

FCX – AX SERIES FLOW TRANSMITTER

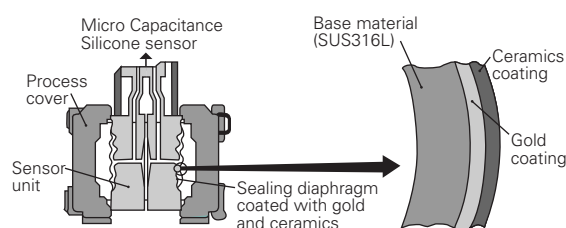
Hydrosel® Diaphragm Version

DATA SHEET
FHF...3

FEATURES

1. Unique hydrosel diaphragm

Permeation of hydrogen into the detecting unit through seal diaphragm can be suppressed thanks to the unique seal diaphragm (double coating) which employs coating of gold and ceramic.



2. High accuracy

±0.15% accuracy for all calibrated spans is the standard feature for flow transmitter covering 3.2 to 130kPa (or, 320 mmH₂O to 13 mH₂O). Fuji's Micro-capacitance silicon sensor assures feature.

3. Minimum environment influence

Fuji's patented "Advanced Floating Cell" design which protects the pressure sensor against changes in temperature, static pressure, and overpressure substantially reduces total measurement error in actual field applications.

4. Application flexibility

Various option that render the FCX-AX series suitable for almost any process applications include.

- Analog indicator at either the electronics side or terminal side
- Full range of hazardous location approvals
- 4½-digit LCD meter
- Stainless steel electronics housing
- Built-in RFI filter and lightning arrester



SPECIFICATIONS

Functional specifications

Service: Liquid, gas, or vapour
Static pressure, span, and range limit:

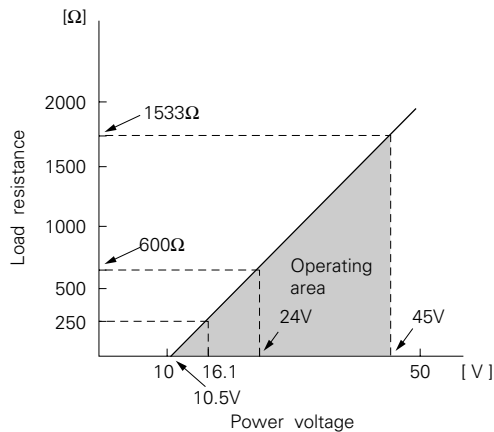
Type	Static pressure [MPa] {bar}	Span limit [kPa] {mbar}		Range limit [kPa] {m bar}
		Min.	Max.	
F□C□33	-0.1 to 16 (-1 to + 160)	3.2) (32)	32 (320)	+/- 32 (+/- 320)
F□C□35	-0.1 to 16 (-1 to + 160)	13 (130)	130 (1300)	+/- 130 (+/- 1300)

- Lower limit of static pressure (vacuum limit) ;
 Silicone fill sensor: See Fig. 1
 Fluorinated fill sensor: 66kPa abs (500mmHg abs) at temperature below 60°C.
 - The maximum span of each sensor can be converted to 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: 4 to 20mA DC
 Square root of differential input pressure between 0.5% and 100% input.
 Linear or zero is selectable below 0.5% of input.

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

Load limitations: see figure below



Hazardous locations: (Approval pending)

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
RIIS SAA	Ex ds IIB+H ₂ T4 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 the external adjustment screw.

The adjustment 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.

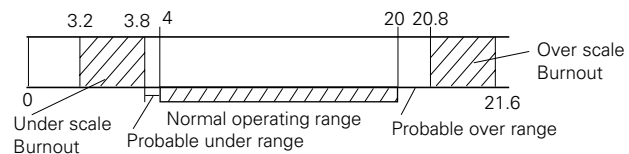
Burnout direction: If self-diagnostic detect transmitter failure, the analog signal will be driven to either "Output Hold", "Output Overscale" or "Output Underscale" modes.

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

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

"Output Overscale": Approx. 21.6mA

"Output Underscale": Approx. 3.8mA



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 +120°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: Output 50 to 100%: 0.15% of span

Output 20 to 50%: 0.375% of span

Output 10 to 20%: 0.75% of span

(Including linearity, hysteresis, and repeatability)

Stability: ±0.15% of upper range limit (URL) for 24 months

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 (% of URL)
"3"/ 32kPa {320m bar} max. span	$\pm (0.25 + 0.19 \frac{URL}{Span}) \% / 28^\circ C$
"4"/ 64kPa {640m bar} max. span	
"5"/ 130kPa {1300m bar} max. span	

Static pressure effect:

Static pressure code (5th digit in "Code symbols")	Shift at 20% output (% of URL)
"3"	±0.375%/10MPa{100bar}

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

Static pressure code (5th digit in "Code symbols")	Shift at 20% output (% of URL)
"3"	±0.75% / 16MPa {160bar} (*)

(*) in case of 6th code "5".

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
FHF□□3	0.45 s	approx. 0.3 s
FHF□4, □5	0.2 s	

Mounting position effect:

Zero shift, less than 0.12kPa {1.2m bar} 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
C	316 stainless steel(*1)	316L stainless steel(*2)	316 stainless steel	316 stainless steel

Notes: * (1) SCS14 per JIS G 5121

(2) The diaphragm face is coated with gold and ceramic.

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

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 (standard), finished with epoxy/polyurethane double coating, or 304 stainless steel, as specified.

Bolts and nuts: Cr-Mo alloy (standard), 304 stainless steel (for static pressure code "1", "2", and "3" only), or 630 stainless steel (for static pressure code "4" only). 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: Carbon steel with epoxy coating or 304 stainless steel, as specified

Environmental protection:

IEC IP67 and NEMA 4X

Mounting:

On 60.5mm (JIS 50A) pipe using mounting bracket, direct wall mounting, or direct process mounting.

Mass{weight}:

Transmitter approximately 4.4kg without options.

Add; 0.5kg for mounting bracket

0.8kg for indicator option

4.5kg for stainless steel housing option

Optional features

Indicator:

A plug-in analog indicator (1.5% accuracy) can be housed in the electronics compartment or in the terminal box of the housing. An optional 4½ 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.

Chlorine service:

Oil-free procedures as above. Includes fluorinated oil for fill.

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 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" (160 bar) is degraded to 100 bar.

Vacuum service:

Special silicone oil and filling procedure are applied.

See below figure.

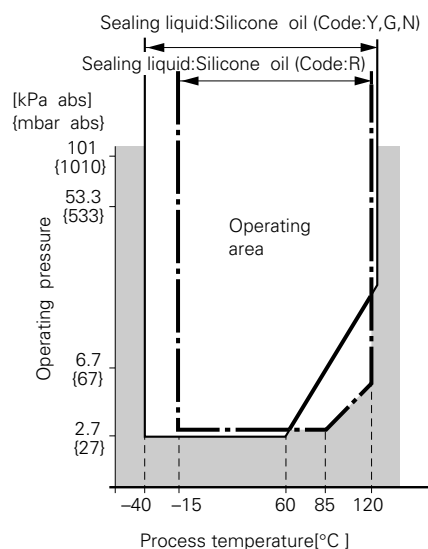


Fig. 1 Relation between process temperature and operating pressure

- Customer tag:** A stainless steel tag with customer tag data is wired to the transmitter.
- Coating of cell:** Cell's surface is finished with epoxy/polyurethane double coating.
Specify if environment is extremely corrosive.

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 16MPa {160bar} or 42MPa{420bar}.

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

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Description				
F	H	F					3								Connections				
															Process connection	Oval flange screw	Conduit connection		
															Rc1/4	7/16-20UNF	G 1/2		
															1/4-18NPT	7/16-20UNF	1/2-14NPT		
															1/4-18NPT	M10	Pg 13.5		
															1/4-18NPT	M10	M20×1.5		
															1/4-18NPT	7/16-20UNF	Pg 13.5		
															Span and materials				
															Static pressure [MPa] (bar)	Span limit (*2) [kPa] (m bar)	Process cover	Diaphragm	Wetted cell body
															33C -0.1 to +16 (-1 to +160)	3.2...32 (32...320)	316 stainless steel	316L stainless steel (*1)	316 stainless steel
															35C	13...130 (130...1300)			
															Indicator and arrester				
															Indicator		Arrester		
															None		None		
															Analog, 0 to 100% linear scale		None		
															Analog, 0 to 100% sq. root scale		None		
															Analog, custom scale		None		
															Analog, double scale		None		
															None		Yes		
															Analog, 0 to 100% linear scale		Yes		
															Analog, 0 to 100% sq. root scale		Yes		
															Analog, custom scale		Yes		
															Analog, double scale		Yes		
															Digital, 0 to 100%		None		
															Digital, 0 to 100%		Yes		
															Approvals for hazardous locations (Approval pending)				
															A	None (for ordinary locations)			
															B	JIS, Flameproof (Conduit seal)			
															C	JIS, Flameproof (Cable gland seal)			
															D	FM, Flameproof (or explosionproof)			
															E	CSA, Flameproof (or explosionproof)			
															M	BASEEFA, Flameproof (Conduit seal)			
															N	BASEEFA, Flameproof (Cable gland seal) (Conduit connection G 1/2 only)			
															G	JIS, Intrinsic safety			
															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-sparking)(Available for 4th digit code "S,T,W")			
															Side vent/ drain and mounting bracket				
															Side vent/drain	Mounting bracket			
															A	None	None		
															B	None	Yes, carbon steel		
															C	None	Yes, stainless steel		
															D	Yes	None		
															E	Yes	Yes, carbon steel		
															F	Yes	Yes, stainless steel		

Notes: * (1) The diaphragm face is coated with gold and ceramic.

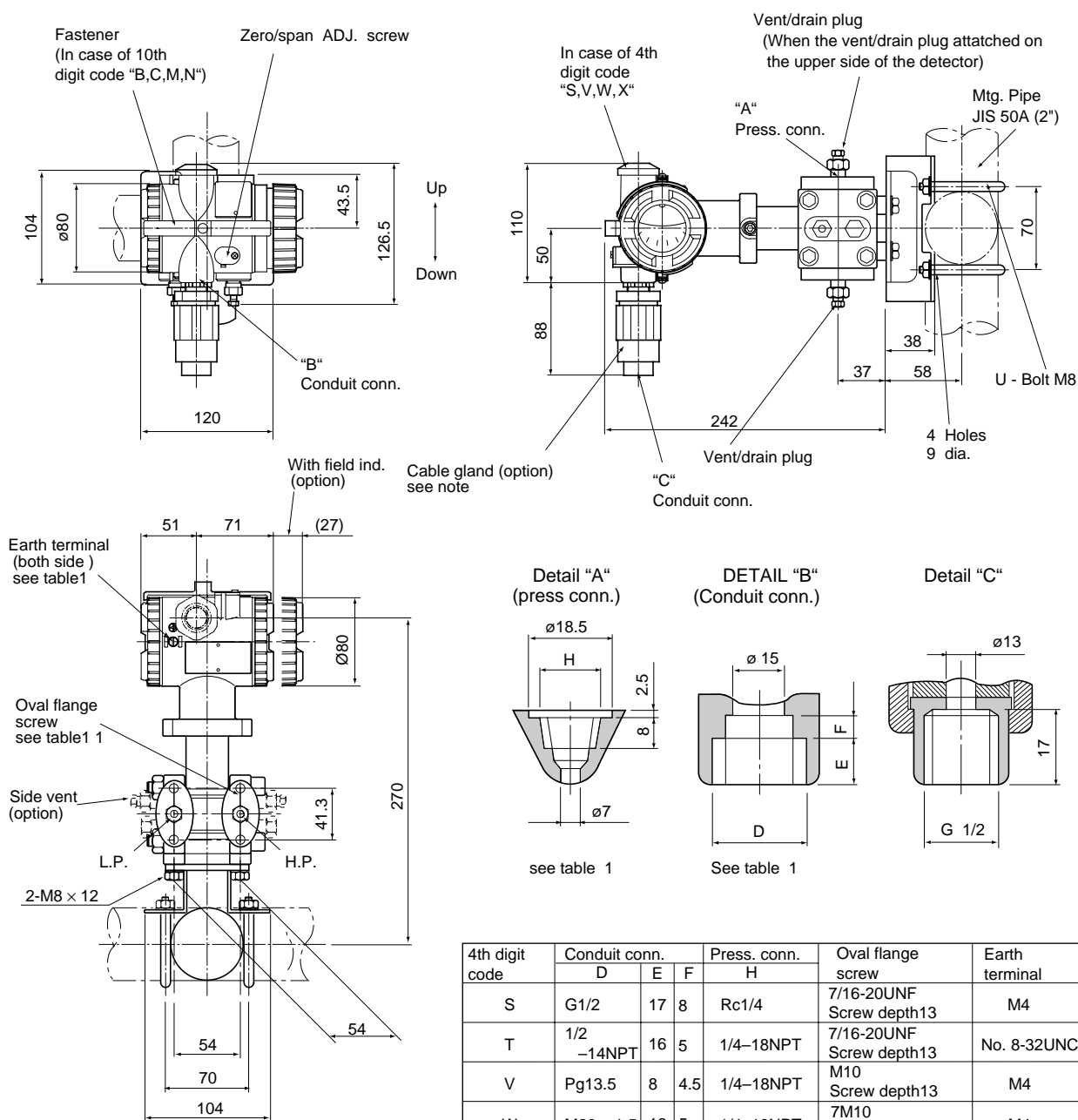
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15				
F	H	F					3	-							Description			
															Stainless steel parts			
															Stainless steel tag plate	Stainless steel elec, housing	Coating of cell	
															Y	None	None	None
															B	Yes	None	None
															C	None	Yes	None
															E	Yes	Yes	None
															M	None	None	Yes
															N	Yes	None	Yes
															P	None	Yes	Yes
															Q	Yes	Yes	Yes
															Special applications and fill fluid			
															Treatment		Fill fluid	
															Y	None (standard)	Silicone oil	
															W	None (standard)	Fluorinated oil	
															G	Degreasing	Silicone oil	
															A	Oxygen service	Fluorinated oil (Material code "W", "V")	
															N	NACE specification	Silicone oil (Not available for 7th digit code "T", "U" and 15th digit code "A", "B")	
															Sensor O-ring			
															A	Viton		
															B	Teflon		
															Bolt/nut			
															A	Cr-Mo alloy hexagon socket head cap screw/carbon steel nut		
															B	Cr-Mo alloy hexagon bolt/nut		
															C	NACE bolt/nut (ASTM A193 B7M/A194 2HM)		
															D	NACE bolt/nut (ASTM A320 L7M/A194 2HM)		
															E	304 stainless steel/304 stainless steel		

Notes: (*2) Static pressure should be -0.1 to +10MPa{-1 to +100bar}.

(*3) Available for the case of stainless steel bolt
with the 5th digit code "3", static pressure should be -0.1 to +10MPa {-1 to + 100bar}.

(*4) In case of tropical use, select a stainless bolts and nuts.

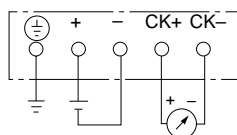
OUTLINE DIAGRAM (Unit:mm)



4th digit code	Conduit conn.			Press. conn.	Oval flange screw	Earth terminal
	D	E	F			
S	G1/2	17	8	Rc1/4	7/16-20UNF Screw depth13	M4
T	1/2 -14NPT	16	5	1/4-18NPT	7/16-20UNF Screw depth13	No. 8-32UNC
V	Pg13.5	8	4.5	1/4-18NPT	M10 Screw depth13	M4
W	M20 \times 1.5	16	5	1/4-18NPT	7M10 Screw depth13	M4
X	Pg13.5	8	4.5	1/4-18NPT	7/16-20UNF Screw depth13	M4

Table 1

CONNECTION DIAGRAM



Note1) : Cable gland is supplied in case of flamproof packing type.
 $\phi 11$ cable is suitable.

FHF

S	T	V	W	X
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		C
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