Fuji Electric

FCX-AII

ANALOG DIFFERENTIAL PRESSURE TRANSMITTER

DATA SHEET **FYC...K, L**

The FYC analog pressure transmitter accurately measures differential pressure and transmits a proportional 4 to 20mA signal.
The transmitter utilizes an unique micromachined capacitive silicon sensor to provide exceptional performance and functionality.
FYC series are specifically designed for safety related applications encountered in nuclear power plants where high reliability and long lifetime undo mild to harsh environment is required (radiation with total integrated dose (TID) 50 kGray).

FEATURES

1. **High accuracy**
   Fuji's micro-capacitance silicon sensor assures a high accuracy for all elevated or suppressed calibration ranges without additional adjustment.

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. **Application flexibility**
   Various features that render the FCX-AII suitable for almost any process applications include.
   - Hazardous area approvals
   - Built-in RFI filter and lightning arrester
   - Stainless steel electronics housing

4. **Fully analog electronics**
   The design of the electronics without any SMART device embedded ensure the ability to address the highest safety levels in nuclear applications.

Functional specifications

Type :
FYC : Analog differential pressure transmitter

Service :
Liquid, gas or vapour

Static pressure, span and range limit :

Type	Static pressure [MPa] {bar}	Span limit [mmWC] {mbar}		Range limit [kPa] {mbar}
		Min.	Max.	
FYC□11	-0.1 to +3.2 {-1 to +32}	20 {2}	100 {10}	±1 {±10}
FYC□22	-0.1 to +10 {-1 to +100}	120 {12}	600 {60}	±6 {±60}
FYC□33	-0.1 to +16 {-1 to +160}	530 {53}	3200 {320}	±32 {±320}
FYC□35	-0.1 to +16 {-1 to +160}	2160 {216}	13000 {1300}	±130 {±1300}
FYC□36	-0.1 to +16 {-1 to +160}	8333 {833}	50000 {5000}	±500 {±5000}
FYC□38	-0.1 to +16 {-1 to +160}	50000 {5000}	300000 {30000}	±3000 {±30000}
FYC□43	-0.1 to +42(*) {-1 to +420(*)}	530 {53}	3200 {320}	±32 {±320}
FYC□45	-0.1 to +42(*) {-1 to +420(*)}	2160 {216}	13000 {1300}	±130 {±1300}
FYC□46	-0.1 to +42(*) {-1 to +420(*)}	8333 {833}	50000 {5000}	±500 {±5000}
FYC□48	-0.1 to +30(*) {-1 to +300(*)}	50000 {5000}	300000 {30000}	±3000 {±30000}

(*) : 250 bar (25 MPa) with EPDM gaskets (digit 14 = E)

Important: For K3-ad qualification
- The Turn Down Ratio
(maximum span/calibrated span) must be = 1 for FYC#11and FYC#22 and ≤ 6 for the other models
- The static pressure must be ≤ 6 bar (0.6 MPa) for FYC#11 and FYC#22

Lower limit of static pressure (vacuum limit) : See fig.1

Over range limit : To maximum static pressure limit

Output signal : 4 to 20mA DC (linear)

Power supply :
Transmitter operates on 13 to 48V DC at transmitter terminals.

Load limitations :
Mini (Ω) = 100Ω
Maxi (Ω) = 600Ω

Hazardous locations :
Designed to meet international 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 is adjustable from outside screw on the electronics housing and the span with the internal screw.

Damping :
Possible damping : 0.1, 0.4, 1.2, 3.2 sec.

Zero elevation / suppression :
Adjustable with the external screw on the electronic housing between -90% to +84% of URL.

Temperature limit :
Ambient (with specified performance) :
0 to 70°C
Accident :
Mini : -40°C
Maxi : 125°C during 65 hours
Process :
-40 to +120°C (silicon oil)
Storage :
-40 to +90°C

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

Performance specifications

(Reference conditions, silicone oil fill).

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

Max span above 32kPa models :
For spans greater than 1/6 of URL :
±0.25% of span
For spans below 1/6 of URL :
Fuji Electric doesn't guaranty the measurement accuracy.

Max span 1kPa, 6kPa models :
For spans greater than 1/5 of URL :
±0.5% of span
For spans below 1/5 of URL :
Fuji Electric doesn't guaranty the measurement accuracy.

Stability :
± 0,2% of upper range limit (URL) for 30 days.

Temperature effect :
Effects per 55°C change

Range (6th digit in code symbols)	Zero shift (% of URL)	Total effect (% of URL)
"1" "2"	±2%	±4%
"3" "5" "6" and "8"	±1%	±2%

Static pressure effect :

Static pressure code (5th digit in code symbols)	Zero shift (% of URL)	Span shift (% of URV)
"1"	± 1% / 10bar	-0,6% / 10bar
"2"	± 0,2% / 32bar	-0,6% / 32bar
"3" "4"	± 0,3% / 100bar	-0,6% / 100bar

Overrange effect :

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

Supply voltage effect :
± 0,005%/V

RFI effect :
Less than 0,25% of URL for the frequencies of 80 to 2000MHz and field strength 10V/m when electronics covers on.

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

Range code (6th digit in code symbols)	Response time
"1"	800 msec
"2"	500 msec
"3"	300 msec
"5" to "8"	200 msec

Mounting position effect :
Zero shift :
Less than 12 mmH2O for a 10° tilt in any plane.
No effect on span.
This error can be corrected by adjusting zero.

Vibration effect :
< ±1.5% of URL
Frequency 10 to 500Hz, acceleration 9,8m/sec^2

Seismic resistance :
Qualification to the "assembly" seismic spectrum x 1.5 according to RCC-E :
- Horizontal 7.5g ZPA
- Vertical 6g ZPA

Integrity to the "components" seismic spectrum as per RCC-E : 30g ZPA

Dielectric strength :
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

Irradiation effect :

±2,5% of URL at total Integrated Dose (50 kGy)
Maximum Total Integrated Dose without permanent failure 65 kGy

Pressure equipment Directive (PED) 2014/68/UE

Digit 5 code 1, 2, 3 according to Article 4.3
Digit 5 code 4 : Category III module H1

Physical specifications

Electrical connections :

M20 x 1,5 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)

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 316L	SS 316
A		Hast C276	Hast C276	Hast C276	Hast C276

Other material, upon request

Process cover gaskets :

EPDM O-ring (mandatory when submitted to radiation with TID > 50 Gy) or FKM (Viton) O-ring

Non-wetted parts material :

Electronics housing :
SS 316
Bolts and nuts :
SS 316 (static pressure ≤ 160 bar) or
SS 660 (static pressure > 160 bar)
Fill fluid :
Silicon 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 : 7,4 kg
Add :
Mounting bracket : 0,5 kg

Optional features

Degreasing :

Process wetted parts are cleaned, but the fill fluid is standard silicone oil.

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)

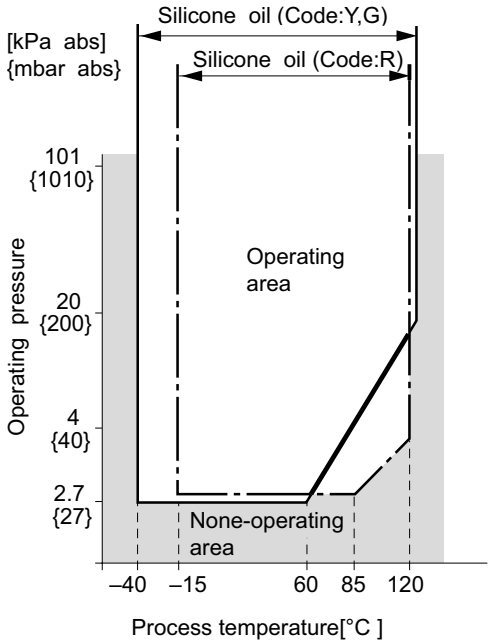


Fig.1 Relation between the temperature of process in contact with cell's diaphragms and operating pressure.

Optional accessories

Oval flanges :

Converts process connection to 1/2"-14 NPT

Manifolds :

Refer to datasheet No. EDS6-F03

CODE SYMBOLS - FYC

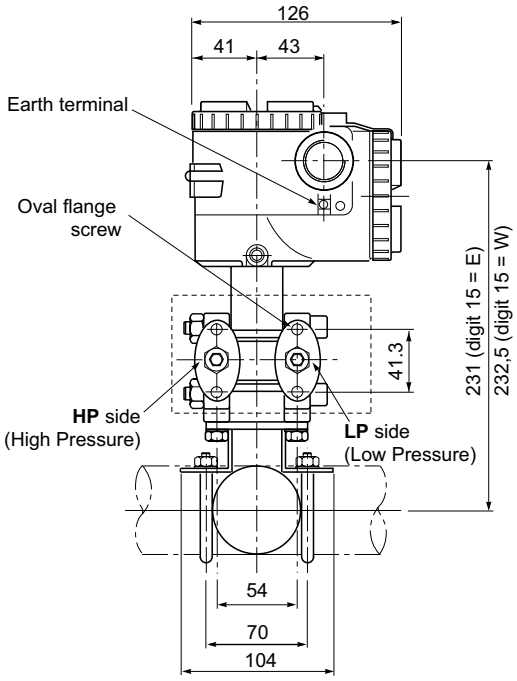
1	2	3	4	5	6	7	8		9	10	11	12	13		14	15	16	Notes	Description
F	Y	C						-	A					-					**Analog differential pressure transmitter**
			W															(1) (7)	**Connections** — Process: 1/4-18 NPT; Oval flange: M10 or M12 (*1); Conduit: M20 x 1,5 - ATEX cable gland for flameproof (optional)
			3															(1) (7)	1/4-18 NPT; M10 or M12 (*1); Souriau 8N45S socket
			6															(1) (6)	1/4-18 NPT; M10 or M12 (*1); Souriau 8N45 socket (not for EPR reactors)
			7															(1) (6)	1/4-18 NPT; M10 or M12 (*1); Souriau 8N35 socket (not for EPR reactors)
			8															(1) (7)	1/4-18 NPT; M10 or M12 (*1); SAIB NU25, ref 251-103-401 / M20 x 1,5 socket (compatible with 8N45 installed equipment)
																			Range & materials
			1	1	V														-1 to 32 bar; 20 / 100 mmWC; SS 316L; SS 316L; SS 318LN
			2	2	V														-1 to 100 bar; 120 / 600 mmWC; SS 316L; SS 316L; SS 318LN
			3	3	V														-1 to 160 bar; 530 / 3200 mmWC; SS 316L; SS 316L; SS 316L
			3	5	V														-1 to 160 bar; 2,16 / 13 mWC; SS 316L; SS 316L; SS 316L
			3	6	V														-1 to 160 bar; 8,333 / 50 mWC; SS 316L; SS 316L; SS 316L
			3	8	V														-1 to 160 bar; 50 / 300 mWC; SS 316L; SS 316L; SS 316L
			4	3	V													(5)	-1 to 420 bar; 530 / 3200 mmWC; SS 316L; SS 316L; SS 316L
			4	5	V													(5)	-1 to 420 bar; 2,16 / 13 mWC; SS 316L; SS 316L; SS 316L
			4	6	V													(5)	-1 to 420 bar; 8,333 / 50 mWC; SS 316L; SS 316L; SS 316L
			4	8	V													(5)	-1 to 300 bar; 50 / 300 mWC; SS 316L; SS 316L; SS 316L
			1	1	A														-1 to 32 bar; 20 / 100 mmWC; Hast C276; Hast C276; Hast C276
			2	2	A														-1 to 100 bar; 120 / 600 mmWC; Hast C276; Hast C276; Hast C276
			3	3	A														-1 to 160 bar; 530 / 3200 mmWC; Hast C276; Hast C276; Hast C276
			3	5	A														-1 to 160 bar; 2,16 / 13 mWC; Hast C276; Hast C276; Hast C276
			3	6	A														-1 to 160 bar; 8,333 / 50 mWC; Hast C276; Hast C276; Hast C276
			3	8	A													(5)	-1 to 160 bar; 50 / 300 mWC; Hast C276; Hast C276; Hast C276
			4	3	A													(5)	-1 to 420 bar; 530 / 3200 mmWC; Hast C276; Hast C276; Hast C276
			4	5	A													(5)	-1 to 420 bar; 2,16 / 13 mWC; Hast C276; Hast C276; Hast C276
			4	6	A													(5)	-1 to 420 bar; 8,333 / 50 mWC; Hast C276; Hast C276; Hast C276
			4	8	A														-1 to 300 bar; 50 / 300 mWC; Hast C276; Hast C276; Hast C276
						K	-	A											**Transmitter version** — EDF "K3ad classification"
						L	-	A										(4)	EDF "Not Classified"
									A										**Approvals for hazardous locations (consult Fuji)** — None (standard)
									X									(3)	Flameproof housing ATEX II 2 GD - Ex d IIC T5/T6
												G							**Vent / drain & mounting bracket** — Vent / drain: Universal, direct mounting; Mounting bracket (SS 304): None
												H							Universal, direct mounting; Yes - Recommended for UTO stock
													C						**Optional customer tag plate & Electronics housing** — Tag plate: Without; Electronics housing: SS 316
													E						Tag plate: SS 316L; Electronics housing: SS 316
														Y					**Special applications & Fill fluids** — Treatment: None; Fill fluids: Silicon oil
														G					Treatment: Degreasing; Fill fluids: Silicon oil
														R					Treatment: Vacuum service; Fill fluids: Silicon oil
															-	A			**Process cover gasket** — FKM
															-	E		(5)	EPDM
																	E	(2)	**Bolts and nuts material** — SS 316/316 (Bolts/nuts) - M10
																	W		SS 660/660 (Bolts/nuts) - M12
																			Accessories (optional)
																	1		ATEX - Flameproof cable gland

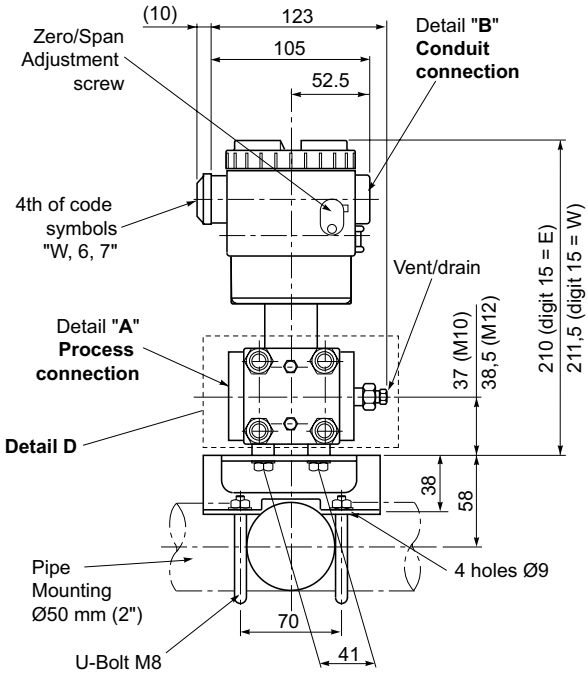
*Notes :

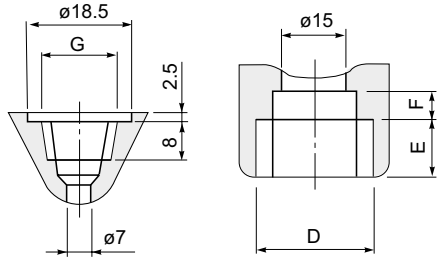
1- M12 oval flange thread for static pressure > 160 bar (16 MPa)
2- M12 process cover bolts for static pressure > 160 bar
3- Only for digit 4 = W.
4- Same transitter design as for the K3A but assembled according to the standard QA process (ISO 9001).
5- Maximum Working Pressure = 250 bar (25 MPa) when digit 14 = E
6- FYC6 and FYC7 transmitters only for existing power plants (not for EPR).
7- FYCW, FYC3 and FYC8 can be used in existing power plants and EPR. FYCW can be equiped with an optionnal flameproof cable gland (Digit 16 = 1)

OUTLINE DIAGRAM (unit : mm)

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



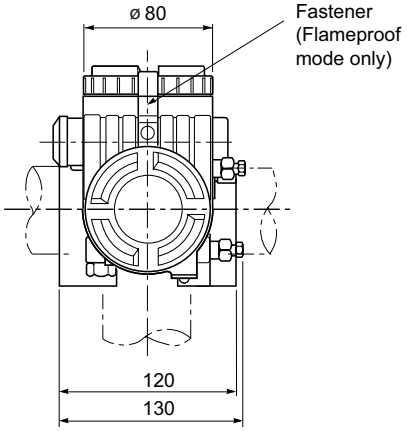




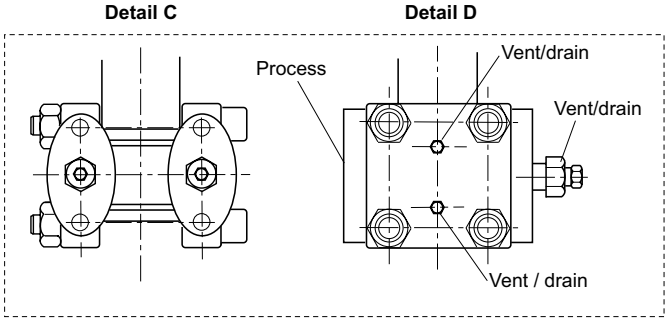
Detail "**A**"
Process connection

Detail "**B**"
Conduit connection

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



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



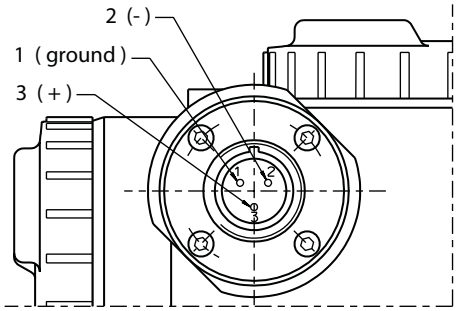
With this configuration, vent/drain function on the **external side** of the process flanges is achieved by way of vent screws directly attached to the flange (sealing is of metal to metal type).There is no more conventional screwed vent seat screwed in the flange and sealed with "PMUC Loctite" type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

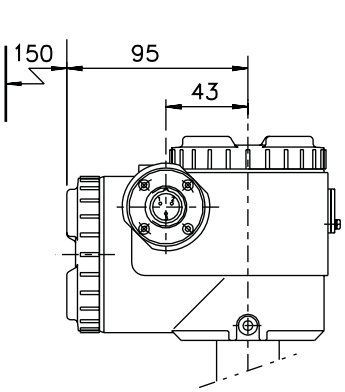
OUTLINE DIAGRAM (unit : mm)

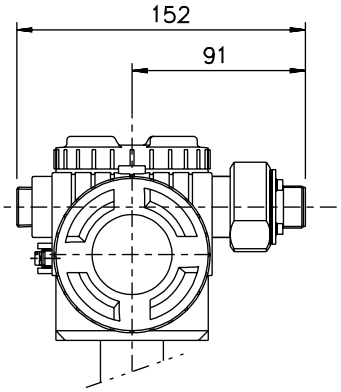
Conduit connection for SOURIAU sockets (4th digit = code 3, 6 or 7)

For Souriau 8N35 socket

CONDUIT CONNECTION - SOURIAU 8N35

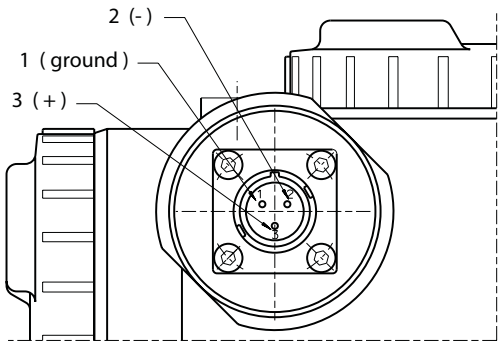


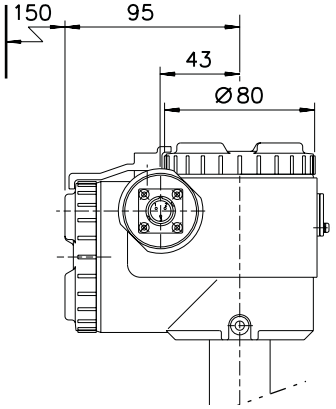


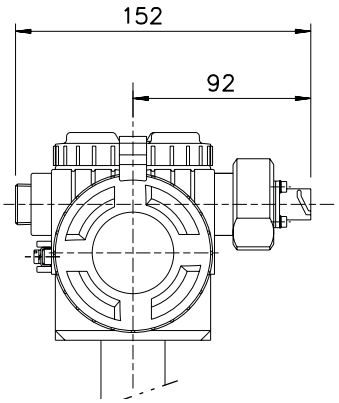


For Souriau 8N45 / 8N45S sockets

Conduit connection - SOURIAU 8N45 / 8N45S

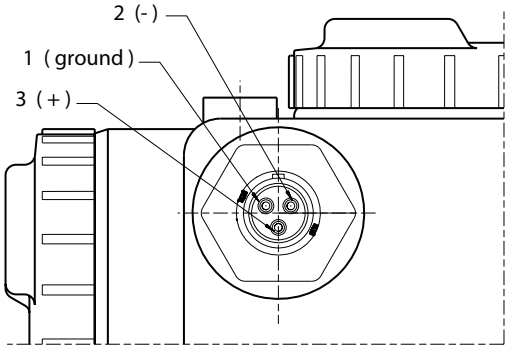


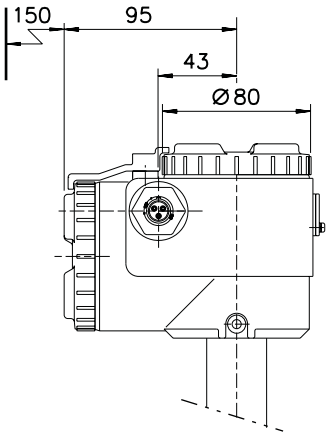


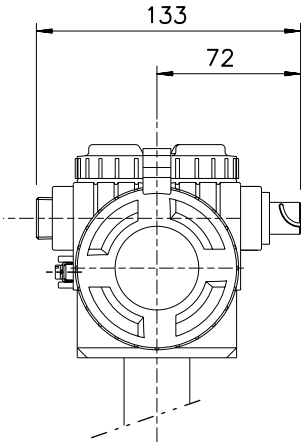


Conduit connection SAIB socket (4th digit = code 8)

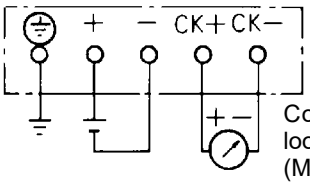
CONDUIT CONNECTION- SAIB socket







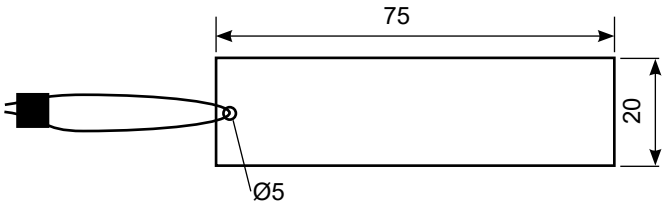
CONNECTION DIAGRAM



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

OPTIONAL CUSTOMER TAG PLATE

Attached to transmitter with SS 304 wire



ELECTROMAGNETIC COMPATIBILITY

All FCX-AII series of pressure transmitters are in conformity with the provision of the EMC Directive 2014/30/EU on the harmonization of the laws of the Members States relating to electromagnetic compatibility.

All these models of pressure transmitters are in accordance with the following harmonized standards :

- **EN 61326-1** *(Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements).*
- **EN 61326-2-3** *(Particular requirements - Test configuration, operational conditions and performance criteria for tranducers with integrated or remote signal conditioning).*

Emission limits (according to EN 55011 / CISPR 11, Group 1 Class A)

Frequency range (MHz)	Limits	Result
30 to 230	40 dB (µV/m) quasi peack, measured at 10 m distance	Passed
230 to 1000	47 dB (µV/m) quasi peack, measured at 10 m distance	

Immunity

Phenomenon	Test value	Standard	Required Performance criteria	Result of criteria
Electrostatic Discharge	±4 kV (Contact) ±8 kV (Air)	EN/IEC 61000-4-2	**B**	**A**
Radiated, Electromagnetic Field	10 V/m (0.08 to 1.0 GHz) 3 V/m (1.4 to 2.0 GHz) 1 V/m (2.0 to 2.7 GHz)	EN/IEC 61000-4-3	**A**	**A**
Fast transients (burst)	2 kV (5/50 ns, 5 kHz	EN/IEC 61000-4-4	**B**	**A**
Surge Transients	1 kV Line to line 2 kV Line to ground	EN/IEC 61000-4-5	**B**	**A**
Conducted RF Disturbances	3 Vrms (150 kHz to 80 MHz) 80% AM @ 1 kHz	EN/IEC 61000-4-6	**A**	**A**
Power Frequency Magnetic Field	30 A/m (50 Hz, 60 Hz)	EN/IEC 61000-4-8	**A**	**A**

Performance criteria (A & B): according to IEC 61326

Fuji Electric

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