

DIFFERENTIAL PRESSURE (FLOW) TRANSMITTER EDF "Not Classified" version and EDF "K3A Classification" version

DATA SHEET

FKC...K, L

The FCX –All differential pressure (flow) transmitter accurately measures differential pressure, liquid level, gauge pressure or flow rate 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**
0.07% accuracy is a standard feature. 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.
- Fuji/HART® bilingual communication protocol**
FCX-All series transmitter offers bilingual communication to speak both Fuji proprietary protocol and HART®. Any HART® compatible devices can communicate with FCX-All.
- Application flexibility**
Various options that render the FCX-All 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
 - 5 digits LCD meter with engineering unit
 - Stainless steel electronics housing
 - Wide selection of materials
- Programmable output Linearisation Function**
In addition to linear and square root, output signal is freely programmable.
- Burnout current flexibility**
(Under Scale : 3,2 to 4,0mA, Over scale : 20,0 to 22,5mA)
Burnout signal level is adjustable using Hand Held Communicator (Fuji FXW) to comply with NAMUR NE43.
- Dry calibration without reference pressure**
Thanks to the best combination of unique construction of mechanical parts (sensor unit), reliability of dry calibration without reference pressure is at equal level as wet calibration.

Functional specifications

Type :

FKC : SMART, 4-20mA cc + digital signal Fuji/HART®

Service :

Liquid, gas or vapour

Static pressure, span and range limit :

Type	Static pressure [MPa] {bar}	Span limit [mmCE] {mbar}		Range limit [kPa] {mbar}	
		Min.	Max.		
FKC□11	-0.1 to +3.2 {-1 to +32}	10 {1}	100 {10}	±1 {±10}	
FKC□22	-0.1 to +10 {-1 to +100}	10 {1}	600 {60}	±6 {±60}	
FKC□33	-0.1 to +16 {-1 to +160}	32 {3.2}	3200 {320}	±32 {±320}	
FKC□35	-0.1 to +16 {-1 to +160}	130 {13}	13000 {1300}	±130 {±1300}	
FKC□36	-0.1 to +16 {-1 to +160}	500 {50}	50000 {5000}	±500 {±5000}	
FKC□38	-0.1 to +16 {-1 to +160}	3000 {300}	300000 {30000}	±3000 {±30000}	
FKC□43	-0.1 to +42 {-1 to +420}	32 {3.2}	3200 {320}	±32 {±320}	
FKC□45	-0.1 to +42 {-1 to +420}	130 {13}	13000 {1300}	±130 {±1300}	
FKC□46	-0.1 to +42 {-1 to +420}	500 {50}	50000 {5000}	±500 {±5000}	
FKC□48	-0.1 to +30 {-1 to +300}	3000 {300}	300000 {30000}	±3000 {±30000}	

Caution :

For K3A qualified models, the ratio max. span / adjusted span (rangeability) must be :

≤ 5:1 for FKC□11, FKC□22
≤ 10:1 for others models.

Lower limit of static pressure (vacuum limit) :

Silicone fill sensor : see fig.1 page 4

Fluorinated fill sensor : 660 mbar abs.(500 torr) at temperature below 60°C.

Over range limit : To maximum static pressure limit

Output signal :

4 to 20mA DC (linear or square root) with Fuji or HART® digital signal superimposed on the 4 to 20mA.

Power supply :

Transmitter operates on 10.5V to 53V DC at transmitter terminals.

Load limitations :

Mini = 0Ω without digital communication
= 250 Ω mini for digital communication (Fuji or HART® protocols)

Maxi (Ω) = (V power supply - 10,5) / 0,0225 for default settings

Maxi (Ω) = (V power supply - 10,5) / (Imax + 0,9) x 1000 for user settings, where Imax (mA) is the highest of the following values :

- Either the max output signal in case of electronics failure (Burnout), when OVER SCALE Burnout is selected
- Or the max output process signal in case saturation over 20mA, when "SATURATE CUR" is selected to "SAT HI"

For details, see FCX-All or FXW Hand Held Communicator manuals.

Note : Above values are applicable for electronics from version 4FA (software 4.06), which includes K3A qualified models.

Hazardous locations :

Designed to meet international intrinsic safety and flameproof (explosionproof) standards.

Please consult the code symbols some pages further on, to know the different types of approvals. Consult Fuji Electric for status.

Zero / span adjustment :

Zero and span are adjustable by the FXW communicator. Local adjustment of zero and span are possible from outside screw on the electronics housing.

Damping :

Additional damping of the output signal is adjustable between 0,12 and 32 sec with the FXW communicator, and/or with the optional LCD indicator.

Zero elevation / suppression :

Adjustable with the FXW communicator or with the external screw on the electronic housing between -100% to +100% of URL.

Normal / reverse action :

Programmable with FXW communicator.

Indication :

A plug-in analog indicator can be mounted on the electronics unit or the terminal block.

The local LCD indicator (5 digits) is assembled on the electronics unit.

Additional local adjustment facilities are possible by the integrated switches in the LCD indicator :

- "Local/comm" switch gives the possibilities to make local adjustments of zero/span, damping or to configure the transmitter with the FXW communicator.
- The "mode" switch with 7 positions gives local adjustment possibilities for zero/span, 4/20mA, enable or inhibit the local adjustments.
- Local damping adjustment is possible via the "damp" switch.

Burnout direction : (selected from the FXW communicator)

If self-diagnostic detect transmitter failure, the analog signal will be driven to either "Output Hold", "Output Overscale" or "Output Underscale" modes.

"Output Hold" :

Output signal is hold at the value just before failure happens.

"Output Overscale" :

Adjustable within the range 20.0 mA to 22.5 mA from the FXW communicator.

"Output Underscale" :

Adjustable within the range 3.2 mA to 4.0 mA from the FXW communicator.

Loop-check output :

Transmitter can be configured to provide constant signal of 3.8mA to 21.6mA by the FXW communicator.

Temperature limit :**Ambient :**

-40 to +60°C (-25 to +55°C for K3A)
-20 to +60°C (-20 to +55°C for K3A) for optional LCD indicator

-20 to +60°C for optional fluorinated oil

For explosionproof units (flameproof or intrinsic safety), ambient temperature must be within the limits specified by each standard.

Process : -40 to +120°C (silicone oil)
-20 to +80°C (fluorinated oil)

Storage : -40 to +90°C

Humidity limit :

0 to 100% RH (electronics housing closed and sealed)

Communication :

With HHC⁽¹⁾ (model FXW, consult DS EDS8-47), following items can be remotely displayed or configured.

Note: HHC's version must be higher than 7.0 (or FXW □□□□1-□4), for FCX-All for supporting these items : "Saturate current", "Write protect", and "History".

Items	Fuji Protocol with FXW		Hart Protocol	
	Display	Set	Display	Set
Tag No.	✓	✓	✓	✓
Model No.	✓	✓	—	—
Serial No. & Software Version	✓	—	✓	—
Engineering unit	✓	✓	✓	✓
Range limit	✓	—	✓	—
Measuring range	✓	✓	✓	✓
Damping	✓	✓	✓	✓
Output mode	Linear	✓	✓	✓
	Square root	✓	✓	✓
Burnout direction	✓	✓	✓	✓
Calibration	✓	✓	✓	✓
Output adjust	—	✓	—	✓
Data	✓	—	✓	—
Self diagnoses	✓	—	✓	—
Printer (In case of FXW with printer option)	✓	—	—	—
External switch lock	✓	✓	✓	✓
Transmitter display	✓	✓	✓	✓
Linearize	✓	✓	—	—
Rerange	✓	✓	✓	✓
Saturate current	✓	✓	✓	✓
Write protect	✓	✓	✓	✓
History				
- Calibration history	✓	✓	✓	✓

Programmable output linearization function :

Output signal can be characterized with "14 points linear approximation function" from the FXW communicator.

Performance specifications

(Reference conditions, silicone oil fill).

For linear output

Accuracy ratings : (including linearity, hysteresis, and repeatability)

Max span above 32kPa models :

For spans greater than 1/10 of URL :

±0.07% of span

For spans below 1/10 of URL :

$$\pm(0,02 + 0,05 \frac{0,1 \times \text{URL}}{\text{Span}}) \% \text{ of span}$$

Max span 1kPa, 6kPa models :

For spans greater than 1/10 of URL :

±0.1% of span

For spans below 1/10 of URL :

$$\pm(0,02 + 0,05 \frac{0,1 \times \text{URL}}{\text{Span}}) \% \text{ of span}$$

Stability : ± 0,1% of upper range limit (URL) for 3 years.

Temperature effect :

Effects per 28°C change between the limits of -25 and +55°C.

Range (6th digit in code symbols)	Zero shift (% of span)	Total effect (% of span)
"1"/100 mmCE max	±(0,125+0,1 $\frac{\text{URL}}{\text{Span}}$) %	±(0,15+0,1 $\frac{\text{URL}}{\text{Span}}$) %
"2"/600 mmCE max		
"3"/3,2 mCE max	±(0,075+0,0125 $\frac{\text{URL}}{\text{Span}}$) %	±(0,095+0,0125 $\frac{\text{URL}}{\text{Span}}$) %
"5"/13 mCE max		
"6"/50 mCE max		
"8"/300 mCE max		

Double the effects for material code A in 7 th digit in codes symbols

Static pressure effect :

Static pressure code (5th digit in code symbols)	Zero shift (% of URL)	Span shift (% of calibrated span)
"1" / 100mmCE	± 0,2% / 10bar	-0,2% / 32bar
"2" / 600mmCE	± 0,1% / 32bar	-0,2% / 32bar
"3" "4"	± 0,05% / 100bar	-0,2% / 100bar

Double the effects for material code A in 7 th digit in codes symbols

Overrange effect :

Static pressure code (5th digit in code symbols)	Zero shift (% of URL)
"1" / 100 mmCE	± 0,3% / 10 bar
"2" / 600 mmCE	± 0,1% / 32 bar
"3"	± 0,1% / 160 bar
"4"	± 0,25% / 420 bar

Double the effects for material code A in 7 th digit in codes symbols

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 30V/m when electronics covers on. (Classification: 2-abc: 0.2% of span per SAMA PMC 33.1)

Response time : (at 63,2% of the output signal)

Range code (6th digit in code symbols)	Time constant	Dead time
"1"	800 msec	Approx.200 msec
"2"	500 msec	
"3"	300 msec	
"5" to "8"	200 msec	

Response time = time constant + dead time

Mounting position effect :

Zero shift :

Less than 12 mmWE for a 10° tilt in any plane. No effect on span.

This error can be corrected by adjusting zero.

Vibration effect :

< ±0,25% of span for spans greater than 1/10 of URL. Frequency 10 to 150Hz, acceleration 39,2m/sec²

Dielectric strenght :

500V AC, 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 + & - on the one hand, and transmitter body on the other hand.

Turn-on time : 4 seconds

Internal resistance for external field indicator :

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

For square root output (√)

Accuracy rating :

Max. span ≥ 32 kPa :

Output signal	Span	
	> 0,1 URL	< 0,1 URL
50 to 100%	± 0,07% of span	±(0,02+0,05 $\frac{0,1 \times \text{URL}}{\text{Span}}$) % of span
20 to 50%	± 0,175% of span	±2,5(0,02+0,05 $\frac{0,1 \times \text{URL}}{\text{Span}}$) % of span
10 to 20%	± 0,35% of span	±5(0,02+0,05 $\frac{0,1 \times \text{URL}}{\text{Span}}$) % of span

Max. span 1kPa, 6kPa :

For spans > 1/5 URL

Output signal	Accuracy (% of span)
50 to 100%	±0,1%
20 to 50%	±0,25%
10 to 20%	±0,5%

Temperature effect :

Effect per 28°C change between the limits of -25 and +55°C (in % of span)

Range code	Shift at 20% output point
"1" and "2"	±(0,3+0,25 $\frac{\text{URL}}{\text{Span}}$) % / 28°C
"3" to "8"	±(0,24+0,03125 $\frac{\text{URL}}{\text{Span}}$) % / 28°C

Double the effects for material code A in 7 th digit in codes symbols

Cut point & Low flow cut-off :

Cut point is configurable to any value between 0 to 20% of adjusted range.

The cut point is used for stabilizing output near 0% when the square root extraction mode is selected for output signal.

There are two modes :

In one mode, output is proportional to DP between 0% & the cut point.

In the other mode, output is forced to 0% between 0% & the cut point. This mode is also called "Low Flow Cut-Off".

Physical specifications

Electrical connections :

M20 x 1,5 or
ATEX flameproof cable gland, or
Souriau 8N35 socket, or
Souriau 8N45S socket, or
Souriau 8N45 socket, or
SAIB NU25 ref. 251-103-401 / M20 x 1,5 socket
(Compatible with 8N45 installed base)
Jaeger M20 x 1,5 socket ref. 536 006 006

Process connections :

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

Process-wetted parts material :

Material code (7th digit)	Process cover	Diaphragm	wetted sensor body	Vent / Drain
V	Ranges 1 & 2	SS 316	SS 316 L SS 318LN (Duplex 1.4462)	SS 316
	Range 3 to 8	SS 316	SS 316 L	SS 316
A		Hast C276	Hast C276	Hast C276
J		SS 316	SS 316 L + gold coat	SS 316

Remark :

Sensor gasket : Viton o-ring

Non-wetted parts material :

Electronics housing :
- Standard :
Low copper die-cast aluminum alloy, finished with
epoxy / polyurethane double coating
- Option : SS 316
Bolts and nuts :
SS 316 (static pressure ≤ 160 bar) or
SS 660 (static pressure > 160 bar)
Fill fluid :
Standard : silicone oil
Option : fluorinated oil
Mounting bracket : SS 304

Environmental protection :

IP66 / IP67

Mounting :

Without mounting bracket :
Direct mounting on manifold (optional)
With optional mounting bracket :
for 50mm (2") pipe or direct wall mounting

Mass {weight} :

Transmitter only : 6 kg
Add :
Mounting bracket : 0,5 kg
indicator (option) : 0,34 kg (0,68 kg in SS)
SS housing (option) : 1,4 kg

Optional features

Indicator :

A plug-in analog indicator (1.5% accuracy) can be located in the electronics compartment or in the terminal box of the housing. Alternatively, an optional 5 digits LCD meter is also available on the electronics compartment side only.

Oxygen service :

Special cleaning procedures are followed throughout the process to maintain all process wetted parts oil-free.
The fill fluid is fluorinated oil.

Degreasing :

Process wetted parts are cleaned, but the fill fluid is standard silicone oil. This option must not be selected for oxygen or chlorine applications.

Optional customer tag plate (75 x 20 mm) :

A 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)

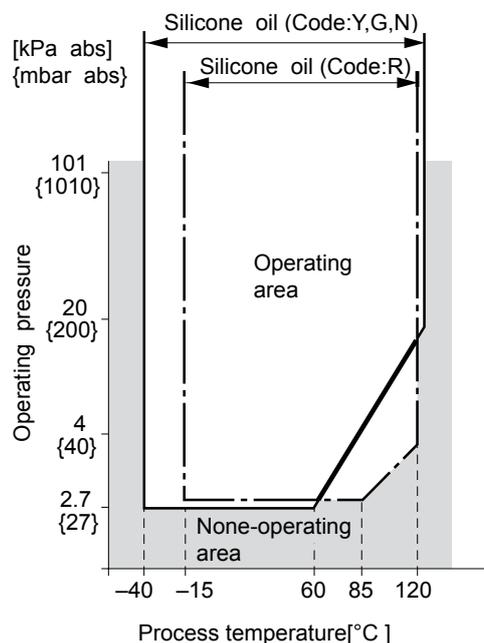


Fig.1 Relation between the temperature of process in contact with cell's diaphragms and operating pressure.

OPTIONAL ACCESSORIES

Oval flanges :

Converts process connection to 1/2"-14 NPT

Manifolds :

Refer to Data Sheet No. EDS6-F03

Hand held communicator FXW :

Model FXW, refer to Data Sheet No.EDS8-47

CODE SYMBOLS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Description
F	K	C											A			
																Differential pressure transmitter SMART : 4-20mA Acc + FUJI et HART® digital signal
																Connections
																Process connection
																Oval flange connection
																Conduit connection
W																M20 x 1,5 (ATEX cable gland for flameproof (optional))
3																Souriau 8N45S socket
6																Souriau 8N45 socket (not for EPR reactors)
7																Souriau 8N35 socket (not for EPR reactors)
8																SAIB NU25, ref 251-103-401 / M20 x 1,5 socket (compatible with 8N45 installed equipment)
9																Jaeger (M20x1,5) socket ref. 536 006 006
																Range & materials
																Static pressure limits
																Spans (*2)
																Process cover LP & HP side
																Measuring diaphragm
																Wetted cell body
1	1	V														(*2)
1	1	A														(*6)
2	2	V														(*6)
2	2	A														(*6)
3	3	V														(*6)
3	3	A														(*6)
3	3	J														(*6)
3	5	V														(*6)
3	5	A														(*6)
3	5	J														(*6)
3	6	V														(*6)
3	6	A														(*6)
3	6	J														(*6)
3	8	V														(*6)
3	8	A														(*6)
3	8	J														(*6)
4	3	V														(*6)
4	3	A														(*6)
4	3	J														(*6)
4	5	V														(*6)
4	5	A														(*6)
4	5	J														(*6)
4	6	V														(*6)
4	6	A														(*6)
4	6	J														(*6)
4	8	V														(*6)
4	8	A														(*6)
4	8	J														(*6)
																Transmitter version, Indicator & Initial setting
																Transmitter version
																Indicator
																Initial setting
K	-	A														EDF "K3A Classification"
K	-	L														EDF "Not Classified"
L	-	A														(*5)
L	-	B														(*5)
L	-	C														(*5)
L	-	D														(*5)
L	-	L														(*5)
L	-	P														(*5)
L	-	M														(*5)
																Approvals for hazardous locations (consult Fuji)
A																None (standard)
X																(4*) Flameproof housing ATEX Ex II 2 GD - EEx d IIC T5/T6
																Vent / drain & mounting bracket
																Vent / drain
																Mounting bracket (SS 304)
A																In line
C																In line
D																Side
F																Side
G																Universal, direct mounting
H																Universal, direct mounting
																Yes - Recommended for UTO stock
																Optional customer tag plate & Electronics housing
																Tag plate
																Electronics housing
Y																(*7) (*6)
B																(*7) (*6)
C																(*7) (*6)
E																(*7) (*6)
																Special applications & fill fluids
																Treatment
																Fill fluids
Y																(*6)
G																(*6)
A																(*6)
R																(*6)
																Process cover gasket
-																Viton
																Bolts and nuts material
E																(*3)
W																(*3)
																Accessories (optional)
1																ATEX - Flameproof cable gland

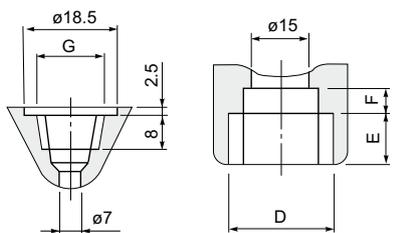
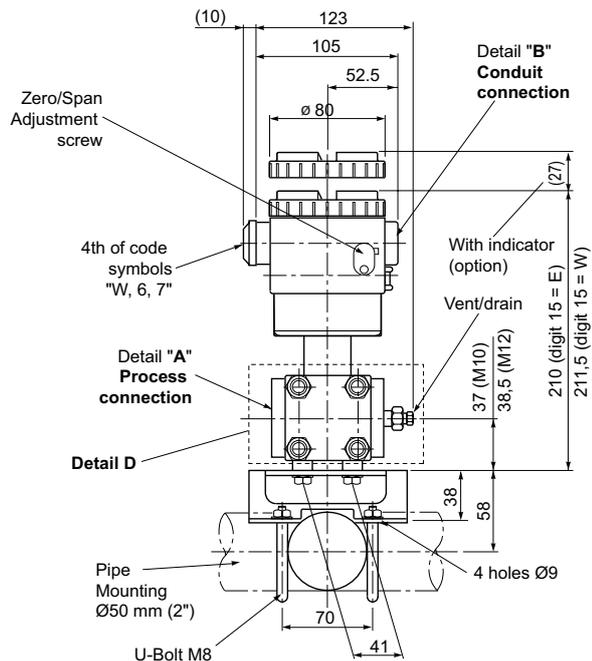
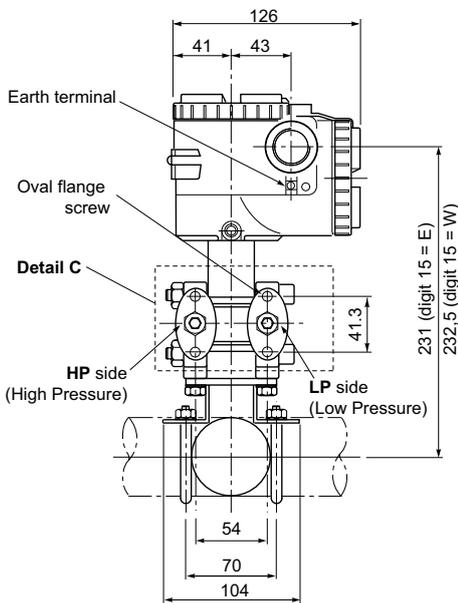
Notes* :

- All models are equipped with surge arrester specifically designed for EDF.
- 1- The thread of process cover is M12, if static pressure of 420 bar (5th digit = 4)
- 2- Turn down of 100 : 1 is possible, but it should be used at a span greater than 1/25 of the maximum span for better performance.
For K3A qualified models, the ratio max. span / adjusted span (rangeability) must be : $\leq 5:1$ for FK□□11, FK□□22
 $\leq 10:1$ for others models.
- 3- SS316 M10 bolting (digit n°15 = E) is only for use with models whose maximum working pressure is up to 160 bar ;
For static pressure > 160 bar, please specify : SS 660 bolts in M12 (15th digit = W);
Bolting for process covers of transmitters Classified K3A has got a corrosion protective treatment on all non machined surfaces.
- 4- Not available for SAIB, Souriau 8N35 / 8N45 / 8N45S and Jaeger sockets.
To use with flameproof cable gland ATEX delivered by FUJI (option) or mounted by EDF.
- 5- Transmitters' design is similar to K3A but on standard QA (ISO 9001)
- 6- Only applicable for transmitter version EDF "Not Classified" Digit 8 code L
- 7- Use only SS316 housing (digit n°12 = C, E) inside salty atmosphere (eg : outside close to sea side), or irradiated area.
- 8- FK□6 & FK□7 transmitters can only be used in existing power plants (not for EPR)
- 9- FK□W, FK□3 & FK□8 transmitters can be used in existing power plants and EPR.
FK□W transmitters can be equipped with (optional) Flameproof cable gland. When mounted on the transmitter, additional 16th digit is set to 1.

OUTLINE DIAGRAM (unit : mm)

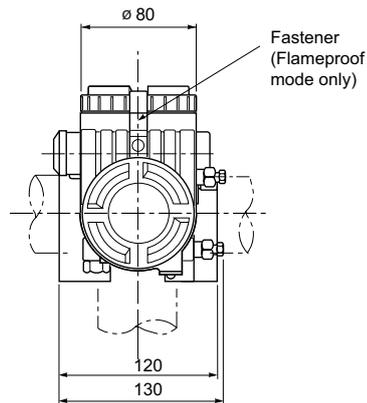
Conduit connection M20 x 1,5 (4th digit = W)

“In line vent/drain” configuration (11th digit : A & C)

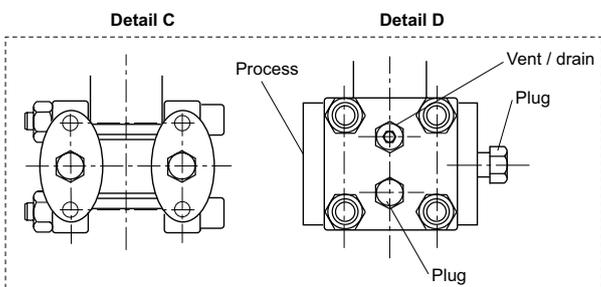


Detail "A" Process connection Detail "B" Conduit connection

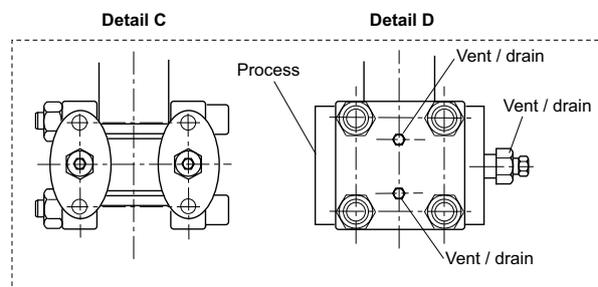
4th digit	Conduit connection			Process connection
	D	E	F	G
W	M20 X 1,5	16	5	1/4-18NPT



“Side vent/drain” configuration (11th digit : D & F)



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



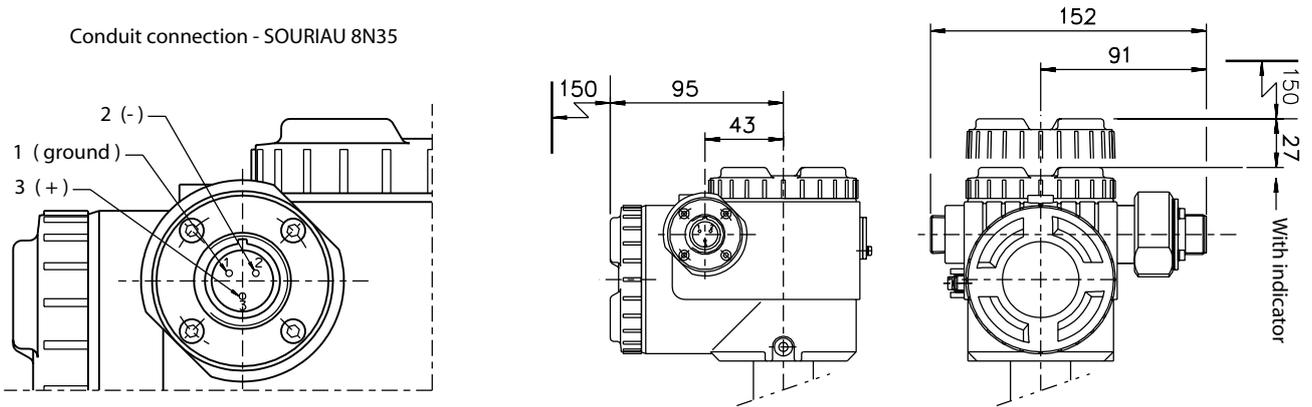
With this configuration, vent/drain function on the **external side** of the process flanges is achieved by way of vent screws directly attached to the flange (sealing is of metal to metal type). There is no more conventional screwed vent seat screwed in the flange and sealed with "PMCU Loctite" type compound.

OUTLINE DIAGRAM (unit : mm)

Conduit connection for SOURIAU sockets (4th digit = code 3, 6 or 7)

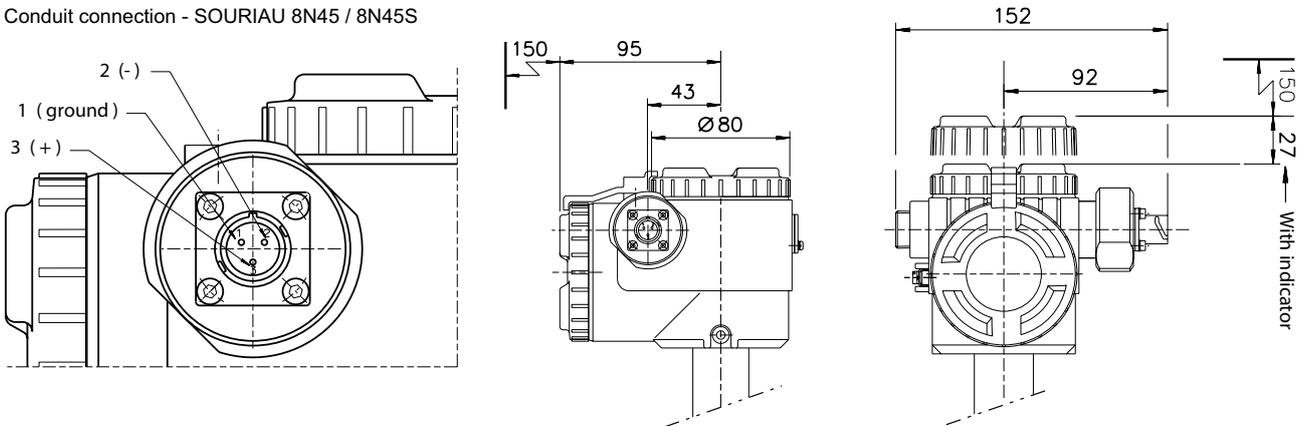
For Souriau 8N35 socket

Conduit connection - SOURIAU 8N35



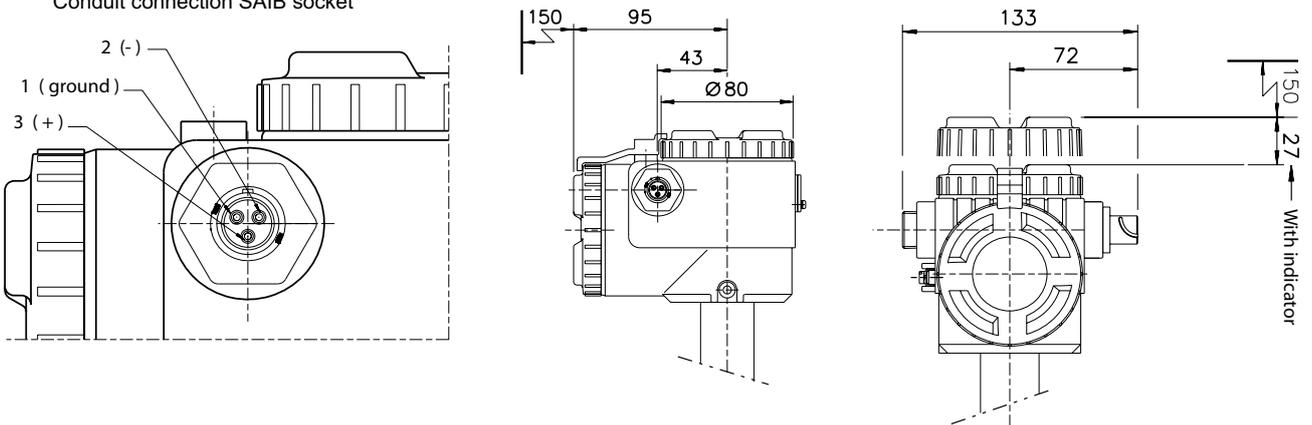
For Souriau 8N45 / 8N45S sockets

Conduit connection - SOURIAU 8N45 / 8N45S



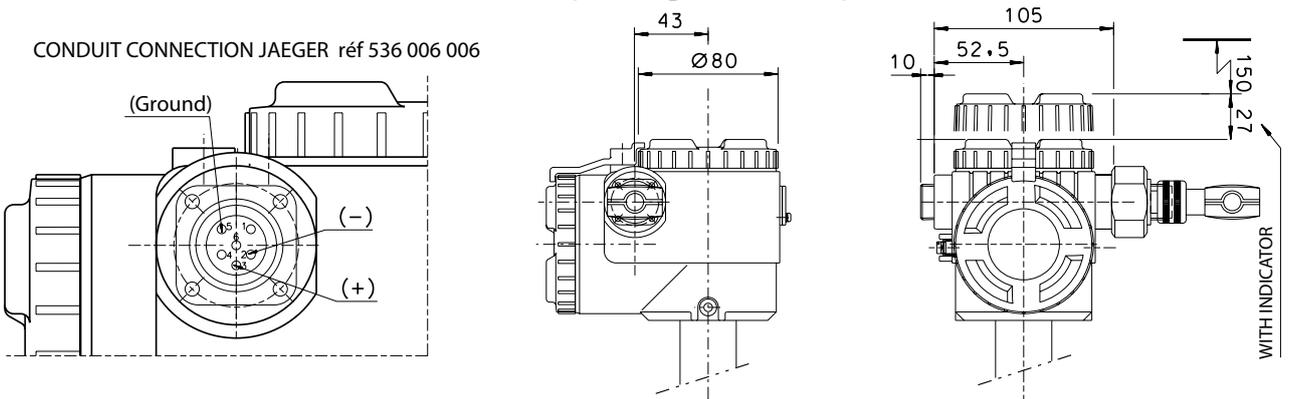
Conduit connection SAIB socket (4th digit = code 8)

Conduit connection SAIB socket

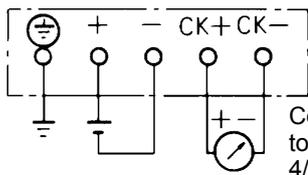


Conduit connection JAEGER socket (4th digit = code 9)

CONDUIT CONNECTION JAEGER réf 536 006 006



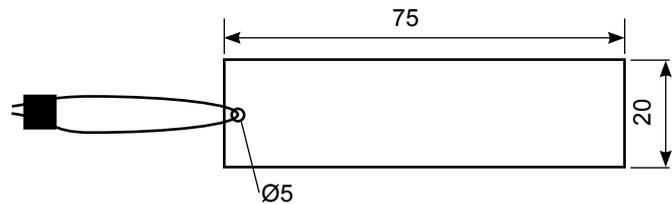
CONNECTION DIAGRAM



Connection of local analog indicator, or remote indicator of current 4/20mA loop test milliammeter. (Max impedance = 12Ω)

OPTIONAL CUSTOMER TAG PLATE

Attached to transmitter with SS 304 wire



EMC Directive (2004/108/EC)

All models of **FCX** series transmitters type **FCX-AII & CII** are in accordance with :

- The harmonized standard EN 61326-1 : 2006 (Electrical equipment for measurement, control and laboratory use - EMC requirements).

Emission limits : EN 61326-1 : 2006

Frequency range (MHz)	Limits	Basic standard
30 to 230	40 dB (μV/m) quasi peak, measured at 10m distance	EN 55011 / CISPR 11 Group 1 Class A
230 to 1000	47 dB (μV/m) quasi peak, measured at 10m distance	

Immunity requirements :

EN 61326-1 : 2006 (Table 2)

Phenomenon	Test value	Basic standard	Performance criteria
Electrostatic discharge	4 kV (Contact) 8 kV (Air)	EN 61000-4-2 IEC 61000-4-2	B
Electromagnetic field	10V/m (80 to 1000 MHz) 3 V/m (1.4 to 2.0 GHz) 1 V/m (2.0 to 2.7 GHz)	EN 61000-4-3 IEC 61000-4-3	A
Rated power frequency magnetic field	30 A/m	EN 61000-4-8 IEC 61000-4-8	A
Burst	2 kV (5/50 NS, 5 kHz)	EN 61000-4-4 IEC 61000-4-4	B
Surge	1 kV Line to line 2 kV Line to ligne	EN 61000-4-5 IEC61000-4-5	B
Conducted RF	3 V (150 kHz to 80 MHz)	EN 61000-4-6 IEC61000-4-6	A

Performance criteria :

A : During testing, normal performance within the specification limits.

B : During testing, temporary degradation or loss of function or performance which is self-recovering.

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