

LEVEL TRANSMITTER

DATA SHEET

FKE, FDE...E

The FCX-AII series level transmitter accurately measures liquid level 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

0.17% accuracy for all calibrated spans is the standard feature for all models covering 3.2 mbar range to 30 bar high differential. The Micro-capacitance silicon sensor assures this feature for all elevated or suppressed calibration ranges without additional adjustment.

0,1% accuracy is available as option.

2. Minimum environmental influence

The "Advanced Floating Cell" design which protects the pressure sensor against temperature variations, static pressure, and overpressure substantially reduces total measurement error in actual field applications.

3. Fuji/HART® bilingual communications protocol and FOUNDATION™ Fieldbus and Profibus™ compatibility

FCX-AII series transmitter offers bilingual communications to speak both Fuji proprietary protocol and HART®. Any HART® compatible devices can communicate with FCX-AII. Further, by upgrading electronics FOUNDATION™ Fieldbus and Profibus™ are also available.

4. Application flexibility

Various options that render the FCX-AII 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 arrester
- 5 digits LCD meter with engineering unit
- Stainless steel electronics housing
- Wide selection of materials
- High temperature, high vacuum service.

5. Programmable output Linearisation Function

Output signal can be freely programmable.
(Up to 14 compensated points at approximation.)

6. Burnout current flexibility (Under Scale : 3,2 to 3,8mA, Over Scale : 20,8 to 21,6mA)

Burnout signal level is adjustable using Model FXW Hand Held Communicator (HHC) to comply with NAMUR NE43.

7. Dry calibration without reference pressure

Thanks to the best combination of unique construction of mechanical parts (Sensor unit) and high performance electronics circuit (Electronics unit), reliability of dry calibration without reference pressure is at equal level as wet calibration.



SPECIFICATIONS

Functional specifications

Type :

FKE : Level transmitter

FDE : FOUNDATION™ Fieldbus & Profibus™

Service :

Liquid, gas or vapour

Static pressure, span and range limit :

Type	Static pressure (bar)	Span limit (mm H ₂ O)		Range limit (mmH ₂ O)
		Min.	Max.	
F□E□□3	Up to flange rating	32	3200	± 3200
F□E□□5		130	13000	± 13000
F□E□□6		500	50000	± 50000
F□E□□8		3000	300000	± 300000

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

Minimum static pressure limit :

Lower limit of static pressure (vacuum limit) is :

Silicone filled sensor : See Fig. 1

Fluorinated filled sensor : 660 mbar abs or 500 torr at temperature below 60°C (See Fig. 2).

Overrange limit :

To maximum static pressure limit.

Output signal :

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

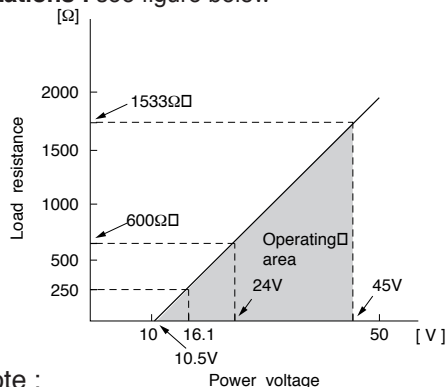
Digital signal based on FOUNDATION™ Fieldbus or Profibus™.

Power supply :

Transmitter operates on 10,5 V to 45 VDC at transmitter terminals.

10,5 V to 32 V DC for the units with optional arrester.

Load limitations : see figure below



Note :

For communication with FXW (HHC), min of 250Ω required.

Hazardous locations :

Designed to meet international intrinsic safety and flameproof (explosionproof) standards.

Please consult the code symbols some pages further on, to know the different types of approvals (digit 10). Consult FUJI for status

Zero/span adjustment :

Zero and span are adjustable by hand held communicator in Hart® or Fuji protocol. Local adjustment of zero are possible from outside screw on the electronic housing.

Damping : adjustable from HHC.

A damping of the output signal is possible between 0 and 32 sec with the hand held communicator HHC. Local adjustment possibilities with LCD indicator (refer to optional indicator).

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

Normal/reverse action :

Selectable from the hand held communicator (HHC).

Indicator :

A plug-in analog indicator can be mounted on the electronics unit or the terminal block. The local LCD indicator (5 digits) is assembled on the electronics unit.

Additional local adjustment facilities are possible by the integrated switches in the LCD indicator :

- "Local/comm" switch gives the possibilities to make local adjustments of zero/span, damping or to configure the transmitter with a hand held communicator.
- The "mode" switch with 7 positions gives local adjustment possibilities for zero/span, 4/20mA, enable or inhibit the local adjustments.
- Local damping adjustment is possible via the "damp" switch.

Burnout direction : selected from HHC

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

"Output Hold" :

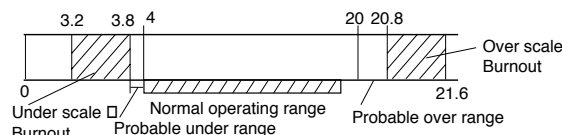
Output signal is hold at the value just before failure happens.

"Output Overscale" :

Adjustable within 20,8 mA to 21,6 mA from the hand held communicator (HHC).

"Output Underscale" :

Adjustable within 3,2 mA to 3,8 mA from the hand held communicator (HHC).



Loop-check output :

Transmitter can be configured via HHC to provide constant signal between 3.8 and 21.6 mA.

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 filled transmitters

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 pressure
Fluorinated oil	W,A	-20 to +120°C	Atmospheric
Silicone oil	Y,G	-40 to +150°C	20 torr

Note : For higher process temperature, please ask FUJI.

Storage: - 40 to +90 °C

Humidity limit : 0 to 100% RH

Communication :

With HHC, following information can be remotely displayed or reconfigured

Note : HHC's version must be more than 6.0 (or FXW □□□□1-A3), for FCX-All)

Items	HART® PROTOCOL		FUJI PROTOCOL	
	Display	Set	Display	Set
Tag n°	Yes	Yes	Yes	Yes
Model n°	-	-	Yes	Yes
Serial n°	Yes	-	Yes	-
Engineering unit	Yes	Yes	Yes	Yes
Range limit	Yes	-	Yes	-
Measuring range	Yes	Yes	Yes	Yes
Damping	Yes	Yes	Yes	Yes
Output mode	Yes	-	Yes	-
Burnout direction	Yes	Yes	Yes	Yes
Adjustment	Yes	Yes	Yes	Yes
Output adjust	-	Yes	-	Yes
Data	Yes	-	Yes	-
Self diagnoses	Yes	-	Yes	-
Printer	-	-	Yes	-
External switch lock	Yes	Yes	Yes	Yes
Transmitter display	Yes	Yes	Yes	Yes
Linearise	-	-	Yes	Yes
Rerange	Yes	Yes	Yes	Yes

Programmable output linearization function :

Output signal can be characterized with "14 points linear approximation function" from HHC.

Field Bus Units :

Digital signal

Transmission technique : according to IEC61158-2

Power supply : 9VDC...32VDC

Base current : 15 ±2mA

Transmission rate : 31,25kbts/s

Profibus-PA : version 3.0, DPVI version 2.0

Foundation Fielbus : FF-890/891

Performance specifications

Accuracy rating :

(including linearity, hysteresis, and repeatability)

For spans greater than 1/10 of URL :

$$\pm 0.17\% \text{ of span}$$

For spans below 1/10 of URL :

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

(option)

For spans greater than 1/10 of URL :

$$\pm 0.1\% \text{ of span}$$

For spans below 1/10 of URL :

$$\pm \left(0.05 + 0.05 \frac{0.1 \times \text{URL}}{\text{Span}} \right) \% \text{ of span}$$

Stability : $\pm 0.2\%$ of upper range limit (URL) for 3 years

Temperature effect :

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

Zero shift transmitter :

$$\pm (0.1 + 0.025 (\text{URL}/\text{Span})) \% \text{ of URL}$$

Zero shift level kit : +0,3mbar/28°C

Total effect :

zero shift of transmitter and level kit $\pm (\pm 0,3)$ of URL

Note : the indicated values are for temperature compensation made on transmitter only, without level kit. Zero shift is improved (2 to 3 times) by an additional temperature compensation of the complete level transmitter (level kit and transmitter)

Static pressure effect :

Zero shift : $\pm 0.2\%$ of URL for flange rating pressure

Span shift : -0.2 of calibrated span for flange rating pressure

Double the zero shift for material code (7th digit in code symbols) "H", "M", "T", "B", "P" and "R"

Overrange effect :

Zero shift : $\pm 0.1\%$ of URL for flange rating pressure

Double the effects for material code (7th digit in code symbols) "H", "M", "T", "B", "P" and "R"

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 1000 MHz and field strength 30 V/m when electronics covers mounted.

(Classification : 2-abc : 0.2% span per SAMA PMC 33.1)

Step response : (without electrical damping)

Range code	Time constant	Dead time
"3"	0,55s	Approx.
"5" to "8"	0,3s	0,2s

Response time = 5 x time constant + dead time

Time constant (τ) = 63 % output signal

Note : faster response time is available as option (maximum update rate : 25 times per second).

Mounting position effect :

Zero shift : < 30 mmH₂O for a 10° tilt in any plane.

(No extension). No effect on span.

This error can be corrected by adjusting zero.

Dielectric strength :

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

Insulation resistance : More than 100M Ω at 500V DC

Turn-on time : 4 seconds

Internal resistance for external field indicator : 12 Ω max.

Physical specifications

Electrical connections :

1/2"-14NPT, Pg 13,5 or M20 x 1,5

Process connections :

LP side : 1/4"-18 NPT

HP side : ANSI or DIN raised face flange.

Refer to "Code symbols"

Raised face flange machining :

stockfinish - SS316 L diaphragm

smooth finish - other diaphragm materials

Process-wetted parts material :

Material code 7th figure in model code	LP side			HP side
	Process cover	Diaphragm	Wetted sensor body	Diaphragm & flange face
V	316SS	316LSS	316SS	316LSS
H	316SS	316LSS	316SS	Hastelloy C
M	316SS	316LSS	316SS	Monel
T	316SS	316LSS	316SS	Tantalum
A	316SS	316LSS	316SS	316LSS + FEP lining
B	316SS	316LSS	316SS	316LSS + gold coating
P	316SS	316LSS	316SS	Titanium
R	316SS	316LSS	316SS	Zirconium

Notes :

Process cover gasket : Viton O-ring or PTFE/15% graphite square section gasket.

Non-wetted parts material :

Electronics housing :

Low copper die-cast aluminum alloy (standard), finished with epoxy / polyurethane double coating or 316SS, as specified.

Bolts and nuts :

Cr-Mo alloy (standard) or 316SS (option)

Filling fluid :

Silicone oil (standard) for the measuring cell and level kit

Silicone oil (standard) for the measuring cell and fluorinated oil (or specific oils upon request) for the level kit.

Mounting flange : 316 LSS

Environmental protection :

IEC IP67 and NEMA 6 / 6P

Flange mounting : See drawings

Weight :

Transmitter approximately 13kg without option.

Add : 0.8 kg for indicator option

4.5 kg for stainless steel housing option

1.0 kg per 50mm extension

Optional features

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 5 digits LCD meter, which can be fitted on the electronic side is also available.

Arrester :

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

Oxygen service :

Special cleaning procedures are followed through the process to maintain all process wetted parts oil-free. The filling fluid is fluorinated oil.

Chlorine 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 filling fluid is standard silicone oil except oxygen or chlorine application.

Customer tag :

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

NACE specification :

Metallic materials for all pressure boundary parts including 316SS bolts and nuts comply with NACE MR-01-75.

Vacuum :

Standard level transmitter with silicone oil filling fluid can be used according fig. 1
Fluorinated oil filling of the level kit (see fig. 2)

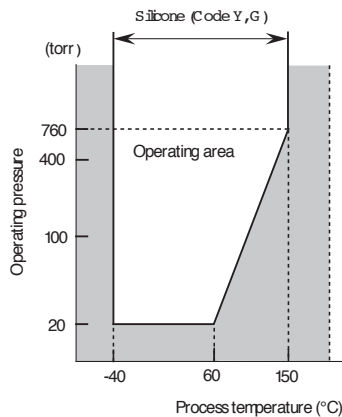


Fig. 1
Relation between process temperature and operating pressure

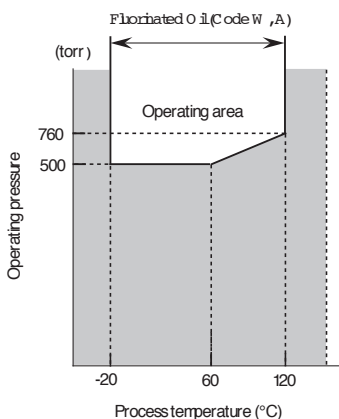


Fig. 2
Relation between process temperature and operating pressure

ACCESSORIES

Oval flanges :

Converts process connection to 1/2-14 NPT in 316SS.

Hand held communicator :

(Model FXW, refer to Data Sheet)

The product conforms to the requirements of the Electromagnetic 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	

EMS (Immunity) EN61326 : 1997

Annex A (std 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	A
Surge	1.2 μs /50 μs 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	B

Note) Definition of performance criteria

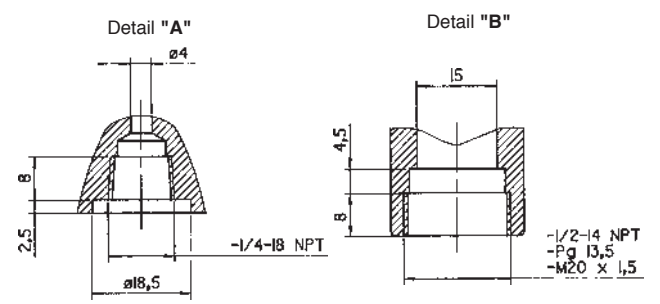
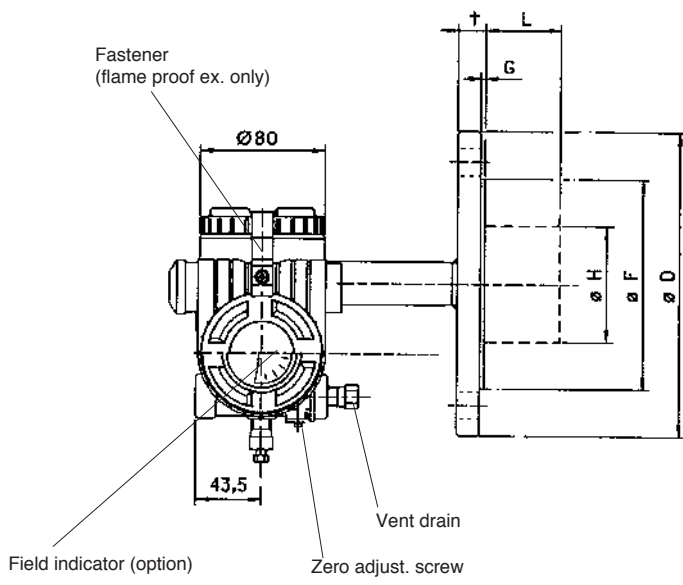
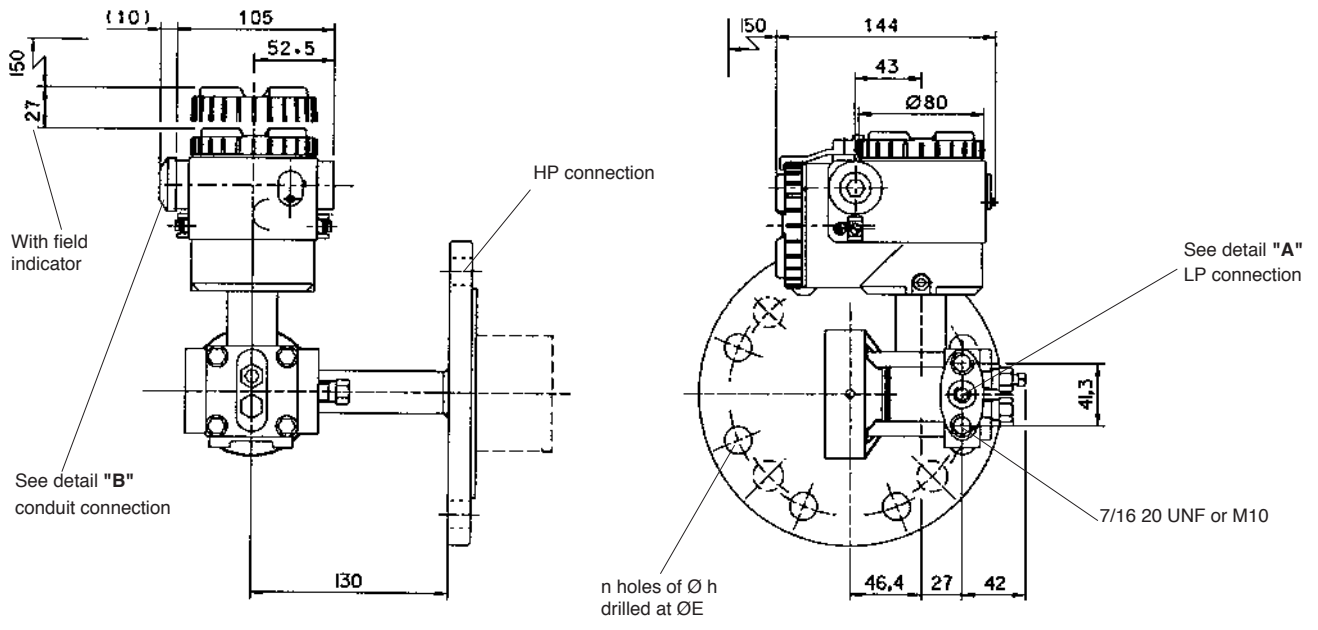
- A** : During testing, normal performance within the specification limits
- B** : During testing, temporary degradation, or loss of function or performance which is self-recovering.

CODE SYMBOLS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
F	K	E					E								
F	D	E					E								
Description															
Approvals for hazardous locations (consult FUJI for availability)															
A															None (standard)
X															Flameproof housing ATEX Ex II 2 GD - EEx d IIC T5/T6
K															Intrinsic safety ATEX Ex II 1 GD - EEx ia IIC T4/T5
D															FM - Flameproof housing Class I, Division 1, Group B,C,D
															Dust ignitionproof Class II/III, Division 1, Group E,F,G - (elec. conn. code "T" only)
E															CSA - Flameproof housing Class I, Group C,D - Class II, Group E,F,G
															Class III - (electrical connection code "T" only)
H															FM - Intrinsic safety Class I, II, III, Division 1, Group A,B,C,D,E,F,G
															Nonincendive Class I,II,III, Division 2, Group A,B,C,D,F,G
J															CSA - Intrinsic safety & Nonincendive Class I, Group A,B,C,D - Class II, Group E,F,G
															Class III - Temp code T4 for all classes (electrical connection code "T" only)
P															ATEX type "n" Ex II 3 GD - EEx nL/nAL IIC T4/T5
Diaphragm extension (mm)															
Extension (mm) Applicable material code															
Y															0 Any
A										(*3)					50
B										(*3)					100
C										(*3)					150
D										(*3)					200
E										(*3)					50
F										(*3)					100
G										(*3)					150
H										(*3)					200
J										(*3)					50
K										(*3)					100
L										(*3)					150
M										(*3)					200
P										(*3)					50
R										(*3)					100
S										(*3)					150
T										(*3)					200
SS parts															
SS tag plate SS housing															
Y															none
B															none
C															yes
E															yes
Special applications and fill fluid (fill fluid of cell = Silicone oil)															
Treatment Fill fluid of diaphragm seal															
Y															None (stand) Silicone oil
W															None (stand) Fluorinated oil
F															None (stand) Sanitary fill fluid
G															Degreasing Silicone oil
A															Oxygen service Fluorinated oil cell & seal (Material code "V" only)
D															Chlorine service Fluorinated oil (Material code "H"&"T" only)
N															NACE Silicone oil
V															Vacuum (max 27 mbar abs) Silicone oil
Process cover gasket															
- A															Viton
- C															PTFE square section ring in SS flange (FEF design)
Bolts/screws material															
A															Cr-Mo (standard)
E															SS 316/316 (bolt/nuts)

- Notes : 3- All wetted parts in the same material (diaphragm, extension, flange gasket area)
 4- Our stainless steel bolts/nuts are in conformity with the NACE requirements and can be used for NACE service.

OUTLINE DIAGRAM for short design (unit : mm)

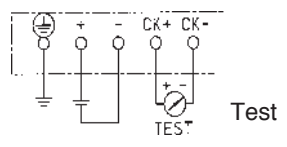


EXTENSION L (mm)	WEIGHT APPROX. (Kg)
0	10 to 13,5
50	10,5 to 17,5
100	11 to 18
150	11,5 to 18,5
200	12 to 19

FLANGE DIMENSIONS									
DIN/ISO						Ø H-flush + ext.	Ø H-flush		
PN	DN	Ø D	Ø E	Ø F	G	SS diaph	other diaph	t	n-Øh
40	80	200	160	138	3	73	89	24	8-18
16	100	220	180	158	3	96	89	20	8-18
20	80	190	152,5	127	1,6	73	89	24	4-20
20	100	230	190,5	158	1,6	96	89	24	8-20

CONNECTION DIAGRAM

FKE unit



FDE unit

