

# FCX – C SERIES DIFFERENTIAL PRESSURE TRANSMITTER

DATA SHEET

FHK, FKK

The FCX –C 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 microprocessor technology to provide exceptional performance and functionality.



## FEATURES

- High accuracy**  
 0.1% accuracy for all calibrated spans is the standard feature covering 0.6kPa {60mbar} draft range to 2000kPa {20bar} high differential. Fuji's micro-capacitance silicon sensor assures this feature for all elevated or suppressed calibration ranges without additional adjustment.
- Minimum inventory**  
 Electronics unit, communication module, local indicators and electronics housing are interchangeable among all FCX –C models. Process cover including bolts and nuts are common for all DP and flow transmitters, rating 3.2 and 14MPa (32 and 140 bar).
- Replaceable Communication Module**  
 Fuji micro-electronics manufacturing technology offers replaceable communication module that makes FCX-A/C transmitter very unique design. In case of change in communication protocol all that needs to be done is just replace the module and the transmitter gets upgraded to the new version.
- Fuji/HART bilingual communication module**  
 The communication module is "bilingual" to speak both Fuji proprietary protocol and HART. Any HART compatible devices can communicate with FCX-A/C series transmitters.
- Application flexibility**  
 Example features that render the FCX –C 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
  - 4  $\frac{1}{2}$ -digits LCD meter

## SPECIFICATIONS

### Functional specifications

**Type:**

Model FHK: 4 to 20mA

Model FKK: 4 to 20mA with digital signal

**Service:**

Liquid, gas, or vapour

**Static pressure, span, and range limit:**

Type	Static pressure [MPa] {bar}	Span limit [kPa] {mbar}			Range limit [kPa] {mbar}
		Min.		Max.	
		FHK	FKK	FHK/FKK	
F□K□12	-0.1 to + 3.2 {-1 to + 32}	0.6 { 6 }	0.375 { 3.75 }	6 { 60 }	+/- 6 { +/- 60 }
F□K□33	-0.1 to + 14 {-1 to + 140}	3.2 { 32 }	2 { 20 }	32 { 320 }	+/- 32 { +/- 320 }
F□K□35	-0.1 to + 14 {-1 to + 140}	13 { 130 }	8.125 { 81.25 }	130 { 1300 }	+/- 130 { +/- 1300 }
F□K□36	-0.1 to + 14 {-1 to + 140}	50 { 500 }	31.25 { 312.5 }	500 { 5000 }	+/- 500 { +/- 5000 }
F□K□37	-0.1 to + 14 {-1 to + 140}	200 { 2000 }	125 { 1250 }	2000 { 20000 }	+/- 2000 { +/- 20000 }

- Lower limit of static pressure (vacuume limit) is:  
Silicone fill sensor: 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<sup>3</sup>kPa=10bar=  
10.19716kgf/cm<sup>2</sup>=145.0377psi  
1kPa=10mbar=101.9716mmH<sub>2</sub>O=4.01463inH<sub>2</sub>O

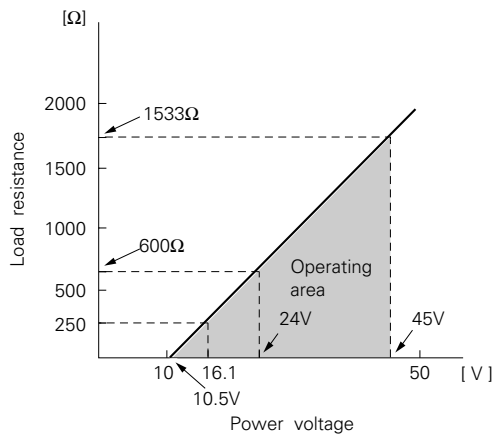
**Overrage limit:** To maximum static pressure limit

**Output signal:**

- Model FHK: 4 to 20mA DC 2-wire, linear signal
- Model FKK: 4 to 20mA DC (linear or square root) with digital signal superimposed on the 4 to 20mA signal

**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:**

Authorities	Flameproof	Intrinsic safety	Type N Nonincendive
BASEEFA Factory Mutual	Ex ds IIC T5, T6 Class I II III Div. 1	EEx ia IIC T4, T5 Class I II III Div. 1	Ex N II T5 Class I II III Div. 2
CSA	Groups B thru. G Class I II III Div. 1	Groups A thru. F Class I II III Div. 1	Groups A thru. G Class I II III Div. 2
SAA	Groups C thru. G Ex d II C T5, T6 IP 66/67	Groups A thru. G Ex ia II C T5, T6 IP 66/67	Groups A thru. G Ex n II C T5, T6 IP 66/67

**Zero/span adjustment:**

Model FHK: Zero is adjustable from an external adjustable screw.

The adjustable screw can also function to adjust span when MODE SWITCH (located on the electronics unit) is in the span mode. INHIBIT mode to disable the adjustable screw is also available.

Model FKK: Zero and span are adjustable either from the HHC. Zero is also adjustable externally from the adjustable screw.

**Damping:**

Adjustable electrical damping.

Model FHK: The time constant is adjustable to 0, 0.3, 1.2, 4.8, or 19.2 seconds.

Model FKK: The time constant is adjustable between 0 to 38.4 seconds.

**Zero elevation/suppression:**

-100% to +100% of URL

**Normal/reverse action:**

Model FHK: Selectable by moving a jumper pin located on the electronics unit.

Model FKK: Selectable from HHC

**Indication:**

Analog indicator or 4 1/2-digit LCD meter, as specified.

**Burnout direction:**

Output hold  
Output 21.6mA } selectable  
Output 3.8mA

Model FHK: Unless otherwise specified, the burnout is in hold position.

Model FKK: Selectable from HHC

**Loop-check output:**

Model FHK: Transmitter can output constant signal of 4mA, 12mA, or 20mA if MODE SWITCH is set to the loop check mode.

Model FKK: Transmitter can be configured to provide constant signal 3.8mA through 21.6mA by HHC.

**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:** (Model FKK only)

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

Items	Display	Set
Tag No.	v	v
Model No.	v	v
Serial No.	v	—
Engineering unit	v	v
Range limit	v	—
Measuring range	v	v
Damping	v	v
Output mode	v	v
Burnout direction	v	v
Adjustment	v	v
Output adjust	—	v
Data	v	—
Self diagnoses	v	—
Printer	—	—
External switch lock	v	v
Transmitter display(*)	v	v

Note: (\*) HHC's version must be higher than 5.0 (or FXW□□□□1-□2), to use this function.

**Performance specifications**

**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 (Model FKK only):

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

**Stability:** 0.2% of upper range limit (URL) for 24 months  
 (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"/6kPa {60mbar} max. span	Zero $\pm(0.25 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$	Total $\pm(0.25+0.25 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$
"3"/32kPa {320mbar} max. span	Zero $\pm(0.1 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$	Total $\pm(0.075+0.1 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$
"5"/130kPa {1300mbar} max. span		
"6"/500kPa {5000mbar} max. span		
"7"/2000kPa {20000mbar} max. span		

**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%	$\pm 0.2 \frac{\text{URL}}{\text{span}}$ / 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	

**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:**

(Model FKK only)

**Accuracy rating:**

Output	Span
	at (1 to 1/2.5) x URL
50 to 100%	±0.1 %
20 to 50%	±0.25%
10 to 20%	±0.5 %

**For span below 1/2.5 of URL**

$\pm(0.05 + 0.05 \frac{0.1 \times \text{URL}}{\text{span}})$	OUTPUT 50 to 100%
$\pm 2.5 \times (0.05 + 0.05 \frac{0.1 \times \text{URL}}{\text{span}})$	OUTPUT 20 to 50%
$\pm 5 \times (0.05 + 0.05 \frac{0.1 \times \text{URL}}{\text{span}})$	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"	$\pm(0.625 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$
"3" through "7"	$\pm(0.25 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$

**Low flow cut-off:** Customer configurable for any point between 7 to 20% of output

**Physical specifications**

**Electrical connections:**

G1/2, 1/2-14 NPT, Pg13.5, or M20 x 1.5 conduit, as specified.

**Process connections:**

1/4-18 NPT or Rc1/4 on 54mm centers, as specified.  
Meets DIN 19213.

**Process-wetted parts material:**

Material code (7th digit in Code symbols)	Process cover	Diaphragm	Wetted sensor body	Vent/drain
V	316 stainless steel(*1)	316L stainless steel	316 stainless steel	316 stainless steel

Notes: \* (1) SCS14 per JIS G 5121

Remark: Sensor O-rings: Viton or teflon selectable.

**Non-wetted parts material:**

Electronics housing: Low copper die-cast aluminum alloy (standard), finished with epoxy/polyurethane double coating, as specified.

Bolts and nuts: Cr-Mo alloy (standard), 304 stainless steel, or 630 stainless steel. Static pressure rating for code "3" with 304 stainless steel bolts is degraded to 10MPa(100bar).

Fill fluid: Silicone oil (standard) or fluorinated oil (Daifloil)

Mounting bracket: 304 stainless steel

**Environmental protection:**

IEC IP67 and NEMA 4X

**Mounting:**

On 60.5mm (JIS 50A or 2B) 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 housed in the electronics compartment or in the terminal box of the housing.

An optional 4 1/2 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 comply with NACE MR-01-75. Includes ASTM B7M or L7M bolts and 2HM nuts. (Class II)

Static pressure rating for code "3" (14 MPa(140bar)) is degraded to 10MPa (100bar).

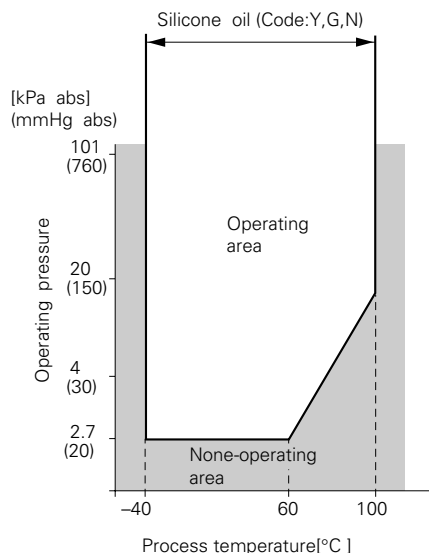


Fig. 1 Relation between process temperature and operating pressure

**Customer tag:**

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

**ACCESSORIES**

**Oval flanges:**

(Model FFP, refer to Data Sheet No. EDS6-10)  
Converts process connection to 1/2-14 NPT or to Rc1/2; in carbon steel or in 316 stainless steel.

**Three-valve manifold:**

(Model FFN, refer to Data Sheet No. EDS6-10)  
Available in carbon steel or in 316 stainless steel and in pressure rating 14MPa (140bar).

**Hand-held communicator:**

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

**Communication module:** (standard for model FKK)

When using this module for model FHK, remote setting function becomes available.

Remark: When the communication module is connected, the operation mode of external zero/span adjustable screw is changed to zero adjustment only.

# CODE SYMBOLS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15																																																
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Note: \*(1) SCS14 per JIS G 5121

\*(2) The scale is selectable "JIS and SI unit" or "Linear and sq. root" or "Linear and sq. root by 10".

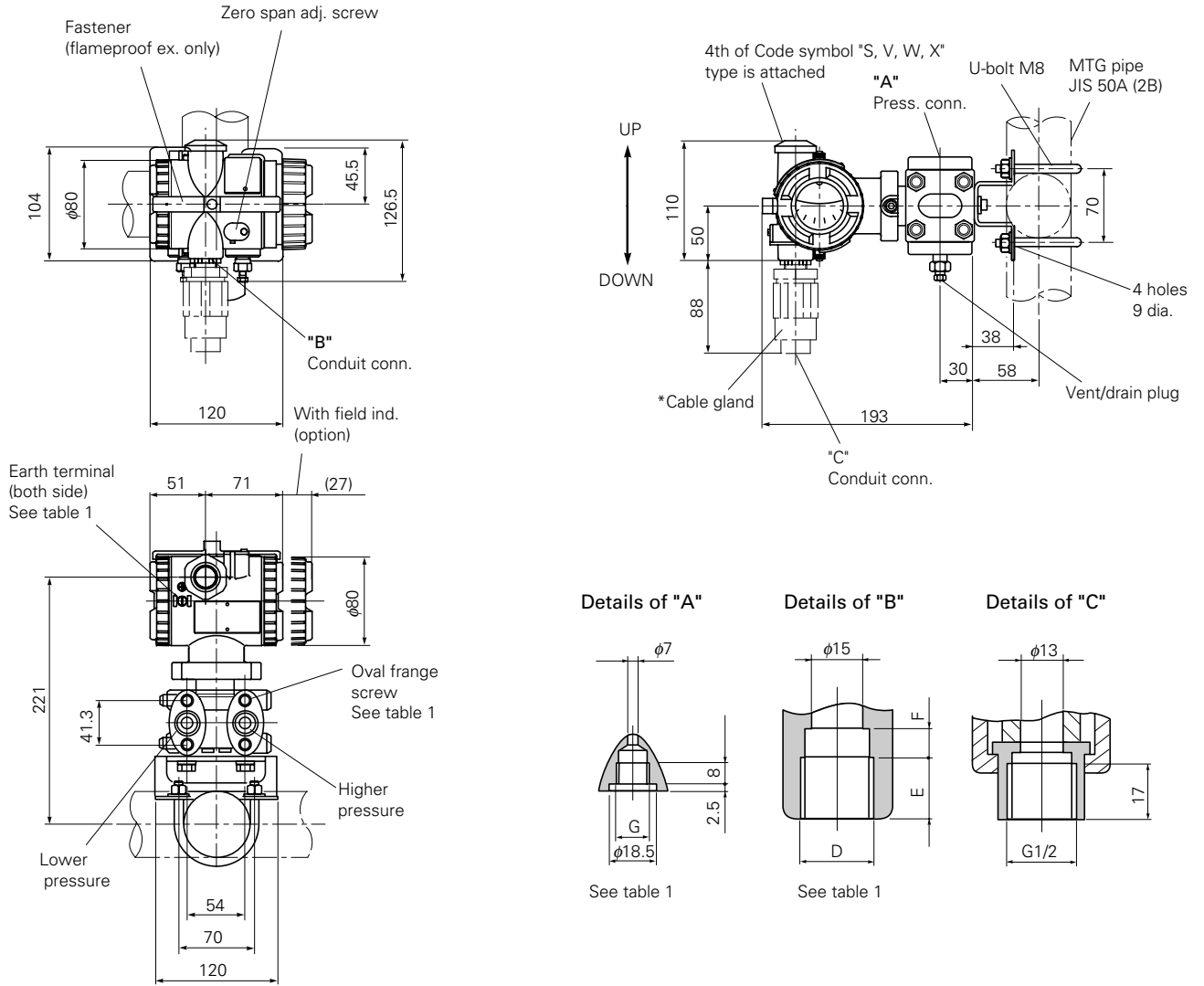
\*(3) In case of FKC, specified, the output mode is linear.

In case of 9th digit code "P", "S" with FKC, specified, the indication is output mode.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F	K						1							
Description														
<b>Optional specification</b>														
Stainless tag														
None														
Yes														
<b>Special applications and fill fluid</b>														
Treatment														
Filled liquid														
None (standard)														
Silicone oil														
Degreasing														
Silicone oil														
Oxygen service														
Fluorinated oil														
NACE specification														
Silicone oil														
<b>O-ring materials</b>														
Viton														
Teflon														
<b>Vent / drain plug type</b>														
<b>Bolt / nut materials</b>														
Standard														
Standard (Cr-Mo hex. socket head cap screw)														
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Cr-Mo hexagon bolt / nut														
Standard														
NACE bolt / nut (ASTM A193 B7M/A194 2HN) } (*2)														
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Standard														
304 / 304 stainless steel (*5) (*3)														
Standard														
630 / 304 stainless steel (*5) (*4)														

- Note : (2) Static pressure should be - 0.1 to +10MPa(-1 to +100bar).  
 (3) Available for the 5th digit code "1" or "3". In case of the 5th digit code "3", static pressure should be - 0.1 to +10MPa(-1 to +100bar).  
 (4) Available for the 5th digit code "3". In case of stainless steel (630 stainless steel) bolt, static pressure should be - 0.1 to +14MPa(-1 to +140bar).  
 (5) In case of tropical use, select a stainless bolts and nuts.

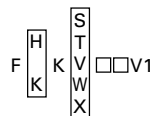
# OUTLINE DIAGRAM (Unit:mm)



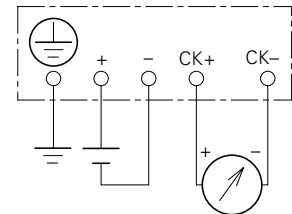
4th of Code symbols	Conduit conn.			Press. conn.	Oval flange screw	Earth terminal
	D	E	F	G		
S	G1/2	17	8	Rc1/4	7/16-20UNF screw depth 13	M4
T	1/2-14NPT	16	5	1/4-18NPT	7/16-20UNF screw depth 13	No. 8-32UNC
V	Pg13.5	8	4.5	1/4-18NPT	M10 or M12 screw depth 13	M4
W	M20x1.5	16	5	1/4-18NPT	M10 or M12 screw depth 13	M4
X	Pg13.5	8	4.5	1/4-18NPT	7/16-20UNF screw depth 13	M4

Table 1

<Optional stainless steel tag>



## CONNECTION DIAGRAMS



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

The product conforms to the requirements of the Electromagnetic compatibility Directive 89/336/EEC as detailed within the technical construction file number TN510412. The applicable standards used to demonstrate compliance are :-

**EMI (Emission) EN50081-1 : 1992**

Test item	Frequency range	Basic standard
Applicable Electro-magnetic Radiation Disturbance	30-1000MHz	EN55022 Class B

**EMS (Immunity) EN50082-1 : 1992**

No.	Test item	Test specification	Basic standard	Performance criteria
1	Electrostatic discharge	8kV (Air)	IEC 801-2:1984	B
2	Radio-frequency electromagnetic field.	27-500MHz 3V/m (Unmodulated)	IEC 801-3:1984	A
3	Fast transients common mode	0.5kV, 5/50 (Tr/Th) ns 5kHz Rep.	IEC 801-4:1988	B

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

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