

PRESSURE TRANSMITTER

DATA SHEET
FKG...5

The FCX-AII pressure transmitter accurately measures gauge pressure and transmits a proportional 4 to 20 mA signal.

The transmitter utilizes a unique micromachined capacitance silicon sensor with state-of-the-art microprocessor technology to provide exceptional performance and functionality.

FEATURES

- High accuracy up to $\pm 0.04\%$**
0.065% accuracy as standard. Fuji's micro-capacitance silicon sensor assures this accuracy for all elevated or suppressed calibration ranges without additional adjustment.
0.04% accuracy as option
- Minimum inventory and design**
Electronics unit, local indicators and electronics housing are interchangeable among all FCX-AII transmitters.
- 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.
- Fuji/HART® bilingual communication protocol**
FCX-AII series transmitter offers bilingual communications to speak both Fuji proprietary protocol and HART®. Any HART® compatible devices can communicate with FCX-AII
- Application flexibility**
Various options that render the FCX-AII suitable for almost any process applications include:
 - Full range of hazardous area approvals
 - Built-in RFI filter and lightning arrester
 - 5-digit LCD meter with engineering unit
 - Stainless steel electronics housing
 - Wide selection of material
- Programmable output Linearization Function**
Output signal can be freely programmable.
(Up to 14 compensated points at approximation).
- Burnout current flexibility (Under Scale: 3.2 to 4.0 mA, Over Scale: 20.0 to 22.5 mA)**
Burnout signal level is adjustable using Model FXW or Hand Held Communicator (HHC) to comply with NAMUR NE43.
- 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.



Functional specifications

Type: FKG : Smart, 4-20 mA cc + Fuji/Hart® digital signal

Service:

Liquid, gas, or vapour

Span, range and overrange limit:

Type	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}

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 (500 mmHg abs) at below 60°C

Output signal:

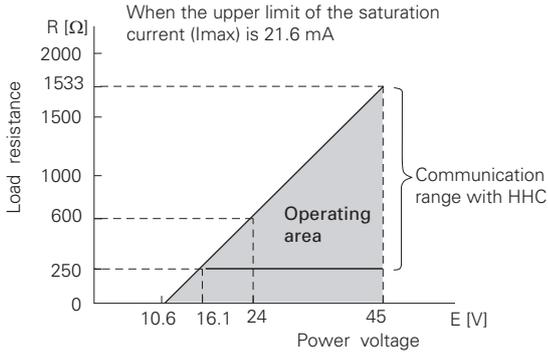
4 to 20 mA DC with digital signal superimposed on the analogic signal.

Power supply:

Transmitter operates on 10.5 V to 45 V DC at transmitter terminals.

10.5 to 32 V DC for the units with optional arrester.

Load limitations: see figure below



Note) 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: For communication with HHC⁽¹⁾ (Model: FXW), min. of 250 Ω required.

Hazardous locations:

Authority (Digit 10 =)	Intrinsic safety																					
ATEX (K)	Ex II 1 G Ex ia IIC T5 (-40°C ≤ Ta ≤ +50 °C) Ex ia IIC T4 (-40°C ≤ Ta ≤ +70 °C) IP66/67 Entity Parameters: Ui ≤ 28 Vdc, li ≤ 94.3 mA, Pi ≤ 0.66 W Ci = 36 nF/26 nF for models with/without Arrester Li = 0.7 mH/0.6 mH for models with/without Analog Indicator																					
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Zero/span adjustment:

Zero and span are adjustable from the HHC⁽¹⁾. Zero and span are also adjustable externally from the adjustment screw.

Damping:

Adjustable from HHC or local adjustment unit with LCD display.

The time constant is adjustable between 0,06 to 32 sec.

Zero elevation/suppression:

Zero can be elevated or suppressed within the specified range limit from -1 bar to +100% URL of each sensor model.

Normal/reverse action:

Selectable from HHC⁽¹⁾.

Indication:

Analog indicator or 5 digit LCD meter, as specified.

An analog display may be mounted at the location of one or the other of the housing..

Burnout direction: Selectable from HHC⁽¹⁾

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

"Output Hold":

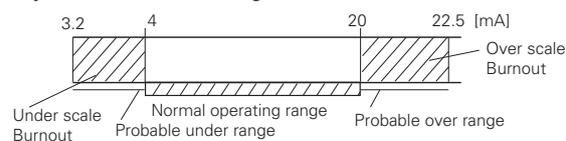
Output signal is hold as the value just before failure happens.

"Output Overscale":

Adjustable within the range 20.0 mA to 22.5 mA from HHC⁽¹⁾

"Output Underscale":

Adjustable within the range 3.2mA to 4.0 mA from HHC⁽¹⁾



Output limits conforming to NAMUR NE43 by order.

Loop-check output:

Transmitter can be configured to provide constant signal 3.2 mA through 22.5 mA by HHC⁽¹⁾.

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 (Relative Humidity)

Communication:

With HHC⁽¹⁾ (model FXW, consult DS N°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		By local configurator (with 3 push button), (LCD indicator)	
	Display	Set	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	✓	✓	✓	✓	✓	✓
- Ambient temperature history	✓	—	✓	—	✓	—

(Note) (1) HHC: Hand Held Communicator

***Local configurator with LCD display (option):**

Local configurator with 3 push button and LCD display can support all items (Fuji Protocol list) except "Linearize" function.

Programmable output linearization function:

Output signal can be characterized with "14 points linear approximation function" from HHC⁽¹⁾.

Performance specifications

Reference conditions, silicone oil fill, SS 316 isolating diaphragms, 4 to 20 mA analog output.

Accuracy rating:

(including linearity, hysteresis, and repeatability)

Max span below 10000 kPa model:

For spans greater than 1/10 of URL:
±0.065% of span or ±0.04% of span

For spans below 1/10 of URL:

$$\pm \left(0.015 + 0.05 \frac{0.1 \times \text{URL}}{\text{Span}} \right) \% \text{ of span}$$

For model with max. span 50000 kPa:

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

For spans below 1/10 of URL:

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

Stability:

±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

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

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

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

Overrange effect:

Zero shift: 0.2% of URL for any overrange to maximum limit (< overrange max admissible)

Supply voltage effect:

Less than 0.005% of calibrated span per 1 V

Update rate: 60 msec

RFI effect : < 0,2% of URL for the frequencies of 20 to 1000 MHz and fieldstrength of 10 V/m when electronic housing covers are on (Classificaion : 2-abc : 0,2% of span according SAMA PMC 33.1)

Response time: (63,3% of output signal without damping)

Time constant: 0.08 sec (at 23°C)
 Dead time: approximately 0.12 sec
 Response time = time constant + dead time

Mounting position effect:

Zero shift, less than 0.1 kPa {1 mbar} for a 10° tilt in any plane. This error can be corrected by adjusting zero.
 (Double the effect for fluorinated fill sensor.
 No effect on span.

Vibration effect:

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

Material fatigue:

Please consult Fuji Electric.

Dielectric strength:

500 V AC, 50/60 Hz 1 min., between circuit and earth.

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) 97/23/EC

Digit 6 code 1, 2, 3, 4 and 9 according to Article 3.3
 Digit 6 code 5 : Category III module B

Physical specifications

Electrical connections:

1/2"-14 NPT, Pg13.5, or M20 × 1.5

Process connections:

1/4"-18 NPT as specified.
 Option: 1/2-14N PT for oval flanges.

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

Process-wetted parts material:

Material code (7th digit in code symbols)	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 "Code symbols".

Non-wetted parts material:

Electronics housing: Low copper die-cast aluminum alloy finished with polyester coating (standard) or SS 316, as specified.

Bolts and nuts:

Standard : Cr-Mo alloy
 Option : SS 316 (L) or SS 660 for 50 MPa unit

Fill fluid:

Standard : silicone oil
 Option : fluorinated oil

Mounting bracket: SS 304L or 316L (option)

Environmental protection:

IEC IP66/IP67 and NEMA 4X

Mounting:

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

Mass {weight}:

Transmitter approximately 2.9 to 3.4 kg without options.
 Add: 0.3 kg for indicator
 0.5 kg for mounting bracket
 2 kg for stainless steel housing (option)

Optional features

Indicator:

A plug-in analog indicator (2.5% accuracy) can be housed in the electronics compartment or in the terminal box of the housing.
 An optional 5 digit LCD meter with engineering unit is also available.

Local configurator with LCD display:

An optional 5 digits LCD meter with 3 push buttons can support items without using communication with HHC ⁽¹⁾.

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 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. Same procedure and same fill fluid that above.

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 bound ary 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 with customer tag data is wired to the transmitter.

ACCESSORIES

Oval flanges:

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

Hand-held communicator:

(FXW Model, refer to datasheet EDS8-47)

CODE SYMBOLS

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C	Hastelloy C	(*4)	PVDF insert	Monel	Monel lining	(*4)	1300 mbar	PVDF insert	Tantalum	Tantalum lining	0,05	SS 316L	SS 316L	SS 316L	SS 316L	Hastelloy C	SS 316L	SS 316L	Hastelloy C	Hastelloy C	SS 316L	Monel	Monel lining	to	SS 316L	Gold coat	SS 316L	(*3)	SS 316L	Gold / ceramic	Gold / ceramic	(*4)	SS 316L	Tantalum	Tantalum lining	(*4)	PVDF insert	Hastelloy C	Hastelloy C	(*4)	5 bar	PVDF insert	Monel	Monel lining	(*4)	PVDF insert	Tantalum	Tantalum lining	0,3	SS 316L	SS 316L	SS 316L	SS 316L	Hastelloy C	SS 316L	SS 316L	Hastelloy C	Hastelloy C	SS 316L	Monel	Monel lining	to	SS 316L	Gold coat	SS 316L	(*3)	SS 316L	Gold / ceramic	Gold / ceramic	(*4)	SS 316L	Tantalum	Tantalum lining	(*4)	PVDF insert	Hastelloy C	Hastelloy C	(*4)	30 bar	PVDF insert	Monel	Monel lining	(*4)	PVDF insert	Tantalum	Tantalum lining	1	SS 316L	SS 316L	SS 316L	SS 316L	Hastelloy C	SS 316L	SS 316L	Hastelloy C	Hastelloy C	SS 316L	Monel	Monel lining	to	SS 316L	Gold coat	SS 316L	(*3)	SS 316L	Gold / ceramic	Gold / ceramic	SS 316L	Tantalum	Tantalum lining	SS 316L	PVDF insert	Hastelloy C	Hastelloy C	SS 316L	PVDF insert	Monel	Monel lining	SS 316L	PVDF insert	Tantalum	Tantalum lining	5	SS 316L	SS 316L	SS 316L	SS 316L	Hastelloy C	SS 316L	SS 316L	Hastelloy C	Hastelloy C	SS 316L	Gold coat	SS 316L	to	SS 316L	SS 316L	(*8)	SS 316L	Hastelloy C	Hastelloy C	(*8)	500 bar	SS 316L	Gold coat	(*3 *8)	SS 316L	SS 316L	SS 316L	SS 316L	Hastelloy C	Hastelloy C	SS 316L	Gold coat	SS 316L
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	DESCRIPTION
F	K	G														
																Side vent/drain & mounting bracket
																Side Vent/drain
																Mounting bracket
A																None
C																None
K																None
D																None
F																(*4) Yes
L																(*4) Yes
																SS parts
																SS tag plate
																SS housing
Y																None
B																Yes
C																None
E																Yes
																Special applications & fill fluid
																Treatment
																Fill fluid
Y																None (std)
W																None (std)
G																Degreasing
A																Oxygen service
D																Chlorine service
N																(*6) NACE
																Process cover gasket
																- A
																- C
																- D
																(*4)
																Bolts/screws material
																A
																U
																V
																W
																W
																(*8)
																(*8)
																Special options or design
																(*5) - *

Notes* :

- 1- M12 oval flange screw required for 500 bar units
- 2- Turn down of 100:1 is possible, but it should be used at a span greater than 1/40 of the maximum span for better performance.
- 3- Gold coating on wetted measuring cell parts for Hydrogen service - Hydroseal version - gold/ceramic coating is available upon request.
- 4- Process cover with PVDF insert with 1/2"-14 NPT side process connection/no vent drain, other upon request - square section PTFE gasket
- 5- When no code can be found in the current code symbols, place * in concerned code digit(s) & add * in 16 th digit
- 6- Our bolts/nuts in SS 660 are in conformity with the NACE MR0175/ISO 15156 requirements and must be used for NACE MR0175/ISO 15156 service
- 7- Code "D & V" FM approval only possible with electrical connection 1/2"-14 NPT.
- 8- SS 660 bolts/nuts have to be used for oil & gas applications

OUTLINE DIAGRAM (Unit:mm)

<7th digit code: V, H, M, T>

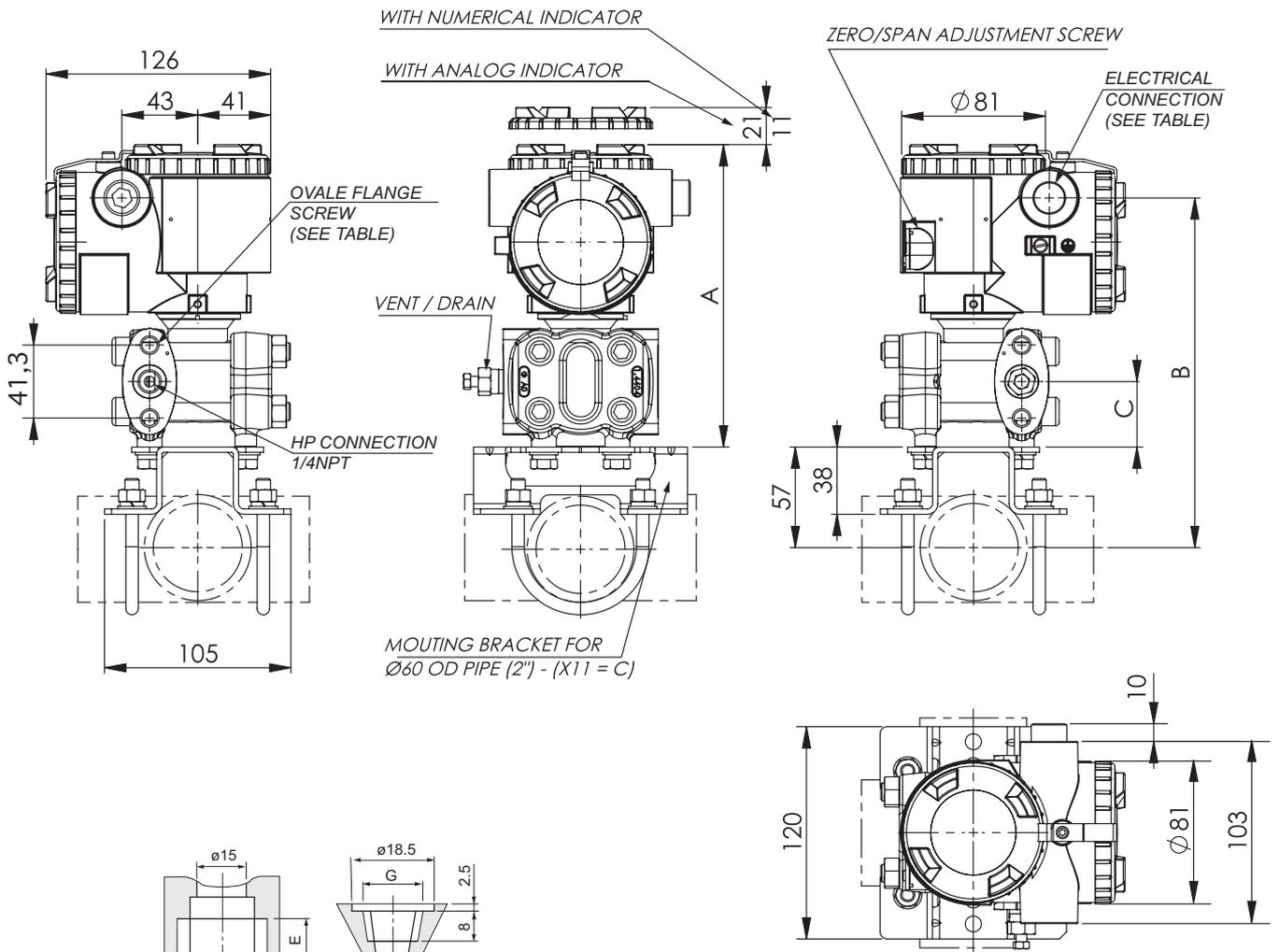


Table 1

Code X=4	Electrical connection		Oval flange screw
	D	E	
R	M20x1.5	16	7/16-20 UNF
T	1/2-14NPT	16	7/16-20 UNF
V	Pg13.5	10,5	M10
W	M20x1.5	16	M10
X	Pg13.5	10,5	7/16-20 UNF

DIMENSIONS			
MODELE MODEL	A	B	C
FKG□01	171	198	37
FKG□02			
FKG□03			
FKG□04			
FKG□05	172,5	199,5	38,5

Weight :

3,5 kg (without option)

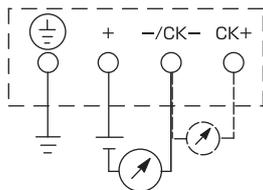
Add : - 0,3 kg for indicator option

- 0,5 kg for mounting bracket

- 2 kg for stainless steel housing option

X1 X2 X3 X4 X5 X6 X7 X8- X9 X10 X11 X12 X13- X14 X15- X16	SPAN LIMIT	
	Min.	Max.
F K G □ 0 □ □ □ 5 - □ □ □ □ □ - □ □ □ □	FKG□01	1,3 KPa (13 mbar) / 130 KPa (1300 mbar)
	FKG□02	5 KPa (50 mbar) / 500 KPa (5 bar)
	FKG□03	30 KPa (0,3 bar) / 3 MPa (30 bar)
	FKG□04	100 KPa (1 bar) / 10 MPa (100 bar)
	FKG□05	500 KPa (5 bar) / 50 MPa (500 bar)

CONNECTION DIAGRAM

**EMC Directive (2004/108/EC)**

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

- the harmonized standards:
 - EN 61326-1 : 2006 (Electrical equipment for measurement, control and laboratory use - EMC requirements).
 - EN 61326-2-3 : 2006 (Part 2-3 : Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning)

Emission limits : EN 61326-1 : 2006

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

Immunity requirements : EN 61326-1 : 2006 (Table 2)

Phenomenon	Test value	Basic standard	Performance criteria
Electrostatic discharge (EDS)	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 line	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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