FCX – C SERIES FLOW TRANSMITTER

DATA SHEET FHN

The FCX–C flow transmitter accurately measures differential pressure generated by a primary element, and transmits 4 to 20mA signal proportional to flow. The transmitter utilizes the unique micromachined capacitive silicon sensor with state-of-the-art microprocessor technology to provide exceptional performance and functionality.

FEATURES

1. High accuracy
   0.1% accuracy (for a range of 50% to 100% of flow) for all calibrated spans is the standard feature for all models covering 0.6kPa{6mbar} draft range to 2000kPa{20bar} high differential. Fuji's micro-capacitance silicon sensor assures this feature.
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 140bar).
3. Upgradable electronics
   A small plug-in communication module (to be ordered separately) can upgrade your FHN flow transmitters to have remote communication functions. A Hand Held Communicator (Model FXW, consult Data sheet No. EDS8-47) can remotely display or reconfigure process values as well as all transmitter configuration parameters at any point on the loop without affecting the transmitter signal.
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

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.	
FHN□12	–0.1 to + 3.2	0.6	6	+/– 6
	{–1 to + 32}	{ 6}	{ 60}	{+/– 60}
FHN□33	–0.1 to + 14	3.2	32	+/– 32
	{–1 to + 140}	{ 32}	{ 320}	{+/– 320}
FHN□35	–0.1 to + 14	13	130	+/– 130
	{–1 to + 140}	{ 130}	{ 1300}	{+/– 1300}
FHN□36	–0.1 to + 14	50	500	+/– 500
	{–1 to + 140}	{ 500}	{ 5000}	{+/– 5000}
FHN□37	–0.1 to + 14	200	2000	+/– 2000
	{–1 to + 140}	{ 2000}	{ 20000}	{+/– 20000}

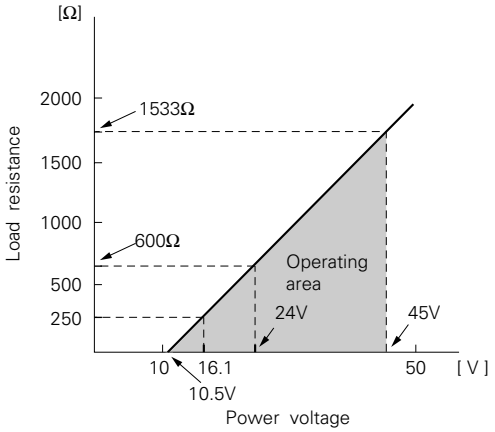
– Lower limit of static pressure (vacuum limit) is;
  Silicone fill sensor: See Fig. 1
  Fluorinated fill sensor: 66kPa abs (500mmHg abs) at temperature below 80°C.
– The maximum span of each sensor can be converted to in different units using below factors.
  $1MPa=10^3kPa=10bar=10.19716kgf/cm^2=145.0377psi$
  $1kPa=10mbar=101.9716mmH_2O=4.01463inH_2O$

Overrange limit: To maximum static pressure limit

Output signal: 4 to 20mA DC
Square root of differential input pressure between 0.5% and 100% of input.
Linear or zero is selectable below 0.5% of input.

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

Load limitations: see figure below



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

Hazardous locations:

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

Zero/span adjustment:
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.

Damping: Adjustable electrical damping.
The time constant is adjustable to 0, 0.3, 1.2, 4.8, or 19.2 seconds.

Zero elevation/suppression:
–100% to +100% of URL

Normal/reverse action:
Selectable by moving a jumper pin located on the electronics unit.

Indication: Analog indicator or $4\frac{1}{2}$-digit LCD meter, as specified.

Burnout direction: Output hold
Output 21.6mA } selectable
Output 3.8mA

Note: Unless otherwise specified, the output is in hold position.

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

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 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

Performance specifications

Accuracy rating: (Including conformity, hysteresis and repeatability)
±0.1% of calibrated span for a range of 50% to 100% of flow.
(±0.25% for a range of 20% to 50% of flow)

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")	Shift at 20% output
"2"/ 6kPa {60mbar} max. span	$\pm(0.625 \frac{URL}{Span})\%$ / 28°C
"3"/ 32kPa {320mbar} max. span "5"/ 130kPa {1300mbar} max. span "6"/ 500kPa {5000mbar} max. span "7"/ 2000kPa {20000mbar} max. span	$\pm(0.25 \frac{URL}{Span})\%$ / 28°C

Static pressure effect:

Static pressure code (5th digit in "Code symbols")	Shift at 20% output (% of URL)
"1" / 6kPa {60mbar} sensor	±1% / 3.2MPa{32bar}
"3"	±0.5% / 10MPa{100bar}

Overrange effect: Shift at 20% output (% of URL)

Static pressure code (5th digit in "Code symbols")	Shift at 20% output (% of URL)
"1"	±1% / 3.2MPa{32bar}
"3"	±1% / 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)

Type	Time constant	Dead time
FHN□12	0.85 s	approx. 0.3 s
FHN□33	0.45 s	
FHN□35 to □37	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

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 figure 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

Note: *(1) SCS 14 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

Communication module:
(Not included in transmitter shipments. Separate order by Part No. ZZPFCX2-A170 is required)
The communication module, that can be pluged-in on the transmitter electronics, provides bidirectional communication with the hand held communicator. (Model FXW, consult Data Sheet EDS 8-47.). The information that can be remotely displayed or reconfigured is as follows.

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 more than 5.0 (or FXW□□□□1–□2), to use this function.

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

Arrester: A built-in arrester protects the electronics from lightning surges.
Lightning surge immunity: 4KV (1.2×50μs)

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. ASTM B7M or L7M bolts and 2HM nuts (Class II) are available.
Static pressure rating for code "3" (14MPa {140bar}) is degraded to 10MPa {100bar}.

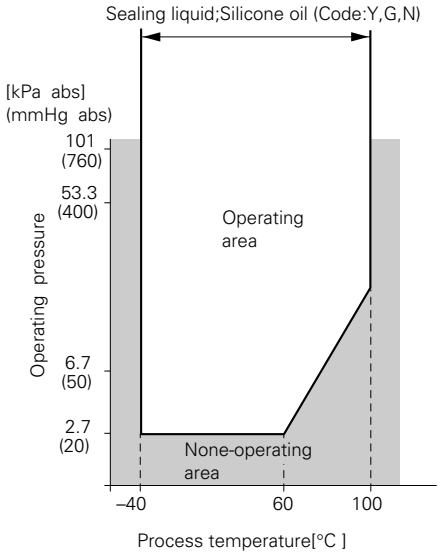


Fig. 1 Relation between process temperature and operating pressure

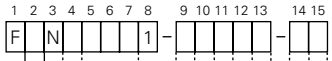
Customer tag: A stainless steel tag with customer tag data is wired to the transmitter.

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

CODE SYMBOLS



Description

Type

H — Without communication module

Connections

	Process conn.	Screw size for oval flange	Conduit conn.
S	Rc1/4	7/16-UNF	G 1/2
T	1/4-18NPT	7/16-UNF	1/2-14NPT
V	1/4-18NPT	M10 or M12	Pg 13.5
W	1/4-18NPT	M10 or M12	M20 x 1.5
X	1/4-18NPT	7/16-UNF	Pg13.5

Span and materials

	Static pressure [MPa] {bar}	Span limit [kPa] {mbar}	Material: Process cover	Material: Element: Diaphragm	Material: Element: Wetted cell body
12V	–0.1 to +3.2 {–1 to +32}	0.6…6 {6…60}	316 stainless steel(*1)	316L stainless steel	316 stainless steel
33V	–0.1 to +14 {–1 to +140}	3.2…32 {32…320}	316 stainless steel(*1)	316L stainless steel	316 stainless steel
35V		13…130 {130…1300}	316 stainless steel(*1)	316L stainless steel	316 stainless steel
36V		50…500 {500…5000}	316 stainless steel(*1)	316L stainless steel	316 stainless steel
37V		200…2000 {2000…20000}	316 stainless steel(*1)	316L stainless steel	316 stainless steel

Indicator and arrester

	Indicator	Arrester
A	None	None
B	Analog, 0 to 100% linear scale	None
D	Analog, custom scale	None
J	Analog, double scale	None
E	None	Yes
F	Analog, 0 to 100% linear scale	Yes
H	Analog, custom scale	Yes
K	Analog, double scale	Yes
L	Digital, 0 to 100%	None
Q	Digital, 0 to 100%	Yes

Approvals for hazardous locations

A	None (for ordinary locations)
D	FM, Flameproof (or explosionproof)
E	CSA, Flameproof (or explosionproof) (Available for 4th digit code "T")
M	BASEEFA, Flameproof (Conduit seal) (Available for 4th digit code "T")
N	BASEEFA, Flameproof (Cable gland seal) (Conduit connection G 1/2 only)
H	FM, Intrinsic safety and Nonincendive
J	CSA, Intrinsic safety and Nonincendive
K	CENELEC, Intrinsic safety
P	CENELEC, Intrinsic safety and BASEEFA, Type N
R	SAA Flameproof (Conduit seal) (Available for 4th digit code "S, T, W")
T	SAA Intrinsic safety (Available for 4th digit code "S, T, W")
Q	SAA Type – N (non-speaking) (Available for 4th digit code "S, T, W")

Process connection

	Side vent Yes / No	Mounting bracket Yes / No
A	None	None
C	None	Yes (Stainless steel)
D	Yes	None
F	Yes	Yes (Stainless steel)

Note: *(1) SCS14 per JIS G 5121

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

F N 1 – –

	Description		
	Optional specification		
	Stainless tag		
Y	None		
B	Yes		
	Special applications and fill fluid		
	Treatment	Filled liquid	
Y	None (standard)	Silicone oil	
G	Degreasing	Silicone oil	
A	Oxgen service	Fluorinated oil	
N	NACE specification	Silicone oil	
	O-ring materials		
A	Viton		
B	Teflon		
	Vent / drain plug type	**Casing bolt / nut materials**	
A	Standard	Standard (Cr-Mo hex. socket head cap screw)	
B	Standard	Cr-Mo hexagon bolt / nut	
C	Standard	NACE bolt / nut (ASTM A193 B7M/A194 2HN)	(*2)
D	Standard	NACE bolt / nut (ASTM A320 L7M/A194 2HM)	(*2)
E	Standard	304 / 304 stainless steel	(*3)
F	Standard	630 / 304 stainless steel	(*4)

(*5)

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 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.

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

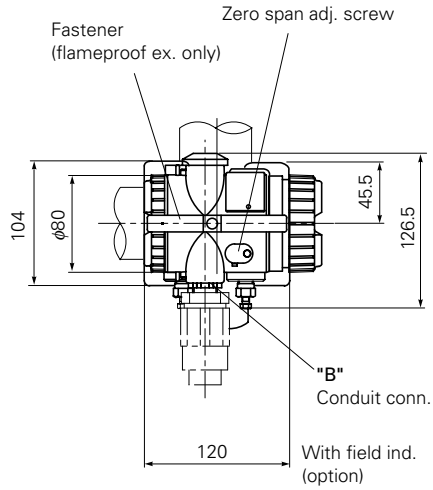
Test item	Frequency range	Basic standard
Applicable Electro-magnetic Radiation Disturbance	30-1000MHz	EN55022 Class B

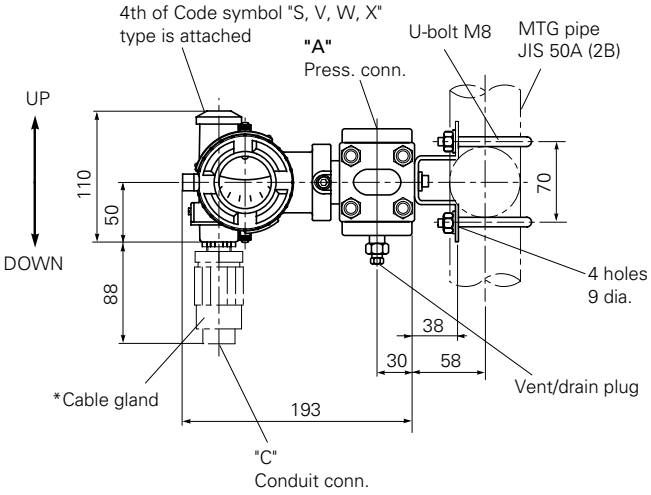
EMS (Immunity) EN50082-1 : 1992

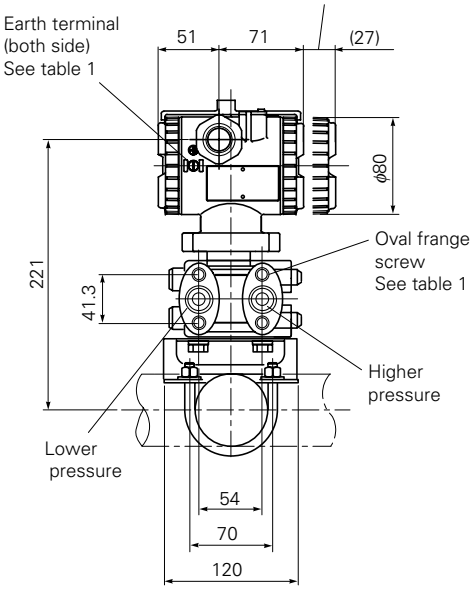
No.	Test item	Test specification	Basic standard	Performance criteria
1	Electrostatic discharge	8kV (Air)	IEC 801-2:1984	B
2	Radio-frequency electromagnetic field.	27-500MHz 3V/m (Unmodulated)	IEC 801-3:1984	A
3	Fast transients common mode	0.5kV, 5/50 (Tr/Th) ns 5kHz Rep.	IEC 801-4:1988	B

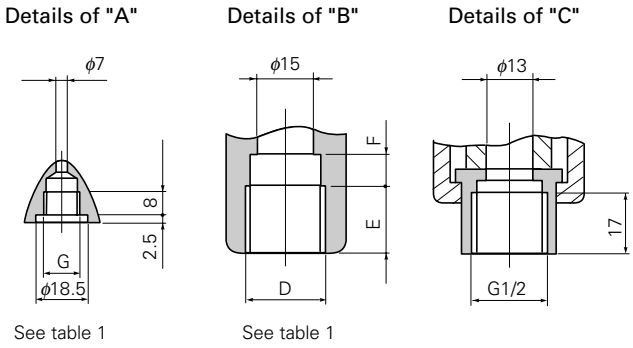
"LVD - The transmitter is not covered by the requirements of the LVD standard."

OUTLINE DIAGRAM (Unit:mm)





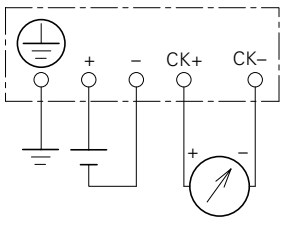




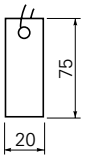
4th of Code symbols	Conduit conn.			Press. conn.	Oval flange screw	Earth terminal
	D	E	F	G		
S	G1/2	17	8	Rc1/4	7/16-20UNF screw depth 13	M4
T	1/2-14NPT	16	5	1/4-18NPT	7/16-20UNF screw depth 13	No. 8-32UNC
V	Pg13.5	8	4.5	1/4-18NPT	M10 or M12 screw depth 13	M4
W	M20x1.5	16	5	1/4-18NPT	M10 or M12 screw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

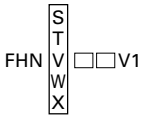
Table 1

CONNECTION DIAGRAMS



<Optional stainless steel tag>





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

⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.

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