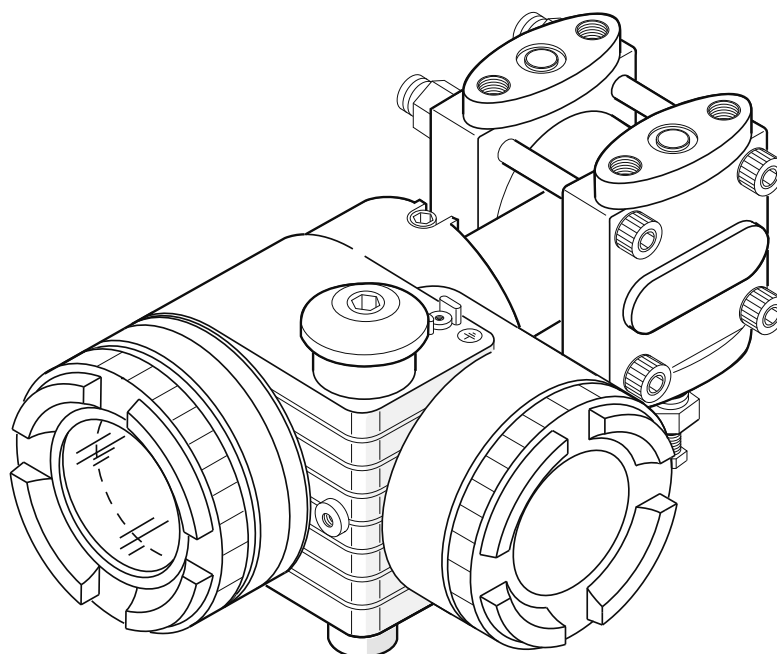


EDF version :

"Not Classified", "K3A Classification"
and "K3-ad Classification" version

"FCX-All V4" SERIES TRANSMITTERS

DIFFERENTIAL PRESSURE :	FKC...4
RELATIVE PRESSURE:	FKG...4
ABSOLUTE PRESSURE :	FKA...4
LEVEL :	FKE...4
WITH REMOTE SEAL(S) :	FKD, FKB, FKM...E



CAUTION :

Rotation of the whole upper part:

The whole upper part (housing + electronics) can be rotated by 90° steps to the left or to the right by removing the 2 socket head cap screws (M6 x 12).

If the entire assembly must be turned more than 90°, or if it is not known if the position has already been amended since the delivery by Fuji, you must remove the electronics of the unit and disconnect the flexible ribbon cable connecting the electronics at the measuring cell to rotate the housing.

If necessary, modify the position of the flexible ribbon cable connecting the electronics and the measuring cell, then refit the different parts.

The non-observance of these instructions may lead to the deterioration of the flexible ribbon cable, which would not be covered by the manufacturer's warranty.

To find out which models are qualified K3A and K3-ad, refer to the latest versions of the revision of the technical specifications of each model.

Example, for the DIFFERENTIAL AND FLOW PRESSURE TRANSMITTER, the technical specification is the document "FDSF6-114n-EDF NC-K3".

In this example, the indication revision is the letter n.



Important

Please note on the electronic unit its configuration at the time of its delivery before any manipulation that rotates it to avoid rotating it more than 90° and thus damaging the cable.



Important

The drawings and schematics presented in this manual are not contractual, so please refer to the specific dimensional plans of the transmitter.

INTRODUCTION

Our pressure transmitters have been designed to meet international standards and regulations. It is necessary to read carefully the manual before use these transmitters, to familiarize yourself with the installation, wiring processes, wiring and all operations and maintenance. The technical information is detailed in each "Technical Specification" for each version of the transmitters. Carefully read the instructions ATEX "HD FCXAII 002" for any use of sensors in dangerous areas.

The instrument nameplate as shown below is attached at the transmission unit of this transmitter. Before use, make sure the contents of the nameplate agree exactly with your specifications.

FCX-AII		Tag No. (1)	FE
(2) _____	Transmitter		
Model _____	(3) _____		
Range _____	(4) _____		
<input type="radio"/> _____			
Power Supply _____	(5) _____		
Output _____	(6) _____	(11)	
Span Limit _____	(7) _____		
M.W.P. _____	(8) _____		
Ser.No. _____	(9) _____	Mfd. _____ (10)	
Made by Fuji Electric France S.A.S. F-63039 Clermont-Ferrand TK4D9256			

- 1 Tag number
- 2 Type of transmitter
- 3 Model no. (see the codification in the corresponding "Technical Specification")
- 4 Maximum range of adjustment possibilities
- 5 Power supply
- 6 Output signal
- 7 Min/max scale
- 8 Maximum service pressure
- 9 Serial No.
- 10 Date of manufacture
- 11 Description of transmitter mounted in hazardous area - see corresponding package leaflet for the transmitters mounted in hazardous area.
- 12 Marking 2014/68/EU G1 TAMB. MIN. -40°C/ MAX. +85°C WITHOUT OPTIONS
For category III or IV devices, G1 = usable on all types of fluid

EMC Directive 2014/30/EU

All electronic pressure transmitters models of the FCX series, type FCX-All are compliant :

- With the harmonised standard EN 61326-1 (electrical equipment for measurement, control and laboratory use - Requirements relating to the EMC - Part 1: General requirements).

Emission limits : EN 61326-1

Frequency range (MHz)	Limits	Basic standard
30 to 230	40 dB ($\mu\text{V}/\text{m}$) quasi peak, measured at 10m distance	EN 55011 / CISPR 11 Group 1 Class A
230 to 1000	47 dB ($\mu\text{V}/\text{m}$) quasi peak, measured at 10m distance	

Immunity requirements : EN 61326-1 (Table 2)

Phenomena	Test values	Basic standard	Performance criteria
Electrostatic discharge (EDS)	4 kV (Contact) 8 kV (Air)	EN 61000-4-2 IEC 61000-4-2	B
Electromagnetic field	10V/m (80 to 1000 MHz) 3 V/m (1.4 to 2.0 GHz) 1 V/m (2.0 to 2.7 GHz)	EN 61000-4-3 IEC 61000-4-3	A
Rated power frequency Magnetic field	30 A/m (50 Hz, 60 Hz)	EN 61000-4-8 IEC 61000-4-8	A
Burst	2 kV (5/50 NS, 5 kHz)	EN 61000-4-4 IEC 61000-4-4	B
Surge	1 kV Line to line 2 kV Line to earth	EN 61000-4-5 IEC61000-4-5	B
Conducted RF	3 V (150 kHz to 80 MHz)	EN 61000-4-6 IEC61000-4-6	A





The suitability criteria (A and B) :

As per EN61326-1, EN 61326-1 paragraph 6.4.

CLASSIFICATION OF SAFETY INSTRUCTIONS

Prior to any operation, carefully read these safety instructions to ensure your safety and the correct use of the transmitter.

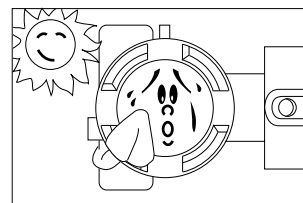
- The risks associated with a non-compliance of safety instructions are prioritised as follows :

 DANGER	Risk of death or serious injury if the security measures are not met.
 ATTENTION	Likelihood of injury or damage to tangible property in case of incorrect handling.
 PRECAUTION	Important instructions to be respected.
 INDICATION	General observations concerning the product, product handling and correct use of the transmitter.

IMPORTANT RECOMMENDATIONS

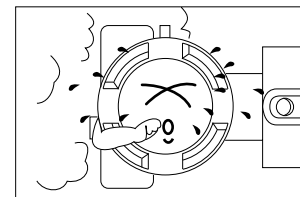
Prolonged storage

If the transmitter is not mounted quickly after the delivery, it should preferably be left in its packaging and stored under normal temperature and humidity conditions.



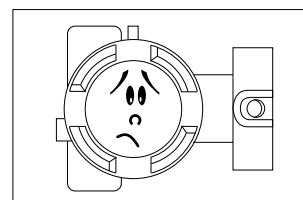
For the installation, choose a suitable location

Choose a location with the minimum of vibration, dirt and corrosive atmosphere.



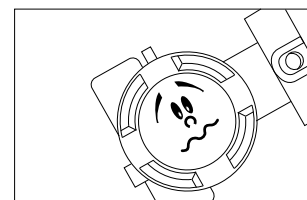
Accessibility

Provide sufficient space around the transmitter to ensure the maintenance and any settings.



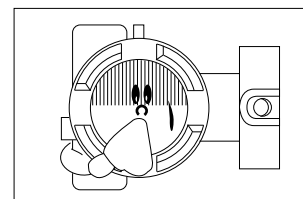
Mounting position

Favour a horizontal or vertical position.



Overpressures

Do not apply pressure that exceeds the limits in the specifications.



Various

Observe the other recommendations given in this manual.

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The pressure transmitters of the FCX-All series measure differential, effective or absolute pressure, and convert it into a directly proportional output signal of 4 to 20 mA. This transmitter can be used for the measurement of flow, fluid level, density or any other application using the principle of differential pressure measurement.

The measurement principle of this transmitter is based on the direct conversion of a differential pressure into a variation of the two capabilities.

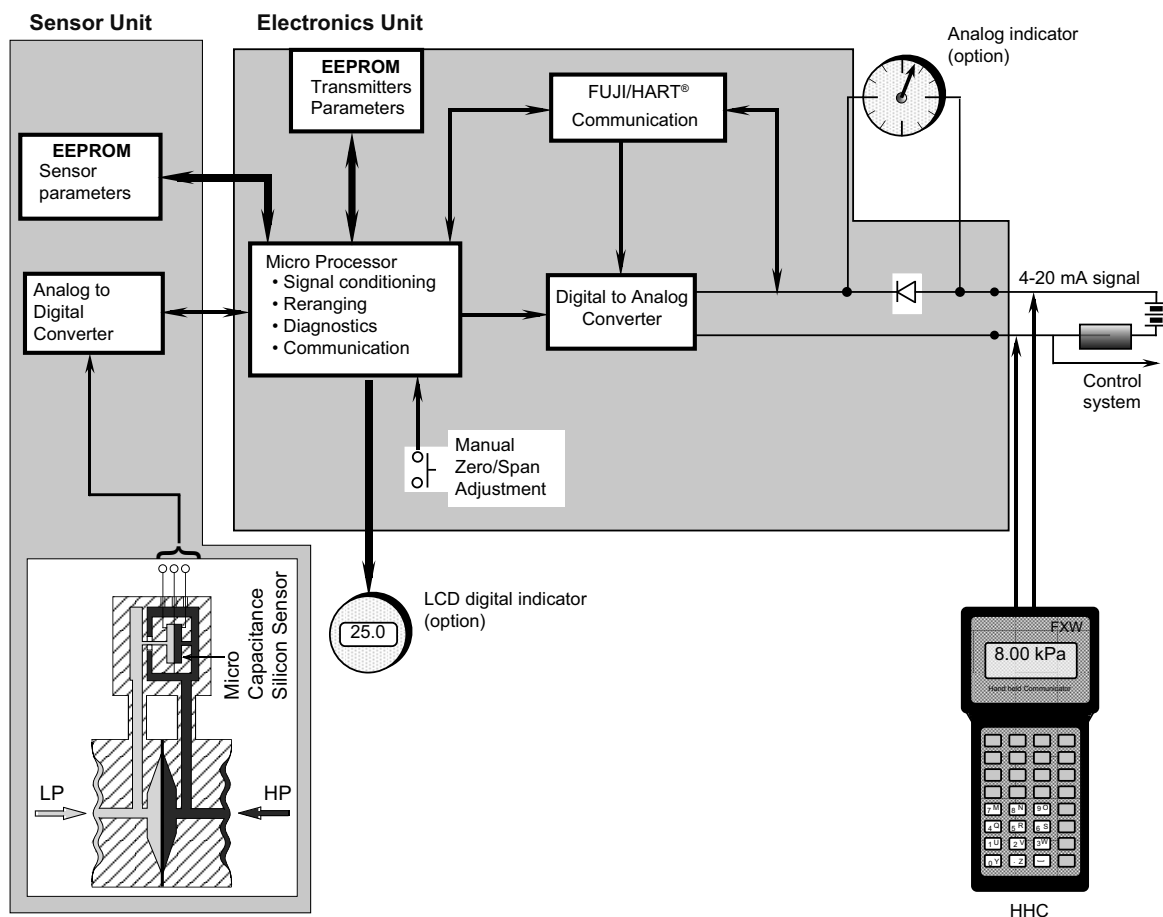
The transmitter is compact and lightweight, thus offering a high precision and high reliability. Local zero setting possible by means of external screw on electronic unit. The smart transmitters can also be adjusted or configured remotely. For example, the measurement range and the damping can be configured from the control room using a portable communicator (Hand Held Communicator).

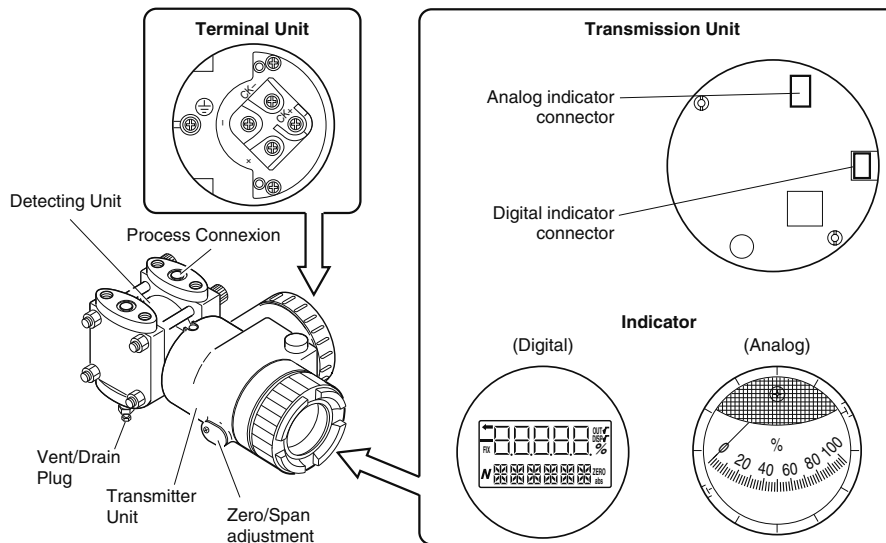
However, zero adjustment may only be done in nuclear power plants with the aid of an FXW mobile communicator.

Measurement principle

The operating principle of the differential pressure transmitter is shown in the diagram below. The differential pressure is applied on the separation membranes and transmitted to the capacitive micro-pressure transmitter, which converts it into a capacitance difference (MEASURING CELL).

The electronic unit has microprocessor and receives a digital signal from the unit cell that it converts it to an analogue output signal 4-20 mA, and a superimposed digital signal. The digital signal is compatible with both the Fuji and HART® communications protocols. The transmitter automatically recognises the protocol used and responds to the connected device using the appropriate protocol.






Description of FCX-All serie transmitters

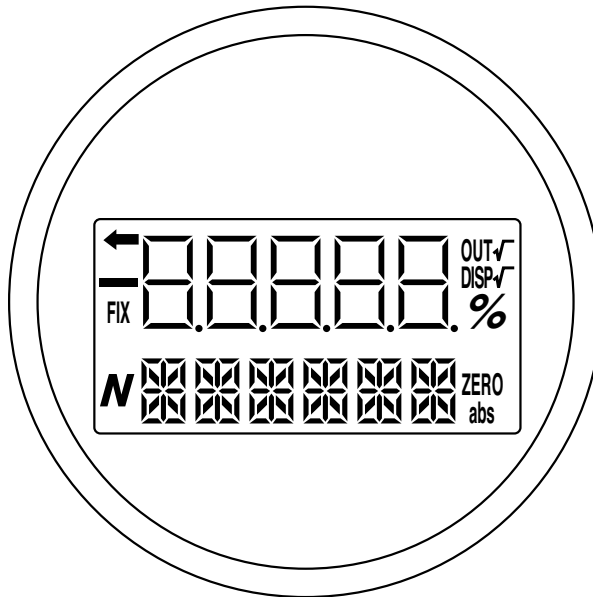
Part name	Description
Detecting unit	Measures pressure, differential pressure or level of fluid
Transmission unit	Converts the detected signal into an 4-20 mA output signal
Vent/drain plug	Used for gas discharge or draining. (Be careful should be used under a high pressure)
Process connection	Connects impulse pipes from the process
Conduit connection	Connects the output cable
Zero adjustment screw	Adjusts zero (refer to Section 6)

Electronic unit

Part name	Description
Analog indicator connector	Used for connecting an analog indicator.
Digital indicator connector	Used for connecting a digital indicator.
Indicator (option)	Analog or digital indicator, available.

Terminals block

Symbol	Description
+, -	Connects the output cable..
CK+, CK-	Used for checking the output or connecting an indicator..
	An external terminal used for grounding.




Mode indication

Mode	If displayed	If not displayed
%	indication in %	Indication in physical size
ZERO	External zero adjustment possible	External zero adjustment impossible
DISP ✓	Digital display in mode ✓	Digital display in linear mode
OUT ✓	Output signal in mode ✓	Output signal in linear mode
FIX	Generation of a constant current	Normal measurement
←	Refreshing of the measure (Flicker)	
abs	Absolute pressure	Relative/differential pressure
-	Output signal < Zero	Output signal ≥ Zero
N	This is displayed when the unit is for a gas or steam standardised at conditions said to be "normal" (101 325 Pa absolute and 0 or 15 or more rarely 20°C according to the reference documents). e.g.: Nm ³ /h = std cubic meter / hour	

Type	Ambient temperature limit	Process temperature limit	Span limit	Static pressure limit	Technical datasheets
Differential pressure	See note*	-40 to 120°C (silicone oil)	10 mbar	-1 to 32 bar	EDSF6-114
			60 mbar	-1 to 100 bar	
			320 mbar	-1 to 160 bar (option : 420 bar)	
		-20 to 80°C (fluorinated oil)	1300 mbar	-1 to 160 bar (option : 420 bar)	
			5000 mbar	-1 to 160 bar (option : 420bar)	
			30000 mbar	-1 to 160 bar (option : 300 bar)	
Gauge Pressure	See note*	-40 to 120°C (silicone oil)	1,3 bar	1,3 bar	EDSF5-80
			5 bar	5 bar	
			30 bar	30 bar	
		-20 to 80°C (fluorinated oil)	100 bar	100 bar	
			500 bar	500 bar	
Absolute Pressure	-25 to 55°C	-40 to 85°C (silicone oil)	0,16 bar abs	0,64 bar abs	EDSF5-79
			1,3 bar abs	1,3 bar abs	
		-20 to 80°C (fluorinated oil)	5 bar abs	5 bar abs	
			30 bar abs	30 bar abs	
Level and remote seal(s)	-25 to 55°C	See note*	320 mbar	According PN/lbs of remote seal	EDSF6-03 EDSF7-60
			1300 mbar		
			5000 mbar		
			30000 mbar		

* Refer to "technical datasheets" about details of process temperature limits of the transmitters.
For specific transmitters with static pressure > 420 bar, ask Fuji Electric.

 INDICATION	Protect the transmitter with a security device when the existing application conditions require it. The transmitter should be installed remote from the measuring point in the case that the process temperature is too high.
--	---

3.1 Installation

When unpacking, check the transmitter and any accessories.

Before installation, the customer must check the compatibility of the materials in contact with the process to be measured.


The transmitter can be fixed on a 2" mounting tube or against a wall.


The FKE level transmitter is equipped with a flange to connect directly to the flange mechanism.

Note :

In the case of wall mounting, the fixing screws (M8) must be provided by the user.

See the "Technical datasheets" for blockage of the transmitters.

 DANGER	For a process involving explosive gas, an ADF certified transmitter (explosion protected) must be fitted, otherwise there is a risk of serious accidents (explosion, fire, etc).
--	--

 INDICATION	If the transmitter is not mounted quickly after the delivery, it should preferably be left in its packaging and stored under normal ambient temperature and humidity conditions (25°C, 60% HR).
--	---



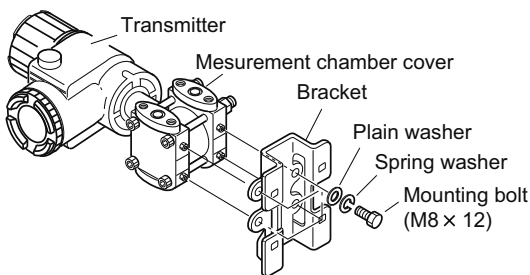
DANGER

- The transmitter is heavy. Handle with caution.
- The installation and connection conditions listed must be observed.
- Improper handling may cause incorrect operation of the transmitter.
- During the installation, ensure that no object likely to cause malfunction or even hazards is located inside the electronic unit.
- When a device is under voltage in ADF zone:
 - Do not change the position of the local indicator.
 - Do not change the position of the electronic unit.
- The isolation valves must be selected on the basis of the maximum line pressure. The connection accessories of the transmitter are provided by the user. If the connections valves and accessories are under-sized, there is a risk of leakage of hazardous gas or liquid.
- The pipes must be sized according to the process/pressure temperature standards.
- As the membranes are very fragile, please take precautions when handling them.
- Do not bend the capillaries excessively

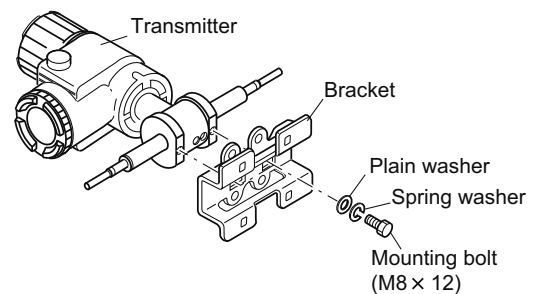
Universal bracket mounting

Mount the universal bracket on the transmitter as shown below.

FKC, FKG and FKA models



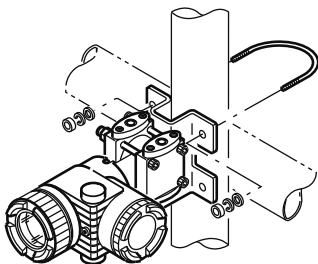
FKD, FKB and FKM models



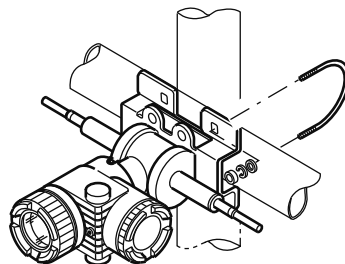
Mounting

Pipe mounting

FKC, FKG and FKA models



FKD, FKB and FKM models



The transmitter must be mounted on its bracket. with the M8 screws, flat washers and grower washers provided, maintaining a screw tightening torque of 15 N.m for the A4-70 screws.

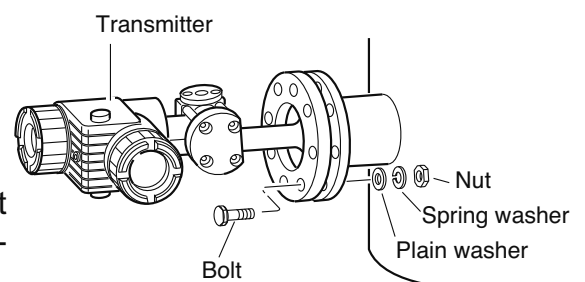
Mount the transmitter on the tube using the U-bracket provided for this purpose. Apply a tightening torque of approximately 15N.m. The diameter of the tube must be 2" (50 mm).

The wall

Secure the bracket to the wall using screws M8

With flange

Introduce the flange of the transmitter to the front of that of the piping or the tank mechanism. Fasten them together with a set of appropriate bolts to the flanges used.



Indicator mounting position



In nuclear power plants, changes or interventions to the sub-assemblies or the internal components of the FCX-All transmitters are prohibited. All changes to the FCX-All transmitters delivered must be carried out in the factory after the return of the hardware to Fuji Electric France.



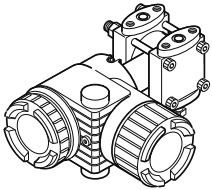
DANGER

Avoid the following procedure in an explosionproof areas.

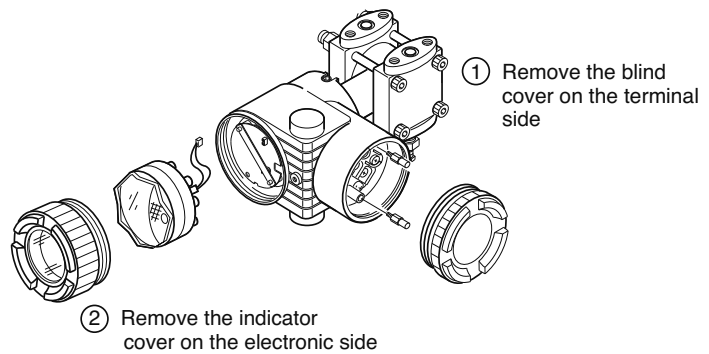
The analog indicator can be mounted on the electronic side or on the terminal side of the electrical connection.

The digital indicator can only be mounted on the electronic side.

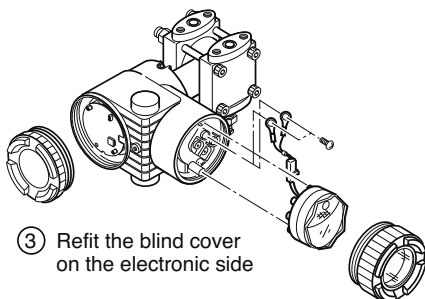
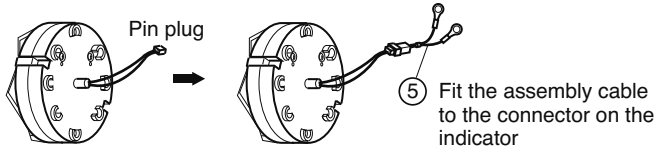
Follow the instructions below to move the analogue indicator from the electronic side to the terminal block side.



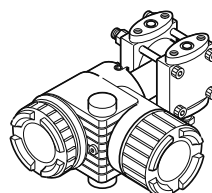
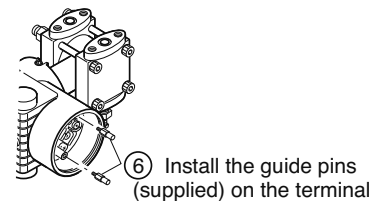
Indicator attached to electronics unit side



- ④ Remove the connector of the indicator on the electronic side



- ⑦ Connect the red wire (+) of the indicator to CK+ and the black wire (-) to CK-. Secure the assembly and refit the cover for the indicator



Indicator attached to terminal block side

Change of electronics housing position

! DANGER Avoid the following procedure in an explosionproof areas.

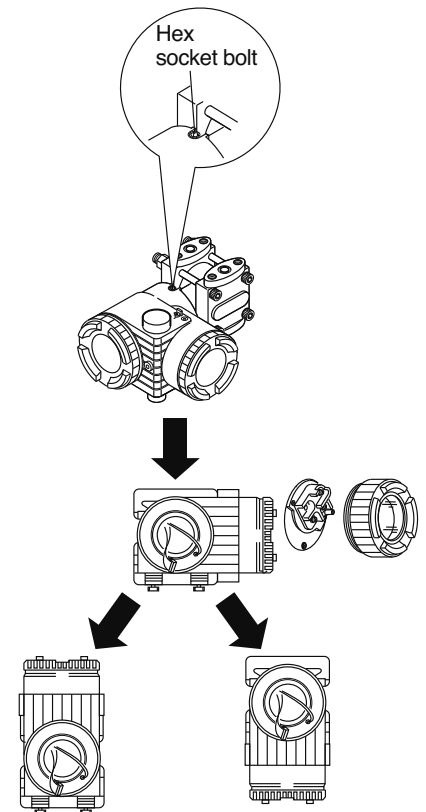
The wiring or the access can be difficult depending on the location of the transmitter, in its original position. The position of the electronic unit of the transmitter can be changed by rotating it by steps of 90 or 180 degrees.

Note):

Please note the configuration of the electronic unit at the time of its delivery on this unit before rotating it in order to avoid it turning more than 90°.

The electronic unit is fixed using two socket head cap screws (M6 x 12).

Loosen the screws, rotate the assembly either to the left or right by 90°, then retighten the screws.



PROHIBITION Never turn the assembly by more than 90° without disassembling the flexible ribbon cable (risk of breakage of the flexible ribbon cable connecting the electronics to the measuring cell).

Before any rotation, check that the assembly has not already been turned (the flexible ribbon cable must NOT be rolled on itself or tight), change the position of the flexible ribbon cable if necessary. To do this, remove the amplifier, undo the connector for the flexible ribbon cable, rotate the electronic box to the desired position, and refit the assembly.

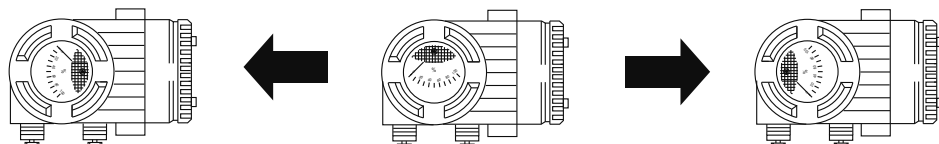
Changing the position of the indicator



In nuclear power plants, changes or interventions to the sub-assemblies or the internal components of the FCX-All transmitters are prohibited. All changes to the FCX-All transmitters delivered must be carried out in the factory after the return of the hardware to Fuji Electric France.

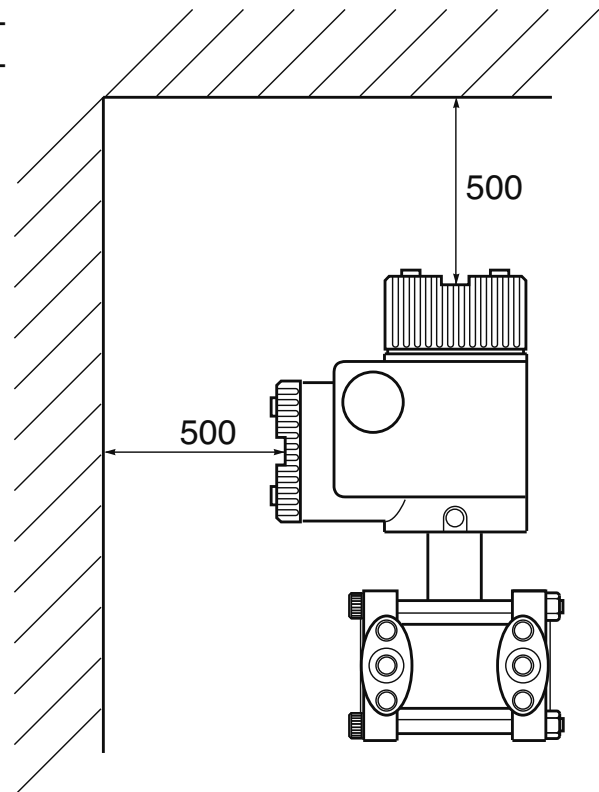
! DANGER Avoid the following procedure in an explosionproof areas.

The analog or digital indicator can be rotated $\pm 180^\circ$ by steps of 90° because it is connected with a pin plug.



Provide enough space around the transmitter

Ensure a space of about 500 mm around the transmitter in order to facilitate the adjustments and maintenance.

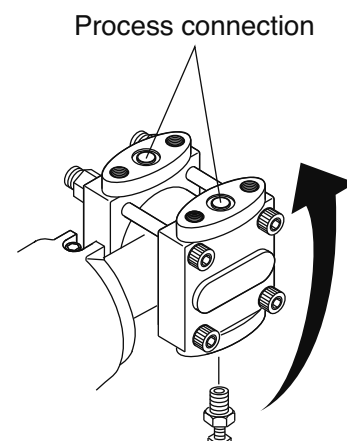


Change of vent/drain plug position



In nuclear power plants, changes or interventions to the sub-assemblies or the internal components of the FCX-All transmitters are prohibited. Any change in the position of the bleed valves must be performed in the factory after the return of the hardware to Fuji Electric France. Any presence of Teflon on the nets is strictly prohibited. The sealing on the nets is performed by Loctite PMUC 5772 PMUC. Loctite PMUC residue on the nets, after the change of the position of the bleed valves, must be eliminated. The minimum polymerisation time of this product, before the transmitters are used under pressure, is 24h. The tightening torque of the bleed valves is 40 N.m

Slowly unscrew the seat of the bleed screw with a hexagonal spanner. Remove the damaged Teflon tape and refit a new one (4 to 8 turns). Refit the bleed valve onto the desired location, by applying a torque of 25N.m





3.2 Piping

The connection of the pipelines to the transmitter must comply with certain rules to generate a properly precise measurement :

- 1) The transmitter must be installed below the piping for the steam and liquid measurement.
- 2) The transmitter must be installed above the piping for the gas measurement.

	ATTENTION
The choice of the manifolds in the installation is done according to the maximum pressure conditions of the process (the accessories such as manifolds and valves are provided by the user). Process leaks from these components can distort the measurement.	

3.2.1 Differential pressure and flow transmitters (FKC)

Locate the “high” and “low” pressure sides of the transmitter

The high pressure side is indicated by **H** and the low pressure side by **L** on the neck of the cell.

Removal of protective cap

The connection mechanisms are protected by the plastic plugs.

Do not forget to remove them before the pipes are connected. Be careful not to damage the threads or the supports of the seal.

Connection of transmitter and impulse pipes

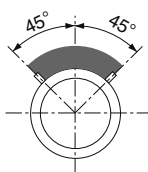
- (1) In general, the pipes are connected to the transmitter via the isolation valves or a manifold. In this last case, the manifold must be fixed to the transmitter with 4 suitable screws (7/16-20UNF), and the pipes must be connected to the manifold. Apply a tightening torque on these bolts between 30 and 40 N.m.
- (2) If not using a valve or manifold, the pipes will be directly linked to the transmitter. If the threads between the transmitter and the pipes are different, use an oval flange.

Position of process fitting taps

The element generating the differential pressure must be adapted so that this pressure is correctly transmitted to the transmitter. The positions of the fitting mechanism are determined based on of the conditions of service (measuring point, process characteristics).

Observe the following mounting positions depending of the process :

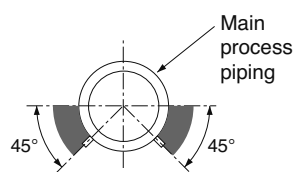
Gas measurement



Upper
 ↓
 Lower

Differential pressure source is located from 0 to 45° toward the top relative to the vertical

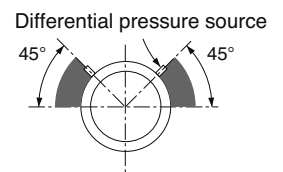
Liquid measurement



Upper
 ↓
 Lower

Differential pressure source is located from 0 to 45° toward the bottom relative to the horizontal

Steam measurement

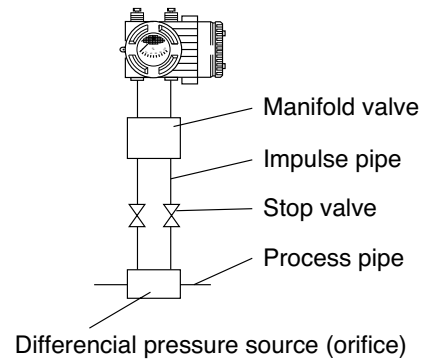


Differential pressure source is located from 0 to 45° toward the top relative to the horizontal

Typical examples of piping - Connection instructions

1- Measurement of gas flow

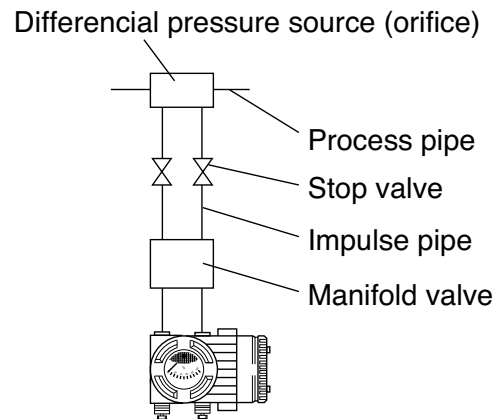
The transmitter must be installed above the pipes. If the temperature of the gas is high, condensate vessels must be used, as with for steam.



2- Measurement of liquid

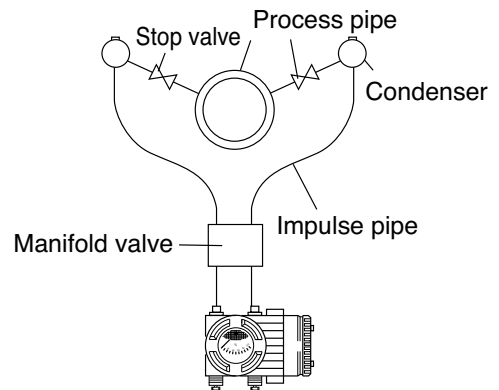
The transmitter must be installed below the pipes. The pipes must be installed so that no gas accumulates in the transmitter.

The installation of a reservoir for collecting gas can be useful.



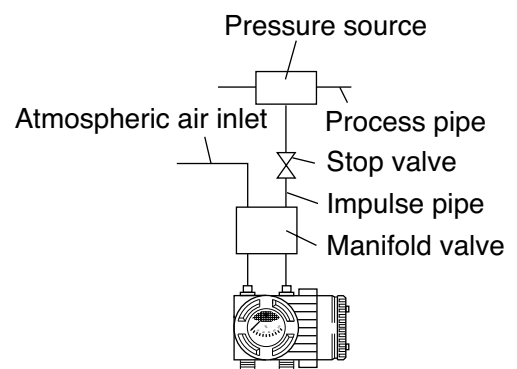
3- Measurement of steam pressure

Two condensate vessels must be installed between the transmitter and the orifice. The pipes connecting the two condensate vessels in the transmitter must be filled in advance with water. A bleed must be installed



4- Measurement of liquid pressure

The transmitter must be installed below the pipes.





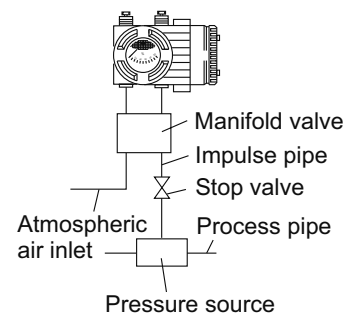
ATTENTION

- (1) When connecting the valves or of manifold, take appropriate protective measures to avoid the ingress of foreign bodies in the atmospheric release vents.
- (2) When measuring low pressures, it is important to take into consideration the following points and to limit the effects as much as possible:
 - Atmospheric pressure variation due to the wind around the transmitter
 - Variation of the ambient temperature in the vicinity of the pressure take-off pipe.
 - Air pressure difference between the pressure take-off pipe and the location of the transmitter.

To prevent the phenomena cited above, the side atmospheric pressure connection must be fitted with a pressure damper (adjustable to low flow), with the transmitter possibly mounted in a protection housing, or a compensation pipe installed on the low pressure side.

5- Measurement of gas pressure

The transmitter must be installed above the pipe to avoid condensation in the connecting pipes and in the measurement chambers of the transmitter.



6- Level measurement

(1) Reference column full

The reference column (on take-off pipe at the top point) must be full of liquid and connected on the low pressure side of the transmitter. The take-off pipe at the low point must be connected on the high pressure side of the transmitter.

Level calculation formula :

$$\text{Zero : } \rho \cdot H_2 - \rho_0 \cdot H_1$$

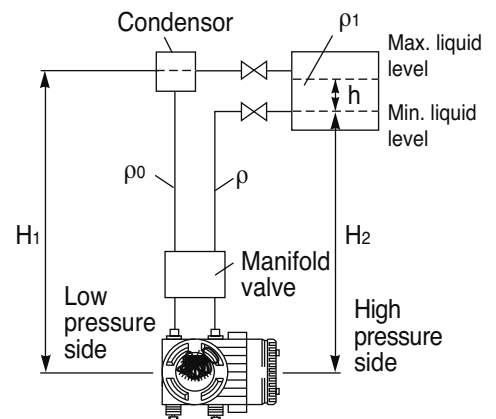
$$\text{Span } (\Delta P) : \rho \cdot H_2 + \rho_1 h - \rho_0 \cdot H_1$$

ρ_0, ρ, ρ_1 : Density

H_2 : Low level

H_1 : High level

h : Variation in level



(2) Reference column empty

For an open tank, leave the low pressure side of transmitter open to atmosphere.

Level calculation formula :

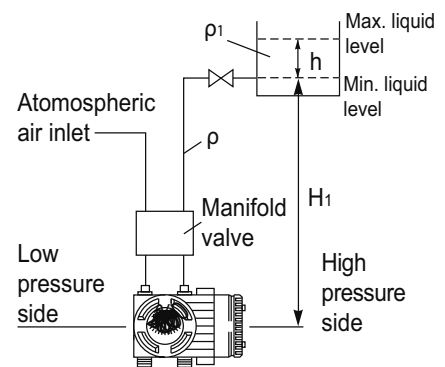
$$\text{Zero : } \rho \cdot H_1$$

$$\text{Span } (\Delta P) : \rho \cdot H_1 + \rho_1 \cdot h$$

ρ, ρ_1 : Density

H_1 : High level

h : Variation in level





Cautions on impulse piping

- For liquids, the connecting pipes of the mechanism toward the transmitter must have a minimum downward slope of 1/10 to avoid gas accumulations.
- For gases, the connecting pipes of the mechanism toward the transmitter must have a minimum upward slope of 1/10 to avoid liquid or condensate accumulations.
- Do not bend the piping excessively, in order to avoid the accumulation of liquid or gas.
- During the connections, do not submit the pipes to excessive mechanical constraints.
- Use condensate vessels or drains if the pipes could not be tilted.
- The pipes must be selected according to the conditions of use of pressure and temperature.
- When mounting, avoid any mechanical constraints on the take up pipes or take appropriate measures.
- In the case of external damage (deposit, corrosion, overflow, shock etc.) or in case of fire, the transmitters concerned must be checked before commissioning. Avoid external damage to the transmitter by installing it in a protective casing.
- The transmitter must not be exposed to fire. In case of fire, the transmitter must be previously verified before being returned to service. It must not be used if it has been partially or totally exposed to heat and/ or flames.

• Freeze protection.

When the measuring fluid is likely to freeze in the cover of the measurement chamber, the cover needs to be warmed up with steam or a heater.

Don't exceed the previous temperature limits (measuring cell: 120°C maxi and transmitter: 85°C). Even when the installations shut down the heat must be maintained, if not the transmitter and impulse pipes must be drained to prevent freezing.

3.2.2 Pressure (FKG) and absolute (FKA) pressure transmitters

Remove of protective cap

The process connection port of the transmitter is fitted with a plastic protective cap. Before piping, do not forget to remove this cap carefully. Be careful not to damage the threads or the support of the seal.

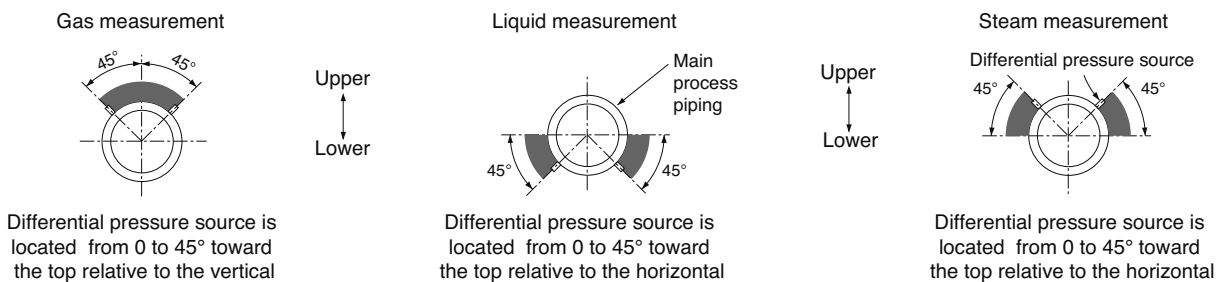
Connecting the transmitter to the impulse pipes

Impulse pipe should be connected with an oval flange. Also, the pipe can directly be screwed into the transmitter. For the measurement of absolute pressure, ensure that the shut-off valves or manifolds used can work under vacuum.

Position of process taps (horizontal main process piping)

The pressure intake must be located as shown on the following figures for the pressure to be transmitted correctly to the transmitter.

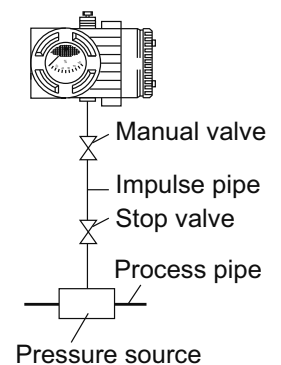
The position of the pressure intake is determined according to the conditions of service (measuring point, characteristics of the process)



Typical examples of piping - Connection instructions

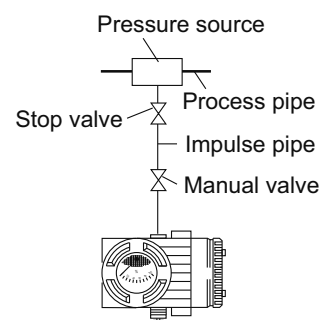
1- Measurement of gas flow

The transmitter must be installed above the piping. If the gas temperature is high, a condensate vessel must be used, in the same way as for the steam..



2- Measurement of liquid

The transmitter must be installed below the piping. The piping should be installed in such a way that no gas accumulates in the transmitter. The installation of a reservoir for collecting gas can be useful.

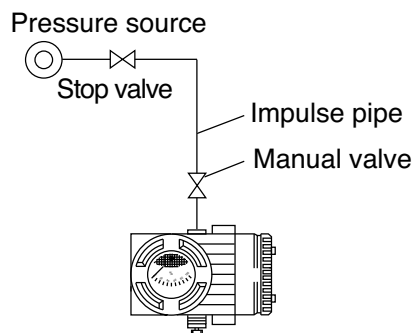


3- Measurement of steam pressure

A drain pot must be installed between the transmitter and the pressure intake.

The impulse pipe connecting the drain pot to the transmitter must be filled of water.

The installation of a purge is necessary.



Cautions on impulse piping

- For liquids, the connecting pipes of the mechanism toward the transmitter must have a minimum downward slope of 1/10 to avoid gas accumulations.
- For gases, the connecting pipes of the mechanism toward the transmitter must have a minimum upward slope of 1/10 to avoid liquid or condensate accumulations.
- Do not bend the piping excessively, in order to avoid the accumulation of liquid or gas.
- During the connections, do not submit the pipes to excessive mechanical constraints.
- Use condensate vessels or drains if the pipes could not be tilted.
- The pipes must be selected according to the conditions of use of pressure and temperature.
- When mounting, avoid any mechanical constraints on the take up pipes or take appropriate measures.
- In the case of external damage (deposit, corrosion, overflow, shock etc.) or in case of fire, the transmitters concerned must be checked before commissioning. Avoid external damage to the transmitter by installing it in a protective casing.
- The transmitter must not be exposed to fire. In case of fire, the transmitter must be previously verified before being returned to service. It must not be used if it has been partially or totally exposed to heat and/ or flames.
- **Freeze protection.**
When the measuring fluid is likely to freeze in the cover of the measurement chamber, the cover needs to be warmed up with steam or a heater.
Don't exceed the previous temperature limits (measuring cell: 120°C maxi and transmitter: 85°C).
Even when the installations shut down the heat must be maintained, if not the transmitter and impulse pipes must be drained to prevent freezing.

3.2.3 Level transmitter (FKE)

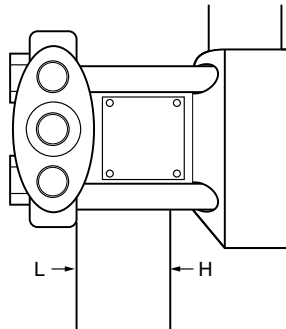
Check of **high/low** pressure sides of transmitter

The detecting unit of the level transmitter bears symbols high (H) and low (L) which represent pressure sides.

The high pressure side is always equipped with flange and identified with H letter on the label.

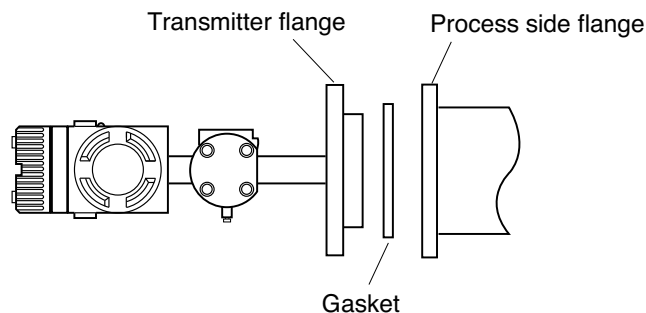
The low pressure side is equipped with a fitting process and a drain plug.


Upon request, the low pressure can be connect with a seal (or remote seal).



Seal on mounting flange face

When mounting the flange on the high pressure side, a gasket should be inserted as follows.



 ATTENTION	<p>The seal must be chosen according type flange mounted on the transmitter. The internal diameter must be greater or equal the diaphragm seal to not press it and effect the measure.</p> <p>When measuring a highly corrosive process fluid, be carreful about corrosion that may occur if the fluid leaks past wetted parts.</p>
--	---

Minimum internal diameter of non-projection type gasket :

Flange size	Ø diaphragm seal (mm)
DN80 / 3"	Stainless steel : 73
	Special material : 89
DN100 / 4"	Stainless steel : 96
	Special material : 89

For others flanges, consult Fuji Electric France.

Screw tightening method of the mounting flange

Tighten bolts of mounting flange and process flange in a diagonal order and about three cycles.

Connecting the low pressure side to the piping

The piping can be connected directly to the connection mechanism of the transmitter or by means of an oval flange. If an isolation valve is used, leave it closed until it is used, to avoid the ingress of foreign bodies.

Remove the protective plug on the low pressure side

The pipe on the low pressure side can be connected with an oval flange. The connection mechanism is protected by a plastic plug. Do not forget to remove it before the connecting the piping. Be careful not to damage the threads or the supports of the seal).

Typical examples of piping - Connection instructions

(1) Level measurement on open tank

Leave the low pressure side of transmitter open to atmosphere.

Level calculation formula :

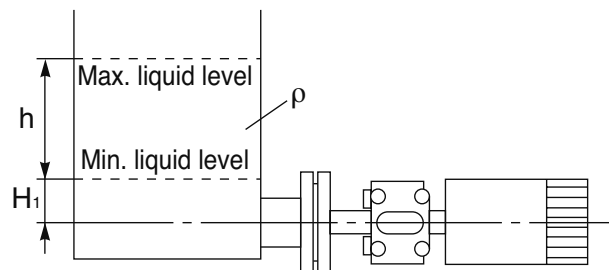
$$\text{Zero : } \rho \cdot H_1$$

$$\text{Span } (\Delta P) : \rho \cdot (H_1 + h)$$

ρ : Liquid density

H_1 : Height between the axis of the transmitter flange and the min level

h : level variation (max-min)



(2) Level measurement on close tank

1- With reference column

Connect the high pressure side of the transmitter to the bottom of the tank and the low pressure side to the take-off pipe from the top of the tank.

Level calculation formula :

$$\text{Zero : } \rho \cdot H_1 - \rho_0 \cdot H_2$$

$$\text{Span } (\Delta P) : \rho \cdot (H_1 + h) - \rho_0 \cdot H_2$$

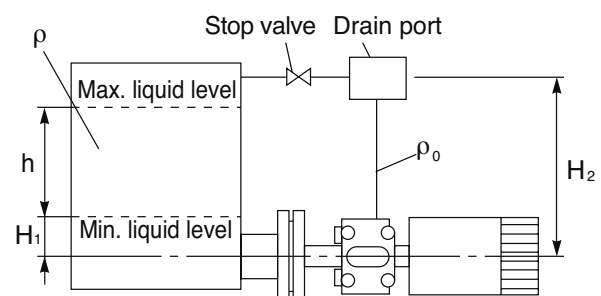
ρ : Liquid density

ρ_0 : Seal liquid density

H_2 : Height of the reference column

H_1 : Height between the axis of the transmitter flange and the min level

h : Level variation (max-min)



2- Without reference column

Connect the high pressure side of the transmitter to the bottom of the tank and the low pressure side to the take-off pipe from the top of tank.

Level calculation formula :

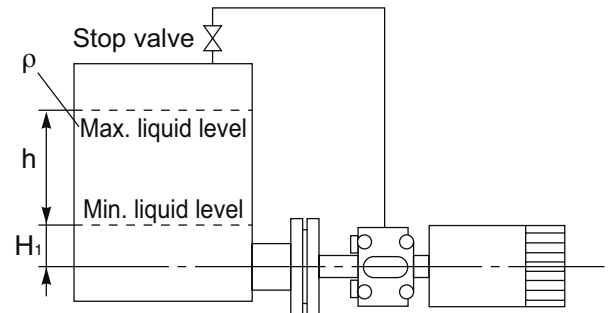
$$\text{Zero : } \rho \cdot H_1$$

$$\text{Span } (\Delta P) : \rho (H_1+h)$$

ρ : Liquid density

H_1 : Height between the axis of the transmitter flange and the min level

h : Level variation (max-min)



Cautions on installation

- H_1 must be greater than half the diameter of the measurement membrane of the transmitter flange. If this is not the case, the measure would not be proportional to the level as long as the membrane is not totally immersed.
- Do not scratch, nor cause shocks on the measurement membrane, as this would definitively damage the transmitter.
- Do not excessively tighten the bolts of the flange mechanism (observe the tightening torques recommended by the applicable piping standards).

• Freeze protection.

When the measuring fluid is likely to freeze in the cover of the measurement chamber, the cover needs to be warmed up with steam or a heater.

Don't exceed the previous temperature limits (measuring cell: 120°C maxi and transmitter: 85°C). Even when the installations shut down the heat must be maintained, if not the transmitter and impulse pipes must be drained to prevent freezing.

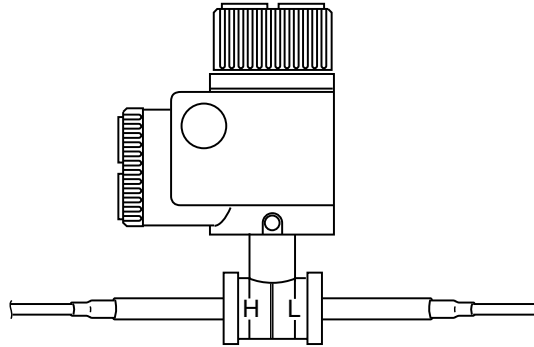
3.2.4 Installation of transmitters with remote seal(s) (FKB, FKD, FKM)

Differential pressure transmitters with remote seals (FKD)

Check of high/low pressure sides of transmitter

The high (H) and low (L) pressure symbols are indicated on the measuring cell. The high pressure side is always equipped with a specific flange connection, welded to a capillary or a rigid sleeve that allows a separator to be connected.

In general, the low pressure side (L) also has this.



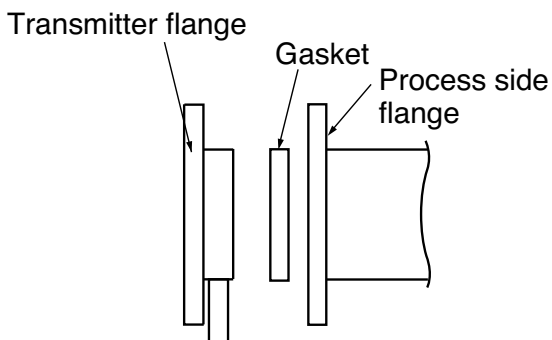
Seal on mounting flange face

A flat seal must be installed between the flange of the separator and the flange of the tank to be fitted. The seal must be selected based on the type of flange fitted to the separator. Its internal diameter must be greater than or equal to that of the measurement membrane, so that it does not press on the latter, which would give a false measurement.

Minimum internal diameter of non projection type gasket :

Flange size	Ø diaphragm seal (mm)
DN80 / 3"	SS : 73
	Special material : 89
DN100 / 4"	SS : 96
	Special material : 89

For others flanges, consult Fuji Electric France.



Connecting method of the mounting flange

Tighten bolts of mounting flange and process flange in a diagonal order and about three cycles.

Typical examples of piping - Connection instructions

(1) Level measurement on opened tank

An open tank should be piped so that the flange on the low pressure side is open to atmosphere.

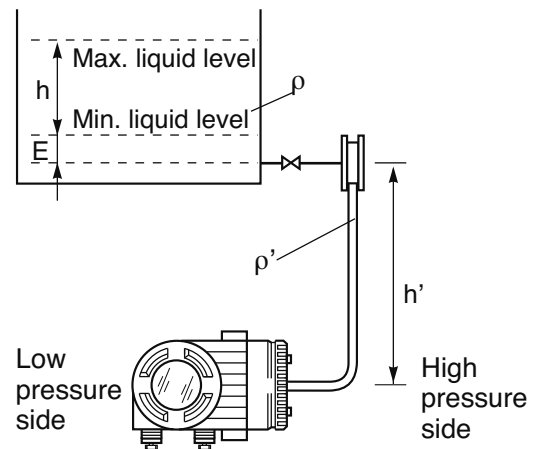
Level calculation formula :

$$\text{Zero} : \rho E + \rho' h'$$

$$\text{Span} : \rho(E + h) + \rho' h'$$

ρ : Liquid density of the process

ρ' : Specific weight of the filling liquid for the capillaries of the remote seals



(2) Level measurement on closed tank

1- With reference column

Connect the highest liquid level tapping of tank to the low pressure side of transmitter, and the low liquid level tapping of tank to the high pressure side of transmitter

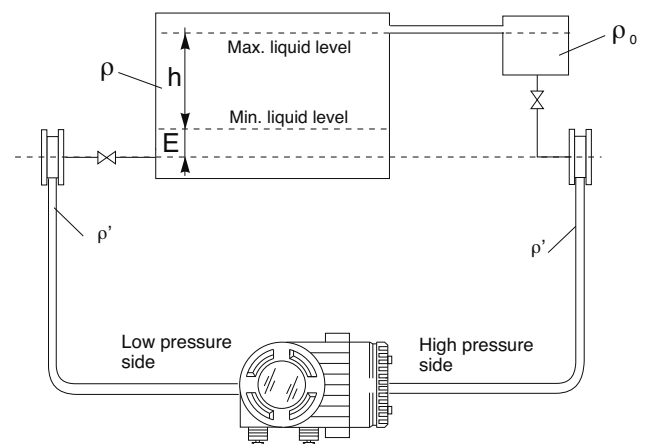
Level calculation formula :

$$\text{Zero} : (-h' \cdot \rho') + \rho \cdot E$$

$$\text{Span } (\Delta P) : (-h' \cdot \rho') + \rho(E + h)$$

ρ : Liquid density

ρ' : Specific weight of the liquid filling the reference column



2- Without reference column

Connect the high pressure side of the transmitter to the bottom of the tank and the low pressure side to the take-off pipe from the top of tank.

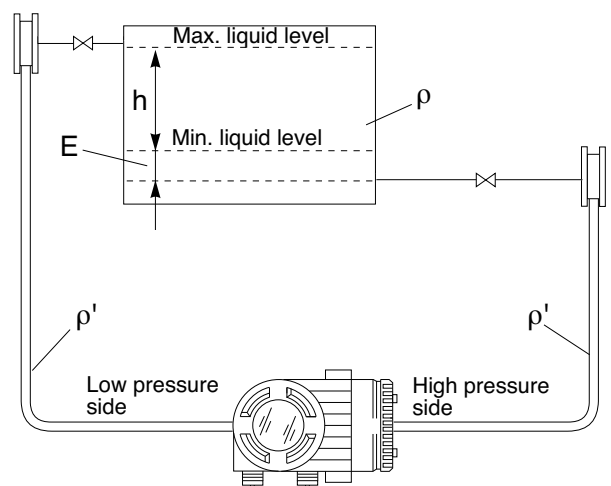
Level calculation formula :

$$\text{Zero} : \rho \cdot E - \rho \cdot (E + h)$$

$$\text{Span } (\Delta P) : \rho \cdot h$$

ρ : Liquid density of the process

ρ' : Height between the axis of the transmitter flange and the min level



Note: formulas valid if the two separators are at the same height.

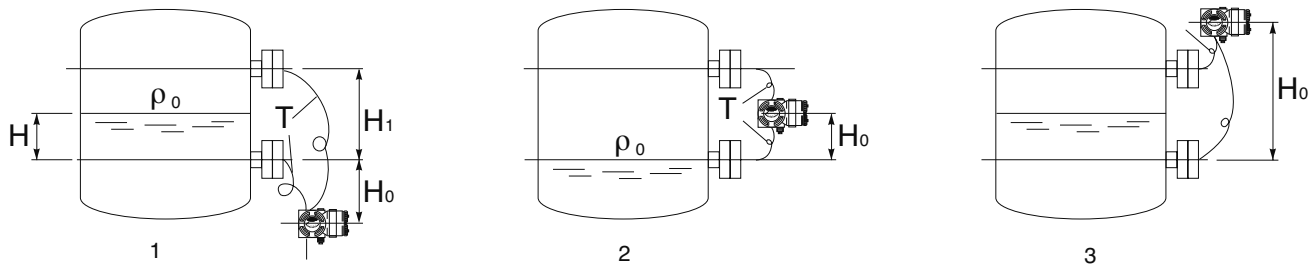
Better accuracy for fill fluid density can be obtained from Fuji Electric France.
 For information, below seal liquid density value at 25°C. :

Fill fluid	Density	Applications
Silicone oil	0,934	For general measurement
	1,07	For high temperature, high temperature and vacuum, high temperature and high vacuum service
Fluorinated oil	1,84	For oxygen service

PROHIBITION It is recommended that the pressure transmitter be installed below the separators. If the pressure of the process is less than the atmospheric pressure, this becomes indispensable (see next page).

Caution when vacuum measurement

PROHIBITION When the pressure of the process is close to a vacuum, the transmitter must always be installed below the lowest pressure take-off pipe, as indicated in Fig1.
 If the installation is performed according to Fig.2 or 3, an additional negative pressure is created by the height H_0 of the filling liquid of the capillaries located between the transmitter and the lower pressure take-off pipe. In this case, it is essential to check that the resulting pressure on the measuring cell of the sender is greater than the minimum service pressure indicated in the technical specifications of the transmitter used.
 In case of doubt, consult Fuji Electric France.



Caution on installation

- Vibrations on the capillaries can create interference with the measurement and distort it. It is therefore advisable to install the transmitter on a vibration free bracket and to attach the capillaries to stable structures.
- Avoid channeling the capillaries on the high pressure side and low pressure side to places where the temperature or the sunshine are very different, because this creates zero drifts. If this cannot be avoided, it is advisable to have a heater cable running along the capillaries to maintain a constant temperature.

3.2.5 Gauge (FKB) and absolute (FKM) pressure transmitters with remote seal

Seal on mounting flange face

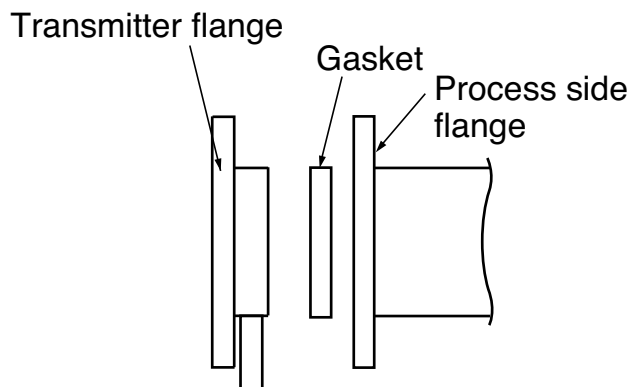
When mounting the flange on the high pressure side, a gasket should be inserted as follows. The seal must be chosen according type flange mounted on the transmitter. The internal diameter must be greater or equal the diaphragm seal to not press it and effect the measure.

When measuring a highly corrosive process fluid, be careful about corrosion that may occur if the fluid leaks past wetted parts.

Minimum internal diameter of non-projection type gasket :

Flange size	Ø diaphragm seal (mm)
DN80 / 3"	SS : 73 Special material : 89
DN100 / 4"	ISS : 96 Special material : 89

For others flanges, consult Fuji Electric.



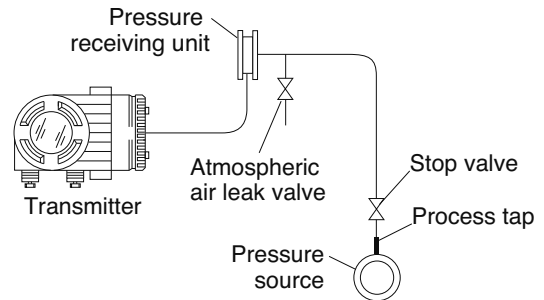
Connecting method of the mounting flange

Tighten bolts of mounting flange and process flange in a diagonal order and about three cycles.

Typical examples of piping - Connection instructions

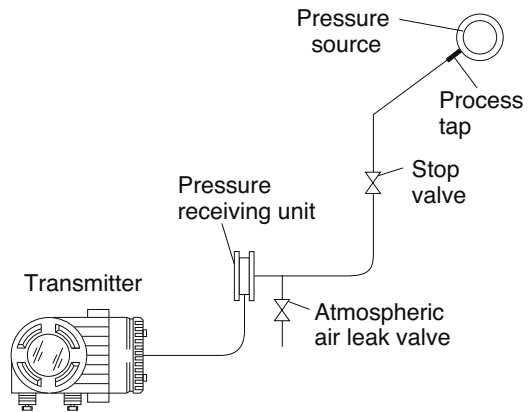
(1) Measurement of gas pressure

The pressure intake must be located in the upper part of the piping and the remote seal above it.



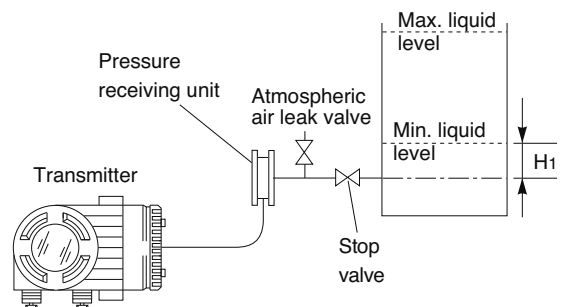
(2) Measurement of liquid pressure

The pressure intake must be located in the upper part of the piping and the remote seal above it.



(3) Level measurement on opened tank


H_1 must be more than half diameter of the remote seal diaphragm diameter. Otherwise the measure will not be linear to the level as far as the diaphragm is not totally submerged.




PROHIBITION

It is recommended that the pressure transmitter be installed below the remote seal. If the pressure of the process is less than the atmospheric pressure, this becomes essential.

Vibrations on the capillaries can create interference with the measurement and distort it. It is therefore advisable to install the transmitter on a vibration-free bracket and to attach the capillaries to stable structures.

 DANGER	In case of an explosion proof arrangement, wiring shall be made in accordance with the relevant regulations to ensure the explosion proofing. Improper wiring can cause a risk of explosion, fire and other serious accidents.
---	--

 ATTENTION	<ul style="list-style-type: none">• Before making wiring work, be sure to turn OFF the main power to prevent electrical shocks.• Use wiring materials of correct rating to prevent fire incidents.• Use correct power source that meets the specifications to prevent fires.• Field ground according the recommendations of electrical connections.• After installing the transmitter, firmly close the covers of the transmitters unit and terminal box. If not, rain water enter the transmitter which may result trouble or incorrect operation.
--	---

Cautions on wiring

- (1) Application of a voltage exceeding 60 VDC or 40 VAC (exceeding 33 VDC or 23 VAC when arrester equipped) between “+” and “-” terminals may result damage to the transmitter.
- (2) Use a shielded cable for the transmission line where possible.
- (3) Avoid installation of signal cable and power cable in same conduit or cable tray in order to prevent increased noise.

Also, do not bring the signal cable close to large electrical equipment.

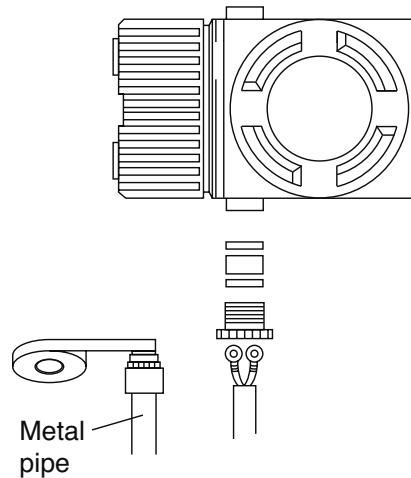
4.1 Wiring procedure :

Sealing of conduit connection

The cable passage depends on the order, see the technical specification for different possibilities and dimensions.

! INDICATION

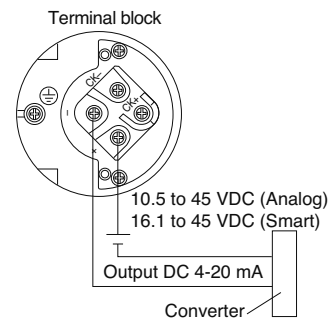
Avoid the use of a metal tube to protect the cable if the inlet is at the top, because this encourages the accumulation of water at the cable inlet of the transmitter, and increases the risk of water getting into the transmitter. Check that the threading of cable routing corresponds to that of mounting accessories used.



Terminal block connection diagram

Tighten the terminal screws (M4 x 10) to a torque of approximately 1.5 Nm so that the wires will not loosen.

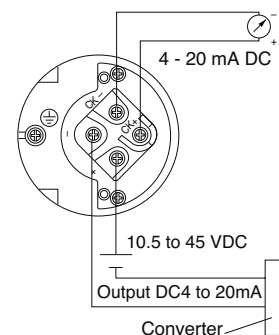
After the wiring, correctly retighten the cover so that it cannot be unscrewed.



When using an external field indicator

For direct connection to an external field indicator, connect the “+” and “-” sides of the field indicator to CK+ and CK- of the transmitter as shown below.

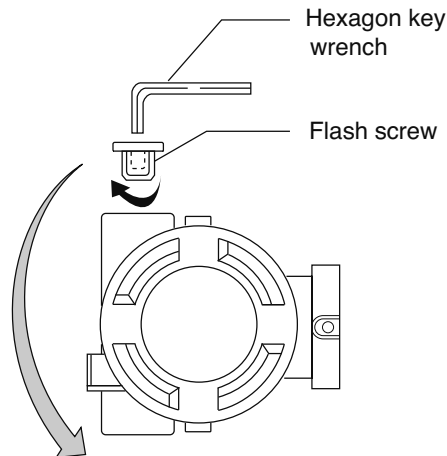
Use an external field indicator with internal resistance of 12Ω or less.



Precautions to be taken during the wiring

Two conduit connection are available and one is closed by a plug. If the open entry is not the desired one, proceed as follows :

- Remove the plug, install Teflon tape on its thread to ensure the sealing, and screw it onto the other cable inlet.
- Pass the cable through the open cable inlet and connect it.

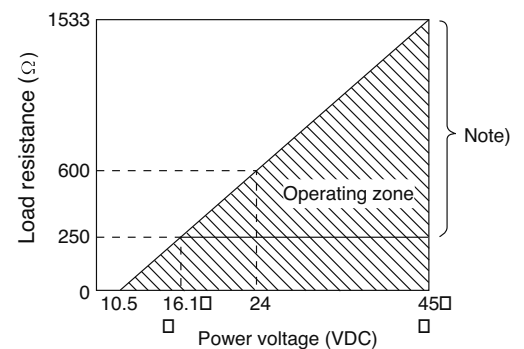


DANGER

- A flameproof plug is essential on the second fitting if the transmitter is protected against explosion by means of an enclosure.
- If the insulation is verified after wiring, a megohmmeter with a test voltage of 250 VDC maximum should be used. If the device is equipped with the arrester, do not perform dielectric testing or insulation resistance testing.

4.2 Power voltage and load resistance

Make sure the load resistance of the wiring connected to the loop is within the range shown below.



Note :

For Smart type, to communicate with the FXW communicator, mini of 250Ω is required

4.3 Grounding

The transmitter must be grounded as below :

1- Standard location use (without special protection)

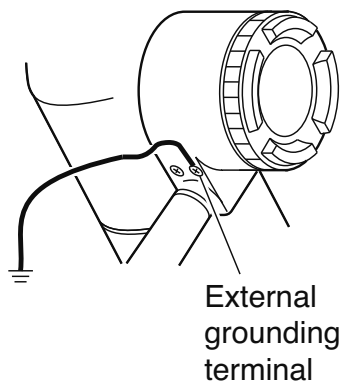
Grounding terminals are provided at two places (at the inside of terminal box and on the side of conduit connection).

By any of the methods given below, ground the transmitter in compliance with the relevant stipulation in the standard on explosion proof installation (for example, grounding resistance 100 Ω or less by one of the methods given below).

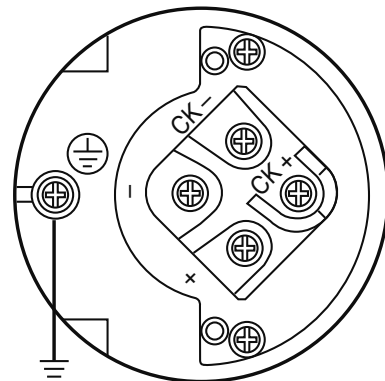
2- Hazardous location use

In case of intrinsically safe and flame proof installation, be sure to use the ground terminal for grounding.

Grounding of transmitter casing



Grounding from ground terminal

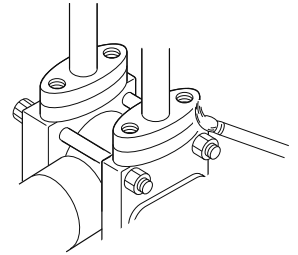


5.1 Installation :

After installation (refer to chapter 3.1) and before start up of the transmitter, be sure to perform the following checks and procedures.

Preparation :

- (1) Check for liquid or gas leakage of the process connection by applying soapy water or similare.
- (2) Check of the electrical connection according to the "Terminal block connection diagram" shown in chapter 4.1.
- (3) Vent the process covers of the transmitter.



DANGER

Carefully read the package leaflet ATEX Ref.HDFCX-AII 002 for starting up appliances in an explosion-protected area (protected against explosion by means of an enclosure).

The compatibility of process with the transmitter, has to be checked and ensured by skilled people from customer side.



ATTENTION

When the plant requires chemical cleaning at the start up operation, be sure to close the isolating valves of the transmitter to avoid that cleaning liquid or particules are introduced to the transmitter wetted parts.

- (4) Perform zero point adjustment.

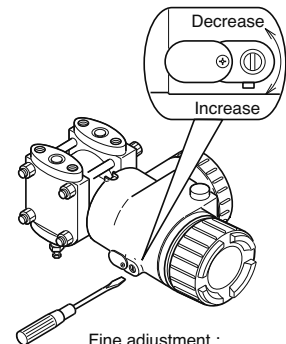
Zero point check

For the adjustment or checking of the zero in a dangerous area (explosion-protected), refer to the leaflet ATEX HDFCX-AII 002.

- Put the device under voltage.
- Check the output signal by connecting a milliammeter to terminals + CK and CK- of the transmitter.
- After at least 10 seconds, adjust the output signal of the transmitter by 4 mA (zero adjustment).

Zero adjustment :

- (1) with the adjustment screw (do not use in nuclear power plants).
Refer to the Section 6.1 "Adjustment with the external screw".
- (2) With the LCD indicator (do not use in nuclear power plants).
Refer to Section 6.2 "Adjustment procedure with the LCD indicator"
- (3) With the Fuji or Hart portable communicator.
Refer to Section 6.3 "Adjustment procedure with the mobile communicator"
As soon as all operations are completed, reassemble and tighten the covers of the enclosure.
(The covers of the unit are mounted "tightened to contact").



Fine adjustment :
Turning slowly (approx. 5 sec by turn)
Rough adjustment :
Turning quickly (approx. 1 sec by turn)



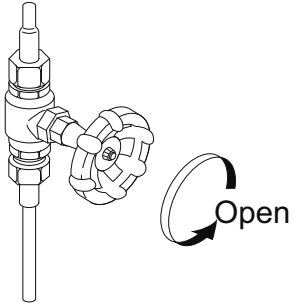
INDICATION

After adjustment of the transmitter, it should be kept energized for about 10 seconds to write the adjustment results into memory.

5.2 Operating mode

(1) Operation of gauge (FKG) and pressure (FKA) transmitters :

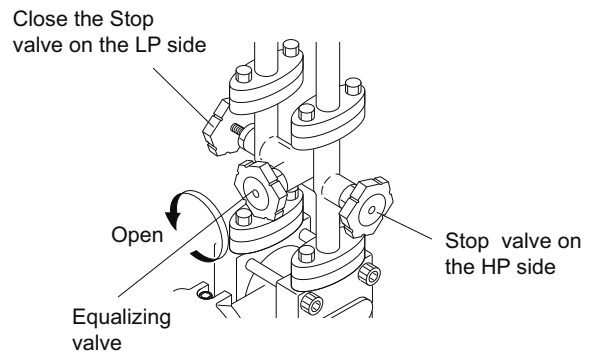
Open the valve slowly to apply a pressure.
When a pressure is applied, the transmitter is set in the operating status.



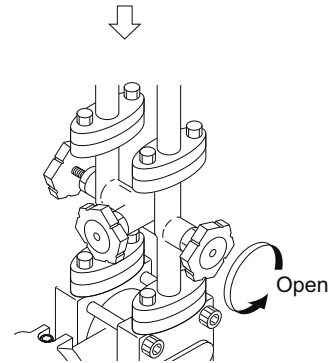
(2) Operation of differential pressure transmitter (FKC) :

The use of the isolation valves when switching on the differential pressure of the transmitter is shown below

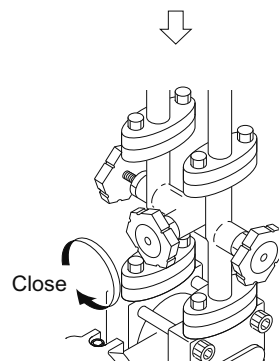
Check that the equalizing valve is open and adjust the zero of the transmitter.



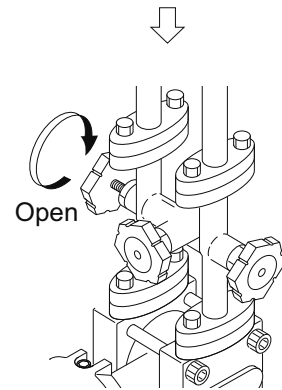
Open the stop valve on the HP side slowly.



Close the equalizing valve.



Finally, open the stop valve on the LP side slowly



Check of operating status

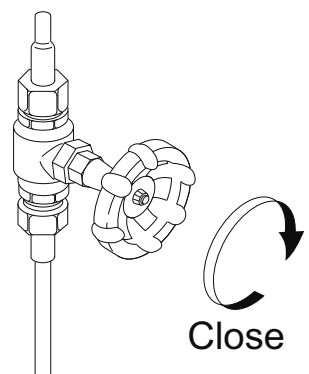
Use a field indicator, receiving instrument or the portable communicator FXW to check the operating status.

5.3 Shutdown

Follow the procedures

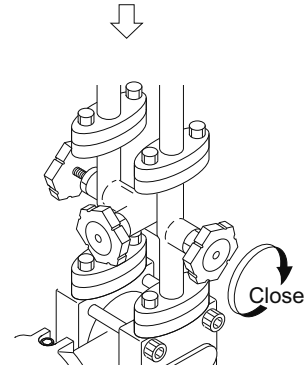
(1) Operation of gauge (FKG) and pressure (FKA) transmitters :

Close the stop valve slowly to stop applying a pressure.
The transmitter is set in the measurement stop status.

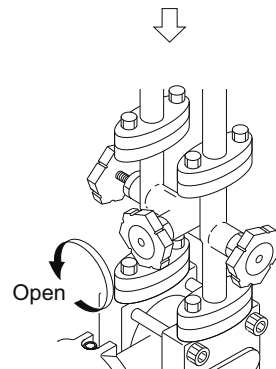


(2) Differential and flow pressure transmitter (FKC) :

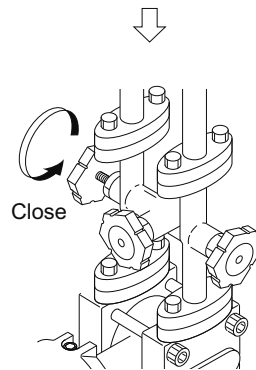
Close the stop valve on the high pressure side (HP side) slowly.



Open the equalizing valve..



Close the stop valve on the low pressure side slowly



PROHIBITION

Before a long shutdown, discharge the process fluid and drain completely from the transmitter. This is to protect the transmitter from freezing, corrosion, etc.

To change or adjust the range of measurement, first perform the zero adjustment and then that of the measurement scale using the external adjusting screw (do not use in nuclear power plants) on the LCD indicator (do not use in nuclear power plants) or with the mobile communicator (if the zero adjustment is done after the adjustment of the measurement scale, the point 100% cannot be adjusted correctly). The zero corresponds to the output signal 4mA (LRV - 0%) and the measurement scale at 20 mA (URV - 100%).

For nuclear power plants, the FXW portable communicator must be used for all the adjustments.

6.1 Adjustment with the FXW portable communicator

⚠ DANGER Never connect an FXW portable communicator directly to the terminal block of the transmitter in an explosionproof atmosphere.

! Important For nuclear power plants, the zero adjustment may be performed only with the aid of a mobile communicator and only when the FCX-All pressure transmitter is not in service.

The measuring range of the transmitter is easily adjustable by using the keys on the keyboard of the FXW without any pressure generation.

This applies if the calibration of the transmitter has not been modified since its manufacture or since a last calibration carried out by competent staff with precise generation of pressure.

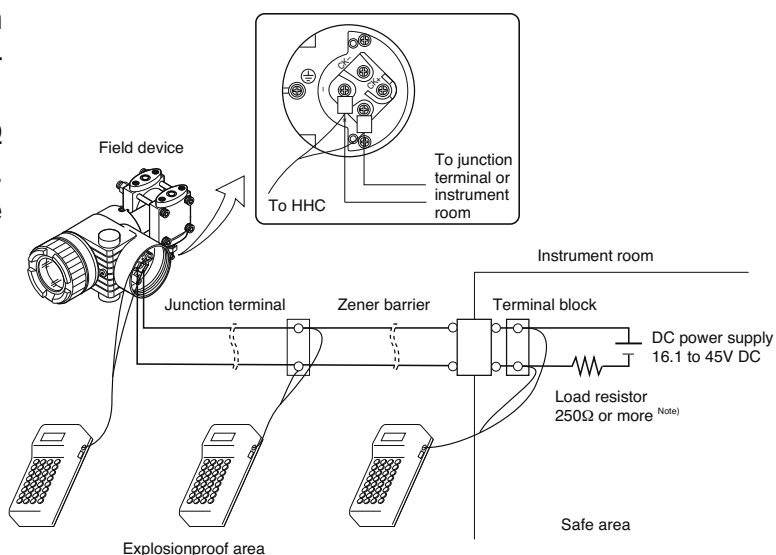
For more details on the communicator FXW, refer to its specific user manual.

! INDICATION After performing the settings, maintain the electrical supply for at least 10 seconds.

6.1.1 Connection of the FXW portable communicator

The FXW portable communicator can be connected at any point of the measurement loop.

A resistance of minimum load of 250Ω is necessary for perfect communication. Refer to the diagram below for the connection of the FXW.



Notes :

- * The mobile communicator must be in the OFF position during the connection. It may not be connected to the test terminal CK+ and CK- of the transmitter terminal block.
- * The mobile communicator is not polarised (the wires of the FXW can be connected equally to the + or - terminals of the transmitter or the wires of the 4-20mA loop).

⚠ DANGER If the sender is installed in a hazardous zone (explosion-proof), the FXW portable communicator may only be connected to junction boxes located outside dangerous zone.



The minimum version of the FXW must be 7.1 for it to be able to communicate with the transmitter.
If an earlier version is being used, please contact Fuji Electric for an update

6.1.2 Start up of the portable communicator FXW

- Put on/off switch of the HHC on "ON" position.
Put on the enclosed "key" in the corresponding location of the HHC. Without the key and with the key in vertical position, you can just read the transmitter parameters.
To write new parameters in the transmitter, the key needs to be in horizontal position. Otherwise, you will have an inscription on the HHC screen **"INHIBIT KEY OK?"** to let you know that the key needs to be turned to enable the programming of new parameters in the transmitter.
NOTA: **"INHIBIT KEY"** means that the key permits or inhibits (prohibited) writing parameters in the transmitter
- Transmitter version and FXW software revision are indicated on the screen during the start up. After around 4 seconds, the inscription **"PUSH MENU KEY"** appears (please push menu key)
HHC with the optional printer will have the inscription "PAPER FEED". Please push on <INC> key. By pushing on <INC> key the paper feed is activated.
"PUSH MENU KEY" will be indicated on the screen by if you push on the clear <CL> key. On the screen appears the inscription **"RECEIVING START"**. The HHC reads out the data from the transmitter, and switches automatically in the first programming menu : TAG menu. In case of a connection problem, **"NO CONNECTION"** will appear on the screen. The **"PUSH MENU KEY"** appears again if you push the clear <CL> key.
The reasons of a communication problem can be :
 - The 4-20 mA output is not powered.
 - The 4-20 mA is disconnected.
 - The connection between the amplifier unit and the measuring cell is wrong.
 - The loop resistance value doesn't correspond to the required one depending on the power supply.
 - The FXW is not connected to the correct terminals

Configuration menus of the FXW portable communicator

The configuration is based on different menus. The identification of the following program steps are indicated on the bottom line of the screen inside following signs (<____>).

The configuration menus are selectable by pushing on the **INC** (increase : configuration N+1), or the **DEC** (decrease : configuration N-1), keys. The most important menus can be selected with a specific, corresponding key.

The <**CHNG**> (CHANGE, modification) key inside each menu gives the possibility to make modifications or to program new parameters in the transmitter with the alphanumeric keys. To program letters, you first need to push the <**ALHA**> key, each time before programming the letter. To add a space between characters, you have to push the keys <**ALHA**>, and <____>. To delete characters, please use the clear key <**CL**>.

When the modification is programmed, you have to push the enter key <**ENT**> to send the new information to the transmitter. For safety reasons, you need to confirm the modification a second time by replying on the question **"CHNG OK ?"** . You confirm by typing a second time on the enter < **ENT**> to confirm.

At this moment the new programmed information are written in the transmitter memory, **"WRITE"** indication will appear on the screen of the FXW communicator.

The following shows the flow of 21 key operations (n°1 to L), explained for the FXW version 7.0 (FXW□□□□1-A4).

FXW prior to Version 7.0 are not available of operation of FCX-All series transmitter. In this case, the user is requested to contact our office for ROM version up.

Classification		Display symbol	Key symbol	Ref. page
1	TAG No.	INC 1: TAG No.	MENU	40
2	Type	INC 2: TYPE	MENU → INC	40
3	Display of serial No.	INC 3: SERIAL No.	MENU → INC → INC	41
4	Industrial value unit	INC 4: UNIT	UNIT	41
5	Range limit	INC 5: RANGE LIMIT	UNIT → INC	42
6	Range change (LRV,URV)	INC 6: RANGE	RANG	42
7	Damping adjustment	INC 7: DAMPING	DAMP	43
8	Output mode and value	INC 8: OUTPUT MODE	LIN / ?	44
9	Burnout direction	INC 9: BURNOUT	LIN / ? → INC	45
A	Calibration of the zero/span	INC A: CALIBRATE	CALB	46
B	Calibration of output circuit	INC B: OUTPUT ADJ	OUT	47
C	Indication of measured data	INC C: DATA	DATA	48
D	Self-diagnosis	INC D: SELF CHECK	DATA → INC	48
E	Printer function	INC E: PRINT	DATA → INC → INC	49
F	Lock of adjustment functions	INC F: XMTR EXT. SW	DATA → INC → INC → INC	49
G	Indication of digital indicator	INC G: XMTR DISPLAY	DATA → INC → INC → INC → INC	50
H	Programmable linearization function	INC H: LINEARIZE	DATA → INC → INC → INC → INC → INC → INC	52
I	Rerange (Set LRV/URV calibration)	INC I: RERANGE	DATA → INC → INC → INC → INC → INC → INC → INC	54
J	Saturation current value and specification setting	INC J: SATURATE CUR	DATA → INC → INC → INC → INC → INC → INC → INC → INC	55
K	Write protect	INC K: WRITE PROTCT	DATA → INC → INC → INC → INC → INC → INC → INC → INC	56

1-Tag number (TAG No)



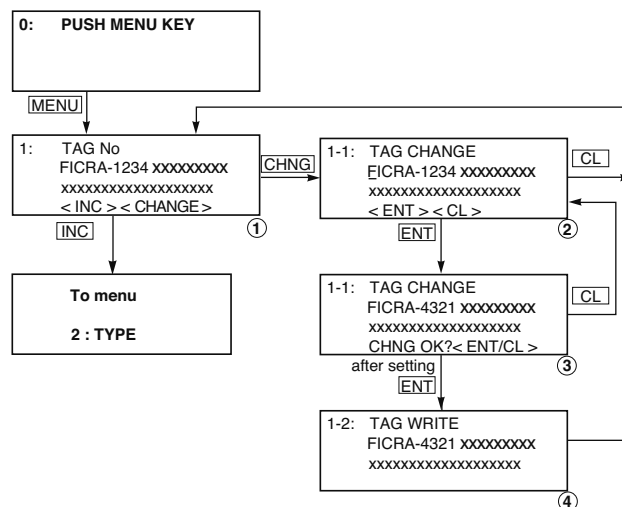
Important

The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection.

The configuration of the tag number on the device must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.

To set the TAG N° of each field device, use the procedures shown in the following diagram. TAG N° can be inputted up to 26 characters of alphanumeric codes.

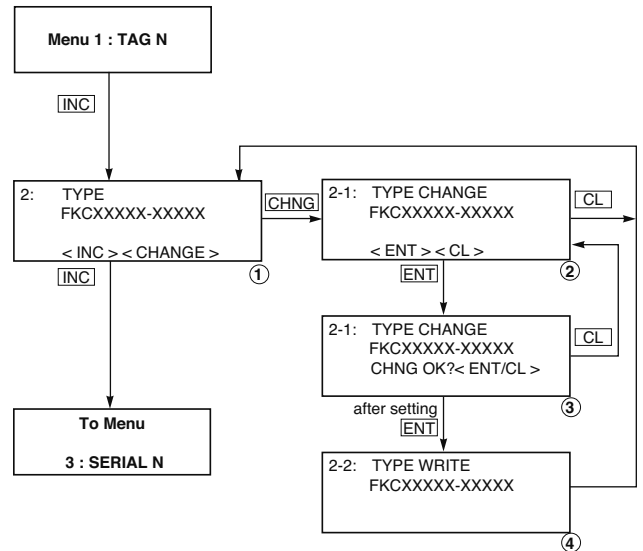
- After PUSH MENU KEY is displayed, press the <MENU> key to display TAG N°.
- To make changes press the <CHNG> key and the cursor will be displayed under display ①.
- Set the alphanumeric keys as necessary under display ② .
To set the alphabet, press the <CHNG ALHA> key first.
Using << >> keys, cursor position can be moved.
- At the completion of setting, press the <ENT> key and a prompt is displayed check entry under display ② .
- If the entry is correct, press the <ENT> key to input it to the field device under display ③ and ④ and the initial image ① is displayed.
- To display TYPE display, press the <INC> key under display ①



2-Type of model (TYPE)

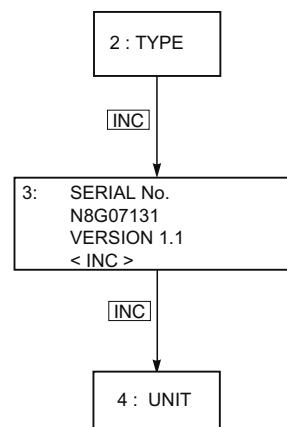
Type of field device is displayed and changed (ex. of differential pressure transmitter).

- After TAG N° is displayed, press the <INC> key to display TYPE image.
- To make changes press the <CHNG> key under display ① and the cursor will be displayed under display ②.
- Set the alphanumeric keys as necessary under display ②. To set the alphabet, press the <CHNG ALHA> key first. Using <◀> <▶> keys, cursor position can be moved.
- At the completion of setting, press the <ENT> key and a prompt is displayed check entry under display ③ and ④ and the initial image ① is displayed.
- If the entry is correct, press the <ENT> key to input it to the field device under display ③ and ④ and the initial image ① is displayed.
- To display SERIAL N°, press the <INC> key under display ①.



3- Serial number and software version (SERIAL No)

The serial number and the software version (EEPROM) of the FXW appear. The serial no., entered in the factory, ensures the traceability of the transmitter in the course of its manufacturing cycle and it cannot be changed by the user (read only). To display the menu <UNIT> press the <INC> key as indicated on screen ①.



4- Industrial value unit (UNIT)



The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection.

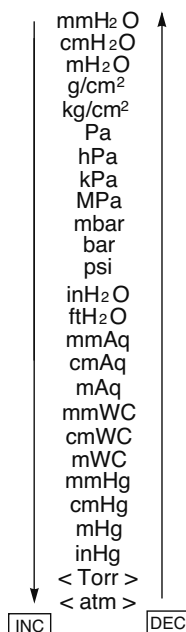
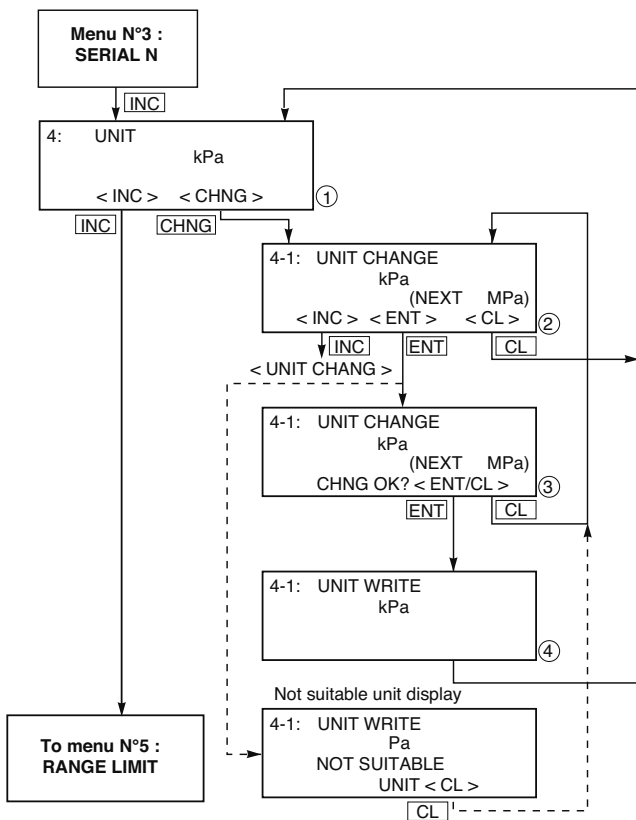
The configuration of the physical units on the device must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.

26 industrial units can be used by the operator (see below).

Note :

The mark <> is settable for absolute pressure transmitter only.

- To change the unit, press <CHNG> in screen ①. Screen ② appears, allowing the transmitter unit to be modified.
 - Select the unit using the <INC> or <DEC> keys on screen ②.
 - Screen 3 appears for confirmation of the change.
 - Screen ④ for the registration of the unit and then screen ① returns.
- At each stage, it is possible to go back through the key <CL>.
- To display the menu <RANGE LIMIT>, press the <INC> key as indicated on screen ①.




If screen 5 appears (otherwise reset screen 5) during the modification of the unit. The latter may not be taken into account due to the scale selected. In this case, press <CL> and change the unit.

5- Limitations of measuring range (RANGE LIMIT)

A modification of this value URL (Upper Range limit) is not possible by the user because it is linked to the maximum measurement range that corresponds to the measuring cell of the transmitter.

- To display the menu <RANGE>, press the <INC> key.

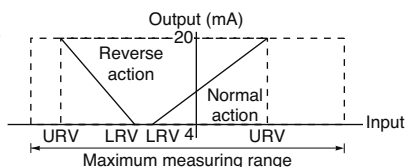
6- Modification of measuring range (RANGE CHANGE)

 Important	<p>The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection. The configuration of the physical units on the device must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.</p>
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This menu allows the following values to be configured for the transmitters :

- **LRV (Lower Range Value)**: lower limit of measurement 0% - 4mA
- **URV (Upper Range Value)**: upper limit of measurement 100% - 20mA

The measuring range can be adjusted :



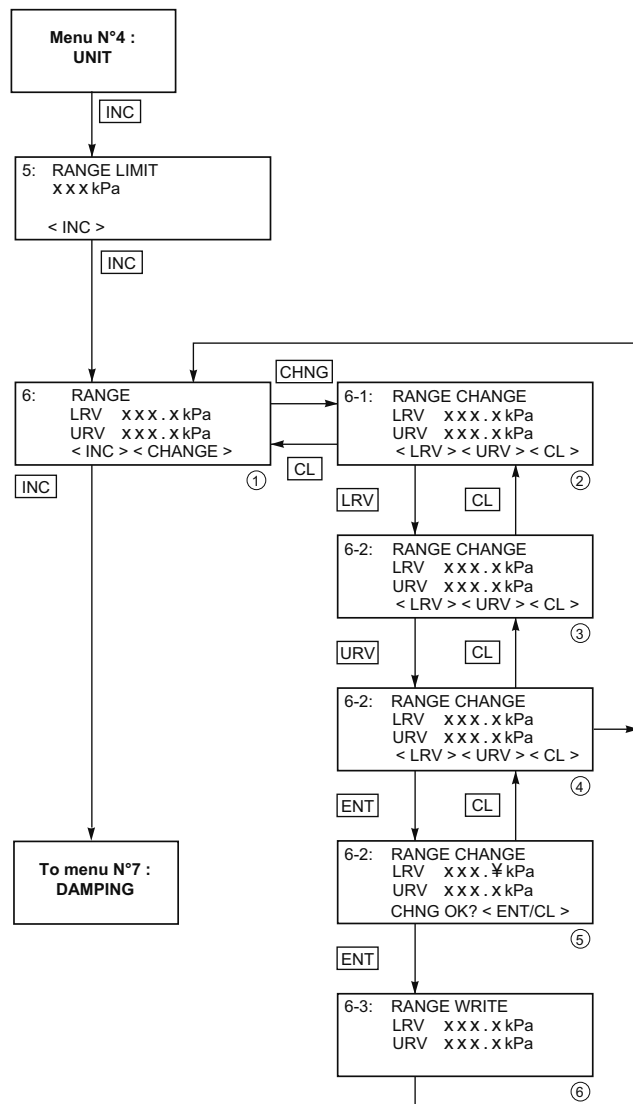
Note :

If the selected measuring range exceeds the authorised limits, "SETTING ERR" (error of adjustment) appears on the lower line of the display.

The maximum range is ± 9999

If the unit is modified, the URV value may exceed the upper limit. If this occurs, change the URV first.


- Press <CHNG> on screen ①. The screen to change the LRV or URV values appears.
 - Press <LRV> to modify the 0% (screen ③)
 - Press <URV> to modify the 100% (screen ④).
 - Under screens ③ or ④, enter the corresponding values for the 0% or 100%.
- Press <ENT> to validate.



Note : Press <+/-> to obtain negative values under screen ③ or ④

Note : If the value of 0% or 100% is outside the measurement range, an error appears, saying "setting error". In this case, please change the measuring range (LRV and/or URV).

- After having confirmed the change, screen ① appears, then press <INC> to obtain the following menu : DAMPING.

 Important	<p>The measuring range of the transmitter is independent of the measuring range of the indicator. After the measuring range has been changed in this menu, the measuring range of the LCD indicator must be changed (menu G). If the transmitter is equipped with an analogue indicator and the measuring range must be changed, the analogue indicator must also be changed.</p>
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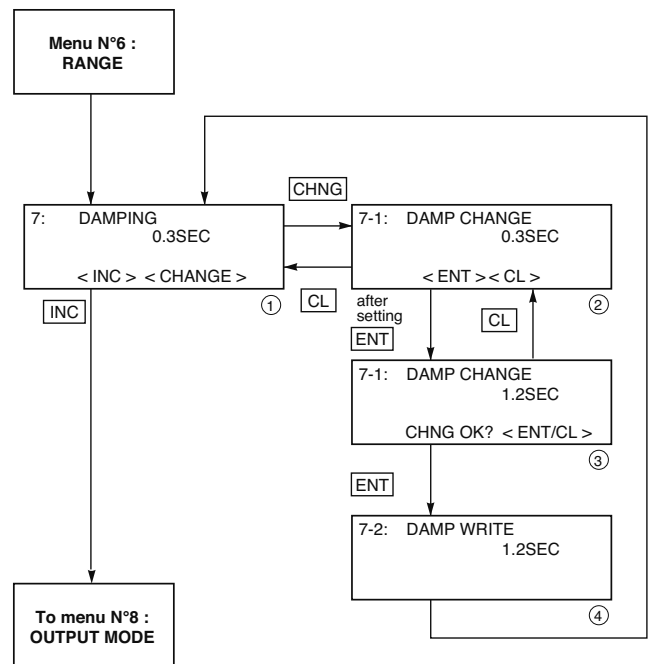
7- Electrical damping (DAMPING)



The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection and electrical damping set to the minimum (0.12 sec). The configuration of the electrical damping on the device must be done before the write protection is lifted according to the provision specified on page (§. After all the operations are complete, the write protection must be replaced.

If the pressure to be measured is exposed to very rapid fluctuations or the transmitter is exposed to vibrations, the damping of the output signal must be programmed to make sure these fluctuations do not disturb the measurement.

- Press <CHNG> to obtain editing screen ②.
- Enter the electrical damping value Adjustment range of the damping value is between 0.12 and 32.0 sec.
- Press <ENT> to validate on screen ③ otherwise press <CL> to return to edit screen ②.
- To change the menu, press <INC> in screen ①.



8- Setting the output signal (OUTPUT MODE)



The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection. The configuration of the physical units on the device must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.

Depending on how the differential pressure sensor is used, the output signal can be programmed either in linear (output proportional to the differential pressure) or in square root output (SQR = SQUARE ROOT; output proportional to the flow rate).

If the square root (SQR) output is chosen, the tipping point and the mode of the output signal between the zero point and the failover point are programmable.

8-1 Changing the output signal mode

The change in this mode (2) is carried out by pressing "CHNG ALHA" and then the "INC" OR "DEC" keys. Validate and confirm with "ENT" (3) or (4) (return with "INC").

After the registration of the new mode (5) or (6), a new screen appears 7 for the square root mode, otherwise screen (1) returns.

8-3. Adjusting the failover point

In square root, the failover point can be changed. The failover point is adjustable between 0.00 and 20.00% of flow to be measured. A failover point close to 0% can cause an unstable output signal. The failover point is used to improve the measurement of very low flow.

Press "CHNG ALHA" to change the value of the failover point (8). Validate and confirm with "ENT" (9). The recording in the transmitter is carried out (10). A new screen appears to set the signalling between zero and the failover point (11) or (12).

8-6 Setting the signalling mode between zero and the failover point

- Linear mode of the output signal between zero and the failover point (Fig A)

- Mode with output signal at zero between the zero for measurement and the failover point (Fig B). Press "CHNG ALHA" to change the mode type. Select <1> or <2> depending on the selected mode (13).

Validate and confirm with "ENT" (14) or (15). Exit this menu by pressing "CL".

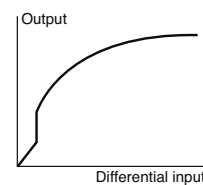
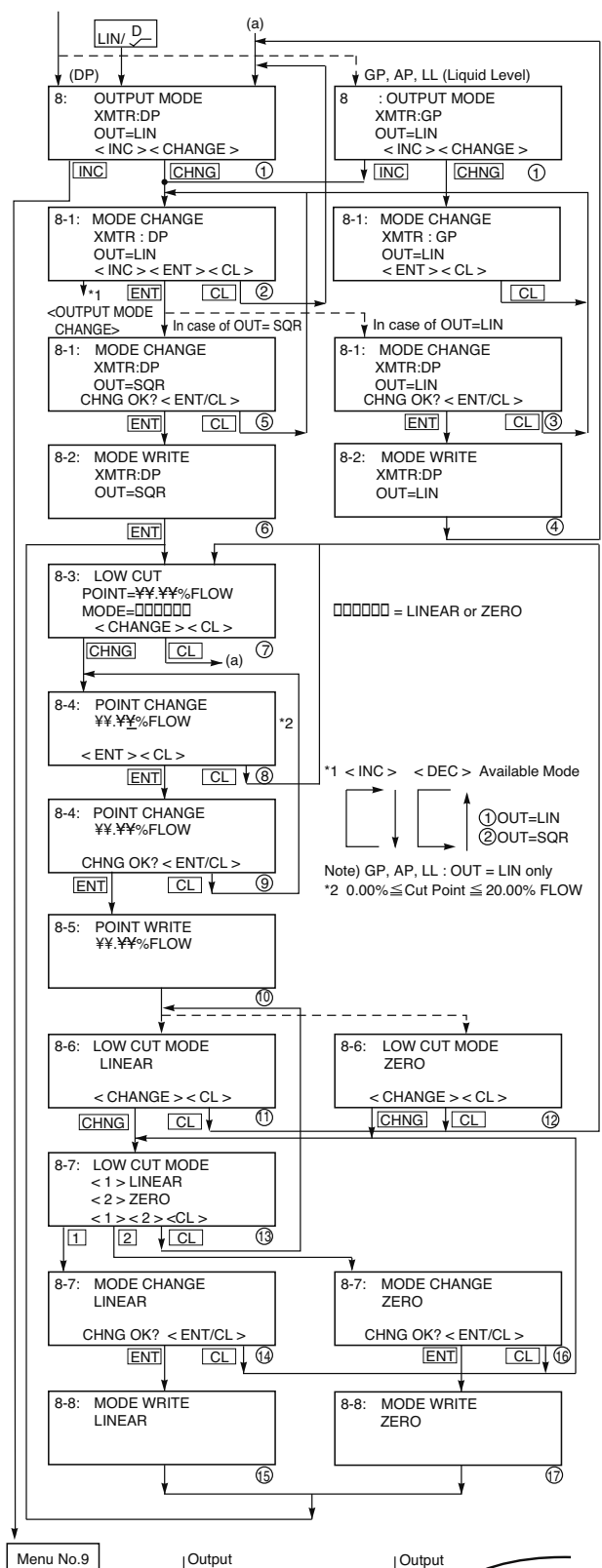


Fig. A: With linear output selected in low cut mode

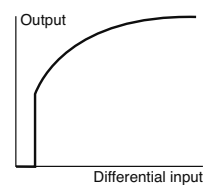


Fig. B: With zero output selected in low cut mode

9- Output signal in the event of defect (BURNOUT EXP.)



Important

The FCX-All pressure transmitters intended for use in nuclear power Impor tant plants are delivered configured with an enabled write protection and with an “OVERSCALE” output signal in the case of a defect. The reconfiguration of the output signal if the device has a defect must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.

9-1 Change of the substitute value

After having pressed “CHNG ALHA” ①, the selection ② can be :

- 1- Not USED (last output signal is maintained)
 - 2- OVER SCALE (above the range of the signal)
 - 3- UNDER SCALE (below the range of the signal)
- By selecting <1>, <2> or <3>.

Press “ENT” to validate ③ and confirm ④.

In mode NOT USED, press “CL” to exit. No parameter is editable.

9-4 Change of the substitute value in UNDER mode (UNDERSCALE)

This display appears when “UNDER” has been selected.

To change the substitute value, press “CHNG ALHA” and then increase or decrease the value with “INC” OR “DEC”.

Validate and confirm with “ENT”.

Setting option :

$3.2 \text{ mA} \geq \text{signal of the substitute value (UNDER)}$
 $\geq \text{current saturation value (lower limit)}$

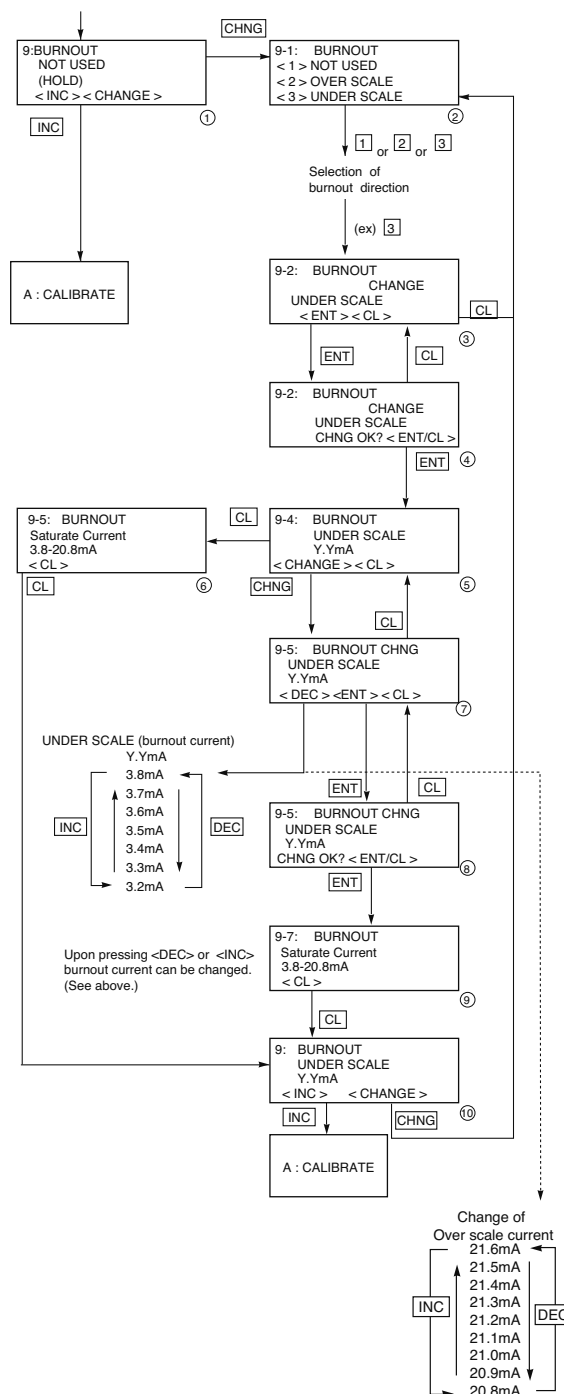
9-4 Change of the substitute value of retrenchment in OVER mode (OVERSCALE)

This display appears when “OVER” has been selected.

To change the substitute value, press “CHNG ALHA” and then increase or decrease the value with “INC” OR “DEC”. Validate and confirm with “ENT”

Setting option:

Current saturation value (upper limit) \leq signal of the substitute value (OVER) $\leq 21.6 \text{ mA}$.



Note:

The current saturation value (high limit and low limit) can be edited by following the “menu J: current saturation value”.

The value of the low current saturation limit is adjustable up to 4.0mA (between 3.2mA and 3.8mA).

The value of the high current saturation limit is adjustable up to 21.6mA (between 20.0mA and 21.6mA).

A- Calibration of the measurement range (CALIBRATE)



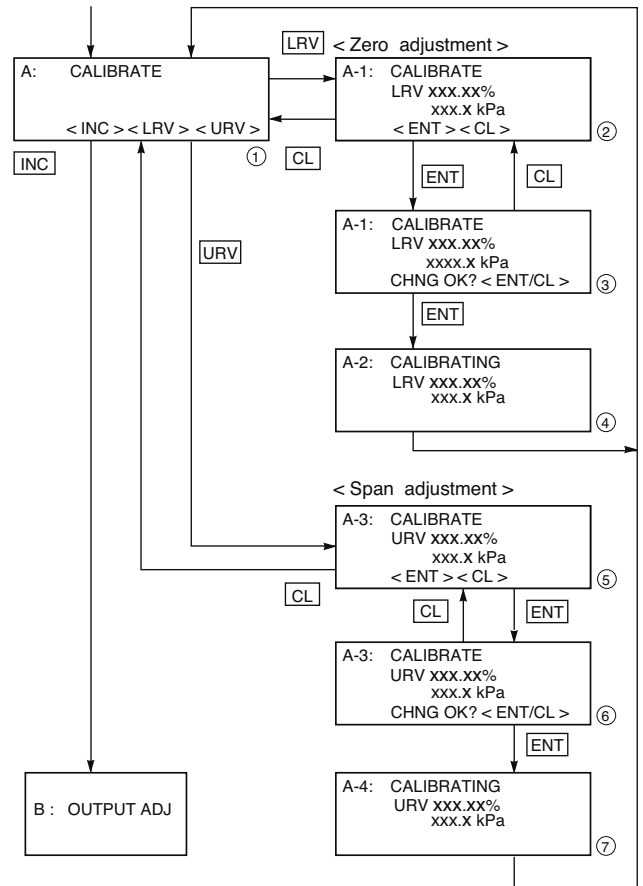
The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection and with a measuring range calibrated at the factory. The on-site configuration of the device must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.

The configuration menu “A:CALIBRATE” (calibration) is intended for the calibration of the measuring limits (LRV and URV). The changes to the measurement range are carried out in the configuration menu “6:RANGE”. Only use the menu “A:CALIBRATE” after having configured LRV and URV correctly in the “RANGE” menu.

Fine adjustment of the lower measurement limit : LRV (Low Range value) = lower measurement limit. It can be done after you have pressed the <LRV> key. The set value is displayed in the menu A-1 that relates to this. Vent the measuring chambers of the transmitter (in the case of a zero offset or for an absolute pressure model, supply the pressure that corresponds to the transmitter), and press the <ENT> key. Then “CHNG OK?” appears on the display, and this must be validated by <ENT> or erased by <CL>. After pressing <ENT>, “A-2: CALIBRATING” is displayed on the screen and the characteristics of the calibration are taken over by the transmitter.

Finally, the configuration menu A “CALIBRATE” reappears on the display.

Fine calibration of the upper measurement limit : URV (Upper Range Value) = upper measurement limit. This is effected once the key <URV> key has been pressed in the same way as for the fine adjustment of the lower measurement limit.



PROHIBITION

- The calibration of the measuring range (URV and LRV) requires a pressure generator with a precision better than that of the device. If the user does not have this type of means of pressure generation, do not use the menu A “CALIBRATE” but only the MENU 6 “RANGE”, otherwise the transmitter would indicate totally erroneous values. The “RANGE” menu allows the accuracy given by the factory calibration to be maintained while varying the measurement range.
- Only use the menu A “CALIBRATE” after having configured LRV and URV correctly in the “RANGE” menu.
- Transmitters with digital indicator and scale specific to the user do not take into account the changed data in the “RANGE” or “CALIBRATE” menus for the display. The displayed values corresponding to points 0% and 100% of the transmitter must be reset for the display to indicate the values consistent with the corresponding pressures.
The configuration displays in 0-100% do not require a new setting.

B- Testing the circuit of the output signal / Calibration of the D/A-converter (OUTPUT ADJ)

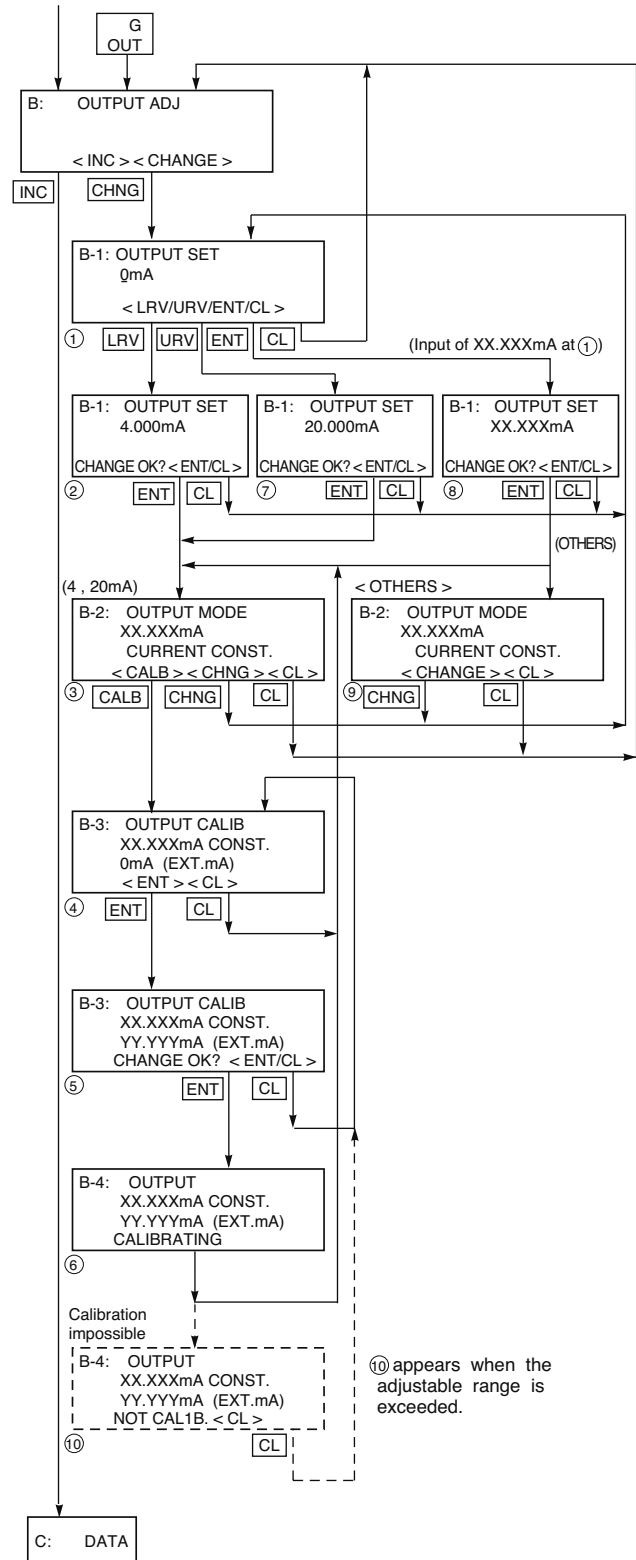
The transmitter has digital electronics. The signals of the measuring cell are processed by a microprocessor and sent to a digital/analogue (D/A-converter) in the form of digital signal. The latter converts this signal into an analogue signal of 4 to 20 mA.

The configuration menu “B:OUTPUT ADJ” (calibration of the output signal) enables the calibration of the digital/analogue converter. The connection of a precision milliammeter, resolution $\pm 1\mu\text{A}$, is used to check the output signal.

This configuration menu also make it possible to verify the operation of all the connected devices in the 4-20mA current loop with the test signals 4 mA and 20 mA.

The configuration menu is selected by pressing the <OUT> key or by pressing <INC> in the menu A. The <LRV> key (lower range value) must be pressed for the calibration of the Initial Value 4 mA and the key <URV> (Upper Range Value) to that of the final value 20 mA. The setpoint value is displayed on the display with the note “CURRENT CONST” (constant current). The corresponding current flows through the circuit once <ENT> is pressed.

If the value read on the precision milliammeter is outside the tolerances of the transmitter, or if it just needs to be refined, a correction may then be carried out. Enter the value read by the milliammeter using the figure keys and validate the entry with <ENT> or clear it with <CL>. As a security measure, “CHNG OK?” appears on the display, and this must be validated with <ENT>. The transmitter will then automatically calculate the deviations between the theoretical value (4 or 20 mA) and the measured value and will make the necessary corrections to the D/A converter. This procedure is applicable at both the LRV (4mA) and the URV (20 mA).

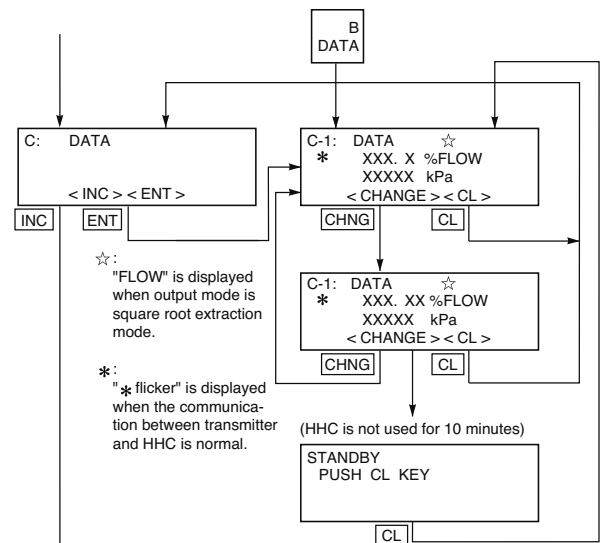


C- Display of the measurement value (DATA)

The measurement values are displayed in the configuration menu "C:DATA".

The flashing "*" indicates that the transmission of the measurement values to the mobile communicator by the transmitter is in progress. The display "%" is increased or reduced by a figure behind the decimal point by pressing <CHNG>.

In this menu, the mobile communicator switches automatically into stand-by mode if no key is pressed for more than 10 minutes. Then just pressing the <CL> makes the measurement values reappear on the display.



D- Self-diagnosis (SELF CHECK)

The configuration menu "D:SELF CHECK" displays the alarm and error messages.

In the selection menu "1:AMP TEMP" (AMPLIFIER TEMPERATURE), the temperature is displayed.

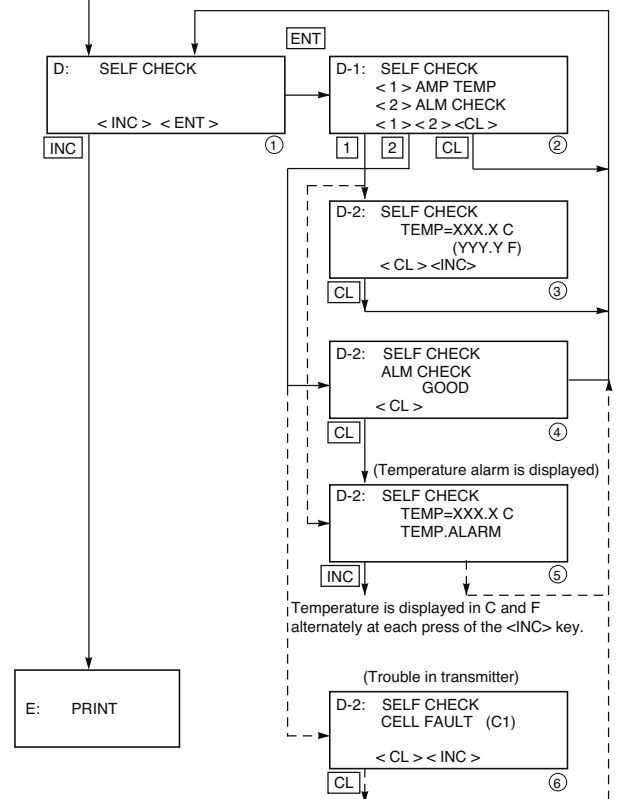
In case of overrun of the temperature limits, "TEMP ALM" (TEMPERATURE ALARM) appears on the third line of the display.

The selection menu "2:ALM CHECK" (ALARM CHECK) (error signal) indicates a possible error.

The display "ALM-CHECK GOOD" means that there is no defect.

In case of problems, the following displays are possible :

- CELL FLT (C), error in the measuring cell
- EEPROM (AMP) FLT, EEPROM defective in the amplifier
- EEPROM (CELL) FLT, EEPROM defective in the measuring cell
- TEMP.ALM, temperature alarm
- XMTR FAULT, electronic module faulty



E- Operation of the printer (PRINT)

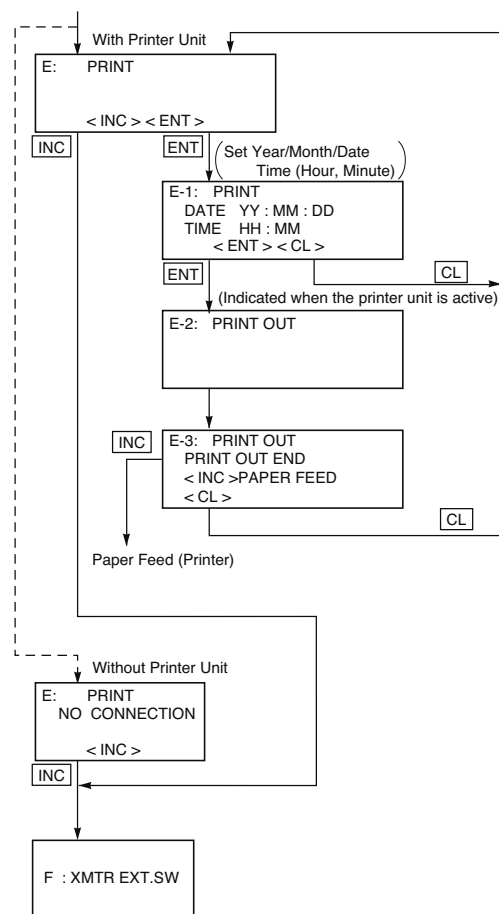
If the printer is connected, the parameters of the transmitter can be printed in the configuration menu “E:PRINT” (print). If the printer is not connected, “NO CONNECTION” appears on the display.

<ENT> must be pressed to print data and enter the date and the hour. After validation by <ENT>, the printing takes place while “PRINT OUT” is displayed. <CL> returns to the output position.

If the printing is finished, “PRINT OUT END” appears on the display. Then the paper can be advanced by <INC> or the configuration menu “E:PRINT” can be returned to by pressing <CL>.

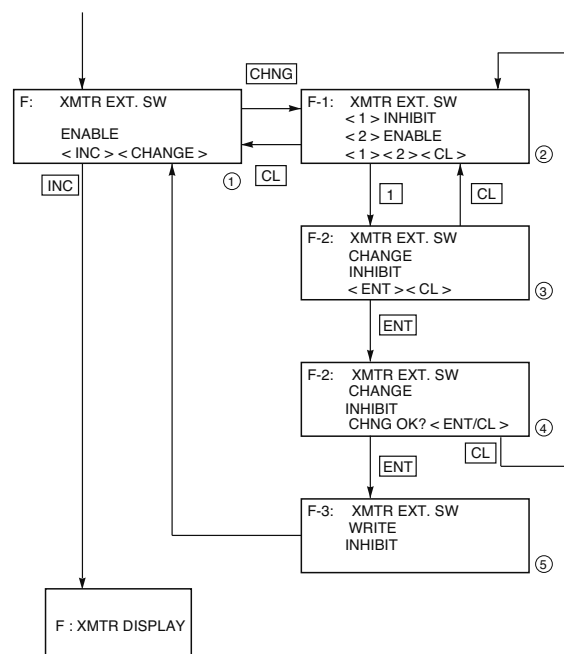
Note:

9 parameters are printed, in addition to the date and time of printing:
(TAG NO, TYPE, URL, RANGE, DAMPING, BURN OUT, DATA, TEMP and RAS).

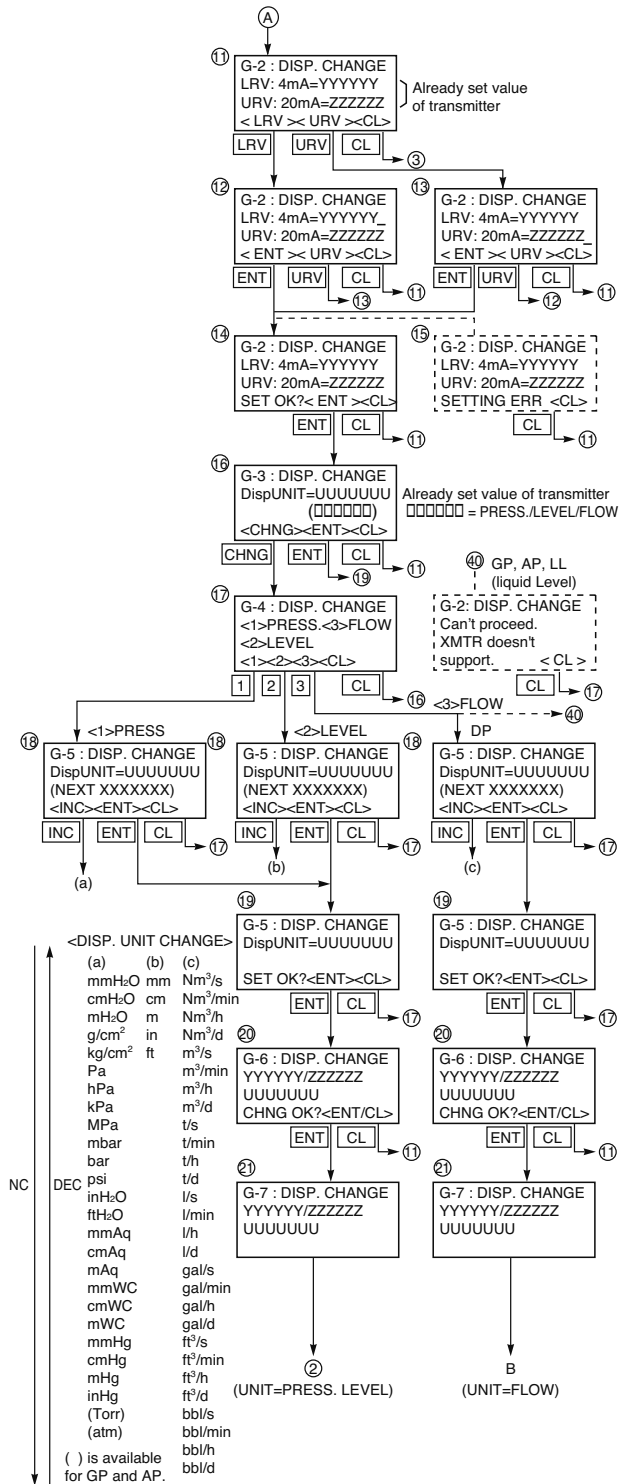
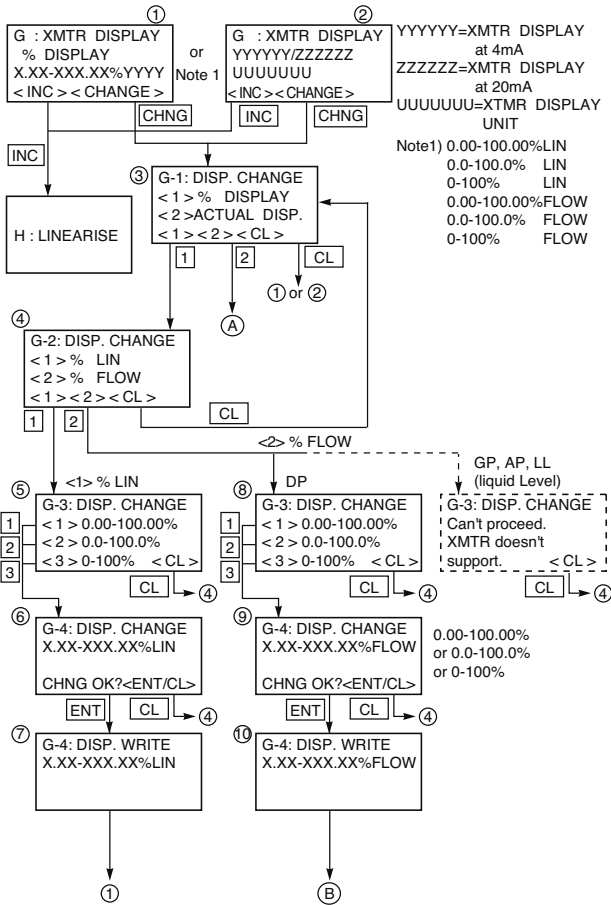


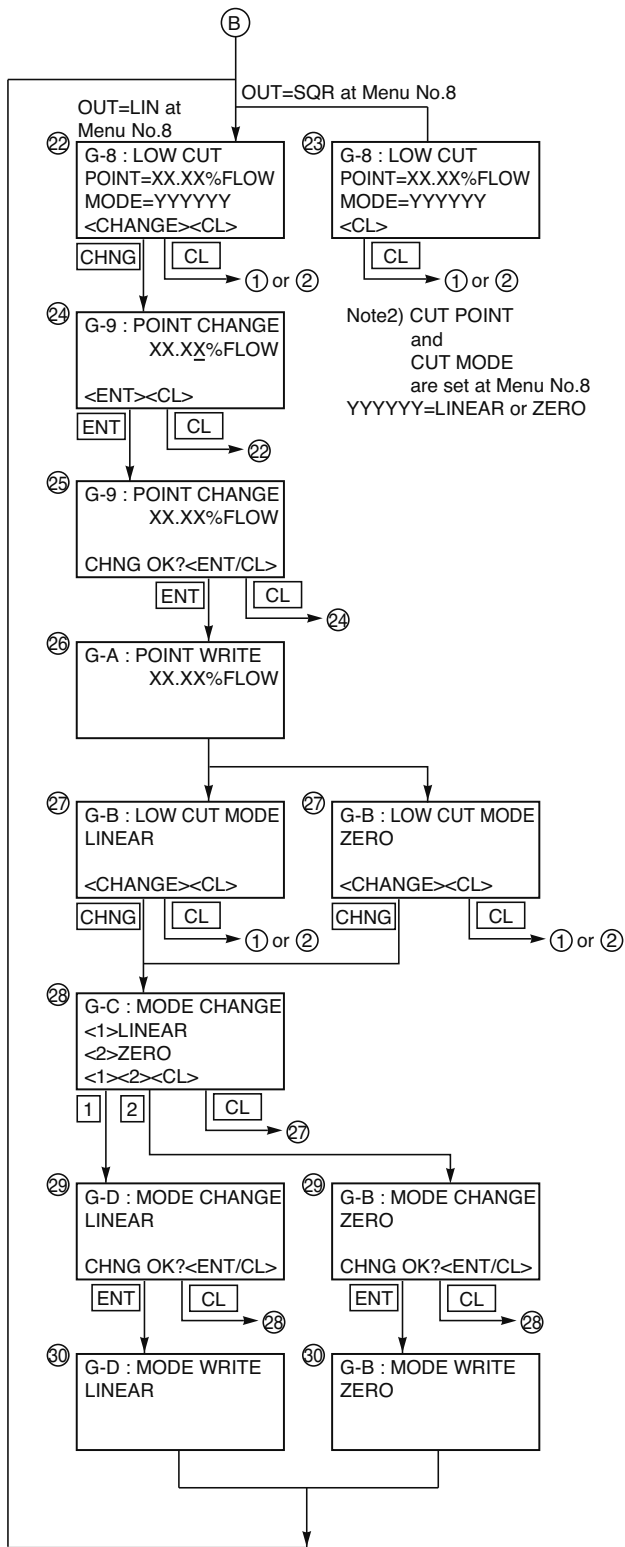
F- Blocking the setting by means of external keys (XMTR EXT.SW)

This menu allows you to lock or unlock the zero adjustment using the external screw. Pressing the <1> key blocks any adjustment by the external screws. Pressing the <2> key authorises this manipulation.

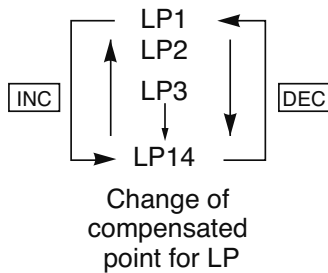
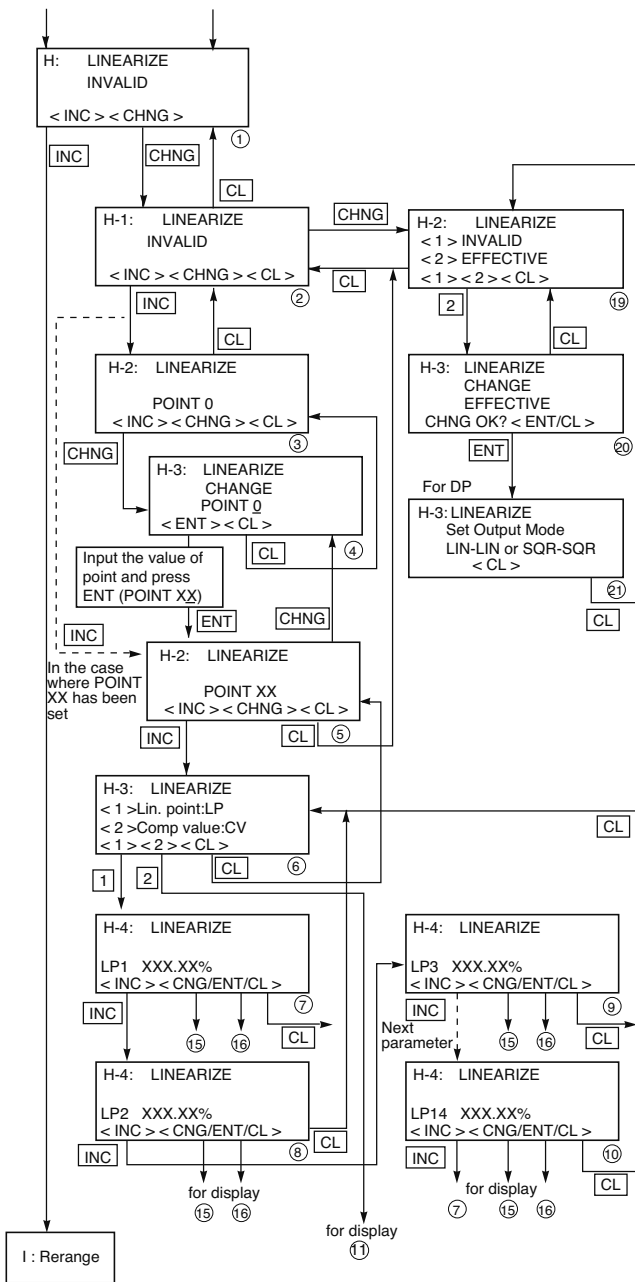


G- Display of the digital indicator (XMTR DISPLAY)





H- Linearisation (LINEARIZE)



The linearisation function can be used for level and capacity measurements in a closed or open tank.

This function is applicable if the geometry of the tank does not allow a linear relationship between level and capacity.

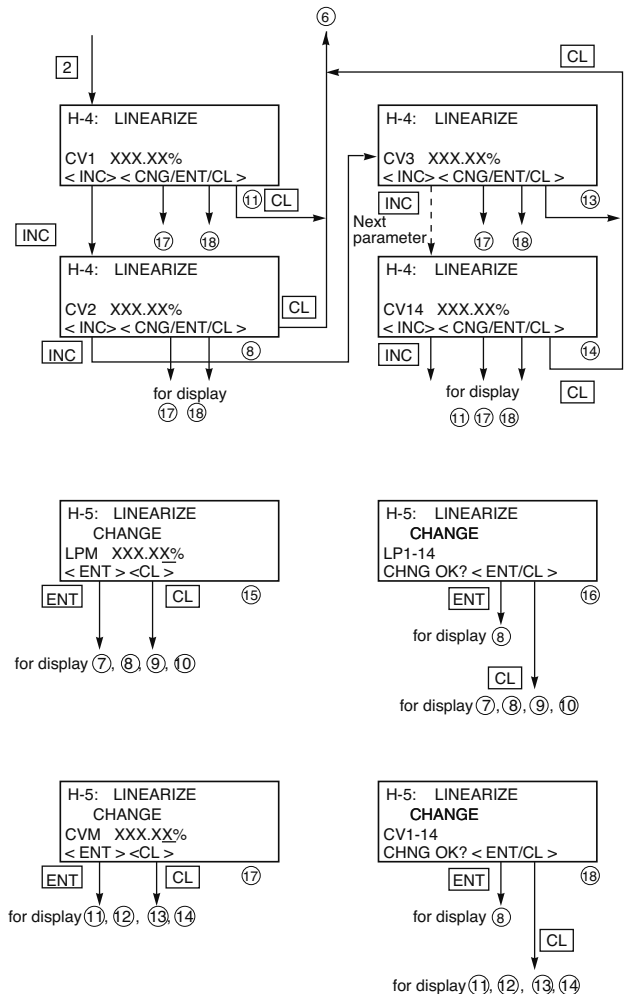
(For example: spherical tank or cylindrical tank lying down...).

14 compensation points are available and they correspond to 15 straight segments.


The linearisation is possible only in version ≥ 6.0 of the mobile communicator and rev. ≥ 25 for the electronics.

Note :

This function is not used in nuclear power plants.



I- Resetting of the measuring range (RERANGE)

 Important	<p>The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection.</p> <p>The resetting of the measuring range must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.</p>
---	--

The function of “RERANGE” can be used in all cases where a zero increase or deletion is necessary (for example a level measurement). The offset and the scale adjustment can be carried on a transmitter that is already installed and which is set to the maximum scale or to the customer's scale.

It is essential to adjust the LRV (4 mA) and URV (20 mA) to apply the corresponding pressure to the transmitter.

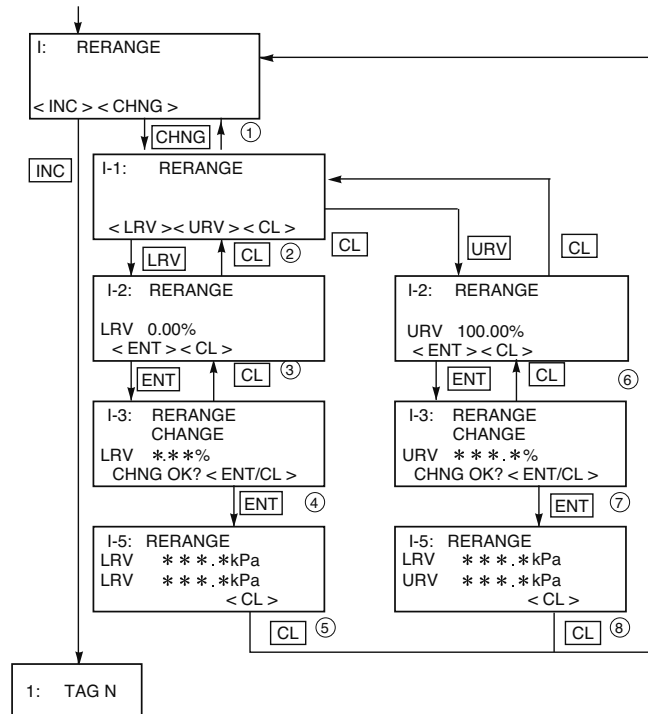
Example :

LRV = 0% empty tank

URV = 100% full tank or other %

Corresponding to a maximum height in the tank.

This function is only possible in version ≥ 6.0 of the mobile communicator and revision ≥ 25 for the electronics.



J- Current saturation value (SATURATE CUR)



Important

The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection and a saturation current set at 3.2 mA at its low value and 21.6 mA at its high value. The reconfiguration of these settings must be done before the write protection is lifted according to the provision specified on page 56. After all the operations are complete, the write protection must be replaced.

The value of the min/max output signal (low limit=SAT LO, high limit=SATO HI) and the extended function (NORMAL= standard setting, EXP. = extended setting) can be configured.

In the normal position the values of the min/max output signal are set to 3.8 mA and 20.8 mA.

To expand the limits of the min/max output signal values, option 3 on the screen "J", (SPEC/NORMAL) must be selected to programme the output signal.

- Modification of the value of the min. output signal (lower limit) by programming "EXP". The value of the output signal can be changed by pressing the buttons on the <INC> or <DEC>.

3.2 mA ≤ substitute value (UNDER SCALE) ≤ saturation current (lower limit) ≤ 4.0 mA

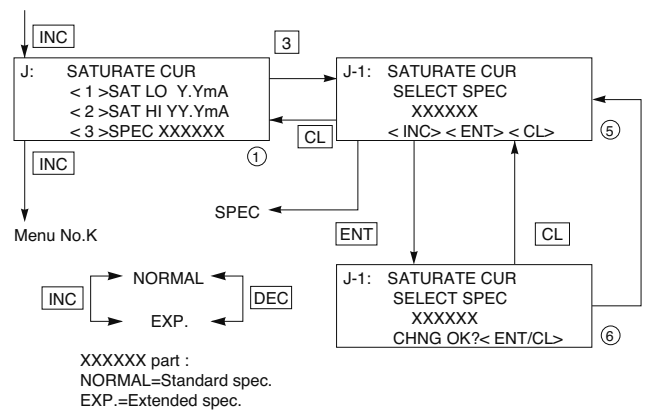
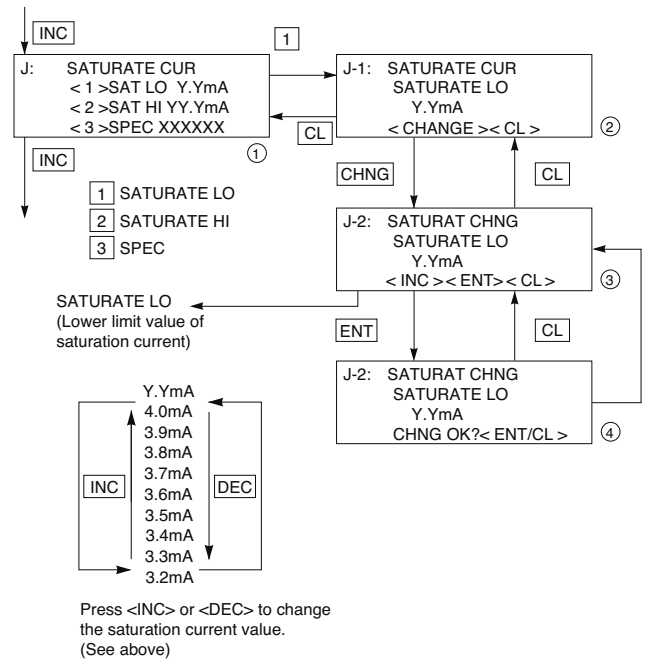
- Modification of the value of the max. output signal (upper limit)

Follow the same procedure as for the programming of the lower limit value. Choose the upper limit by pressing 2.


Change the value of the output signal by using the keys <INC> or <DEC>.

20.0 mA maximum saturation current ≤ substitute value (OVER SCALE) 21.6 mA.

* The output signal corresponding to the substitute value is programmable in the menu "9".



K- Write protection (WRITE PROTCT)

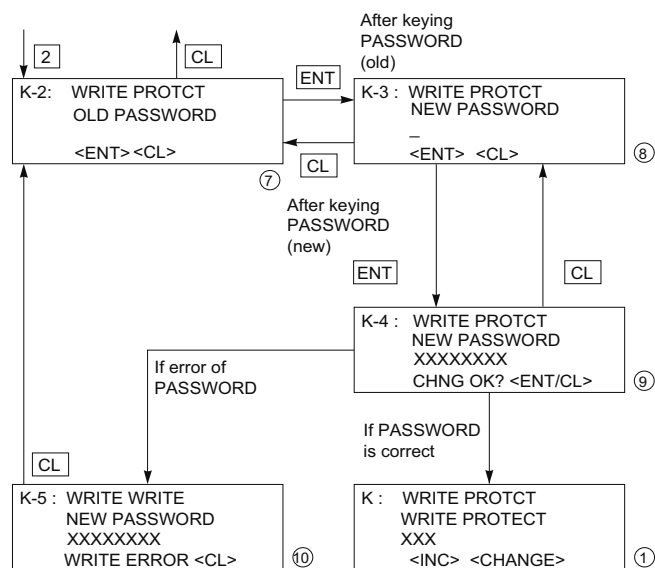
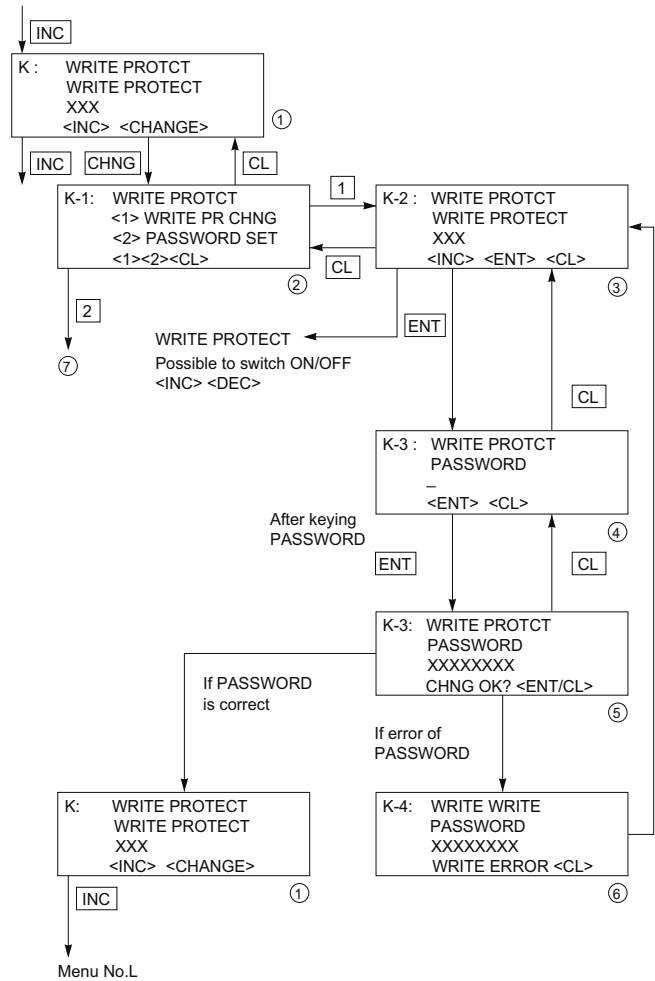
 Important	<p>The FCX-All pressure transmitters intended for use in nuclear power plants are delivered configured with an enabled write protection. A password is required to unlock it.</p>
---	---

The adjustment of the transmitter can be locked (write protection) by entering a password (PASSWORD)

If the lock is active, the write protection cannot be deleted using the push buttons on the digital indicator.

Refer to the menu "K: Write protection" for the local setting using the push-buttons.

* The locking of the transmitter settings (write protection) using the password is identical to the locking function of the local setting with the push buttons.

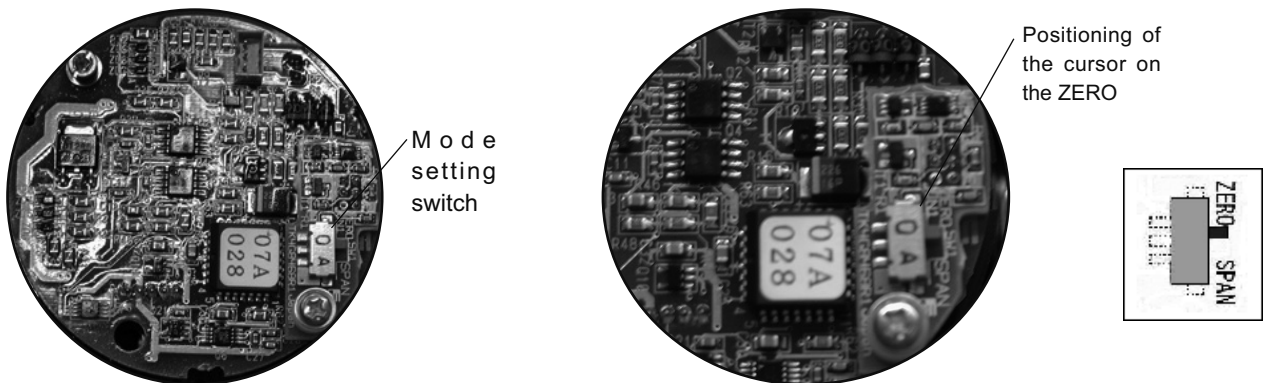


6.2 Zero adjustment procedure with the external screws (do not use in nuclear power plants)

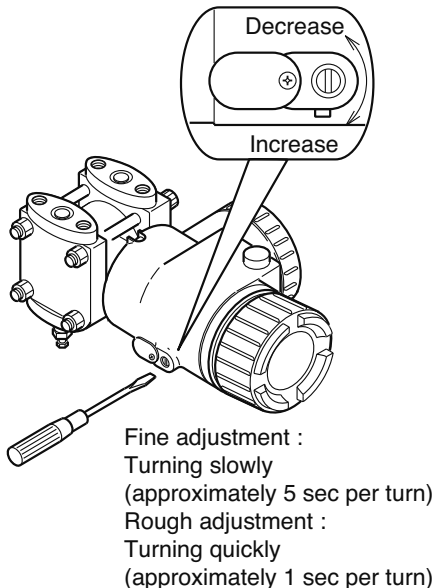
In nuclear power plants, the zero adjustment may only be done with the aid of the mobile communicator.

The point 0 can be adjusted with the external setting screw following the procedure below :

- (1) Position the cursor of the switch on the ZERO



- (2) Apply an input pressure corresponding to the LRV value (4mA - 0%)
- (3) Refine the output 4mA using the external screws.



Notes :

- 1) If the local zero setting has been prohibited by the FXW, the external screw adjustment is inoperative. The FXW must be used again to authorise its activation.
- 2) If a digital indicator is mounted on the transmitter, check that the "ZERO" LED indicator light is lit.

! INDICATION

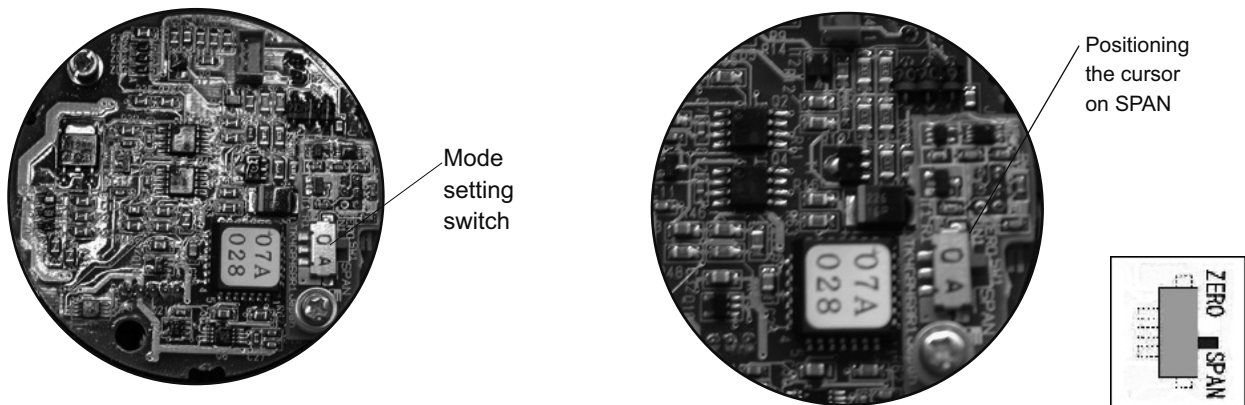
After performing the settings, maintain the electrical supply for at least for 10 seconds to allow data to be recorded.

6.3 Span adjustment procedure with the external screws

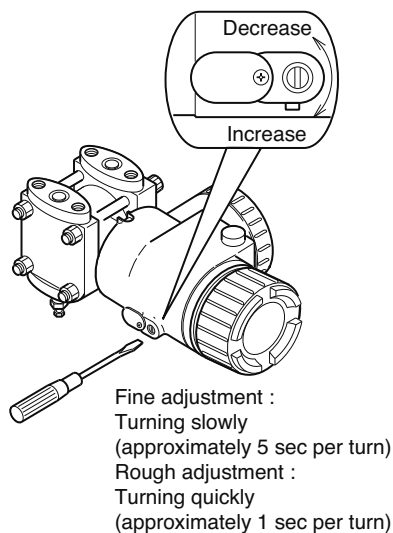
In nuclear power plants, the measurement scale may only be adjusted with the aid of the mobile communicator.

The measurement scale can be adjusted with the external adjustment screw following the procedure below :

(1) Position the switch cursor on SPAN



- (2) Apply an input pressure corresponding to the value URV (20 mA - 100%)
- (3) Refine the output 20mA using the external screws.



Notes :

- 1) If the local zero setting has been prohibited by the FXW portable communicator, the external screw adjustment is inoperative. The FXW must be used again to authorise its activation.
- 2) If a digital indicator is mounted on the transmitter, check that the "ZERO" LED indicator light is lit.

! INDICATION

After performing the settings, maintain the electrical supply for at least for 10 seconds to allow data to be recorded.

6.4 Local adjustment unit with LCD display

In nuclear power plants, all on site modifications of the configuration of the FCX-All transmitters may only be done with the aid of the mobile communicator.

1. Description

If the transmitter is equipped with a numerical indicator, the local adjustment on the FCX-All transmitter is possible without the use of the FXW communicator.

The following switches are integrated on the digital indicator to perform the local settings :

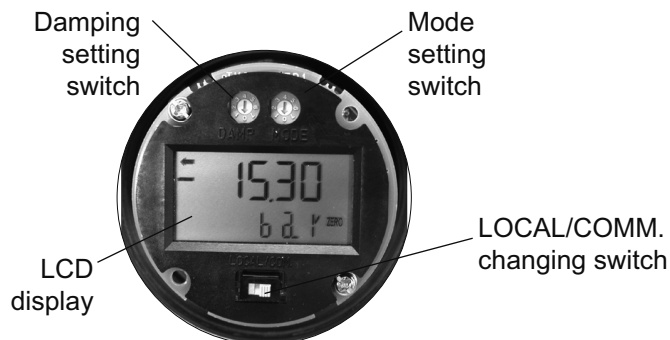


Table 1. Functions of "Mode" setting switch

Position of switch	Functions of external adjustment screw	DP and Flow transmitter (Model FKC)	Gauge and Absolute pressure transmitter (model: FKG/FKA)
0	Zero Adjustment	Proportional to differential pressure	Proportional to pressure
1	Span Adjustment	Proportional to differential pressure	Proportional to pressure
2	Locking of function	Proportional to differential pressure	Proportional to pressure
3	Adjustment fixed current	4 mA fixed current	4 mA fixed current
4	Adjustment fixed current	12 mA fixed current	12 mA fixed current
5	Adjustment fixed current	20 mA fixed current	20 mA fixed current
6	Span Adjustment	Proportional to flow	Proportional to pressure
7	Locking of function	Proportional to flow	Proportional to pressure

Table 2. Functions of "Damping" setting switch

Position of switch	Time constant (sec)
0	0
1	0,3
2	0,6
3	1,2
4	2,4
5	4,8
6	9,6
7	19,2

Table 3. LOCAL/COMM. changing switch

Position of switch	Adjustment methods
LOCAL	Adjustments of transmitter are carried out by MODE setting switch and DAMPING switch.
COMM.	Adjustments of transmitter are carried out by FXW or UHI 275

2. Transmitter adjustment method

The “LOCAL/COMM” switch makes it possible to perform the transmitter setting either locally or remotely with a mobile communicator.

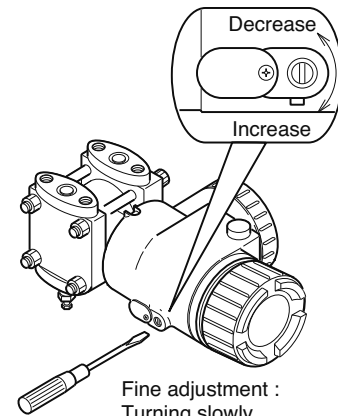
In the “**COMM**” position, the settings are changed with a mobile communicator or with a PC. In the “**LOCAL**” position, the transmitter settings are changed using the external screws on the electronic unit and following the position of the switch on “**Mode**” or “**Damp**”.

3. Local setting

3.1 Zero adjustment (Change Lower Range Value)

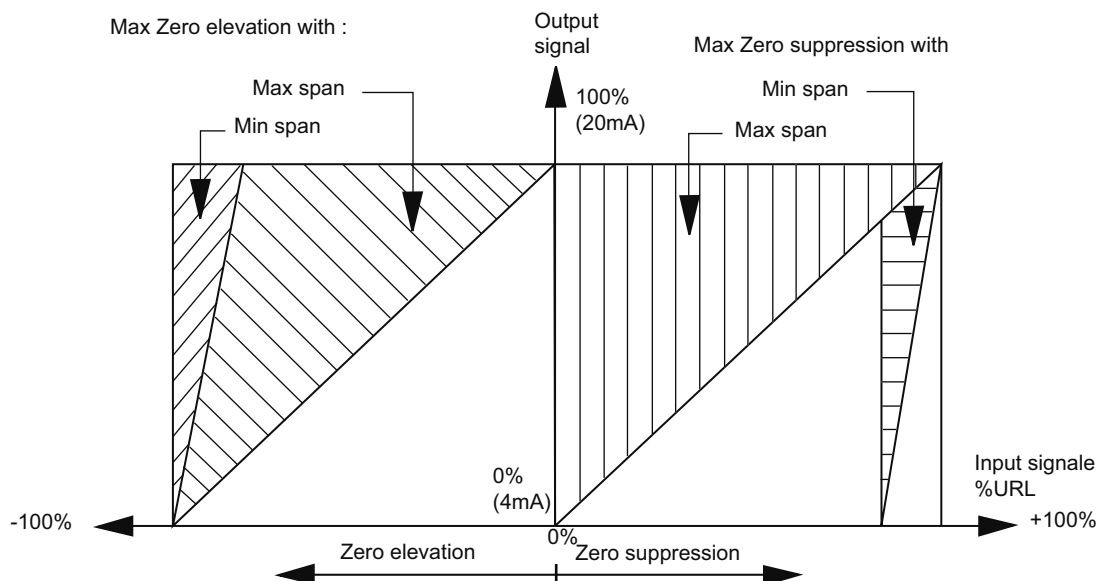
The zero (4 mA) can be adjusted thanks to the external screw located on the electronic control unit on the condition that the switch (2 positions) is on “LOCAL” and the switch “Mode” to “0”.

- (1) Check that the “zero” is indicated on the digital indicator in which case put the switch “Mode” to position “0”.
- (2) Apply the pressure corresponding to zero on HP.
- (3) Adjust using the external screw located on the electronic control unit the output signal to 4 mA.



Fine adjustment :
Turning slowly
(approximately 5 sec per turn)
Rough adjustment :
Turning quickly
(approximately 1 sec per turn)

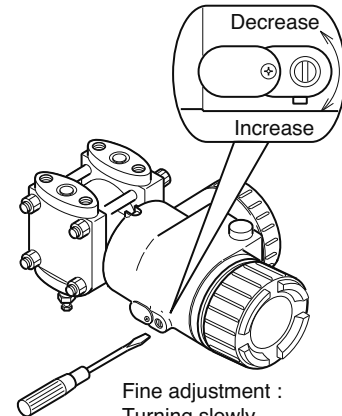
To adjust a positive or negative offset (deletion or elevation of the zero), you must apply the corresponding pressure on the transmitter and adjust the output signal to 4 mA, using the external screw located on the electronic unit.



3.2 Span adjustment (Change Upper Range Value)

Prior to the adjustment of the measuring range, first check the “zero” setting. There is no interference between the zero adjustment and the measuring range.

Each type of transmitter has its own maximum measuring range. The measuring range (20mA) can be adjusted with the external screw located on the electronic control unit on the condition that the switch (2 positions) is on “LOCAL” and the “Mode” switch is in position “1” or “6”.



- (1) Put the “Mode” switch to position “1” or “6”.
- (2) Apply pressure corresponding to that of the measuring range of the transmitter.
- (3) Adjust the output signal to 20 mA with the external screw.
- (4) Check the output signal corresponding to the zero by applying the corresponding pressure and check that the output signal is 4 mA, put the “Mode” switch in the appropriate position for your measurement.
- (5) After the settings described (1) to (4), put the “Mode” switch in the appropriate position for your measurement.

Fine adjustment :
Turning slowly
(approximately 5 sec per turn)
Rough adjustment :
Turning quickly
(approximately 1 sec per turn)

! INDICATION

After adjustment, the transmitter should be kept energized at about 10 sec to write the adjustment parameter into memory.

4. Damping adjustment

If the pressure variation to be measured entails a variation of the impulsive output signal, it is recommended that the output signal be dampened.

The damping is adjustable with the 7 positions of the “Damp” switch.

Additional time is added to the response time of the transmitter, through the position of the “Damp” switch.

These added times can be adjusted to 0, 0.3, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2 seconds without influencing the setting of the measuring range.

The relationship between the position of the “Damp” switch and the damping time is indicated in Table 2.

Note :

The damping is a time value added to the output signal and concerns only the electronics of the transmitter. (See details in the technical specification)

! INDICATION

After the damping time is set, the damping time of the system must be adapted. Check the compatibility of the 2 damping time settings.

5. Fixed current output and its adjustment.

The transmitter can provide an output signal of 4, 12 or 20 mA based on the position of the “Mode” switch in position 3, 4 or 5.

The adjustment loop can be checked by this function. The adjustment of the output signal (4/20 mA) can be performed if the “Mode” switch is in position 3 and 5.

No maintenance of transmitter is necessary.

According to the application conditions and the measured process, a periodic check of the output signal of the transmitter has to be done by skilled people (suggested period 36 months).

7.1 The following verifications are suggested by the manufacturer

- Leak check of the tightness of the transmitter and the process connections as often as required.
- Check and possible clean all wetted transmitter parts (see parts list) to make guarantee the chemical resistance of the wetted parts. In the case of corrosion, find out the reasons of the corrosion and replace and adapt the concerned parts or replace the complete transmitter with an adapted one. Please follow the replacement procedure of the measuring cell described later.
- Visual inspection of the no-wetted parts of the transmitter. Protect or replace the transmitter if necessary.

7.2 Troubleshooting

If troubleshooting, check the fault by using the Hand Held Communicator (HHC) with function "SELF CHECK" - Refer the chapter " Operation" in this manual.

The transmitter is supplied with the burnout adjusted : "fixed" output signal in case of failure.

If an abnormality occurred in the process or transmitter, action should be taken with references to the table below.



Faults	Cause	Remedy
Output current overshoots scale (exceeds 20mA).	(1) The manifold valve does not open/close normally. (2) Pressure leak is occurring. (3) Process piping is improper. (4) Process pipe is clogged. (5) Power supply voltage and/or load resistance is improper. (6) Voltage between the external connection terminals of transmission unit is wrong. (7) Zero and span are not adjusted. (8) Electronics unit is faulty.	Repair the valve so that it opens/closes normally. Repair a leak. Make correct piping. Eliminate the cause of clogging. Make arrangement to obtain proper values. For power supply voltage and load resistance, refer to 4.2. (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.) Check for faulty cable, insulation, etc. and repair as needed. For power supply voltage and load resistance, refer to "4.2". (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.) Readjust according to chapter 6. Replace the electronics unit according to 7.3.
No output current (less than 3.8 mA).	(1) Same as (1) to (4) above (2) Power supply polarity is wrong. (3) Power supply voltage and/or load resistance is improper. (4) Voltage between the external connection terminals is wrong. (5) Electronics unit is faulty.	Correct wiring according to 7.1. Make arrangement to obtain proper values. (For power supply voltage and load resistance, refer to 7.2.) (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.) Check for faulty cable, insulation, etc. and repair as needed. (For power supply voltage and load resistance, refer to 4.2.) (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.) Replace the electronics unit according to 7.3.
Output current error	(1) Process piping is improper. (2) Gas or solution is mixed in. (3) Liquid density changes. (4) Ambient temperature changes widely. (5) Zero or span has deviated. (6) Electronics unit is faulty.	Correct the piping. Vent or drain the transmitter. Perform density compensation. Minimize the temperature change. Readjust zero or span. Replace the electronics unit according to 7.3.

If remedy is impossible, contact Fuji Electric's service department.

7.3 Replacement of defective parts

In nuclear power plants , repairs, modifications or interventions on the sub-assemblies or the internal components of the FCX-All transmitters are prohibited. In the event of a fault, the transmitters must be replaced on site by the new equipment. New spare parts must be used.

If the transmitter fails and the parts need to be changed, bleed the measuring cell chambers completely.

Remove the transmitter and take it to the workshop.

The transmitter consists mainly of the amplifier and the measuring cell.

Launch a self-test with the FXW to facilitate the diagnosis.



DANGER

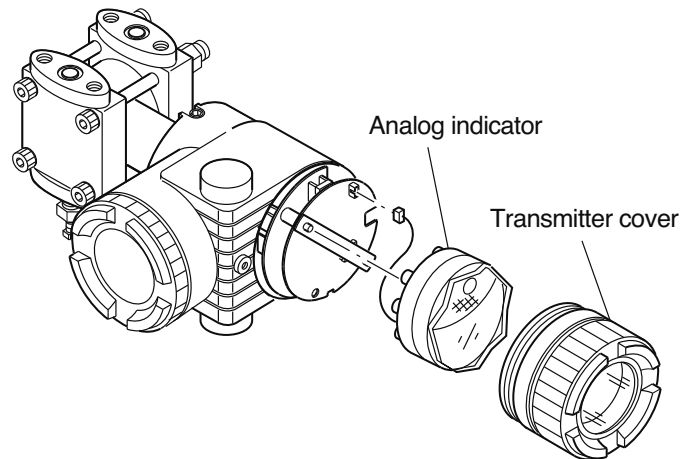
During the disassembly of an explosion-protected device, cut off the power supply and then disconnect the pipes and the wiring. To avoid any risk of an accident (explosion, fire, etc), never disconnect the transmitter under voltage.

Identification of the defective part

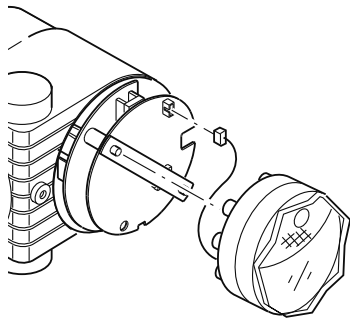
Please contact Fuji Electric to analyse the failure and replace the defective parts.

Replacement of the analog indicator

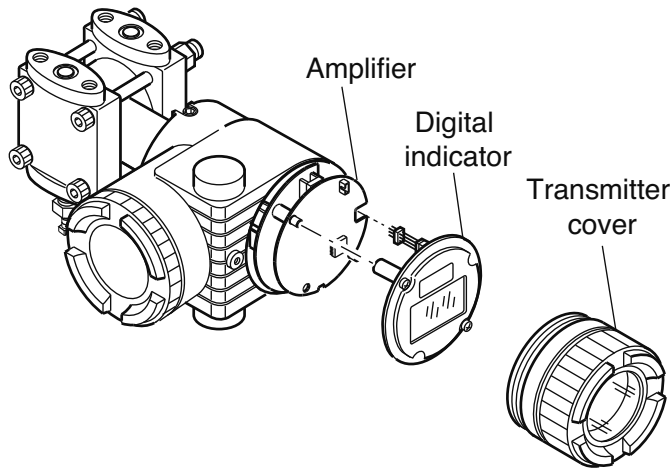
In nuclear power plants , repairs, modifications or interventions on the sub-assemblies or the internal components of the FCX-All transmitters are prohibited. In the event of a fault, the transmitters must be replaced on site by the new equipment.



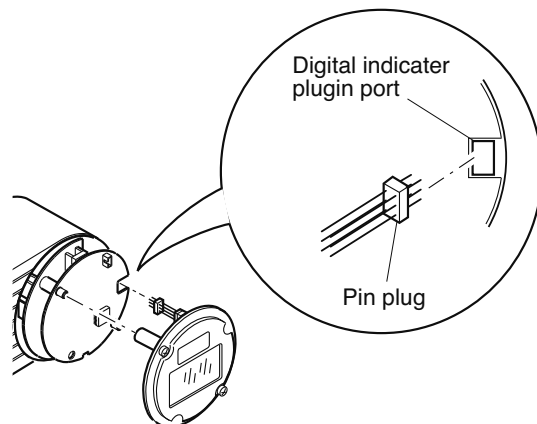
- (1) Remove the cover on the indicator side
- (2) Remove the indicator as well as the connector
- (3) Refit a new indicator in the reverse order of disassembly
- (4) Screw on the cover



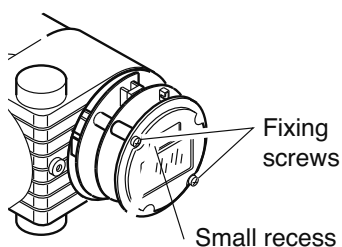
Replacement of the digital indicator



- (1) Remove the cover on the electronic side
- (2) Remove the 2 fixing screws of the indicator
- (3) Pull on the white part (locking) of the connector located on the amplifier, at the end of the flexible ribbon cable of the indicator. Pull gently on the flexible ribbon cable that has been released.
- (4) Refit a new indicator in the reverse order of disassembly. Push well on the white part (locking) of the connector located on the amplifier.
- (5) Assemble the two units by tightening the 2 fixing screws



Before tightening, make sure a small recess on the surface is positioned at the top as shown below. Make sure not to damage the connection pads.



7.4 Adjustment after replacement of the amplifier unit or the measuring cell

Adjustment

After completion of the assembly work mentioned above, use the following procedures for adjustment and setting.

Adjustment should be performed using the FXW portable communicator.

(1) After replacement of electronics unit (including replacement of internal parts)

Step	Adjustment item	Page
1	Constant current output (output circuit) Digital/Analog	27-28
2	TAG N°	40
3	Type of transmitter	40
4	Unit	42
5	Adjustment of the zero and span	43
6	Calibration of the zero and span adjustment	43
7	Damping	44
8	Output mode LIN / $\sqrt{\quad}$	45
9	Burnout	46
10	Lock of adjustment local function	50

(2) After replacement of detecting unit (including replacement of internal parts)

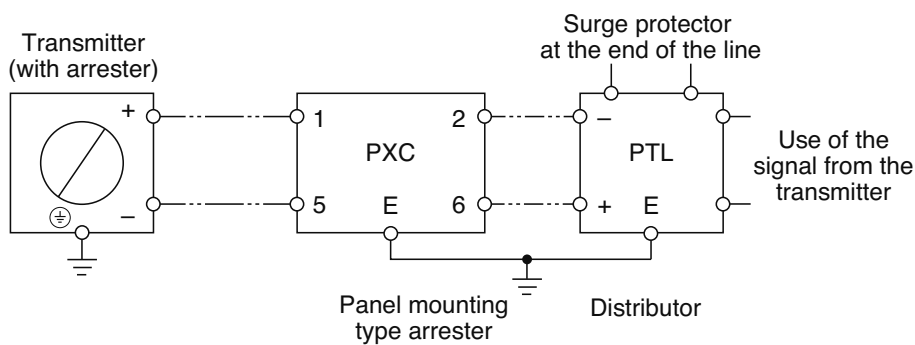
Step	Adjustment item	Page
1	Adjustment of the zero and span	43

An arrester is used to protect a transmitter or receiver from an abnormal voltage such as lightning surges induced into signal lines. A built-in type arrester is mounted behind the terminal unit.

A nameplate marked “**with arrester**” is attached to the terminal unit of transmitter with a built-in arrester.

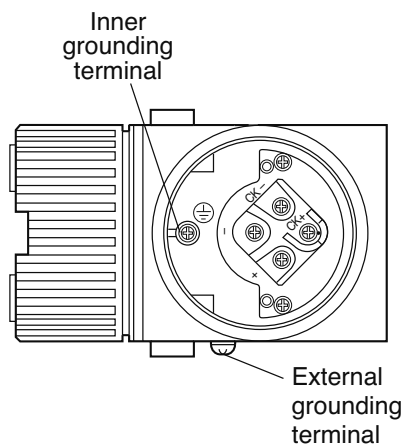
Installation

If power surges are likely to appear on the 4-20 mA loop, for example because of the lightning, it is advisable to also install a surge protector at the end of the line, at the side where it is used (control room), to protect the instruments that also receive the signal from the transmitter.



Grounding

The grounding terminal of the surge suppressor is connected to that of the transmitter, on the inside. It is therefore only necessary to link that the external terminal of the transmitter to the earth. The internal terminal for grounding is only used if a transmitter with intrinsic safety or an explosion-proof one is used.



! INDICATION

Grounding resistor should be 100 Ω.

For earthing, do not use an earthing cable intended for a protection against lightning.

In the case of a device with the option of a surge protector, the maximum supply voltage is 32 Vdc.

Maintenance

Check of arrester :

Measure the output current of the transmitter on the 4/20 mA loop on the one hand, and between terminals CK+ and CK- on the other hand.

If the measured values are the same, the surge protector is in good condition.

If the measured values differ by more than 0.1% (0.016 mA), the surge protector is defective.

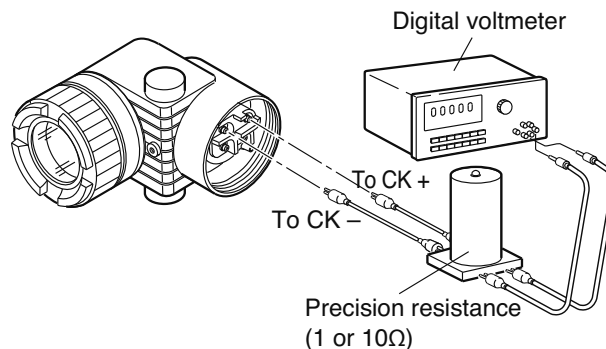
The whole terminal block must then be replaced.

Do not perform a dielectric test on of transmitters equipped with a surge protector.

The test equipment generates high voltages which would damage the surge protector.

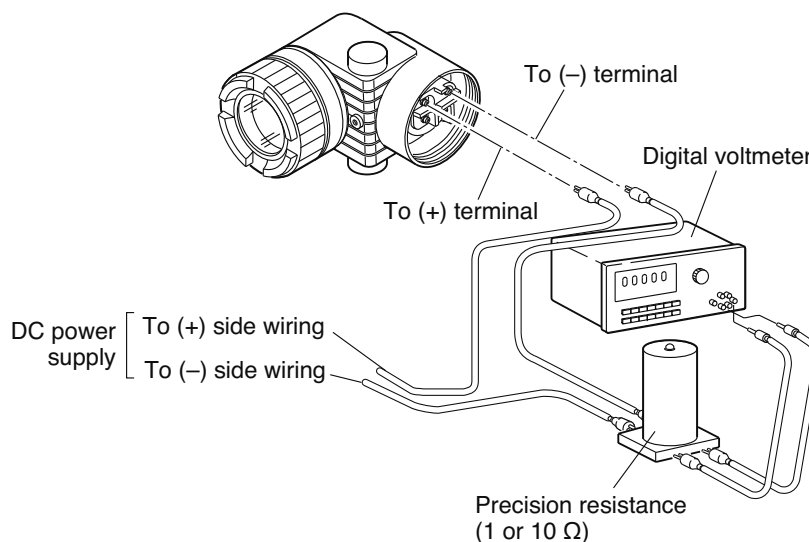
If an insulation test is done, use a low voltage ohmmeter (27 Vdc max) with an internal insulation resistance of 12Ω max.

Output current between terminals CK+ and CK- :



Current output on the 4/20 mA loop

Disconnect the wire from the loop of the “-” of the terminal, connect one end of the test resistance to the previous wire and the other end to the “-” terminal.



Preparation for calibration

The transmitter should be calibrated in a calibration room. For calibration of each transmitter, the following devices are required.

- Pressure source and pressure measuring equipment (should have as high an accuracy as possible 0,05% mini)
 - *Measurable ranges are listed in the table below.
- DC power supply (24 V DC)
- Load resistance 250Ω with a precision better than 0.01%.
- Digital voltmeter with an accuracy better than 0.1%.
 - *Use meter having a 5-digit display.
- FXW type portable communicator to test the transmitters.

Measurable range

Differential pressure range

FKC model kPa (mbar)
0.1~1 (1~10)
0.1~6 (1~60)
0.32~32 (3.2~320)
1.3~130 (13~1300)
5~500 (50~5000)
30~3000 (300~30000)

Pressure range

FKG model kPa (bar)
1.3~130 (0.013~1.3)
5~500 (0.05~5)
30~3000 (0.3~30)
100~10000 (1~100)
500~50000 (5~500)

Absolute range

FKA model kPa abs. (bar abs.)
1.6~16 (0.016~0.16)
1.6~130 (0.016~1.3)
5~500 (0.05~5)
30~3000 (0.3~30)

Differential pressure range with remote seal(s)

FKD model kPa (mbar)
0.32~32 (3.2~320)
1,3~130 (13~1300)
5~500 (50~5000)

Pressure range with remote seal

FKB model kPa (bar)
1.3~130 (0.013~1.3)
5~500 (0.05~5)
30~3000 (0.3~30)
100~10000 (1~100)
500~50000 (5~500)

Level pressure range

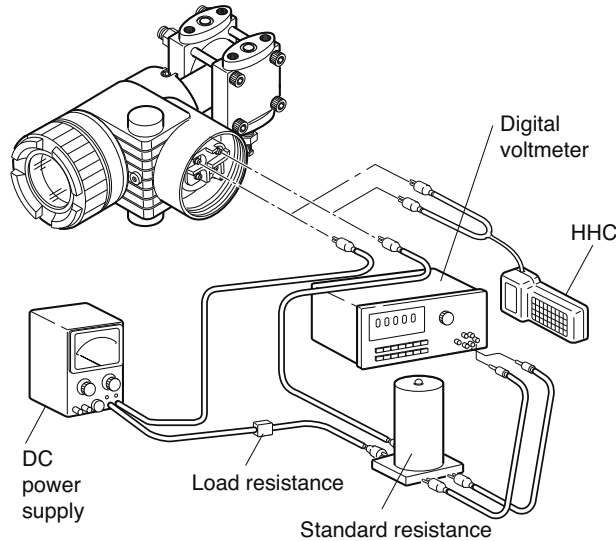
FKE model kPa (mbar)
0.32~32 (3.2~320)
1.3~130 (13~1300)
5~500 (50~5000)

Calibration procedure

(1) Make wiring according to the diagram below.

Connect DC power supply (power source), digital voltmeter (measuring device), standard resistance and HHC (Hand Held Communicator):

When current is measured with an ammeter connected to CK+ and CK – terminals, the internal resistance of the ammeter should be 12Ω or less.



INDICATION

To establish a circuit in conformity with a correct communication during the use of the FXW, a load resistance of 250Ω minimum is necessary.

(2) Calibration of output circuit D/A :

This Menu has to be used to change the output signal values corresponding to zero and 100% of the output signal. No pressure generator is required.

(3) Zero/span adjustment:
(refer pages 57 to 61)

(4) Accuracy test

Apply input pressures in the order of 0%, 25%, 50%, 75%, 100%, 75%, 50%, 25% and 0%, and read output at each input pressure.

Make sure the difference between each output value and input pressure (%) is within the accuracy rating listed in the table below.

The voltage values in the table are dependent on use of "DC power supply + standard resistance 250Ω + digital voltmeter (measuring device).

Measurement category	Reference value	Accuracy (according type)	
		Accuracy : 0,1%	Accuracy : 0,2%
Percent display %	0, 25, 50, 75, 100	±0,1	±0,2
Current measurement (mA)	4, 8, 12, 16, 20	±0,016	±0,032
Voltage measurement (V) On load resistance of 250 Ω	1, 2, 3, 4, 5	±0,004	±0,008

A3 PARAMETER SETTING PRIOR DELEVERY

The damping value (time constant), function of zero/span adjust screw, output current mode, indicator scale, cut point, mode below cut point and burnout, have been set prior to delivery as shown in the following.

Each parameter is changed by using FXW portable communicator.

N°	Item	contents of parameter
1	Damping value (time constant)	No damping (= measuring period)
2	Zero adjust external screw	Zero point adjustable possible (Note 1)
3	Current output mode	Could be set in factory when ordering (note 2)
	Digital indicator scale (9th digit of code symbol)	Could be set in factory when ordering
4	Cut point (square root extraction mode setting)	7.07%
5	Mode below cut point (square root setting)	linear
6	Burnout	Could be set in factory when ordering (note 3)
7	Linearize function	Invalid

Note 1) For span adjustment, a portable communicator should be used and can also be used for zero adjustment.

Note 2) In both the differential pressure transmitter (FKC) and remote seal type (FKD), the output current mode is set in linear unless it is designated.

Note 3) Burnout direction is selectable from a portable communicator, Hold, Over Scale (20.8 to 22.5 mA), Under Scale (3.2 to 3.8 mA).





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