

FCX – A SERIES LEVEL TRANSMITTER

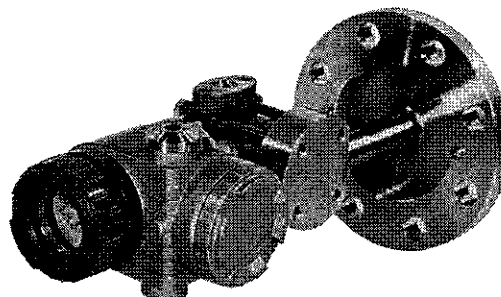
DATA SHEET

FHE, FKE...2

The FCX –A level transmitter accurately measures liquid level and transmits a proportional 4 to 20mA signal. The transmitter utilizes a unique micromachined capacitive silicon sensor with state-of-the-art microprocessor technology to provide exceptional performance and functionality.

FEATURES

- High accuracy**
0.2% accuracy for all calibrated spans is a standard feature for all models covering 3.2kPa(32mbar) range to 500kPa(5bar) high differential. Fuji's micro-capacitance silicon sensor assures this accuracy for all elevated or suppressed calibration ranges without additional adjustment.
- 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.
- Smart / Traditional convertible**
Fuji micro-electronics manufacturing technology offers free selection of Smart / Traditional transmitters. A small plug-in communication module upgrades your model FHE to smart type model FKE, which has full remote communication capabilities. A Hand Held Communicator (HHC), model FXW can remotely display or reconfigure all transmitter parameters at any point on the loop without affecting the transmitter signal.
- 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-A/C series transmitters.
- Application flexibility**
Example options that render the FCX –A suitable for almost any process applications includes:
 - Analog indicator at either the electronics side or terminal side
 - Full range of hazardous area approvals
 - Built-in RFI filter and lightning arrestor
 - 4 $\frac{1}{2}$ -digits LCD meter
 - Stainless steel electronics housing
 - Wide selection of materials
 - High temperature, high vacuum service.



SPECIFICATIONS

Functional specifications

Type:

Model FHE: 4 to 20mA, Traditional type

Model FKE: 4 to 20mA with digital signal, Smart type

Service: Liquid, gas, or vapour

Static pressure, span, and range limit:

Type	Static pressure	Span limit [kPa] {m bar}			Range limit [kPa] {m bar}
		Min.		Max.	
		FHE	FKE	FHE/FKE	
F□E□□3	Up to flange rating	3.2 {32}	0.32 {3.2}	32 {320}	+/- 32 { +/- 320}
F□E□□4		6.4 {64}	0.64 {6.4}	64 {640}	+/- 64 { +/- 640}
F□E□□5		13 {130}	1.3 {13}	130 {1300}	+/- 130 { +/- 1300}
F□E□□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: 66kPa abs (500mmHg abs) at temperature below 60 °C.
- The maximum span of each sensor can be converted to different units using factors as below.
1MPa=10³kPa=10bar=10.19716kgf/cm²=145.0377psi
1kPa=10mbar=101.9716mmH₂O=4.01463inH₂O

Overrange limit: To maximum static pressure limit

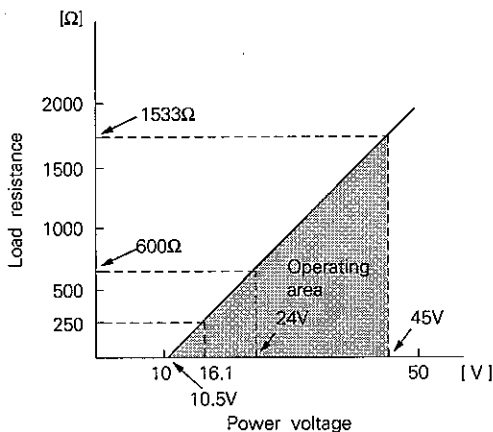
Output signal:

Model FHE: 4 to 20mA DC 2-wire, linear signal

Model FKE: 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 FXW, min. of 250Ω required.

Hazardous locations:

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. G	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 SAA	Ex ds IIB+H ₂ T4 Ex d II C T5, T6 IP 66 / 67	i2G4 Ex ia IIC T5, T6 IP 66 / 67	— Ex n IIC T5, T6 IP 66 / 67

Zero/span adjustment:

Model FHE: Zero is adjustable externally from the adjustment screw (UP and DOWN). 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 FKE: Zero and span are adjustable from the HHC. Zero is also adjustable externally from the adjustment screw.

Damping: Adjustable electrical damping.

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

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

Zero elevation/suppression:

- 100% to + 100% of URL

Normal/reverse action:

Model FHE: Selectable by moving a jumper pin located on the electronics unit.

Model FKE: Selectable from HHC

Indication: Analog indicator or 4 1/2 -digit LCD meter, as specified.

Burnout direction: Output hold
Output 21.6mA } selectable.
Output 3.8mA }

Model FHE: Unless otherwise specified, the output is in hold position.

Model FKE: Selectable from HHC

Loop-check output:

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

Model FKE: 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)

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	2.7kPa abs {20.3mmHg abs}
	J	85 to 300°C	
	Y and G	-40 to 120°C	
	S	-15 to 250°C	0.13kPa abs {0.98mmHg abs}
	T	85 to 300°C	
	K	-15 to 150°C	

Low pressure side contact liquid temperature on transmitter of Code H, J, S, T is 120°C or lower. Low pressure side contact liquid temperature of Code K is 85°C or lower

Storage: - 40 to + 90°C

Humidity limit: 0 to 100% RH

Communication: (Model FKE 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

(*) 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)
 For spans greater than 1/10 of URL: $\pm 0.2\%$ of span
 For spans below 1/10 of URL (Model FKE only):

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

Linearity: 0.1% of calibrated span
Stability: $\pm 0.2\%$ of upper range limit (URL) for 12 months

Temperature effect:

Effects per 55°C change between the limits of - 40°C and + 85°C
 Zero shift: $\pm 0.7\%$ of URL
 Total effect: $\pm 1.0\%$ of URL

Higher performance type (Option)

Zero shift: $\pm 0.6\% / 55^\circ\text{C}$ $x \geq \frac{1}{4}\text{URL}$

$$\pm \left(0.2 + 0.1 \frac{\text{URL}}{x} \right) \% / 55^\circ\text{C} \quad x < \frac{1}{4}\text{URL}$$

Total shift: $\pm 0.8\% / 55^\circ\text{C}$ $x \geq \frac{1}{4}\text{URL}$

$$\pm \left(0.4 + 0.1 \frac{\text{URL}}{x} \right) \% / 55^\circ\text{C} \quad x < \frac{1}{4}\text{URL}$$

x : Calibrated span

URL : Upper Range Limit

Twice the value for 7th digit code "H", "M", "T", "B", "L", "U", "P", "R".

Static pressure effect:

Zero shift: $\pm 0.2\%$ of URL for flange rating pressure

Span shift: - 0.2% of calibrated span for flange rating pressure

Double the zero shift for material code (7th digit in "Code symbols") "H", "M", "T", "B", "L", "U", "P" and "R".

Overrange effect: Zero shift; $\pm 0.3\%$ of URL for flange rating pressure

Double the effects for material code "H", "M", "T", "B", "L", "U", "P" and "R".

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: (without electrical damping)

Range code	Time constant	Dead time
"3"	0.4 s	approx. 0.3 s
"4" through "6"	0.3 s	

Mounting position effect:

Zero shift, less than 0.3kPa{3m bar} for a 10° tilt in any plane. (No extension)
 No effect on span.

This error can be corrected by adjusting zero.

(Double the effect for fluorinated fill sensors)

Dielectric strength:

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

Insulation resistance:

More than 100MΩ at 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 x 1.5 conduit, as specified.

Process connections:

LP side: 1/4-18 NPT or Rc1/4.

HP side: ANSI, DIN, or JIS raised face flange. See OUTLINE DIAGRAM for detailed dimensions.

Refer to "Code symbols"

Process-wetted parts material:

Material code (7th figure in "Code symbols")	LP side			HP side
	Process cover	Diaphragm	Wetted sensor body	Diaphragm & flange face
V	316 stainless steel (**)	316L stainless steel	316 stainless steel	316L stainless steel
H	316 stainless steel (**)	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
M	316 stainless steel (**)	Monel	Monel lining	Monel
T	316 stainless steel (**)	Tantalum	Tantalum lining	Tantalum
B	Hastelloy-C lining	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
L	Monel lining	Monel	Monel lining	Monel
U	Tantalum lining	Tantalum	Tantalum lining	Tantalum
P	316 stainless steel (**)	Titanium	Titanium	Titanium
R	316 stainless steel (**)	Zirconium	Zirconium	Zirconium

* (1) Sensor O-rings: Viton or teflon selectable

(2) SCS14 Per JIS G5121

Non-wetted parts material:

Electronics housing: Low copper die-cast aluminum alloy (standard), finished with epoxy/polyurethane double coating, or 316 stainless steel, as specified.

Bolts and nuts: Cr-Mo alloy (standard) or 304 stainless steel

Fill fluid: Silicone oil (standard) or fluorinated oil (Daifloil)

Mounting flange: Carbon steel or 304 stainless steel, as specified

Environmental protection:

IEC IP67 and NEMA 4X

Flange mounting: See drawings

Mass(weight): Transmitter approximately 13kg without options.

Add; 0.5kg for mounting bracket

0.8kg for indicator option

4.5kg for stainless steel housing option

1.0kg 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 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 x 50 μs)
- 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.

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

ACCESSORIES

- Oval flanges:** (Model FFP, refer to Data Sheet No. EDS6-10)
Converts process connection to 1/2-14 NPT or to Rc1/2; in carbon steel or in 316 stainless steel.
- Hand held communicator:** (Model FXW, refer to Data Sheet No. EDS 8-47)
- Communication module:** (Standard for model FKE)
When using this module for model FHE, remote setting function becomes available.
Remark: When the communication module is connected, the operation mode of external zero/span adjustment screw is changed to zero adjustment.

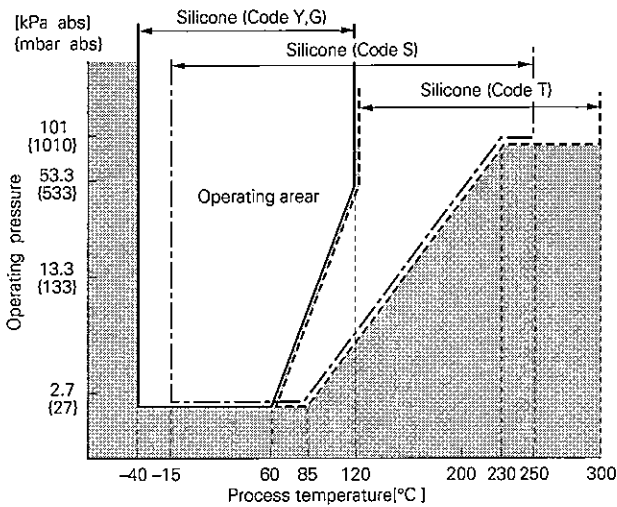


Fig. 1 Relation between process temperature and operating pressure

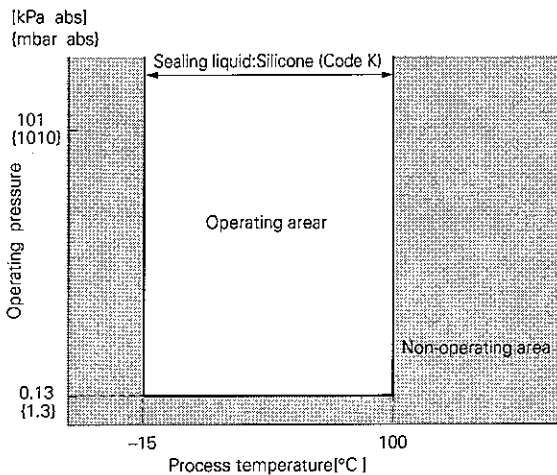


Fig. 2 Relation between process temperature and operating pressure

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

ORDERING INFORMATION

When ordering this instrument, specify:

1. CODE SYMBOLS
2. Measuring range
3. Output orientation (burnout direction) when abnormality is occurred in the transmitter. (Unless otherwise specified, output hold function is supplied).
4. TAG No. (up to 26 alphanumeric characters), if required.

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."

CODE SYMBOLS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15																		
							2								Description			
FHE															Type			
FKE															4 to 20mA, Traditional type			
															4 to 20mA with digital signal, Smart type			
															Connections			
															Process connection	Oval flange screw	Conduit connection	
S															Rc1/4	7/16-20UNF	G 1/2	
T															1/4-18NPT	7/16-20UNF	1/2-14NPT	
V															1/4-18NPT	M10	Pg 13.5	
W															1/4-18NPT	M10	M20x1.5	
X															1/4-18NPT	7/16-20UNF	Pg 13.5	
															Mounting flange			
															Material	Size and rating		
0															304 stainless steel	JIS 10K 80A		
1														JIS 10K 100A				
2														JIS 30K 80A				
3														JIS 30K 100A				
4														ANSI/JPI 150LB 3"				
5														ANSI/JPI 150LB 4"				
6														ANSI/JPI 300LB 3"				
7														ANSI/JPI 300LB 4"				
8														DIN PN40 DN80				
9														DIN PN16 DN100				
A														Carbon steel	JIS 10K 80A			
B															JIS 10K 100A			
C															JIS 30K 80A			
D															JIS 30K 100A			
E															ANSI/JPI 150LB 3"			
F															ANSI/JPI 150LB 4"			
G															ANSI/JPI 300LB 3"			
H															ANSI/JPI 300LB 4"			
J															DIN PN40 DN80			
K														DIN PN16 DN100				
															Span limit (*1) [kPa] {m bar}			
															FHE/FKE			
															3	3.2/0.32...32/32		
															4	{32 /3.2...320/320}		
															5	6.4/0.64...64/64		
															6	{64/6.4...640/640}		
																13/1.3...130/130		
																{130/13...1300/1300}		
																50/5...500/500		
																{500/50...5000/5000}		
															Material			
															LP side		HP side	
															Process cover	Diaphragm	Wetted sensor body	Diaphragm and flange face
															316 stainless steel	316L stainless steel	316 stainless steel	316L stainless steel
															316 stainless steel	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
															316 stainless steel	Monel	Monel lining	Monel
															316 stainless steel	Tantalum	Tantalum lining	Tantalum
															Hastelloy-C lining	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
															Monel lining	Monel	Monel lining	Monel
															Tantalum lining	Tantalum	Tantalum lining	Tantalum
															316 stainless steel	Titanium	Titanium	Titanium
															316 stainless steel	Zirconium	Zirconium	Zirconium

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

(*2) Material Code R; 6th digit code "6" is not available.

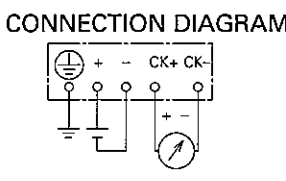
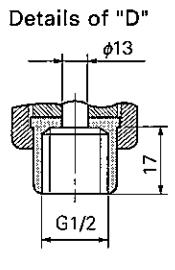
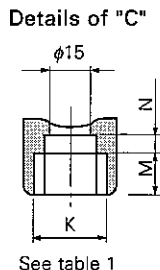
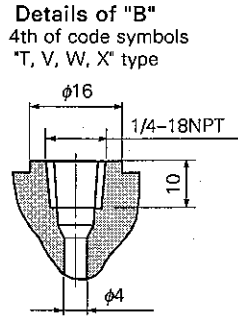
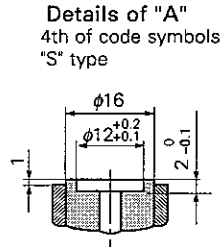
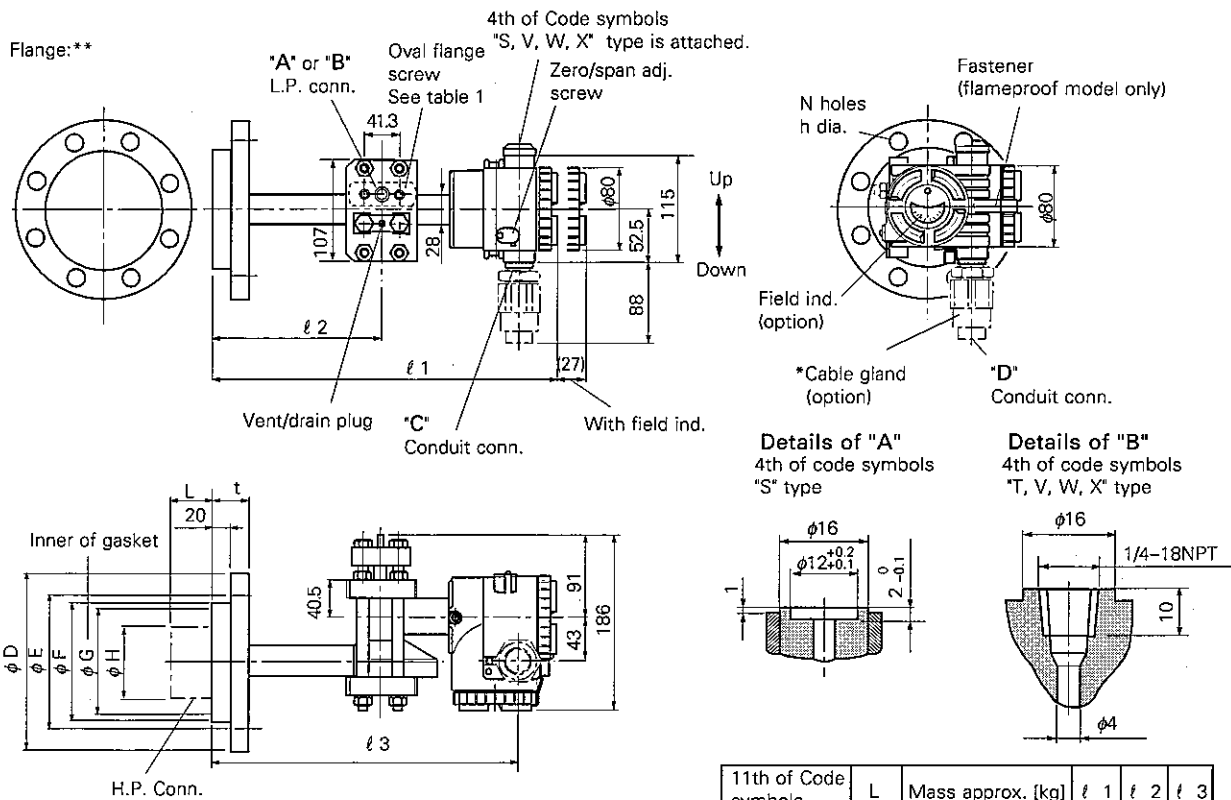
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F	H	E					2							
F	K	E					2							

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 FKE only)	
Q Digital, 0 to 100%	Yes	
S Digital, custom scale	Yes (Model FKE only)	
Approvals for hazardous locations		
A None (for ordinary locations)		
B JIS, Flameproof (Conduit seal)		
C JIS, Flameproof (Cable gland seal)		
D FM, Flameproof (or explosionproof)		
E CSA, Flameproof (or explosionproof)		
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) (*3)		
T SAA, Intrinsic safety (*3)		
Q SAA, Type N (Non-sparking) (*3)		
Diaphragm extension [mm]		
Extension [mm]	Applicable material code	
Y 0	Any	
A 50	} (7th digit code "V" only)	
B 100		
C 150		
D 200		
E 50	} (7th digit code "H" or "B" only)	
F 100		
G 150		
H 200		
Stainless steel parts		
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 "V" only)	
D Chlorine service	Fluorinated oil (7th digit code "H", "T", "B" and "U")	
H High temp. 250°C	} 7th digit code "V" } (*4)	
J High temp. 300°C		
S High temp. and vacuum (250°C)		
T High temp. and vacuum (300°C)		
K High temp. and high vacuum		
	Silicone oil	
O-ring and Teflon membrane		
O-ring	Teflon membrane	
A Viton	None	
B Teflon	None	
C Viton	Yes	
D Teflon	Yes	
	} (5th digit code "0", "2", "4", "6", "8", "A", "C", "E", "G", "J", and 11th digit code "Y")	
Bolt/nut		
A Cr-Mo alloy hexagon socket head cap screw/carbon steel nut		
B Cr-Mo alloy hexagon bolt/nut		
E 304 stainless steel/304 stainless steel (*5)		

Notes: (*3) Available for 4th digit code "S", "T", "W".

(*4) Treatment; None

(*5) In case of tropical use, select a stainless bolts and nuts.



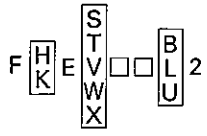
11th of Code symbols	L	Mass approx. [kg]	ℓ 1	ℓ 2	ℓ 3
Y	0	11.5 to 15	350	150	286
A E	50	12 to 19	344	144	290
B F	100	12.5 to 19.5			
C G	150	13 to 20			
D H	200	13.5 to 20.5			

φ D	φ E	φ F	φ G	φ H	t	N-φ h	Flange
185	150	126	100	73	38	8-19	JIS-10K-80A
210	175	151	103	96	38	8-19	JIS-10K-100A
210	170	126	100	73	48	8-23	JIS-30K-80A
240	195	151	103	96	52	8-25	JIS-30K-100A
191	152.5	126	100	73	44	4-20	ANSI/JPI-150LB-3B
229	190.5	151	103	96	44	8-20	ANSI/JPI-150LB-4B
210	168	126	100	73	49	8-23	ANSI/JPI-300LB-3B
254	200	151	103	96	52	8-23	ANSI/JPI-300LB-4B
200	160	126	100	73	44	8-18	DIN PN40 DN80
220	180	151	103	96	40	8-18	DIN PN16 DN100

4th of Code symbols	Conduit conn.			Oval flange screw	Earth terminal
	X	M	N		
S	G1/2	17	8	Not attached	M4
T	1/2-14NPT	16	5	7/16-20UNF screw depth 13	No. 8-32UNC
V	Pg13.5	8	4.5	M10 screw depth 13	M4
W	M20x1.5	16	5	M10 screw depth 13	M4
X	Pg13.5	8	4.5	7/16-20UNF screw depth 13	M4

Table 1

Note *: Cable gland is supplied in case of flameproof packing type. ø11 cable is suitable.
 **: A 4-hole flange is used with the Flange Standard ANSI/JPI-150LB-3B. Take care about the hole position.



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