FUJI ELECTRIC

FCX

FCX – AX SERIES REMOTE SEAL TYPE
DIFFERENTIAL PRESSURE TRANSMITTER

DATA SHEET FHD, FKD···3

The FCX – AX differential pressure transmitter accurately measures differential pressure, liquid level or 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 DP models covering 3.2kPa{32mbar} range to 500kPa{5bar} high differential 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, static pressure, 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. Programmable output Linearization Function
   In addition to Linear and Square Root, output signal can be freely programmable.
   (Up to 14 compensated points at approximation.)
   (Available for amplifier unit from version 24 and FXW(HHC) version 5.3.)
7. 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.)
8. 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 FHD: 4 to 20mA
Model FKD: 4 to 20mA with digital signal

Service: Liquid, gas, or vapour

Static pressure, span, and range limit:

Type	Static pressure	Span limit [kPa] (m bar) Min. FHD	Min. FKD	Max. FHD/FKD	Range limit [kPa] {m bar}
F□D□□3	Up tp flange rating	3.2 { 32 }	0.32 { 3.2 }	32 { 320 }	+/– 32 {+/– 320}
F□D□□5		13 { 130 }	1.3 { 13 }	130 { 1300 }	+/– 130 {+/– 1300}
F□D□□6		50 { 500 }	5 { 50 }	500 { 5000 }	+/– 500 {+/– 5000}

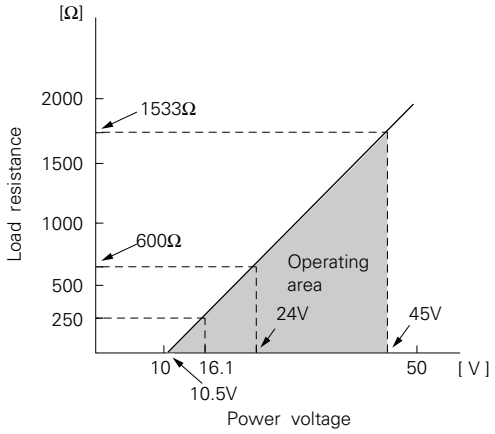
Remark : To minimize environmental influence, span should be greater than 1/40 of the max. span in most applications.
- Lower limit of static pressure (vacuum limit),
  Silicone fill sensor: See Fig. 1
  Fluorinated fill sensor: Atmospheric pressure
- The maximum span of each sensor can be converted to different units using factors as below.
  1MPa=10^3kPa=10bar=10.19716kgf/cm^2=145.0377psi
  1kPa=10mbar=101.976mmH_2O=4.01463H_2O

Overrage limit: To maximum static pressure limit

Output signal:
Model FHD: 4 to 20mA DC 2-wire, linear signal
Model FKD: 4 to 20mA DC (linear or square root) 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 required.

Hazardous locations: (Approval pending)

Authorities	Flameproof	Intrinsic safety	Type N Nonincendive
BASEEFA	Ex ds IIC T5, T6	EEx ia IIC T4, T5	Ex N II T5
Factory Mutual	Class I II III Div. 1 Groups B thru. G	Class I II III Div. 1 Groups A thru. F	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	Exds 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 FHD: 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 FKD: Zero and span are adjustable from the HHC. Zero is also adjustable externally from the adjustment screw.

Damping: Adjustable electrical damping.
- Model FHD: The time constant is adjustable to 0, 0.3, 1.2, 4.8, or 19.2 seconds.
- Model FKD: The time constant is adjustable between 0 to 38.4 seconds.

Zero elevation/suppression:
–100% to +100% of URL

Normal/reverse action:
- Model FHD: Selectable by moving a jumper pin located on the electronics unit.
- Model FKD: Selectable from HHC

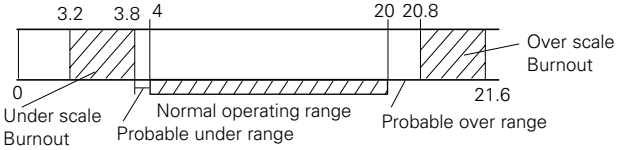
Indication: Analog indicator or $4\frac{1}{2}$-digit LCD meter, as specified.

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 FHD: Unless otherwise specified in the order, the transmitter will be shipped in "Output Hold" mode. (Output signal just before failure happens is maintained.)
- Model FKD: 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 FHD: Transmitter can output constant signal of 4mA, 12mA, or 20mA if MODE SWITCH is set to the loop check mode.
- Model FKD: 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 in 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 FKD 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
Linearise (**)	v	v
Rerange (**)	v	v

Notes: (*) HHC's version must be more than 5.0 (or FXW □□□□1–□2), to use this function.
(**) HHC's version must be more than 5.3, and Amplifier unit version 24.

Programmable output linearization function:
In smart version, output signal can be characterized with "14 points linear approximation function" from HHC.

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 FKD only):

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

(Option)
For spans greater than 1/10 of URL: 0.1% of span
For spans below 1/10 of URL (Model FKD 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 (*):
Effects 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
Note: * Excluding effect by temperature difference between the seals.

Static pressure effect:
Zero shift; 0.2% of URL for flange rating pressure
Double the zero shift for material code.
"H", "F", "G", "K", "L", "M", "T", "P" and "R"
Span shift: $-0.2 \, ^{+0}_{-0.1}$ % of calibrated span for flange rating pressure

Overrange effect: Zero shift; 0.3% of URL for flange rating pressure
Double the effects for material code.
"H", "F", "G", "K", "L", "M", "T", "P" and "R"

Supply voltage effect:
Less than 0.05% fo 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: (without electrical damping)

Range code	Time constant (*)	Dead time
"3"	2 s	Approx. 0.3 s
"5"	1.7 s	
"6"	1.7 s	

Note: * Capillary length: 1.5m

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.
JIS: 10K80A, 10K100A, 30K80A, or 30K100A
ANSI: 150LB 3", 150LB 4", 300LB 3", or 300LB 4"
DIN: PN40 DN80 or PN16 DN100
See OUTLINE DIAGRAM for detailed dimensions.

Diaphragm extension:
0, 50, 100, 150, or 200mm as specified.
(See model code. Extended diaphragm is available only with 316L stainless steel or Hastelloy-C diaphragm)

Process-wetted parts material:
Diaphragm: 316L stainless steel, Hastelloy-C,
Monel, Tantalum, Titanium or Zirconium
Flange face: 316 stainless steel, Hastelloy-C lining
Monel lining, or Tantalum lining
Extension: 316 stainless steel or Hastelloy-C

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 15kg 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.

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

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

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. EDS 8-47)

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

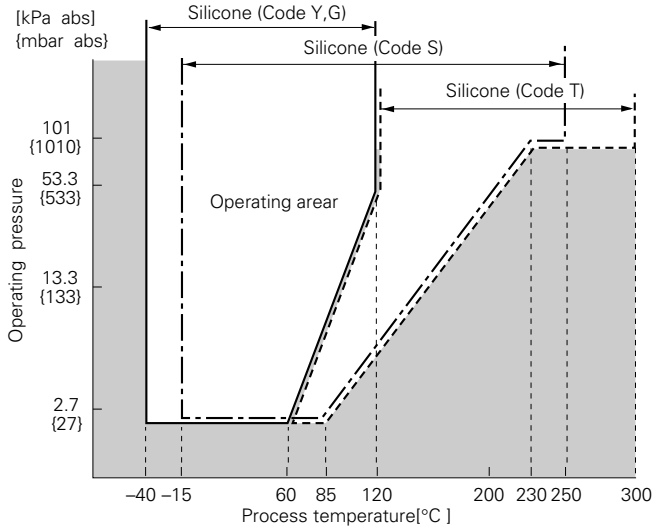


Fig. 1 Relation between process temperature and operating pressure

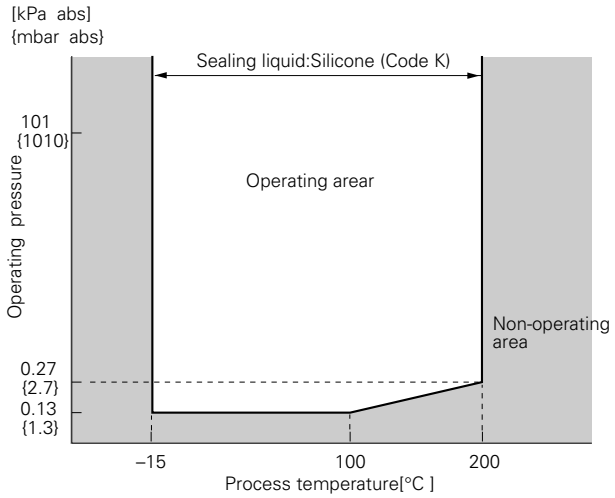


Fig. 2 Relation between process temperature and operating pressure

CODE SYMBOLS

1 2 3	4	5	6	7	8	9 10 11 12 13	14 15	Description
					3		- 0	
FHD FKD								**Type** 4 to 20mA, Output type 4 to 20mA with digital signal, Output type
	S T V W							**Conduit connection** G 1/2 1/2-14NPT Pg 13.5 M20 × 1.5
		0 1 2 3 4 5 6 7 8 9 A B C D E F G H J K P Q						**Flange** Mounting flange: 304 stainless steel Flange size and rating: JIS 10K 80A / JIS 10K 100A / JIS 30K 80A / JIS 30K 100A / ANSI/JPI 150LB 3" / ANSI/JPI 150LB 4" / ANSI/JPI 300LB 3" / ANSI/JPI 300LB 3" / ANSI/JPI 300LB 4" / DIN PN16/40 DN80 / DIN PN16 DN100 Mounting flange: Carbon steel Flange size and rating: JIS 10K 80A / JIS 10K 100A / JIS 30K 80A / JIS 30K 100A / ANSI/JPI 150LB 3" / ANSI/JPI 150LB 4" / ANSI/JPI 300LB 3" / ANSI/JPI 300LB 4" / DIN PN16/40 DN80 / DIN PN16 DN100 Mounting flange: None (wafer type) Flange size and rating: 3 inch wafer / 4 inch wafer
			3 5 6					**Span limit** (*1) [kPa]{m bar} FHD/FKD 3.2/0.32…32/32 {32/3.2…320/320} 13/1.3…130/130 {130/13…1300/1300} 50/5…500/500 {500/50…5000/5000}
				W A B C D H F G K L M T P R				**Material/diaphragm extension** 316L stainless steel / 316 stainless steel / Diaph. extension [mm]: 0, 50, 100, 150, 200 (*2) Hastelloy-C / Hastelloy-C / Diaph. extension [mm]: 0, 50, 100, 150, 200 Monel / Monel / 0 Tantalum / Tantalum / 0 Titanium / Titanium / 0 Zirconium / Zirconium / 0

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

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

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

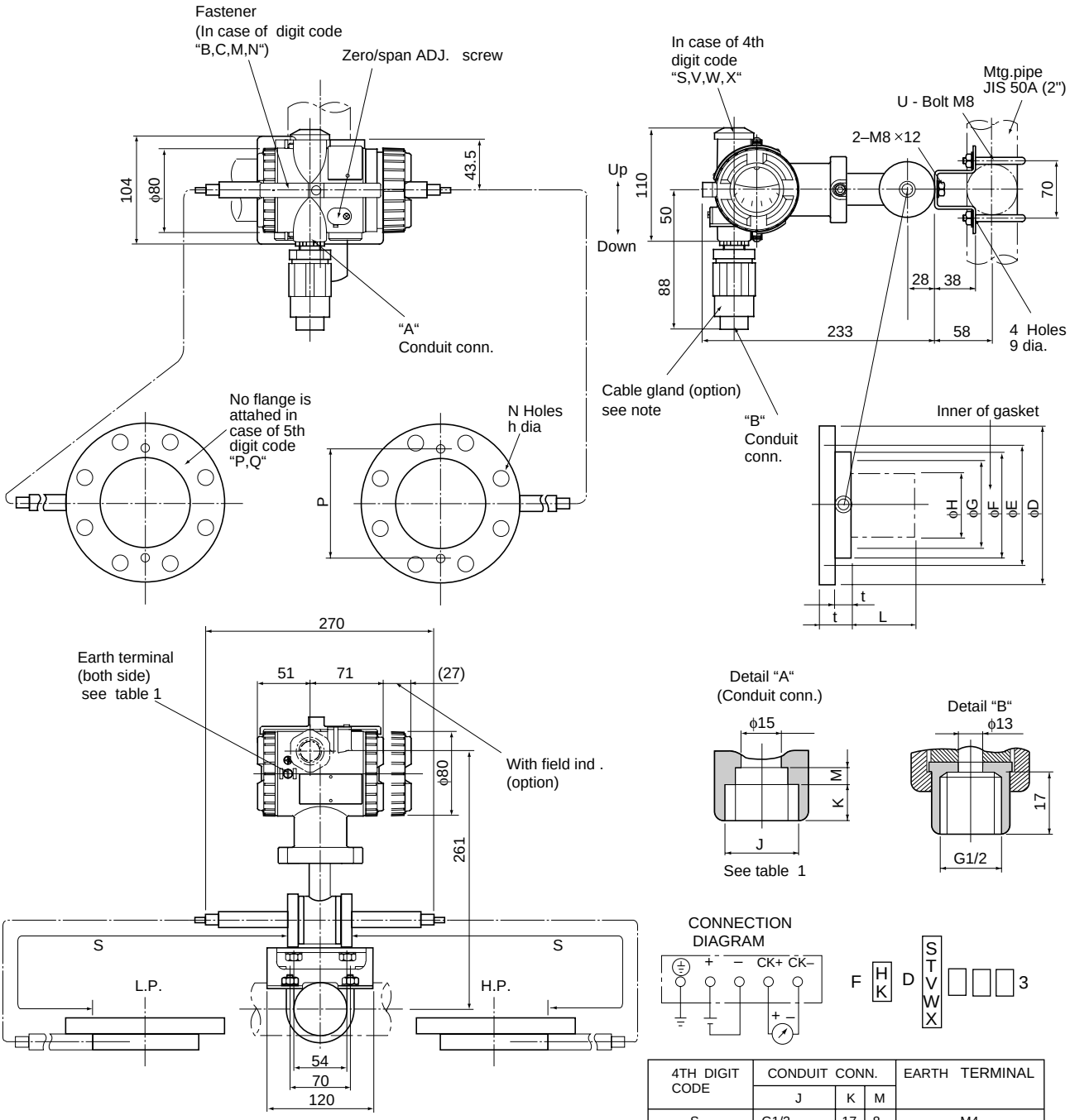
F H D [ ] [ ] [ ] [ ] 3 – [ ] [ ] [ ] [ ] [ ] – [ ] 0

[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] – [ ] [ ] [ ] [ ] [ ] – [ ] 0

	Description
	Indicator and arrester
	Indicator / Arrester
A	None / None
B	Analog, 0 to 100% linear scale / None
C	Analog, 0 to 100% sq. root scale / None
D	Analog, custom scale / None
J	Analog, double scale / None
E	None / Yes
F	Analog, 0 to 100% linear scale / Yes
G	Analog, 0 to 100% sq. root scale / Yes
H	Analog, custom scale / Yes
K	Analog, double scale / Yes
L	Digital, 0 to 100% / None
P	Digital, custom scale / None (Model FKD only)
Q	Digital, 0 to 100% / Yes
S	Digital, custom scale / Yes (Model FKD 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 G1/2 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
	7th digit code "W", "A", "B", "C", and "D" (*3)
	Teflon membrane
	None
Y	Yes (Available for 5th digit code "0", "2", "4", "6", "8", "A", "C", "E", "G", "J", "P" and 7th digit code
C	"W", "H", "M", "T", "P", "R".)

Notes: * (1) Available for 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

OUTLINE DIAGRAM (Unit:mm)



ϕD	ϕE	ϕF	ϕG	ϕH	t	P	N - ϕh	Flange
185	150	126	100	73	38	116	8–19	JIS–10K–80A
210	175	151	103	96	38	141	8–19	JIS–10K–100A
210	170	126	100	73	48	116	8–23	JIS–30K–80A
240	195	151	103	96	52	141	8–25	JIS–30K–100A
191	152.5	126	100	73	44	116	4–20	ANSI/JPI–150LB-3"
229	190.5	151	103	96	44	141	8–20	ANSI/JPI–150LB-4"
210	168	126	100	73	49	116	8–23	ANSI/JPI–300LB-3"
254	200	151	103	96	52	141	8–23	ANSI/JPI–300LB-4"
200	160	126	100	73	44	116	8–18	DIN PN40 DN80
220	180	151	103	96	40	141	8–18	DIN PN16 DN100

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

7th digit code	L	Mass.approx. (kg)
W,H,M,T,P,R	0	14 to 19.5
A,F	50	15 to 30.5
B,G	100	15.5 to 31
C,K	150	16 to 31.5
D,L	200	16.5 to 32

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

Note) : Cable gland is supplied in case of flameproof packing type.
ϕ11 cable is suitable.

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 Electro-magnetic 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."

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