

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 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 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.

2. 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).

3. 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.

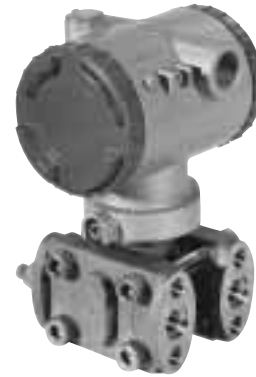
4. Fuji/HART® bilingual communication module

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.

5. 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 (vacuum 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=10³kPa=10bar=10.19716kgf/cm²=145.0377psi

1kPa=10mbar=101.9716mmH₂O=4.01463inH₂O

Overrange 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 :

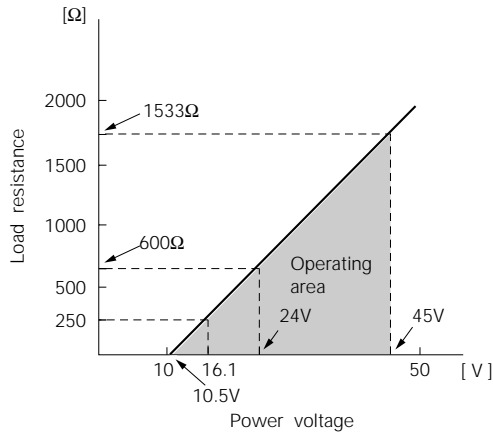
Transmitter operates on 10.5V to 45V DC at transmitter terminals.

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

EDS6-90d1

Date Feb. 10, 2000

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 :

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.

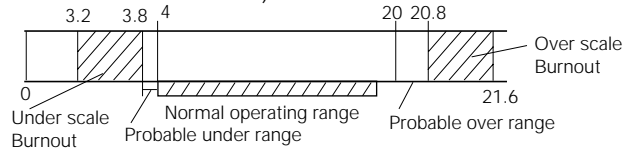
Burnout direction:

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

- **Model FHK :**
Unless otherwise specified in the order, the transmitter will be shipped in "Output Hold" mode. (Output signal just before failure happens is maintained)

- **Model FKK :**
Selected from HHC
"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 :

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 FKH only)

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

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

Note : (*) HHC's version must be more than 5.0 (or FXW###1-2#), to use LCD indicator programm.

(**) HHC's version must be more than 5.3, and Amplifier unit version 25.

Programmable output linearization function :

In smart version, output signal can be characterized with "14 points linear approximation function" from HHC.

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) :
± (0.05 + 0.05 $\frac{0.1 \times \text{URL}}{\text{span}}$) % 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 : $\pm(0.1 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$
"5" /130kPa {1300mbar} max. span	Zero : $\pm(0.1 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$
"6" /500kPa {5000mbar} max. span	Total : $\pm(0.075+0.1 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$
"7" / 2000kPa {20000mbar} max. span	Total : $\pm(0.075+0.1 \frac{\text{URL}}{\text{span}}) \% / 28^\circ\text{C}$

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	

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 ss	316L ss	316 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, as specified.

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 (Daifloil)

Mounting bracket :

304 stainless steel

Environmental protection :

IEC IP67 or NEMA 4X

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 4 $\frac{1}{2}$ digits LCD meter is also available.

Arrester :

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

Lightning surge immunity : 4KV (1.2 x 50 μ s)

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. 316 stainless steel bolts and nuts, ASTM B7M or L7M bolts and 2HM nuts (Class II) Static pressure rating for code "3" (14 MPa(140bar)) is degraded to 10MPa (100bar).

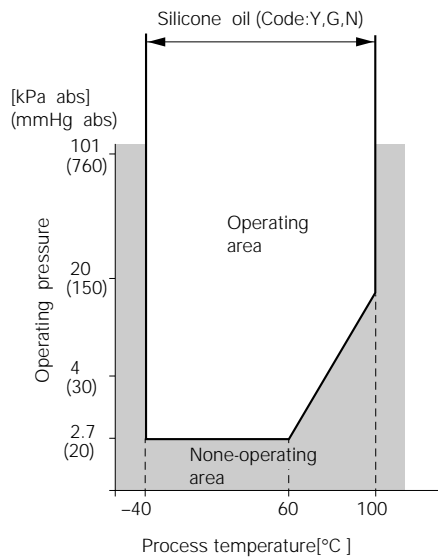


Fig.1 Relation between process temperature and operating pressure

Customer tag :

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

ACCESSORIES

Oval flanges :

Converts process connection to 1/2-14 NPT, material : 316 ss

Three-valve manifold :

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.

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."

CODE SYMBOLS

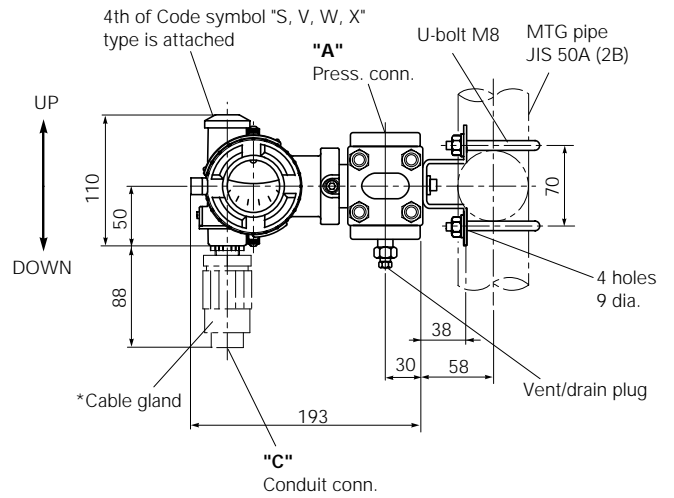
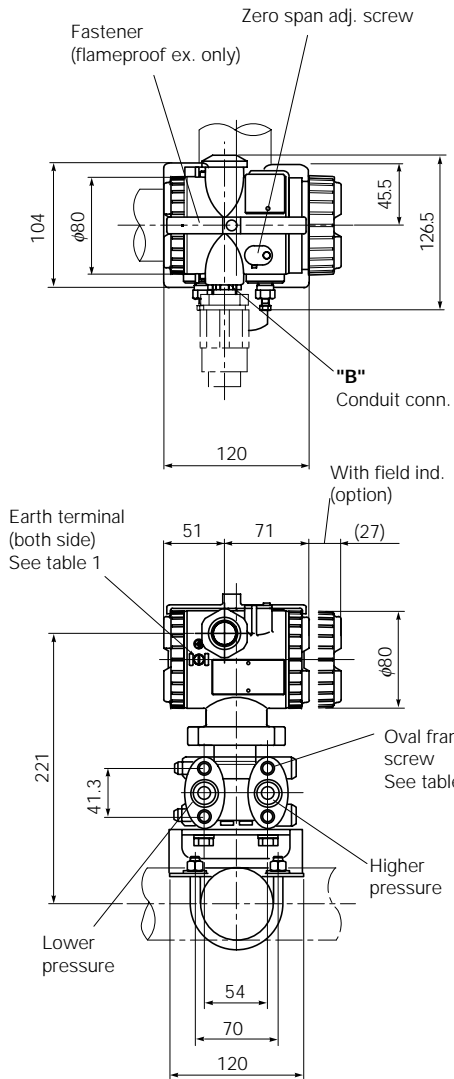
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	DESCRIPTION										
							1								Special applications & fill fluid <table border="1"> <thead> <tr> <th>Treatment</th><th>Fill fluid</th></tr> </thead> <tbody> <tr> <td>None (std)</td><td>silicone oil</td></tr> <tr> <td>Degreasing</td><td>silicone oil</td></tr> <tr> <td>Oxygen serv.</td><td>fluorinated oil</td></tr> <tr> <td>NACE</td><td>silicone oil</td></tr> </tbody> </table>	Treatment	Fill fluid	None (std)	silicone oil	Degreasing	silicone oil	Oxygen serv.	fluorinated oil	NACE	silicone oil
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															Process cover gasket - A Viton - C PTFE square section gasket in SS flange (FEF design)										
															Bolts/screws material A Cr-Mo (standard) C Recommendation NACE (ASTM A193 B7M bolts & A 194 2HM nuts) D Recommendation NACE (ASTM A320 L7M bolts & A 194 2HM nuts, for Canada) (*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)

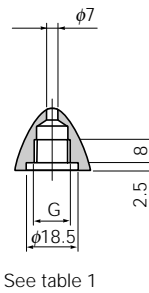
Test certificate based on 5 measuring points up and down(option)

OUTLINE DIAGRAM (Unit:mm)



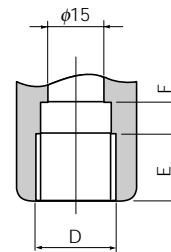
Note *: Cable gland is supplied in case of flameproof packing type. $\phi 11$ cable is suitable.

Details of "A"



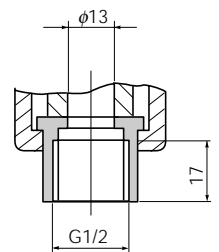
See table 1

Details of "B"



See table 1

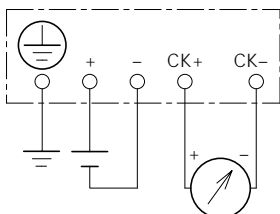
Details of "C"



4th of Code symbols	Conduit conn.			Press. conn.	Oval flange screw	Earth terminal
	D	E	F			
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

CONNECTION DIAGRAMS



Optional stainless steel tag

