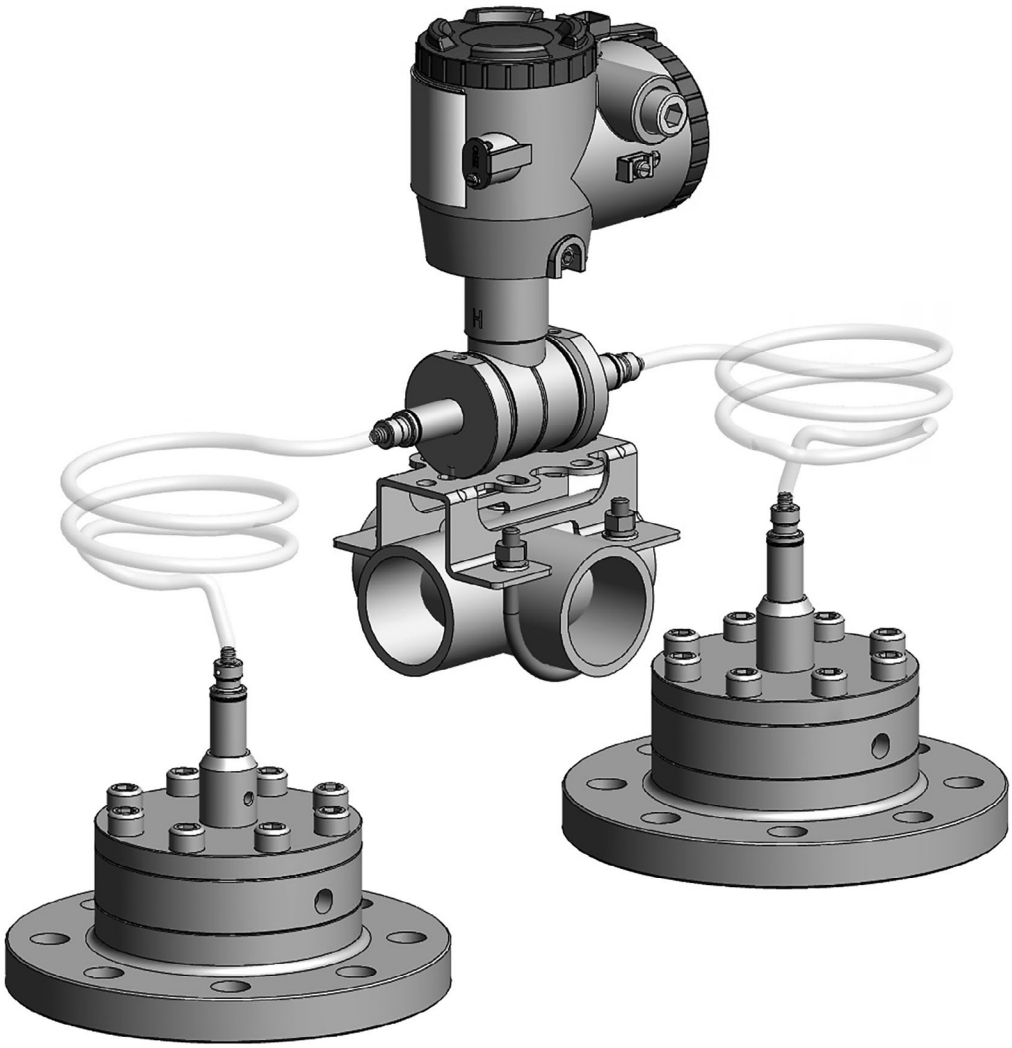
Fuji Electric

USER MANUAL and SERVICE INSTRUCTIONS

Analog pressure transmitters EDF version : “Non-classified category”, “Category K3A” and “Category K3-AD”

"FCX-AII-V4" Series transmitters

Differential pressure :	**FYC**
Gauge pressure :	**FYG**
Remote seal Type:	**FYD, FYB**



Fuji Electric France S.A.S.

TN4 FCXA2 Analog-E
Date January 2022

ATTENTION :

Rotating the upper assembly part :

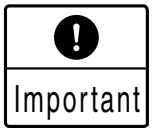
The upper assembly (housing + electronics) can be rotated by 90° steps to the left or to the right by removing the 2 socket head cap screws (M6 x 12).

If the assembly parts must be turned over than 90°, or if the position is already amended since the delivery by Fuji Electric, it's necessary to remove the electronic unit from the housing and disconnect the flat cable from the electronic measuring cell before turning the housing.

If necessary, amend the flatcable's position connecting electronic unit and measuring cell, then fit the different parts.

The non-observance of these instructions may lead to the deterioration of the flexible ribbon cable, which is not 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.

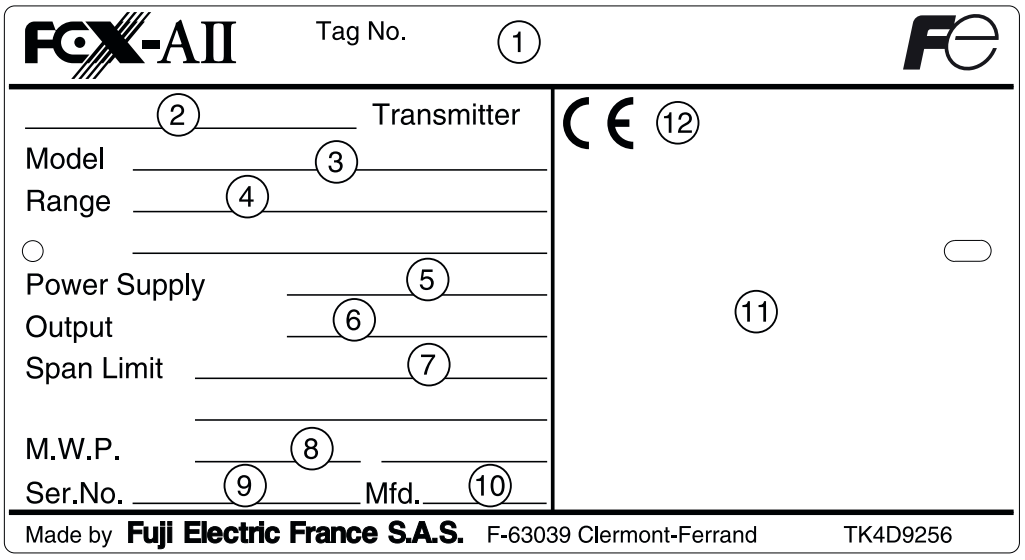


The drawings and schematics presented in this manual are not contractual, so please refer to the specific dimensional drawings of the transmitters.

INTRODUCTION

These transmitters have been designed to meet the standards and regulations in force. This manual must be read carefully before the transmitters are used to familiarise yourself with the installation, the connection processes, the wiring and all the operations for start-up and maintenance. The technical information is detailed in each “Technical Specification” for each transmitter version. Carefully read the ATEX “HD FCX AII 002” instructions for any use of the transmitters in hazardous areas.

The identification plate below is riveted onto the electronic unit.
Verify before use that the equipment provided matches your needs.



1	Tag number
2	Model
3	Transmitter type (see corresponding "technical datasheet")
4	Range
5	Power supply
6	Output
7	Span limit
8	MWP
9	Serial number
10	Manufacturing date
11	Hazardous locations description
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 COMPLIANCE

EMC Directive 2014/30/EU

All electronic pressure transmitters models of the FCX series, type FCX-AII 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 (µV/m) quasi peak value, measured at 10m	EN 55011 / CISPR 11 Group 1 Class A
230 to 1000	47 dB (µV/m) quasi peak value, measured at 10m	

Minimum requirements for the tests of immunity : EN 61326-1 (Table 2)

Phenomena	Test values	Basic standard	Stability criterion
Electrostatic discharge (ESD)	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**
Magnetic field assigned at the frequency of the network	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 by line 2 kV line to earth of the enclosur	EN 61000-4-5 IEC61000-4-5	**B**
RF disturbances conducted	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 related to a non-respect of the instructions are priorized as follows :

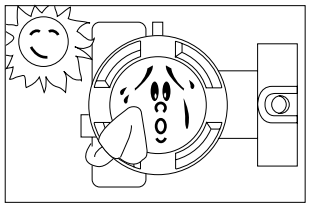
DANGER	Risk of death or sever injury if the safety instructions are not followed.
ATTENTION	Likelihood of injury or damage in case of incorrect handling.

PRECAUTION	Important instructions to be respected.
INDICATION	General observations concerning the product, product handling and correct use of the transmitter.

IMPORTANT RECOMMENDATIONS

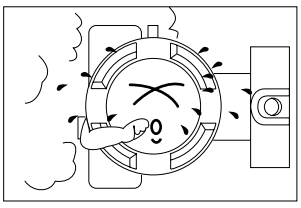
Storage for a long period

If the Pressure transmitter is not mounted rapidly on site afterthe delivery, please store the transmitter in a dry room at normal temperature and humidity (25°c and 60% RH).



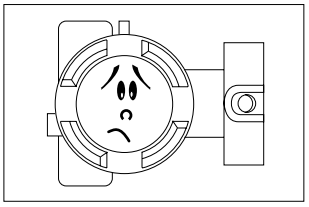
For installation, select an appropriate place

Site at location with minimal vibration, dust and corrosive gas.



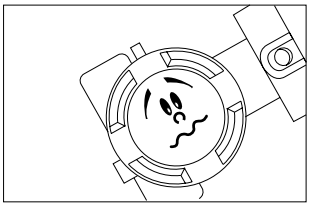
Accessibility

Site at location large enough to allow maintenance and checking



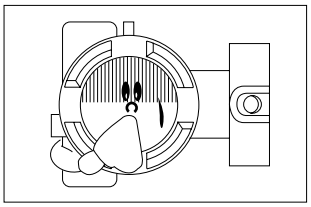
Mounting position

Mount to a pipe horizontally or vertically



Overpressures

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



Others

Besides the above, be sure to observe the cautions given in this manual.

CONTENTS

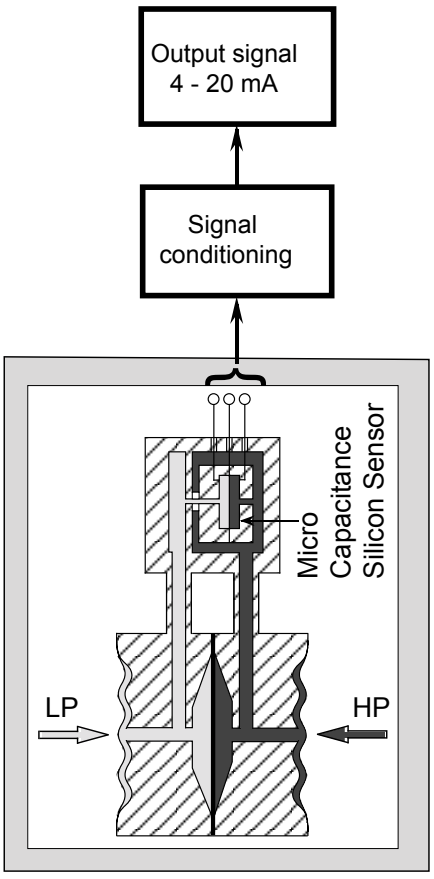
1 DESCRIPTION

The FCX-AII series transmitter measures the differential or gauge pressure, and transmits a proportional current signal of 4 to 20mA.
This transmitter can be used for flowrate, fluid level, density measurement or any other application using differential pressure measurement.
The measurement principle of this transmitter is based on the direct conversion of a differential pressure into a variation of two capacities.
The transmitter is compact and lightweight, provides high accuracy and high reliability.
Local span adjustment is possible by means of internal screw located in the electronic unit.

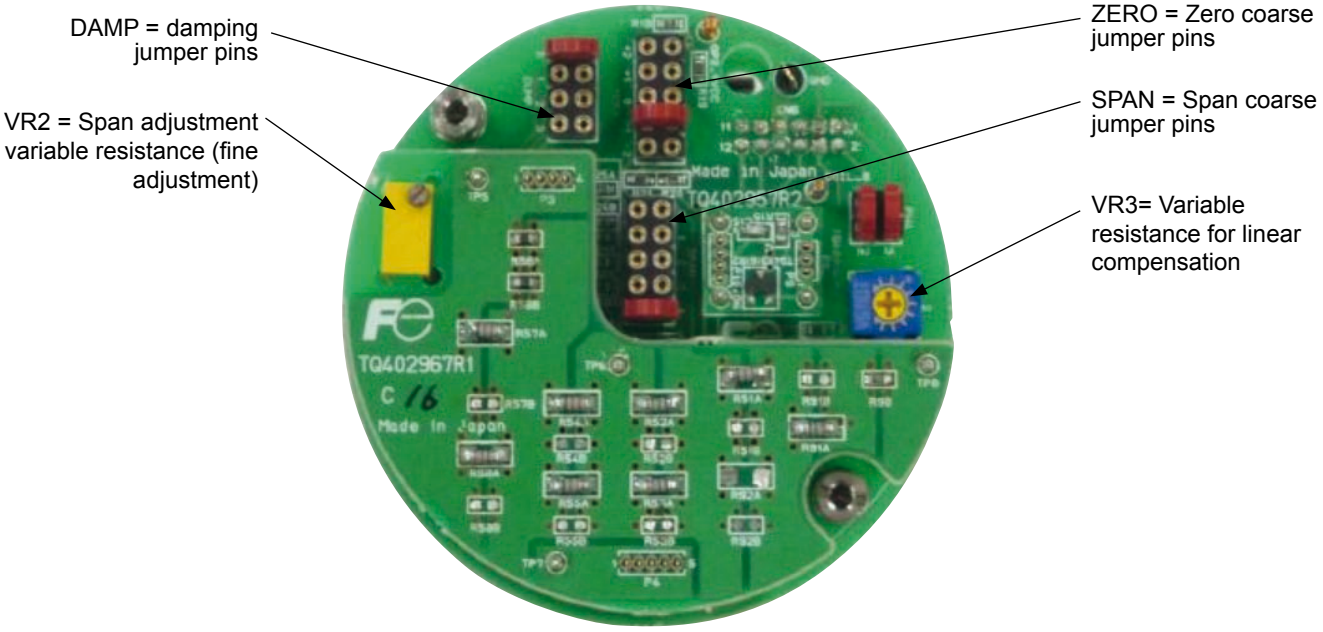
Measurement principle

The operating principle of the differential pressure transmitter is shown in the diagram below. The input pressure is changed into an electrostatic capacitance in the detecting unit.

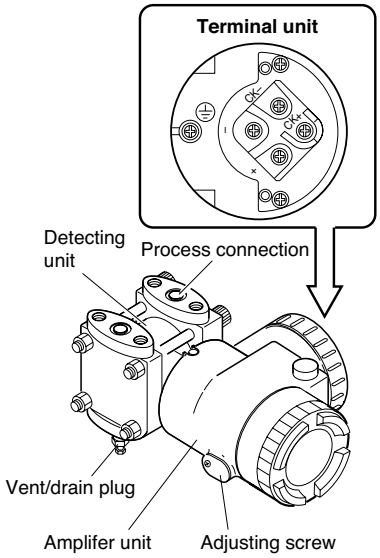
The electronic unit performs the conditioning of the output signal without any SMART device embedded and delivers a proportional output current 4-20mA.



Sensor unit



Top view of Analog Transmitter Amplifier



Description of FCX-All series transmitters

Part name	Description
Measuring cell	Measures pressure, differential pressure or level of liquid.
Amplifier unit	Converts detected signal into an analog output signal.
Vent/drain plug	Used for gas discharge or draining.
Process connection	Enables connection to the impulse pipes from the process.
Electrical connection	Connects of the power supply cable or specific socket for EDF.
Zero adjustment screw	Adjusts the zero.

Terminal block

Symbol	Description
+, –	Connect the output cable
CK+, CK–	Used to check the value of the analogue output signal, or to connect an indicator.
⏚	An external terminal used for grounding.

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	EDSF6-124
			60 mbar	-1 to 100 bar	
			320 mbar	-1 to 160 bar (option : 420 bar)	
			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	EDSF5-90
			5 bar	5 bar	
			30 bar	30 bar	
			100 bar	100 bar	
			500 bar	500 bar	
Remote seals	see note*	see note*	320 mbar 1300 mbar 5000 mbar 30000 mbar	as per PN40	EDSF6-07

* 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 wetted parts for the application.
The transmitter can be installed on a 2” tube or wall mounting.

Note :
For the wall mounting, the customer has to supply the M8 bolting.
Please refer to the datasheets for the outline dimension drawings of the transmitters.

DANGER An hazardous location certified transmitter has to be used on a process with explosive gas otherwise there will be a risk of accident (fire, explosion, etc...)

INDICATION If the transmitter is not used soon after delivery, leave it packed and store it in a room at the normal temperature and humidity (25°C, 60% RH).

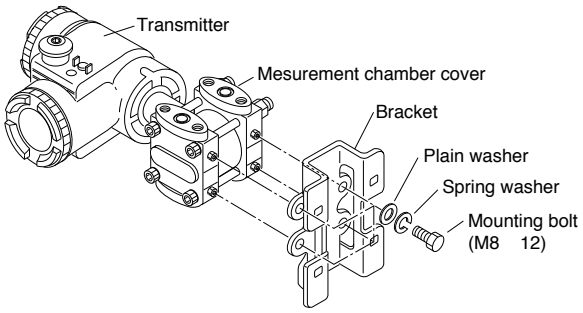
DANGER

- The transmitter is heavy. Handle with care.
- the installation and wiring conditions detailed in this manual shall be strictly followed.
- Improper handling may cause a disfunction of the transmitter.
- During installation, make sure that no parts that coulds imply a disfunction or any hazard located inside the electronic housing.
- When the transmitter is installed in a hazardous location :
  - Do not change the position of the electronic housing.
- The rating of the isolation valves must correspond to the maximum line pressure in the pipe. If the 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.
- Membranes are very sensitive, please handle them with care.
- Do not bend the capillaries excessively

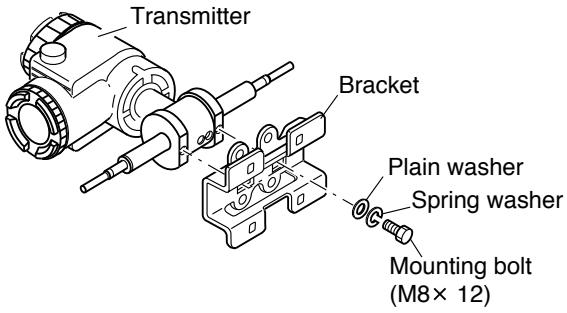
Bracket mounting

Mount the bracket on the transmitter as shown below :

FYC or FYG models



FYB or FYD models

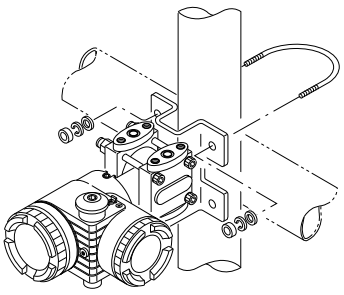


Mounting

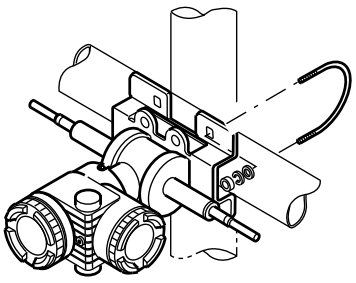
Pipe mounting

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" (60.5 mm)

FYC or FYG models



FYB or FYD models



Mounting wall

Secure the bracket to the wall using screws M8

Important

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.

Change of electronics housing position

DANGER These manipulations must be avoided in explosion-proof areas.

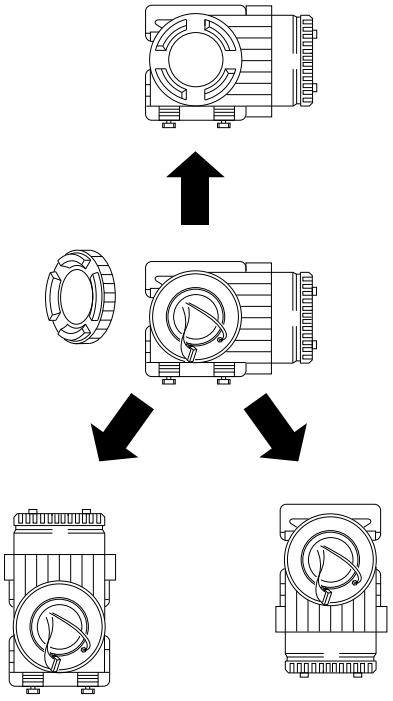
The wiring or the access can be difficult depending on the location of the transmitter, in its original position. The position of the electronic unit of the transmitter can be changed by rotating it by steps of 90 or 180 degrees..

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.

PRECAUTION

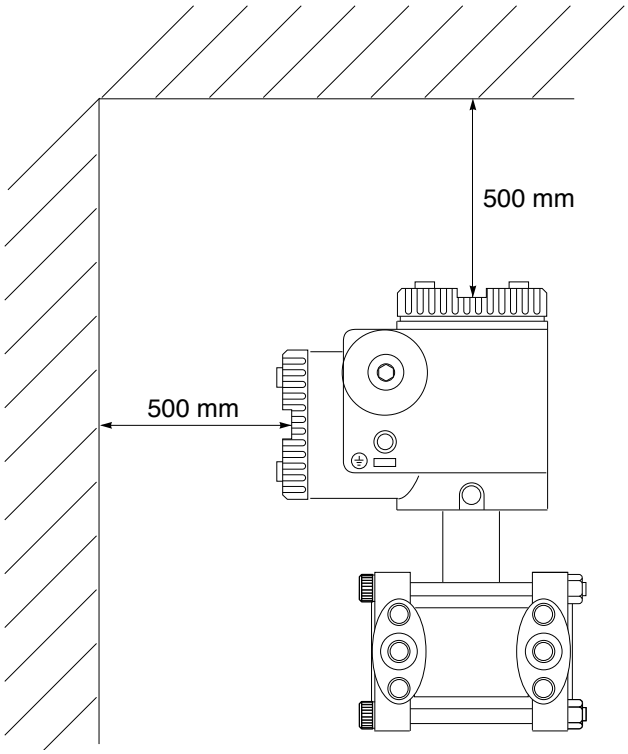
Never turn the assembly by more than 90° without disassembling the flexible ribbon cable (risk of breakage of the flexible ribbon cable connecting the electronics to the measuring cell).

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.



Check space around the transmitter

Leave a free space of approximately 500 mm around the transmitter in order to facilitate the adjustments and maintenance.



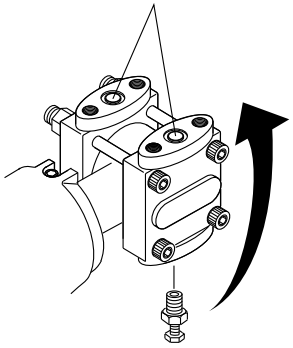
Change in the position of vent / drain plugs

Important

In nuclear power plants, changes on the sub-assemblies or the internal components of the FCX-AII transmitters are prohibited.
Any change in the position of vent/drain plugs must be performed in factory at Fuji Electric France. Any use of Teflon on the threads is strictly prohibited.
The sealing on the threads shall be performed by Loctite PMUC 5772 PMUC. Loctite PMUC in excess on the threads must be removed.
The minimum polymerisation time of this product, before the transmitters are used under pressure, is 24h. The tightening torque of the hexagonal part of the vent/drain plug is 40 N.m.

Slowly unscrew the hexagonal part of the vent/drain plug with a hexagonal spanner. Remove the remaining Loctite sealant product and apply some Loctite PMUC 5772 PMUC on the threads. The curing time shall be taken into account before any pressurization of the transmitter.
Mount and tighten the vent / drain plug on the new location, with a 40N.m tightening torque.

Process connection



3.2 Process connection

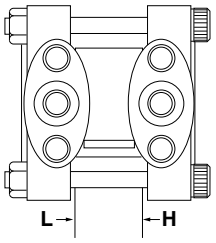
The piping connection must respect some rules to have an accurate measurement.
General recognitions are :

1) Transmitter must be mounted below the process piping for liquid and steam measurement.
2) Transmitter must be mounted above the process piping for gas measurement..

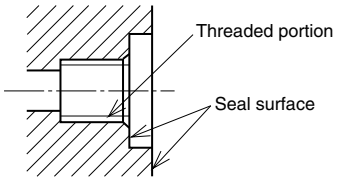
> **⚠ ATTENTION** Main valve or manifold used for piping should be selected with the maximum pressure of the process taken into account (piping parts such as-main valve, etc. should be furnished by user). If the main valve and other parts do not meet the rating, it may result in leakage of gas or liquid which could lead to a hazard.

3.2.1 Differential pressure transmitters (FYC)

Check of "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 cell neck.



Remove the protective cap.
The process connection ports of the transmitter and manifold valve are fitted with protective caps. Before piping, be sure to remove the caps. When removing caps, carrefully protect the threaded portion and sealing face from damage.



Connect the transmitter to the pipes.

(1) When using the manifold valve, it should be fixed to the transmitter by tightening four oval flange set bolts (7/16-20UNF), and then the impulse pipe should be connected to the manifold valve.

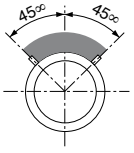
Tightening torque of 7/16-20UNF mounting bolt should be 30 to 40 Nm (3 to 4 kgf m).

(2) If a manifold is not used, the impulse pipes can directly be screwed into the transmitter. If thread size does not match between the transmitter and impulse pipes, an oval flange should be used. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 Nm (3 to 4 kgf m).

Position of process connection

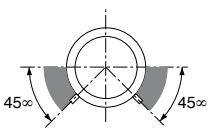
The position of the process connection is determined by the relationship between the condition, characteristics and measuring point of the process fluid.
Follow the process position according to the process :

Gas measurement



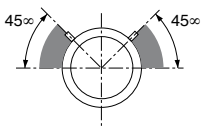
0 to 45° up from the vertical

Liquid measurement



0 to 45° down from the vertical

Steam measurement

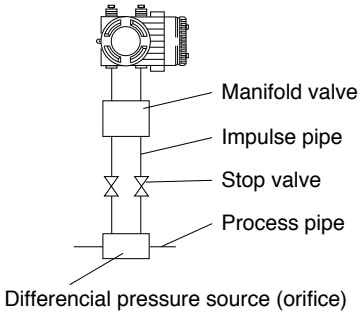


0 to 45° up from the Horizontal

Recommandation for process connection

1- Gas flow measurement

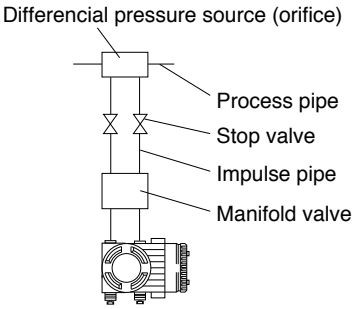
Place the transmitter above the process pipe. If the process temperature is high, please use a condensate chamber like for steam



1- Liquid flow measurement (in case of liquid)

Place the transmitter below the process pipe

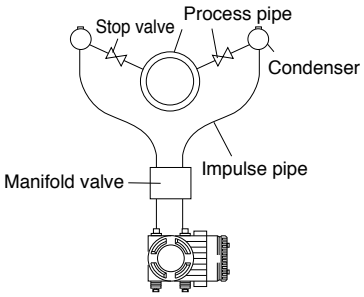
Make piping so that gas in the impulse pipe is not delivered to the transmitter, and incorporate gas reservoirs as required..



2- Steam flow measurement

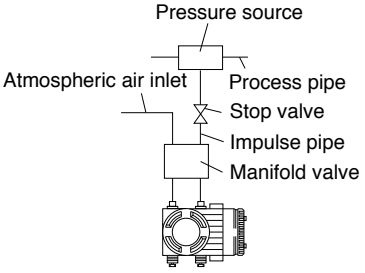
Set two condensers at the same height between the transmitter and the primary element.

Fill the pipe between the condensers and transmitter with water.
Installation of a drain is necessary



4- Measurement of liquid pressure

The transmitter must be installed below the pipes.



⚠ ATTENTION

(1) During valves and manifold installation, please make sur that no dust enter through the atmospheric air inlet.

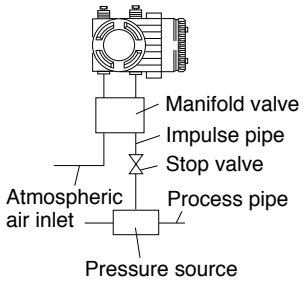
(2) If pressure measurement is low (below 10kPa (1000mmH_2O), the following should be considered.

- Pressure variation due to wind around atmospheric air inlet
- Temperature variation near process connection
- Difference in atmospheric pressure between process connection and transmitter location.

To overcome this, provide atmospheric pressure-side pipe with a proper orifice and consider accommodating the transmitter and atmospheric air inlet in a box.

5- Pressure measurement for gas

Place the transmitter above the process pipes to preventing condensation in the impulse pipe and in the measuring

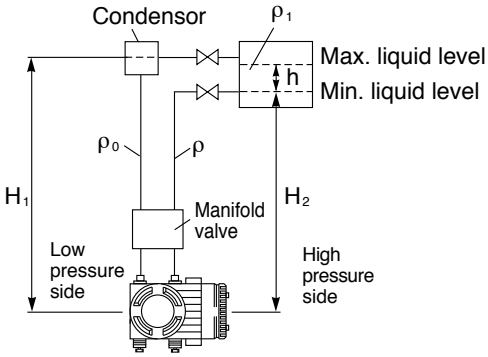


6- Level measurement

(1) Reference column filled

For measurement, connect the highest liquid level of tank with the low pressure side of transmitter, and the lowest liquid level of tank with the high pressure side of transmitter.

The reference column (connected to the highest level of tank) must be filled of fluid.



Level calculation formula :

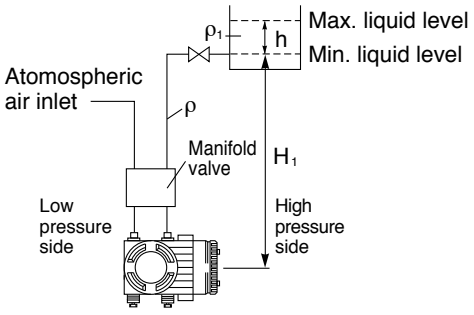
LRV : $\rho H_2 - \rho_0 H_1$

URV : $\rho H_2 + \rho_1 h - \rho_0 H_1$

LRV : Low limit of measurement (0% point)
URV : High limit of measurement (100% point)
ρ_0, ρ, ρ_1 : Density
H_1, H_2 : Liquid level,
h : Liquid level change

(3) Reference column empty

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



Level calculation formula :

LRV : ρH_1

URV : $\rho H_1 + \rho_1 h$

LRV : Low limit of measurement (0% point)
URV : High limit of measurement (100% point)
ρ, ρ_1 : Density
H_1 : Liquid level,
h : Liquid level change

Cautions on impulse piping

- For liquid, the impulse pipes should have an downward slope of 1/10 or more between the process connection and the transmitter to prevent accumulation of gas, etc. in the detecting unit.

- For gas, the impulse pipes should have a upward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of liquid or condensat, etc. in the detecting unit.

- Avoid any sharp bends in impulse pipe which may cause gas or liquid to accumulate in the impulse pipe.

- Do not apply an excessive force to impulse pipe during the connection.

- Install condensate chambers or vent drain when impulse pipes can not be inclined.

- The impulse pipes used should be suitable for the working temperature, pressure standards.

- During installation, avoid mechanical constrains of the transmitter connections.

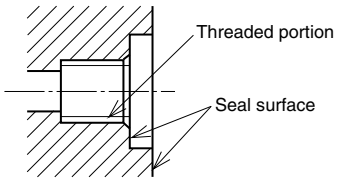
- In case of external degradation (corrosion, overflow, shock ... etc) or in case of fire, the concerned transmitter must be checked before commissioning.
- To avoid the deterioration of the transmitter mounted externally, it will be mounted in a box protection.
- The transmitter should never be exposed to fire. In case of fire, the transmitter characteristics need to be checked before started up. The transmitter must not be reused if it has been partially or totally exposed to fire and heat.

- **Freeze protection.**
  If the fluide can freeze, the transmitter and the impulse pipe must be warmed up with steam or a heater.
  Do not exceed the temperature limits (measuring cell : 120°C maxi and transmitter : 125°C during 65 hours).
  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 Gauge pressure transmitter (FYG)

Remove the protective cap

The process connection port of the transmitter is fitted with a protective cap.
Before piping, be sure to remove the cap.
When removing the cap, carefully protect the threaded portion and sealing face from damage.



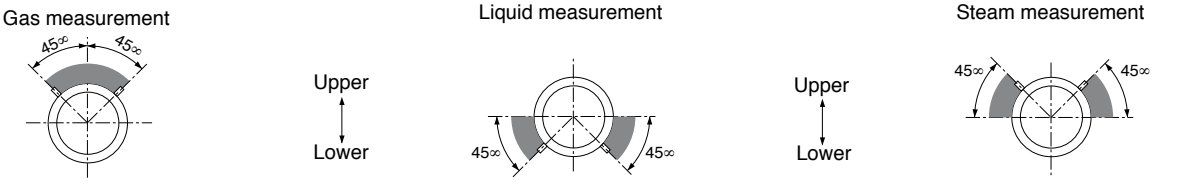
Connect the transmitter to impulse pipes

- When using the manifold valve, it should be fixed to the transmitter by tightening four oval flange set bolts (7/16-20UNF), and then the impulse pipe should be connected to the manifold valve. Tightening torque of 7/16-20UNF mounting bolt should be 30 to 40 Nm (3 to 4 kgf m).
- If manifold is not used, the inpulse pipes can directly screwed into the transmitter. If thread size does not match between the transmitter and impulse pipes, an oval flange should be used. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 Nm (3 to 4 kgf m).
- For an absolute pressure measurement, make sure that isolating valves or manifold can be designed for vacuum service.

Position of process connection

The position of the process connection is determined by the relationship between condition, characteristics and measurement point of process fluid.

Follow the process position according to the process :



0 to 45° up from the vertical

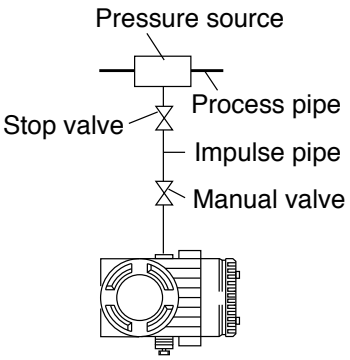
0 to 45° down from the vertical

0 to 45° up from the Horizontal

Connection instructions

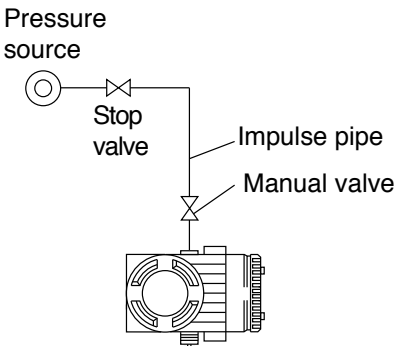
1- Measurement of liquid

Place the transmitter below the process pipe.
Make piping so that gas in the impulse pipe is not delivered to the transmitter and incorporate gas reservoir as required.



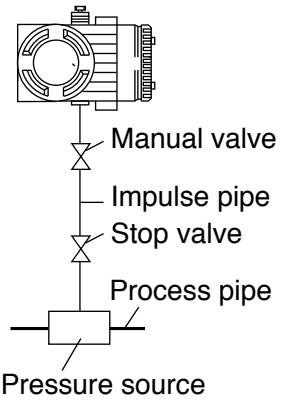
2- Measurement of steam pressure

A condensate chamber must be installed between the transmitter and the pressure intake.
The piping between the condensate chamber and the transmitter must be pre-filled with water.
A bleed must be installed.



3- Measurement of gas pressure

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



Precautions for connecting to the process pipe

- For liquids, the connecting process pipes toward the transmitter must have a minimum downward slope of 1/10 to avoid gas accumulations.
- For gases, the connecting process pipes 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 chambers 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.
- **Protection against freezing.**

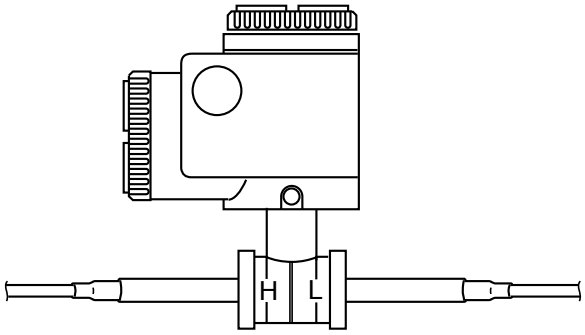
  If there is a risk of the fluid mechanism freezing, the transmitter and connecting pipes must be equipped with a heater, as well as a steam or electrical tracer.
  Do not exceed the limits of the intended temperatures (measuring cell 120°C max, transmitter 125°C during 65 hours).
  Even if the installation stops, the heating should be maintained, otherwise the transmitter and connecting pipes must be drained to prevent freezing.

3.2.3 Installation of remote seal type transmitters (FYB and FYD)

(1) Remote seal type differential pressure transmitter (FYD)

Locate the “High” and “Low” pressure sides

The high “**H**” and low “**L**” pressure symbols are indicated on cell neck. The high pressure side is always equipped with a capillary or rigid seal (direct mounting) allowing a remote seal mounting.

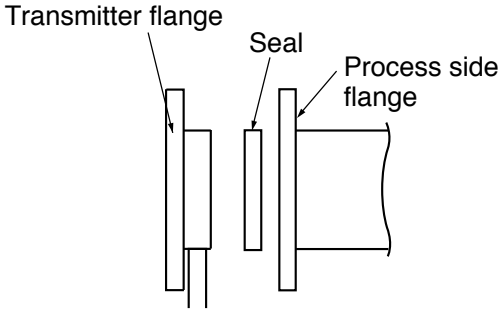


Seal on mounting flange face

A flat seal must be installed between the flange adaptor of the separator and the flange of the tank to be fitted.

A flange adaptor enables to fit the flange of the separator with the process flange to be mounted on. The dimension of the membrane in all cases is 73mm.

For other types of flanges, consult Fuji Electric.



Connecting method of the mounting flange

Perform a three - staged sequence of criss-cross tightening of the screws.

Apply the relevant tightening torque as per the characteristics of the screws (dimensions and material) and as per the flange standard.

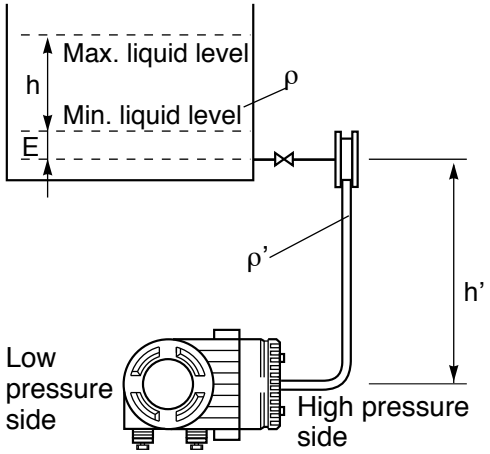
Connection instructions

(1) Level measurement on opened tank

The low pressure side is at atmospheric pressure.
The formula for the calculation of the level :

Level calculation formula :
Zero : $\rho E + \rho' h'$
Span : $\rho(E + h) + \rho' h'$

ρ : specific weight of the process liquid
ρ' : specific weight of the filling liquid of the seal diaphragm

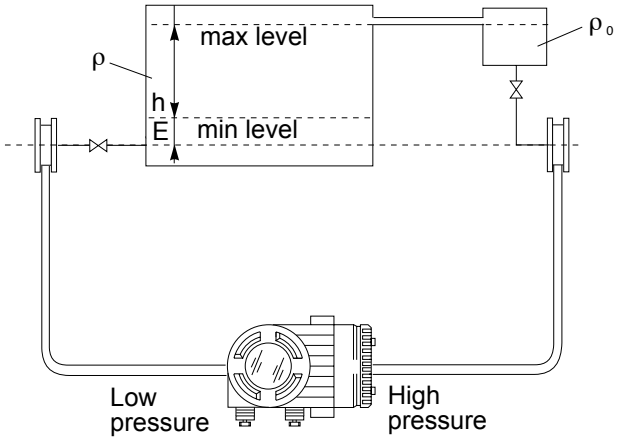


(2) Level measurement on closed tank

With reference column
Connect the high pressure side of the transmitter to the bottom of the tank and the low pressure side to the highest level connection of the tank.

Level calculation formula :
Zero : $\rho.E - \rho_0.(E + h)$
Span : $\rho.h$

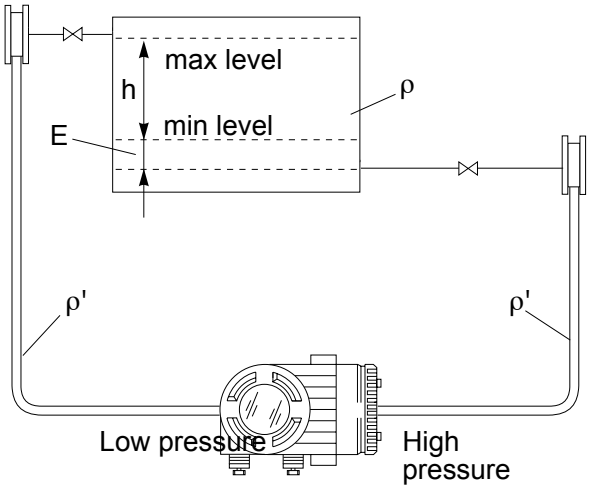
ρ: specific weight of the process liquid
ρ_0: specific weight of the illing liquid of the reference column



Without reference column
Connect the high pressure side of the transmitter to the bottom of the tank and the low pressure side to the highest level connection of the tank.

Level calculation formula :
Zero : $\rho.E - \rho'.(E + h)$
Span : $\rho.h$

ρ: specific weight of the process liquid
ρ': specific weight of the illing liquid of the reference column



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

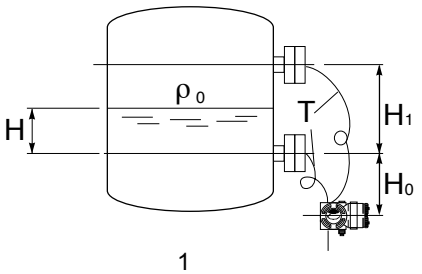
The specific weight of filling liquids can be obtained from Fuji Electric France.
For information, the current valuesare the following. :

Fill fluid	Density	Applications
Silicone oil	0,95	For general measurement
	1,07	For high temperature, high temperature and vacuum, high temperature and high vacuum service

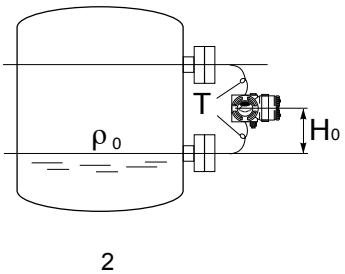
PRECAUTION It is recommended that the pressure transmitter be installed below the seal diaphragm.
If the process pressure is lower than the atmospheric pressure (operation under vacuum), it is mandatory (see afterwards).

Caution when vacuum measurement

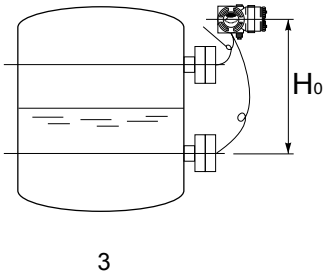
PRECAUTION When process pressure is nearly vacuum pressure, the transmitter must be installed below the pressure tap (see fig.1)
If installation is like fig. 2 or 3, an additionnal negative pressure is done by H_0 of filling liquid in the capillaries between transmitter and the low pressure tap.
In this case, it is imperative to check that the resulting pressure of measurement cell of transmitter is greater than minimum pressure service (refer the technical specifications of the transmitter model used).
When in doubt, please consult Fuji Electric France.



1



2



3

Caution on installation

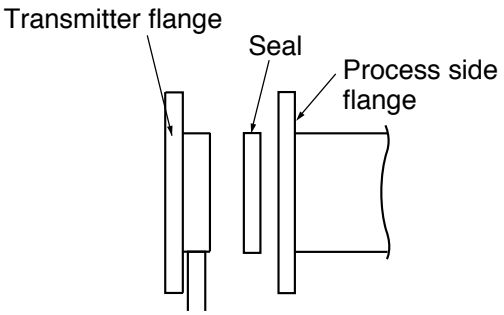
- Vibrations on the capillaries can create interference with the measurement and distort it. It is therefore advisable to install the transmitter on a vibration-free bracket and to attach the capillaries to stable structures.
- Avoid to locate (high and low pressure) in a place where ambient temperature and sunlight are very different since it may induce a drift in the output signal. If this cannot be avoided, it is advisable to have a heater cable running along the capillaries to maintain a constant temperature.

3.2.4 Remote seal type relative pressure transmitter (FYB)

Seal on mounting flange face

A flat seal must be installed between the flange adaptator of the separator and the flange of the tank to be fitted.
A flange adaptor enables to fit the flange of the separator with the process flange to be mounted on. The dimension of the membrane in all cases is 73 mm.

For other types of flanges, consult Fuji Electric.



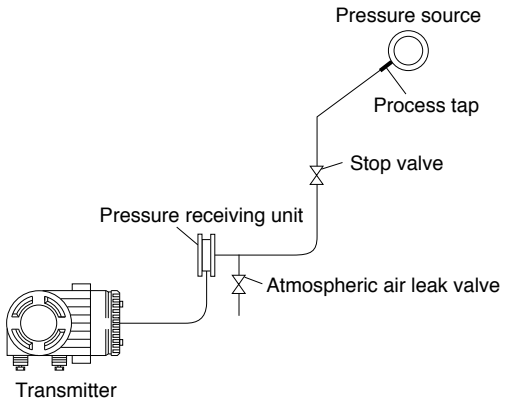
Method for screwing the mounting flange

Perform a three - staged sequence of criss-cross tightening of the screws. Apply the relevant tightening torque as per the characteristics of the screws (dimensions and material) and as per the flange standard.

Recommandation for process connection

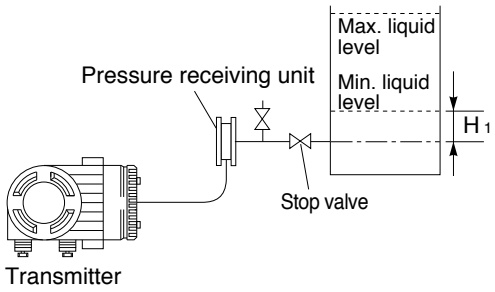
(1) liquid measurement

Locate the process tap below the pressure source



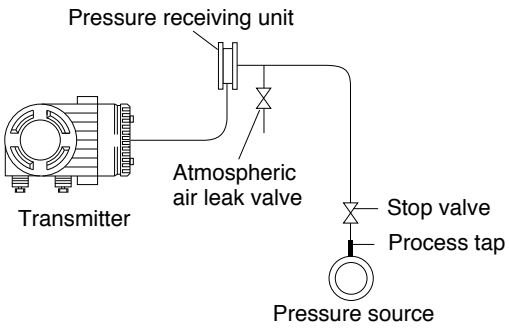
(2) Level measurement on opened tank

H_1 must be more than half 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.



(3) Gas measurement

Locate the process tap above the pressure source



PRECAUTION

It's recommanded to install the transmitter below the remote seal(s). it becomes necessary if process pressure is less than atmospheric pressure. In order to prevent vibration of the transmitter body and capillary from interfering with output, the transmitter body should be installed at a vibration free place and the capillary should be fixed to a stable support.

4 WIRING

DANGER If a transmitter is the explosion-proof type in an enclosure, the following rules must be strictly adhered to for the electrical connection. Bad wiring can cause a risk of explosion, fire and other serious accidents.

ATTENTION

- Switch off the power before any connection or any electrical manipulation on the transmitter.
- Use standardised cables in order to prevent any risk of incidents.
- Use a power source that complies with specifications to prevent fires.
- Perform the grounding according to the recommendations for electrical connections.
- Once the device is connected, screw the covers on the electronic side and the terminal block side and tighten them until the stop. If this operation is not carried out, water infiltration from rain can cause electrical faults or damage.

Cautions on wiring

(1) Application of a voltage greater than 55V DC between the "**+**" and "**-**" of the terminal can damage the transmitter.

(2) It is preferable to use a shielded cable.

(3) To avoid interference, do not place the cables of the transmitter in the same duct as the power supply cables.

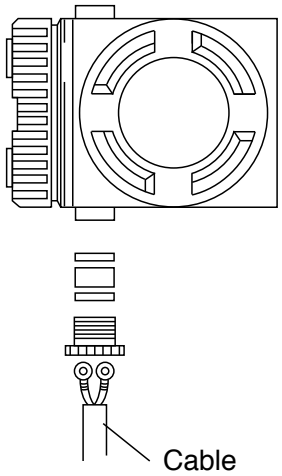
4.1 Wiring procedure :

Sealing of cable entry

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

INDICATION

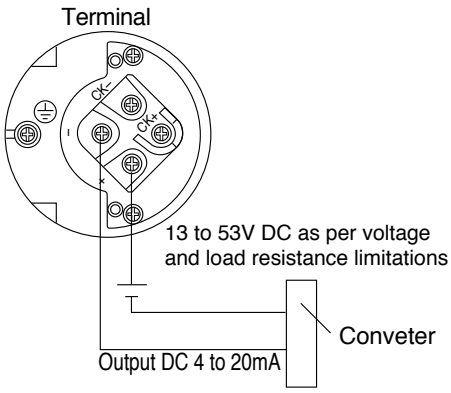
If the conduit connection is located on the top side of the transmitter when using a protective tube for the wiring, then water may enter into the protective tube and have an adverse effect on the transmitter.
The thread of tube connection should match with the transmitter conduit thread.



In case of SOURIAU or SAIB socket, a female quick connector enables to perform the wiring.

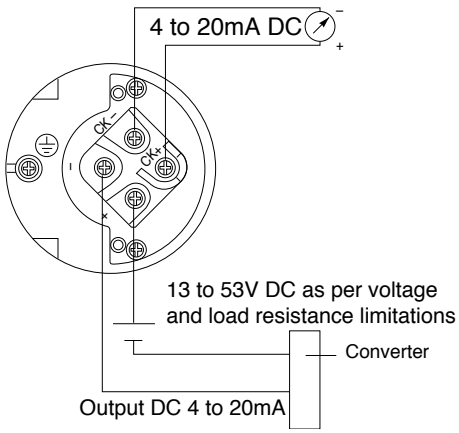
Connection diagram of the terminal

Tighten the terminal screws (M4 x 10) to a torque of approximately 1.5 Nm.
After the wiring, correctly retighten the cover so that it cannot be unscrewed.



When using an external Field indicator

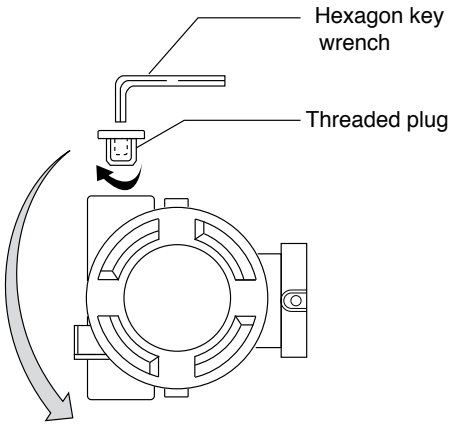
For direct connection to an external field indicator, connect the "**+**" and "**–**" sides of the field indicator to CK+ and CK– of the transmitter as shown below.
Use an external field indicator with internal resistance of 12Ω or less.



Precautions to be taken during the wiring

Two cable entries are available, one of which is closed by a plug. If the open entry is not the desired one, proceed as follows :

- Remove the plug, and the compression packing dedicated to the sealing function, and screw it onto the other cable inlet.
- Insert the cable through the free terminal connection and connect it.

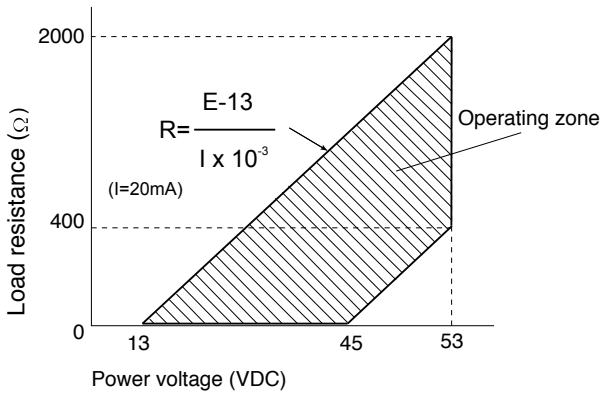


DANGER

- The unused terminal connection is of great importance to use in hazardous location and water prevention.
- If the insulation is verified after wiring, a megohmmeter with a test voltage of 250V DC maximum should be used.

4.2 Power supply and load resistance

Check that the load resistance is in the operating zone indicated on the diagram below.



4.3 Grounding

Perform the grounding in compliance with the recommendations below.

1- Standard use (without special protection)

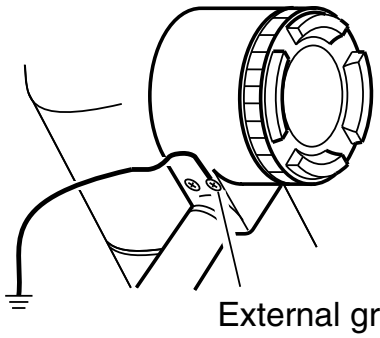
Grounding terminals are provided at two places (at the inside of terminal box and on the side of the conduit connection).

By any of the methods given below, ground the transmitter in compliance with the relevant stipulation in the standard on hazardous location insatllation (for example, grounding resistance 100 ohm or less by one of the methods given below..

2- Use in hazardous locations

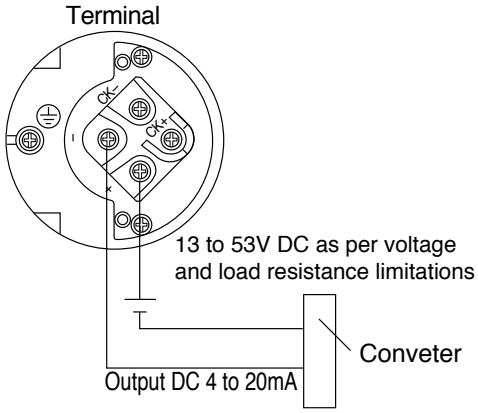
In case of explosion-proof hazardous locations protection mode, use the gounding terminal located in the terminal block.

Ground terminal
(outside)



External grounding terminal

Ground terminal
(inside)

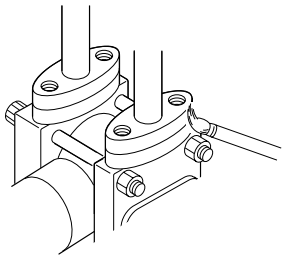


5 START UP AND SHUTDOWN

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 equivalent.
(2) Check of the electrical connection according to the “Terminal block connection diagram” shown in 4.1.
(3) Vent the process covers of the transmitter.

DANGER	Before starting up the transmitter in flameproof area, please read carrefully the technical instruction note ATEX Ref.HDFCX-AII 002 for requirements in hazardous locations.

The compatibility of the process with the transmitter must 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 the zero.

Zero point check

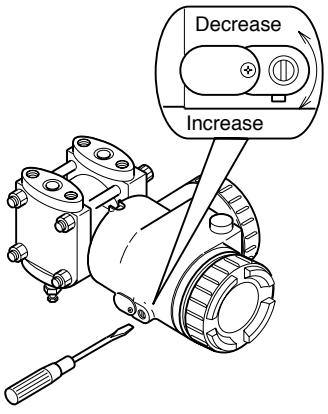
For the adjustment or checking of the zero in a dangerous area (explosion-protected), refer to the leaflet ATEX HDFCX-AII 002.

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

Zero adjustment :

The zero adjustment can be done :
With the adjustment screw (do not use in nuclear power plants)
Refer to the Section 3.1 “Adjustment with the external screw”

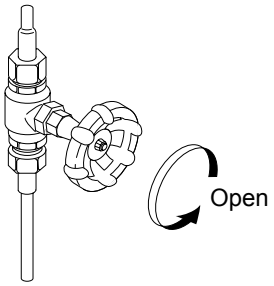
As soon as all operations are completed, reassemble and tighten the covers till the contact with the amplifier case is obtained.



5.2 Operating mode

(1) Operation of gauge pressure transmitter (FYG) :

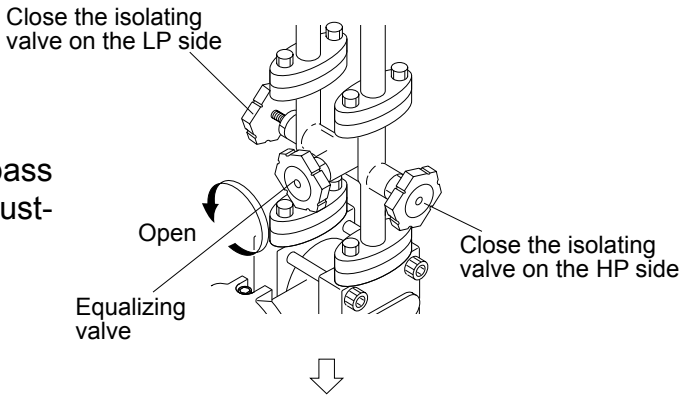
Open slowly the isolating valve to apply the pressure.
When pressure is applied, the transmitter is set in the operating status.



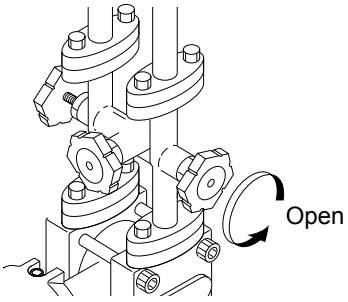
(2) Operation of differential pressure transmitter (FYC) :

Set the operating status by manipulating the isolating valve.

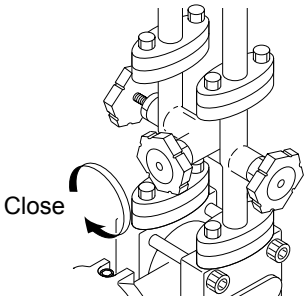
Make sure the equalizing valve (by-pass valve) is open and perform zero adjustment.



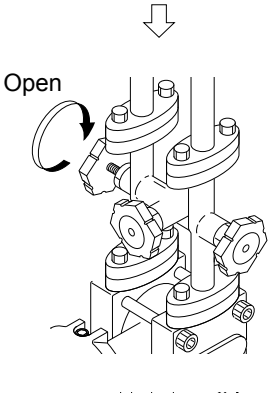
Open slowly the isolating valve on the HP side.



Close the equalizing valve.



Open slowly the stop valve on the LP side



Check of operating status

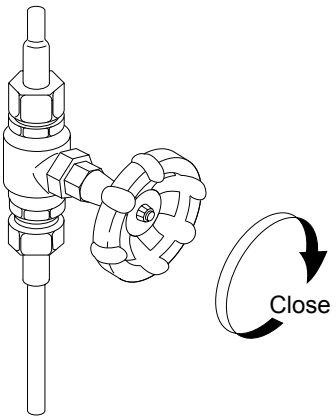
Use a multimeter to check the operating status of the transmitter.

5.3 Shutdown

Follow the procedures detailed hereafter :

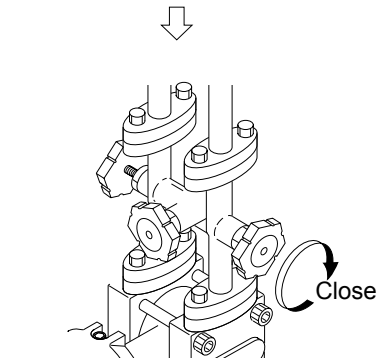
(1) Gauge pressure transmitter (FYG) :

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

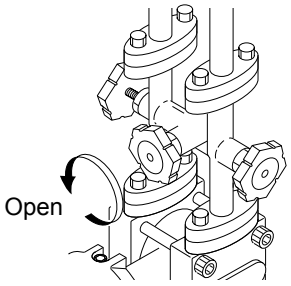


(2) Differential pressure transmitter (FYC) :

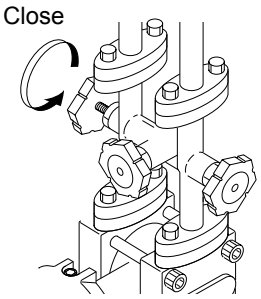
Close slowly the isolating valve on the HP side.



Open the equalizing valve.



Close slowly the isolating valve on the LP side.

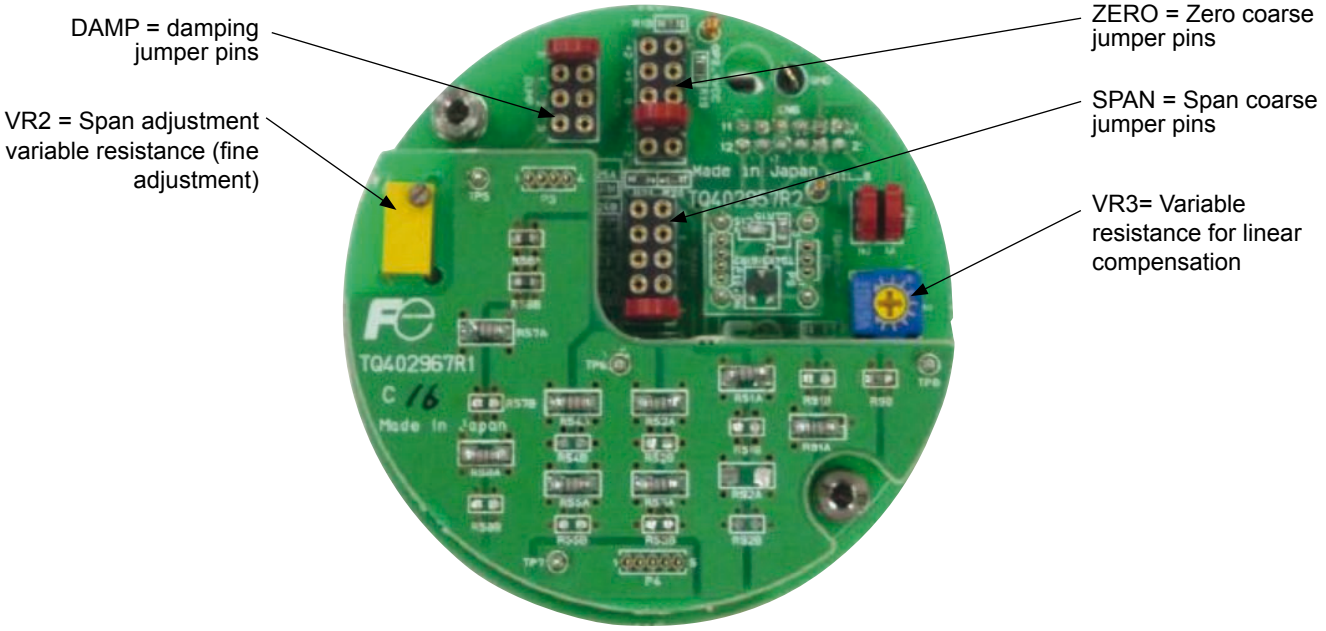


PRECAUTION	Before a long shutdown, discharge the process fluid and drain completely from the transmitter in order to avoid any freezing or corrosion issue.

Different settings on analog transmitters are allowed :

- Zero adjustment including suppression and elevation
- Span adjustment including rangeability
- Electronic damping adjustment

This document provides you a set of guidelines to help you to use this functions :



Top view of Analog Transmitter Amplifier

> **PRECAUTION** **DO NOT USE VR3 :**
> Be careful, modification of position of this variable transmitter will result with major malfunction of transmitter. Only for factory use.

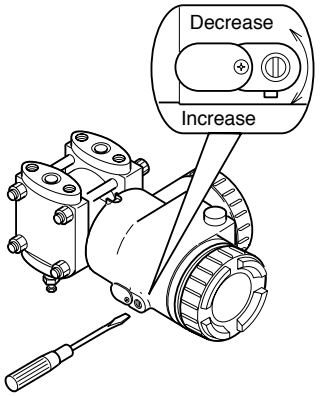
6.1 Adjustment procedure

6.1.1 Zero adjustment

The zero point can be adjusted following the procedure below :

(1) Apply standard input pressure corresponding to the Lower Range value (LRV) value (4mA - 0%)

(2) Perform a fine adjustment of the output current to 4mA using the external screw.



6.1.2 Span adjustment

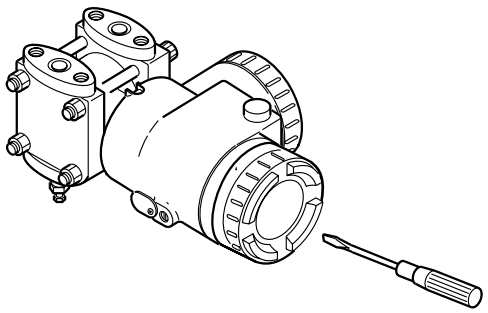
The measuring range can be adjusted with the VR2 adjustment screw located inside the electronic unit following the procedure below :

(1) Apply standard input pressure corresponding to the Upper Range value (URV) (20mA - 100%).

(2) Perform a fine adjustment at 20mA of the output signal by means of the span adjustment screw located in the electronics unit.

(3) check and adjust the output current when a standard input pressure corresponding to the Lower Range Value (LRV) is applied.

(4) Iterate action (1), (2) and (3) till the accuracy ratings of both the zero and span output value are complied with.



6.2 Setting of the electronic damping of the output signal

When the process input fluctuates or when there are significant vibration of the installation site, it is required to set appropriate damping time in order to avoid the output fluctuation.

The damping is adjustable with the 4 positions of the "damping" jumper pins located in the electronics unit (see “Top view of Analog Transmitter Amplifier”).
Additional time is added to the time constant of the transmitter, through the position of the “Damp” jumper pin.

“DAMP” jumper pin position	DAMPING
0	Mini (approximately 0.1s)
1	0.4s
2	1.2s
3	3.2s

Damping coarse jumper pins approximations

Note : The damping is a time value added to the output signal and concerns only the electronics of the transmitter (refer details in the technical datasheet).

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.

7 MAINTENANCE

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 Periodic inspection

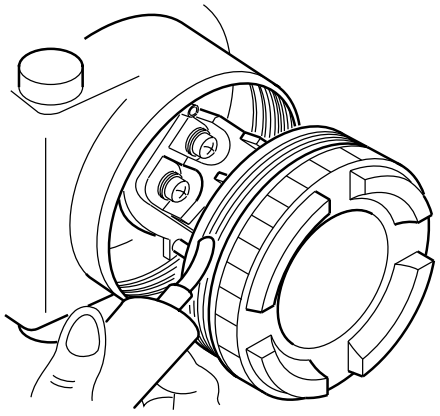
The following verifications are suggested by the manufacturer.
Check for tightness of the transmitter and the process connections as often as required.

Visual inspection

Visually inspect each part of the transmitter for damage, corrosion, etc.
Check and if possible clean all wetted parts of the transmitter to make sure the chemical resistance of the wetted parts. In case of corrosion, find out the reasons and replace or adapt the concerned parts.
Please follow the replacement procedure of the measuring cell described later.
Visual inspection of the transmitter for damage, corrosion etc...
Protect or replace the transmitter if necessary.

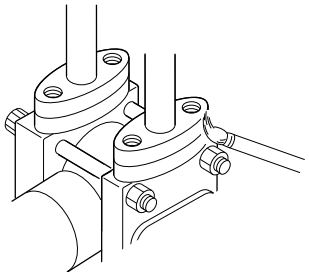
Covers and termial O-ring

FCX-AII serie transmitters are designed to be water and dust-proof. Make sure the O-ring of the housing covers are not damaged
Check that no foreign matters are stuck on the cover treads and grease them before remounting with a product certified for use in nuclear power plants (PMUC certified product).



Piping leakage check

Using soapy water or the like, check the all process connections for leakage of process fluid.
If necessary, drain the moisture which has accumulated in the transmitter and process pipe.housing covers are not damaged.



7.2 Troubleshooting

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
Saturated output current (beyond 20mA)	(1) Incorrect position of the by-pass valve	Place the valve in the correct postion..
	(2) Process leakage.	Repair seal.
	(3) Problem with the piping.	Check the pipes.
	(4) Plugged pipe.	Unblock the pipes.
	(5) Error of the electrical supply and/or the load resistance.	Checking the power supply and load resistance values (refer to Sec. 5.2).
	(6) The value of the supply voltage at the transmitter terminals is incorrect.	Check the cable and the power supply as shown above.
	(7) Defect of zero adjustment or the range of measurement.	Adjust according to Section 6.
	(8) Amplifier defect	Replace the transmitter.
No output current (less than 3.8 mA).	(1) Identical to causes 1 to 4 above.	
	(2) Inversion of polarity on the power terminals.	Check the wiring (see Section 5.1).
	(3) Defect of the electrical supply and/or the load resistance.	Checking of the power supply and load resistance values (refer to Section 75.2).
	(4) The value of the power supply is incorrect.	Check the cable and the power supply as shown above.
	(5) Amplifier defect	Replace the transmitter.
Output current error	(1) Bad connection of the mechanism.	Correct the piping.
	(2) Mixture of liquid and gas.	Vent or drain the transmitter.
	(3) Variation of the density of the liquid.	Perform density compensation.
	(4) Large change in the ambient temperature.	Minimize the temperature change.
	(5) zero drift and drift in the measurement range.	Readjust zero or span.
	(6) Amplifier defect.	Replace the transmitter.

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

7.3 Replacement of defective parts

If the transmitter fails and needs to be replaced, perform gas discharge or drain the measuring cell chambers completely.

DANGER	**During the disassembly of an explosion-proof device, switch 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.**

A1 BUILT-IN ARRESTER

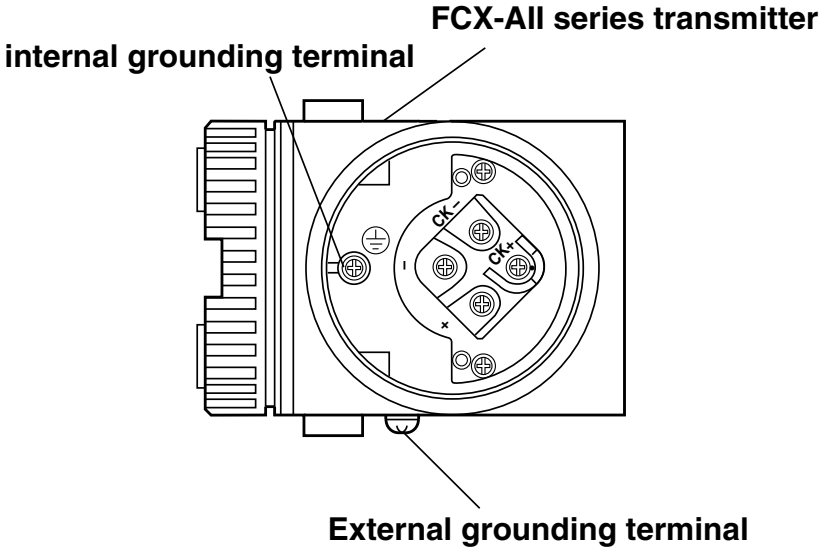
A surge protector is used to protect the transmitter against the accidental surges that may occur on the power supply. This surge protector is mounted into the terminal block of the transmitter.

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 (control room) to protect the instruments that also receive the signal from the transmitter.

Grounding

The grounding can be done either with the internal or external ground terminals.



Preparation for calibration

Remove the transmitter for the calibration in the workshop. Provide the following equipment :

- Pressure generator with a precision better than 0.05%.

* See pressure to be generated below.

- Electrical power supply 24 V DC.
- Digital Ampmeter with a precision better than 0.1%.

Measurable ranges

Differential pressure range

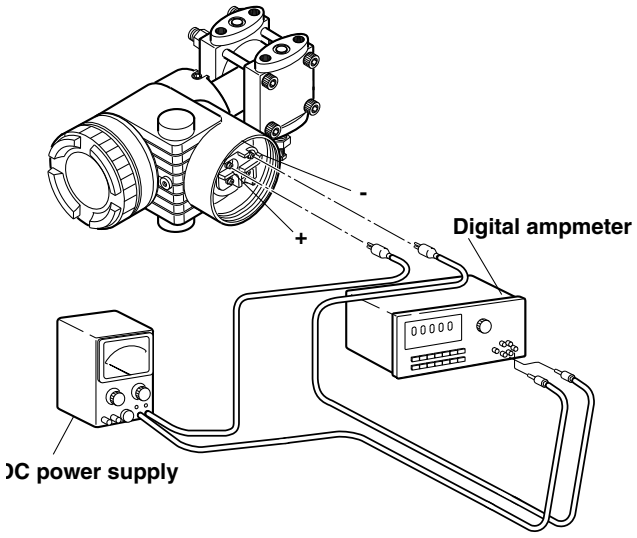
FYC model kPa (mbar)
0,1~1 (1~10)
0,1~6 (1~60)
0,32~32 (3,2~320)
1,3~130 (13~1300)
5~500 (50~5000)
30~3000 (300~30000)

Gauge Pressure range

FYG 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)

Calibration procedure

(1) Perform the connections according to the diagram below.



(2) Perform the calibration of either zero or span as described in the section 6.1.1 and 6.1.2

(3) Verification of the accuracy :
Apply the pressure in the following order: 0%, 25%, 50%, 75%, 100%, 75%, 50%, 25% and 0%, and read the output signal for each point.
Check that the read values (%) are within the tolerances specified in the product data-sheet.

Damping: default factory setting: 0

Fuji Electric

Fuji Electric France S.A.S.
46 rue Georges Besse - ZI du brézet - 63039 Clermont ferrand
Tél : 04 73 98 26 98 - Fax : 04 73 98 26 99
Mail : sales.dpt@fujielectric.fr - web : www.fujielectric.fr