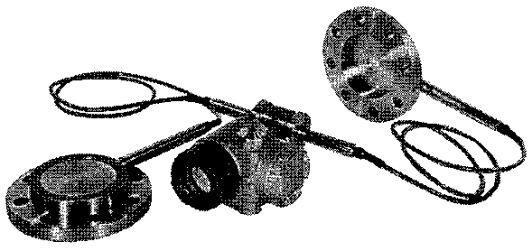
FUJI ELECTRIC

FCX

FCX – A SERIES REMOTE SEAL TYPE
DIFFERENTIAL PRESSURE TRANSMITTER

DATA SHEET FHD, FKD···2

The FCX –A differential pressure transmitter accurately measures differential pressure, liquid level or gauge pressure and transmits a proportional 4 to 20mA signal. The transmitter utilizes a unique micromachined capacitive silicon sensor with state-of-the-art microprocessor technology to provide exceptional performance and functionality. Totally welded construction of the seals assures excellent reliability in high temperature and highly corrosive process conditions.



FEATURES

1. **High accuracy**
   0.2% accuracy for all calibrated spans is a standard feature for all DP models covering 3.2kPa{32mbar} range to 500kPa{5bar} high differential. Fuji's micro-capacitance silicon sensor assures this accuracy for all elevated or suppressed calibration ranges without additional adjustment.
2. **Minimum environmental influence**
   The "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.
3. **Smart / Traditional convertible**
   Fuji micro-electronics manufacturing technology offers free selection of Smart / Traditional transmitters.
   A small plug-in communication module upgrades your model FHD to smart type model FKD, which has full remote communication capabilities. A Hand Held Communicator (HHC), model FXW can remotely display or reconfigure all transmitter 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 options that render the FCX –A suitable for almost any process applications includes:
   - Analog indicator at either the electronics side or terminal side
   - Full range of hazardous area approvals
   - Built-in RFI filter and lightning arrestor
   - $4\frac{1}{2}$ -digits LCD meter
   - Stainless steel electronics housing
   - Wide selection of materials
   - High temperature, high vacuum seals

SPECIFICATIONS

Functional specifications

Type:
Model FHD: 4 to 20mA, Traditional type
Model FKD: 4 to 20mA with digital signal, Smart type

Service: Liquid, gas, or vapour

Static pressure, span, and range limit:

Type	Static pressure	Span limit [kPa] (m bar) Min. FHD	Min. FKD	Max. FHD/FKD	Range limit [kPa] (m bar)
F□D□□3	Up tp flange rating	3.2 { 32}	0.32 { 3.2 }	32 { 320}	+/– 32 {+/– 320}
F□D□□4		6.4 { 64}	0.64 { 6.4 }	64 { 640}	+/– 64 {+/– 640}
F□D□□5		13 { 130}	1.3 { 13}	130 { 1300}	+/– 130 {+/– 1300}
F□D□□6		50 { 500}	5 { 50}	500 { 5000}	+/– 500 {+/– 5000}

Remark : To minimize environmental influence, span should be greater than 1/40 of the max. span in most applications.

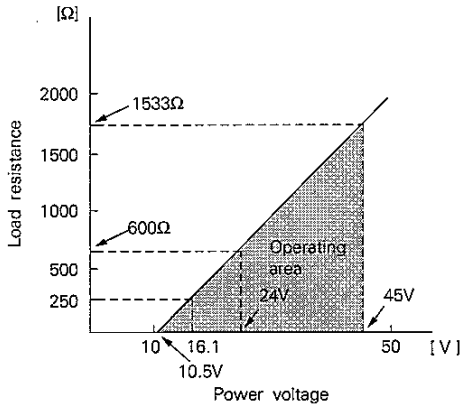
- Lower limit of static pressure (vacuum limit),
  Silicone fill sensor: See Fig. 1
  Fluorinated fill sensor: Atmospheric pressure
- The maximum span of each sensor can be converted to different units using factors as below.
  1MPa=10^3kPa=10bar=10.19716kgf/cm^2=145.0377psi
  1kPa=10mbar=101.976mmH_2O=4.01463H_2O

Overrage limit: To maximum static pressure limit

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

Power supply: Transmitter operates on 11V to 45V DC at transmitter terminals.
11V 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. G	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
RIIS	Exds IIB + H_2 T4	i3aG4	—
SAA	Ex d II C T5, T6 IP 66 / 67	Ex ia IIC T5, T6 IP 66 / 67	Ex n IIC T5, T6 IP 66 / 67

Zero/span adjustment:
Model FHD: 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 adjustment screw is also available.
Model FKD: Zero and span are adjustable from the HHC. Zero is also adjustable externally from the adjustment screw.

Damping: Adjustable electrical damping.
Model FHD: The time constant is adjustable to 0, 0.3, 1.2, 4.8, or 19.2 seconds.
Model FKD: The time constant is adjustable between 0 to 38.4 seconds.

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

Normal/reverse action:
Model FHD: Selectable by moving a jumper pin located on the electronics unit.
Model FKD: Selectable from HHC

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

Burnout direction: Output hold / Output 21.6mA / Output 3.8mA } selectable.
Model FHD: Unless otherwise specified, the output is in hold position.
Model FKD: Selectable from HHC.

Loop-check output:
Model FHD: Transmitter can output constant signal of 4mA, 12mA, or 20mA if MODE SWITCH is set to the loop check mode.
Model FKD: 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 fill transmitter)
(– 10 to + 85°C for silicone oil "H", "S", "K")
(+ 20 to + 85°C for silicone oil "J", "T")
For explosionproof units (flameproof or intrinsic safety), ambient temperature must be within the limits specified in each standard.

Process:

Fill fluid	Code in the 13th digit of "Code symbols"	Process temperature	Lower limit of static press.
Fluorinated oil	W, A and D	– 20 to 120°C	Atmospheric pressure
Silicone oil	H	– 15 to 250°C	
	J	85 to 300°C	
	Y and G	– 40 to 120°C	2.7kPa abs {20mmHg abs}
	S	– 15 to 250°C	
	T	85 to 300°C	
	K	– 15 to 200°C	0.13kPa abs {1mmHg abs} or more

Storage: – 40 to +90°C

Humidity limit: 0 to 100% RH

Communication: (Model FKD 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 more 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: 0.2% of span
For spans below 1/10 of URL (Model FKD only):

$$\pm\left(0.1+0.1\,\frac{0.1\times \text{URL}}{\text{Span}}\right)\ \%\ \text{of span}$$

Linearity: 0.1% of calibrated span

Stability: ±0.2% of upper range limit (URL) for 12 months

Temperature effect (*):
Effects per 55°C change between the limits of – 40°C and +85°C
Zero shift: ±0.7% of URL
Total effect: ±1.0% of URL

Higher performance type (Option)
Zero shift: ±0.6% / 55°C $x \geqq \frac{1}{4}$URL
$\pm\left(0.2+0.1\frac{\text{URL}}{x}\right)$%/ 55°C $x < \frac{1}{4}$URL
Total shift: ±0.8% / 55°C $x \geqq \frac{1}{4}$URL
$\pm\left(0.4+0.1\frac{\text{URL}}{x}\right)$%/ 55°C $x < \frac{1}{4}$URL
x : Calibrated span
URL : Upper Range Limit

Twice the value for 7th digit code "H", "F", "G", "K", "L", "M", "T", "P", "R".

Note: * Excluding effect by temperature difference between the seals.

Static pressure effect:
Zero shift; 0.2% of URL for flange rating pressure
Double the zero shift for material code. "H", "F", "G", "K", "L", "M", "T", "P" and "R"
Span shift: $-0.2\,^{+0.2}_{-0.1}$ % of calibrated span for flange rating pressure

Overrange effect: Zero shift; 0.3% of URL for flange rating pressure
Double the effects for material code. "H", "F", "G", "K", "L", "M", "T", "P" and "R"

Supply voltage effect:
Less than 0.05% fo 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
"3"	2 s	Approx. 0.3 s
"4"	1.7 s	
"5"	1.7 s	
"6"	1.7 s	

Note: * Capillary length: 1.5m

Dielectric strength:
500V AC, 50/60Hz 1 min., between circuit and earth.

Insulation resistance:
More than 100MΩ/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 × 1.5 conduit, as specified.

Process connections:
JIS, ANSI, or DIN raised face flanges.
JIS: 10K80A, 10K100A, 30K80A, or 30K100A
ANSI: 150LB 3", 150LB 4", 300LB 3", or 300LB 4"
DIN: PN40 DN80 or PN16 DN100
See OUTLINE DIAGRAM for detailed dimensions.

Diaphragm extension:
0, 50, 100, 150, or 200mm as specified. (See model code. Extended diaphragm is available only with 316L stainless steel or Hastelloy-C diaphragm)

Process-wetted parts material:
Diaphragm: 316L stainless steel, Hastelloy-C, Monel, Tantalum, Titanium or Zirconium
Flange face: 316 stainless steel, Hastelloy-C lining Monel lining, or Tantalum lining
Extension: 316 stainless steel or Hastelloy-C

Non-wetted parts material:
Electronics housing: Low copper die-cast aluminum alloy (standard), finished with epoxy/polyurethane double coating, or 316 stainless steel, as specified.
Capillary: PVC armored stainless steel
Mounting flange: (option) 304 stainless steel or carbon steel
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

Mass (weight): Transmitter approximately 15kg without options.
Add; 0.5kg for mounting bracket
0.8kg for indicator option
4.5kg for stainless steel housing option
1.5kg per 50mm extension of diaphragm

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 $4\frac{1}{2}$ -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 μs)

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.

Vacuum service: Special silicone oil and filling procedure are applied.
See below figure.

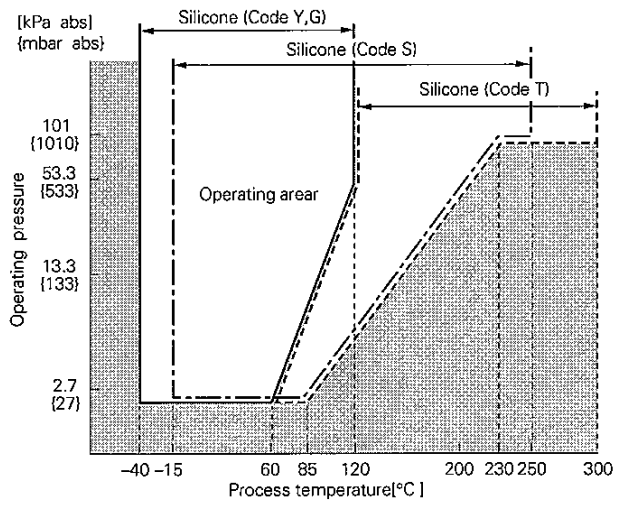


Fig. 1 Relation between process temperature and operating pressure

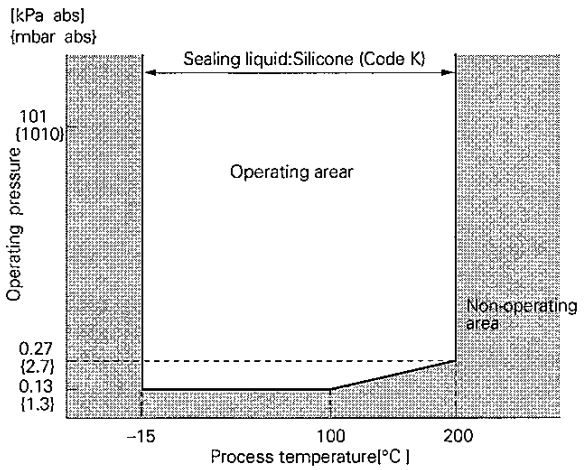


Fig. 2 Relation between process temperature and operating pressure

Customer tag: A stainless steel tag for 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

Hand-held communicator:
(Model FXW, refer to Data Sheet No. EDS 8-47)

Communication module: (standard for model FKD)
When using this module for model FHD, remote setting function becomes available.
Remark: When the communication module is connected, the operation mode of external zero/span adjustment screw is changed to zero adjustment.

CODE SYMBOLS

1 2 3 4 5 6 7 8	9 10 11 12 13	14 15	Description
			Type
FHD			4 to 20mA, Traditional type
FKD			4 to 20mA with digital signal, Smart type
			Conduit connection
S			G 1/2
T			1/2-14NPT
V			Pg 13.5
W			M20 × 1.5
			Flange

		Mounting flange	Flange size and rating
0		304 stainless steel	JIS 10K 80A
1			JIS 10K 100A
2			JIS 30K 80A
3			JIS 30K 100A
4			ANSI/JPI 150LB 3"
5			ANSI/JPI 150LB 4"
6			ANSI/JPI 300LB 3"
7			ANSI/JPI 300LB 4"
8			DIN PN16/40 DN80
9			DIN PN16 DN100
A		Carbon steel	JIS 10K 80A
B			JIS 10K 100A
C			JIS 30K 80A
D			JIS 30K 100A
E			ANSI/JPI 150LB 3"
F			ANSI/JPI 150LB 4"
G			ANSI/JPI 300LB 3"
H			ANSI/JPI 300LB 4"
J			DIN PN16/40 DN80
K			DIN PN16 DN100
P		None (wafer type)	3 inch wafer
Q			4 inch wafer

			Description
			Span limit (*1) [kPa]{m bar}
			FHD/FKD
3			3.2/0.32...32/32 {32/3.2...320/320}
4			6.4/0.64...64/64 {64/6.4...640/640}
5			13/1.3...130/130 {130/13...1300/1300}
6			50/5...500/500 {500/50...5000/5000}

				Material/diaphragm extension		
				Diaphragm	Flange face	Diaph. extension [mm]
W				316L stainless steel	316 stainless steel	0
A						50 (*2)
B						100 (*2)
C						150 (*2)
D						200 (*2)
H				Hastelloy-C	Hastelloy-C	0
F						50
G						100
K						150
L						200
M				Monel	Monel	0
T				Tantalum	Tantalum	0
P				Titanium	Titanium	0
R				Zirconium	Zirconium	0

Notes: (*1) 100: 1 turn down is possible for model FKD, but should be used at a span greater than 1/40 of the maximum span for better performance.

(*2) In case of 7th digit code "A", "B", "C", "D" and 13th digit code. "S", "T", "K", 5th digit code "1", "3", "5", "7", "B", "D", "E", "F", "H", "Q" is available.

1 2 3 4 5 6 7 8	9 10 11 12 13	14 15
F H D		0
F K D		0

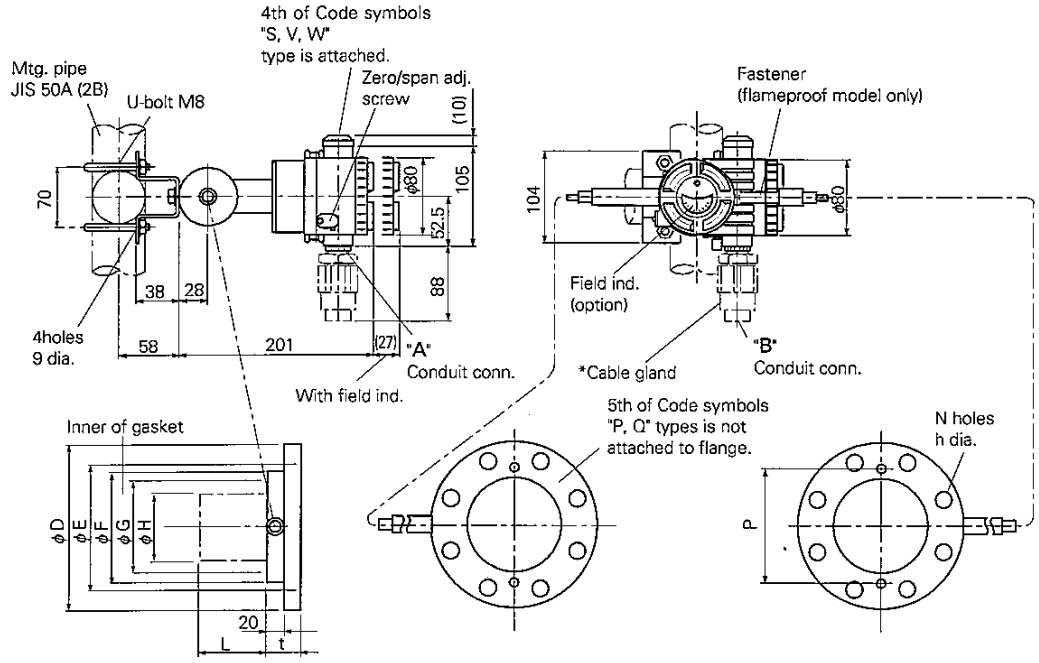
Description		
Indicator and arrester		
Indicator		Arrester
A	None	None
B	Analog, 0 to 100% linear scale	None
C	Analog, 0 to 100% sq. root scale	None
D	Analog, custom scale	None
J	Analog, double scale	None
E	None	Yes
F	Analog, 0 to 100% linear scale	Yes
G	Analog, 0 to 100% sq. root scale	Yes
H	Analog, custom scale	Yes
K	Analog, double scale	Yes
L	Digital, 0 to 100%	None
P	Digital, custom scale	None (Model FKD only)
Q	Digital, 0 to 100%	Yes
S	Digital, custom scale	Yes (Model FKD only)
Approvals for hazardous locations		
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 G1/2 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) (*3)	
T	SAA, Intrinsic safety (*3)	
Q	SAA, Type N (Non-sparking) (*3)	
Capillary and mounting bracket		
Capillary		Mounting bracket
A	1.5 m	Carbon steel
B	3	Carbon steel
G	5	Carbon steel
C	6	Carbon steel
H	7 (*4)	Carbon steel
J	8 (*4)	Carbon steel
K	10 (*4)	Carbon steel
D	1.5	Stainless steel
E	3	Stainless steel
L	5	Stainless steel
F	6	Stainless steel
M	7 (*4)	Stainless steel
N	8 (*4)	Stainless steel
P	10 (*4)	Stainless steel
Stainless steel parts (*5)		
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 (7th digit code "W", "A", "B", "C" and "D")
D	Chlorine service	Fluorinated oil (7th digit code "H", "F", "G", "K", "L" and "T")
H	High temp. 250°C	Silicone oil
J	High temp. 300°C	Silicone oil
S	High temp. and vacuum (250°C)	Silicone oil
T	High temp. and vacuum (300°C)	Silicone oil
K	High temp. and high vacuum	Silicone oil

7th digit code "W", "A", "B", "C", and "D" Not available for 14th digit code "C" (*6)

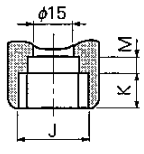
Teflon membrane	
Y	None
C	Yes (Available for 5th digit code "0", "2", "4", "6", "8", "A", "C", "E", "G", "J", "P" and 7th digit code "W", "H", "M", "T", "P", "R".)

Notes: (*3) Available for 4th digit code "S", "T", "W".
(*4) Available for 13th digit code "Y, W, G, A, D". Inquire about in case of 13th other code.
(*5) Not applicable to carbon steel flange material.
(*6) Treatment; None

OUTLINE DIAGRAM (Unit:mm)

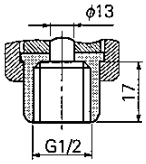


Details of "A"

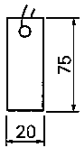


See table 1

Details of "B"



<Optional stainless steel tag>



4th of Code symbols	Conduit conn.			Earth terminal
	J	K	M	
S	G1/2	17	8	No. 8-32UNC
T	1/2-14NPT	16	5	M4
V	Pg13.5	8	4.5	M4
W	M20x1.5	16	5	M4

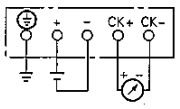
Table 1

φD	φE	φF	φG	φH	t	P	N-φh	Flange
185	150	126	100	73	38	118	8-19	JIS-10K-80A
210	175	151	103	96	38	143	8-19	JIS-10K-100A
210	170	126	100	73	48	118	8-23	JIS-30K-80A
240	195	151	103	96	52	143	8-25	JIS-30K-100A
191	152.5	126	100	73	44	118	4-20	ANSI/JPI-150LB-3B
229	190.5	151	103	96	44	143	8-20	ANSI/JPI-150LB-4B
210	168	126	100	73	49	118	8-23	ANSI/JPI-300LB-3B
254	200	151	103	96	52	143	8-23	ANSI/JPI-300LB-4B
200	160	126	100	73	44	118	8-18	DIN PN40 DN80
220	180	151	103	96	40	143	8-18	DIN PN16 DN100

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

F [H/K] D [S/T/V/W] □□□2

CONNECTION DIAGRAM



7th of Code symbols	L	Mass approx. [kg]
W, H, M, T	0	14 to 19.5
A, F	50	15 to 30.5
B, G	100	15.5 to 31
C, K	150	16 to 31.5
D, L	200	16.5 to 32

11th of code symbols	Capillary length S [mm]
A,D	1500
B, E	3000
G, L	5000
C, F	6000
H, M	7000
J, N	8000
K, P	10000

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."

ORDERING INFORMATION

When ordering this instrument, specify:

1. CODE SYMBOLS
2. Measuring range
3. Output orientation (burnout direction) when abnormality is occurred in the transmitter.
   (Unless otherwise specified, output hold function is supplied).
4. Output mode in case of FKD (linear or square root output).
   (Unless otherwise specified, output mode is linear).
5. Indication method (indicated value and unit) in case of the digital indicator/actual scale (codes P and S on 9th digit) when FKD is in the square root output mode.
   (Unless otherwise specified, the indication is square root 0 to 100%).
6. TAG No. (up to 26 alphanumerical characters), if required.

Fuji Electric Co.,Ltd.

Head office
11-2 Osaki 1-chome, Shinagawa-ku, Tokyo, 141-0032 Japan
Phone: 81-3-5435-7111
http://www.fujielectric.co.jp/eng/sg/KEISOKU/welcome.htm

Fuji Electric Instruments Co.,Ltd.

Sales Div.
International Sales Dept.
No.1, Fuji-machi, Hino-city, Tokyo, 191-8502 Japan
Phone: 81-42-585-6201, 6202
Fax: 81-42-585-6187, 6189