

PRESSURE TRANSMITTER

DATA SHEET
FKG...6

The FKG model of the FCX-A IV series of pressure transmitters accurately measures a gauge pressure and transmits a proportional 4-20 mA output signal

The transmitter uses an unique micro-capacitive silicon sensor in combination with a state-of-the-art digital signal processing to provide exceptional performances interms of accuracy and stability.

FCX-A IV series of pressure transmitters comply with Safety Integrity Level 2 or 3 according to IEC 61508 and IEC 61511 standards.

FEATURES

1. High accuracy up to $\pm 0.04\%$

Fuji Electric's micro-capacitive silicon sensor provides in standard $\pm 0,065\%$ accuracy for all elevated or suppressed calibration ranges without additional adjustments.

$\pm 0.04\%$ accuracy is available in option.

2. Minimum inventory and design

Electronics parts, local indicators and electronics housing are interchangeable among all FCX-A IV transmitters.

3. Minimum environmental influence

The Advanced Floating Cell technology provides a high immunity against temperature variations and overpressure commonly found in the process industry and substantially reduces the overall measurement error.

4. HART 7 communication protocols

FCX-A IV series of pressure transmitters can communicate using the universal HART communication protocol.

By the use of the HART Device Description files, HART compatible devices can communicate with any FCX-A IV transmitter.

5. Application flexibility

Various options are available to address most of the process industry applications, including:

- Full range of hazardous area approvals
- Built-in RFI filter and lightning arrester
- 5 digits local display with engineering units
- Stainless steel electronics housing
- Wide selection of wetted part materials

6. Programmable output Linearization Function

The output signal can be linearized using up to 14 pairpoints.

7. Burnout current flexibility

The burnout current value can be adjusted in the ranges of [3.4 ; 3.8] and [20.8 ; 22.5] mA and can be compliant with NAMUR NE43 recommendations.

8. Contactless local adjustment

An optional local configurator with 3 magnetic switches allows to configure the transmitter without opening the indicator cover (flameproof approvals for hazardous locations). The Magnetic pen is required to enable the 3 magnetic switches (Please refer to ACCESSORIES).



FUNCTIONAL SPECIFICATIONS

Type:

FKG: Smart, 4-20 mA with HART communication protocol

Service:

Liquid, gas, or vapour

Span, range and overrange limit:

Model	Span limit kPa {bar}		Range limit kPa {bar}		Overrange limit MPa {bar}
	Min.	Max.	Lower limit	Upper limit	
FKG□01	1.3 {0.013}	130 {1.3}	-100 {-1}	130 {1.3}	1 {10}
FKG□02	5 {0.05}	500 {5}	-100 {-1}	500 {5}	1.5 {15}
FKG□03	30 {0.3}	3000 {30}	-100 {-1}	3000 {30}	9 {90}
FKG□04	100 {1}	10000 {100}	-100 {-1}	10000 {100}	15 {150}
FKG□05	500 {5}	50000 {500}	-100 {-1}	50000 {500}	75 {750}

Note: Span higher than 1/10 of the URL is recommended for optimal accuracy.

Lower range limit: (vacuum limit)

Silicone fill sensor: see fig.1

Fluorinated fill sensor:

66kPa abs (500 mmHg abs) at temperature -20 to 60°C

Output signal:

4-20 mA with HART communication protocol.

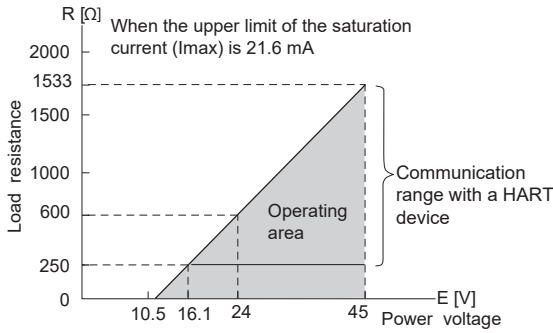
Power supply:

10.5 to 45 V DC at transmitter terminals.

10.5 to 32 V DC with the optional arrester.

Refer to hazardous location table for specific limitations

Load limitations: see figure below



Note 1 : The load resistance varies with the upper limit of the saturation current [I max]

$$R [\Omega] = \frac{E [V] - 10.5}{(I \text{ max [mA]} + 0.9) \times 10^{-3}}$$

Note 2 : For communication with a HART device, a minimum load of 250 Ω is required.

Hazardous locations:

Marking (Digit 10 th)	Protection type			
ATEX	K	Intrinsic Safety "i"		
		Ex II1 G/D		
		Ex ia IIC T4 Ga (Ta: -40°C to +60°C)		
		Ex ia IIC T5 Ga (Ta: -40°C to +50°C)		
		Ex ia IIIC T ₂₀₀ 135°C Da (Ta: -40°C to +60°C)		
		Ex ia IIIC T ₂₀₀ 100°C Da (Ta: -40°C to +50°C)		
		Ui = 28Vdc, li = 110mA, Pi = 0.77W		
		Ci = 14.9nF (without optional Arrester)		
		Ci = 26.0nF (with optional Arrester)		
		Li = 0.181mH		
	X	Flameproof Enclosure "d"		
		Ex II2 G		
		Ex db IIC T6... T4 Gb		
		Temperature class	Ambient temperature	Process temperature
		T6	-40°C to +65°C	-40°C to +85°C
		T5	-40°C to +85°C	-40°C to +100°C
		T4	-40°C to +60°C	-40°C to +120°C
M	IP66/67			
M	Combination (K) + (X) pending			
IECEX	T	Intrinsic Safety "i"		
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		T5	-40°C to +85°C	-40°C to +100°C
		T4	-40°C to +60°C	-40°C to +120°C
		IP66/67		
N	Combination (T) + (R) pending			

cCSAus pending		Intrinsic Safety/Non-Incendive
		J
E	Flameproof Enclosure XP Class I Division 1 Groups CD Class II Groups EFG, Class III T6 (-40°C ≤ Ta ≤ +65°C) T5 (-40°C ≤ Ta ≤ +85°C) T4 (-40°C ≤ Ta ≤ +60°C) Vmax = 45Vdc	
L	Combination (J) + (E)	

Configuration:

Configuration of the FCX-A IV series of pressure transmitters can be carried out by either using a HART device or the optional local configurator.

A third party HART device can be used in combination with Fuji Electric FCX-A IV HART Device Description files. (<https://fieldcommgroup.org>).

Functions	HART Protocol		Local configurator	
	Display	Set	Display	Set
Tag Nb	✓	✓	✓	✓
Model Nb	✓	✓	✓	✓
Serial Nb & Software revision	✓	—	✓	—
Engineering units	✓	✓	✓	✓
Upper Range Value	✓	—	✓	—
Measuring Range	✓	✓	✓	✓
Damping	✓	✓	✓	✓
Output signal type	Linear	✓	✓	✓
	Square Root	✓	✓	✓
Burnout current	✓	✓	✓	✓
Calibration	✓	✓	✓	✓
Output Adjust	—	✓	—	✓
Measuring Value	✓	—	✓	—
Self Diagnosis	✓	—	✓	—
External Adj Screw Lock	✓	✓	✓	✓
Transmitter Display	✓	✓	✓	✓
Linearization	✓	✓	✓	✓
Rerange	✓	✓	✓	✓
Saturation Current	✓	✓	✓	✓
Write Protect	✓	✓	✓	✓
History				
– Calibration History	✓	✓	✓	✓
– Ambient T° History	✓	—	✓	—

Zero and span adjustment:

Zero and span are remotely adjustable by a HART device or locally by the local configurator or the external adjustment screw.

Damping:

The damping time constant can be adjusted within the range of [0.04 to 32] seconds.

Zero elevation/suppression:

Zero can be adjusted within the range of -1 barg to +100% of the URL of the sensor.

Normal/reverse action:

Selectable by range setting

Local indicator:

Optional 5-digits LCD unit or local configurator with 3 magnetic switches and push-buttons.

A magnetic pen is required to enable this local configurator function.

(Please refer to the ACCESSORIES section.)

Saturation currents:

Lower limit: 3.6 to 4.0mA, Default value: 3.8mA
 Upper limit: 20.0 to 21.6mA, Default value: 20.8mA

Burnout direction and output current:

In the self-diagnostic functions detect a transmitter failure, the burnout function will drive the output signal to either "Output Hold", "Output Overscale" or "Output Underscale" modes.

When "Output Hold":

The output signal is held as the latest value just before the failure happens.

When "Output Overscale":

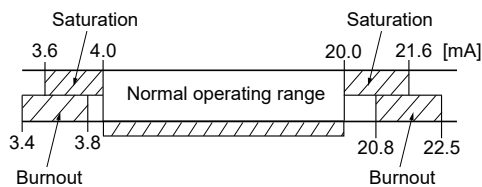
The output signal is set within the range of [20.8 to 22.5] mA, Default value: 21.6mA

When "Output Underscale":

The output signal is set within the range of [3.4 to 3.8] mA, Default value: 3.6mA

IEC 61511 considerations:

For safety applications, the "Output Hold" MUST NOT be used. Only "Output Overscale" and "Output Underscale" must be used to clearly notify a "failure" state.

**Loop-check/fixed output current:**

The transmitter can be configured to provide a constant output signal from 3.4 up to 22.5 mA.

Temperature limit:

Ambient
 -40 to +85°C
 -20 to +80°C (with optional LCD unit)
 -40 to +60°C (with optional arrester)

Please refer to the hazardous locations table for ambient temperature limitations according to the standard and type of protection.

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 (Relative Humidity)

PERFORMANCE SPECIFICATIONS

Reference conditions, silicone oil filling, SS 316 isolating diaphragms, 4-20 mA analog output.

Accuracy rating:

(including linearity, hysteresis, and repeatability)

For models up to 10000 kPag:

For spans > 1/10 of URL:
 $\pm 0.065\%$ (standard) of span or
 $\pm 0.04\%$ (option) of span
 For < 1/10 of URL:
 $\pm \left(0.015 + 0.005 \frac{\text{URL}}{\text{Span}} \right) \% \text{ of span}$

For 50000 kPag model:

For spans > 1/10 of URL: $\pm 0.1\%$ of span
 For spans < 1/10 of URL:
 $\pm \left(0.05 + 0.005 \frac{\text{URL}}{\text{Span}} \right) \% \text{ of span}$

Stability:

$\pm 0.1\%$ of upper range limit (URL) for 10 years.

Temperature effect:

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

Zero shift: $\pm \left(0.075 + 0.0125 \frac{\text{URL}}{\text{Span}} \right) \%$

Total effect: $\pm \left(0.095 + 0.0125 \frac{\text{URL}}{\text{Span}} \right) \%$

Double the effects for material code (7th digit in model code) "H", "M", "T"

Overrange effect:

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

Supply voltage effect:

Less than 0.005% of calibrated span per 1 V

Update rate:

40 msec

Turn on time:

6 sec

Response time: (63.3% of output signal without damping)

Time constant: 0.08 sec (at 23°C)

Dead time: about 0.06 sec

Response time = time constant + dead time

Electromagnetic compatibility:

FCX-A IV transmitters are in accordance with the following harmonized standards:

EN 61326-1
EN 61326-2-3
EN 61326-3-1

RFI effect:

< 0.2% of the URL for the frequencies from 20 up to 1000 MHz with an electrical field strength of 10 V/m and housing covers in place. (Classification: 2-abc: 0.2% of span according SAMA PMC 33.1).

Mounting position effect:

Zero shift:
 Less than 0.1 kPa {1 m bar} for a 10° tilt in any position. This error can be corrected by adjusting zero. (Double the effect for fluorinated fill sensors).
 No effect on span.

Vibration effect:

< $\pm 0.25\%$ of URL
 Frequency 10 to 150 Hz, acceleration 29.4 m/sec²

Dielectric strength:

500 V AC, 50/60Hz 1 min., between circuit and earth (except with the optional arrester)

Insulation resistance:

More than 100 MΩ at 500 V DC.

Internal resistance for external field indicator:

12 Ω max (connected to test terminal CK+ and CK-)

Pressure equipment directive (PED) 2014/68/EU:

According to Article 4.3

PHYSICAL SPECIFICATIONS

Electrical conduit connections:

1/2"-14 NPT, Pg13.5 or M20 × 1.5

Process connections:

Standard: 1/4"-18 NPT

Option: 1/2"-14 NPT with oval flanges.

Remark: the codification doesn't include the oval flange accessories.

Process-wetted parts material:

Material code (7th digit in the model code)	Process cover	Diaphragm	Wetted sensor body	Vent/drain
V	SS 316L	SS 316L	SS 316L	SS 316L
W	SS 316L	Hastelloy-C	SS 316L	SS 316L
J	SS 316L	SS 316L +Au coating	SS 316L	SS 316L
H	SS 316L	Hastelloy-C	Hastelloy-C	SS 316L
M	SS 316L	Monel	Monel lining	SS 316L
T	SS 316L	Tantalum	Tantalum lining	SS 316L

Remark: Gasket : Viton o-ring or PTFE square section gasket.
Availability of above material design depends on ranges and static pressure.
Refer to "Model codes".

Non-wetted parts material:

Electronics housing:

Low copper die-cast aluminum alloy finished with polyester coating (standard) or SS 316 (option)

Bolts and nuts:

Carbon steel, SS 316L or SS 660

Filling fluid:

Standard: Silicone oil

Option: Fluorinated oil

Mounting bracket: SS 316L (option)

Environmental protection:

IEC IP66 & IP67 and Type 4X

Mounting:

DN50(2") pipe or wall mounting using the mounting bracket.

Direct to process cover connections without the mounting bracket.

Mass {weight}:

Transmitter: 3.0 kg without options.

Add: 0.2 kg for indicator

0.5 kg for mounting bracket

2 kg for stainless steel housing (option)

ACCESSORIES

Oval flanges:

Converts process connection to 1/2"-14 NPT.

Magnet pen:

To be used with the 3 push-buttons optional indicators.

Order number = ZZP*TQ507742C1

OPTIONAL FEATURES

Local indicator:

An optional 5 digits indicator with engineering units is available.

A local configurator can be carried out using the 3 magnetic switches and push-buttons.

A separately ordered magnet pen is required for adjustment using the 3 magnetic push-buttons.

See the accessories section.

Arrester:

A built-in arrester protects the electronics from lightning surges.

Lightning surge immunity: ±4 kV (1.2 × 50 μs)

Oxygen service:

Special cleaning procedures are applied during the manufacturing process to maintain oil free all process wetted part. The filling fluid is fluorinated oil.

Chlorine service:

Same procedures and filling fluid as for oxygen service.

Degreasing:

Process-wetted parts are cleaned and the filling fluid is standard silicone oil. Not for use with oxygen or chlorine presence.

NACE specification:

Metallic materials for all pressure boundary parts comply with NACE MR 0175/ISO 15156.

SS 660 or SS 660/660 bolts and nuts comply with NACE MR 0175/ISO 15156.

Optional tag plate:

An extra stainless steel tag plate with customer tag data is wired to the transmitter.

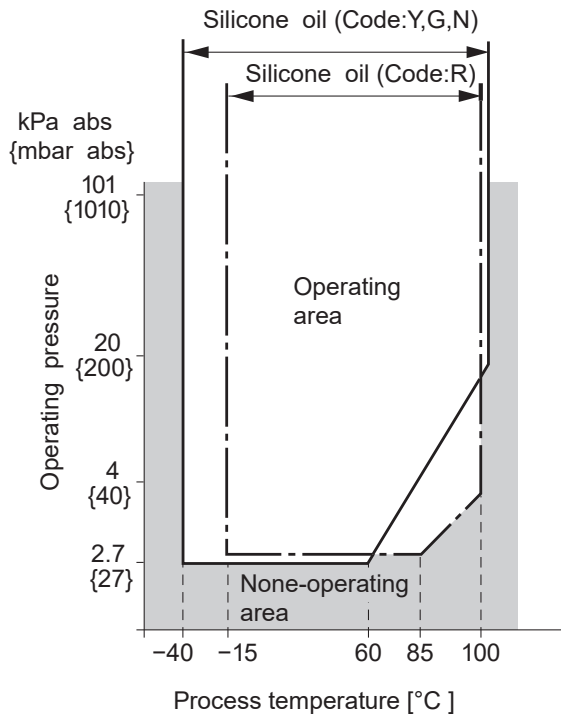
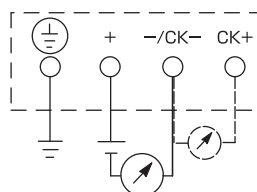


Fig. 1 Relation between process temperature and operating pressure

CONNECTION DIAGRAM



MODEL CODE SYMBOLS

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		Hastelloy C	Hastelloy C																																																																																																																																				
		Monel	Monel lining																																																																																																																																				
		Gold coating	SS 316L																																																																																																																																				
		Tantalum	Tantalum lining																																																																																																																																				
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	PVDF insert	Monel	Monel lining																																																																																																																																				
		Tantalum	Tantalum lining																																																																																																																																				
		0.05 to 5 bar 5 to 500 kPa 50 to 5000 mbarg 0.73 to 72.5 psig	SS 316L	SS 316L	SS 316L																																																																																																																																		
				Hastelloy C	Hastelloy C																																																																																																																																		
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	Monel		Monel lining																																																																																																																																				
	Tantalum		Tantalum lining																																																																																																																																				
	0.3 to 30 bar 30 to 3000 kPa 0.3 to 30 barg 4.35 to 435 psig		SS 316L	SS 316L	SS 316L																																																																																																																																		
				Hastelloy C	Hastelloy C																																																																																																																																		
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		Tantalum	Tantalum lining																																																																																																																																				
		1 to 100 bar 100 to 10000 kPa 1 to 100 barg 14.5 to 145 psig	SS 316L	SS 316L	SS 316L																																																																																																																																		
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	Gold/ceramics		Gold/ceramics																																																																																																																																				
	Tantalum		Tantalum lining																																																																																																																																				
5 to 500 bar 500 to 50000 kPa 5 to 500 barg 72.5 to 7251 psig	SS 316L	SS 316L	SS 316L																																																																																																																																				
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																Improvement Symbol																																																																																																																							
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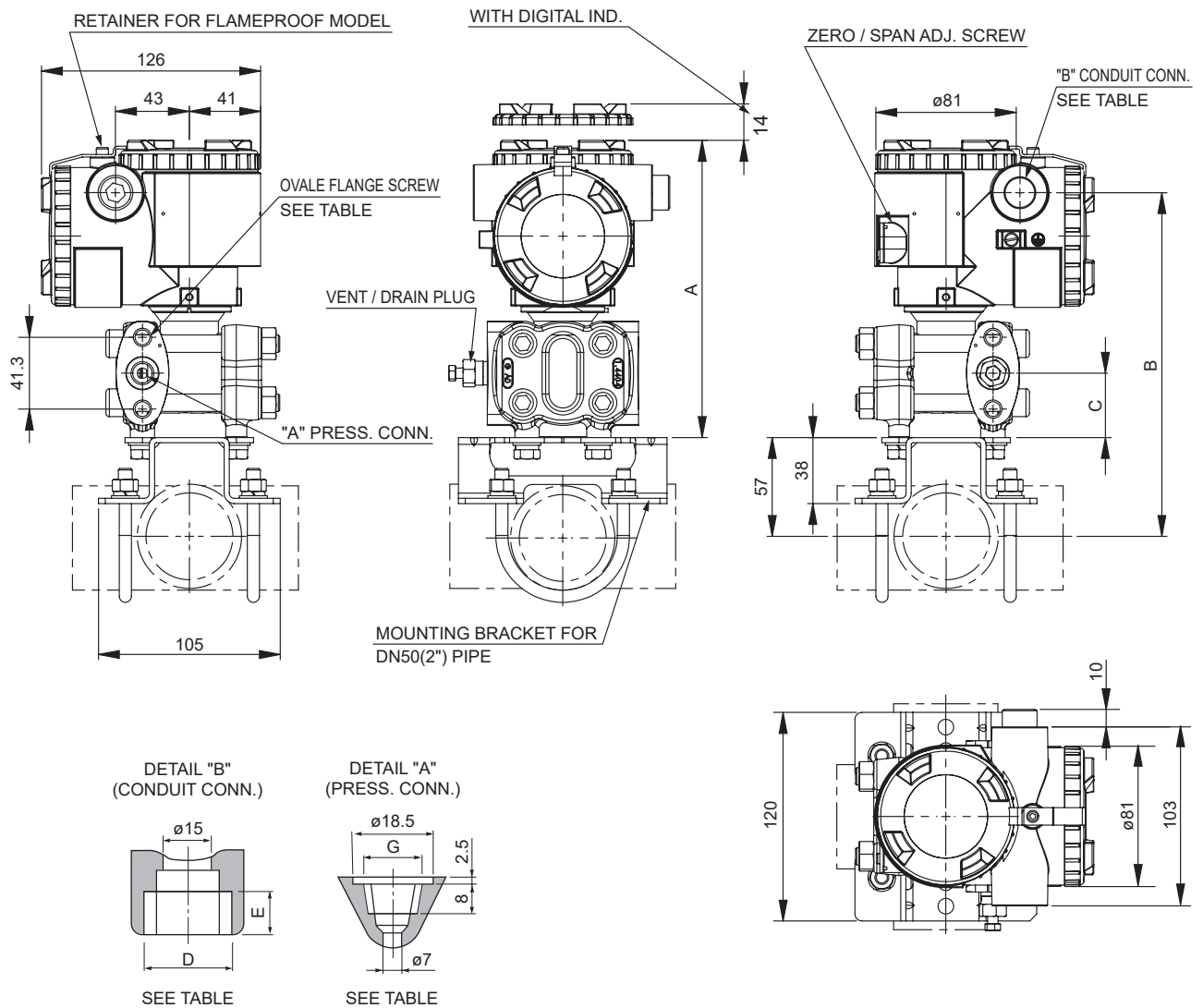
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	DESCRIPTION
F	K	G					6									Hazardous location approvals
A																None
X																(*4) ATEX - Flameproof
K																ATEX - Intrinsic Safety
M																(*4) ATEX - Combination Flameproof and Intrinsic Safety pending
E																cCSAus - Explosion proof pending
J																cCSAus - Intrinsic Safety and Non Incendive pending
L																(*4) cCSAus - Combination Explosion proof, Intrinsic Safety and Non Incendive pending
R																IECEX - Flameproof
T																IECEX - Intrinsic Safety
N																(*4) IECEX - Combination Flameproof and Intrinsic Safety pending
W																IECEX - ATEX - cCSAus - Explosion/Flameproof, Intrinsic Safety and Non Incendive pending
A																(*2) Side vent/drain
K																None (standard)
D																Mounting bracket
L																None
																SS 316L
																Yes
																None
																SS 316L
																Stainless steel parts
																TAG plate
Y																None
B																Yes
C																None
E																Yes
																None
																Yes
																Housing
																None
																Yes
																Paint of detecting unit
																None
																Special applications & Filling fluids
																Treatment
Y																None
W																Silicone oil
G																Fluorinated oil
A																Degreasing
D																Oxygen service
N																Fluorinated oil (only with digit 7=J,V,W)
																Chlorine service
																Fluorinated oil (only with digit 7=H,T)
																NACE
																Silicone oil
																Process cover gasket
C																PTFE square section gasket
G																Standard type
H																Carbon steel - M10 for static pressure < 160 bar (16MPa)
J																SS 316L / 316L - M10 for static pressure < 160 bar (16MPa)
K																Carbon steel - M12for static pressure > 160 bar (16MPa)
D																(*5) PTFE square section gasket
E																Standard type
M																Carbon steel - M10 for static pressure < 160 bar (16MPa)
4																SS 660 / 660 - M10 for static pressure < 160 bar (16MPa)
5																PTFE square section gasket in PVDF insert
6																Standard type
7																Carbon steel - M10 for static pressure < 160 bar (16MPa)
8																SS 316L / 316L - M10 for static pressure < 160 bar (16MPa)
																PTFE square section gasket in PVDF insert
																Standard type
																Carbon steel - M12for static pressure > 160 bar (16MPa)
																(*5) PTFE square section gasket in PVDF insert
																Standard type
																Carbon steel - M10 for static pressure < 160 bar (16MPa)
																SS 660 / 660 - M10 for static pressure < 160 bar (16MPa)
																Viton
																Standard type
																Carbon steel - M10 for static pressure < 160 bar (16MPa)
																SS 316L / 316L - M10 for static pressure < 160 bar (16MPa)
																Viton
																Standard type
																Carbon steel - M12for static pressure > 160 bar (16MPa)
																(*5) Viton
																Standard type
																Carbon steel - M10 for static pressure < 160 bar (16MPa)
																SS 660 / 660 - M10 for static pressure < 160 bar (16MPa)
																(*5) Viton
																Standard type
																Carbon steel - M12 for static pressure > 160 bar (16MPa)
																SS 660 / 660 - M12 for static pressure > 160 bar (16MPa)
																Special options
L																None
T																High accuracy type
																Instruction manual unattached
																(*6) * special, no code available

Notes* :

- 1- Turn Down Ratio < 10 is recommended for optimal performances.
- 2- Process cover with PVDF insert: 1/2-14 NPT side process connection only, square section PTFE gasket, no vent/drain
- 3- Gold/ceramic coating available upon request.
- 4- Only with M20 x 1.5 or 1/2-14 NPT electrical conduit
- 5- SS 660 bolts/nuts are in conformity with NACE MR0175/ISO 15156 and must be used for NACE service.
- 6- When no code can be found in the current model code, place "*" in the corresponding digit code as well as in the 16th digit

OUTLINE DIAGRAM (Unit : mm)

<L SHAPE> <4TH DIGIT CODE: R, T, X AND 7TH DIGIT CODE V, H, M, T>



4TH MODEL CODE	CONDUIT CONNECTION		PRESS. CONN.	OVAL FLANGE SCREW
	D	E	G	
R	M20×1.5	16	1/4-18NPT	7/16-20UNF
T	1/2-14NPT	16	1/4-18NPT	7/16-20UNF
X	Pg13.5	10.5	1/4-18NPT	7/16-20 UNF

TABLE

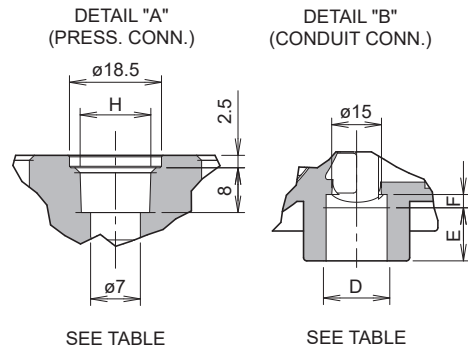
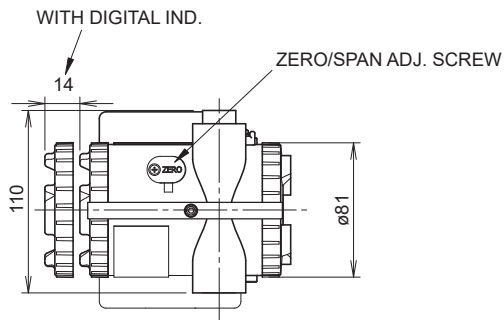
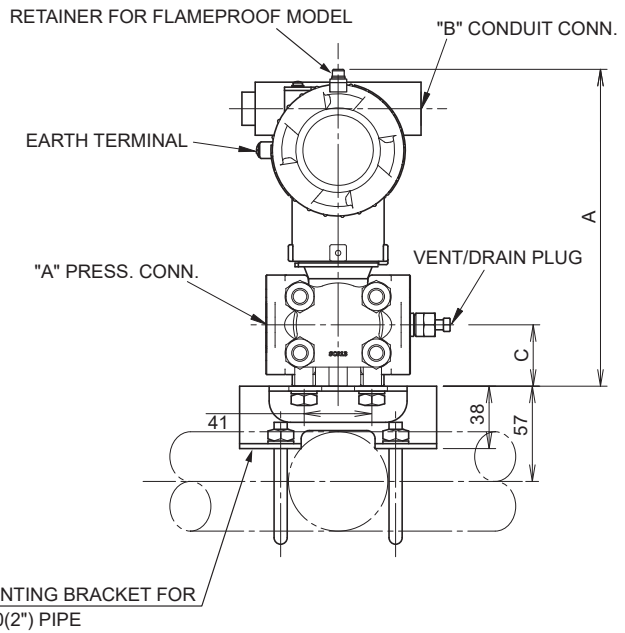
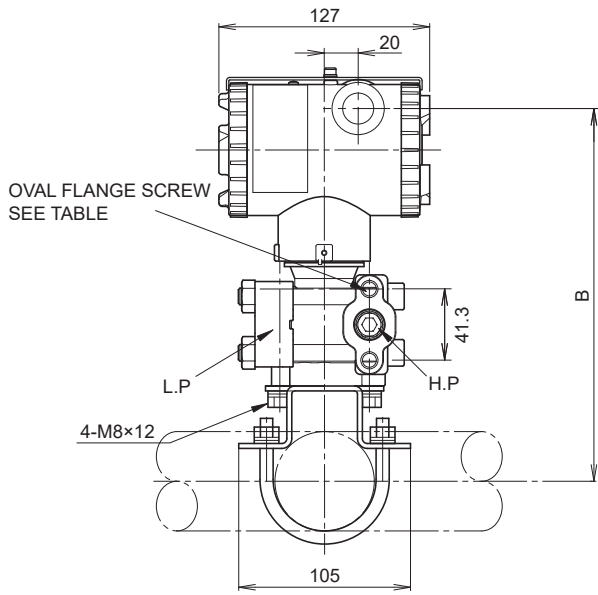
MODEL	DIMENSIONS		
	A	B	C
FKG□01	171 (175) NOTE	198 (202) NOTE	37 (38.5) NOTE
FKG□02			
FKG□03			
FKG□04			
FKG□05	172.5	199.5	38.5

NOTE: 7TH MODEL CODE "M", "T"

- WEIGHT : - 3.0 kg (WITHOUT OPTION)
 ADD : - 0.2 kg FOR INDICATOR
 - 0.5 kg FOR MOUNTING BRACKET
 - 2.0 kg FOR STAINLESS STEEL HOUSING OPTION

OUTLINE DIAGRAM (Unit : mm)

<T SHAPE> <4TH DIGIT CODE: 3, 6, 9 AND 7TH DIGIT CODE V, H, M, T>



4TH MODEL CODE	CONDUIT CONNECTION			PRESS. CONN.	OVAL FLANGE SCREW
	D	E	F	H	
3	M20×1.5	16	4	1/4-18NPT	7/16-20UNF
6	1/2-14NPT	16	4	1/4-18NPT	7/16-20UNF
9	Pg13.5	10.5	4.5	1/4-18NPT	7/16-20UNF

TABLE

MODEL	DIMENSIONS		
	A	B	C
FKG□01			
FKG□02	192 (196)	225 (229)	37 (38.5)
FKG□03	NOTE	NOTE	NOTE
FKG□04			
FKG□05	193.5	226.5	38.5

NOTE: 7TH MODEL CODE "M", "T"

- WEIGHT : - 3.0 kg (WITHOUT OPTION)
 ADD : - 0.2 kg FOR INDICATOR
 - 0.5 kg FOR MOUNTING BRACKET
 - 2.0 kg FOR STAINLESS STEEL HOUSING OPTION



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