FUJI ELECTRIC

FCX

FCX – AX SERIES SMALL FLANGE LEVEL TRANSMITTER

DATA SHEET FHY, FKY···3

The FCX –AX Series small flange level transmitter accurately measures liquid level 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.

FEATURES

1. Directly connectable to 1-1/2 in. and 2 in. flanges
   The transmitter is connectable to 1-1/2 in. and 2 in. pipes without a reducer.
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 protocl, 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
   — 4½ digits LCD meter
   — Stainless steel electronics housing
   — Wide selection of materials
   — High temperature, vacuum service.
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 FHY: 4 to 20mA
Model FKY: 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}			Range limit [kPa] {m bar}
		Min.		Max.	
		FHY	FKY	FHY/FKY	
F□Y□□5	Up to flange rating	13 {130}	3 {30}	130 {1300}	+/– 130 { +/– 1300}
F□Y□□6	Up to flange rating	50 {500}	12.5 {125}	500 {5000}	+/– 500 { +/– 5000}

— 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.

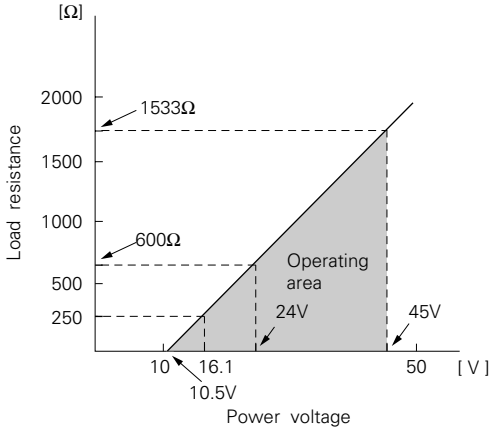
— The maximum span of each sensor can be converted to different units using factors as below.
1MPa=10^3kPa=10bar=10.19716kgf/cm^2=145.0377psi
1kPa=10mbar=101.9716mmH_2O=4.01463inH_2O

Overrange limit: To maximum static pressure limit

Output signal:
Model FHY: 4 to 20mA DC 2-wire, linear signal
Model FKY: 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 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
RIIS	Ex ds IIB+H_2 T4	—	—

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

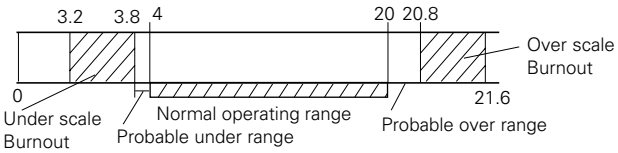
Damping: Adjustable electrical damping.
Model FHY: The time constant is adjustable to 0, 0.3, 1.2, 4.8, or 19.2 seconds.
Model FKY: The time constant is adjustable between 0 to 38.4 seconds.

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

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

Indication: Analog indicator or 4½ -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 FHY: Unless otherwise specified in the order, the transmitter will be shipped in "Output Hold" mode.
(Output signal just before failure happens is maintained.)
Model FKY: 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 FHY: Transmitter can output constant signal of 4mA, 12mA, or 20mA if MODE SWITCH is set to the loop check mode.
Model FKY: Transmitter can be configured to provide constant signal 3.8mA through 21.6mA by HHC.

Temperature limit:
Ambient: – 15 to + 65°C
(– 15 to + 65°C for LCD indicator)
(– 15 to + 60°C for arrester option)
(– 10 to + 60°C for fluorinated oil fill transmitter)
(– 10 to + 60°C for silicon oil "H", "S")
For explosionproof units (flameproof or intrinsic safety), ambient temperature must be within the limits specified in each standard.
Process:

Fill fluid	13th digit of "Code symbols"	Process temperature	Lower limit of static press
Fluorinated oil	W, A and D	–20 to 80°C	Atmospheric pressure
Silicone oil	H	0 to 250°C	
	Y and G	–40 to 120°C	2.7kPa abs {20.3mmHg abs}
	S	0 to 250°C	

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

Storage: – 40 to + 70°C

Humidity limit: 0 to 100% RH

Communication: (Model FKY 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

(*) 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: ±0.25% of span
For spans below 1/10 of URL (Model FKY only):

$$\pm \left(0.17 + 0.08\frac{0.1 \times \text{URL}}{\text{Span}}\right) \%\ \text{of span}$$

(Option)
For spans greater than 1/10 of URL:±0.1% of span
For span below 1/10 of URL (Model FKY 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 6 months
Temperature effect:
Effects per 28°C change between the limits of – 15°C and + 65°C
Zero shift; ±0.5%/28°C
(x equal to 1/2 URL or more)

$$\text{Zero shift; } \left(\pm 0.5\ \frac{\text{URL}}{2 \times x}\right) \%/28°C$$

(x less than 1/2 URL)
Total shift; ±0.75%/28°C
(x equal to 1/2 URL or more)

$$\text{Total shift; } \pm\left(0.25 + 0.5 \times \frac{\text{URL}}{2 \times x}\right) \%/28°C$$

(x less than 1/2 URL)

High performance type (option) ...
Zero shift; ±0.5%/28°C
(x equal to 1/6.5 URL or more)

$$\text{Zero shift; } \pm\left(0.5\ \frac{\text{URL}}{6.5 \times x}\right) \%/28°C$$

(x less than 1/6.5 URL)
Total shift; ±0.75%/28°C
(x equal to 1/6.5 URL or more)

$$\text{Total shift; } \pm\left(0.25 + 0.5\ \frac{\text{URL}}{6.5 \times x}\right) \%/28°C$$

(x less than 1/6.5 URL)

Where, x: Calibrated span
URL: Maximum span (Upper Range Limit)

Note: 2.5 times the effects for material code (7th digit) "H", "M", :T", "B", "L", "U".

Static pressure effect:
Zero shift: ±0.2% of URL/1MPa (10 bar)
Span shift: – 0.2% of calibrated span for flange rating pressure
2.5 times the zero shift for material code "H", "M", "T", "B", "L", "U".

Overrange effect: Zero shift; ±0.3% of URL for flange nominal pressure
2.5 times the effects for material code "H", "M", "T", "B", "L", "U".

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.

Step response: (without electrical damping)

Time constant	Dead time
0.3 s	approx. 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, or JIS raised face flange.
See OUTLINE DIAGRAM for detailed dimensions.
Refer to "Code symbols"

Process-wetted parts material:

Material code (7th digit in "Code symbols")	LP side			HP side
	Process cover	Diaphragm	Wetted sensor body	Diaphragm & flange face
V	316 stainless steel (*2)	316L stainless steel	316 stainless steel	316L stainless steel
H	316 stainless steel (*2)	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
M	316 stainless steel (*2)	Monel	Monel lining	Monel
T	316 stainless steel (*2)	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

*(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 polyester 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

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) EN 50081-1 : 1992

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

EMS (Immunity) EN 50082-1 : 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 : 1984	B

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

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 4½ digits LCD meter is also available.

Arrester: A built-in arrester protects the electronics from lightning surges.
Lightning surge immunity is 4kV (1.2 x 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.

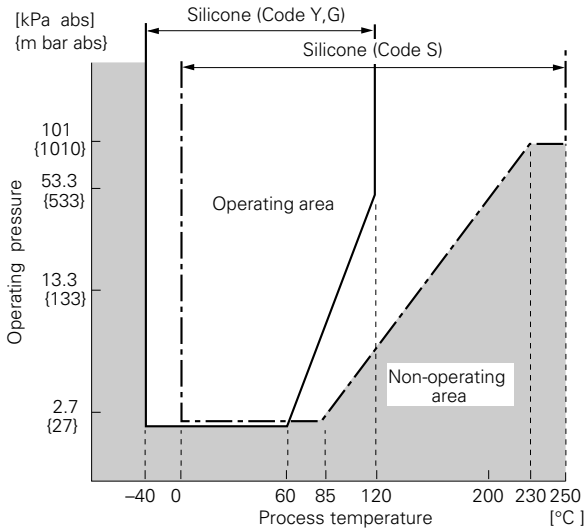


Fig. 1 Relation between process temperature and operating pressure

Customer tag: A stainless steel tag with 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.

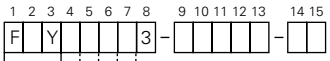
ACCESSORIES

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 FKY)
By adding communiction module, remote setting function becomes available for model FHY.
Remark: When the communication module is connected, the operation mode of external zero/span adjustament screw is limited to zero adjustment only.

CODE SYMBOLS



Description
Type
FHY 4 to 20mA, Output type
FKY 4 to 20mA with digital signal, Output 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	M20×1.5
X	1/4-18NPT	7/16-20UNF	Pg 13.5

Mounting flange

	Material	Size and rating
0	304 stainless steel	JIS 10K 40A
1		JIS 10K 50A
2		JIS 20K 40A
3		JIS 20K 50A
4		JIS 30K 40A
5		JIS 30K 50A
A		ANSI/JPI 150LB 1 1/2"
B		ANSI/JPI 150LB 2"
C		ANSI/JPI 300LB 1 1/2"
D		ANSI/JPI 300LB 2"
G	Carbon steel	JIS 10K 40A
H		JIS 10K 50A
J		JIS 20K 40A
K		JIS 20K 50A
L		JIS 30K 40A
M		JIS 30K 50A
Q		ANSI/JPI 150LB 1 1/2"
R		ANSI/JPI 150LB 2"
S		ANSI/JPI 300LB 1 1/2"
T		ANSI/JPI 300LB 2"

Span limit [kPa] {m bar}

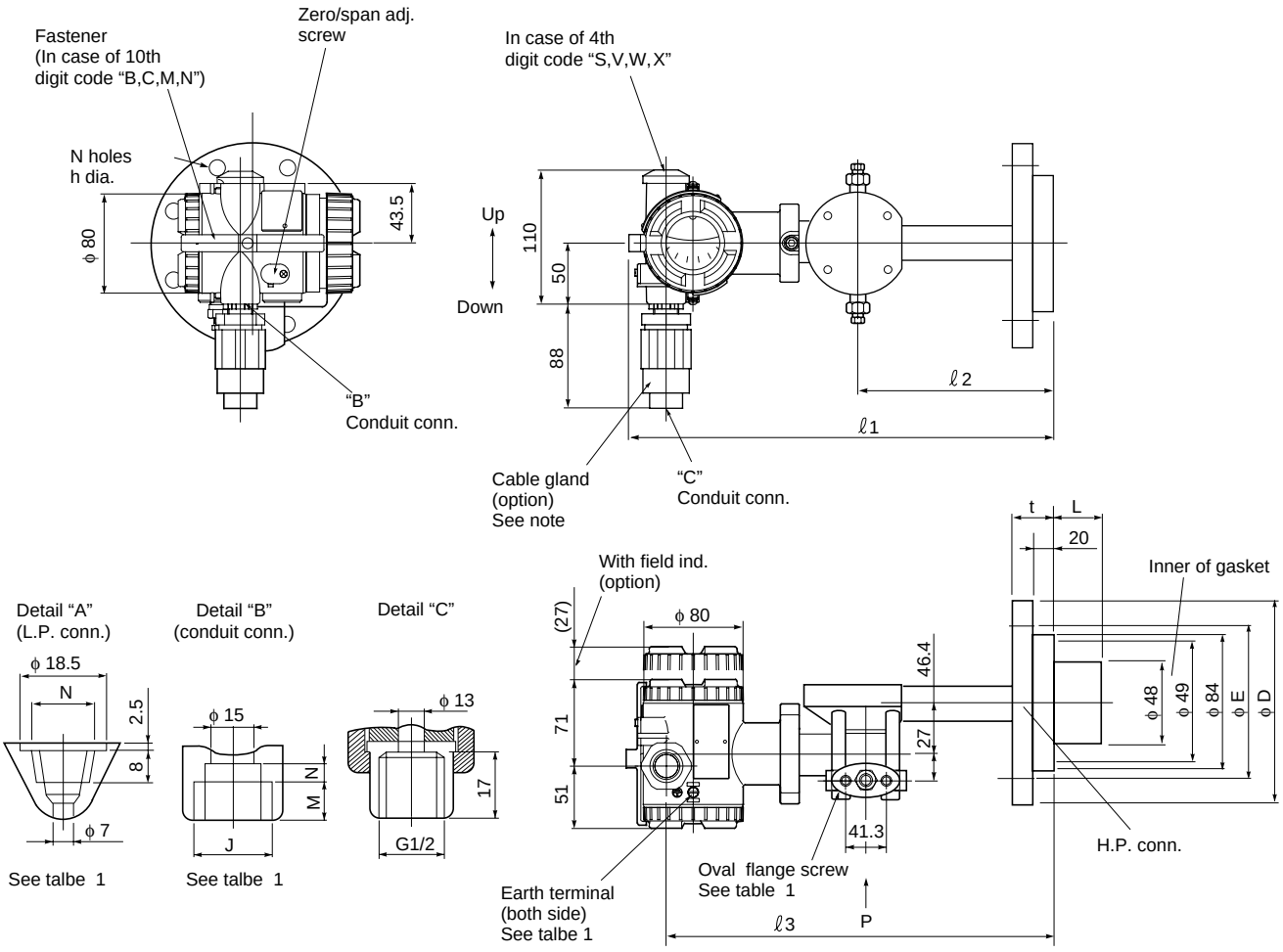
	FHY	FKY
5	13···130 {130···1300}	3···130 { 30···1300}
6	50···500 {500···5000}	12.5···500 {125···5000}

Material

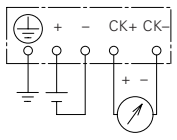
	LP side			HP side
	Process cover	Diaphragm	Wetted sensor body	Diaphragm and flange face
V	316 stainless steel	316L stainless steel	316 stainless steel	316L stainless steel
H	316 stainless steel	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
M	316 stainless steel	Monel	Monel lining	Monel
T	316 stainless steel	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

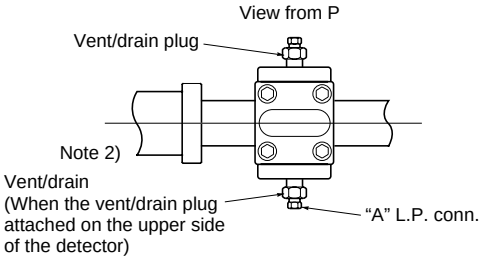
1 2 3 4 5 6 7 8	9 10 11 12 13	14 15	Description
F Y			
			Indicator and arrester
			Indicator / Arrester
	A		None / None
	B		Analog, 0 to 100% linear scale / None
	D		Analog, custom scale / None
	J		Analog, double scale / None
	E		None / Yes
	F		Analog, 0 to 100% linear scale / Yes
	H		Analog, custom scale / Yes
	K		Analog, double scale / Yes
	L		Digital, 0 to 100% / None
	P		Digital, custom scale / None (Model FKY only)
	Q		Digital, 0 to 100% / Yes
	S		Digital, custom scale / Yes (Model FKY only)
			Approvals for hazardous locations (Approval pending)
	A		None (for ordinary locations)
	B		JIS, Flameproof (Conduit seal) (Available for 4th code "S")
	C		JIS, Flameproof (Cable gland seal) (Available for 4th code "S")
	D		FM, Flameproof (or explosionproof) (Available for 4th 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
	K		CENELEC, Intrinsic safety
	P		CENELEC, Intrinsic safety and BASEEFA, Type N
			Diaphragm extension [mm]
			Extension [mm] / Applicable material code
	Y		0 / Any
	A		50 / (7th digit code "V" only, $1\frac{1}{2}$ in. flange is not applicable)
	B		100 / (7th digit code "V" only, $1\frac{1}{2}$ in. flange is not applicable)
	C		150 / (7th digit code "V" only, $1\frac{1}{2}$ in. flange is not applicable)
	D		200 / (7th digit code "V" only, $1\frac{1}{2}$ in. flange is not applicable)
			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 / Silicone oil (7th digit code "V" only)
	S		High temp. and vacuum (250°C) / Silicone oil (7th digit code "V" only)
			O-ring and Teflon membrane
			O-ring / Teflon membrane
		A	Viton / None
		B	Teflon / None
		C	Viton / Yes (11th digit code "Y" only)
		D	Teflon / Yes (11th digit code "Y" only)
			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

OUTLINE DIAGRAM (Unit:mm)



CONNECTION DIAGRAM





11th digit of Code symbols	L [mm]	Mass approx. [kg]	ℓ 1	ℓ 2	ℓ 3
Y	0	9.5 to 12	355	150	325
A	50	10 to 17	349	144	319
B	100	10.5 to 17.5			
C	150	11 to 18			
D	200	11.5 to 18.5			

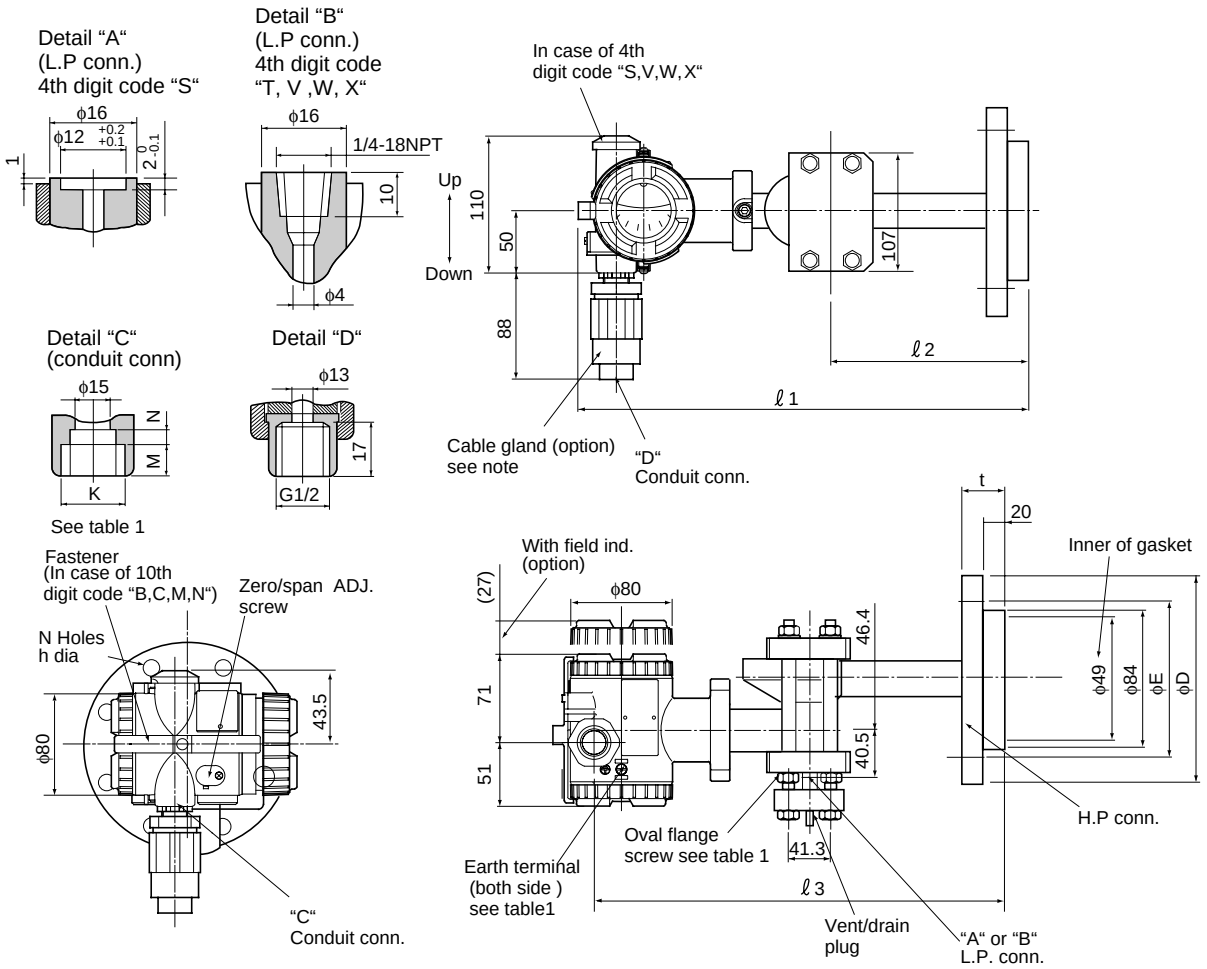
5th digit of Code symbols	ϕ D	ϕ E	t	N-ϕ h	Flange
0, G	140	105	36	4-19	JIS-10K-40A
1, H	155	120	36	4-19	JIS-10K-50A
2, J	140	105	38	4-19	JIS-20K-40A
3, K	155	120	38	8-19	JIS-20K-50A
4, L	160	120	42	4-23	JIS-30K-40A
5, M	165	130	42	8-19	JIS-30K-50A
A, Q	127	98.4	37.5	4-16	ANSI/JPI-150LB-1 1/2"
B, R	152	120.6	39.5	4-20	ANSI/JPI-150-2"
C, S	156	114.3	41	4-23	ANSI/JPI-300LB-1 1/2"
D, T	165	127	42.5	8-20	ANSI/JPI-300LB-2"

Note * : Cable gland is supplied only for flameproof packing type.
ϕ11 cable is suitable.

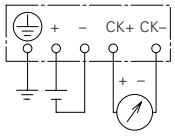
4th digit of Code symbols	Conduit conn. J	K	M	Press. conn. N	Oval flange screw	Earth terminal
S	G1/2	17	8	Rc1/4	7/16-20UNF screw depth 13	M4
T	1/2-14NPT	16	5	1/4-18NPT	7/16-20UNF screw depth 13	No. 8-32UNC
V	Pg13.5	8	4.5	1/4-18NPT	M10 screw depth 13	M4
W	M20x1.5	16	5	1/4-18NPT	M10 screw depth 13	M4
X	Pg13.5	8	4.5	1/4-18NPT	7/16-20UNF screw depth 13	M4

Table 1

<Optional stainless steel tag>



CONNECTION DIAGRAM



11th digit of Code symbols	Mass approx. [kg]	ℓ 1	ℓ 2	ℓ 3
Y	11.5 to 15	355	150	325

5th digit of Code symbols	ϕ D	ϕ E	t	N-ϕ h	Flange
0, G	140	105	36	4-19	JIS-10K-40A
1, H	155	120	36	4-19	JIS-10K-50A
2, J	140	105	38	4-19	JIS-20K-40A
3, K	155	120	38	8-19	JIS-20K-50A
4, L	160	120	42	4-23	JIS-30K-40A
5, M	165	130	42	8-19	JIS-30K-50A
A, Q	127	98.4	37.5	4-16	ANSI/JPI-150LB-1 1/2"
B, R	152	120.6	39.5	4-20	ANSI/JPI-150-2"
C, S	156	114.3	41	4-23	ANSI/JPI-300LB-1 1/2"
D, T	165	127	42.5	8-20	ANSI/JPI-300LB-2"

Note * : Cable gland is supplied only for flameproof packing type.
ϕ11 cable is suitable.

4th digit of Code symbols	Conduit conn. J	K	M	Oval flange screw	Earth terminal
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

F [H K] Y [S T V W X] □□ [B L U] 3

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