

NUCLEAR QUALIFIED ANALOG DIFFERENTIAL PRESSURE TRANSMITTER

DATA SHEET
FYC...K, L

FYC nuclear qualified analog pressure transmitters accurately measure a differential pressure and convert it into a directly proportional 4-20mA output signal.

The main measuring element consists of a silicon micro-capacitive sensor highly proven in the continuous process industries.

The FYC series of FCX analog transmitters are specifically designed for safety in nuclear applications requiring high reliability and long lifetime in harsh environments (up to 55 kGy Total Integrated Dose).



FEATURES

1. High accuracy

The silicon micro-capacitive sensor provides exceptional precision over different measurement ranges.

2. Minimal environmental influence

The "floating measuring cell" concept helps to minimize errors due to variations in parameters such as temperature and overpressure.

3. Flexibility of use

Various features makes the FCX-All suitable for almost any process applications:

- Built-in RFI filter and lightning arrester
- Stainless steel electronics housing

4. Full analog design

The 100% analog design of the electronics ensures the highest level of reliability in nuclear applications.

FUNCTIONAL SPECIFICATIONS

Type:

FYC : Analog differential pressure transmitter

Service:

Liquid, gas, or vapour

Span, range and over range limit:

Type	Static pressure MPa {bar}	Span limits mmWC {mbar}		Range limit kPa {mbar}
		Min.	Max.	
FYC□11	-0.1 to +0.6 {-1 to +6} ⁽¹⁾	0...40 {0...4} ⁽¹⁾	0...100 {0...10}	±1 {±10}
FYC□22	-0.1 to +3.2 {-1 to +32} ⁽¹⁾	0...120 {0...12} ⁽¹⁾	0...600 {0...60}	±6 {±60}
FYC□33	-0.1 to +16 {-1 to +160}	0...530 {0...53}	0...3200 {0...320}	±32 {±320}
FYC□35	-0.1 to +16 {-1 to +160}	0...2170 {0...217}	0...13000 {0...1300}	±130 {±1300}
FYC□36	-0.1 to +16 {-1 to +160}	0...8333 {0...833}	0...50000 {0...5000}	±500 {±5000}
FYC□38	-0.1 to +16 {-1 to +160}	0...50000 {0...5000}	0...300000 {0...30000}	±3000 {±30000}
FYC□43	-0.1 to +42 ⁽²⁾ {-1 to +420 ⁽²⁾ }	0...530 {0...53}	0...3200 {0...320}	±32 {±320}
FYC□45	-0.1 to +42 ⁽²⁾ {-1 to +420 ⁽²⁾ }	0...2170 {0...217}	0...13000 {0...1300}	±130 {±1300}
FYC□46	-0.1 to +42 ⁽²⁾ {-1 to +420 ⁽²⁾ }	0...8333 {0...833}	0...50000 {0...5000}	±500 {±5000}
FYC□48	-0.1 to +30 ⁽²⁾ {-1 to +300 ⁽²⁾ }	0...50000 {0...5000}	0...300000 {0...30000}	±3000 {±30000}

Note (1):

K3 and K3ad Qualification (digit 8 = K):

- The maximum Turn Down Ratio must be 1:1 for FYC#11, FYC#22 and ≤ 6:1 for the other models.
- FYC#11 and FYC#22: the static pressure must be ≤ 6 bar.
- FYC#11 et FYC#22 are qualified for gaseous fluids.

Unclassified devices (digit 8 = L):

- FYC#11: the minimum measuring range is 4 mbar.

Note (2):

Maximum Working Pressure:

- MWP = 250 bar (25 MPa) with EPDM gasket (digit 14 = E).

Lower limit of static pressure (vacuum limit):

See fig.1.

Unilateral over range limit:

To maximum static pressure limit.

Output signal:

4 to 20mA (linear).

Power supply:

Transmitter operates on 13 to 53 Vdc
at transmitter terminals.

Load limitations:

Minimal: 0 Ω @ 13 Vdc or 200 Ω @ 17 Vdc.

Typic: 250 Ω @ 24 Vdc.

Maximum: 600 Ω .

Zero/span adjustment:

Zero is adjustable with the external adjustment screw located on the electronics enclosure and the measuring scale from an internal adjustment screw.

Damping:

Possible settings: 0.4, 1.2, 3.2 sec.

Zero elevation / suppression:

FYC#11: adjustable with the external adjustment screw between -40% to +60% of the URL.

Other models: adjustable with the external adjustment screw between -90% to +84% of the URL.

Temperature limits:

Ambient: -35°C to 70°C.

Process: -40°C to +120°C (silicon oil).

Storage: -40°C to +90°C.

Ambient pressure limit:

6 bar abs.

Humidity limit:

0 to 100% RH.

PERFORMANCE SPECIFICATIONS

(Reference conditions: 23 °C, SS 316L measuring diaphragm, silicone oil filled cell).

Upper Range Limit = URL, Gain = G

Accuracy:

Including linearity, hysteresis, and repeatability
For K3 qualified versions, 1 kPa and 6 kPa model are calibrated at the full scale (URL)

Models above 6 kPa:

For span between 1/6 URL & URL:

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

For span below 1/6 of URL:

Fuji Electric does not guaranty the measurement accuracy.

1 & 6 kPa model:

For span between 1/5 URL and URL for 6 Kpa model and between 4 mbar and URL for 1 kPa model:

$$\pm \left(0.5 \times \frac{\text{URL}}{\text{Span}} \right) \% \text{ of span.}$$

For span below 1/5 of URL for 6kPa model or below 4 mbar for 1kPa model (not classified versions):

Fuji Electric doesn't guaranty the measurement accuracy.

Stability:

±0.4 % of the URL for 1 year.

Temperature effect:

Reference condition: +23 °C ± 1°C, atmospheric pressure.
Effect per 28°C change on -35°C to 70°C range.

Measuring range (Digit 6)	Total effect G=1 (*) (% of URL)
"1", "2"	±2%
"3", "5", "6", "8"	±0.5%

(*) Multiply the total effect by G

Ambient pressure effect:

± 0.1 % of the calibrated span per 6 bar abs.

Static pressure effect:

Static pressure (Digit 5)	Total effect G=1 (*) (% of URL)
"1", "2"	± 0.05 % / 6 bar
"3", "4"	± 0.08 % / 100bar

(*) Multiply the total effect by G

Overrange effect:

Digit (5)	Total effect (% of URL)
"1", "2"	± 0.6 % / 2 bar
"3"	± 0.075 % / 160 bar
"4"	± 0.2 % / 420 bar

Supply voltage effect:

± 0.005%/V.

Response time:

As per IEC 60770-1, full scale input step, 63 % of the output signal.

Measuring range (Digit 6)	Response time
"1"	800 msec
"2"	500 msec
"3"	300 msec
"5" or "6" or "8"	200 msec

Above values to be multiplied by G when span not set at full scale.

Mounting position effect:

Zero shift:

Less than 12 mm H₂O for a 10° tilt in any plane. No effect on span. This error can be corrected by adjusting zero.

Vibration effect:

Lower than ± 1.5% of span. Frequency 10 to 500Hz, acceleration 9,8m/sec²

Seismic resistance:

Digit 4 = 3, 8:

Sismic integrity and operability according to RCC-E "UK components" S1 & S2 spectrums (0x-0z, 0y-0z: S1 17.5 g/S2 35 g).

Digit 4 = W, 6, 7

Sismic integrity and operability according to RCC-E
"Components" (0x-0z, 0y-0z: S1 15 g/S2 30 g)

Dielectric strength:

500Vrms, 50/60Hz during 1 min. between terminals + & -
on the one hand, and transmitter body on the other hand.
Leak current less than 3mA.

Insulation resistance:

More than 100MΩ at 500V DC, during 1 min., between
terminals + & - and transmitter housing.

Turn-on time:

4 seconds.

Irradiation effect:

±2.5% of URL at 55 kGy Total Integrated Dose Integrity
Integrity after 55 kGy TID.

Pressure equipment Directive (PED) 2014/68/UE:

According to Article 4.3.

PHYSICAL SPECIFICATIONS

Electrical connections:

M20 x 1,5 or
Souriau 8N35 socket, or
Souriau 8N45S socket, or
Souriau 8N45 socket, or
SAIB NU25.

Process connections:

Standard: 1/4" - 18 NPT.
Option: 1/2" - 14 NPT with oval flange.

Wetted parts material:

Digit (7)	Process cover	Diaphragm	Cell body	Vent / Drain
V	Ranges 1 & 2	SS 316L	SS 318LN	SS 316L
	Range 3 to 8	SS 316L		
J	Ranges 1 & 2	SS 316L	SS 316L + Au	SS 318LN
	Range 3 to 8	SS 316L	SS 316L + Au	SS 316L
A	All	C276 alloy		

Process cover gaskets:

EPDM (mandatory for K3, K3ad versions).
FKM (digit 8 = L only), high level of radiation.

Non-wetted parts material:

Transmitter housing: SS 316L.
Bolts and nuts:
SS 316L (static pressure ≤ 160 bar) or.
SS 660 (static pressure > 160 bar).
Filling fluid: Silicon oil.
Mounting bracket: SS 304L.

Environmental protection:

IP66 and IP67.

Mounting:

Optional SS 304 L mounting bracket for 50 mm (2") pipe.
Optional direct mounting on manifold without bracket.

Mass {weight}:

Transmitter only: 7 kg.
Add : Mounting bracket 0,5 kg.

OPTIONAL FEATURES

Degreasing:

Process wetted parts are cleaned.

Optional customer tag plate (75 x 20 mm):

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

Vacuum service:

Special silicone oil and filling procedure are applied.
(See below figure 1)

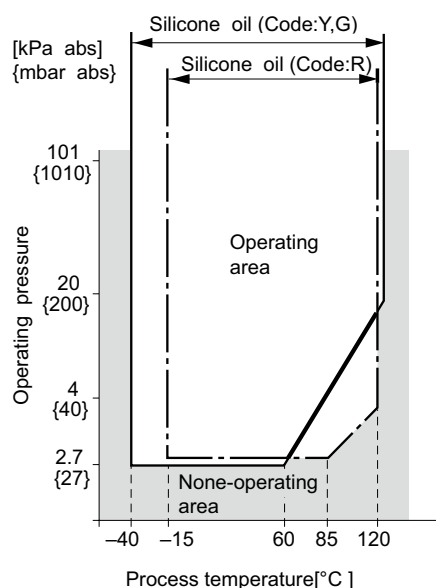


Fig.1 Relation between the temperature of process in contact
with cell's diaphragms and operating pressure.

OPTIONAL ACCESSORIES

Oval flanges:

Converts process connection to 1/2" - 14 NPT

MODEL CODE SYMBOLS - FYC

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Notes	Description
F	Y	C						A									Analog differential pressure transmitter
W																(1)	Connections
																(2)	Process Oval flange Conduit
																(3)	1/4-18 NPT M10 or M12 M20 x 1,5
																(3)	1/4-18 NPT M10 or M12 Souriau 8N45S socket
																(3)	1/4-18 NPT M10 or M12 Souriau 8N45 socket (not for EPR)
																	1/4-18 NPT M10 or M12 Souriau 8N35 socket (not for EPR)
																	1/4-18 NPT M10 or M12 SAIB NU25 socket
Range & materials																	
																	Static pressure limits Spans Process cover LP & HP side Measuring diaphragm Wetted cell body
1	1	V														(4)	SS 316L SS 316L SS 318LN
1	1	A														(4)	-1 to 6 bar 40 / 100 mmWC C276 alloy C276 alloy C276 alloy
1	1	J														(4)	SS 316L SS 316L + Au SS 318LN
2	2	V														(7)	SS 316L SS 316L SS 318LN
2	2	A														(7)	-1 to 32 bar 120 / 600 mmWC C276 alloy C276 alloy C276 alloy
2	2	J														(7)	SS 316L SS 316L + Au SS 318LN
3	3	V															SS 316L SS 316L SS 316L
3	3	A															530 / 3200 mmWC C276 alloy C276 alloy C276 alloy
3	3	J															SS 316L SS 316L + Au SS 316L
3	5	V															SS 316L SS 316L SS 316L
3	5	A															2.17 / 13 mWC C276 alloy C276 alloy C276 alloy
3	5	J															SS 316L SS 316L + Au SS 316L
3	6	V															SS 316L SS 316L SS 316L
3	6	A															8.33 / 50 mWC C276 alloy C276 alloy C276 alloy
3	6	J															SS 316L SS 316L + Au SS 316L
3	8	V															SS 316L SS 316L SS 316L
3	8	A															50 / 300 mWC C276 alloy C276 alloy C276 alloy
3	8	J															SS 316L SS 316L + Au SS 316L
4	3	V														(5)	SS 316L SS 316L SS 316L
4	3	A														(5)	530 / 3200 mmWC C276 alloy C276 alloy C276 alloy
4	3	J														(5)	SS 316L SS 316L + Au SS 316L
4	5	V														(5)	SS 316L SS 316L SS 316L
4	5	A														(5)	-1 to 420 bar 2.17 / 13 mWC C276 alloy C276 alloy C276 alloy
4	5	J														(5)	SS 316L SS 316L + Au SS 316L
4	6	V														(5)	SS 316L SS 316L SS 316L
4	6	A														(5)	8.33 / 50 mWC C276 alloy C276 alloy C276 alloy
4	6	J														(5)	SS 316L SS 316L + Au SS 316L
4	6	V														(5)	SS 316L SS 316L SS 316L
4	6	A														(5)	-1 to 300 bar 50 / 300 mWC C276 alloy C276 alloy C276 alloy
4	6	J														(5)	SS 316L SS 316L + Au SS 316L
Transmitter version																	
K	-	A															EDF "K3ad classification"
L	-	A														(6)	EDF "Not Classified"
Approvals for hazardous locations																	
A																	None
Vent / drain & mounting bracket																	
																	Vent / drain Mounting bracket (SS 304 L)
G																	Universal, direct mounting None
H																	Universal, direct mounting Yes - Recommended for UTO stock
Optional customer tag plate & Electronics housing																	
																	Tag plate Electronics housing
C																	Without SS 316 L
E																	SS 316L SS 316 L
Special applications & Fill fluids																	
																	Treatment Fill fluids
Y																	None Silicon oil
G																	Degreasing Silicon oil
R																	Vacuum service Silicon oil
Process cover gasket																	
-	A															(2)	FKM
-	E															(5)	EPDM
Bolts and nuts material																	
																(1)	SS 316 L /316 L (Bolts/nuts) - M10
E																	SS 660/660 (Bolts/nuts) - M12
W																	
Accessories (optional)																	
0																	Without
1																(2)	Cable gland

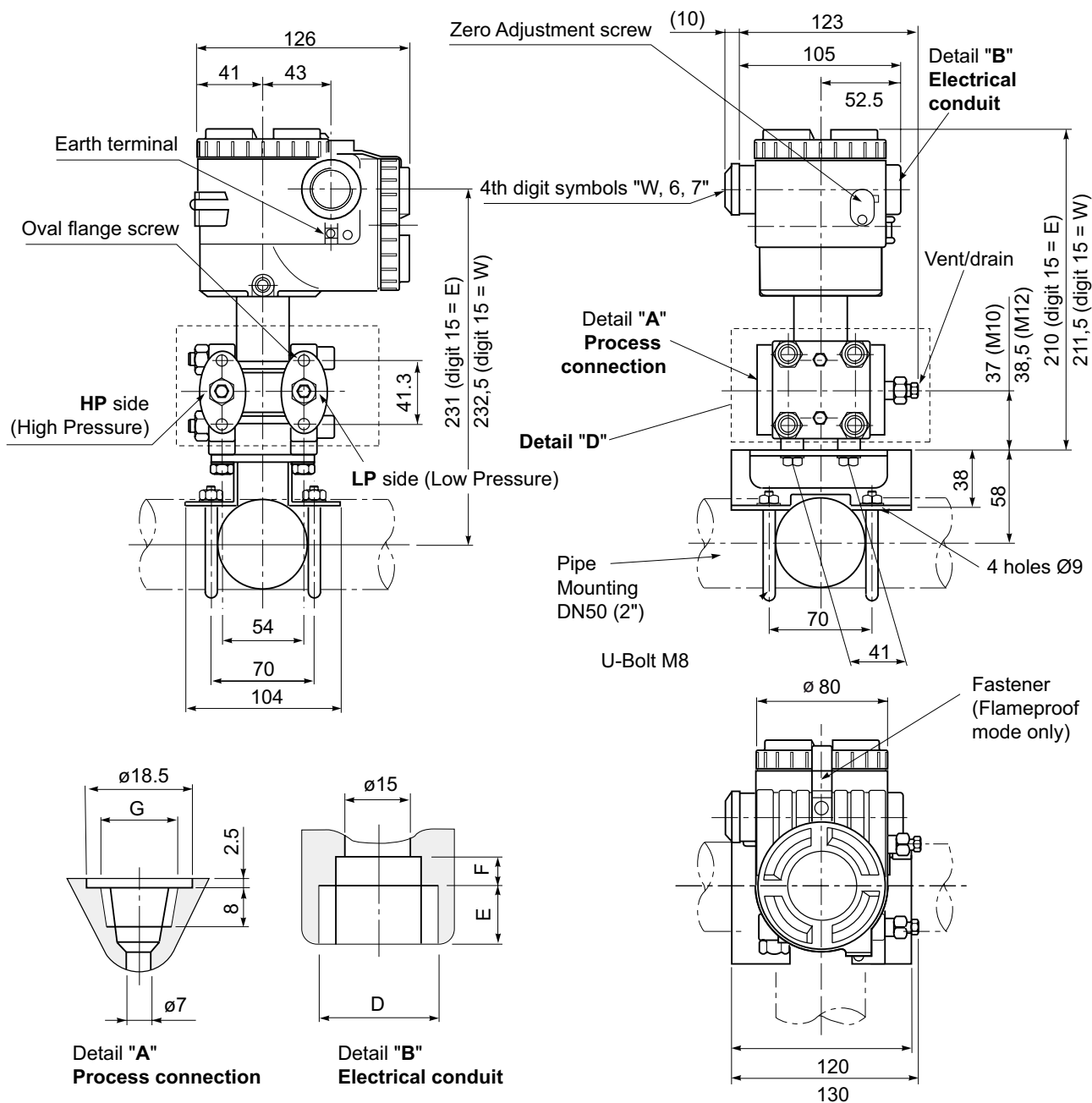
Notes* :
1- M12 oval flange thread for static pressure > 160 bar (16 Mpa) (Digit 5 = 4)
2- Digit 8 = L only.
3- Not for EPR (only existing power plant).
4- Qualified version (Digit 8 = K): calibrated span = 10 mbar & max static pressure = 6 bars.
5- MWP 250 bar when digit 14 = E
6- Same transmitter design as

Notes* :

- 1- M12 oval flange thread for static pressure > 160 bar (16 Mpa) (Digit 5 = 4)
- 2- Digit 8 = L only.
- 3- Not for EPR (only existing power plant).
- 4- Qualified version (Digit 8 = K): calibrated span = 10 mbar & max static pressure = 6 bars.
- 5- MWP 250 bar when digit 14 = E
- 6- Same transmitter design as for the K3 but assembled according to the standard QA process (ISO 9001).
- 7- Qualified version (Digit 8 = K): calibrated span = 60 mbar & max static pressure = 6 bars.

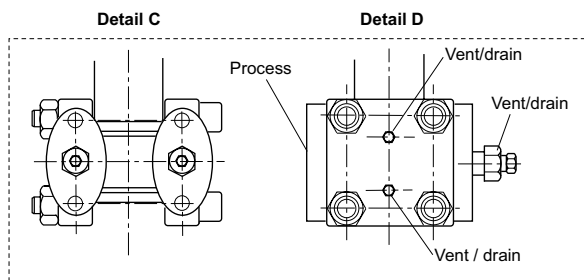
OUTLINE DIAGRAM (Unit : mm)

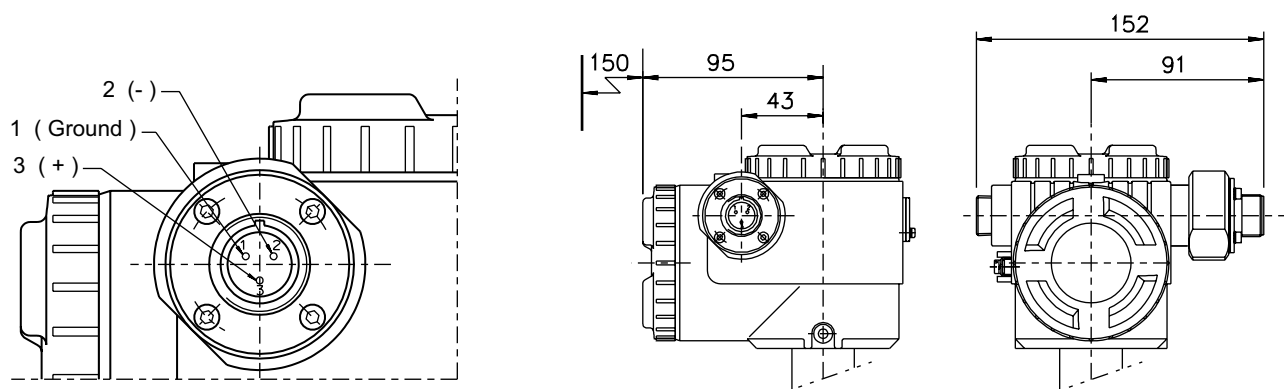
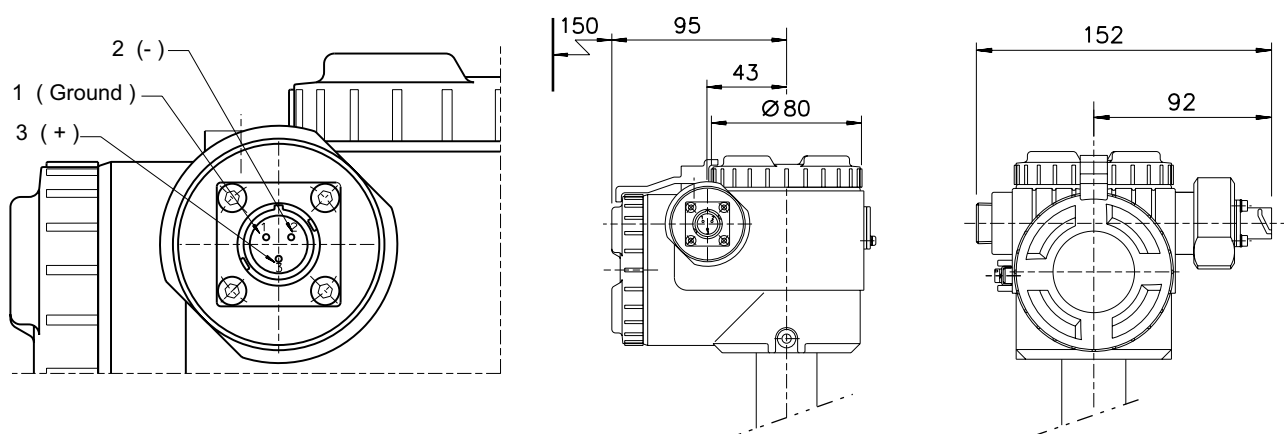
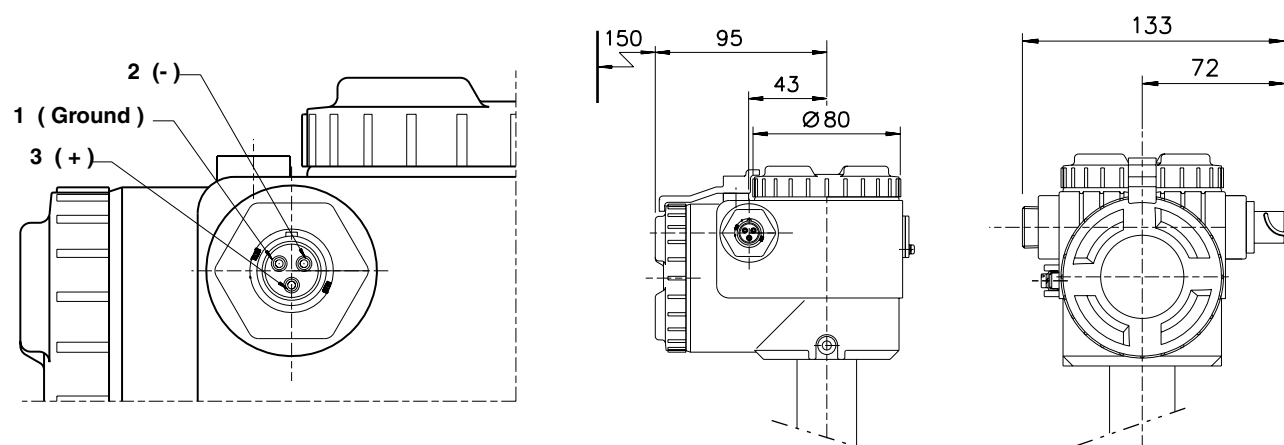
<ELECTRICAL CONDUIT M20 X 1,5> <DIGIT 4 = W>



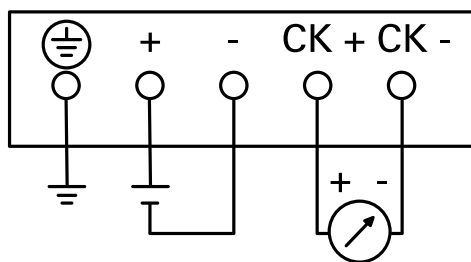
4th Digit	Conduit connection			Process connection
	D	E	F	G
W	M20 x 1,5	16	5	1/4-18NPT

“Universal vent/drain, direct mounting” configuration (11th digit : G & H)



OUTLINE DIAGRAM (Unit : mm)**CONDUIT CONNECTION FOR SOCKETS (4TH DIGIT = 3, 6, 7 OR 8)****SOURIAU 8N35 SOCKET (DIGIT 4 = 7)****SOURIAU 8N45 / 8N45S SOCKETS (4TH DIGIT = 6, 3)****SAIB NU25 SOCKET (4TH DIGIT = 8)**

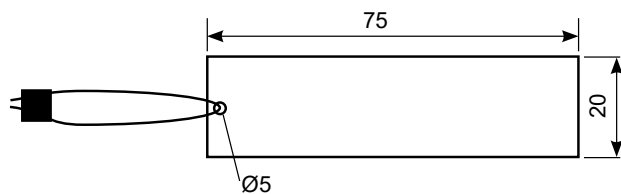
CONNECTION DIAGRAM



Connection of current 4/20mA loop test ammeter.
(Max impedance = 12Ω)

OPTIONAL CUSTOMER TAG PLATE

Attached to transmitter with SS 304 wire





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