FUJI ELECTRIC

FCX-C II

DIFFERENTIAL PRESSURE (FLOW) TRANSMITTER

DATA SHEET **FKK, FDK...4**

The FCX-CII differential pressure transmitter accurately measures differential pressure, liquid level or gauge pressure and transmits proportional 4 to 20mA signal. The transmitter utilizes the unique micromachined capacitive silicon sensor with state-of-the-art micro-processor technology to provide exceptional performance and functionality.

FEATURES

1- High accuracy
0.1% accuracy for all calibrated spans is the standard feature covering 3.75mbar draft range to 20bar high differential. Fuji's micro-capacitance silicon sensor assures this feature for all elevated or suppressed calibration ranges without additional adjustment.

2- Minimum inventory
Electronics unit, local indicators and electronics housing are interchangeable among all FCX-CII models. Process cover including bolts and nuts are common for all DP and flow transmitters, rating 32 and 140 bar.

3- Fuji/HART® bilingual communication protocol and FOUNDATION FIELDBUS and PROFIBUS compatibility
FCX-CII series transmitter offers bilingual communication to speak both Fuji proprietary protocol and HART®.
Any HART® compatible devices can communicate with FCX-CII. Further, by upgrading electronics Foundation Fieldbus and Profibus is also available.

4- Application flexibility
Example features that render the FCX-CII suitable for almost any process applications includes.
- Analog indicator at either the electronics side or terminal side
- Full range of hazardous location approvals
- Built-in RFI filter and lightning arrester
- 5 digits LCD meter

5- Programmable output Linearisation Function
In addition to linear and square root, output signal can be freely programmable.

6- Burnout current flexibility (Under Scale : 3,2 to 3,8mA, Over scale : 20,8 to 21,6mA)
Burnout signal level is adjustable using Model FXW Hand Held Communicator (HHC) to comply with NAMUR NE43.

7- 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.

SPECIFICATIONS

Functional specifications

Type :
FKK : Smart, 4-20mA dc + Fuji/Hart® digital signal
FDK : Fieldbus Foundation & Profibus

Service :
Liquid, gas or vapour

Static pressure, span and range limit :

Type	Static pressure (bar)	Span limit (mbar)		Range limit (mbar)
		Min.	Max.	
F☐K☐12	-1 to +32	3.75	60	±60
F☐K☐33	-1 to +140	20	320	±320
F☐K☐35	-1 to +140	81.25	1300	±1300
F☐K☐36	-1 to +140	312.5	5000	±5000
F☐K☐37	-1 to +140	1250	20000	±20000

Lower limit of static pressure (vacuum limit) is :
Silicone fill sennsor : See Fig. 1
Fluorinated fill sensor : 66kPa abs (500mm Hg abs) at temperature below 80°C

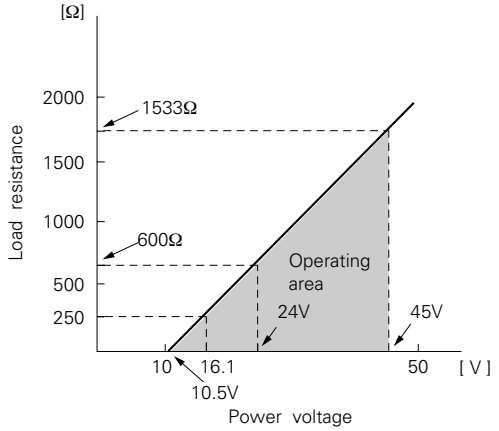
The maximum span of each sensor can be converted to in different units using below factors.
$1MPa=10^3kPa=10bar=10.19716kgf/cm^2=145.0377psi$
$1kPa=10mbar=101.9716mmH_2O=4.01463inH_2O$

Overrage limit : To maximum static pressure limit.

Output signal :
4 to 20mA DC (linear or square root) with digital signal superimposed on the 4 to 20mA signal
Digital signal based on Foundation Fieldbus or Profibus

Power supply :
Transmitter operates on 10.5V to 45V DC at transmitter terminals.
10.5V to 32V DC for the units with optional arrester.

Load limitations : see figure below



Note: For communication with FXW, min. of 250Ω required.

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 (digit 10). Consult FUJI for status.

Zero / span adjustment :

Zero and span are adjustable from the HHC. Zero is also adjustable externally from the adjustable screw.

Damping : adjustable electrical damping.

The time constant is adjustable between 0 to 38.4 seconds with the HHC.

Zero elevation / suppression :

-100% to +100% of URL

Normal / reverse action :

Selectable from HHC.

Indication :

Analog indicator or 5 digit LCD meter, as specified.

Burnout direction: Selected from HHC

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

"Output Hold" :

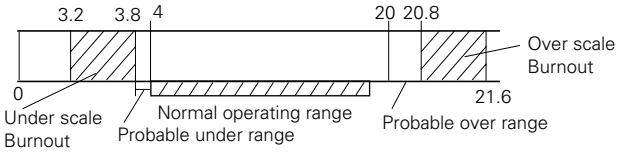
Output signal is hold as the value just before failure happens.

"Output Overscale" : approx. 21,6 mA

Adjustable within the range 20,8 mA to 21,6 mA from the HHC

"Output Underscale" : approx. 3,8 mA

Adjustable within the range 3,2 mA to 3,8 mA from the HHC



Loop-check output :

Transmitter can be configured by HHC to provide constant signal output between 3.8mA and 21.6mA.

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 filled transmitters)

For explosionproof units (flameproof or intrinsic safety), ambient temperature must be within the limits specified in 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

Communication :

With HHC (Model FXW, consult Data Sheet No. EDS8-47), following information can be remotely displayed or reconfigured.

Note : HHC's version must be more than 6.0 (or FXW□□□□1- A3)

	HART® PROTOCOL		FUJI PROTOCOL	
Items	Display	Set	Display	Set
Tag n°	Yes	Yes	Yes	Yes
Model n°	_	_	Yes	Yes
Serial n°	Yes	_	Yes	_
Engeineering unit	Yes	Yes	Yes	Yes
Range limit	Yes	_	Yes	_
Measuring range	Yes	Yes	Yes	Yes
Damping	Yes	Yes	Yes	Yes
Output mode	Yes	_	Yes	_
Burnout direction	Yes	Yes	Yes	Yes
Adjustment	Yes	Yes	Yes	Yes
Output adjust	_	Yes	_	Yes
Data	Yes	_	Yes	_
Self diagnoses	Yes	_	Yes	_
Printer	_	_	_	_
External switch lock	Yes	Yes	Yes	Yes
Transmitter display	Yes	Yes	Yes	Yes
Linearise	_	_	Yes	Yes
Rerange	Yes	Yes	Yes	Yes

Programmable output linearization function :

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

Field Bus units :

Digital signal

Transmission technique : according to IEC61158-2

Power supply : 9VDC...32VDC

Base current : 15 ±2mA

Transmission rate : 31,25kbits/s

Profibus-PA : version 3.0, DPVI version 2.0

Foundation Fielbus : FF-890/891

Performance specifications for linear output

Accuracy rating :

(including linearity, hysteresis, and repeatability)

For spans greater than 1/10 of URL :

±0.1% of span

For spans below 1/10 of URL :

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

Stability :

0.2% of upper range limit (URL) for 2 years

(In case of 6th digit code "3", "5", "6", "7")

Temperature effect :

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

Range code (6th digit in Code symbols)	Zero shift	Total effect
"2"/ 60mbar max. span	$\pm(0.25 \ \frac{URL}{span})\%$ / 28°C	$\pm(0.25+0,25 \ \frac{URL}{span})\%$ / 28°C
"3"/ 320mbar max.span "5"/ 1,3bar max. span "6"/ 5bar max. span "7"/ 20bar max. span	$\pm(0.1 \ \frac{URL}{span})\%$ / 28°C	$\pm(0.075+0.1 \ \frac{URL}{span})\%$ / 28°C

Static pressure effect :

Static pressure code (5th digit in Code symbols)	Zero shift (% of URL)	Span shift (% of calibrated span)
"1" / 6kPa {60mbar} sensor	±0.4% / 3.2MPa{32bar}	±0.4% / 3.2MPa{32bar}
"3"	±0.2%/10MPa{100bar}	$-0.2\%^{+0.2}_{-0.3}$ / 10MPa{100bar}

Overrange effect :

Static pressure code (5th digit in Code symbols)	Zero shift (% of URL)
"1"	±0.4% / 3.2MPa {32bar }
"3"	±0.4% / 14MPa {140bar }

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 30 V/m when electronics covers on.

(Classification : 2-abc : 0.2% span per SAMA PMC 33.1)

Step response : (without electrical damping)

Range code	Time constant	Dead time
"2"	0.85 s	approx. 0.3 s
"3"	0.45 s	
"4" through "7"	0.2 s	

Response time = 5 x time constant + dead time

Time constant (τ) = 63 % output signal

Note : faster response time is available as option (maximum update rate : 25 times per second).

Mounting position effect :

Zero shift, less than 0.12kPa {1.2mbar} for a 10° tilt in any plane.

No effect on span.

This error can be corrected by adjusting Zero.

(Double the effect for fluorinated fill sensors)

Dielectric strength :

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

Insulation resistance :

More than 100MΩ at 500V DC.

Turn-on time : 4 sec.

Internal resistance for external field indicator :

12Ω or less

Performance specifications for square root output :

Accuracy rating :

Output	Span at (1 to 1/10) x URL
50 to 100%	±0.1 %
20 to50%	±0.25 %
10 to20%	±0.5 %

For span below 1/10 of URL :

$\pm(0.05 + 0.05 \ \frac{0.1 \times URL}{span})$	OUTPUT 50 to 100%
$\pm2.5 \times (0.05 + 0.05 \ \frac{0.1 \times URL}{span})$	OUTPUT 20 to 50%
$\pm5 \times (0.05 + 0.05 \ \frac{0.1 \times URL}{span})$	OUTPUT 10 to 20%

Temperature effect :

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

Range code	Shift at 20% output point
"2"	$\pm(0.625 \ \frac{URL}{span})\%$ / 28°C
"3" through "7"	$\pm(0.25 \ \frac{URL}{span})\%$ / 28°C

Low flow cut-off :

Customer configurable for any point between 0 to 20% of output

Physical specifications

Electrical connections :

1/2"-14 NPT, Pg13.5 or M20 x 1.5

Process connections :

Standard : 1/4"-18 NPT on 54mm centers meets DIN 19213.

Option : 1/2" NPT for oval flanges

Process-wetted parts material :

Material code (7th digit in Code symbols)	Process cover	Diaphragm	Wetted sensor body	Vent/drain
V	316L SS	316L SS	316L SS	316 SS

Remark :

Sensor gasket : viton o-rings or PTFE square section gasket.

Non-wetted parts material :

Electronics housing :

Low copper die cast aluminum alloy (standard), finished with epoxy/polyurethane double coating.

Bolts and nuts :

Cr-Mo alloy (std), 316 stainless steel or 630 ss .

Static pressure rating for code "3" with 316 stainless steel bolts is degraded to 10MPa (100bar).

Fill fluid :

Silicone oil (standard) or fluorinated oil

Mounting bracket :

304 stainless steel

Environmental protection : IEC IP67 and NEMA 6/6P

Mounting :

On 50mm (2") pipe using mounting bracket, direct wall mounting, or direct process mounting.

Mass{weight} :

Transmitter approximately 3.4kg without options.

Add : 0.5kg for mounting bracket

0.8kg for indicator (option)

Optional features

Indicator :

A plug-in turnable analog indicator (1.5% accuracy) can be located in the electronics compartment or in the terminal box of the housing.

An optional 5 digits LCD meter is also available.

Arrester :

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

Lightning surge immunity : 4KV (1.2 x 50μs)

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.

Not for use for oxygen or chlorine measurement.

NACE specification :

Metallic materials for all pressure boundary parts including 316SS bolts and nuts comply with NACE MR-01-75.

Vacuum service :

Special silicone oil and filling procedure are applied.

See figure 1 below

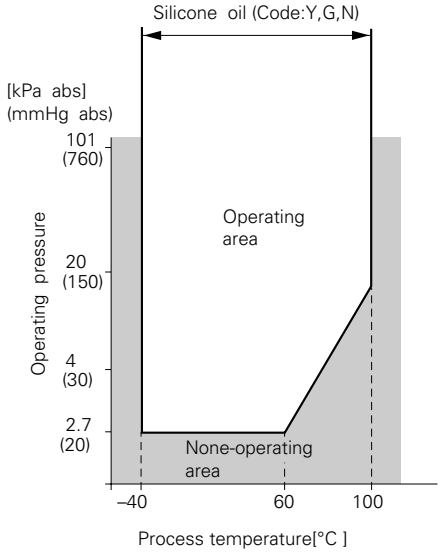


Fig.1 Relation between process temperature and operating pressure

Customer tag :

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

ACCESSORIES

Oval flanges :

Converts process connection to 1/2"-14 NPT, material : 316L SS

Three-valve manifold :

Available in 316 stainless steel and pressure rating 14MPa (140bar).

Hand-held communicator :

(Model FXW, refer to Data Sheet No. EDS 8-47)

The product conforms to the requirements of the Electromagnetic compatibility Directive 89/336/EEC as detailed within the technical construction file number TN513035. The applicable standards used to demonstrate compliance are :

EMI (Emission) EN50081-2 : 1993

Test item	Frequency range	Basic standard
Applicable Electro-magnetic Radiation Disturbance	30-1000MHz	EN55011 Class B

EMS (Immunity) EN50082-2 : 1995

Test item	Test specification	Basic standard	Performance criteria
Electrostatic discharge	8kV (Air)	EN61000-4-2 (1995)	B
Radio-frequency Electromagnetic Field Amplitude Modulated	80-1000MHz 10V/m (unmodulated) 80% AM/1kHz	ENV50140 (1993)	A
Radio-frequency Electromagnetic Field Pulse Modulated	900MHz 10V/m (unmodulated) 50% Duty 200 Hz (Rep. Freq.)	ENV50204 (IEC 1000-4-3, 1995)	A
Radio-frequency Common Mode Amplitude Modulated	150kHz-80MHz 10V/m(unmodulated) 80% AM/1kHz	ENV50141 (IEC 1000-4-6, 1995)	A
Fast transients common mode	2kV, 5/50 (Tr/Th) ns 5kHz Rep.	EN61000-4-4 (IEC 1000-4-4, 1995)	B

"LVD - The transmitter is not covered by the requirements of the LVD standard."

CODE SYMBOLS

1	2	3	4	5	6	7	8	-	9	10	11	12	13	-	14	15	DESCRIPTION
							4										
																	Type
F	K	K															Smart, 4-20 mAdc + Fuji/Hart® digital signal
F	D	K															Fieldbus Foundation & Profibus
																	Connections

	Process connections	Oval flange connection	Electrical connection
M	1/4-18 NPT	M10	M 20 x 1,5 (*3)
N	1/4-18 NPT	M10	Pg 13,5 (*3)
P	1/4-18 NPT	M10	1/2-14 NPT (*3)
R	1/4-18 NPT	7/16-20 UNF	M 20 x 1,5
T	1/4-18 NPT	7/16-20 UNF	1/2-14 NPT
V	1/4-18 NPT	M10 or M12	Pg 13,5
W	1/4-18 NPT	M10 or M12	M 20 x 1,5
X	1/4-18 NPT	7/16-20 UNF	Pg 13,5

Range & wetted parts material

	Static pressure limits	Spans	Process - cover	Measuring diaphragm	Wetted cell body
1 2 V (*1)	-1 to 32 bar	60/600 mm WC	316L SS	316L SS	316L SS
3 3 V	-1 to 140 bar	320/3200 mmWC	316L SS	316L SS	316L SS
3 5 V		1,3/13 m WC	316L SS	316L SS	316L SS
3 6 V		5/50 m WC	316L SS	316L SS	316L SS
3 7 V		20/200 m WC	316L SS	316L SS	316L SS

Indicator & Arrester

	Indicator	Arrester	Initial setting
4 - A	None	none	
4 - B	Analog, 0-100% linear scale	none	4-20 mA DC
4 - C	Analog, 0-100% √ scale	none	
4 - D	Analog, Custom scale	none	
4 - J	Analog, double scale	none	+
4 - E	None	yes	
4 - F	Analog, 0-100% linear scale	yes	
4 - G	Analog, 0-100% √ scale	yes	Hart®/FUJI
4 - H	Analog, Custom scale	yes	digital signal
4 - K	Analog, double scale	yes	"Smart"
4 - L	Digital, 0-100%	none	
4 - P	Digital, Custom scale	none	
4 - M	Digital, 0-100% √ scale	none	
4 - Q	Digital, 0-100%	yes	
4 - S	Digital, Custom scale	yes	
4 - N	Digital, 0-100% √ scale	yes	
4 - R	None	yes	Fieldbus Foundation
4 - T	Digital	yes	Fieldbus Foundation
4 - V	None	yes	Profibus
4 - W	Digital	yes	Profibus

Approvals for hazardous locations (consult FUJI for availability)

A	None (standard)
X	Flameproof housing ATEX ⟨Ex⟩ II 2 GD - EEx d IIC T5/T6
K	Intrinsic safety ATEX ⟨Ex⟩ II 1 GD - EEx ia IIC T4/T5
D	FM - Flameproof housing
E	CSA - Flameproof housing
H	FM - Intrinsic safety & Nonincendive
J	CSA - Intrinsic safety & Nonincendive
P	ATEX type "n" ⟨Ex⟩ II 3 GD - EEx nL IIC T4/T5

Side vent/drain & mounting bracket

	Side vent/drain	mounting bracket
A	None	None
C	None	Yes, SS
D	Yes	None
F	Yes	Yes, SS

SS parts

	Tag plate
Y	None
B	Yes

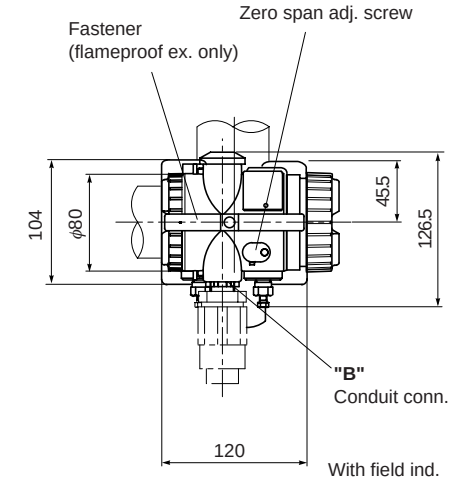
1	2	3	4	5	6	7	8		9	10	11	12	13		14	15	DESCRIPTION
							4	-						-			
																	Special applications & fill fluid
																	Treatment / Fill fluid
													Y				None (std) / silicone oil
													G				Degreasing / silicone oil
													A				Oxygen serv. / fluorinated oil
												(*2)	N				NACE / silicone oil
																	Process cover gasket
														-	A		Viton
														-	C		PTFE square section gasket in SS flange (FEF design)
																	Bolts/screws material
																A	Cr-Mo (standard)
															(*1)	E	SS 316/316 (bolt/nuts)
																F	SS 630/304 (bolt/nuts)

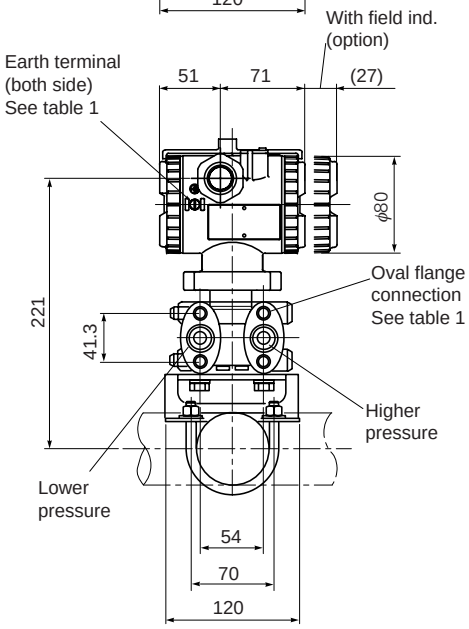
*Notes : 1- Maximum static pressure 100 bar with 316/316 bolts/nuts (digit 15 code E)
For static pressure >100 bar 630/304 bolts/nuts are required (digit 15 code F)

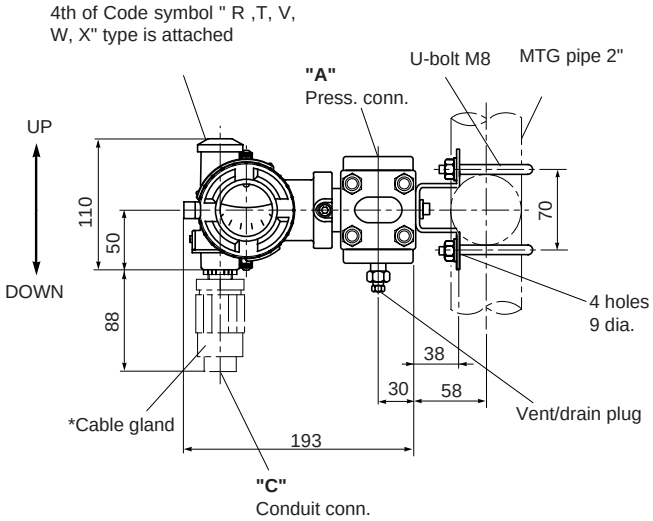
2- Our stainless steel bolts/nuts are in conformity with the NACE requirements and can be used for NACE sevice.

3- Process connection compatible with "Coplanar ™"design

OUTLINE DIAGRAM (Unit : mm)

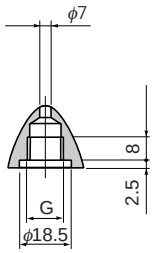






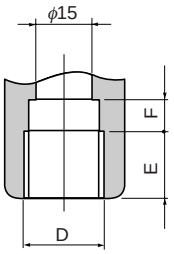
Note *: Cable gland is supplied in case of flameproof packing type.
ø11 cable is suitable.

Details of "A"



See table 1

Details of "B"



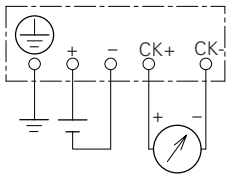
See table 1

4th of Code symbols	Conduit conn.			Press. conn.	Oval flange connection
	D	E	F	G	
T	1/2-14NPT	16	5	1/4-18NPT	7/16-20UNF
V, X	Pg13.5	8	4.5	1/4-18NPT	M10 or M12
R, W	M20 x 1.5	16	5	1/4-18NPT	M10 or M12

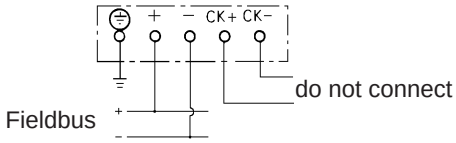
Table 1

CONNECTION DIAGRAMS

FKK unit



FDK unit



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