field indicator:
12Ω or less

Physical specifications

Electrical connections:
G1/2, 1/2-14 NPT, Pg13.5, or M20 × 1.5 conduit, as specified.

Process connections:
JIS, ANSI, or DIN raised face flanges or screw connection JIS/ISO G1 external thread.
Refer to "Code symbols."

Process-wetted parts material:
Diaphragm: 316L stainless steel, Hastelloy-C Monel, Tantalum, Titanium or Zirconium
Flange face: 316 stainless steel, Hastelloy-C Monel, Tantalum, Titanium or Zirconium
Extension: 316 stainless steel, Hastelloy-C
(Refer to "Code symbols")

Non-wetted parts material:
Electronics housing: Low copper die-cast aluminum alloy (standard), finished with polyester coating, or 316 stainless steel (SCS14 per JIS G5121), as specified.
Capillary: In case of 13th code "Y, W, G, A, D", PVC armored stainless steel.
In case of 13th code "H, J, S, T, K", stainless steel armored stainless steel.
Mounting flange: 304 stainless steel or carbon steel
Fill fluid: Silicone oil (standard) or fluorinated oil (Daifloil)
Mounting bracket: Carbon steel with epoxy coating or 304 stainless steel, as specified

Environmental protection:
IEC IP67 and NEMA 4X

Mounting: On 60.5mm (JIS 50A) pipe using mounting bracket, direct wall mounting

Mass {weight}: Transmitter approximately 10kg without options.
Add; 0.5kg for mounting bracket
0.8kg for indicator option
4.5kg for stainless steel housing option
1.5kg per 50mm extension of diaphragm

Optional features

Indicator: A plug-in analog indicator (1.5% accuracy) can be housed in the electronics compartment or in the terminal box of the housing.
An optional $4\frac{1}{2}$ digits LCD meter is also available.

Arrester: A built-in arrester protects the electronics from lightning surges.
Lightning surge immunity:
4KV (1.2 × 50μs)

Oxygen service: Special cleaning procedures are followed throughout the process to maintain all process wetted parts oil-free.
The fill fluid is fluorinated oil.

Chlorine service: Oil-free procedures as above. Includes fluorinated oil for fill.
Not available with material code "W".

Degreasing: Process-wetted parts are cleaned, but the fill fluid is standard silicone oil. Not for use on oxygen or chlorine measurement.

Vacuum and high temperature service:
Special silicone oil and filling procedure are applied.
See below figure.

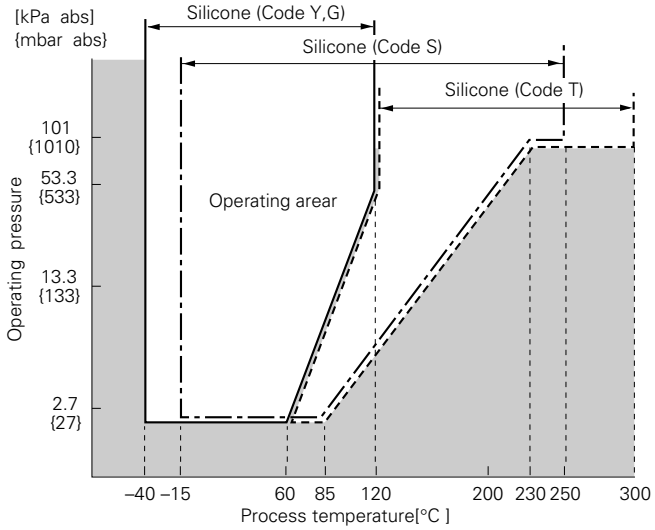


Fig. 1 Relation between process temperature and operating pressure

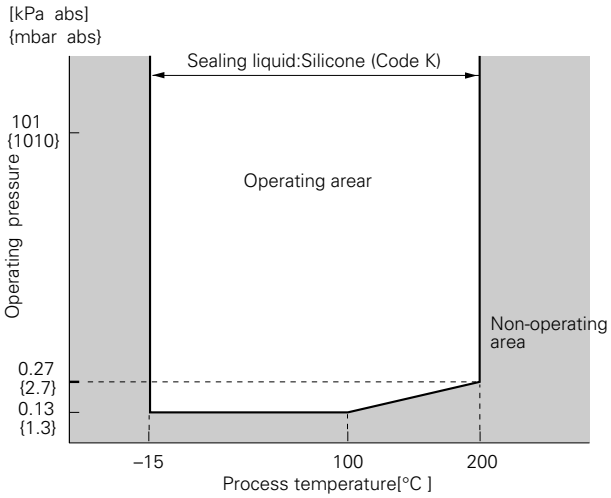


Fig. 2 Relation between process temperature and operating pressure

Customer tag: A stainless steel tag for customer tag data is wired to the transmitter.

Coating of cell: Cell's surface is finished with epoxy/polyurethane double coating. Specify if environment is extremely corrosive.

ACCESSORIES

Hand-held communicator:
(Model FXW, refer to Data Sheet No. EDS8-47)

Communication module: (Standard for FKB)
By adding communication module, remote setting function becomes available for FHB.
Remark: When the communication module is connected, the operation mode of external zero/span adjustment screw is limited to zero adjustment only.

The product conforms to the requirements of the Electromagnetic compatibility Directive 89/336/EEC as detailed within the technical construction file number TN510412. The applicable standards used to demonstrate compliance are :-

EMI (Emission) EN50081-1 : 1992

Test item	Frequency range	Basic standard
Applicable Electromagnetic Radiation Disturbance	30-1000MHz	EN55022 Class B

EMS (Immunity) EN50082-1 : 1992

No.	Test item	Test specification	Basic standard	Performance criteria
1	Electrostatic discharge	8kV (Air)	IEC 801-2:1984	B
2	Radio-frequency electromagnetic field.	27-500MHz 3V/m (Unmodulated)	IEC 801-3:1984	A
3	Fast transients common mode	0.5kV, 5/50 (Tr/Th) ns 5kHz Rep.	IEC 801-4:1988	B

"LVD - The transmitter is not covered by the requirements of the LVD standard."

CODE SYMBOLS

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

3

Description
Type FHB 4 to 20mA, Output type FKB 4 to 20mA with digital signal, Output type
Conduit connection S G 1/2 T 1/2-14NPT V Pg 13.5 W M20 × 1.5

Flanges

	Mounting flange	Flange size and rating	Ranges 1	2	3	4	5
0	304 stainless steel	JIS 10K 80A	*	*	*		
1		JIS 10K 100A	*	*	*		
2		JIS 30K 50A			*		
3		ANSI/JPI 150LB "3"	*	*	*		
4		ANSI/JPI 150LB "4"	*	*	*		
5		ANSI/JPI 600LB "2"			*		
6		DIN PN16/40 DN80	*	*	*		
7		DIN PN16 DN100	*	*	*		
8		DIN PN40 DN50			*		
A	Carbon steel	JIS 10K 80A	*	*	*		
B		JIS 10K 100A	*	*	*		
C		JIS 30K 50A			*		
D		ANSI/JPI 150LB "3"	*	*	*		
E		ANSI/JPI 150LB "4"	*	*	*		
F		ANSI/JPI 600LB "2"			*		
G		DIN PN16/40 DN80	*	*	*		
H		DIN PN16 DN100	*	*	*		
J		DIN PN40 DN50			*		
K		Screw type, JIS/ISO G1				*	*
P	None (wafer type)	3 inch wafer	*	*	*		
Q		4 inch wafer	*	*	*		
R		2 inch wafer			*		

Span limit (*2) [kPa]{bar}

FHB/FKB

1 6.4/0.64…64/64 {0.064/0.0064…0.64/0.64}

2 50/5…500/500 {0.5/0.05…5/5}

3 300/30…3000/3000 {3/0.3…30/30}

4 1000/100…10000/10000 {10/1…100/100}

5 5000/500…50000/50000 {50/5…500/500}

} Available only with material code "W"

Material/diaphragm extension

(*1)

	Diaphragm	Flange face	Diaph. extension [mm]
W	316L stainless steel	316 stainless steel	0
A			50
B			100
C			150
D			200
H	Hastelloy-C	Hastelloy-C	0
F			50
G			100
K			150
L			200
M	Monel	Monel	0
T	Tantalum	Tantalum	0
P	Titanium	Titanium	0
R	Zirconium	Zirconium	0

(*3) for 50 / 100 / 150 / 200

(*4) for Titanium / Zirconium

Notes: * (1) If range 4 or 5 is selected, specify material "W" in any cases.

(2) 100: 1 turn down is possible for model FKB, but should be used at a span greater than 1/40 of the maximum span for better performance.

(3) In case of 7th digit code "A", "B", "C", "D" and 13th digit code "S", "T", "K", 5th digit code "1","4","7","B","E","H","Q" is available.

(4) In case of 6th digit code "2","3" and 5th digit "0","3","6","A","D","G","P" is available.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

FHB□□□□3-□□□□□-□□

FKB□□□□3-□□□□□-□□

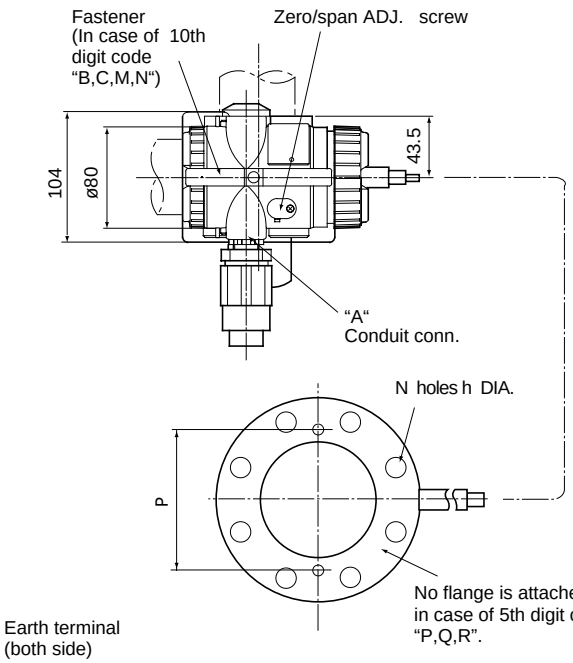
Description		
Indicator and arrester		
	Indicator	Arrester
A	None	None
B	Analog, 0 to 100% linear scale	None
D	Analog, custom scale	None
J	Analog, double scale	None
E	None	Yes
F	Analog, 0 to 100% linear scale	Yes
H	Analog, custom scale	Yes
K	Analog, double scale	Yes
L	Digital, 0 to 100%	None
P	Digital, custom scale	None (Model FKB only)
Q	Digital, 0 to 100%	Yes
S	Digital, custom scale	Yes (Model FKB only)
Approvals for hazardous locations (Approval pending)		
A	None (for ordinary locations)	
B	JIS, Flameproof (Conduit seal)	(Available for 4th digit code "S")
C	JIS, Flameproof (Cable gland seal)	(Available for 4th digit code "S")
D	FM, Flameproof (or explosionproof)	(Available for 4th digit code "T")
E	CSA, Flameproof (or explosionproof)	(Available for 4th digit code "T")
M	BASEEFA, Flameproof (Conduit seal)	
N	BASEEFA, Flameproof (Cable gland seal) (Conduit connection G 1/2 only)	
H	FM, Intrinsic safety and nonincendive	
J	CSA, Intrinsic safety and nonincendive	
K	CENELEC, Intrinsic safety	
P	CENELEC, Intrinsic safety and BASEEFA, Type N	
R	SAA Flameproof (Conduit seal)(Available for 4th digit cord (S,T,W)	
T	SAA Intrinsic safety (Available for 4th digit cord (S,T,W)	
Q	SAA Type–N (non-sparking)(Available for 4th digit cord (S,T,W)	
Capillary and mounting bracket		
	Capillary	Mounting bracket
A	1.5 m	Carbon steel
B	3	Carbon steel
G	5	Carbon steel
C	6	Carbon steel
H	7 (*1)	Carbon steel
J	8 (*1)	Carbon steel
K	10 (*1)	Carbon steel
D	1.5	Stainless steel
E	3	Stainless steel
L	5	Stainless steel
F	6	Stainless steel
M	7 (*1)	Stainless steel
N	8 (*1)	Stainless steel
P	10 (*1)	Stainless steel
Stainless steel parts (*2)		
	Stainless steel tag plate	Stainless steel elec. housing / Coating of cell
Y	None	None / None
B	Yes	None / None
C	None	Yes / None
E	Yes	Yes / None
M	None	None / Yes
N	Yes	None / Yes
P	None	Yes / Yes
Q	Yes	Yes / Yes
Special applications and fill fluid		
	Treatment	Fill fluid
Y	None (standard)	Silicone oil
W	None (standard)	Fluorinated oil
G	Degreasing	Silicone oil
A	Oxygen service	Fluorinated oil (7th digit code "W", "A", "B", "C" and "D")
D	Chlorine service	Fluorinated oil (7th digit code "H", "F", "G", "K", "L" and "T")
H	High temp. 250°C	Silicone oil
J	High temp. 300°C	Silicone oil
S	High temp. and vacuum (250°C)	Silicone oil
T	High temp. and vacuum (300°C)	Silicone oil
K	High temp. and high vacuum	Silicone oil

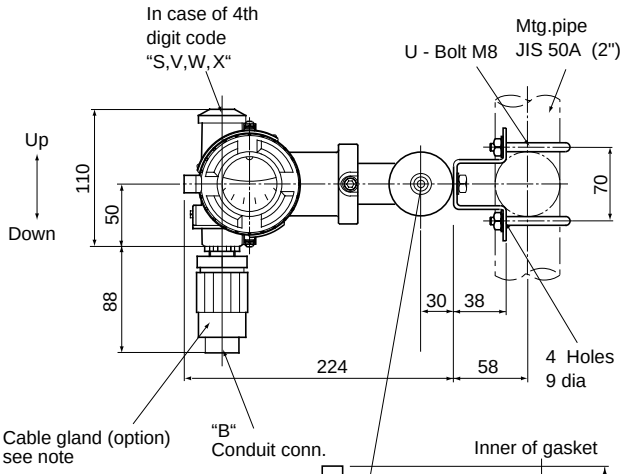
(*3)
- Available for 6th digit code "1", "2" or "3". In case of 13th code "S", "T", "K", available for 6th digit code "2" only.
- Available for 7th digit code "W", "A", "B", "C" or "D".

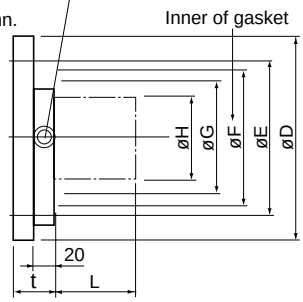
Teflon membrane		
Y	None	
C	Yes (Available for the 5th digit code "0", "2", "3", "5", "6", "8", "A", "C", "D", "F", "G", "J", "P", "R". and 7th digit code "W", "H", "M", "T", "P", "R".)	
Bolt/nut		
Y	None	(6th digit code "1", "2", "3")
A	Cr-Mo alloy hexagon socket head cap screw/carbon steel nut	(6th digit code "4", "5")
B	Cr-Mo alloy hexagon bolt/nut	(6th digit code "4", "5")
E	304 stainless steel/304 stainless steel	(6th digit code "4") (*4)
F	630 stainless steel/304 stainless steel	(6th digit code "5") (*4)

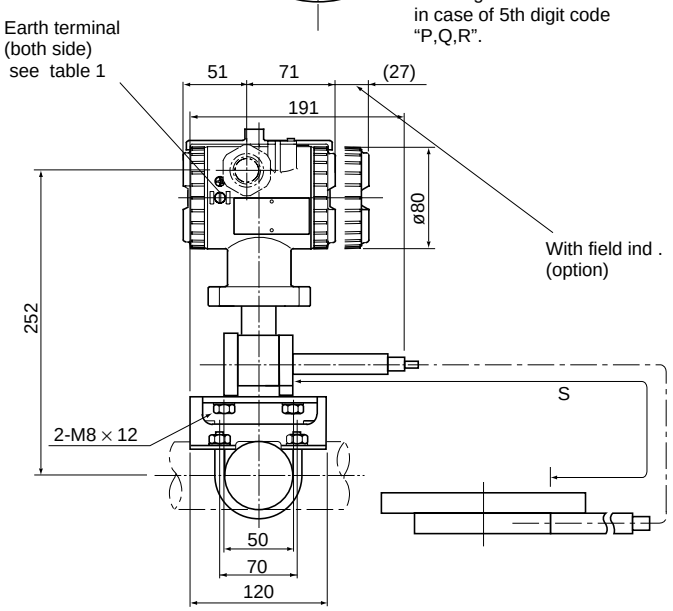
Notes: * (1) Available for 5th digit code "0, 1, 3, 4, 6, 7, A, B, D, E, G, H, P, Q and 13th digit code "Y, W, G, A, D". Inquire about in case of 13th other code.
(2) Not applicable to carbon steel flange material.
(3) Treatment; None
(4) In case of tropical use, select a stainless bolts and nuts.

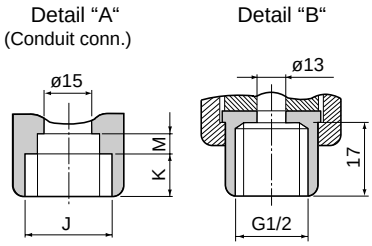
OUTLINE DIAGRAM (Unit:mm)











See table 1

øD	øE	øF	øG	øH	t	P	N-øh	Flange
185	150	126	100	73	38	118	8–19	JIS–10K–80A
210	175	151	103	96	38	143	8–19	JIS–10K–100A
165	130	84	52	48	42	50	8–19	JIS–30K–50A
191	152.5	126	100	73	44	118	4–20	ANSI/JPI –150LB–3"
229	190.5	151	103	96	44	143	8–20	ANSI/JPI –150LB–4"
165	127	84	52	48	45.5	50	8–20	ANSI/JPI –600LB–2"
200	160	126	100	73	44	118	8–18	DIN PN40 DN80
220	180	151	103	96	40	143	8–18	DIN PN16 DN100
165	125	84	52	48	40	50	4–18	DIN PN40 DN50

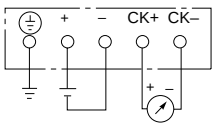
7th digit code	L	Mass approx.(kg)
W H M T P R	0	9.5
A F	50	10.5
B G	100	11.5
C K	150	12
D L	200	12.5

11th digit code	S (m)
A D	1.5
B E	3
G L	5
C F	6
H M	7
J N	8
K P	10

4th digit code	Conduit conn.			Earth terminal
	J	K	M	
S	G1/2	17	8	M4
T	1/2 –14NPT	16	5	No. 8 –32UNC
V	Pg13.5	8	4.5	M4
W	M20 × 1.5	16	5	M4

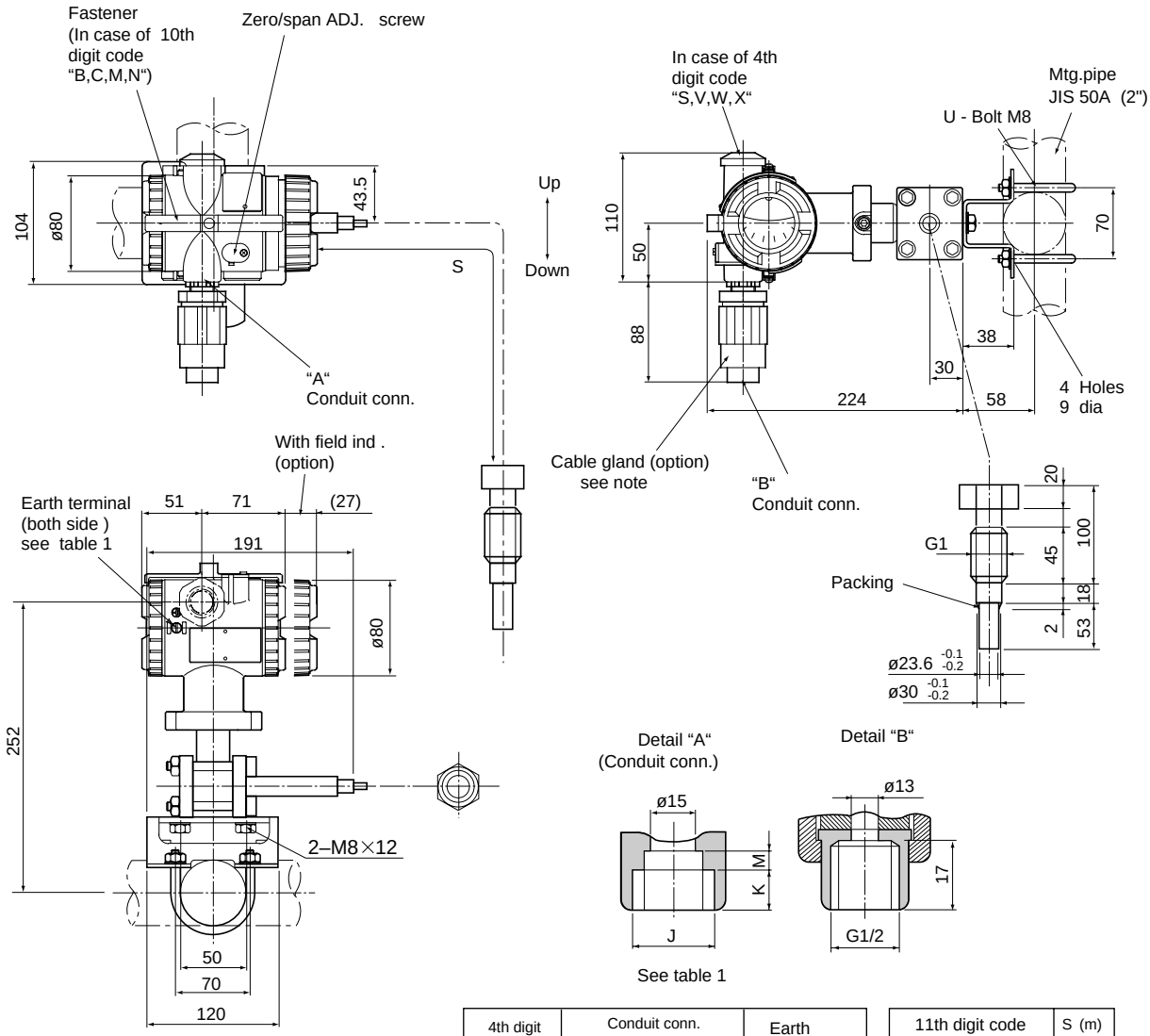
Table 1

CONNECTION DIAGRAM



F H K B S T V W X □ 1 2 3 □ 3

Note) : Cable gland is supplied in case of flameproof packing type.
ø11 cable is suitable.

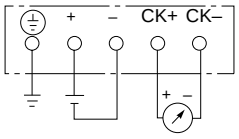


4th digit code	Conduit conn.			Earth terminal
	C	D	E	
S	G1/2	17	8	M4
T	1/2-14NPT	16	5	No.8-32UNC
V	Pg13.5	8	4.5	M4
W	M20 × 1.5	16	5	M4

Table 1

11th digit code	S (m)
A D	1.5
B E	3
G L	5
C F	6
H M	7
J N	8
K P	10

CONNECTION DIAGRAM



F [H K] B [S T V W X] K [V H M T] W3

Note) : Cable gland is supplied in case of flameproof packing type.
ø11 cable is suitable.

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