FUJI ELECTRIC

FCX

FCX – AX SERIES PRESSURE TRANSMITTER

DATA SHEET FHG,FKG···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 tech- nology to provide exceptional performance and functionality.

FEATURES

1. High accuracy
   0.07% accuracy for all calibrated spans is a standard feature for pressure transmitter covering 6.4 to 50000kPa {0.064 to 500bar}. Fuji's micro-capacitance silicon sensor assures this accuracy for all elevated or suppressed calibration ranges without additional adjustment.
2. Minimum environmental influence
   The "Advance 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
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 FHG: 4 to 20mA
Model FKG: 4 to 20mA with digital signal
Service: Liquid, gas, or vapour
Span, range and overrange limit:

Type	Span limit [kPa] {bar} Min. FHG	Min. FKG	Max. FHG/FKG	Range limit [kPa] {bar}	Overrange limit [MPa] {bar}
F□G□01	6.4 {0.064}	0.64 {0.0064}	64 {0.64}	–64 to + 64 {–0.64 to +0.64}	1 {10}
F□G□02	50 {0.5}	5 {0.05}	500 {5}	–100 to +500 {–1 to + 5}	1.5 {15}
F□G□03	300 {3}	30 {0.3}	3000 {30}	–100 to +3000 {–1 to + 30}	9 {90}
F□G□04	1000 {10}	100 {1}	10000 {100}	–100 to +10000 {–1 to + 100}	15 {150}
F□G□05	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.

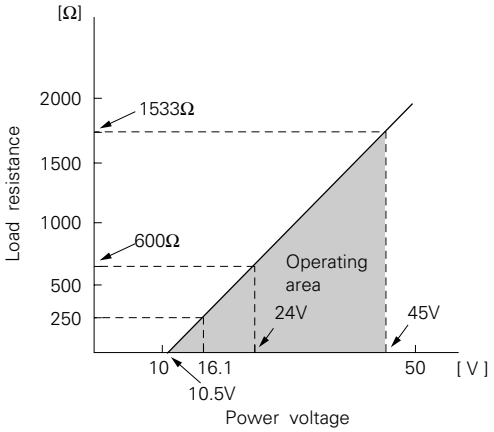
— Lower range limit (vacuum limit) ;
Silicone fill sensor: See Fig. 1
Fluorinated fill sensor: 66kPa abs (500mmHg abs) at below 60°C

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

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

Power supply: Transmitter operates on 11V to 45V DC at transmitter terminals.
11V to 32V DC for the units with optional arrester.

Load limitations: see figure below



Note: For communication with HHC (Model: FXW), min. of 250 Ω 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	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 FHG: 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 FKG: Zero and span are adjustable from the HHC. Zero is also adjustable externally from the adjustment screw.

Damping: Adjustable electrical damping.

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

Model FKG: The time constant is adjustable between 0 to 38.4 seconds. (9 steps)

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.

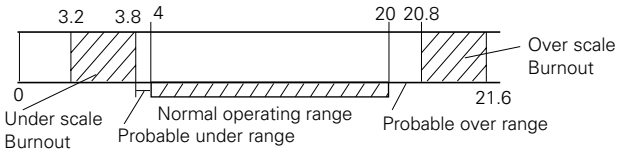
Model FHG: Unless otherwise specified in the order, the transmitter will be shipped in "Output Hold" mode.
(Output signal just before failure happens is maintained.)

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

Model FKG: 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 by each standard.
Process: –40 to +100°C for silicone fill sensor
–20 to +80°C for fluorinated oil fill sensor
Storage: –40 to +90°C

Humidity limit: 0 to 100% RH

Communication: (Model FKG 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)

Max span below 10000kPa model:

For spans greater than 1/10 of URL: ±0.07% of span

For spans below 1/10 of URL (Model FKG only):

$$\pm \left(0.02+0.05 \frac{0.1 \times \text{URL}}{\text{Span}}\right) \% \text{ of span}$$

Max span 50000kPa model:

For spans greater than 1/10 of URL: ±0.1% of span

For spans below 1/10 of URL (Model FKG only):

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

Linearity: 0.05% of calibrated span

Stability: ±0.1% of upper range limit (URL) for 24 months

Temperature effect:

Effects per 28°C change between the limits of –40°C and +85°C

Zero shift: $\pm(0.1+0.025 \frac{\text{URL}}{\text{span}})$% /28°C

Total effect: $\pm(0.125+0.025 \frac{\text{URL}}{\text{span}})$%/28°C

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

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: 0.2s
Dead time: approximately 0.3s
(without electrical damping)

Mounting position effect:

Zero shift, less than 0.1kPa {1m bar} for a 10° tilt in any plane.
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 × 1.5 conduit, as specified.

Process connections:

1/4-18 NPT or Rc1/4 as specified.

Process-wetted parts material:

Material code (7th digit in Code symbols)	Process cover	Diaphragm	Wetted sensor body	Vent/drain
V	316 stainless steel(*1)	316L stainless steel	316 stainless steel	316 stainless steel
H	316 stainless steel(*1)	Hastelloy-C	Hastelloy-C lining	316 stainless steel
M	316 stainless steel(*1)	Monel	Monel lining	316 stainless steel
T	316 stainless steel(*1)	Tantalum	Tantalum lining	316 stainless steel
B	Hastelloy-C lining	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
L U	Monel lining Tantalum lining	Monel Tantalum	Monel lining Tantalum lining	Monel Tantalum

Note: *(1) SCS14 per JIS G 5121

Remark: Sensor O-rings: Viton and teflon selectable
Availability of above material design depends on ranges.
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.

Bolts and nuts: Cr-Mo alloy (standard), or 304 stainless steel (630 stainless steel for 50MPa unit).

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, or direct process mounting.

Mass {weight}: Transmitter approximately 3.4kg without options.

Add; 0.5kg for mounting bracket
0.8kg for indicator option
4.5kg for stainless steel housing option

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: The fill fluid is fluorinated oil.

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

NACE specification:
Metallic materials for all pressure boundary parts comply with NACE MR-01-75. ASTM B7M or L7M bolts and 2HM nuts (Class II) are available.

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

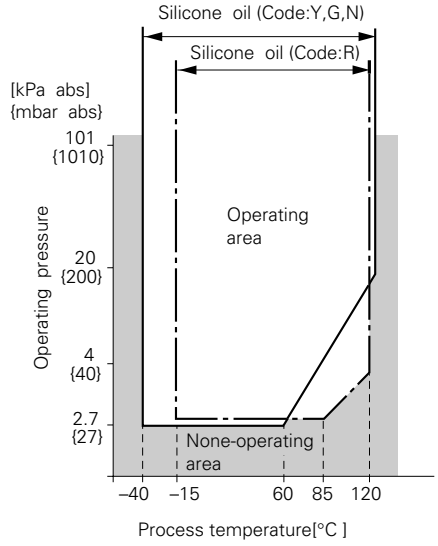


Fig. 1 Relation between process temperature and operating pressure

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 extermely 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. EDS8-47)

Communication module: (Standard for model FKG)
By adding communication module, remote setting function becomes available for model FHG.
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	14 15	Description
	0		3		–	
FHG						**Type** 4 to 20mA, Output type
FKG						4 to 20mA with digital signal, Output type

Connections

	Process connection	Oval flange screwConduit	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 (or M12)(*1)	Pg 13.5
W	1/4-18NPT	M10 (or M12)(*1)	M20×1.5
X	1/4-18NPT	7/16-20UNF	Pg 13.5

Span and materials

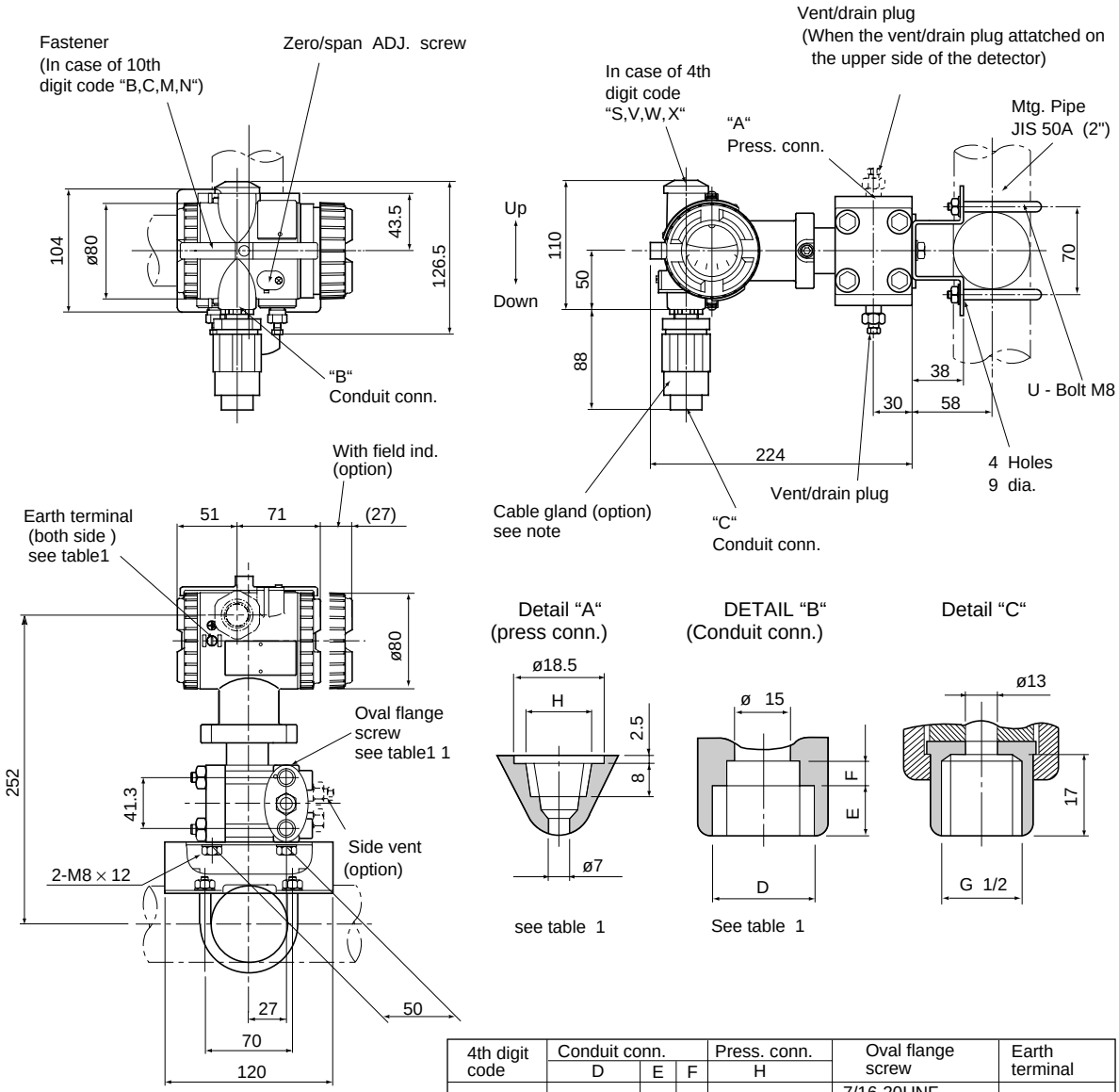
	Span limit FHG/FKG [kPa]{bar}(*2)	Process cover	Diaphragm	Wetted cell body
1V	6.4/0.64…64/64	316 stainless steel	316L stainless steel	316 stainless steel
1H	{0.064/0.0064…0.64/0.64}	316 stainless steel	Hast. C	Hast. C lining
1M		316 stainless steel	Monel	Monel lining
1T		316 stainless steel	Tantalum	Tantalum lining
1B		Hast. C lining	Hast. C	Hast. C lining
1L		Monel lining	Monel	Monel lining
1U		Tantalum lining	Tantalum	Tantalum lining
2V	50/5…500/500	316 stainless steel	316L stainless steel	316 stainless steel
2H	{0.5/0.05…5/5}	316 stainless steel	Hast. C	Hast. C lining
2M		316 stainless steel	Monel	Monel lining
2T		316 stainless steel	Tantalum	Tantalum lining
2B		Hast. C lining	Hast. C	Hast. C lining
2L		Monel lining	Monel	Monel lining
2U		Tantalum lining	Tantalum	Tantalum lining
3V	300/30…3000/3000	316 stainless steel	316L stainless steel	316 stainless steel
3H	{3/0.3…30/30}	316 stainless steel	Hast. C	Hast. C lining
3M		316 stainless steel	Monel	Monel lining
3T		316 stainless steel	Tantalum	Tantalum lining
3B		Hast. C lining	Hast. C	Hast. C lining
3L		Monel lining	Monel	Monel lining
3U		Tantalum lining	Tantalum	Tantalum lining
4V	1000/100…10000/10000	316stainless steel	316L stainless steel	316 stainless steel
4H	{10/1…100/100}	316stainless steel	Hast. C	Hast. C lining
4M		316 stainless steel	Monel	Monel lining
4T		316 stainless steel	Tantalum	Tantalum lining
4B		Hast. C lining	Hast. C	Hast. C lining
4L		Monel lining	Monel	Monel lining
4U		Tantalum lining	Tantalum	Tantalum lining
5V	5000/500…50000/50000 {50/5…500/500}	316 stainless steel	316L stainless steel	316 stainless steel

Notes: * (1) For 50MPa {500bar} units, M12 is provided rather than M10.
(2) 100: 1 turn down is possible for model FKG, but should be used at the span greater than 1/40 of the maximum span for better performance.

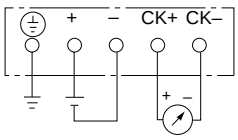
1 2 3 4 5 6 7 8	9 10 11 12 13	–	14 15	Description
F H G 0 3		–		
F K G 0 3		–		
				Indicator and arrester
				Indicator / Arrester
	A			None / None
	B			Analog, 0 to 100% linear scale / None
	D			Analog, custom scale / None
	J			Analog, double scale / None
	E			None / Yes
	F			Analog, 0 to 100% linear scale / Yes
	H			Analog, custom scale / Yes
	K			Analog, double scale / Yes
	L			Digital, 0 to 100% / None
	P			Digital, custom scale / None (Model FKG only)
	Q			Digital, 0 to 100% / Yes
	S			Digital, custom scale / Yes (Model FKG 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)
				Side vent/ drain and mounting bracket
				Side vent/drain / Mounting bracket
	A			None / None (Specify "A", "B", or "C" for the 7th digit code "B", "L", or "U")
	B			None / Yes, carbon steel
	C			None / Yes, stainless steel
	D			Yes / None
	E			Yes / Yes, carbon steel
	F			Yes / Yes, stainless steel
				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", "U")
	N			NACE specification / Silicone oil (Not available for 6th digit code "5", 7th digit code "T", "U", 15th digit code "A", "B")
	R			Vacuum service / Silicone oil for vacuum use
				Sensor O-ring
			A	Viton
			B	Teflon
				Bolt/nut
			A	Cr-Mo alloy hexagon socket head cap screw/carbon steel nut
			B	Cr-Mo alloy hexagon bolt/nut
			C	NACE bolt/nut (ASTM A193 B7M/A194 2HM) (Not available for 6th digit code "5")
			D	NACE bolt/nut (ASTM A320 L7M/A194 2HM) (Not available for 6th digit code "5")
			E	304 stainless steel/304 stainless steel (*1) (Not available for 6th digit code "5")
			F	630 stainless steel/304 stainless steel (*1) (Available for 6th digit code "5")

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

OUTLINE DIAGRAM (Unit:mm)



CONNECTION DIAGRAM

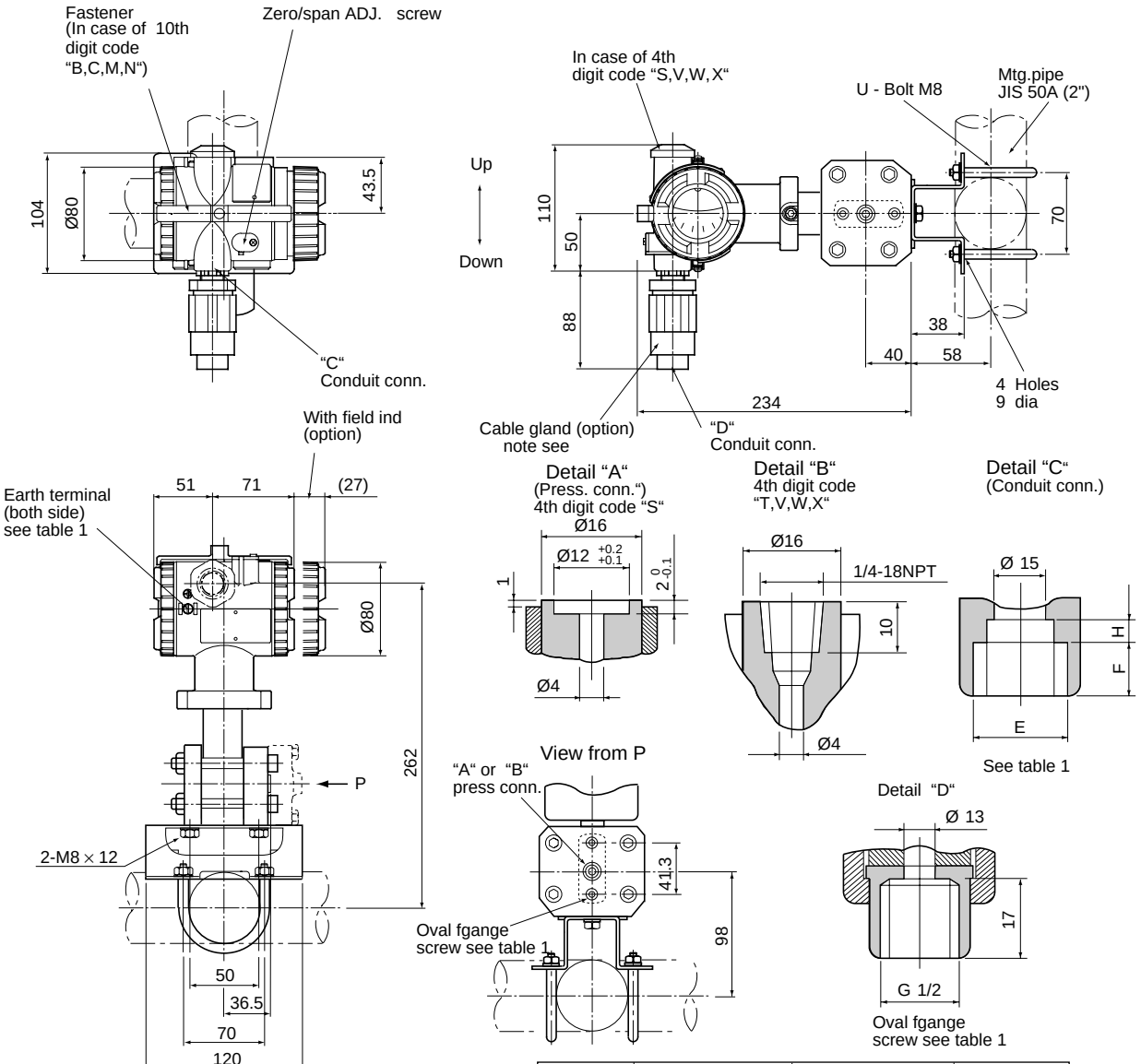


4th digit code	Conduit conn.			Press. conn.	Oval flange screw	Earth terminal
	D	E	F	H		
S	G1/2	17	8	Rc1/4	7/16-20UNF Screw depth13	M4
T	1/2 –14NPT	16	5	1/4–18NPT	7/16-20UNF Screw depth13	No. 8-32UNC
V	Pg13.5	8	4.5	1/4–18NPT	M10 Screw depth13	M4
W	M20 × 1.5	16	5	1/4–18NPT	7M10 Screw depth13	M4
X	Pg13.5	8	4.5	1/4–18NPT	7/16-20UNF Screw depth13	M4

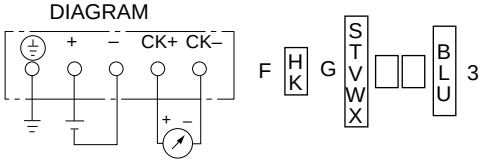
Table 1

Note1) : Cable gland is supplied in case of flamproof packing type.
ø11 cable is suitable.

F [H K] G [S T V W X] 0 □ [V H M T] 3



CONNECTION DIAGRAM



F [H K] G [S T V W X] [ ][ ] [B L U] 3

4th digit coode	Conduit conn.			Oval flange screw	Earth terminal
	E	F	H		
S	G1/2	17	8	7/16–20UNF Screw depth 13	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	M20 × 1.5	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.

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