

# FCX SERIES FLOW TRANSMITTER

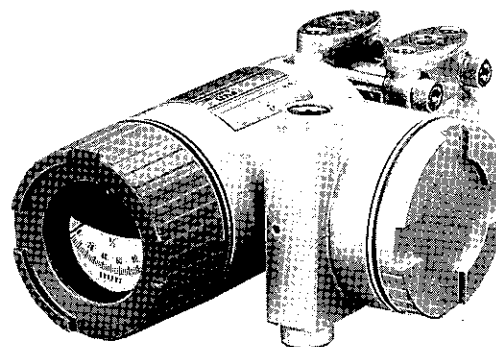
DATA SHEET

FHF

The FCX series 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

- Outstanding accuracy**  
0.1% accuracy for all calibrated spans is the standard feature for all models covering 0.1kPa {1mbar} draft range to 3000kPa (30bar) high differential. Fuji's Micro-capacitance silicon sensor assures this feature.
- Minimum environment influence**  
"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.
- Upgradable electronics**  
A small plug-in communication module (to be ordered separately) can upgrade your FHF flow transmitters to have remote communication functions. A Hand held communicator (Model FXW, consult Data sheet No. EDS 8-47) 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.
- Application flexibility**  
Example features that render the FCX series 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-digits LCD meter
  - Stainless steel electronics housing
  - Wide selection of materials



## SPECIFICATIONS

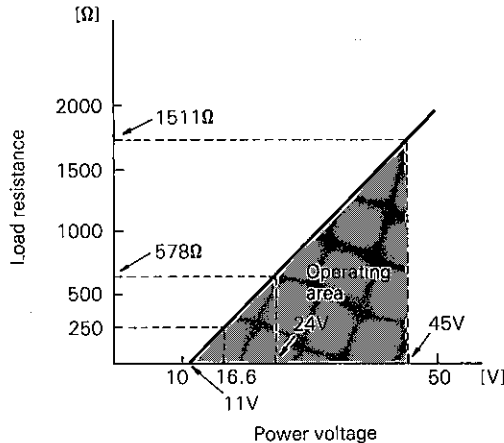
### Functional specifications

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

Type	Static pressure [MPa] (bar)	Span limit [kPa] (mmH <sub>2</sub> O)		Range limit [kPa] (mmH <sub>2</sub> O)
		Min.	Max.	
FHF□11	-0.1 to + 3.2 {-1 to + 32}	0.1 ( 10)	1 ( 100)	+/- 1 (+/- 100)
FHF□12	-0.1 to + 3.2 {-1 to + 32}	0.6 ( 60)	6 ( 600)	+/- 6 (+/- 600)
FHF□23	-0.1 to + 10 {-1 to + 100}	3.2 ( 320)	32 ( 3200)	+/- 32 (+/- 3200)
FHF□24	-0.1 to + 10 {-1 to + 100}	6.4 ( 640)	64 ( 6400)	+/- 64 (+/- 6400)
FHF□25	-0.1 to + 10 {-1 to + 100}	13 ( 1300)	130 ( 13000)	+/- 130 (+/- 13000)
FHF□26	-0.1 to + 10 {-1 to + 100}	50 ( 5000)	500 ( 50000)	+/- 500 (+/- 50000)
FHF□33	-0.1 to + 16 {-1 to + 160}	3.2 ( 320)	32 ( 3200)	+/- 32 (+/- 3200)
FHF□34	-0.1 to + 16 {-1 to + 160}	6.4 ( 640)	64 ( 6400)	+/- 64 (+/- 6400)
FHF□35	-0.1 to + 16 {-1 to + 160}	13 ( 1300)	130 ( 13000)	+/- 130 (+/- 13000)
FHF□36	-0.1 to + 16 {-1 to + 160}	50 ( 5000)	500 ( 50000)	+/- 500 (+/- 50000)
FHF□38	-0.1 to + 16 {-1 to + 160}	300 (30000)	3000 (300000)	+/- 3000 (+/-300000)
FHF□43	-0.1 to + 42 {-1 to + 420}	3.2 ( 320)	32 ( 3200)	+/- 32 (+/- 3200)
FHF□44	-0.1 to + 42 {-1 to + 420}	6.4 ( 640)	64 ( 6400)	+/- 64 (+/- 6400)
FHF□45	-0.1 to + 42 {-1 to + 420}	13 ( 1300)	130 ( 13000)	+/- 130 (+/- 13000)
FHF□46	-0.1 to + 42 {-1 to + 420}	50 ( 5000)	500 ( 50000)	+/- 500 (+/- 50000)
FHF□47	-0.1 to + 42 {-1 to + 420}	200 (20000)	2000 (200000)	+/- 2000 (+/-200000)

- Lower limit of static pressure (vacuum limit) is;  
Silicone fill sensor: See Fig. 1  
FHF□38 and FHF47: -50kPa {-0.5bar}  
Fluorinated fill sensor: 66kPa abs (500mmHg abs)  
temperature below 60°C
- The maximum span of each sensor can be converted to in different units using below factors.  
1MPa=10<sup>3</sup>kPa=10 bar=10.19716kgf/cm<sup>2</sup>  
=145.0377psi  
1kPa=10mbar=101.9716mmH<sub>2</sub>O=4.01463 in H<sub>2</sub>O

**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 with differential pressure below 0.5% of input.  
**Power supply:** Transmitter operates on 11V to 45V DC at transmitter terminals.  
 11 to 27V DC for the units with optional arrester.  
**Load limitations:** see figure below



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

**Hazardous locations:**  
 Designed to meet international intrinsic safety and flameproof (explosionproof) standards.

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. G Class I II III Div. 1	Groups A thru. G Class I II III Div. 2
RIIS SAA NEPSI	ds 2 G4 Exd IIB T6 d IIC T5	Groups A thru. G i 3a G4 Ex ia IIC T5, T6 ia IIC T4	Groups A thru. G — — —

**Zero/span adjustment:**  
 Zero is adjustable externally from the push buttons (UP and DOWN).  
 The push buttons can also function to adjust span when MODE SWITCH (located on the front face of electronics unit) is in the span mode.  
**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-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 +120°C for silicone fill sensor  
 -20 to +120°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:** ±0.1% of upper range limit (URL) for 6 months  
**Temperature effect:**  
 Effects per 55°C change between the limits of -40°C and +85°C

Range code (6th digit in "Code symbols")	Shift at 20% output (% of URL)
"1" and "2"	±1.5% / 55°C
"3" through "8"	±0.7% / 55°C

**Static pressure effect:**

Static pressure code (5th digit in "Code symbols")	Shift at 20% output (% of URL)
"1" / 1kPa (100mmH <sub>2</sub> O) sensor	±0.5% / 1MPa (10bar)
"1" / 6kPa (600mmH <sub>2</sub> O) sensor	±0.5% / 3.2MPa (32bar)
"2"	±0.25 / 10MPa (100bar)
"3"	
"4"	

Double the shift for material code (7th digit in Code symbols) "H", "M", "T", "B", "L" and "U".

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

Static pressure code (5th digit in "Code symbols")	Shift at 20% output (% of URL)
"1" / 1kPa (100mmH <sub>2</sub> O) sensor	±0.75% / 1MPa (10bar)
"1" / 6kPa (600mmH <sub>2</sub> O) sensor	±0.75% / 3.2MPa (32bar)
"2"	±0.75% / 10MPa (100bar)
"3"	±0.75% / 16MPa (160bar)
"4"	±1.25% / 42MPa (420 bar)

Double the effects for material code "H", "M", "T", "B", "L" and "U".

**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 10 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□11	1.25 s	approx. 0.3 s
FHF□12	0.85 s	
FHF□□3	0.45 s	
FHF□4 to□8	0.2 s	

**Mounting position effect:**

Zero shift, less than 0.12kPa (12mmH<sub>2</sub>O) 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 (For the type with arrester, remove earthing plate.)

**Insulation resistance:**

More than 100MΩ at 500V DC (For the type with arrester, remove earthing plate.)

**Turn-on time:**

4 sec.

**Physical specifications****Electrical connections:**

G1/2, 1/2-14 NPT, Pg13.5, or M20×1.5 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
W	316 SS (*2)	Hastelloy-C	316 SS	316 SS
V (*1)	316 SS (*2)	316L SS	316 SS	316 SS
H	316 SS (*2)	Hastelloy-C	Hastelloy-C lining	316 SS
M	316 SS (*2)	Monel	Monel lining	316 SS
T	316 SS (*2)	Tantalum	Tantalum lining	316 SS
B	Hastelloy-C lining	Hastelloy-C	Hastelloy-C lining	Hastelloy-C
L	Monel lining	Monel	Monel lining	Monel
U	Tantalum lining	Tantalum	Tantalum lining	Tantalum

Notes: \* (1) Not available for the 6th digit code "6, 7, 8"  
(2) SCS14 per JIS G 5121

Remarks: (1) Sensor O-rings: Viton for material code "W", "V", "H", "M", and "T"  
Teflon for material code "B", "L", and "U"  
Availability of above material design depends on ranges and static pressure. Refer to "Code symbols".

(2) SS : Stainless steel

**Non-wetted parts material:**

Electronics housing: Low copper die-cast aluminum alloy (standard), finished with epoxy/polyurethane double coating, or 304 SS, as specified.

Bolts and nuts: Cr-Mo alloy (standard), 304 SS (for static pressure code "1", "2", and "3" only), or 630 SS (for static pressure code "4" only). Static pressure rating for code "3" with 304 SS bolts is degraded to 10MPa.

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

Mounting bracket: Carbon steel with epoxy coating or 304 SS, as specified

**Environmental protection:**

IEC IP67 and NEMA 4X

**Mounting:**

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

**Mass(weight):**

Transmitter approximately 5kg without options.

Add; 0.5kg for mounting bracket

0.8kg for indicator option

4.5kg for stainless steel housing option

**Optional features****Communication module:**

(Not included in transmitter shipments. Separate order by Part No. ZZPFCX1-A170 is required.)

The communication module, that can be plugged-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

- 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 digits LCD meter is also available.
- Arrester:** A built-in arrester protects the electronics from lightning surges.  
Not available with intrinsic safety approvals.
- 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:** The fill fluid is fluorinated oil.  
Not available with material code "W" and "V".
- 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" (16 MPa) is degraded to 10MPa.
- Vacuum service:** Special silicone oil and filling procedure are applied.  
See below figure.

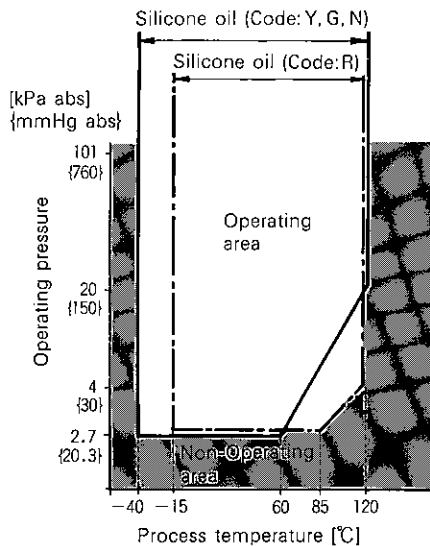


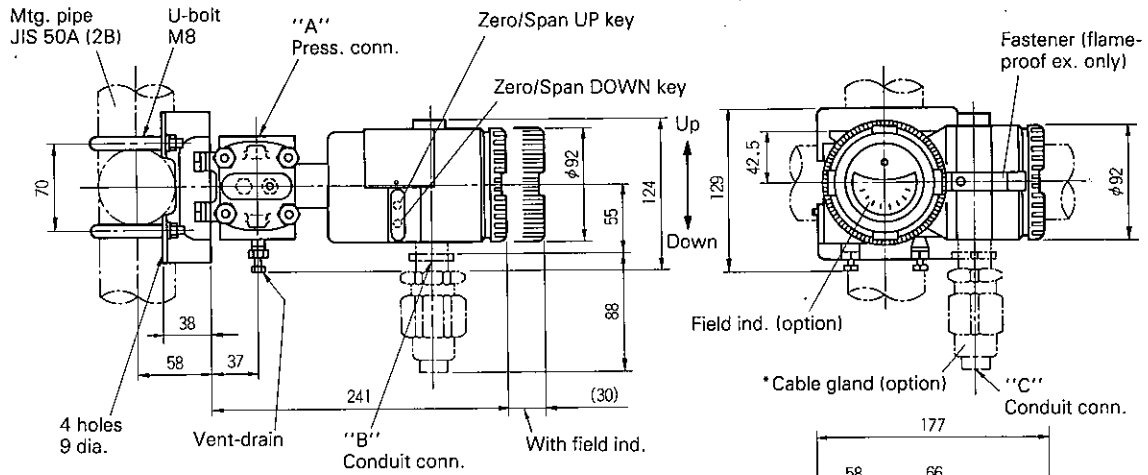
Fig. 1 Relation between process temperature and operating pressure

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

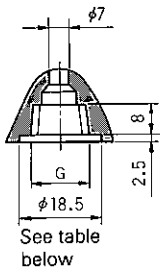
## ACCESSORIES

- 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 SS.
- Three-valve manifolds:**  
(Model FFN, refer to Data Sheet No. EDS6-10)  
Available in CS or in 316SS and in pressure rating 16MPa or 42MPa.

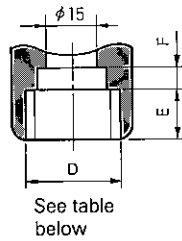
# OUTLINE DIAGRAM (Unit:mm)



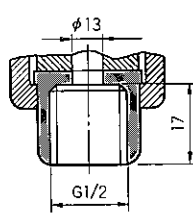
Details of "A" (press. conn.)



Details of "B" (conduit conn.)



\*Details of "C" (conduit conn.)

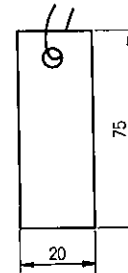
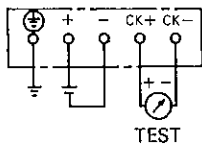


Note: The part marked \* is supplied in case of flameproof packing type.  $\phi 11$  cable is suitable.

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

< Optional stainless steel tag >

## CONNECTION DIAGRAM



CODE SYMBOLS

1	2	3	4	5	6	7	8	9	10	11	12	13
F	H	F						1				

S  
T  
V  
W  
X

		Description						
		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 (or M12) *	Pg 13.5				
		1/4-18NPT	M10 (or M12) *	M20x1.5				
		1/4-18NPT	7/16-20UNF	Pg 13.5				
		Span and materials						
		Static pressure [MPa] {bar}	Span limit [kPa] {mmH <sub>2</sub> O}	Process cover	Diaphragm	Wetted cell body		
11W		-0.1 to +3.2 (-1 to +32)	0.1...1 (10...100)	316SS	Hast. C	316SS		
11V				316SS	316L SS	316SS		
11H				316SS	Hast. C	Hast. C lining		
12W		0.6...6 (60...600)	316SS	Hast. C	316SS			
12V				316SS	316L SS	316SS		
12H				316SS	Hast. C	Hast. C lining		
33W		-0.1 to +16 (-1 to +160)	3.2...32 (320...3200)	316SS	Hast. C	316SS		
33V				316SS	316L SS	316SS		
33H				316SS	Hast. C	Hast. C lining		
33M				316SS	Monel	Monel lining		
33T				316SS	Tantalum	Tantalum lining		
34W				6.4...64 (640...6400)	316SS	Hast. C	316SS	
34V						316SS	316L SS	316SS
34H						316SS	Hast. C	Hast. C lining
34M						316SS	Monel	Monel lining
34T				13...130 (1300...13000)	316SS	Tantalum	Tantalum lining	
35W		316SS	Hast. C			316SS		
35V			316SS			316L SS	316SS	
35H			316SS			Hast. C	Hast. C lining	
35M			316SS			Monel	Monel lining	
35T			316SS			Tantalum	Tantalum lining	
36W			50...500 (5000...50000)	316SS	Hast. C	316SS		
36V		316SS			Hast. C	Hast. C lining		
36M		316SS			Monel	Monel lining		
36T		316SS			Tantalum	Tantalum lining		
38W		300...3000 (30000...300000)	316SS	Hast. C	316SS			
43W		-0.1 to +42 (-1 to +420)	3.2...32 (320...3200)	316SS	Hast. C	316SS		
43V				316SS	316L SS	316SS		
43H				316SS	Hast. C	Hast. C lining		
43M				316SS	Monel	Monel lining		
44W				6.4...64 (640...6400)	316SS	Hast. C	316SS	
44V						316SS	316L SS	316SS
44H						316SS	Hast. C	Hast. C lining
44M						316SS	Monel	Monel lining
45W				13...130 (1300...13000)	316SS	Hast. C	316SS	
45V						316SS	316L SS	316SS
45H		316SS	Hast. C			Hast. C lining		
45M		316SS	Monel			Monel lining		
46W		50...500 (5000...50000)	316SS	Hast. C	316SS			
46H				316SS	Hast. C	Hast. C lining		
46M				316SS	Monel	Monel lining		
47W		200...2000 (20000...200000)	316SS	Hast. C	316SS			
23B		-0.1 to +10 (-1 to +100)	3.2...32 (320...3200)	Hast. C lining	Hast. C	Hast. C lining		
23L				Monel lining	Monel	Monel lining		
23U				Tantalum lining	Tantalum	Tantalum lining		
24B				6.4...64 (640...6400)	316SS	Hast. C lining	Hast. C	Hast. C lining
24L						Monel lining	Monel	Monel lining
24U						Tantalum lining	Tantalum	Tantalum lining
25B						13...130 (1300...13000)	316SS	Hast. C lining
25L				Monel lining	Monel			Monel lining
25U				Tantalum lining	Tantalum			Tantalum lining
26B				50...500 (5000...50000)	316SS			Hast. C lining
26L						Monel lining	Monel	Monel lining
26U						Tantalum lining	Tantalum	Tantalum lining

Note: \* The thread is M12, if 42MPa (420bar) static pressure is specified.

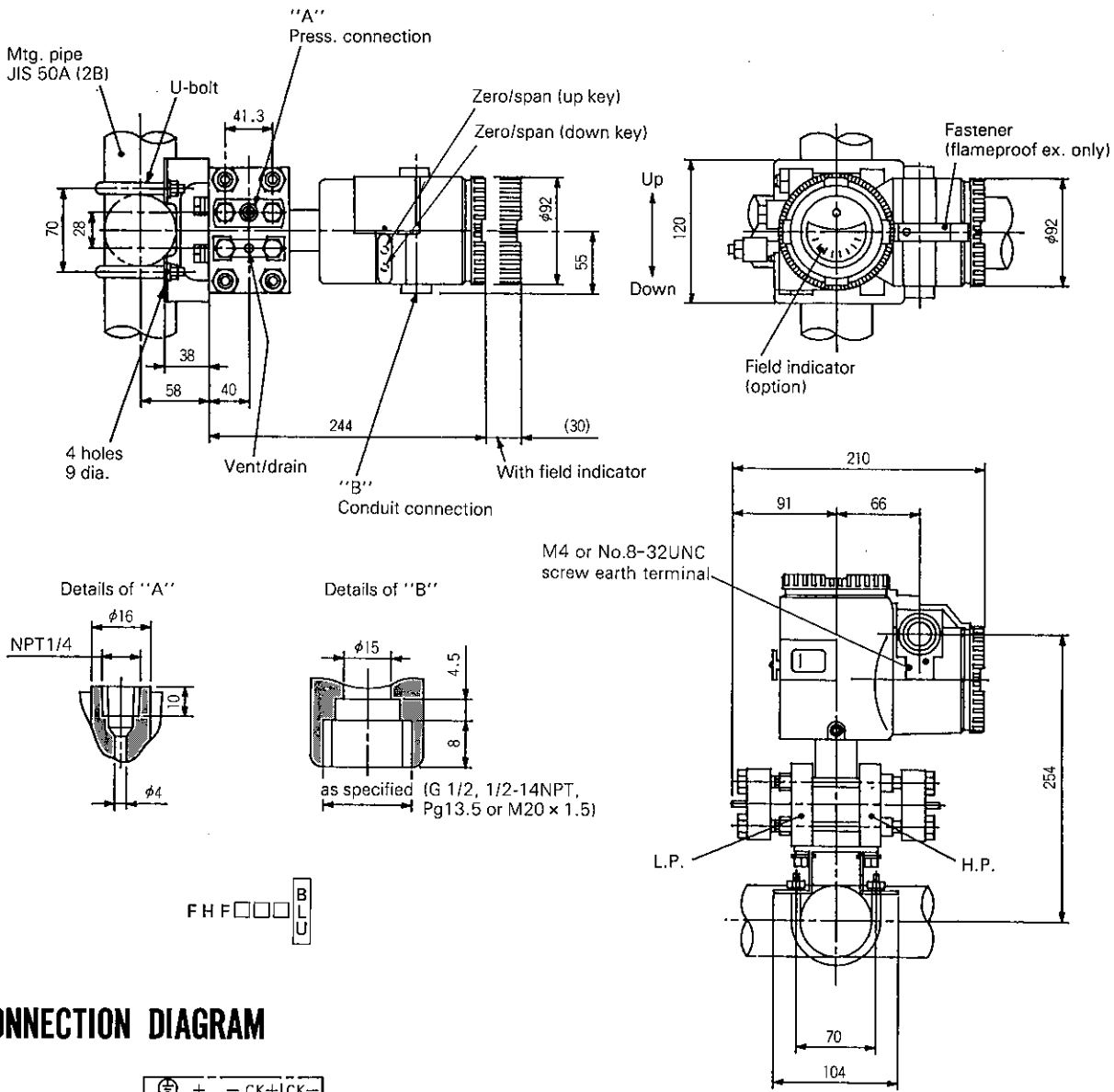
1 2 3 4 5 6 7 8 9 10 11 12 13  
 F H F | | | | 1 - | | | | |

		Description		
		<b>Indicator and arrester</b>		
	Indicator	Arrester(*)		
A	None	None		
B	Analog, 0 to 100% linear scale	None		
D	Analog, custom scale	None		
E	None	Yes		
F	Analog, 0 to 100% linear scale	Yes		
H	Analog, custom scale	Yes		
L	Digital, 0 to 100%	None		
O	Digital, 0 to 100%	Yes		
		<b>Approvals for hazardous locations</b>		
A	None (for ordinary locations)			
B	JIS, Flameproof (Conduit seal)			
C	JIS, Flameproof (Cable gland seal)			
D	FM, Flameproof (for explosionproof)			
E	CSA, Flameproof (or explosionproof)			
M	BASEEFA, Flameproof (Conduit seal)			
N	BASEEFA, Flameproof (Cable gland seal) (Conduit connection G 1/2 only)			
R	SAA, Flameproof (Conduit seal)			
S	SAA, 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	BASEEFA, Intrinsic safety			
P	BASEEFA, Intrinsic safety and Type N			
T	SAA, Intrinsic safety			
V	NEPSI, Flameproof (Conduit seal)			
W	NEPSI, Intrinsic safety			
		<b>Side vent/ drain and mounting bracket</b>		
	Side vent/drain	Mounting bracket		
A	None	None		
B	None	Yes, CS		
C	None	Yes, stainless steel		
D	Yes	None		
E	Yes	Yes, CS		
F	Yes	Yes, stainless steel		
		} Specify "A", "B", or "C" for the 7th digit code "B", "L", or "U"		
		<b>Stainless steel parts</b>		
	SS bolt/nut	SS tag plate	SS elec, housing	
Y	None	None	None	
A	Yes	None	None	
B	None	Yes	None	
C	None	None	Yes	
D	Yes	Yes	None	
E	None	Yes	Yes	
F	Yes	None	Yes } (*4)	
G	Yes	Yes	Yes	
H	Yes	None	None	
J	Yes	Yes	None } (*5)	
K	Yes	None	Yes	
L	Yes	Yes	Yes	
		<b>Special applications and fill fluid</b>		
	Treatment	Fill fluid		
Y	None (standard)	Silicone oil		
W	None (standard)	Fluorinated oil		
G	Degreasing	Silicone oil		
A	Oxygen service	Fluorinated oil (7th digit code "W", "V" only)		
D	Chlorine service	Fluorinated oil (7th digit code "H", "T", "B" and "U")		
N	NACE specification	Silicone oil		
R	Vacuum service	Silicone oil for vacuum use		

Notes: \*(3) Arrester option is not available when intrinsic safety is specified.  
 (4) Available for the 5th digit code "1", "2", "3", or "4". In the case of stainless steel bolt with the 5th digit code "3", static pressure should be -0.1 to +10MPa (-1 to +100bar).  
 (5) Available for the 5th digit code "3". Material of bolts is 630SS. Static pressure is -0.1 to +16MPa (-1 to +160bar).

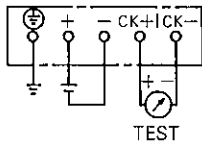
# OUTLINE DIAGRAM (Unit:mm)

< Models with special material process covers >

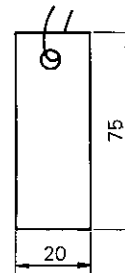


FHF □ □ □ B  
U

## CONNECTION DIAGRAM



< Optional stainless steel tag >



## Fuji Electric Co.,Ltd.

**Head office**  
12-1 Yurakucho 1-chome, Chiyoda-ku, Tokyo, 100 Japan  
Phone: Tokyo 3211-7111  
Telex: J22331 FUJIELEA or FUJIELEB

**Instrumentation System Div.**  
No.1, Fuji-machi, Hino-city, Tokyo 191 Japan  
Phone: 0425-85-2800  
Fax: 0425-85-2810