

# ABSOLUTE PRESSURE TRANSMITTER

## DATA SHEET

**FKH...5**

The FCX-AII absolute pressure transmitter (Direct mount type) accurately measures absolute pressure and transmits proportional 4 to 20mA signal.

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

0.2% accuracy for all calibrated spans is the standard feature. Fuji's micro-capacitance silicon sensor assures this feature for all suppressed calibration ranges without additional adjustment.

### 2. Minimum inventory

Electronics unit, communication module, local indicators and electronics housing are interchangeable among all FCX-AII models.

### 3. Replaceable Communication Module

Fuji micro-electronics manufacturing technology offers replaceable communication module that makes FCX-AII 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-AII series transmitters.

### 5. Application flexibility

Example features that render the FCX-AII suitable for almost any process applications includes:

- Full range of hazardous location approvals
- Built-in RFI filter and lightning arrester
- 5-digits LCD meter
- The maximum span of each sensor can be converted to in different units using below factors.

## SPECIFICATIONS

### Functional specifications

#### Type:

**FKH:** Smart, 4 to 20mA DC + Fuji/Hart® digital signal

#### Service:

Liquid, gas, or vapour

#### Span, range, and overrange limit:

Type	Span limit [kPa abs] {bar abs}		Range limit [kPa abs] {bar abs}	Overrange limit [MPa] {bar}
	Min.	Max.		
FKH□02	8.125 {0.08125}	130 {1.3}	0 to 130 {0 to 1.3}	0.5 {5}
FKH□03	31.25 {0.3125}	500 {5}	0 to 500 {0 to 5}	1.5 {15}
FKH□04	187.5 {1.875}	3000 {30}	0 to 3000 {0 to 30}	9 {90}

#### Output signal:

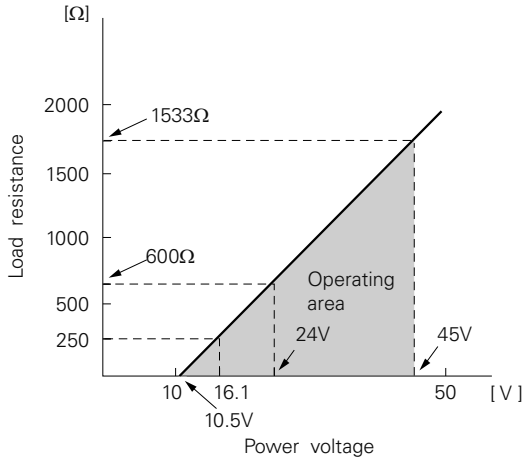
4 to 20mA DC with digital signal superimposed on the 4 to 20mA signal.

#### Power supply:

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

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

**Load limitations:** see figure below



Note: For communication with HHC <sup>(1)</sup>, min. of 250 Ω required.

**Hazardous locations:**

Authority (Digit 10=)	Intrinsic safety																					
ATEX (K)	Ex II 1 G Ex ia IIC T5 (-40°C ≤ Ta ≤ +50 °C) Ex ia IIC T4 (-40°C ≤ Ta ≤ +70 °C) IP66/67 Entity Parameters: Ui ≤ 28 Vdc, Ii ≤ 94.3 mA, Pi ≤ 0.66 W Ci = 36 nF/26 nF for models with/without Arrester Li = 0.7 mH/0.6 mH for models with/without Analog Indicator																					
Factory Mutual (pending) (H)	Class I II III Div.1 Groups A, B, C, D, E, F, G T4 Entity Type 4X <table border="1"> <thead> <tr> <th colspan="2">Model code</th> <th>Tamb</th> </tr> <tr> <th>9th digit</th> <th>13th digit</th> <th></th> </tr> </thead> <tbody> <tr> <td>A,B,C,D,J</td> <td>Y,G,N</td> <td>-40°C to +85°C</td> </tr> <tr> <td>L,P,M,1,2,3</td> <td>Y,G,N</td> <td>-20°C to +80°C</td> </tr> <tr> <td>Q,S,N,4,5,6</td> <td>Y,G,N</td> <td>-20°C to +60°C</td> </tr> <tr> <td>E,F,G,H,K</td> <td>Y,G,N</td> <td>-40°C to +60°C</td> </tr> <tr> <td>-</td> <td>W,A,D</td> <td>-10°C to +60°C</td> </tr> </tbody> </table> Entity Parameters: Vmax=42.4V, Imax=113mA, Pi=1W, Ci=35.98nF, Li=0.694mH	Model code		Tamb	9th digit	13th digit		A,B,C,D,J	Y,G,N	-40°C to +85°C	L,P,M,1,2,3	Y,G,N	-20°C to +80°C	Q,S,N,4,5,6	Y,G,N	-20°C to +60°C	E,F,G,H,K	Y,G,N	-40°C to +60°C	-	W,A,D	-10°C to +60°C
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CSA (J)	Ex ia Class I, Groups A, B, C and D; Class II, Groups E,F and G; Class III Per drawing TC 522873 Temp. code T5 for Tamb max = +50°C Temp. code T4 for Tamb max = +70°C Entity Parameters: Vmax = 28 Vdc, Imax = 94.3 mA, Pmax = 0.66 W Ci = 36 nF/25 nF for models with/without Arrester Li = 0.7 mH/0.6 mH for models with/without Analog Indicator																					
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Authority	Flameproof																					
ATEX (X)	Ex II 2 GD Ex d IIC T6 (-40°C ≤ Ta ≤ +65 °C) Ex d IIC T5 (-40°C ≤ Ta ≤ +85 °C) Ex tD A21 IP66/67 T 85°C Ex tD A21 IP66/67 T 100°C Electrical ratings Model Without arrester: Ui ≤ 45 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W Model With arrester: Ui ≤ 32 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W																					
Factory Mutual (pending) (D)	Class I Div.1 Groups B, C, D T6 Type 4X Class II III Div.1 Groups E, F, G T6 Type 4X Tamb max = +60°C																					
CSA (E)	Class I, Groups C and D; Class II, Groups E,F and G ; Class III Maximum ambient temperature 85°C Maximum working pressure 50 Mpa Electrical ratings Model Without arrester: Ui ≤ 45 Vdc, 4-20 mA Model With arrester: Ui ≤ 32 Vdc, 4-20 mA Note: "Seal not required"																					
IECEX (R)	Ex d IIC T6 (-40°C ≤ Ta ≤ +65 °C) Ex d IIC T5 (-40°C ≤ Ta ≤ +85 °C) DIP A21 IP66/67 T 85°C DIP A21 IP66/67 T 100°C Electrical ratings Model Without arrester: Ui ≤ 45 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W Model With arrester: Ui ≤ 32 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W																					
Authority (Digit 10=)	Type n Nonincendive																					
ATEX (P)	Ex II 3 G Ex nA II T5 (-40°C ≤ Ta ≤ +70 °C) IP66/67 Electrical ratings Model Without arrester: Ui ≤ 45 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W Model With arrester: Ui ≤ 32 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W Optional Analog indicator is not available for type "n"																					
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IECEX (Q)	Ex nA II T5 (-40°C ≤ Ta ≤ +70 °C) IP66/67 Electrical ratings Model Without arrester: Ui ≤ 45 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W Model With arrester: Ui ≤ 32 Vdc, 4-20 mA loop powered, Pi ≤ 1.0125 W Optional Analog indicator is not available for type "n"																					

**Zero/span adjustment:**

Zero and span are adjustable either from the HHC<sup>(1)</sup> in Hart™ or Fuji protocol. Zero is also adjustable externally from the adjustable screw.

**Damping:** Adjustable from the HHC<sup>(1)</sup>.

A damping of the output signal is possible between 0 to 32.0 seconds.

**Zero elevation/suppression:**

Zero may be elevated within the specified range limit of each sensor model.

**Normal/reverse action:**

Configurable from HHC<sup>(1)</sup>.

**Indication:**

Analog indicator or 5-digit LCD meter, as specified.

**Burnout direction:** Selectable from HHC<sup>(1)</sup>

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

“Output Hold”:

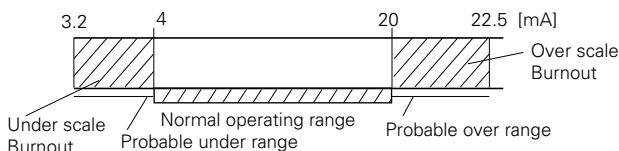
Output signal is hold as the value just before failure happens.

“Output Overscale”:

Adjustable within the range 20.0mA to 22.5mA from HHC<sup>(1)</sup>

“Output Underscale”:

Adjustable within the range 3.2mA to 4.0mA from HHC<sup>(1)</sup>



**Loop-check output:**

Transmitter can be configured to provide constant signal 3.2mA through 22.5mA by HHC<sup>(1)</sup>.

**Temperature limit:**

Ambient: -40 to +85°C  
 (-20 to +80°C for LCD indicator)  
 (-40 to +60°C for arrester option)

For explosionproof units (flameproof or intrinsic safety), ambient temperature must be within the limits specified by each standard.

Process: -40 to +85°C for silicone fill sensor

Storage: -40 to +90°C

**Humidity limit:**

0 to 100% RH

**Communication:**

With HHC<sup>(1)</sup> (model FXW, consult DSN°EDS8-47), following items can be remotely displayed or configured.

Note:

HHC's version must be higher than 7.0 (or FXW □□□□ 1-□4), for FCX -AII for supporting these items : “Saturate current”, “Write protect”, and “History”.

Items	Fuji Protocol with FXW		Hart Protocol	
	Display	Set	Display	Set
Tag No.	✓	✓	✓	✓
Model No.	✓	✓	—	—
Serial No. & Software Version	✓	—	✓	—
Engineering unit	✓	✓	✓	✓
Range limit	✓	—	✓	—
Measuring range	✓	✓	✓	✓
Damping	✓	✓	✓	✓
Output mode	✓	—	✓	—
Burnout direction	✓	✓	✓	✓

Calibration	✓	✓	✓	✓
Output adjust	—	✓	—	✓
Data	✓	—	✓	—
Self diagnoses	✓	—	✓	—
Printer (In case of FXW with printer option)	✓	—	—	—
External switch lock	✓	✓	✓	✓
Transmitter display	✓	✓	✓	✓
Linearize*	✓	✓	—	—
Rerange	✓	✓	✓	✓
Saturate current	✓	✓	✓	✓
Write protect	✓	✓	✓	✓
History				
- Calibration history	✓	✓	✓	✓
- Ambient temperature history	✓	—	✓	—

(Note) (1) HHC: Hand Held Communicator

**\*Local configurator with LCD display (option):**

Local configurator with 3 push button and LCD display can support all items (Fuji Protocol list) except “Linearize” function.

**Programmable output linearization function:**

Output signal can be characterized with “14 points linear approximation function” from HHC<sup>(1)</sup>.

**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:

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

**Stability:**

±0.2% of upper range limit (URL) for 10 years

(In case of 6th digit code "3", "4")

**Temperature effect:**

Effect per 28°C change between the limits of -40°C and +85°C

$$\text{Zero shift: } \pm (0.4 + 0.2 \frac{URL}{span}) \% / 28^\circ\text{C}$$

$$\text{Total effect: } \pm (0.475 + 0.2 \frac{URL}{span}) \% / 28^\circ\text{C}$$

**Overrange effect:**

Zero shift, 0.3% of URL for any overrange to maximum limit

**Update rate:**

60 msec

**Response time:** (without electrical damping)

Time constant: 0.08 s (at 23°C)

Dead time: about 0.12 s

Response time = time constant + dead time

**Mounting position effect:**

Zero shift, less than 0.1kPa for a 10° tilt in any plane. No effect on span.

This error can be corrected by adjusting zero.

**Vibration effect:**

< ±0.25% Of spans for spans greater than 1/10 of URL.

Frequency 10 to 150Hz, acceleration 39,2m/sec<sup>2</sup>

**Material fatigue:**

Please consult Fuji Electric.

**Dielectric strength:**

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

**Insulation resistance:**

More than 100M $\Omega$  at 500V DC.

**Internal resistance for external field indicator:**

12 $\Omega$  Max (connected to test terminal CK+ and CK-

**ACCESSORIES****Hand held communicator:**

(Model FXW, refer to Data Sheet No.EDS 8-47)

**Two valve Manifold:**

Available in 316 stainless steel and pressure rating 10MPa (100bar).

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

1/2-14NPT, Pg13.5, or M20 x 1.5

**Process connections:**

1/2-14 NPT, 1/4-18NPT, Rc 1/2, G1/2 A manometer fitting.

**Process-wetted parts material:**

Material code (7th digit in "Code symbols")	Process cover	Diaphragm	Wetted sensor body	Vent/drain
J	316L SS	316L SS + gold coat	316L SS	316 SS
V	316 SS	316L SS	316L SS	316 SS

**Non-wetted parts material:**

Electronics housing:

Low copper die cast aluminum alloy (standard), finished with polyester coating, as specified.

Fill fluid: Silicone oil

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 2.2kg without options.

Add; 0.5kg for mounting bracket

**Optional features****Indicator:**

A plug-in turnable analog indicator (2.5% accuracy)

An optional 5 digits LCD meter is also available.

**Local configurator with LCD display:**

An optional 5 digits LCD meter with 3 push buttons can support items as using communication with FXW.

**Arrester:**

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

Lightning surge immunity: 4KV (1.2 $\times$ 50 $\mu$ s)

**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.

**Customer tag:**

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

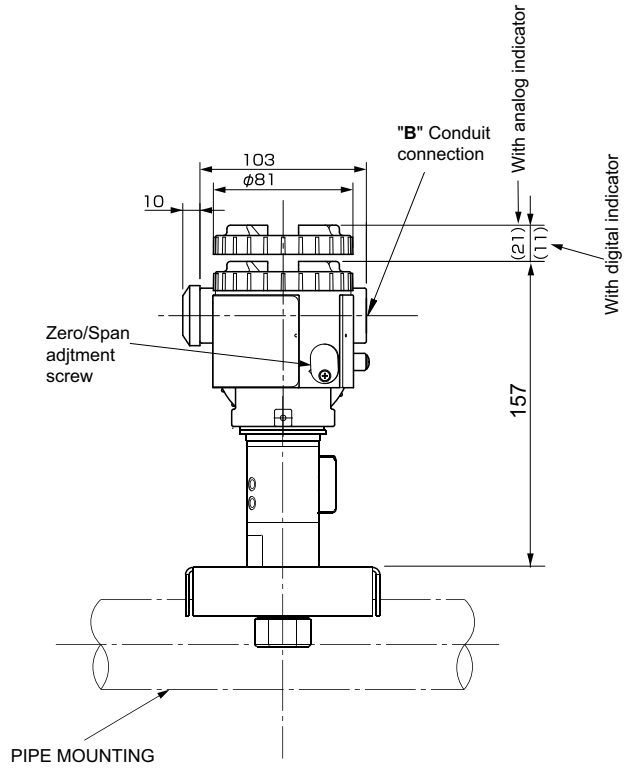
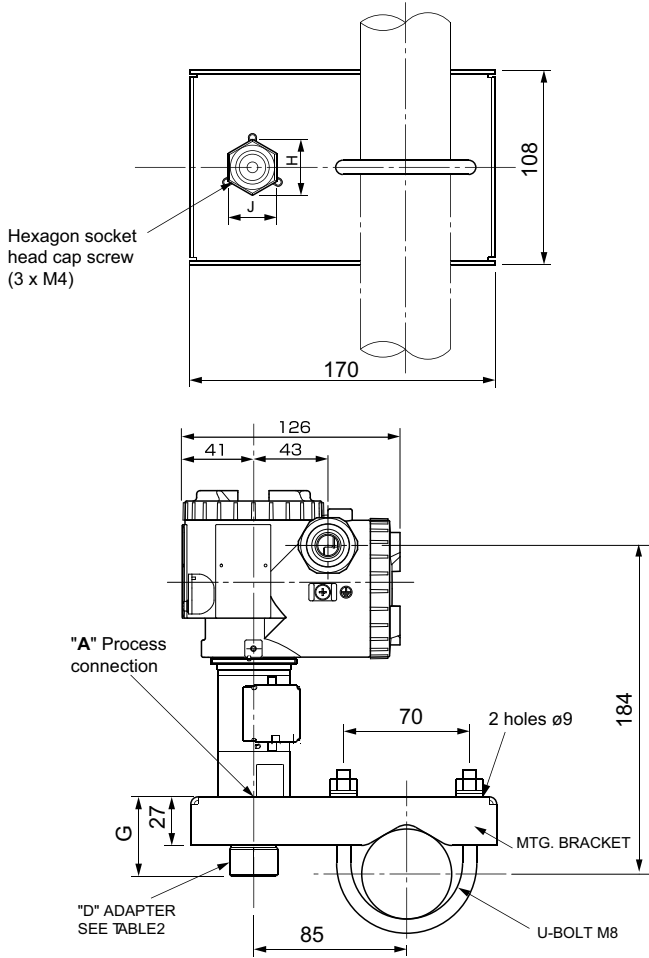
# CODE SYMBOLS

1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		DESCRIPTION				
F	K	H		0				5	-																	0								
																																<b>Type</b> Smart, 4-20 mA/dc + Fuji/Hart® digital signal		
																																<b>Connections</b>		
																																Process connection	Electrical connection	
																																See digit 15	1/2-14 NPT	
																																See digit 15	Pg 13,5	
																																See digit 15	M 20 x 1,5	
																																<b>Range &amp; wetted parts material</b>		
																																Span	Diaphragm material	Wetted parts
																																0,08125/1,3 bar	316 L SS	316 SS
																																0,08125/1,3 bar	316 L SS/gold coat	316 SS
																																0,3125/5 bar	316 L SS	316 SS
																																0,3125/5 bar	316 L SS/gold coat	316 SS
																																1,875/30 bar	316 L SS	316 SS
																																1,875/30 bar	316 L SS/gold coat	316 SS
																																<b>Indicator &amp; Arrester</b>		
																																Indicator	Arrester	Initial setting
																																None	None	
																																Analog, 0-100% linear scale	None	
																																Analog, Custom scale	None	
																																Analog, double scale	None	
																																None	Yes	4-20 mA DC
																																Analog, 0-100% linear scale	Yes	
																																Analog, Custom scale	Yes	+
																																Analog, double scale	Yes	
																																Digital, 0-100%	None	Hart® / Fuji
																																Digital, Custom scale	None	digital signal
																																Digital, 0-100%	Yes	"SMART"
																																Digital, Custom scale	Yes	
																																<b>Approvals for hazardous locations (consult FUJI for availability)</b>		
																																None (Standard)		
																																ATEX - Flameproof enclosures (digit 4 = "R, T" & "W" only)		
																																ATEX - Intrinsic Safety		
																																FM - Explosion-Proof (digit 4 = "T" only)		
																																CSA - Explosion-Proof (digit 4 = "T" only)		
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																																ATEX - Type "n" (digit 9 = A, E, 1, 2, 3, 4, 5 & 6 only)		
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																																IECEX - Intrinsic Safety		
																																CSA - Explosion-Proof & Intrinsic Safety combined approval (digit 4 = "T" only)		
																																ATEX - Flameproof enclosures & Intrinsic Safety combined approval (digit 4 = "R, T" & "W" only)		
																																IECEX - Flameproof enclosures & Intrinsic Safety combined approval (digit 4 = "R, T" & "W" only)		
																																FM - Explosion-Proof & Intrinsic Safety combined approval (digit 4 = "T" only)		
																																<b>Mounting bracket</b>		
																																None		
																																Yes (SS)		
																																<b>SS parts</b>		
																																SS tag plate	SS housing	
																																None	None	
																																Yes	None	
																																None	Yes	
																																Yes	Yes	
																																<b>Special applications &amp; fill fluid</b>		
																																Treatment	Fill fluid	
																																None (std)	Silicone oil	
																																Degreasing	Silicone oil	
																																NACE	Silicone oil	
																																<b>Processconnection (welded) adaptor - all stainless steel parts</b>		
																																None - (1/2 - 14 NPTI connection)		
																																Rc 1/2 I		
																																1/4 - 18 NPTI		
																																1/2 - 14 NPTI		
																																G 1/2"A manometer fitting		

Notes\* :

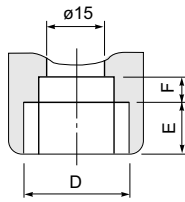
1- Code "D" FM approval only possible with electrical connection 1/2" NPT.

OUTLINE DIAGRAM (Unit:mm)



"D" ADAPTER				
CONN.L	G	H	J	K
1/4 NPT	14	25	22	8

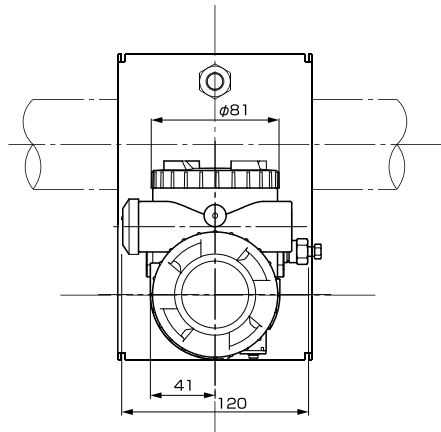
Table 2



Details of "B"

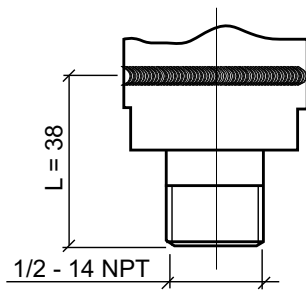
4th digit of the code symbols	Conduit connections		
	D	E	F
T	1/2-14NPT	16	5
V	Pg13.5	8	4.5
W	M20x1.5	16	5

Table 1

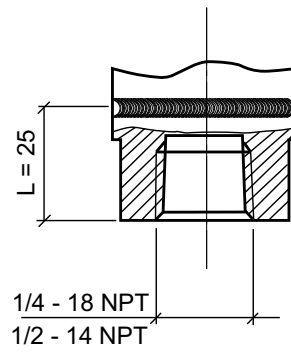


## Details "A" - Process connection

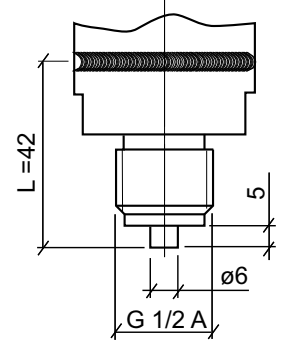
Code digit 15 = D



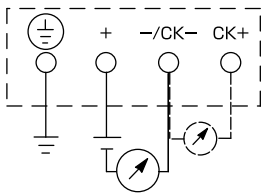
Code digit 15 = Y ou C



Code digit 15 = E



## CONNECTION DIAGRAM



The product conforms to the requirements of the Electro-magnetic compatibility Directive 89/336/EEC as detailed within the technical construction file number TN513035. The applicable standards used to demonstrate compliance are :

**EMI (Emission) EN61326 : 1997**

Class A (std for Industrial Location)

Frequency range MHz	Limits	Reference Standard
3 to 230	40dB ( $\mu\text{V/m}$ ) quasi peak measured at 10m distance	CISPR16-1 and CISPR16-2
230 to 1000	47dB ( $\mu\text{V/m}$ ) quasi peak, measured at 10m distance	

**Note) Definition of performance criteria**

- A : During testing, normal performance within the specification limits**
- B : During testing, temporary degradation, or loss of function or performance which is self-recovering.**

**EMS (Immunity) EN61326 : 1997**

Annex A (standard for Industrial Location)

Phenomenon	Test value	Basic Standard	Performance criteria
Electrostatic discharge	4kV (Contact) 8kV (Air)	IEC61000-4-2	B
Electromagnetic field	80 to 1000MHz 10V/m 80%AM (1kHz)	IEC61000-4-3	A
Rated power frequency magnetic field	30A/m 50Hz	IEC61000-4-8	A
Burst	2kV 5kHz	IEC61000-4-4	B
Surge	1.2 $\mu\text{s}$ /50 $\mu\text{s}$ 1kV (Line to line) 2kV (line to ground)	IEC61000-4-5	B
Conducted RF	0.15 to 80MHz 3V , 80%AM (1kHz)	IEC61000-4-6	A

## Fuji Electric France S.A.

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