

"FCX-All-V5" serie transmitters

Type : FKC...5

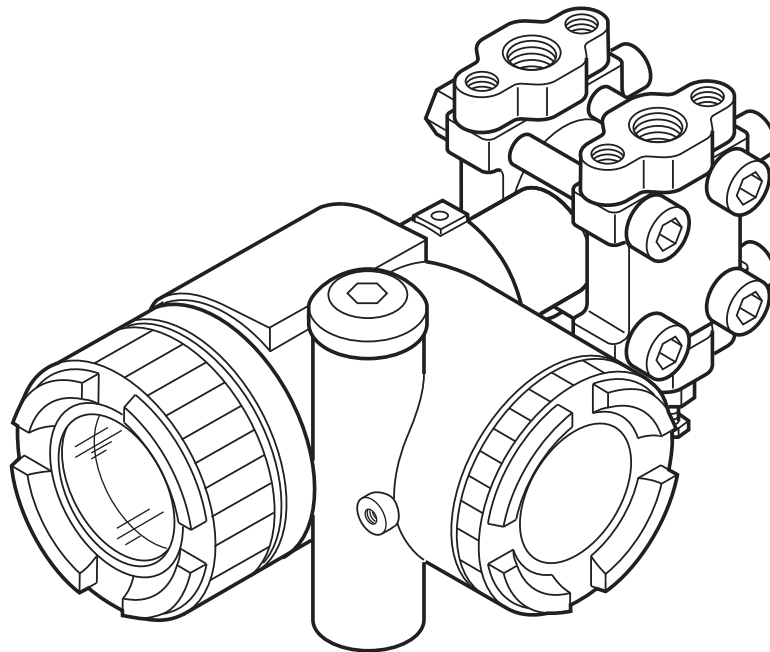
FKG...5, FKP...5

FKA...5, FKH...5

FKE...F

FKD, FKB, FKM...F

FKP, FKH...F







CAUTION :

Rotating the upper assembly part :

The upper assembly (housing and electronic unit) can be rotated by 90° left or right just by removing the 3 hexagonal screws.

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

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

Failure to observe this may lead to the deterioration of the flat cable, which is not covered by the manufacturer's warranty.

INTRODUCTION

First read this instruction manual carefully until an adequate understanding is required, and then proceed to installation, operation and maintenance of the FCX-AIIV5 series transmitter. The specifications of the transmitter will be changed without prior notice for further product improvement.

Modification of the transmitter without permission is strictly prohibited. Klay Instruments will not bear any responsibility for a trouble caused by such a modification.

This instruction manual should be kept by a person who is actually using the transmitter.

After reading this manual, keep it at a place easier to access.

This manual should be delivered to the end user without fail.

For detail specifications and outline diagrams, refer to the specifications supplied separately.

Our pressure transmitters have been designed to meet international standards and directives. 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 102"** for any use of sensors in dangerous areas.

The instrument nameplate as shown below is attached on the housing of this transmitter.

Before use, make sure the contents of the nameplate agree exactly with your specifications.

FCX-AII Tag No. ①	
Model ② _____ ③ _____	CE ⑫
Range Limit ④ _____	
Span Limit ⑤ _____	⑪ ○
<input type="checkbox"/> Power Supply ⑥ _____	
Output ⑦ _____	
M.W.P. ⑧ _____ OAN _____	
Ser.No. ⑨ _____ Mfd ⑩ _____	

- 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 97/23/EC G1 or PED G1 (for equipments specified category III or IV)
G1 = for use with all kinds of fluid

CEM COMPATIBILITY

EMC Directive (2004/108/EC)

All models of **FCX** series transmitters type **FCX-AII** are in accordance with :

- the harmonized standards:
 - EN 61326-1 : 2006 (Electrical equipment for measurement, control and laboratory use - EMC requirements).
 - EN 61326-2-3 : 2006 (Part 2-3 : Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning)

Emission limits : EN 61326-1 : 2006

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

Immunity requirements : EN 61326-1 : 2006 (Table 2)

Phenomenon	Test value	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	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 line	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

Performance criteria :





A : During testing, normal performance within the specification limits.

B : During testing, temporary degradation or loss of function or performance which is self-recovering.

CLASSIFICATION OF SAFETY INSTRUCTIONS

First of all, read carefully the “Safety instructions” for your own safety and for correct use of the transmitter.

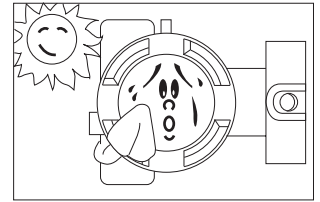
- The risks related to a non-respect of the instructions are prioritized as follow :

 DANGER	Risk of death or sever injury if the safety instructions are not followed.
 ATTENTION	In case of wrong handling probable injury or physical damage can happen.
 PRECAUTION	Important instructions to be respected.
 INDICATION	General observations concerning the product, product handling and correct use of the transmitter.

IMPORTANT RECOMMENDATIONS

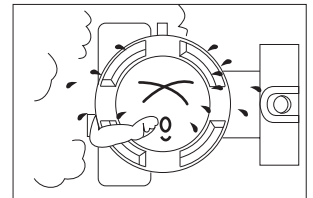
Storage for a long period

Store the transmitter in a dry room at normal temperature and humidity.
Keep protection caps in place at the conduit connection and process connection.



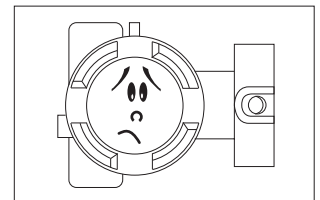
For installation, select an appropriate place

Site at location with minimal vibration, dust and corrosive gas



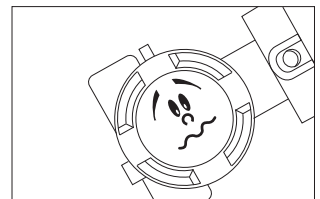
At a place allowing an adequate space for check-up

Site at location large enough to allow maintenance and checking.



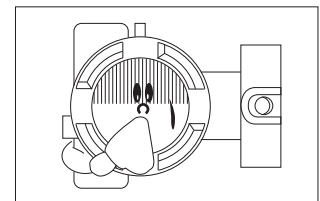
Mounting position

Mount to a pipe horizontally or vertically.



Attention to overload

Do not apply a pressure outside the specified range.



Others

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

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The FCX-A2 V5 series transmitter accurately measures the differential pressure, level of liquid, gauge pressure or flow rate, and transmits a proportional current signal of 4 to 20mA DC. All the adjustment functions are incorporated in the transmission unit for making adjustments easily and exactly.

Transmitter settings (such as range and damping time constant, etc.) can be changed from an HHC (Hand Held Communicator).

The transmitter utilizes a unique micromachined capacitive silicon sensor with state-of-the-art microprocessor technology to provide exceptional performance and functionality.

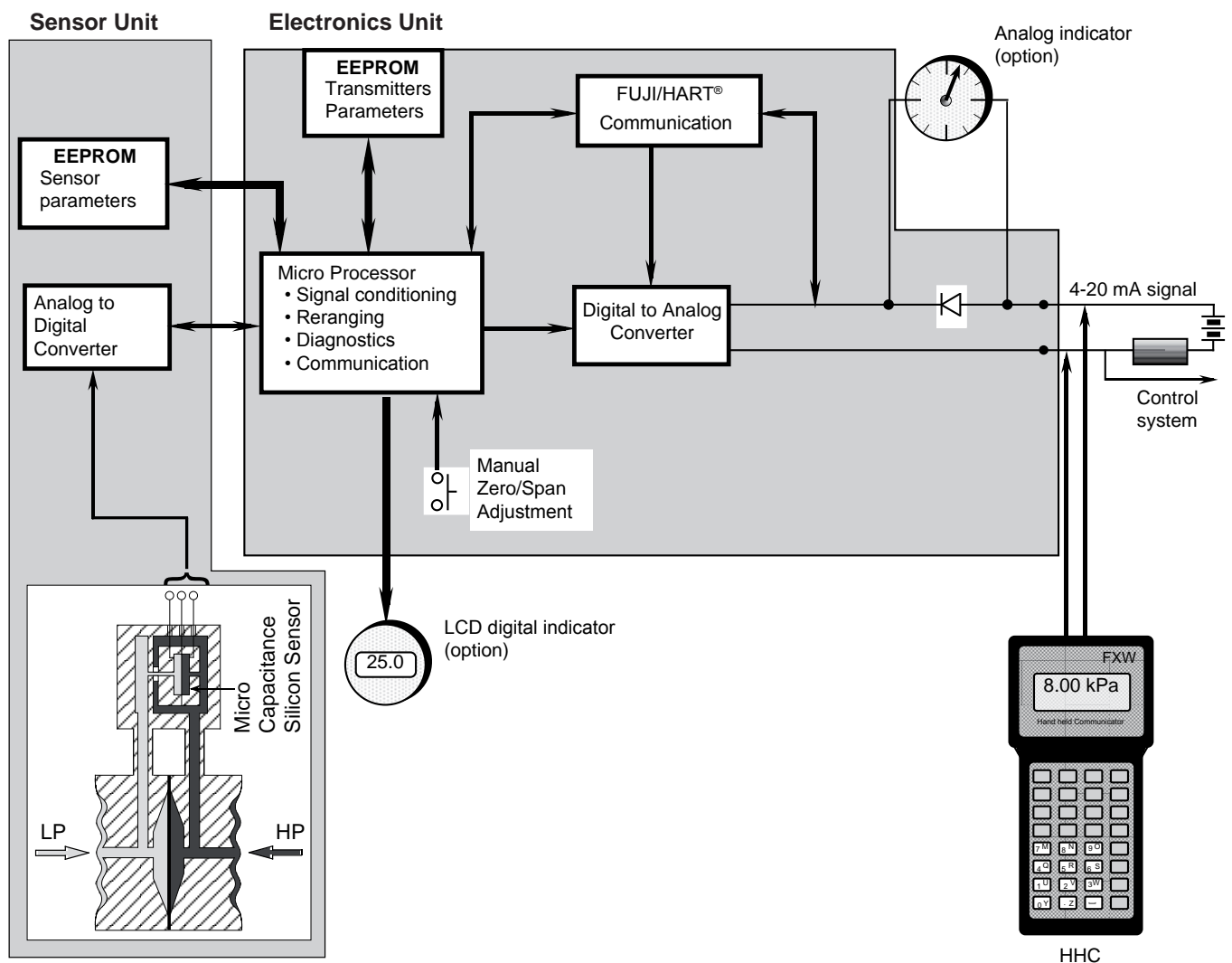
The transmitter is compact and light, provide high accuracy and reliability.

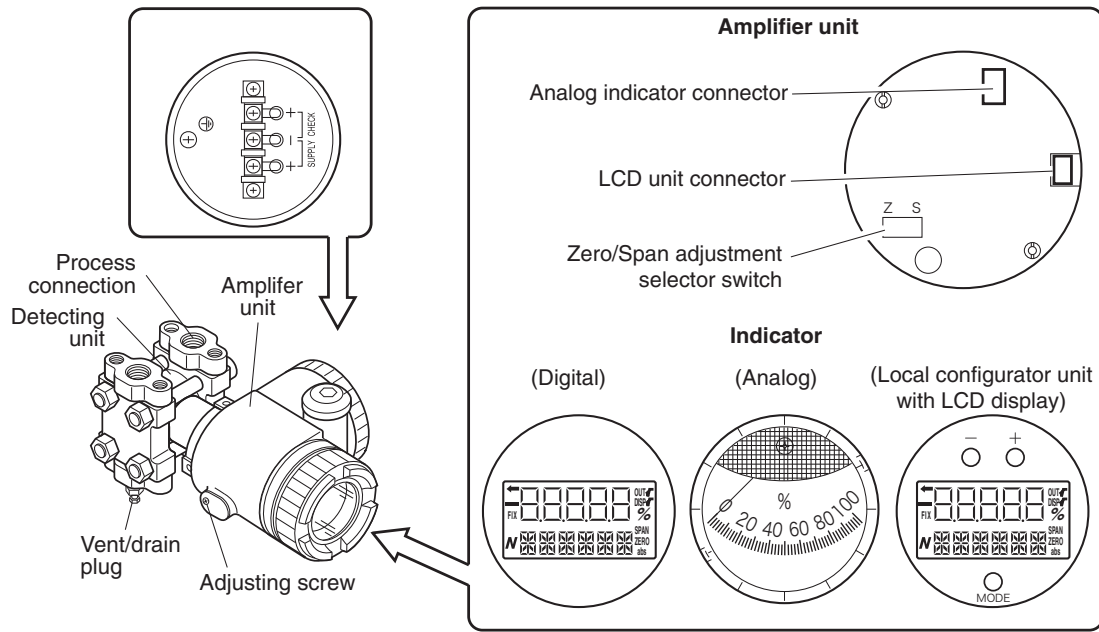
Local adjustment of zero and span are possible from outside screw on the electronic housing.

Measuring principle

The operating principle of the FCX-A2 V5 series transmitter is shown in the below block diagram. The input pressure is changed into an electrostatic capacitance in the detecting unit.

The change proportional to the pressure undergoes conditioning and amplification in the transmission unit, and is then output as a current of 4 to 20mA DC





Description of FCX-A2 V5 serie transmitters

Part name	Description
Detecting unit	Detects pressure, differential pressure or level of liquid.
Amplifier unit	Converts the detected signal into an output signal.
Vent/drain plug	Used for gas discharge or draining.
Process connection	Connects impulse pipes from the process.
Conduit connection	Connects the output cable.
Zero Adjusting screw	Used for adjustment.
Terminal unit	External terminal unit to connect an input-output line and ground wire

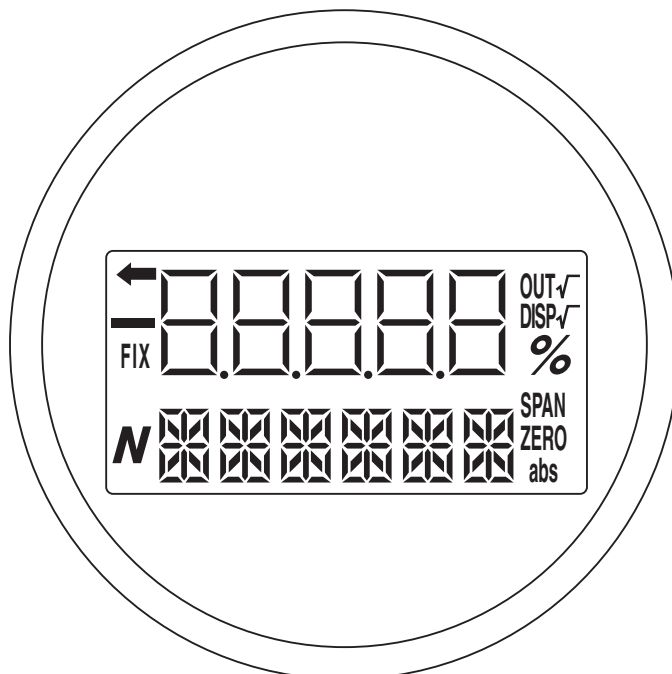
Amplifier Unit

Part name	Description
Analog indicator connector	Used for connecting an analog indicator.
LCD unit connector	Used to connect the digital indicator or the local configurator unit with LCD display.
Indicator (option)	The analog or digital indicator, or the local configurator unit with LCD display can be mounted.
Zero/Span adjustment selector switch	Used to select the function (zero/span) to be adjusted by the external adjusting screw.

Terminals

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

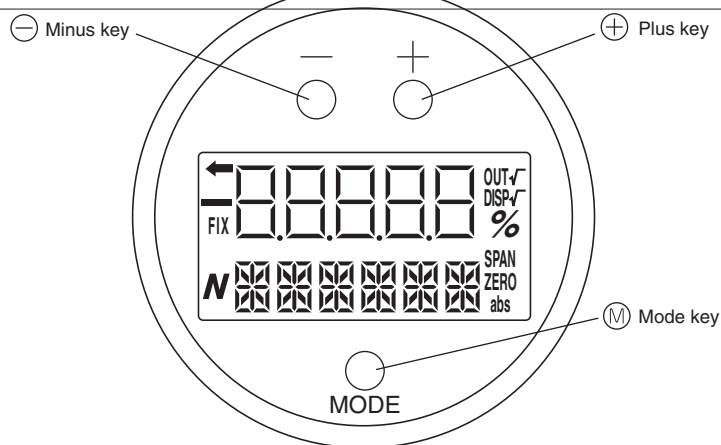
Mode indicating function of digital indicator



Mode indication

Mode	When indicated	When not indicated
%	% output	Actual scale
ZERO	Possible external zero adjustment	External zero adjustment not possible
SPAN	Possible external span adjustment	External span adjustment not possible.
DISP √	Digital indicator √ display	Digital indicator LIN display
OUT √	√ output	LIN output
FIX	Fixed current mode	Measurement mode
←	The transmitter is in operation (blinking).	The transmitter is not in operation.
abs	Absolute pressure	Gauge pressure
-	Output value < Zero	Output value ≥ Zero
N	(a part of unit indicator)	

Modes of the local configurator unit with LCD display and functions of the 3 push button key switches

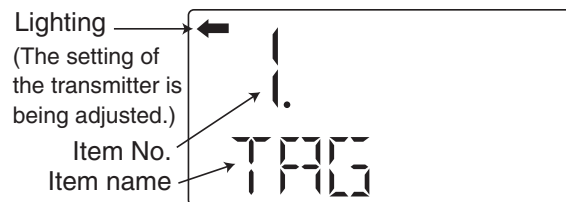


Normal mode (normal mode for indicating a measured value)



* For status indication in the normal mode, refer to the previous section "Mode indicating function of digital indicator."

Setting mode (functions of the 3 push button key switches)



Functions of the 3 push button key switches

Name	Main function
Ⓜ Mode key	Switches between the normal and setting modes.
⊖ Minus key	Changes an item No. or item name to the minus (decrease) direction.
⊕ Plus key	Changes an item No. or item name to the plus (increase) direction.

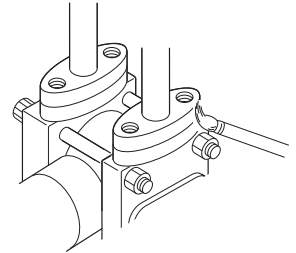
* Refer to Section "Adjustment procedure by the local configurator unit with LCD display" for details.

3.1 Installation :

After installation (refer to chapter 6.1) 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 7.1.
- (3) Vent the process covers of the transmitter.



DANGER

Before starting up the transmitter in flameproof area, please read carefully the technical instruction note ATEX Ref.HDFCX-AII V5 002.

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

The zero point check or zero adjustment in flameproof area, is only possible by the outside screw on the electronics housing without opening the covers of this housing and in case of adjustment via HHC, the local wiring (connection) is not allowed.

Turn on the power to the transmitter.

Check the output signal of the transmitter by connecting a DC ammeter across CK+ and CK- of the terminal block.

After ten minutes or longer, adjust the transmitter output current at 4 mA (zero adjustment). (See below)

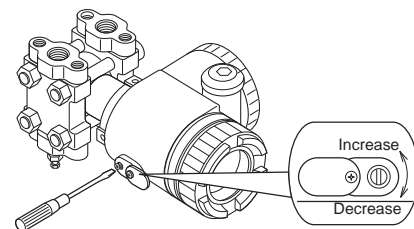
Zero adjustment:

Adjustment by zero adjustment screw

Zero adjustment is possible from outside screw on electronic housing.

Adjust zero point of the transmitter to 4 mA by turning the zero adjustment screw.

The higher you turn the screw, the quicker is the change of the zero.



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

After all operations are finished, assemble and tight the covers of the electronics housing. (Tightening torque: 20 N.m).



INDICATION

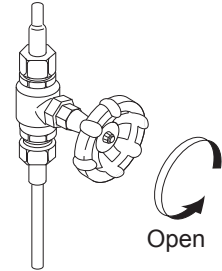
After adjustment of the transmitter, it should be kept energized for about 10 seconds to write the adjustment results into memory.

3.2 Operation

(1) Operation of gauge (FKG) and absolute (FKA) pressure transmitter :

Open the valve slowly to apply a pressure.

When a pressure is applied, the transmitter is set in the operating status.

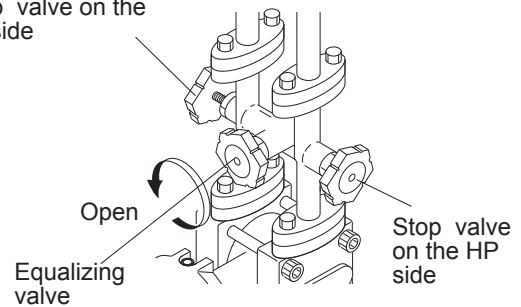


(2) Operation of differential pressure transmitter (FKC):

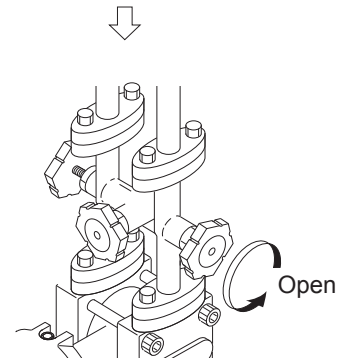
Set the operating status by manipulating the manifold valve.

Make sure the equalizing valve is open

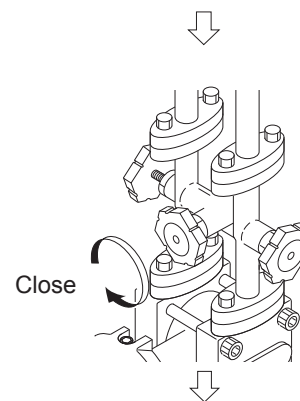
Stop valve on the LP side



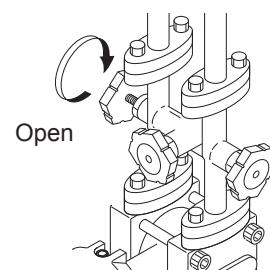
Open the stop valve on the HP side slowly.



Close the equalizing valve.



Finally, open the stop valve on the LP side slowly



Check of operating status

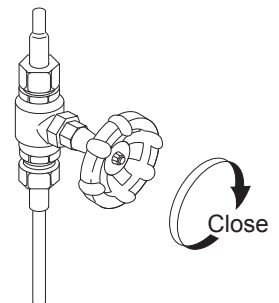
Use a field indicator, receiving instrument or HHC to check the operating status.

3.3 Shutdown

Follow the procedures

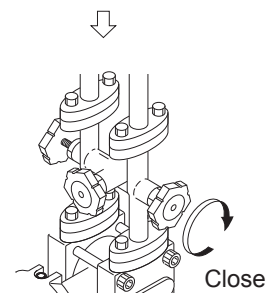
(1) Absolute and gauge pressure transmitters (FKG/FKP or FKA/FKH) :

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

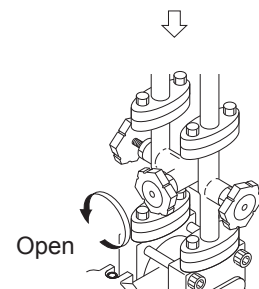


(2) Flow and differential pressure transmitter (FKC) :

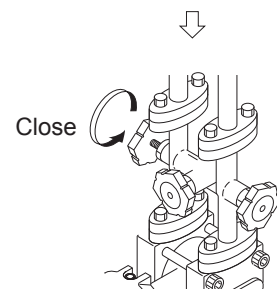
Close the stop valve on the high pressure side (HP side) slowly.



Open the equalizing valve..



Close the stop valve on the low pressure side slowly



PRECAUTION

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

For changing the measuring range, carry out zero adjustment first, and span adjustment next. (If zero adjustment is performed after span adjustment, the 100% point may not be adjusted correctly.)

Accordingly, the zero point (LRV) or span (URV-LRV) of the measuring range is changed. To confirm the changed values, display the measuring range (LRV, URV) by the HHC or the LCD unit with three push buttons after this operation



DANGER

In the case of a flameproof transmitter, do not open the cover from amplifier case to make following adjustments with active DC power supply.

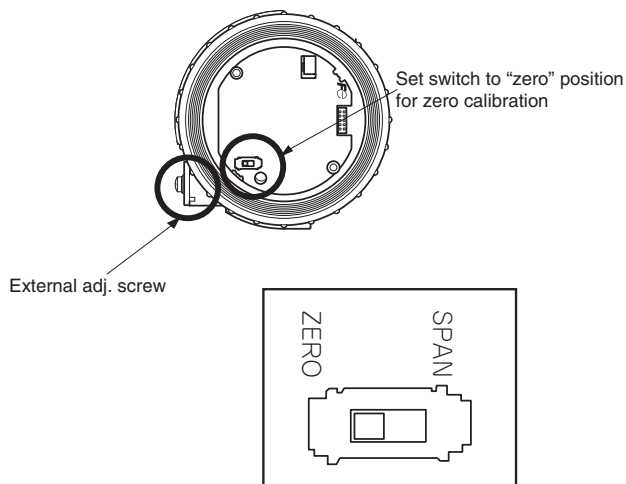
4.1 Adjustment procedure using the external adjusting screw

4.1-1 Zero adjustment by the screw

Zero point of the transmitter is adjustable by the outside screw with the mode setting switch in the housing set at zero position.

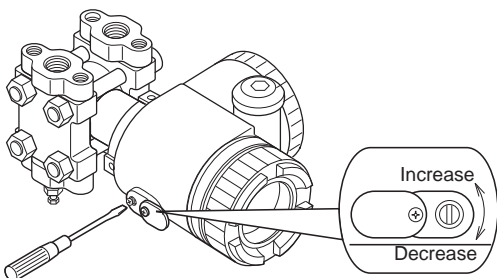
The figure shown below is an example of "Mode setting switch" is attached.

(1) Set the mode setting switch to zero position.



(2) Apply standard input pressure corresponding to new Lower Range Value

(3) Adjust output to 4mA by turning the outside screw



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

For zero suppression or elevation, apply the specified input pressure in advance and adjust the output to 4mA using the outside screw.

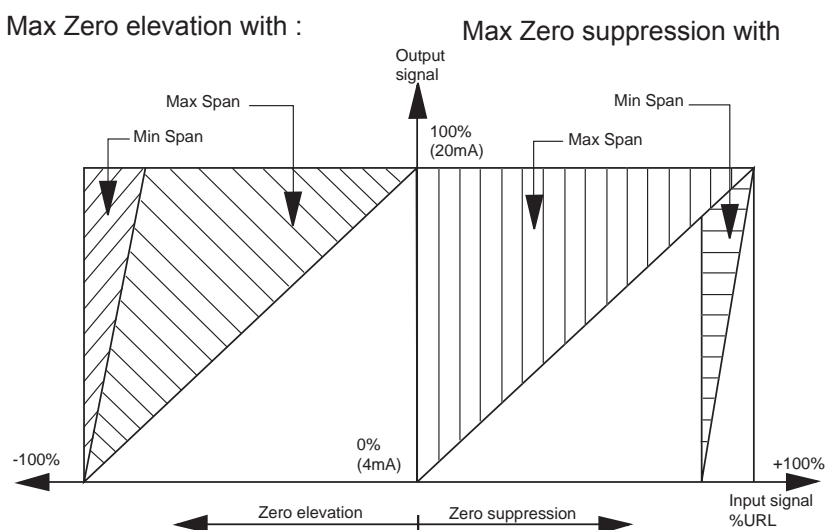
Note :

- 1) If the transmitter is locked, it can't be adjusted by the external adjustment screw.
- 2) When a digital indicator is attached to the transmitter, make sure that the LCD lamp "ZERO" is ON.

! INDICATION

After adjustment, the transmitter should be kept energized at about 10 seconds to write the adjustment results into memory. When a digital indicator is attached to the transmitter, it's necessary to remove this indicator and to replace it in the same place by the zero/span adjustment electronic circuit.

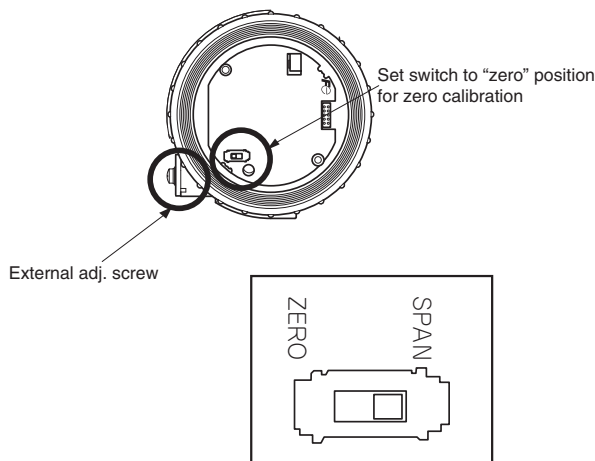
For zero suppression or elevation ranges, apply the specified LRV pressure in advance and adjust the output signal to 4.00mA using the external adj. screw.



4.1-2 Span adjustment by the screw

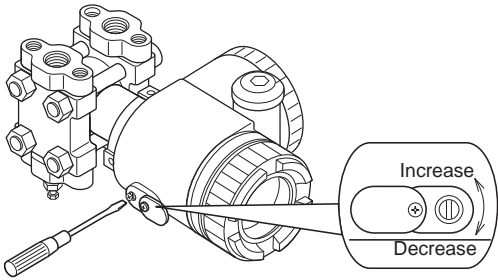
The measuring range for each transmitter is determined according to its type. Span is changed by the outside screw with the mode setting switch in the housing set at span position. The figure shown below is an example of "Mode setting switch" is attached.

(1) Set the mode setting switch to span position.



(2) Apply standard input pressure corresponding to new Lower Range Value

(3) Adjust output to 20mA by turning the outside screw



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

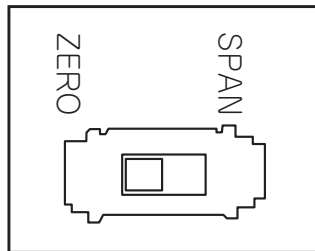
Note :

1) After adjustment the span, reset the mode setting switch to Zero position

Note :

1) If the transmitter is locked, it can't be adjusted by the external adjustment screw.
 2) When a digital indicator is attached to the transmitter, make sure that the LCD lamp "ZERO" is ON.

(4) Then return to applying input pressure of zero again and make sure output is 4 mA.




! INDICATION

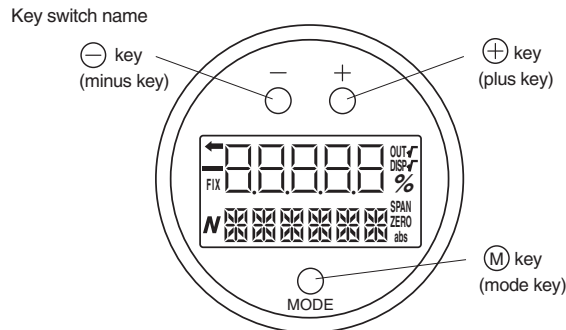
After adjustment, the transmitter should be kept energized at about 10 seconds to write the adjustment results into memory.
 When a digital indicator is attached to the transmitter, it's necessary to remove this indicator and to replace it in the same place by the zero/span adjustment electronic circuit.

4.2 Adjustment procedure by local configurator unit with LCD display

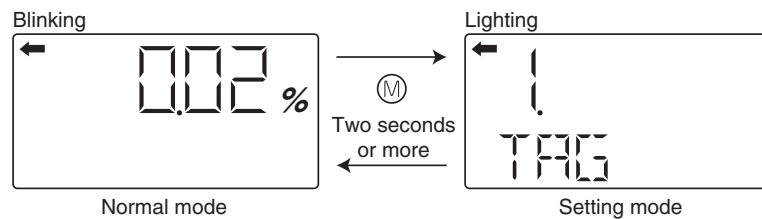
You can use various functions of the FCX-All V5 serie transmitters with 3 push button key switches by installing the local configurator unit with LCD display in the transmitter.

Cautions for opération

 DANGER	<p>To change the set value, check that the control loop of the host system (such as an instrumentation system) can be performed manually.</p>
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Mode switching



- To switch the normal mode to the setting mode:
Press the Ⓜ key for two seconds or more.
- To switch the setting mode to the normal mode:
Press the Ⓜ key for two seconds or more on the item name selection screen.
If no operation is performed for three minutes in the setting mode, the mode is automatically switched back to the normal mode.

Cautions for setting

- Setting error
If a setting error occurs, an error display shown on the lower right appears in the display. Press the Ⓜ key to return to the item name selection screen in the setting mode.
- Adjusting screw
You cannot use the adjusting screw in the setting mode. 
- HHC transmission
After switching to the setting mode, you can input commands during the item name selection screen.
After switching to the setting mode, you cannot input commands after selecting items.

4.2.1 Menu list

The following are the menu items. Adjust each setting as required.

Item (large classification)		Item name	Description	Page
1	TAG No.	1. TAG	Display and setting of TAG No. (*1)	22
2	Model code	2. TYPE	Display and setting of type (*1)	23
3	Serial No.	3-1. SERIAL N	Display of serial No.	24
		3-2. VER	Display of transmitter software version	24
4	Engineering unit	4. UNIT	Display and change of engineering unit (*1)	25
5	Range limit	5. URL	Display of maximum measuring range	25
6	Measuring range	6-1. LRV	Change of LRV (lower range value of measuring range = 0% point) (*1)	26
		6-2. URV	Change of URV (upper range value of measuring range = 100% point) (*1)	27
7	Damping	7. DAMP	Change of damping time constant (*1)	28
8	Output mode	8-1. OUT Md	Change of output mode (*3) (*1)	29
		8-2. CUT Pt	Setting of low flow rate cut point (*3) (*1)	29
		8-3. CUT Md	Setting of low flow rate cut mode (*3) (*1)	30
9	Direction and value of burnout	9-1. BURNOT	Change of burnout direction (*1)	31
		9-2. OVER	Change of output value when burnout direction = OVERSCALE (*4) (*1)	31
		9-3. UNDER	Change of output value when burnout direction = UNDERSCALE (*5) (*1)	33
A	Zero/span calibration	A-1. ZERO	Zero calibration (*6) (*2)	33
		A-2. SPAN	Span calibration (*6) (*2)	34
B	Output circuit calibration	b-1. 4mAAdj	4 mA calibration (*8) (*2)	35
		b-2. 20mAAdj	20 mA calibration (*8) (*2)	35
		b-3. FIXcur	Constant current output (*8)	35
D	Self-diagnosis	d-1. AMPTMP	Display of internal temperature of transmitter	36
		d-2. ALMCHK	Display of self diagnosis.	36
F	Locking of adjustment functions	F. LOCK	Locking and unlocking of the adjusting screw and the adjustment function in the setting mode (*1)	37
G	LCD display range setting	G-1. LDV	LDV (Lower Display Value) setting (*1)	38
		G-2. UDV	UDV (Upper Display Value) setting (*1)	39
		G-3. DP	DP (number of digit after Decimal Point) setting (*1)	39
		G-4. LcdUnit	LcdUnit (LCD Unit Code) setting (*1)	40
		G-5. LcdOpt	LcdOpt (LCD Option) setting (*1)	40
I	Input-output range adjustment	I-1. LRVAdj	Zero adjustment by range (LRV) change (*6) (*2)	41
		I-2. URVAdj	Span adjustment by range (URV) change (*6) (*2)	42
J	Value and specification of saturation current	J-1. SAT LO	Change of saturation current value (lower limit) (*7) (*1)	43
		J-2. SAT HI	Change of saturation current value (upper limit) (*7) (*1)	43
		J-3. SPEC	Selection (Nomal specification/expanded specification) of specifications of burnout & saturation current (*1)	44
K	Protective function of set value	K. GUARD	Setting and cancellation of set value protection (write protect) (*9)	45
L	History information	L-1. HisZERO	Display of zero calibration data for users	46
		L-2. HisSPAN	Display of span calibration data for users	46
		L-3. HisCLEAR	Clearing of zero/span calibration data (*1)	46
		L-4. HisAMP	Display of min/max of amplifier temperature history information	46
		L-5. HisCELL	Display of min/max of cell temperature history information	46

*1: If the write protect is selected at "K. GUARD," the display for selecting whether the setting will be performed does not appear, but "GUARD" appears. You cannot change the value in this condition.

*2: If the adjustment function is locked at "F.Lock" or the write protect is selected at "K. GUARD," the item names is not displayed.

*3: Only differential pressure transmitters have this function. Other transmitters do not display the item name.

*4: This item is valid only if when the burnout direction = "OVERSCALE." If not, the item name is not displayed.

*5: This item is valid only if when the burnout direction = "UNDERSCALE." If not, the item name is not displayed.

*6: This item is valid only if polygonal line correction is invalid. If the polygonal line correction is valid or the equipment is defective, the item name is not displayed.

*7: You cannot change the value if the nomal specification is selected at "J-3: SPEC."

*8: In the multidrop mode, this item is invalid and the item name is not displayed.

*9: If the write protect function (with a password) is selected by the HHC, the item name is not displayed.

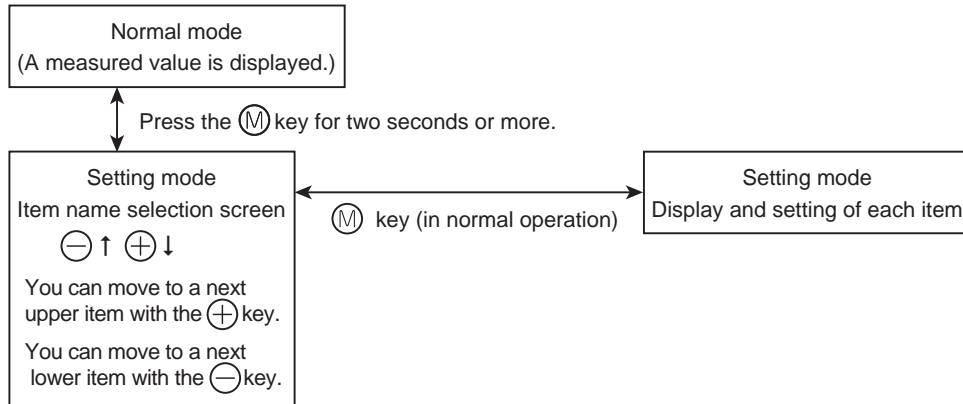
4.2.2 Switching menus

Setting mode (item name selection screen □ display and setting of each item)

Press the M key for a few seconds to switch the normal mode to the setting mode (item name selection screen).

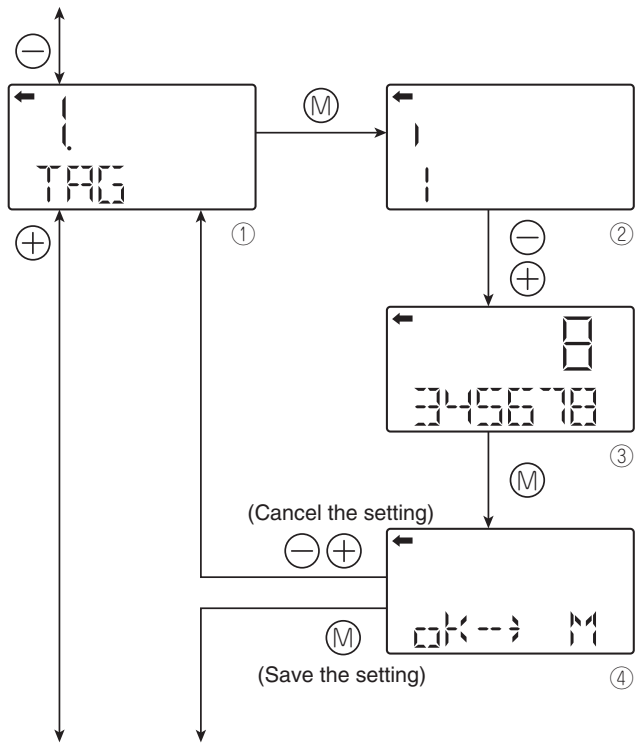
Press the M key for a few seconds to switch the setting mode (item name selection screen) to the normal mode.

After selecting an item with the \ominus/\oplus keys, press the M key (in normal operation) to move to each item.



1. TAG	↑ ↓	→ 1. Display and setting of TAG No.
2. TYPE	↑ ↓	→ 2. Display and setting of type
3-1. SERIAL N	↑ ↓	→ 3-1. Display of serial No.
3-2. VER	↑ ↓	→ 3-2. Display of transmitter software version
4. UNIT	↑ ↓	→ 4. Display and change of engineering unit
5. URL	↑ ↓	→ 5. Display of maximum measuring range
6-1. LRV	↑ ↓	→ 6-1. Change of LRV (lower range value of measuring range = 0% point)
6-2. URV	↑ ↓	→ 6-2. Change of URV (upper range value of measuring range = 100% point)
7. DAMP	↑ ↓	→ 7. Change of damping time constant
8-1. OUT Md	↑ ↓	→ 8-1. Change of output mode
8-2. CUT Pt	↑ ↓	→ 8-2. Setting of low flow rate cut point
8-3. CUT Md	↑ ↓	→ 8-3. Setting of low flow rate cut mode
9-1. BURNOT	↑ ↓	→ 9-1. Change of burnout direction
9-2. OVER	↑ ↓	→ 9-2. Change of output value when burnout direction = OVERSCALE
9-3. UNDER	↑ ↓	→ 9-3. Change of output value when burnout direction = UNDERSCALE
A-1. ZERO	↑ ↓	→ A-1. Zero calibration
A-2. SPAN	↑ ↓	→ A-2. Span calibration
B-1. 4mAAdj	↑ ↓	→ B-1. 4 mA calibration
B-2. 20mAAdj	↑ ↓	→ B-2. 20 mA calibration
B-3. FIXcur	↑ ↓	→ B-3. Constant current output
D-1. AMPTMP	↑ ↓	→ D-1. Display of internal temperature of transmitter
D-2. ALMCHK	↑ ↓	→ D-2. Display of self-diagnosis.
F. LOCK	↑ ↓	→ F. Locking and unlocking of the adjusting screw and the adjustment function in the setting mode
G-1. LDV	↑ ↓	→ G-1. LDV (Lower Display Value) setting
G-2. UDV	↑ ↓	→ G-2. UDV (Upper Display Value) setting
G-3. dP	↑ ↓	→ G-3. DP (Digit Number Under Decimal Point) setting
G-4. LcdUnit	↑ ↓	→ G-4. LcdUnit (LCD Unit Code) setting
G-5. LcdOpt	↑ ↓	→ G-5. LcdOpt (LCD Option) setting
I-1. LRVAdj	↑ ↓	→ I-1. Zero adjustment by range (LRV) change
I-2. URVAdj	↑ ↓	→ I-2. Span adjustment by range (URV) change
J-1. SAT LO	↑ ↓	→ J-1. Change of saturation current value (lower limit)
J-2. SAT HI	↑ ↓	→ J-2. Change of saturation current value (upper limit)
J-3. SPEC	↑ ↓	→ J-3. Selection (nomal specification/expanded specification) of specifications of burnout & saturation current
K. GUARD	↑ ↓	→ K. Setting and cancellation of set value protection (write protect)
L-1. HisZERO	↑ ↓	→ L-1. Display of zero calibration data for users
L-2. HisSPAN	↑ ↓	→ L-2. Display of span calibration data for users
L-3. HisCLEAR	↑ ↓	→ L-3. Clearing of zero/span calibration data
L-4. HisAMP	↑ ↓	→ L-4. Display of min/max of amplifier temperature history information
L-5. HisCELL	↑ ↓	→ L-5. Display of min/max of cell temperature history information

4.2.3 Operating procedure



TAG N°

To set the TAG No. of each field device, use the procedures shown in the following diagram. TAG NO. can be inputted up to 26 character of alphanumeric codes.

- Press the **M** key on the screen ① to display the TAG No. setting (②).
- Input alphanumeric characters as required with the **-** and **+** keys on the screen ②.

Functions of the keys:

- key: To input characters at the cursor position (0 to 9, space, A to Z, -)
- +** key: To move the cursor position to the next (1 \boxtimes 2 \boxtimes 3 ... \boxtimes 26 \boxtimes 1)

Note)

Characters other than numerical characters, capital letters of the alphabet, space, and “-” are displayed as “.”.

Initial six characters are displayed. (The cursor position is displayed by a vertical bar.)

To display the seventh and following characters, scroll the characters to the left. (The cursor position (far right) is displayed as a number.)

The cursor position is 1 in the example ②. (Number 1 is input as the first character.)

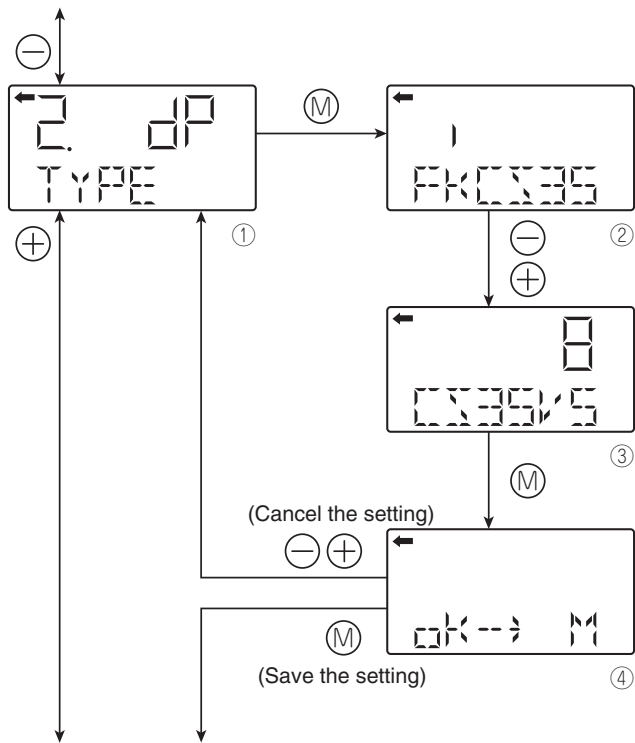
The cursor position is 8 in the example ③. (Number 8 is input as the eighth character.)

If HART is selected, the initial eight characters are treated as TAG information.

- Select whether the TAG No. setting is saved on the screen ④.

Press the **M** key to save the TAG No. setting.

Press the **-** or **+** key to cancel the setting.



Model code (TYPE)

Model code of field device is displayed and changed (example of differential pressure transmitter).

- Press the **M** key on the screen ① to display the model code setting screen (②).
- Input alphanumeric characters as required with the **⊖** and **⊕** keys on the screen ②.

Functions of the keys:

- ⊖ key: To input characters at the cursor position.
(0 to 9, space, A to Z, -)
- ⊕ key: To move the cursor position to the next.
(1 ⌘ 2 ⌘ 3 ... ⌘ 16 ⌘ 1)

Note)

Characters other than numerical characters, capital letters of the alphabet, space, and "-" are displayed as "*".

Initial six characters are displayed. (The cursor position is displayed by a vertical bar.)

To display the seventh and following characters, scroll the characters to the left. (The cursor position (far right) is displayed as a number.)

The cursor position is 2 in the example ②. ("K" is input as the second character.)

The cursor position is 8 in the example ③. ("5" is input as the eighth character.)

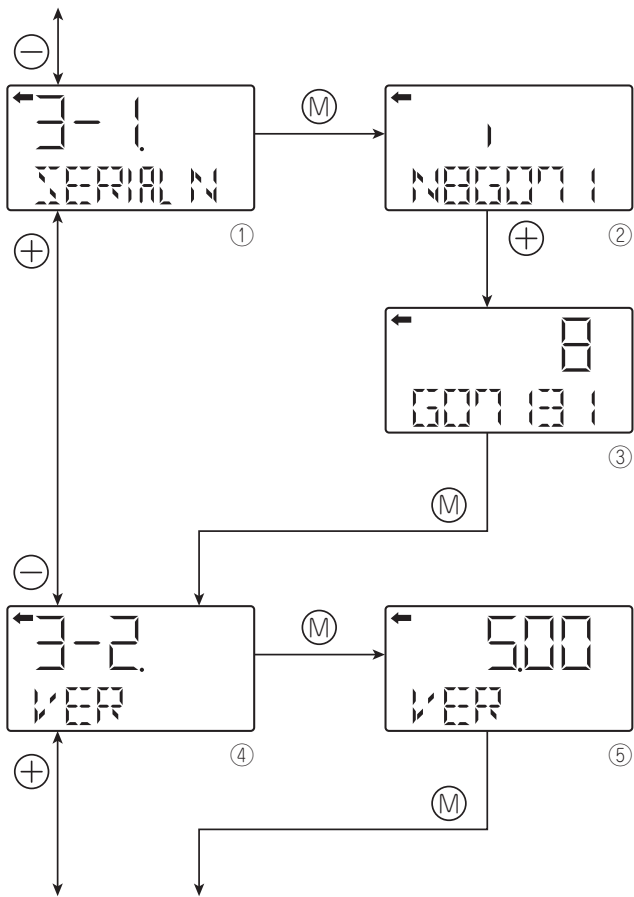
- Select whether the type setting is saved on the screen ④. Press the **M** key to save the type setting. Press the **⊖** or **⊕** key to cancel the setting.

* Description of the displays on the first line on the item name selection screen (①)

⌘⌘: Differential pressure transmitter

⌘⌘: Pressure (gauge pressure) transmitter

⌘⌘: Absolute pressure transmitter



Serial N°

SERIAL N°(8 letters) and transmitters software version are displayed.

Display of SERIAL No.

- Press the (M) key on the screen ☒ to display the SERIAL N° (☒)

Note)

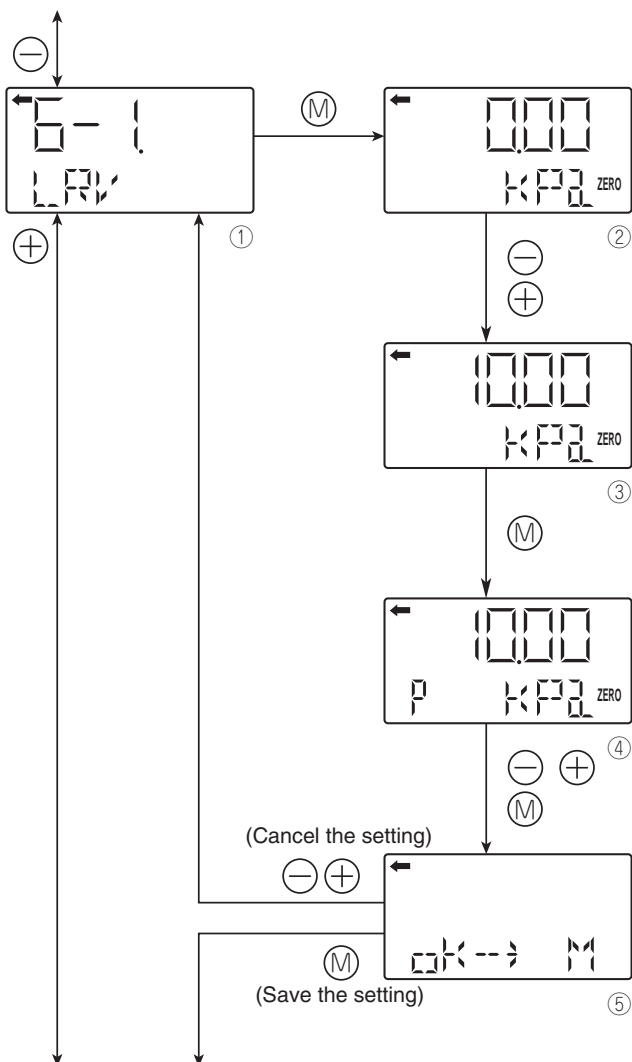
Characters other than numerical characters, capital letters of the alphabet, space, and “-” are displayed as “*.”

Initial six characters are displayed. (The cursor position is displayed by a vertical bar.)

To display the seventh and following characters, scroll the characters to the left by pressing + key. (The cursor position (far right) is displayed as a number.)

Display of transmitter software version

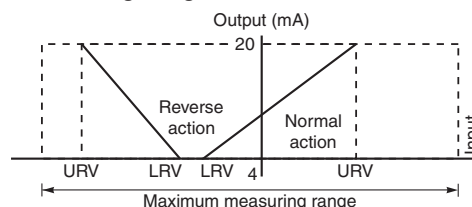
- To display the software version (☒), press the (M) key on the screen ☒.



Measuring range (LRV, URV)

LRV: Lower range value (0% point)
 URV: Upper range value (100% point)

Selectable setting range



Note) If the set value of the LRV is outside the range, an error also occurs in the URV setting, and vice versa.

The maximum setting range is ± 99999 .

The URV may exceed the upper limit depending on the change of the UNIT. If that happens, change the URV first.

Change of LRV (lower limit of the measuring range = 0% point)

- Press the M key on the screen \boxtimes to display the screen for setting the zero point range \boxtimes .
- Input the numerical values with the \ominus and \oplus keys on the screen \boxtimes .

Functions of the keys:

\ominus key: To decrease the value.

\oplus key: To increase the value.

Range: $-99999 \leq \text{LRV} \leq 99999$

Note) If "UUUUU" is displayed as a LRV value, the unit is not supported.

- To set the decimal point position, press the M key on the screen \boxtimes . "P" is displayed at the left of the unit name \boxtimes and you can set the decimal point position with the \ominus and \oplus keys.

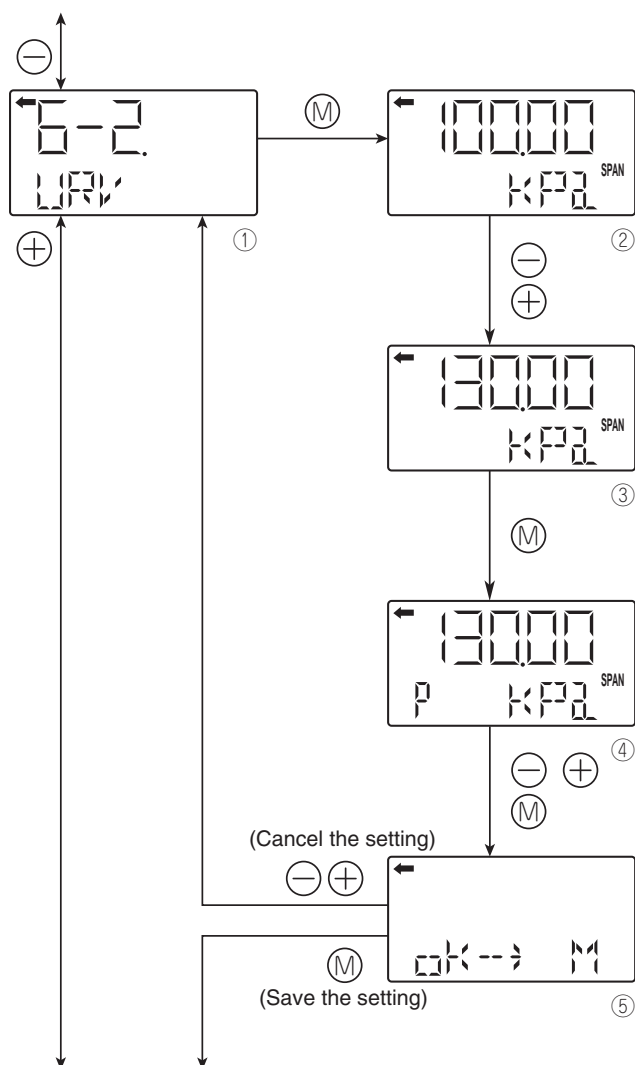
\ominus key: To move the decimal point position to left

\oplus key: To move the decimal point position to right

- Select whether the LRV setting is saved on the screen \boxtimes .

Press the M key to save the zero point range setting.

Press the \ominus or \oplus key to cancel the setting.



Change of URV (upper limit of the measuring range = 100% point)

- Press the `M` key on the screen `☒` to display the screen for setting the 100% point (`☒`).
- Input the numerical values with the `-` and `+` keys on the screen `☒`.

Functions of the keys:

`-` key: To decrease the value.

`+` key: To increase the value.

Range: $-99999 \leq \text{URV} \leq 99999$

Note)

If "UUUUU" is displayed as a URV value, the unit is not supported.

- To set the decimal point position, press the `M` key on the screen `☒`. "P" is displayed at the left of the unit name (`☒`) and you can set the decimal point position with the `-` and `+` keys.

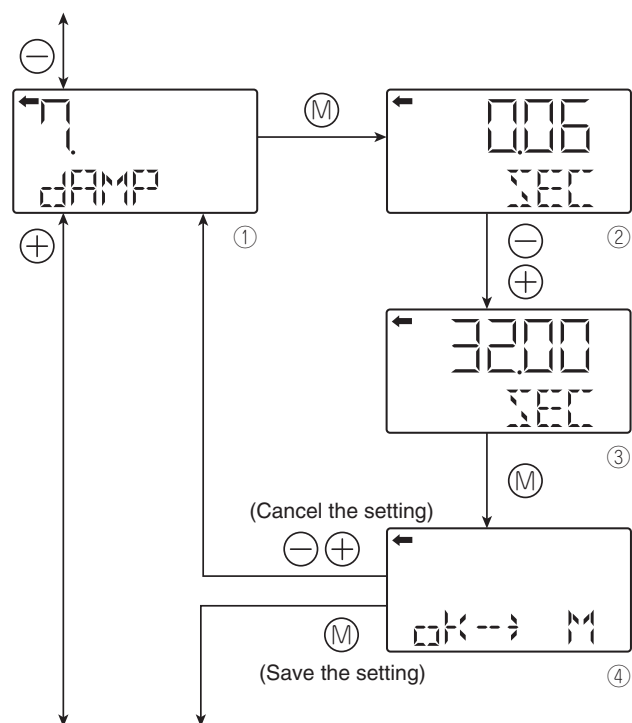
`-` key: To move the decimal point position to left

`+` key: To move the decimal point position to right

- Select whether the URV setting is saved on the screen `☒`.

Press the `M` key to save the 100% point setting.

Press the `-` or `+` key to cancel the setting.



Damping

In the case where the process input fluctuation is large, the vibration of the installation site is large, and minute differential pressure is measured, if the output fluctuation is large, set appropriate damping time constant to suppress the output fluctuation.

Change of damping time constant

- Press the **M** key on the screen \boxtimes to display the screen for changing the damping time constant (\boxtimes).
- Input the damping time constant with the **-** and **+** keys on the screen \boxtimes . Press the **-** key to decrease the value and press the **+** key to increase the value.

Settable range: 0.06 to 32.0 sec

- Select whether the damping time constant setting is saved on the screen \boxtimes .

Press the **M** key to save the damping time constant setting.

Press the **-** or **+** key to cancel the setting

About the output fluctuation of the transmitter caused by vibration and damping

1) Magnitude of output fluctuation (oscillation) caused by vibration

If the transmitter is mounted to a place subject to severe vibration, output fluctuation (oscillation) may increase. Since the transmitter uses oil as internal pressure transmitting medium, if acceleration is caused by vibration, internal pressure is generated in accordance with the acceleration value, thus resulting in the output fluctuation. The magnitude of output oscillation may become the value shown below at the maximum.

Oscillation frequency: 10 to 150 Hz

Within $\pm 0.25\%$ of URL/(9.8m/s²)

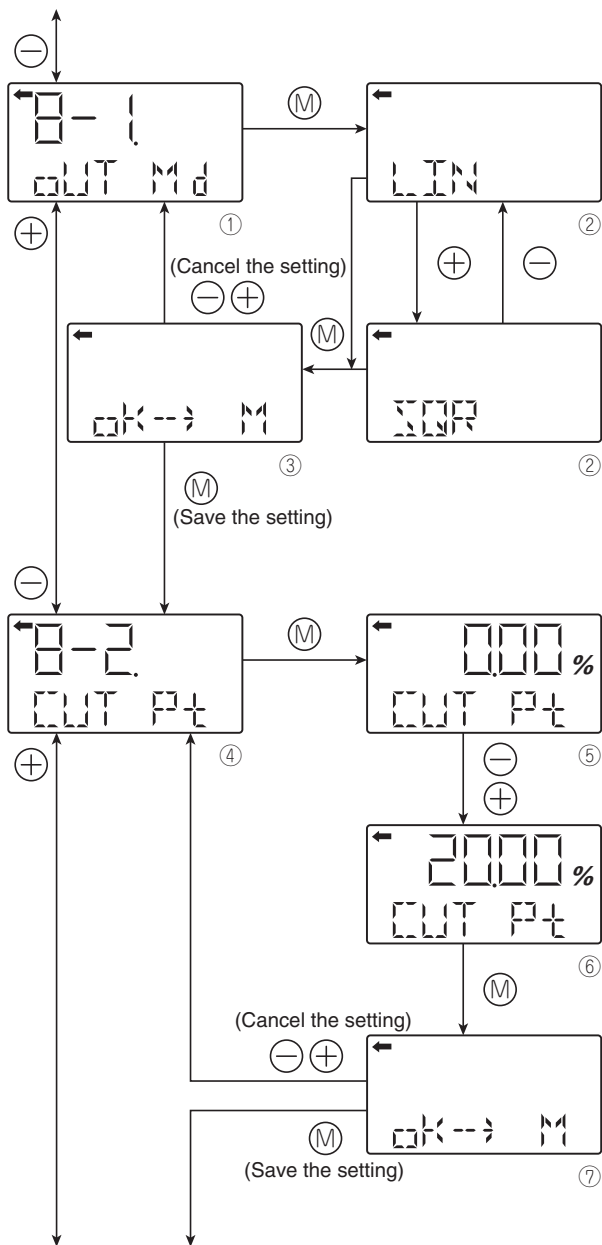
2) Damping

The output fluctuation (oscillation) of the transmitter in an environment subject to vibration can be damped by setting appropriate damping time constant using the HHC. The following table shows the effect of damping on the vibration of 10Hz where the output fluctuation becomes the maximum.

Guideline of the effect of damping on the output fluctuation (oscillation)

Damping set value [sec]	Damping of output oscillation	Remarks
1.2	1/3 or lower	
4.8	1/5 or lower	
19.2	1/10 or lower	

Note) In the oscillation range from 10 to 150Hz, the output fluctuation (oscillation) becomes the maximum at 10Hz, that is, the lowest frequency.



Output mode

The output mode is used to select the proportional mode (proportional to input differential pressure) or square root extraction mode (proportional to flow rate) for the output signal (4 to 20 mA) of the differential pressure transmitter.

In the square root extraction mode, you can set the cut point of low cut and the modes below the cut point.

Change of output mode

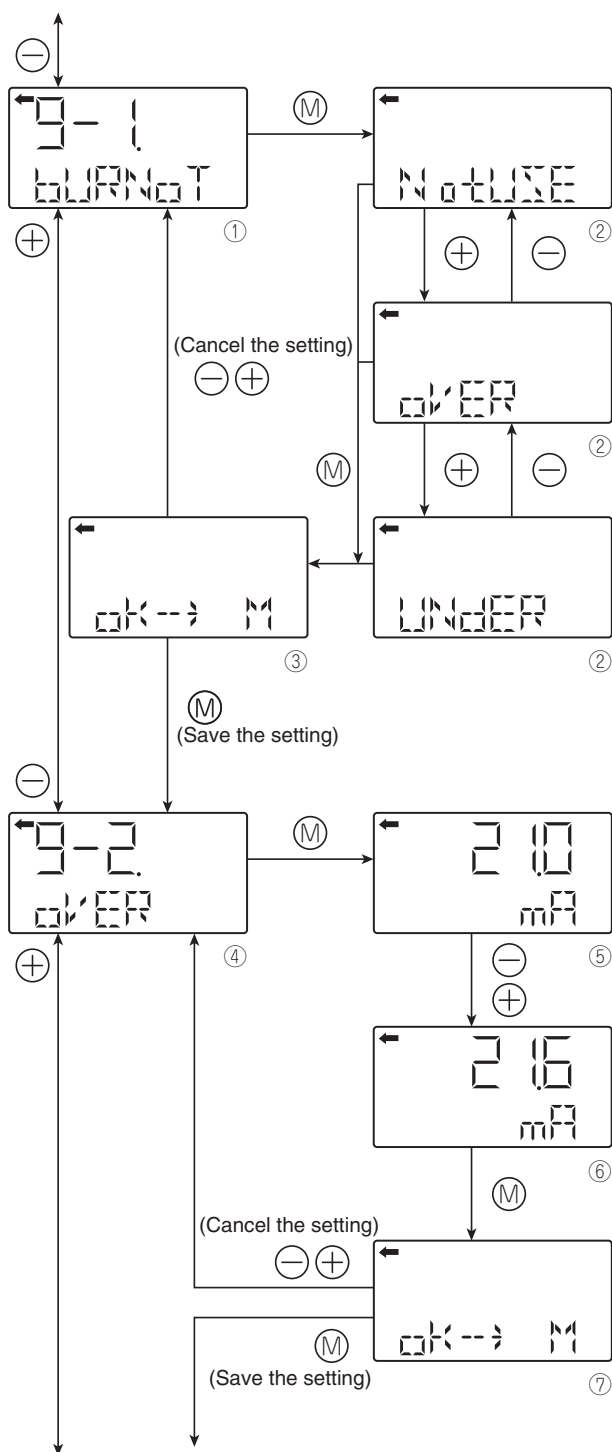
- Press the **M** key on the screen **8-1** to display the screen for changing output mode **8-1**.
- You can select the proportional or square root extraction mode on the screen **8-1**.
Select LIN (proportional mode) or SQR (square root extraction mode) with the **+** or **-** key and press the **M** key.
- Select whether the output mode setting is saved on the screen **8-1**.
Press the **M** key to save the output mode setting.
Press the **+** or **-** key to cancel the setting.

Low cut point setting

If you select the square root mode, set the low cut point.

Cut point is adjustable within the range of 0.00 to 20.00%. Note that if the cut point is set to a small value around 0%, even a minute differential pressure change causes a sudden output fluctuation. The cut point is used for stabilizing output near 0% when the square root extraction mode is selected for output signal.

- Press the **M** key on the screen **8-2** to display the screen for setting the low cut point **8-2**.
- You can set and change the low cut point by inputting the numerical values with the **+** and **-** keys on the screen **8-2**.
Settable range: 0.00 to 20.0%
- Select whether the cut point setting is saved on the screen **8-2**.
Press the **M** key to save the cut point setting.
Press the **+** or **-** key to cancel the setting.



See the next page for the procedure when UNDER is selected.

Burnout direction

Used for selecting output at occurrence of a fault in the detecting unit.

Change of burnout direction

NotUse → Output hold

OVER → OVERSCALE

UNDER → UNDERSCALE

- Press the **M** key on the screen **☒** to display the screen for changing the burnout direction (**☒**).
- Select NotUse, OVER or UNDER on the screen (2) with the **⊖** or **⊕** key and press the **M** key.
- Select whether the burnout direction setting is saved on the screen **☒**.
Press the **M** key to save the burnout direction setting.
Press the **⊖** or **⊕** key to cancel the setting.

Change of burnout current when OVER (OVERSCALE) is selected for the burnout direction

This display appears if you select "OVER" for the burnout direction.

- Press the **M** key on the screen **☒** to display the screen for changing the burnout current for OVERSCALE (**☒**).
- You can change the burnout current with the **⊖** and **⊕** keys on the screen **☒**.

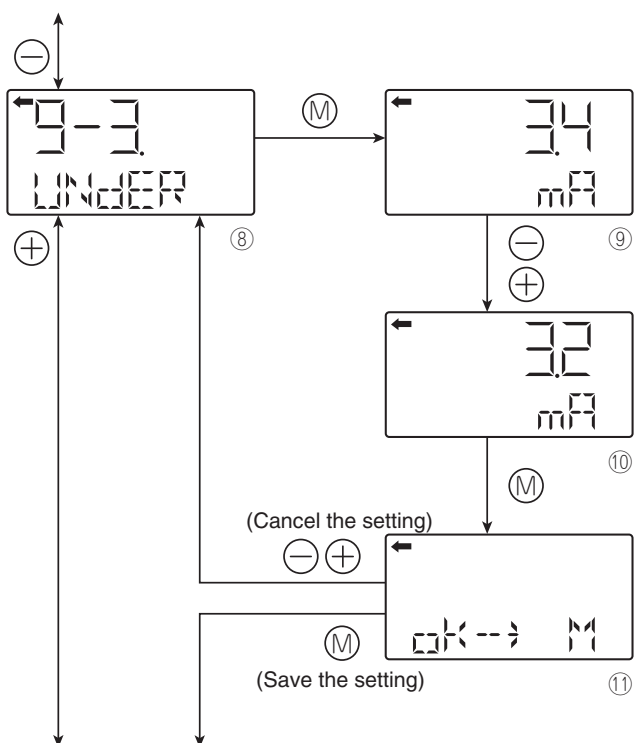
Settable range:

Saturation current value (upper limit) ≤ Burnout (OVER) ≤ 21.6 mA

Note)

You can change the saturation current value (upper limit) setting at "J: Value and specification of saturation current."

- Select whether the burnout current setting is saved on the screen **☒**.
Press the **M** key to save the burnout current setting for OVERSCALE.
Press the **⊖** or **⊕** key to cancel the setting.



Change of burnout current when UNDERSCALE is selected for the burnout direction

This display appears if you select “UNDER” for the burnout direction.

- Press the M key on the screen 8 to display the screen for changing the burnout current for UNDERSCALE (9).

- You can change the burnout current with the \ominus and \oplus keys on the screen 9 .

Settable range:

$3.2 \text{ mA} \leq \text{Burnout (UNDER)} \leq \text{Saturation current value (lower limit)}$

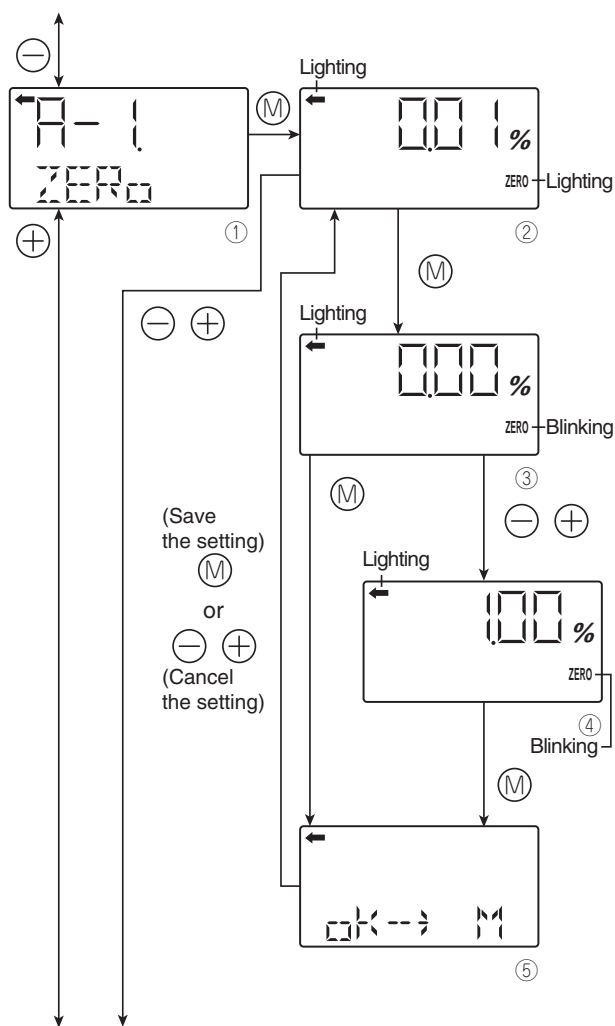
- Select whether the burnout current setting is saved on the screen 11 .

Press the M key to save the burnout current setting for UNDERSCALE.

Press the \ominus or \oplus key to cancel the setting.

Note)

You can change the saturation current value (lower and upper limits) setting in “J. Value and specification of saturation current.”



Zero/span calibration

Zero and span are adjustable by applying an reference pressure.

! INDICATION

1. After performing a zero calibration, perform a span calibration.
2. If you input the value that exceeds the adjustable range, the setting will not be changed even after the setting is saved.

Adjustable range

Zero calibration: within $\pm 40\%$ of the max span

Span calibration: within $\pm 20\%$ of the set span

Zero calibration

- Press the M key on the screen \boxtimes to select the zero calibration mode.
- The measured value and unit on the screen (\boxtimes) are the same as those in the normal mode and “←” and “ZERO” light up.
- Apply the actual input pressure on the screen \boxtimes . After checking the measured value, press the M key.
- “ZERO” blinks on the screen \boxtimes . Press the M key on the screen \boxtimes to perform a zero calibration at the input pressure at the time. To perform a zero calibration at a point other than 0%, input an appropriate set value (%) (\boxtimes) with the \ominus and \oplus keys, and press the M key.

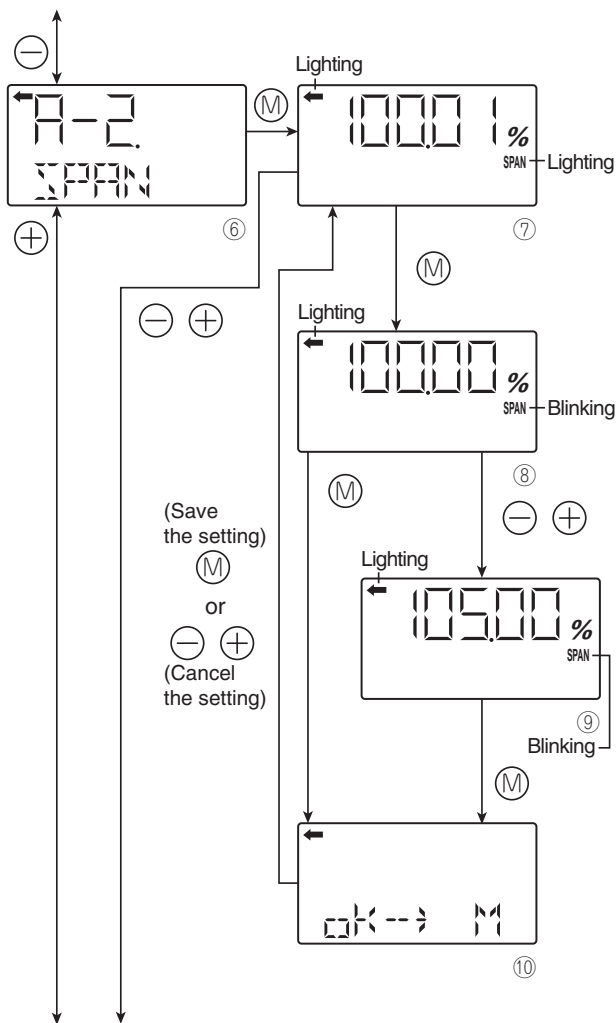
Settable range:

$$-1.000\%CS \leq PL \leq 100.000\%CS$$

$$PL = \frac{\text{Lower limit of adjustment point} \times 100}{\text{Setting range}}$$

Setting range

- * CS is an abbreviation of Calibrated Span, which means an actual measurement range.
- Select whether the zero calibration value setting is saved on the screen \boxtimes . Press the M key to save the zero calibration value setting and return to the screen \boxtimes . Press the \ominus or \oplus key to cancel the setting and return to the screen \boxtimes .
- Check that the zero calibration was performed as intended. Press the M key to perform a zero calibration again. Press the \ominus or \oplus key to move to the next screen for item name selection.



Span calibration

- Press the (M) key on the screen [] to select the span calibration mode.

The measured value and unit on the screen [] are the same as those in the normal mode and “←” and “SPAN” light up.

- Apply the actual input pressure on the screen []. After checking the measured value, press the (M) key.
- “SPAN” blinks on the screen []. Press the (M) key on the screen [] to perform a span calibration at the input pressure at the time. To perform a span calibration at a point other than 100%, input an appropriate set value (%) [] with the (-) and (+) keys, and press the (M) key.

Settable range:

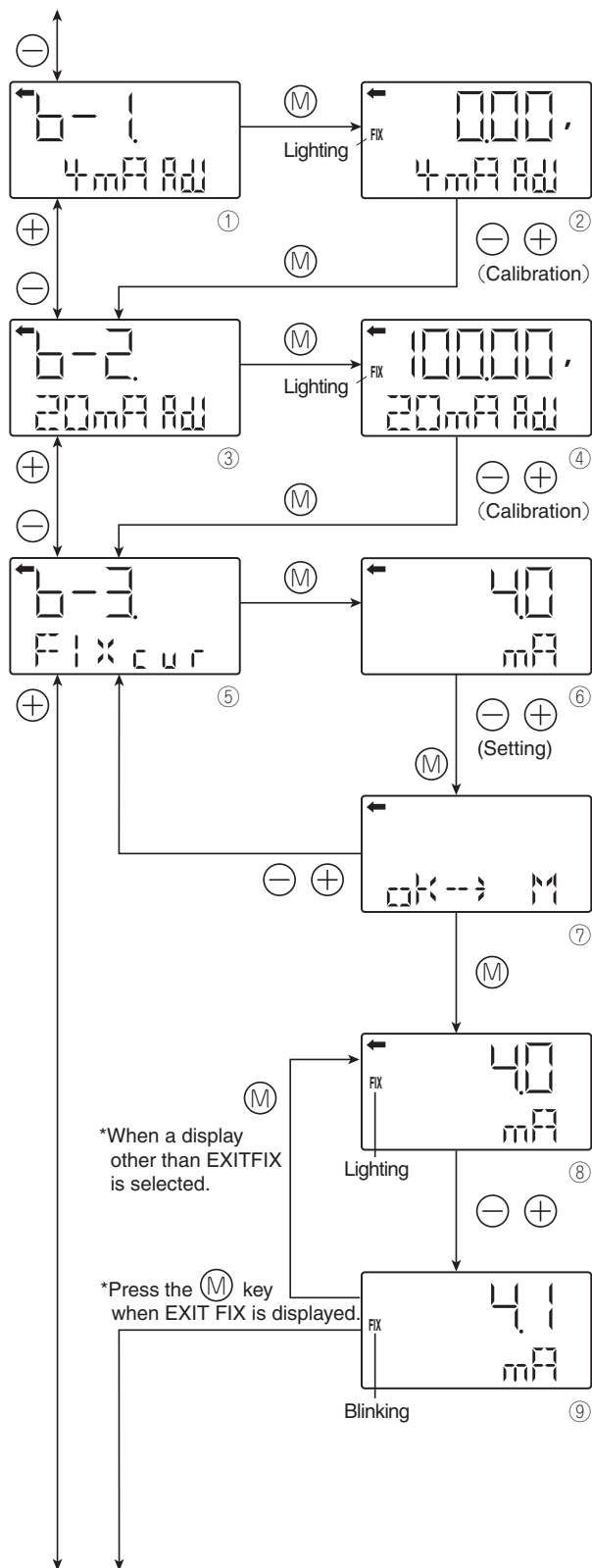
$0.000\%CS \leq PH \leq \text{Saturation current (upper limit) set value (\%CS)}$

$PL = \frac{\text{Upper limit of adjustment point} \times 100}{\text{Setting range}}$

Setting range

- Select whether the span calibration value setting is saved on the screen []. Press the (M) key to save the span calibration value setting and return to the screen []. Press the (-) or (+) key to cancel the setting and return to the screen [].
- Check that the span calibration was performed as intended. Press the (M) key to perform a span calibration again. Press the (-) or (+) key to move to the next screen for item name selection.

* CS is an abbreviation of Calibrated Span, which means an actual measurement range.



Calibration of output circuit (D/A)

The output circuit (D/A) should be calibrated by the following procedure when necessary.

Make calibration wiring transmitter according to "Calibration" in Appendix A2, and calibrate the output circuit using the following procedure.

4 mA adjustment

- Press the (M) key on the screen \boxtimes to display the screen for calibrating the constant current mode 4 mA (\boxtimes).
- Perform a calibration for 4 mA on the screen \boxtimes with the \ominus and \oplus keys.
- After the calibration, press the (M) key to move to the screen for calibration of 20 mA.

20 mA adjustment

- Press the (M) key on the screen \boxtimes to display the screen for calibrating the constant current mode 20 mA (\boxtimes).
- Perform a calibration of 20 mA on the screen \boxtimes with the \ominus and \oplus keys.
- After the calibration, press the (M) key to move to the constant current output screen.

Constant current output

- Press the (M) key on the screen \boxtimes to display the screen for performing a constant current output (\boxtimes).
- Input a current to be output on the screen \boxtimes with the \ominus and \oplus keys.

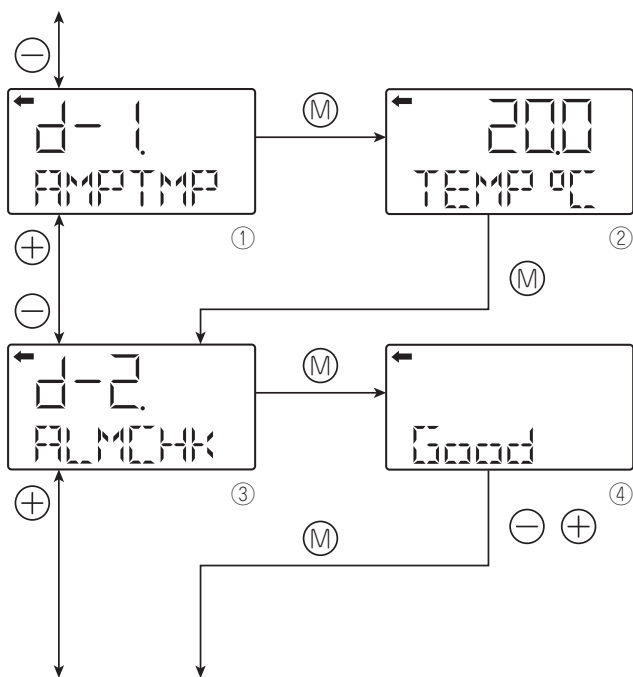
Output value range

3.2 mA \leftrightarrow 21.6 mA \leftrightarrow EXITFIX (cancellation) \leftrightarrow 3.2 mA

- Press the (M) key on the screen \boxtimes to output the input current value and the screen \boxtimes appears. Press the \ominus or \oplus key to cancel the input and return to the screen \boxtimes .
- Press the \ominus or \oplus key on the screen \boxtimes . FIX blinks and you can reset the constant current output value (\boxtimes). Input a set value with the \ominus and \oplus keys, press the (M) key to return to the screen \boxtimes , and output the reset current.
- Select EXITFIX on the screen \boxtimes and press the (M) key to terminate the constant current output and move to the item name selection screen.

Note)

If nothing is input for three minutes in the status of the constant current output, the screen returns to the normal mode with the constant current output kept. You can confirm it by the lighted FIX. Select the setting mode again. Select "FIX cur" on the display \boxtimes in the items of "6-3. FIX cur" and press the (M) key to terminate the constant current output.



Self-diagnosis

Self-diagnosis display shows the internal temperature of the transmitter and the failure description.

Internal temperature of the transmitter

- Press the M key on the screen \boxtimes to display the screen of internal temperature of the transmitter (\boxtimes). When a temperature alarm is issued, "TEMP" is changed to "ALM."

(This corresponds to "AMP TMP" of "Error display of self-diagnosis" in the following table.)

If the temperature cannot be measured due to defective internal data, "IMPOSS" is displayed.

(This corresponds to any of "RAM ER", "PAR ER" or "AMP EP" of "Error display of self-diagnosis" in the following table.)

Display of self-diagnosis results

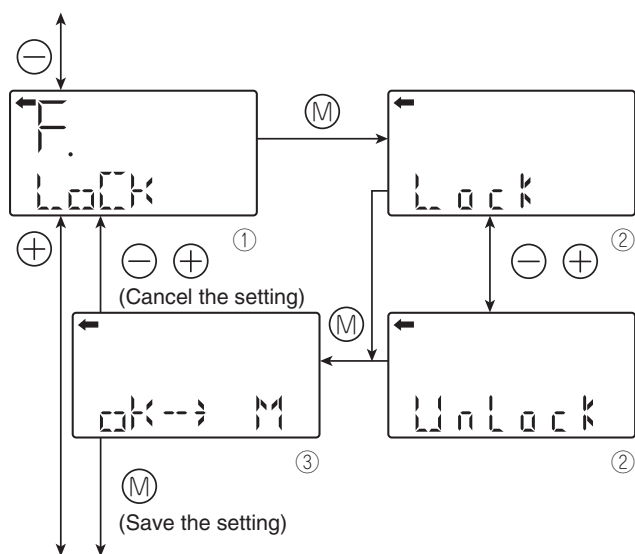
- Press the M key on the screen \boxtimes to show the self-diagnosis results (\boxtimes). Press the \ominus and \oplus keys to display errors sequentially.

See the following table "Contents of message" for the errors of the transmitter.

[Contents of message]

As a result of self-diagnosis, the message below is appeared on the LCD display, when there are trouble in the transmitter. For each error, its cause and remedy are suggested.

Error display of self-diagnosis	Display in normal mode	Cause	Remedy
C1 ERR ~ C9 ERR	FL-1	Error of detecting unit	Check the wiring between the detecting unit and transmitter. If the error is not recovered, replace the detecting unit.
RAM ER	FL-1	Calculation parameter (RAM) error	Replacement of amplifier
PAR ER		Error of magnitude relation of temperature data	
AMP EP	FL-2	EEPROM error on amplifier side	Replacement of amplifier
CEL EP	FL-3	EEPROM error on cell side	Replacement of detecting unit
AMP TMP	T. ALm	Amplifier temperature error	Transmitter temperature is normalized.
CEL TMP	T. ALm	Cell temperature error	
	OVER	Input pressure: J-2, saturation current (Hi) or higher	Correction of input pressure
	UNDER	Input pressure: J-1, saturation current (Lo) or lower	Correction of input pressure



Lock of adjustment functions

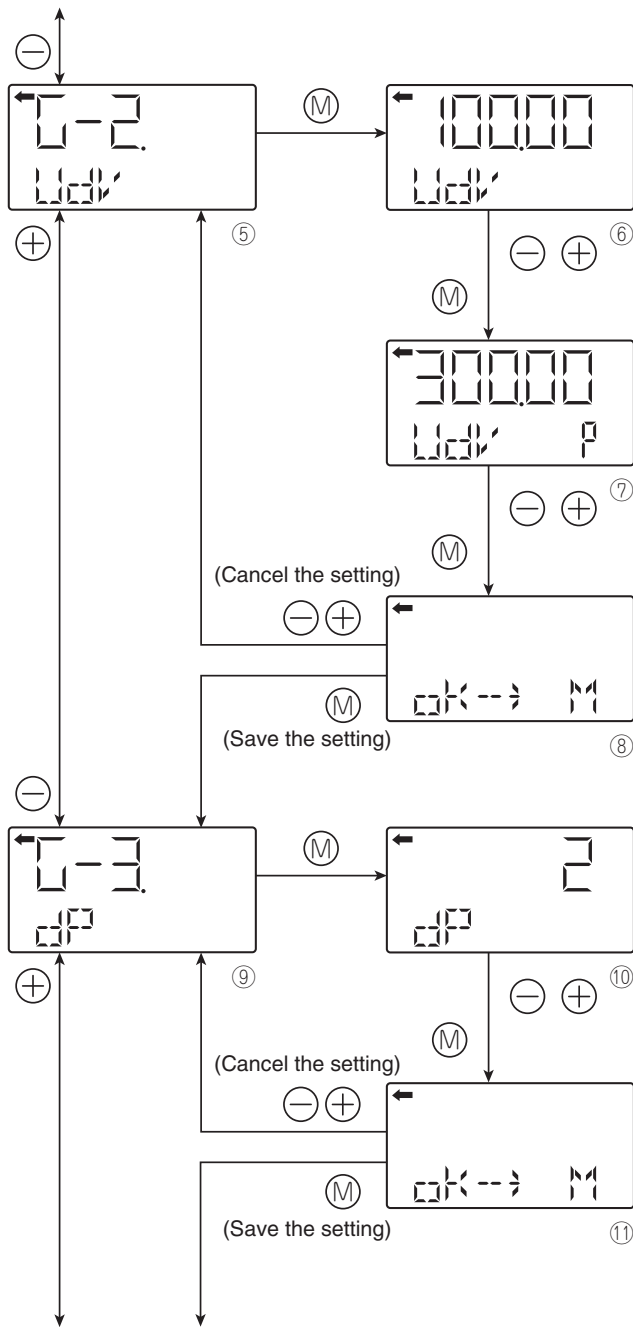
You can lock/unlock the adjustment function of the local configurator unit as follows.

When the adjustment functions are locked, the external adjusting screw is also locked.

- Press the **M** key on the screen \boxtimes to display the lock selection screen of adjusting functions (\boxtimes).
- Select the locking/unlocking of the adjustment functions on the screen \boxtimes with the **-** and **+** keys. Select the locking to lock the adjustment functions of the local configurator unit with LCD display. Select the UnLock to cancel the lock of the adjustment functions of the local configurator unit with LCD display.
- Select whether the locking/unlocking of the adjustment functions are saved on the screen \boxtimes . After selecting the locking/unlocking, press the **M** key to save the setting. Press the **-** or **+** key to cancel the setting and return to the screen \boxtimes .

List of adjustment functions locked/unlocked

A. Zero/span calibration	A-1. ZERO
	A-2. SPAN
B Output circuit calibration	b-1. 4mA Adj
	b-2. 20mA Adj
I. Input/Output range adjustment	I-1. LRV Adj
	I-2. URV Adj



- UDV (Setting of the indicated value of 100% (20 mA))
- Press the M key on the screen \boxtimes to display the screen for setting the indicated value corresponding to 100% (\boxtimes).
 - Input the indicated value corresponding to 100% of the actual scale on the screen \boxtimes with the \ominus and \oplus keys.
 - Functions of the keys:
 - \ominus key: To decrease the value
 - \oplus key: To increase the value
 - To set the decimal point position, press the M key on the screen \boxtimes . "P" is displayed at the right of the unit name (\boxtimes) and you can set the decimal point position with the \ominus and \oplus keys.
 - \ominus key: To move the decimal point position to left
 - \oplus key: To move the decimal point position to right
 - Select whether the indicated value setting of 100% is saved on the screen \boxtimes . Press the M key to save the indicated value setting. Press the \ominus or \oplus key to cancel the setting.

DP setting (number of digits after Decimal Point))
Set the number of digits after decimal point for the LCD indicated value.

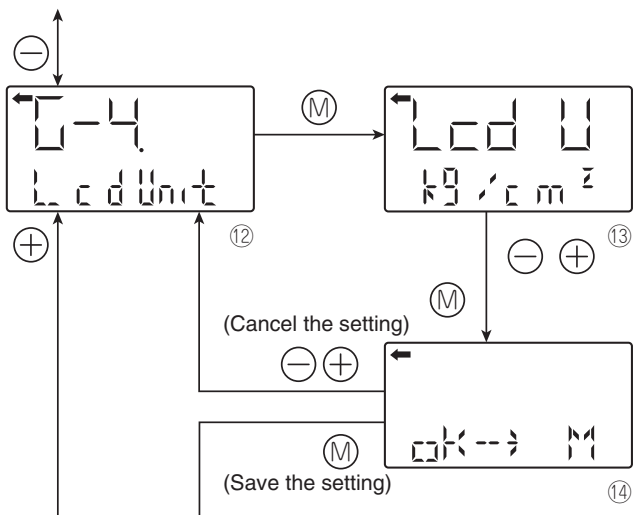
- Press the M key on the screen \boxtimes to display the screen for setting the DP (\boxtimes).
- Input the DP on the screen (10) with the \ominus and \oplus keys.

Setting range:

$$0 \leq \text{DP} \leq 4$$

	Display range
DP=0	-99999 ~ 99999
DP=1	-9999.9 ~ 9999.9
DP=2	-999.99 ~ 999.99
DP=3	-99.999 ~ 99.999
DP=4	-9.9999 ~ 9.9999

- Select whether the DP setting is saved on the screen \boxtimes . Press the M key to save the DP setting. Press the \ominus or \oplus key to cancel the setting.



LCD Unit (Setting of the actual scale unit)

- Press the **M** key on the screen **12** to display the screen for setting the unit (**13**).
- Input the unit on the screen **13** with the **-** and **+** keys.
- Select whether the unit setting is saved on the screen **14**.
Press the **M** key to save the unit setting.
Press the **-** or **+** key to cancel the setting.

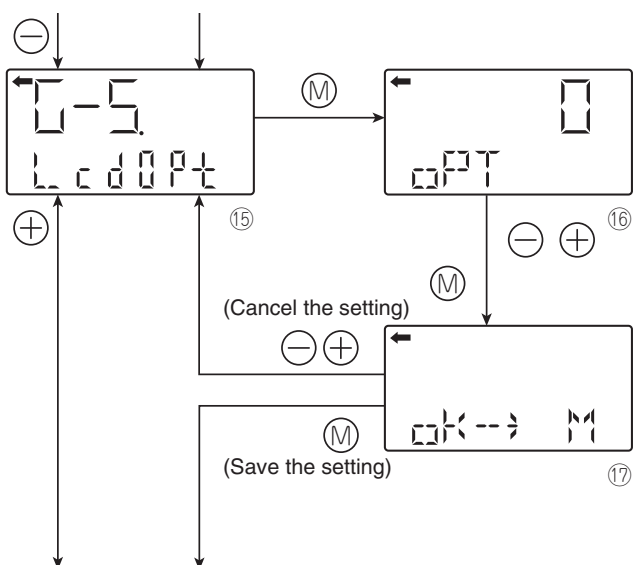
Available unit for FCX-All

(The units with * cannot be used because they are not legal units in Japan.)

(a)	(b)	(c)
%(LIN)	mm	%(SQR)
NONE(LIN)	cm	NONE(SQR)
MPa	m	Nm ² /s
kPa	in *	Nm ² /min
hPa	ft *	Nm ² /h
Pa		Nm ² /d
bar		m ³ /s
mbar		m ³ /min
kg/cm ² *		m ³ /h
g/cm ² *		m ³ /d
mmH ₂ O *		NI/s
cmH ₂ O *		NI/min
mH ₂ O *		NI/h
inH ₂ O *		NI/d
ftH ₂ O *		l/s
mmAq *		l/min
cmAq *		l/h
mAq *		l/d
mmWC *		gal/s *
cmWC *		gal/min *
mWC *		gal/h *
mmHg *		gal/d *
cmHg *		ft ³ /s *
mHg *		ft ³ /min *
inHg *		ft ³ /h *
PSI *		ft ³ /d *
<atm> *		bbl/s *
<Torr> *		bbl/min *
		bbl/h *
		bbl/d *
		kg/s
		kg/min
		kg/h
		kg/d
		t/s
		t/min
		t/h
		t/d

The units in parentheses < > are displayed only when the absolute pressure transmitter is used.

The flow units in the column (c) can be set only for the group of differential pressure transmitters.



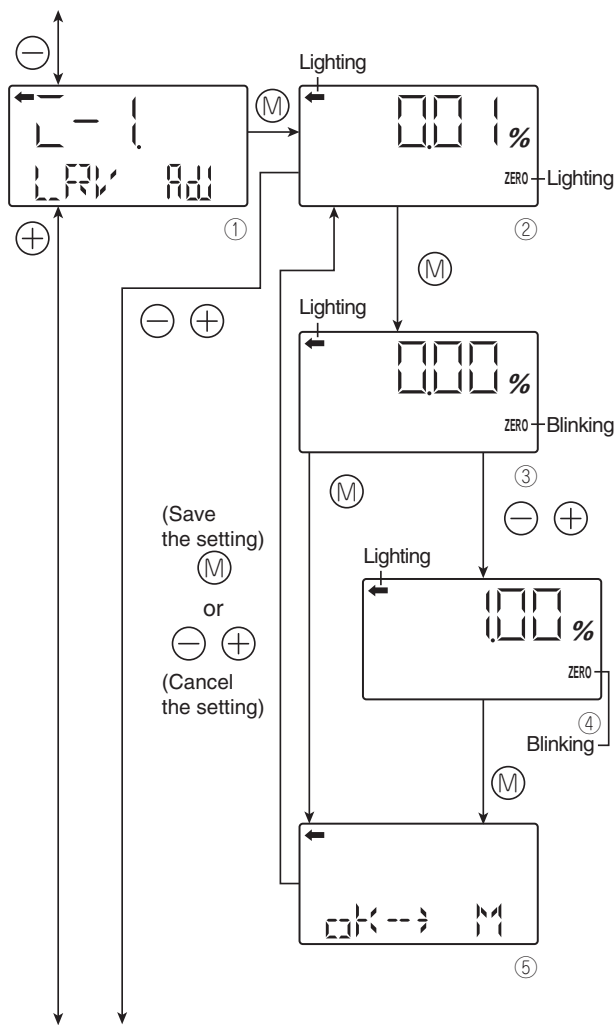
LCD Option

- Press the **M** key on the screen **15** to display the screen for setting the LCD option (**16**).
- Input the option No. on the screen **16** to set the LCD option with the **-** and **+** keys.
Setting range:

$$0 \leq \text{LCD Option} \leq 3$$

LCD Option	Function
0	Normal display (Display set at G1 to G4)
1	Alternate display (Display set at G1 to G4 and % display [in increments of 1%])
2	Alternate display (Display set at G1 to G4 and % display [in increments of 0.1%])
3	Alternate display (Display set at G1 to G4 and % display [in increments of 0.01%])

- Select whether the option setting is saved on the screen **17**.
Press the **M** key to save the option setting.
Press the **-** or **+** key to cancel the setting.



Input-output range adjustment (Rerange: adjustment by LRV/URV change)

(application to level measurement) at change of level (LRV/URV)

The input-output range adjustment enables you to change the measurement range by readjusting the lower limit of the measurement (LRV) or the upper limit of the measurement (URV) in the level measurement of the tank.

Zero adjustment by changing the range (LRV) (LRV adjustment)

- Press the (M) key on the screen \boxtimes to select the LRV adjustment mode.

The measured value and unit on the screen \boxtimes are the same as those in the normal mode and "←" and "ZERO" light up.

- Apply the actual input pressure on the screen \boxtimes . After checking the measured value, press the (M) key.

- "ZERO" blinks on the screen \boxtimes . Press the (M) key on the screen \boxtimes to perform a zero adjustment at the input pressure at the time. To perform a zero adjustment at a LRV point other than 0%, input an appropriate set value (%) (\boxtimes) with the − and + keys. Press the (M) key to set the new measurement range appropriate for the input pressure.

Settable range:

$$-1.00\% \leq \text{LRV (Note 1)} \leq 100.00\%$$

Note 1:

Output adjustment value (%) corresponding to the input pressure for the LRV adjustment

- Select whether the LRV adjustment value setting is saved on the screen \boxtimes .

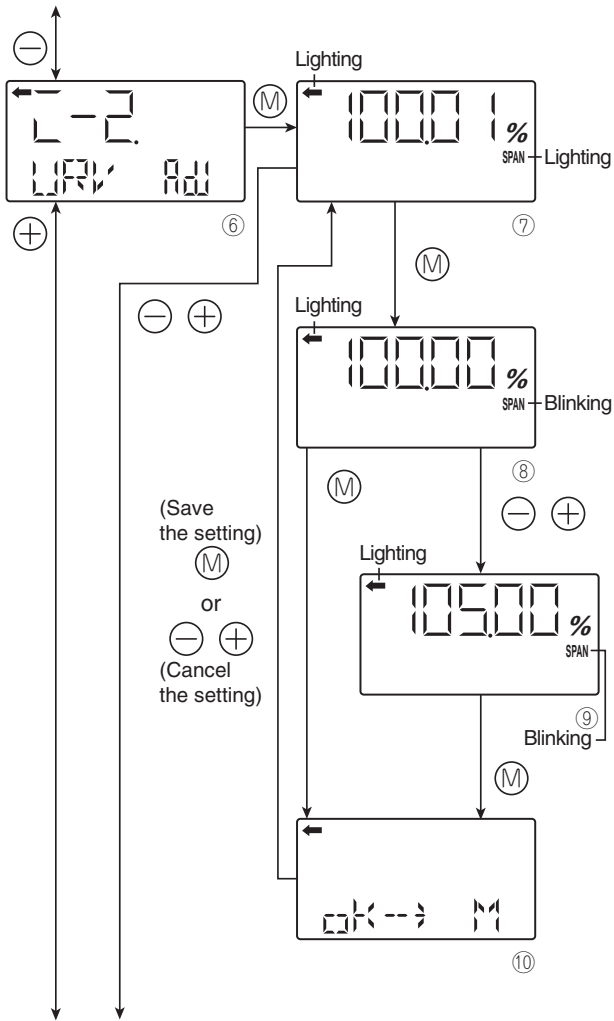
Press the (M) key to save the LRV adjustment value setting and return to the screen \boxtimes .

Press the − or + key to cancel the setting and return to the screen \boxtimes .

- Check that the zero adjustment (LRV) was performed as intended on the screen \boxtimes .

Press the (M) key to perform a zero adjustment again.

Press the − or + key to move to the next screen for item name selection.



Span adjustment by changing the range (URV) (URV adjustment)

- Press the (M) key on the screen ☒ to select the URV adjustment mode.

The measured value and unit on the screen ☒ are the same as those in the normal mode and “←” and “ZERO” light up.

- Apply the actual input pressure on the screen ☒. After checking the measured value, press the (M) key.
- “SPAN” blinks on the screen ☒. Press the (M) key on the screen ☒ to perform a span (100% point) adjustment at the input pressure at the time. To perform a span adjustment at a URV point other than 100%, input an appropriate set value (%) (☒) with the ⊖ and ⊕ keys. Press the (M) key to set the new measurement range appropriate for the input pressure.

Settable range:

$$0.00\% \leq \text{URV (Note 2)} \leq \text{Saturation current value (upper limit)}$$

Note 2:

Output adjustment value (%) corresponding to the input pressure for the URV adjustment

- Select whether the URV adjustment value setting is saved on the screen ☒. Press the (M) key to save the URV adjustment value setting and return to the screen ☒. Press the ⊖ or ⊕ key to cancel the setting and return to the screen ☒.
- Check that the span adjustment (URV) was performed as intended on the screen ☒. Press the (M) key to perform a span adjustment again.
- Press the ⊖ or ⊕ key to move to the next screen for item name selection.

PRECAUTION

If the input-output is adjusted, the measurement range is changed as shown in the following page.

LRV adjustment

- The measurement range (LRV and URV) are changed. The span is not changed.

URV adjustment

- Only the URV (span) of the measurement range is changed. The zero point (LRV) is not changed.

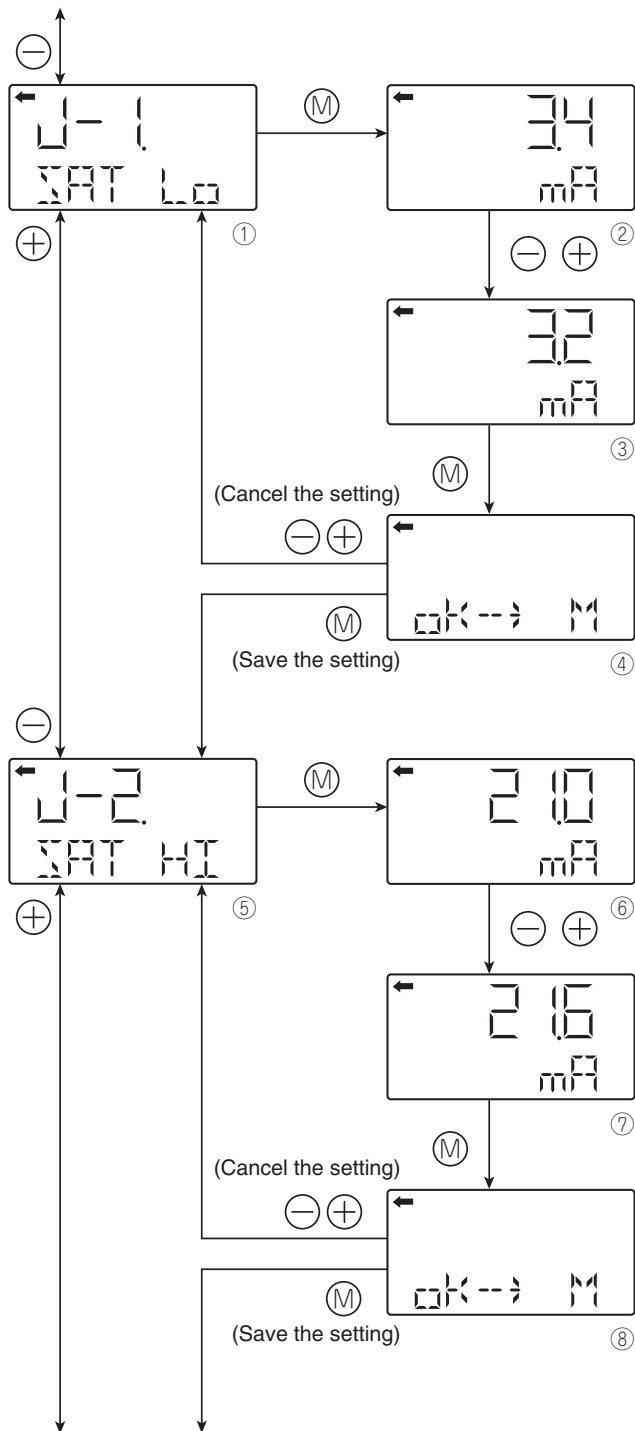
The following are the setting conditions for the adjustment point:

$$-1.00\% \leq \text{LRV (Note 1)} \leq 100.00\%$$

$$0.00\% \leq \text{URV (Note 2)} \leq \text{Saturation current value (upper limit)}$$

Note 1: Output adjustment value (%) corresponding to the input pressure for the LRV adjustment

Note 2: Output adjustment value (%) corresponding to the input pressure for the URV adjustment



Value and specification of saturation current

*: You cannot change the saturation current setting if "NoRMAL (normal specification)" is selected at "J-3." To change the saturation current setting, select "EXP (expanded specification)" at "J-3" as shown in the following page.

Change of the saturation current value (lower limit) (available only when the expanded specification is selected)

- Press the M key on the screen \boxtimes to display the screen for setting the lower limit of the saturation current (\boxtimes).
- Input the lower limit on the screen \boxtimes with the \ominus and \oplus keys.

Setting range:

$$3.2 \text{ mA} \leq \text{Burnout current (UNDER)} \leq \text{Saturation current (lower limit)} \leq 4.0 \text{ mA}$$

- Select whether the lower limit setting of the saturation current is saved on the screen \boxtimes .

Press the M key to save the lower limit setting.

Press the \ominus or \oplus key to cancel the setting.

Change of the saturation current value (upper limit) (available only when the expanded specification is selected)

- Press the M key on the screen \boxtimes to display the screen for setting the upper limit of the saturation current (\boxtimes).
- Input the upper limit on the screen \boxtimes with the \ominus and \oplus keys.

Setting range:

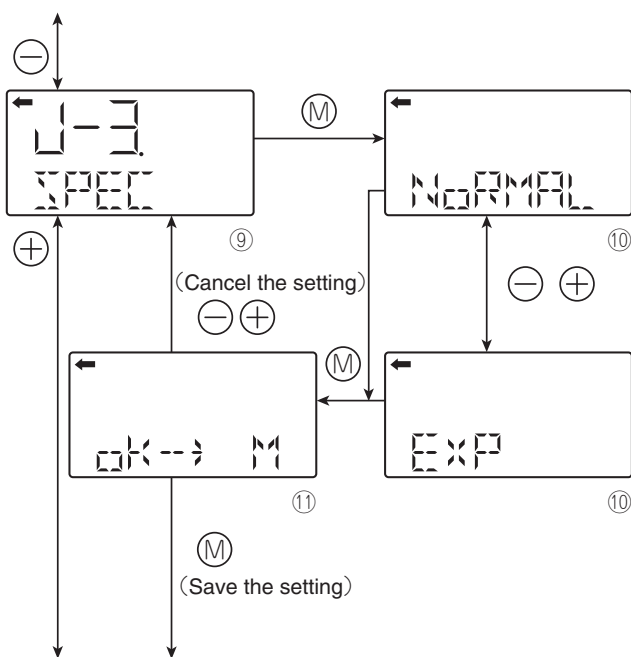
$$20.0 \text{ mA} \leq \text{Saturation current (upper limit)} \leq \text{Burnout current (OVER)} \leq 21.6 \text{ mA}$$

- Select whether the upper limit setting of the saturation current is saved on the screen \boxtimes .

Press the M key to save the upper limit setting.

Press the \ominus or \oplus key to cancel the setting.

* You can change the burnout current setting at "9: Direction and value of burnout."



Selection of the burnout & saturation current value specification (normal specification/expanded specification)

- Press the **M** key on the screen \boxtimes to display the screen for selecting the burnout & saturation current value specification \boxtimes .
 - Select "NoRMAL (normal specification)" or "EXP (expanded specification)" on the screen \boxtimes with the **⊖** and **⊕** keys.
- Select "NoRMAL" for the normal setting.
Select "EXP" for the expanded setting.

* To change the saturation current value (upper limit, lower limit), select the expanded specification.

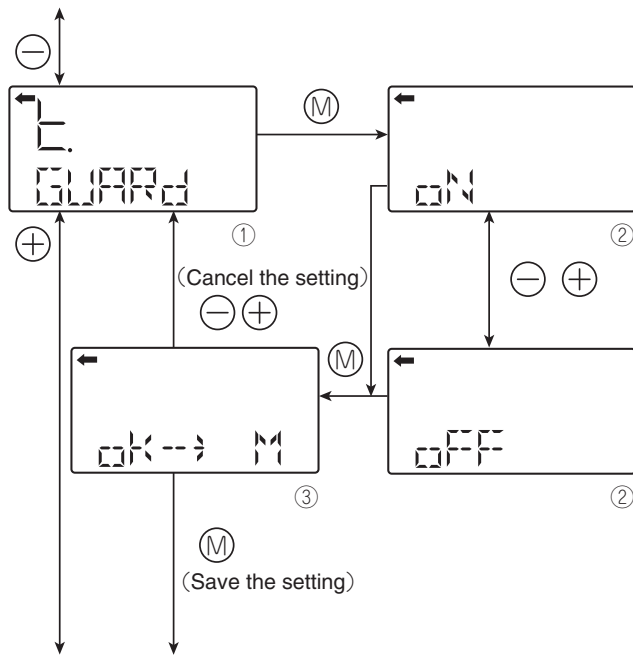
	Normal specification	Expanded specification
Saturation current value (lower limit)	3.8 mA (fixed)	3.2 mA to 4.0 mA Settable in increments of 0.1 mA
Saturation current value (upper limit)	20.8 mA (fixed)	20.0 mA to 21.6 mA Settable in increments of 0.1 mA

The table below lists the output current value for burnout (OVER, UNDER).

	Normal specification	Expanded specification
Burnout (UNDER)	3.2 to 3.8 mA	3.2 mA to saturation current value (lower limit)
Burnout (OVER)	20.8 to 21.6 mA	Saturation current value (upper limit) to 21.6 mA

The values in the table above can be set in increments of 0.1 mA.

- Select whether the NoRMAL/EXP setting is saved on the screen \boxtimes .
- Press the **M** key to save the NoRMAL/EXP setting.
Press the **⊖** or **⊕** key to cancel the setting and return to the screen \boxtimes .

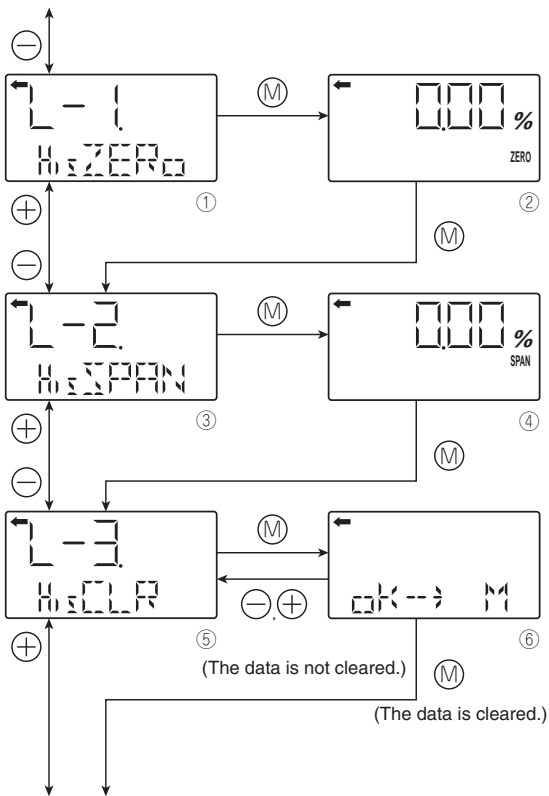


Protective function of set value (Write protect)

- Press the M key on the screen \boxtimes to display the screen for setting/canceling write protect (\boxtimes).
- Select oN (setting)/oFF (canceling) on the screen \boxtimes with the \ominus and \oplus keys.
To enable write protect, select "ON."
To disable write protect, select "OFF."
- Select whether the selection of oN (setting)/oFF (canceling) is saved on the screen \boxtimes .
After selecting oN/oFF, press the M key to save the setting.
Press the \ominus or \oplus key to cancel the setting and return to the screen \boxtimes .

Note:

- If you enable write protect and set a password by the HHC, you cannot cancel the setting with the 3 push buttons and the item name of "K. GUARD" does not appear.
- If you enable write protect by setting the protective function of set value (GUARD) with the 3 push buttons, you can cancel the setting by the HHC.



History information

Display of zero calibration data for users

- The zero calibration value at the time is displayed.
- Press the **M** key on the screen **☒** to display the zero calibration value (**☒**).
- Press the **M** key on the screen **☒** to move to “Display of span calibration data for users.”

Display of span calibration data for users

- The span calibration value at the time is displayed.
- Press the **M** key on the screen **☒** to display the span calibration value (**☒**).
- Press the **M** key on the screen **☒** to move to “Clearing of zero/span calibration data.”

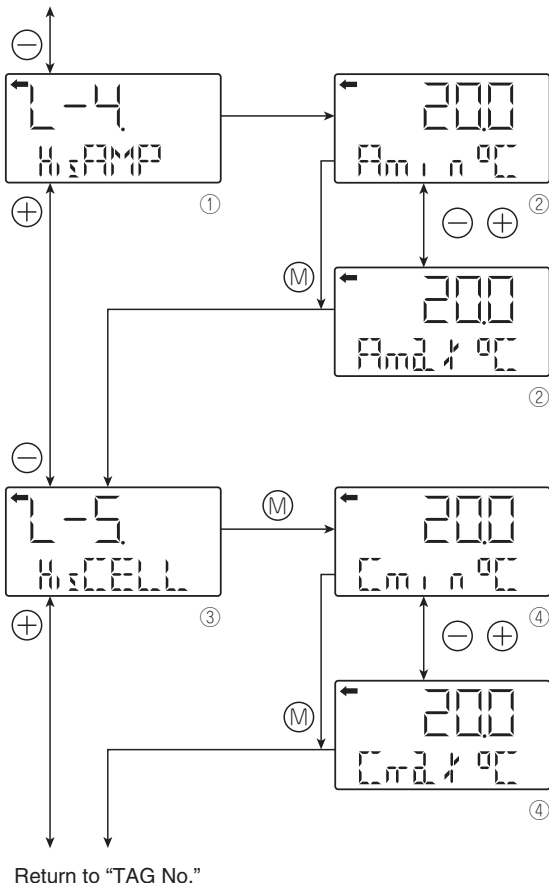
Clearing of zero/span calibration data

- The zero/span calibration value at the time is cleared.
- Press the **M** key on the screen **☒** to display the screen for confirming the zero/span calibration value (**☒**).
- Press the **M** key on the screen **☒** to clear the zero/span calibration data.
Press the **-** or **+** key to return to the screen **☒** without clearing the data.



PRECAUTION

Note that if you clear the zero/span calibration data, the adjusted zero/span calibration value is deleted and reset to the factory default.



Display of min/max of amplifier temperature history information

- The min/max values of the amplifier temperature history are displayed.
- Press the **M** key on the screen **☒** to display the min/max values of amplifier temperature (**☒**).
- Select and display the min/max values on the display **☒** with the **-** and **+** keys.
Select “Amin” to display the min value of the amplifier temperature history.
Select “Amax” to display the max value of the amplifier temperature history.
- Press the **M** key on the screen **☒** to move to “Display of min/max of cell temperature history information.”

Display of min/max of cell temperature history information

- The min/max values of the cell temperature history are displayed.
- Press the **M** key on the screen **☒** to display the min/max values (**☒**).
- Select and display the min/max values on the display **☒** with the **-** and **+** keys.
Select “Cmin” to display the min value of the cell temperature history.
Select “Cmax” to display the max value of the cell temperature history.
- Press the **M** key on the screen **☒** to return to “TAG No.”

To operate the FCX-A2 V5 serie transmitters, the FXW (HHC) is used for each adjustment.

4.3 Adjustment with hand held Commnicator (h h C)

DANGER In the case of a flameproof transmitter, never connect the HHC to the terminal block of the transmitter in hazardous area installations.

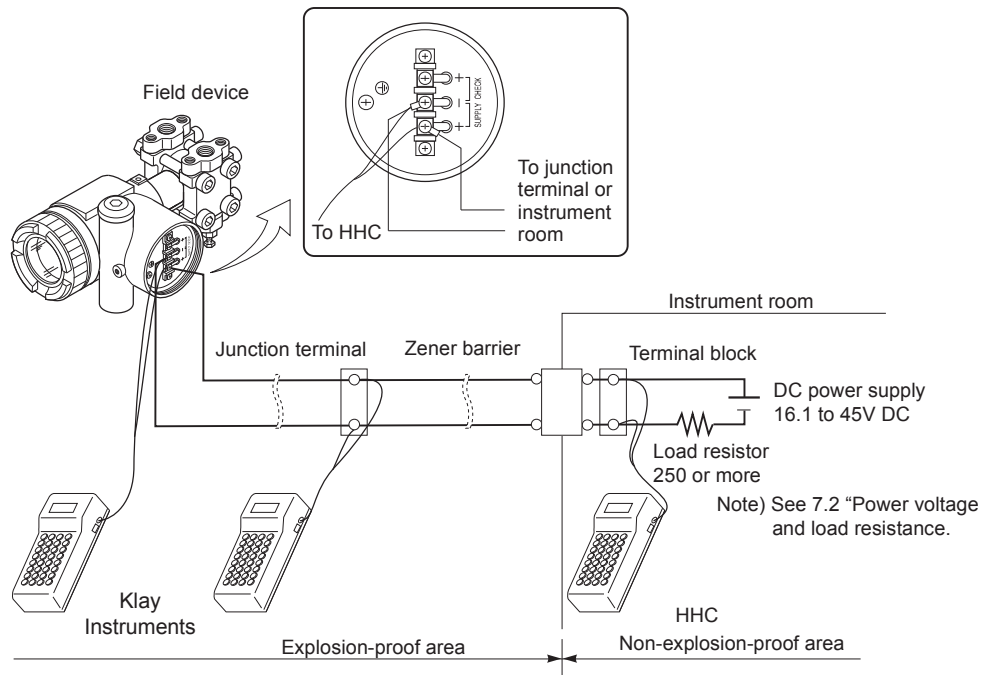
The span adjustment of the transmitter can be done by using the HHC without applying a reference pressure. Here after you will find the wiring of the HHC to modify the transmitter parameters. For the use and the start up of the HHC, please refer to the instructions of FXW (HHC).

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

4.3.1 Connection of h h C

The HHC can be connected in any point of the loop.
To communicate with the HHC, a load resistor of 250Ω mini is required.

Refer the following diagram connection of the HHC (hand Held Communicator).



Remarks :

- * The HHC must be on "OFF" position during the connection. It can't be connected to the junction terminal "CHECK + and -" of the transmitter.
- * The HHC has no polarity. (You can connect either the red or black electrical wire to the terminals + or - of the transmitter or on the wires of the loop).

DANGER In the case of a flameproof transmitter, the HHC can only be connected via the junction box located outside the hazardous area.

4.3.2 Start up of the HHC

- 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
- The transmitter version and the revision of the HHC software 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 HHC is not connected to the correct terminals

Configuration menus of HHC

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 HHC

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

FXW prior to Version 7.0 are not available of operation of FCX-A2 V5 serie transmitters. In this case, the user is requested to contact our office for ROM version up.

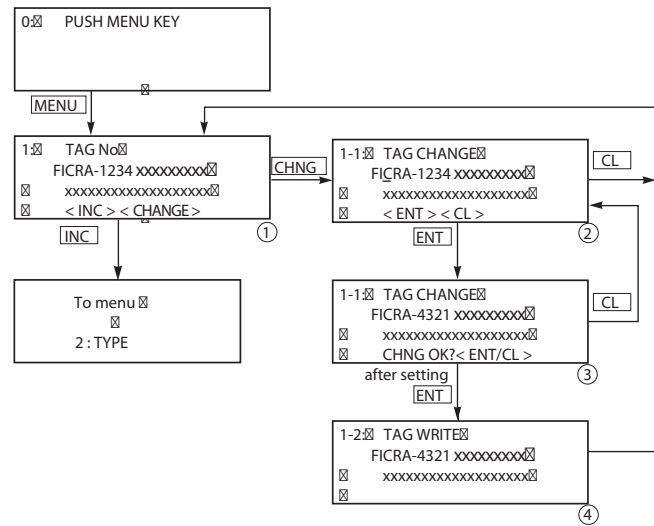
Classification		Display symbol	Key symbol	Referential page
1	TAG No.	INC 1: TAG No.	MENU	50
2	Type	INC 2: TYPE	MENU ⇄ INC	50
3	Display of serial No.	INC 3: SERIAL No.	MENU ⇄ INC ⇄ INC	51
4	Industrial value unit	INC 4: UNIT	UNIT	51
5	Range limit	INC 5: RANGE LIMIT	UNIT ⇄ INC	52
6	Range change (LRV,URV)	INC 6: RANGE	RANG	52
7	Damping adjustment	INC 7: DAMPING	DAMP	53
8	Output mode and value	INC 8: OUTPUT MODE	LIN / ?	54
9	Burnout direction	INC 9: BURNOUT	LIN / ? ⇄ INC	55
A	Calibration of the zero/span	INC A: CALIBRATE	CALB	56
B	Calibration of output circuit	INC B: OUTPUT ADJ	OUT	57
C	Indication of measured data	INC C: DATA	DATA	58
D	Self-diagnosis	INC D: SELF CHECK	DATA ⇄ INC	58
E	Printer function	INC E: PRINT	DATA ⇄ INC ⇄ INC	59
F	Lock of adjustment functions	INC F: XMTR EXT. SW	DATA ⇄ INC ⇄ INC ⇄ INC	59
G	Indication of digital indicator	INC G: XMTR DISPLAY	DATA ⇄ INC ⇄ INC ⇄ INC ⇄ INC	60
H	Programmable linearization function	INC H: LINEARIZE	DATA ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC	62
I	Rerange (Set LRV/URV calibration)	INC I: RERANGE	DATA ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC	64
J	Saturation current value and specification setting	INC J: SATURATE CUR	DATA ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC	65
K	Write protect	INC K: WRITE PROTCT	DATA ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC	66
L	History information	INC L: HISTORY	DATA ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC ⇄ INC	67

Tag N°

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.

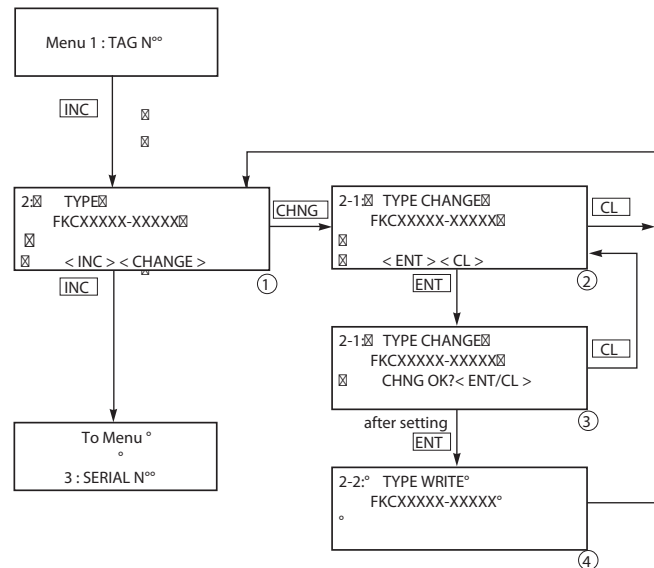
- After PUSH MENU KEY is displayed, press the <MENU> key to display TAG N°.
- To make changes press the <CHNG> key and the cursor will be displayed under display ①.
- Set the alphanumeric keys as necessary under display ②. To set the alphabet, press the <CHNG ALHA> key first. Using <◀> <▶> keys, cursor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



Type

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

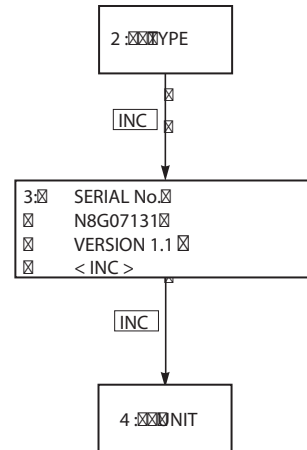
- After TAG N° is displayed, press the <INC> key to display TYPE image.
- To make changes press the <CHNG> key under display ① and the cursor will be displayed under display ②.
- Set the alphanumeric keys as necessary under display ②. To set the alphabet, press the <CHNG ALHA> key first. Using <◀> <▶>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



Serial N°

SERIAL N° and transmitters software version are displayed.

- After setting TYPE, press the <INC> key to display SERIAL N° and software version of transmitter.
- By pressing the <INC> key, UNIT setting image is displayed.



Industrial value Unit

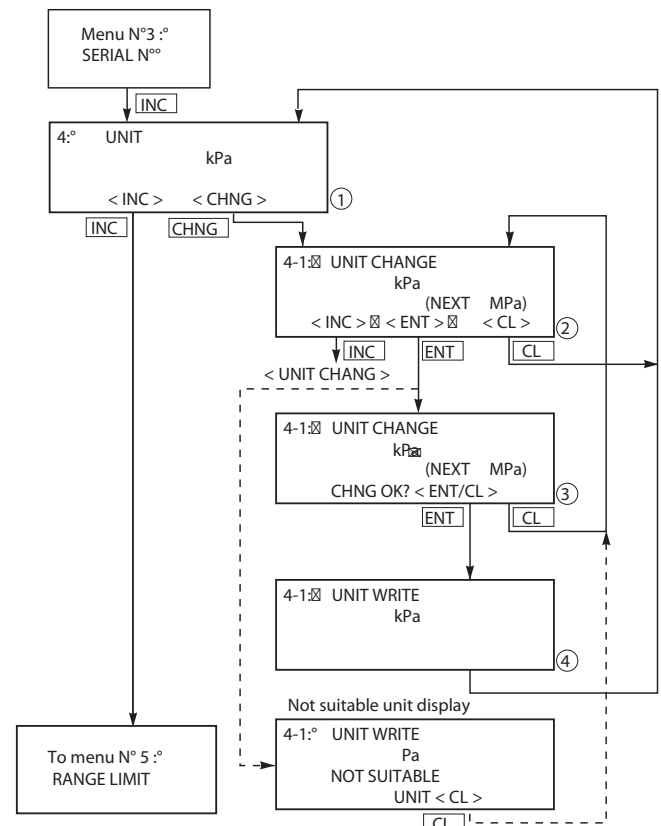
26 industrial units can be used by the operator (see below).

Note:

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

- When pressing <CHNG> under display ①, the display for changing the unit of industrial value ② appears.
- The desired unit of industrial value is selectable by using <INC> or <DEC> under display ②.
- Display ③ is provided for confirming your change.
- Display ④ is for registering the unit of industrial value.

- mmH₂O
cmH₂O
mH₂O
g/cm²
kg/cm²
Pa
hPa
kPa
MPa
mbar
bar
psi
inH₂O
ftH₂O
mmAq
cmAq
mAq
mmWC
cmWC
mWC
mmHg
cmHg
mHg
inHg
< Torr >
< atm >
- ↑ INC
↓ DEC



Range Limit

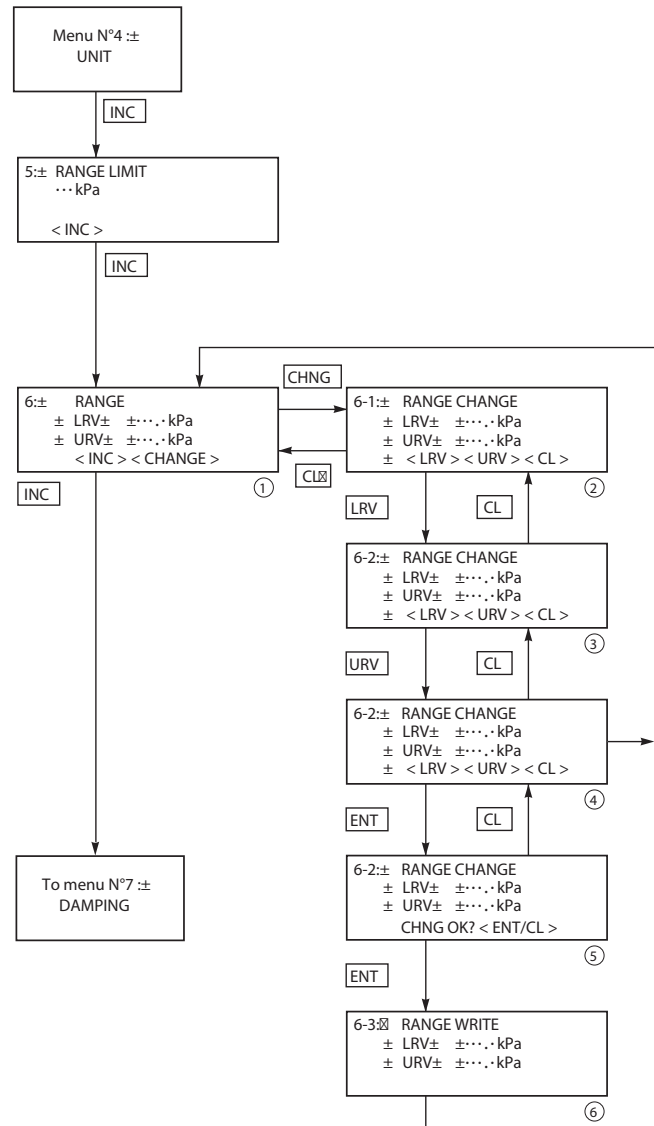
Indicates the maximum measuring range of this transmitter.

Range change (LRV, URV)

LRV: Lower range value (0% point)

URV: Upper range value (100% point)

- When pressing <CHNG> under display ①, display changes to the LRV and URV selection screen. Press <LRV> for presenting the display for setting the zero point range (display ③), or <URV> for presenting the display for setting the span range (display ④).
- Under displays ③ and ④, input zero point and span values. *Press <ENT> after setting LRV and URV.
- When pressing <+/-> under display ③, ④, negative value is available.

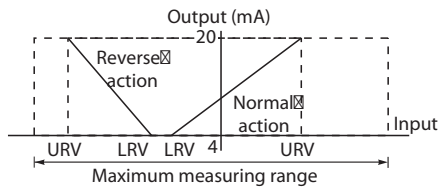


Allow to read or modify the points 0% and 10 %.

0% = 4 mA = LRV

100% = 20 mA = URV

Selectable setting range



In case of the actual scale specification with a digital indicator provided, if the range is changed, indicator display does not match. So, setting is required again in response to the display in the digital indicator (G: XMTR DISPLAY). In case of the actual scale specification with an analog indicator provided, if the range is changed, indicator display does not match. So, replacement of the analog indicator is required.

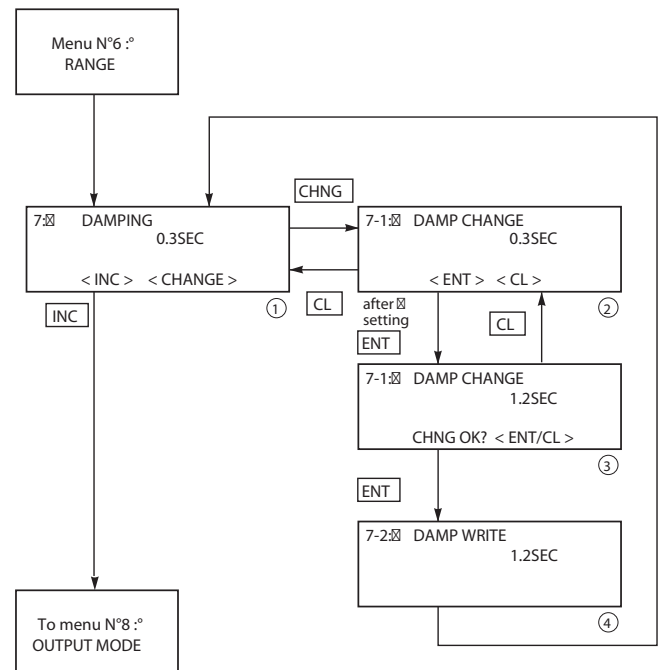
Damping Adjustment

The configuration menu 7 “DAMPING” allows adjusting the damping of the output signal according to the application conditions. It is important to make the difference between the damping, the time constant and the response time.

The damping corresponds to an average value on the output signal for a pressure input who changes very quickly programmable over a certain period of time called damping value in sec.

The time constant τ is a fixed value related to the measuring upper range limit of a transmitter

The response time corresponds to the time that the output signal takes to reach around 62.3% when a pressure is applied corresponding 0 to 100% of span. The response time takes in account the time constant and the dead time of the transmitter.



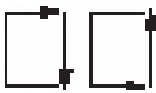
Output Mode

The output mode is used to select the proportional mode (proportional to input differential pressure) or square root extraction mode (proportional to flow rate) for output signal (4 to 20mA).

In case of square root extraction mode, the cut point and the mode below the cut point can be set. Under display ②, press <INC> or <DEC> for selection of the square root extraction mode or proportional mode.

Change of output mode

<INC> <DEC>



a: OUT=LIN
b: OUT=SQR

Since display ⑦ is presented when the square root extraction mode is selected, the low flow cut point should be set.

Cut point is adjustable within the range of 0.00 to 20.00%. The cut point is used for stabilizing output near 0% when the square root extraction mode is selected for output signal.

There are two modes; in one mode, proportional output is selected for output below a cut point (Fig. A) and in the other mode, output is forcibly reduced to 0% for output below a cut point (Fig. B).

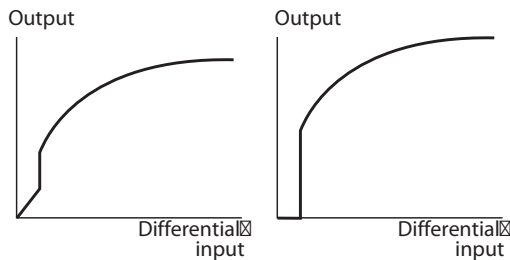
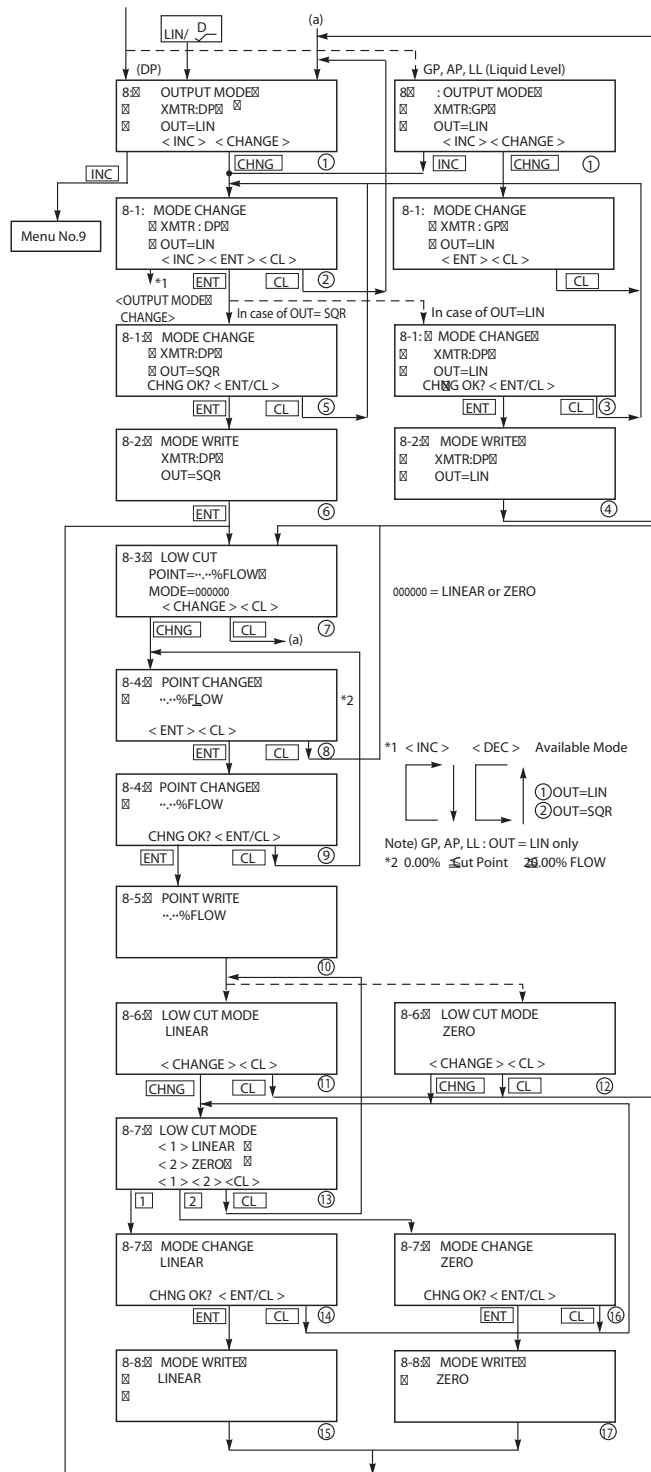


Fig. A: With linear output selected in low cut mode

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

Under display ⑬, linear or zero output is selectable for output below the cut point.



Burnout direction

Used for selecting output at occurrence of a fault in the detecting unit. Burnout direction is selectable under display ②

- For selection of NOT USED, press <1>.
- For selection of OVER SCALE, press <2>.
- For selection of UNDER SCALE, press <3>.

The meaning of each condition above is as follows.

- NOT USED → Not used (Output hold)
Saturation current = 3.8, 20.8mA

Note)

Output value just before the occurrence of trouble is given in the output hold mode.

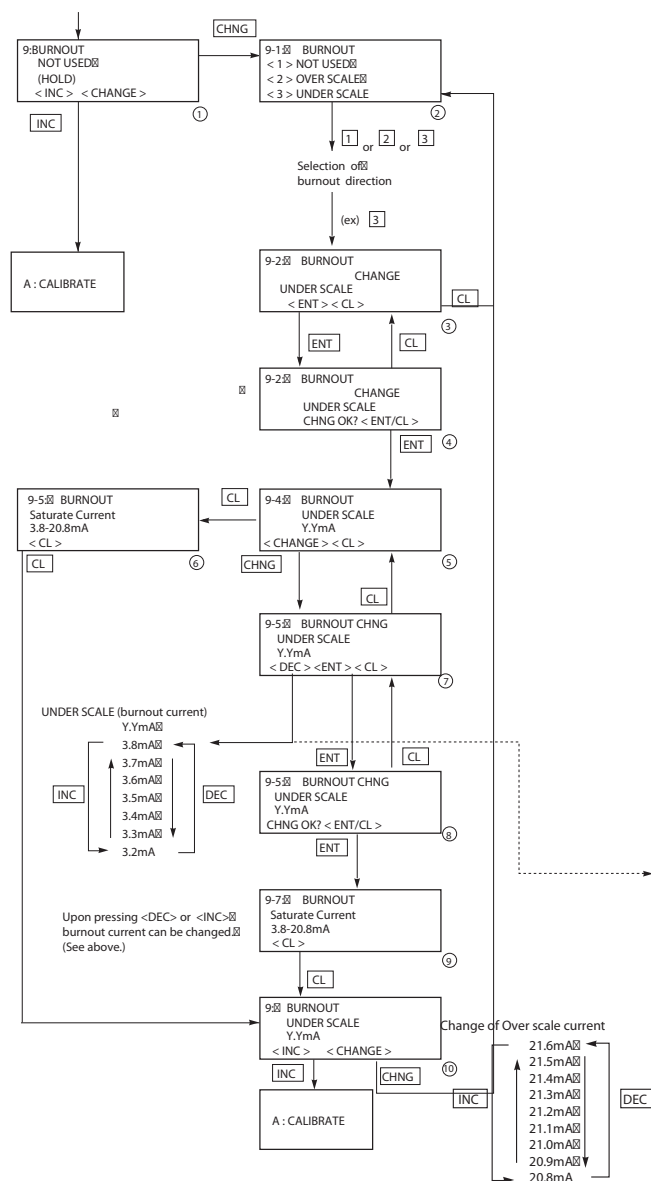
- OVER SCALE → Over scale (Output 20.8 to 21.6mA)
Saturation current = 3.8, 20.8mA
- UNDER SCALE → Under scale (Output 3.2 to 3.8 mA)
Saturation current = 3.8, 20.8mA

Burnout Current of FCX-All series transmitter

Over scale burnout current = 20.8 to 21.6mA

Under scale burnout current=3.2 to 3.8mA

Saturation current = 3.8, 20.8mA



Calibration of the zero and span

Configuration menu A “CALIBRATE” gives the possibility to calibrate zero and span of the transmitter LRV and URV).

The ranging of the transmitter needs to be done in the “RANGE” menu 6. Please use menu A “CALIBRATE” only when the LRV and URV are fixed in the “RANGE” menu. It is absolutely necessary to apply an accurate reference pressure corresponding to the zero or LRV point as well as the span or URV point when making a calibration.

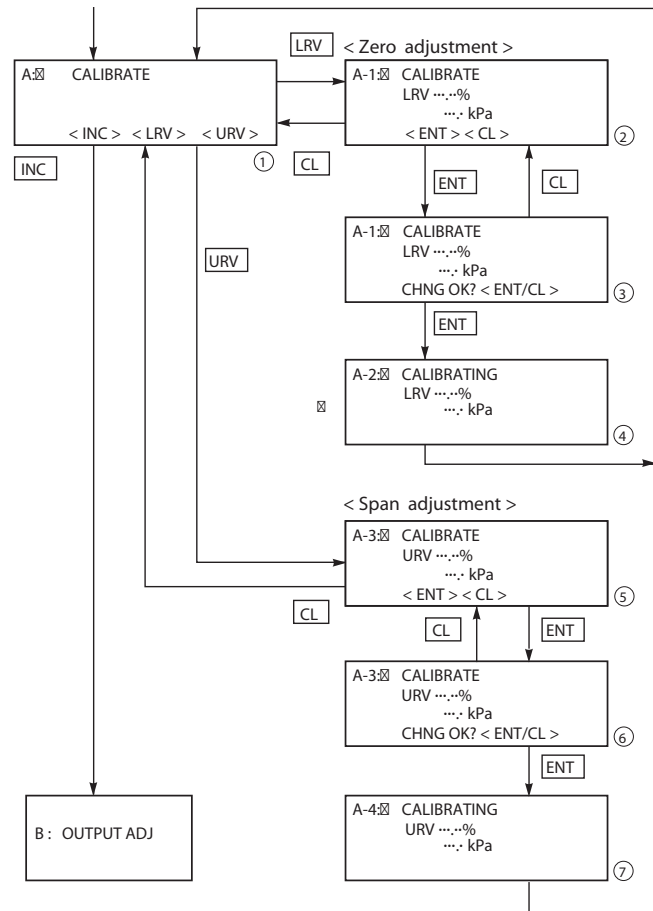
Adjustment of the Low Range Value (LRV) : In the CALIBRATE menu you push key LRV to adjust the zero point corresponding to analog output 4 mA.

Reference pressure is applied on the transmitter, and you enter the corresponding value through the key pad on HHC.

Please confirm the value by applying in key “ENTER”.

Adjustment of the Low Range value (URV): In the CALIBRATE menu you push key URV to adjust the span point corresponding to the analog output 20 mA. Reference pressure is applied on the transmitter corresponding to the span, and you enter the corresponding value through the key pad on HHC.

Please confirm the value by applying in key “ENTER”.



PRECAUTION

- The calibration (LRV & URV) require a pressure generator with an better accuracy than the transmitter. If the customer do not have this kind of pressure generator, he should not use this menu but only the “RANGE” menu to make a ranging of the transmitter without applying a reference pressure. The “RANGE” menu will always keep the factory calibration done with very accurate pressure equipment.
- The menu “CALIBRATE” has always to be used when the transmitter has been previously adjusted in “RANGE” menu.
- On transmitters with local indicator option : the modification of the Zero/ Span in “RANGE” and “CALIBRATE” menu will not modify automatically the configuration of the LCD indicator. A new adjustment of the LCD indicator for the zero and span indication has to be performed. Indicator with 0 to 100% indication don’t need to be changed.

Calibration of output circuit D/A

The output circuit (D/A) should be calibrated by the following procedure when necessary.

Make calibration wiring transmitter according to "Calibration" in appendix A2, and calibrate the output circuit with the HHC using the following procedure.

When the <LRV> key is pressed at the display of ①, the display ② for 4mA current output and its calibration will appear on the screen. When the <URV> key is pressed, the display ⑦ for 20mA current output and its calibration will appear on the screen.

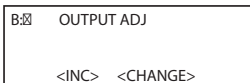
Under display ①, input a desired value within a range of 3.8 to 20.8mA and then press <ENT> two times.

At this input value, a regulated current output is available.

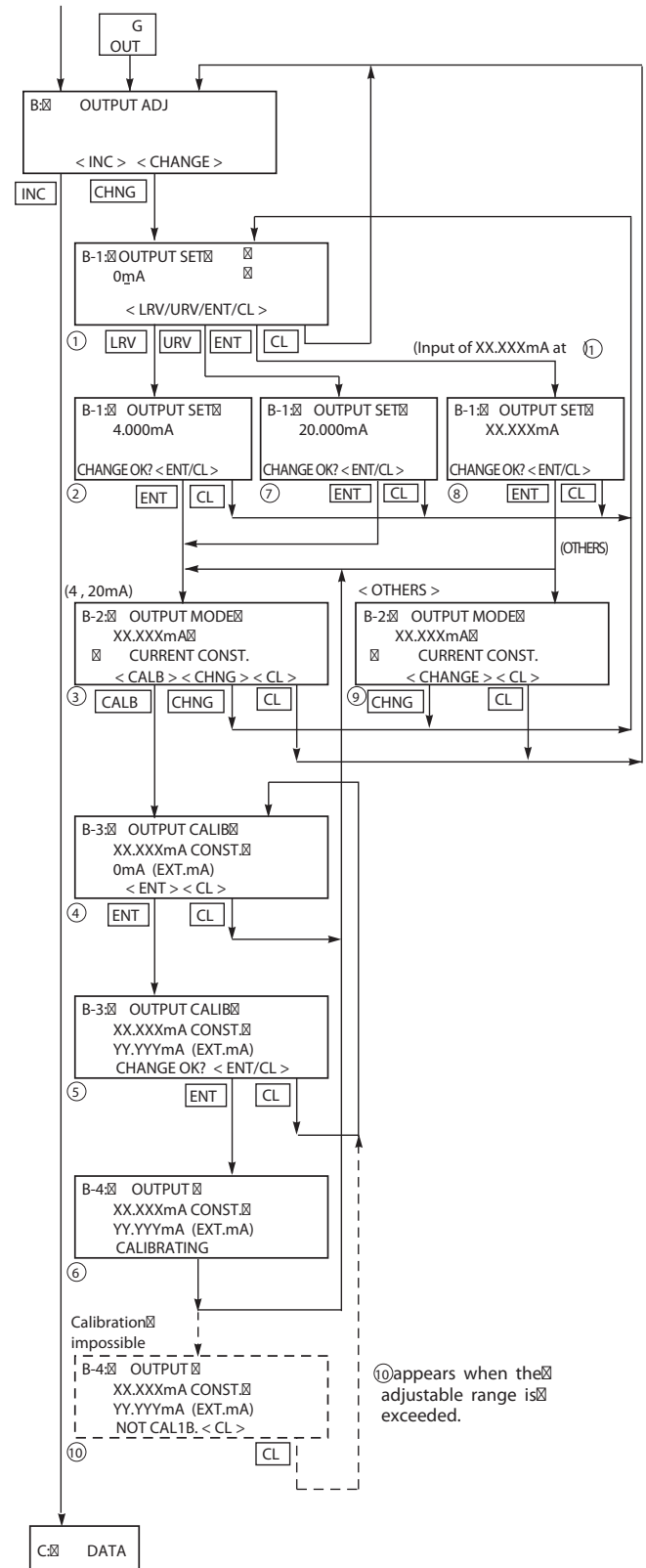
Under display ④, input digital values measured by digital voltmeter.

Under display ④, the output circuit is calibrated when pressing <ENT>.

After setting and calibrating the constant current output, be sure to reset the HHC display to the initial display.



In this way, the transmitter output is reset to the measurement output. It should be noted that if HHC is removed from the transmitter loop or the HHC power is turned OFF when the constant current output has been set, the transmitter output is retained at the constant current output.



Indication of measured data

The measured value can be indicated.
For more information about operating procedure, refer to the instruction manual of HHC.

Self-diagnosis

Use for displaying the measured temperature in the transmitter and the alarm information.
When pressing <1> on display ②, the temperature in the amplifier (AMP TEMP) is displayed. When pressing <2>, result of self-diagnosis about transmitter (ALM CHECK) is displayed.

Result of diagnosis

When the temperature in the amplifier is normal:

```
D-2: SELF CHECK
    TEMP= xxx.x °C
    <CL>
```

When temperature alarm is detected:

```
D-2: SELF CHECK
    TEMP= xxx.x °C
    TEMP.ALARM
    <CL>
```

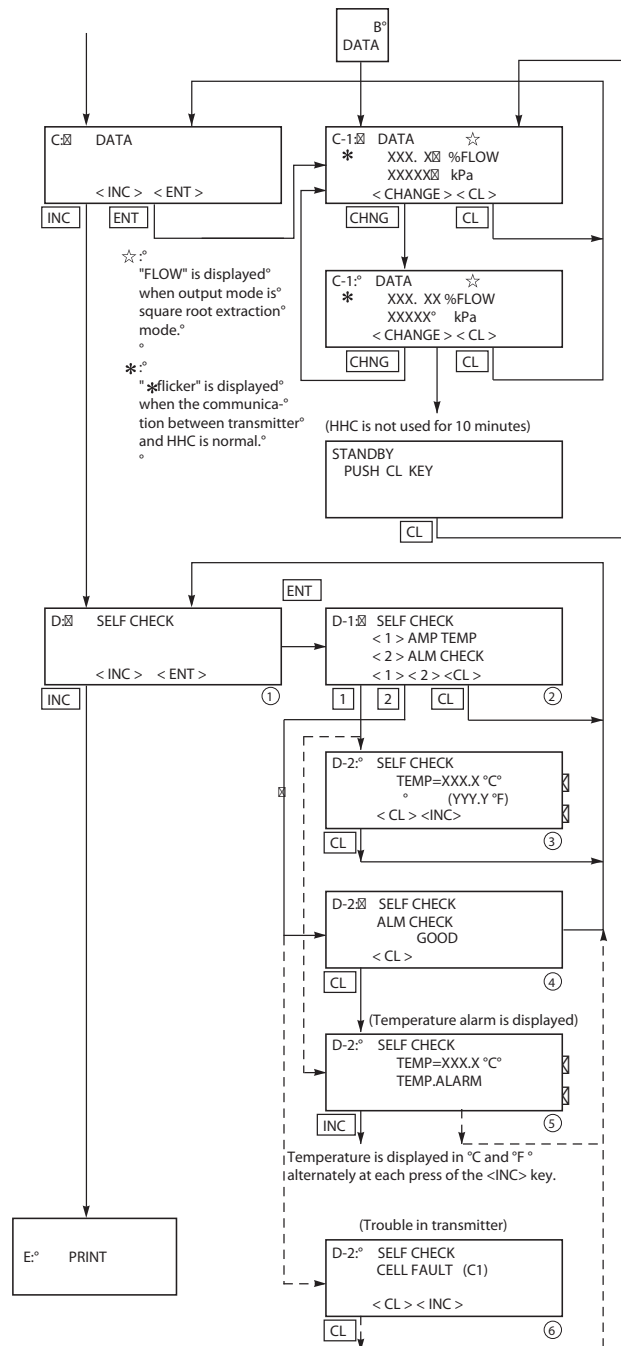
When no error has occurred:

```
D-2: SELF CHECK
    ALM CHECK
    GOOD
    <CL>
```

When an error has occurred:




```
D-2: SELF CHECK
    CELL FAULT (C1)
    <CL> <INC>
```

For contents of error, refer to "Contents of message" on the next page.



[Contents of message]

As a result of self-diagnosis, the message below is appeared on the LCD display of HHC, when there are trouble in the transmitter. For each error, its cause and remedy are suggested.

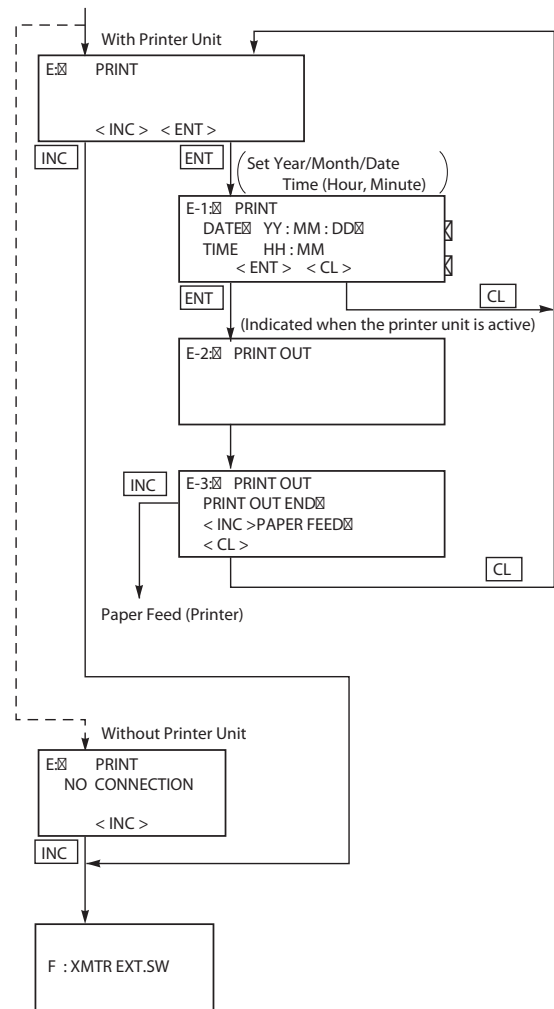
Message	Indication on digital indicator	Cause	Remedy
CELL FAULT (C1) }	FL-1	Error of detecting unit	Replacement of detecting unit
CELL FAULT (C9) ^(*)			
EEPROM (AMP) FLT	FL-2	EEPROM error on amplifier side	Replacement of amplifier
EEPROM (CELL) FLT	FL-3	EEPROM error on cell side	Replacement of detecting unit
TEMP. ALARM	 ^(*) T.ALAM	Transmitter temperature is not within the allowable range (-45 to 90°C).	Transmitter temperature is normalized.
XMTR FAULT	FL-1	Amplifier error	Replacement of amplifier
	 ^(*) OVER	Input pressure is 105% or higher of setting range.	Properly controlled.
	 ^(*) Under	Input pressure is -1.25% or lower of setting range.	Properly controlled.

(*) CELL FAULT (C5) to (C9) are appeared in case of "9" in 6th digit code of FK. C.

(*) Real indication

Printer function

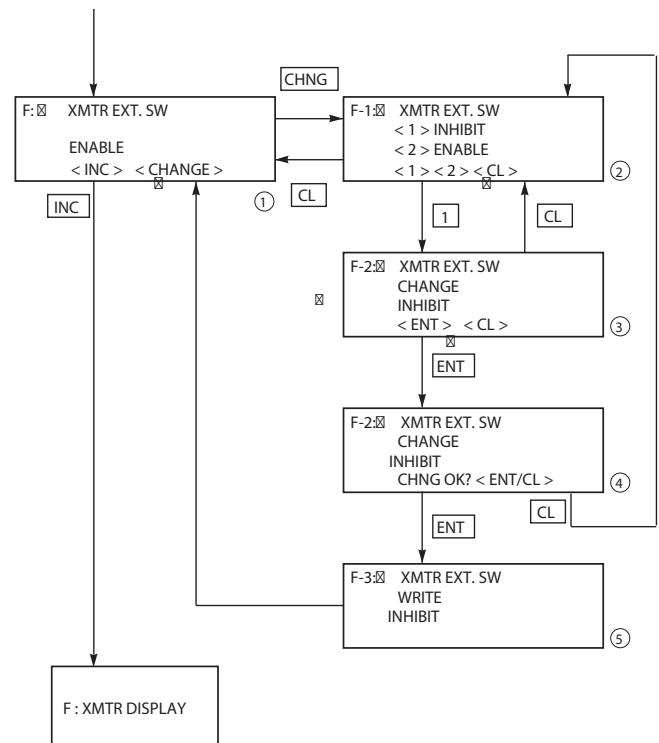
Usable only when a printer is connected.
Refer to the instruction manual of HHC.

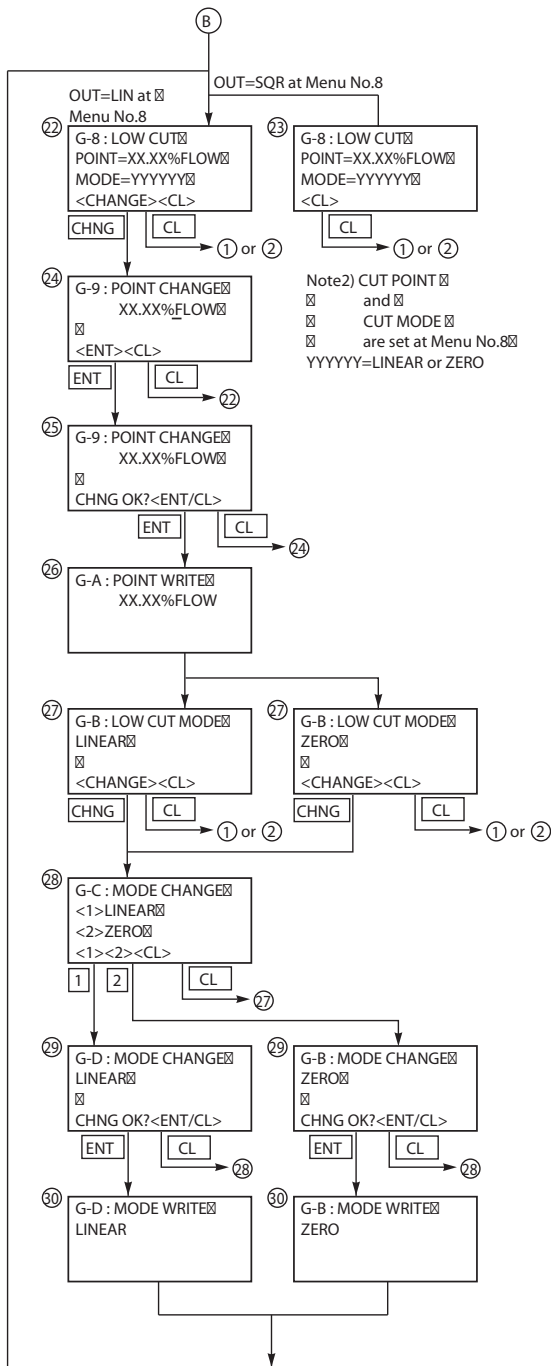


Lock of adjustment function

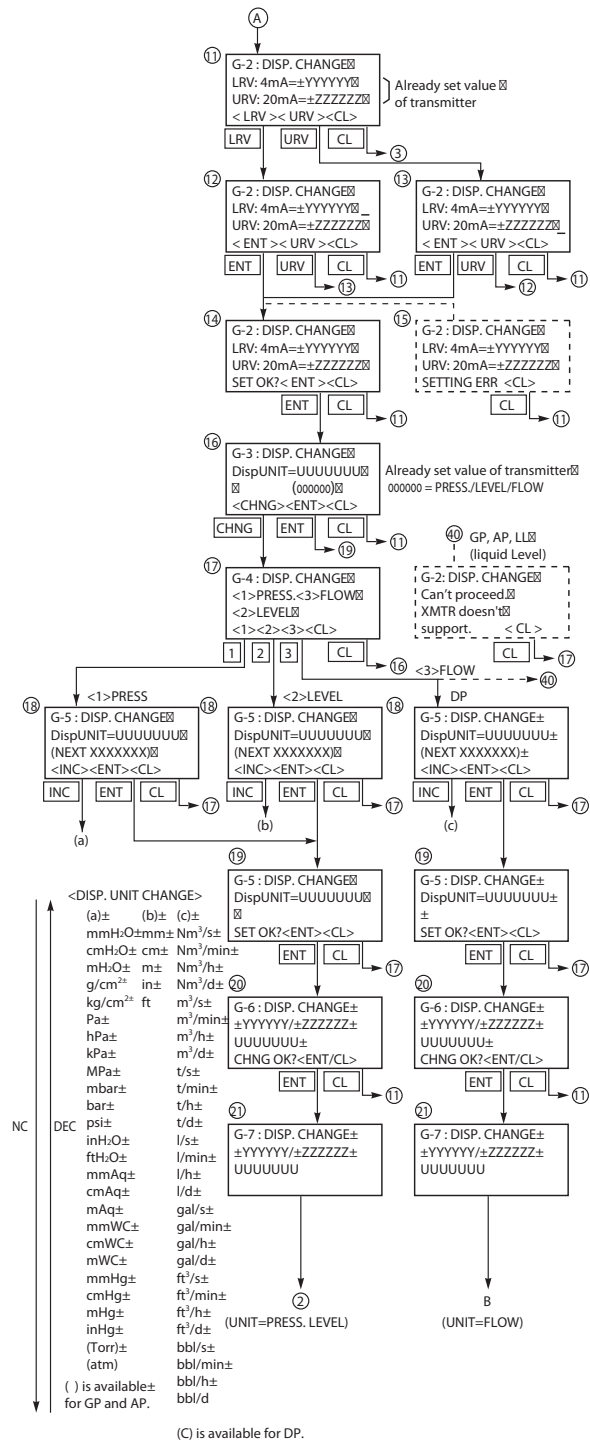
The zero adjustment function can be locked by the transmitter adjust screw.

When pressing <1> (INHIBIT) under display ②, the external switch lock function is activated, and it is released when pressing <2> (ENABLE).





When setting of % Flow in % display or Flow unit in actual scale display, low flow cut point and low flow cut mode are displayed (②② or ②③).
 When, in the OUTPUT MODE (Menu N° 8), OUT = SQR is set, already set low flow cut point and low flow cut mode are displayed (②③).
 With OUT = LIN set, the present low flow cut point and low flow cut mode are displayed (②②). Then, enter <CHANGE>, and the setting can be renewed.



When setting the actual scale display, first select <2> ACTUAL DISP in ③.
 Next, after setting the actual scale display value (①① to ①④), perform the actual scale display unit setting (①⑥ to ①⑨).
 In case of pressure transmitter, absolute pressure transmitter and level transmitter, the flow units can't be set as shown in ①⑦ .

After making sure of the setting of the actual scale display ②⑩ , enter the [ENT] and then data is written in the transmitter.

Programmable linearization function

User can set output compensation against the input using 14 compensation points, $(X_1, Y_1), (X_2, Y_2) \dots (X_{14}, Y_{14})$. Each compensation value between (X_n, Y_n) and (X_{n+1}, Y_{n+1}) is connected by first order approximate formula.

This linearization function is useful to compensate the tank figure in level measurement application and the flow rate of steam or gas in flow measurement application.

Functions for LINEARIZE are available for FXW Version 6.0 and upward.

By pressing INC at display of ②, the display is shifted to the setting of LINEARIZE POINT ③. Press CHNG at display of ③ and input POINT XX to be compensated. Then press ENT and the display will be shifted to ⑤.

Press INC at display of ⑤ and the display will be shifted to y for selection of <1> Lin. point: LP and <2> Comp. value: CV.

Select <1> Lin. point: LP at display of 6 and input XXX.XX% to each point (LP1-LP□).

At the completion of input to all the compensated points, press ENT twice and the write of LP will be finished.

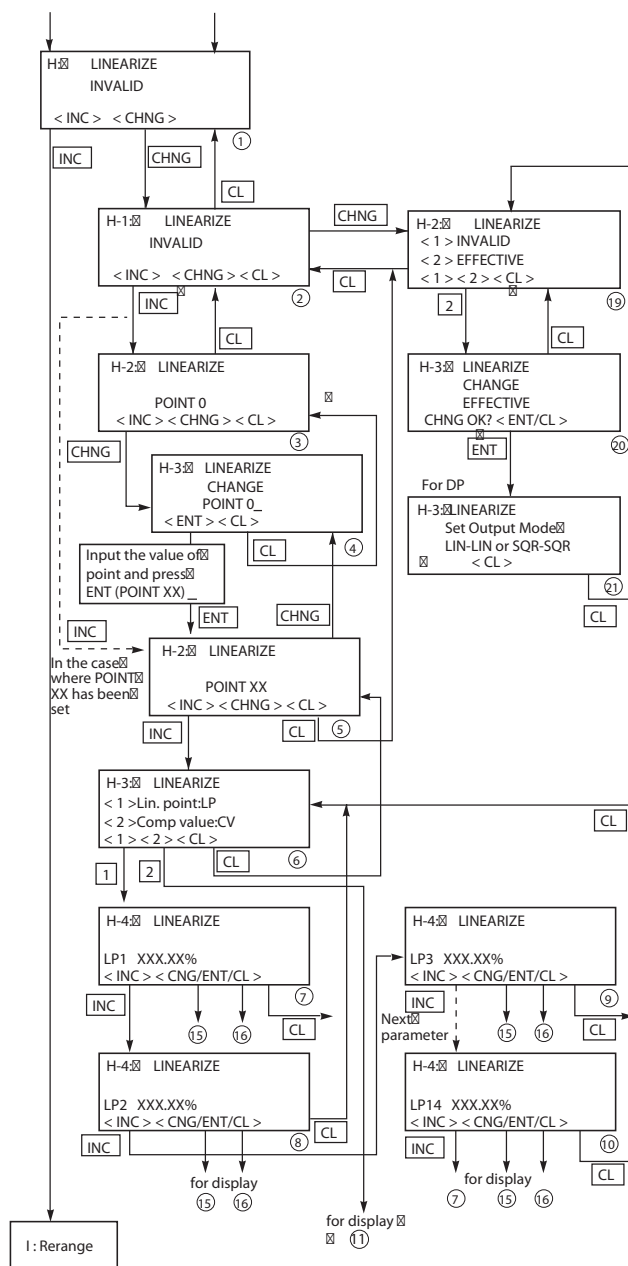
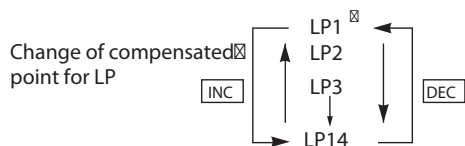
At this time, the display is shifted to ⑥.

Select <2> Comp. point: CV at display of ⑥ and input XXX.XX% to each point (CV1-CV□) in the same way as noted in <1> LP.

At the completion of input to all the compensated points, press ENT twice and the write of CV will be finished.

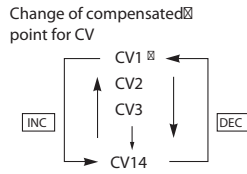
At the completion of write of compensated program for LP/CV, press CL twice at the display of ⑥ for shifting to ②.

Then, press CHNG for selection of <1> INVALID and <2> EFFECTIVE of ⑱. At display of ⑱, press <2> and the display will be changed to EFFECTIVE.



Note) In the key stroke for Linearization, please set each parameter in the below sequence.

1. Set the number of compensation points in the range of 2 to 14.
2. Set each linearization option point (LP*) correctly, and write them.
3. Set each compensation value (CV*) correctly, and write them.
4. Set linearization option into EFFECTIVE and write.



When INC is pressed at display of ③, the following is displayed,

H-2: LINEARIZE
POINT 0
SETTING ERR <CL>

or

When ENT is pressed at display of ④, the following is displayed,

H-3: LINEARIZE
POINT 15
POINT SET
SETTING ERR <CL>

POINT=2 ≤ (number of correction) ≤ 14
setting err=00 or 01 or ≥15

When ENT is pressed at display of ⑮, the following is displayed,

H-5: LINEARIZE
CHANGE
LPM 150.01%
SETTING ERR <CL>

Requirement of setting

-1.25% ≤ LP1 < LP2... < LP14 ≤ +110%

When ENT is pressed at display of 17, the following is displayed,

H-5: LINEARIZE
CHANGE
CVM 100.01%
SETTING ERR <CL>

Requirement of setting

-100% ≤ CV1 < CV2... < CV14 ≤ +100%

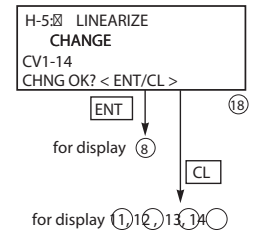
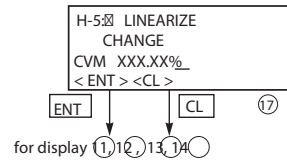
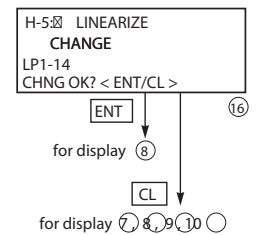
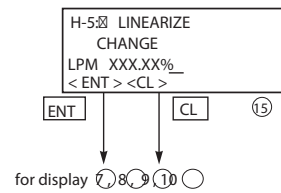
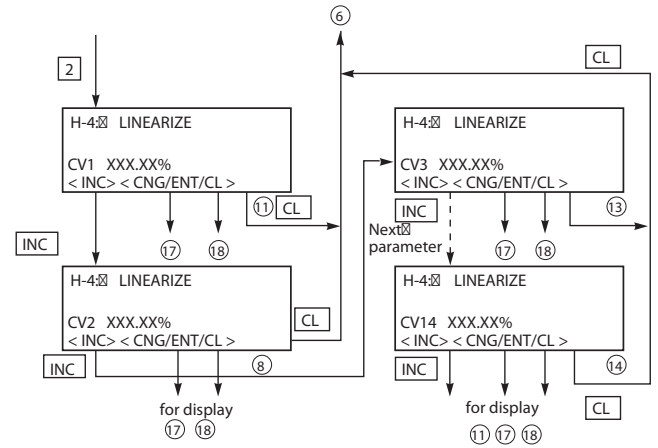
Before performing the LINEARIZE setting, set either of the following equations in the OUTPUT mode (Menu No.8) and XMTR DISPLAY (Menu No. G):

OUT = LIN SMTR DISP = LIN or

OUT = SQR XMTR DISP = FLOW (Note 1)

Note 1)

XMTR DISP = FLOW means the settings of % FLOW in % display or of FLOW units in actual scale display.



When ENT is pressed at display of 0, the following is displayed,

H-3: LINEARIZE
Set LINEARIZE
Point, LP and CV
correctly. <CL>

Requirement of setting

1. LP ≤ LP2 ≤ LP3...LP8 ≤ LP9...LP13 ≤ LP14 (In the case that LP1-LP14=All Zero, it is inhibited to be set enable)

2. If CVa ≠ CVb, then it must be LPa < LPb (Note1)

3. If LPa = LPb, then it must be CVa = CVb (Note1)

Note1)

a, b show next numeral such as

a=1 b=2 or a=2 b=3 ora=13 b=14.

or the following is displayed.

H-3: LINEARIZE
Set OUTPUT MODE
LIN-LIN or
SQR-SQR <CL>

Rerange (Set LRV/URV calibration)

Application to level measurement at change of level (LRV/URV)

Functions of RERANGE can be made with FXW Version 6.0 or upward.

When the lower range value (LRV) and upper range value (URV) need to be adjusted again during measurement of tank level, the measurement levels can be changed at the same time by setting the LRV or URV to be adjusted from FXW.

Apply an input pressure required for rerange of LRV at display of ③ and press ENT twice.

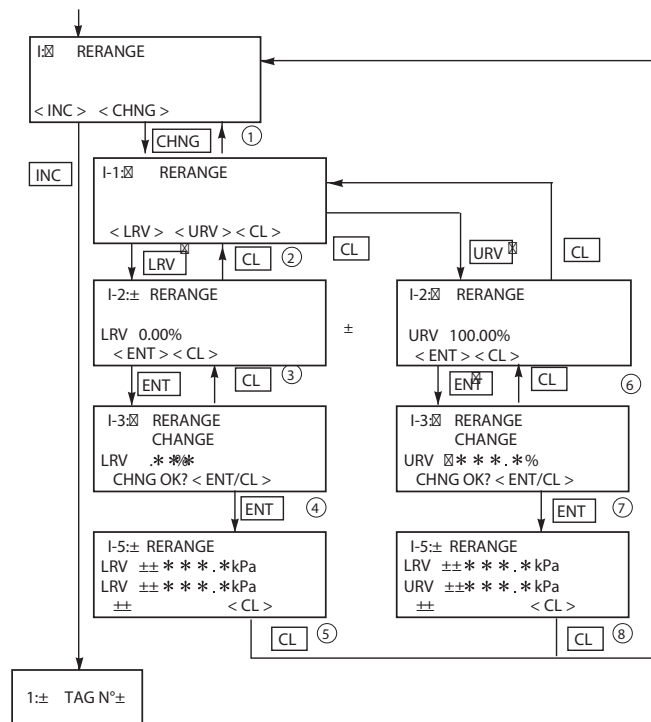
In this way, the rerange of LRV is completed, then the new measurement range LRV and URV, which conforms to the actual input pressure, is displayed.

When rerange is made at a point other than 0%, input the set value (PV%) of that point at display of ③, and press ENT at display of ④ while applying a corresponding pressure. In this way, the measurement range can be changed to the input corresponding to that pressure.

Apply an input pressure required for rerange of URV at display of ⑥ and press ENT twice. The rerange of URV is completed, then the new measurement range LRV and URV corresponding to the actual input pressure is displayed. When rerange is made at a point other than 100%, input the set value (PV%) of that point at display of ⑥ and press ENT at display of ⑦ while applying a corresponding pressure. In this way, the measurement range can be changed to the input corresponding to that pressure.

Note)

The unit of LRV/URV at ⑤ and ⑧ are displayed in the unit selected by Menu N° 4:UNIT.



Adjustment point setting condition

$-1.00\% \leq \text{LRV} < 100.00\%$

$0.00\% \leq \text{URV} < 110.00\%$

In the case that point is out of setting limit.

(Ex)

```

1-2:RERANGE
LRV      100.01%
SETTING ERR <CL>
  
```

In case of the actual scale specification with a digital indicator provided, if the range is changed, indicator display might not match. So, setting is required again in response to the display in the digital indicator (G:XMTR DISPLAY).

In case of the actual scale specification with an analog indicator provided, if the range is changed, the scale for indicator might not ensure exact reading.

When CHNG is pressed at display of q, the following is displayed.

```

1-1:RERANGE
Can't proceed.
Set Linearize
invalid. <CL>
  
```

This means that RERANGE can't be made because MENU N° H:LINEARIZE is set in EFFECTIVE.

In this case, press the CL key and set in INVALID on the panel of N° H: LINEARIZE.

Saturation current value and specification

Saturation current value (Lower limit value=SAT LO, Upper limit value=SATO HI) and specification (NORMAL= Existing specification, EXP. = Extended specification) are settable.

When the setting of specification (SPEC) is for existing specification, saturation current is not be settable.

When change the setting of saturation current, EXP. should be set for the SPEC setting.

- Change of saturation current value (Lower limit) (Changeable only for the extended specification) Settable setting range by <INC> or <DEC> key on the display ③ is as follows.

$3.2\text{mA} \leq \text{Burnout current (UNDER SCALE)} \leq \text{Saturation current (Lower limit value)} \leq 4.0\text{mA}$

- Change of saturation current value (Upper limit value)

Make a setting as same as the setting of the lower limit value by input ② from Menu.

Selectable setting range by <INC> or <DEC> key is as follows.

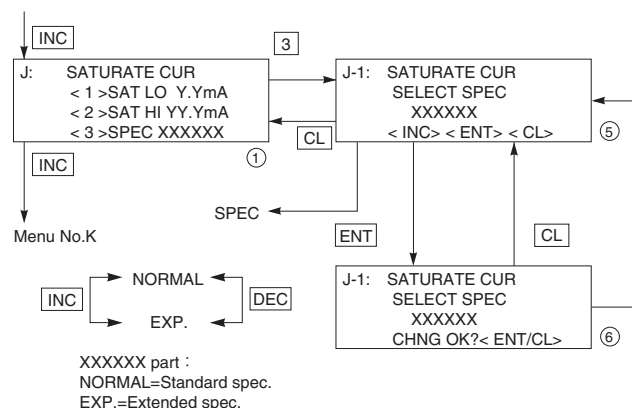
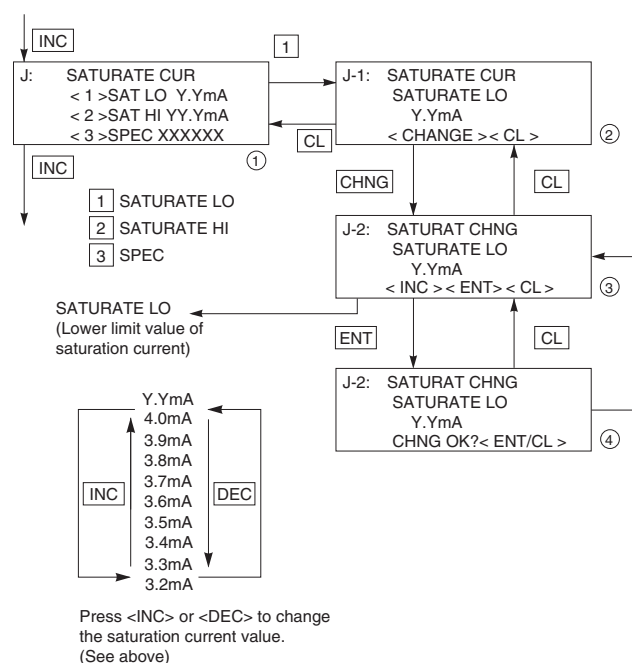
$20.0\text{mA} \leq \text{Saturation current (Upper limit value)} \leq \text{Burnout current (OVER SCALE)} 21.6\text{mA}$

- * Burnout current is settable according to "9. Burnout direction and value".

- Change of the specification

Existing specification or enhanced specification is selectable.

Refer to "J-3" in "J. Saturation current value and specification" of a local configurator unit with LCD display for details.



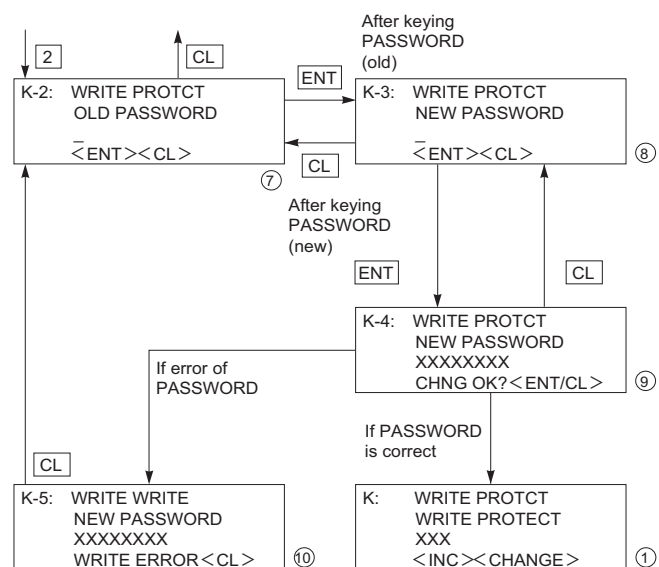
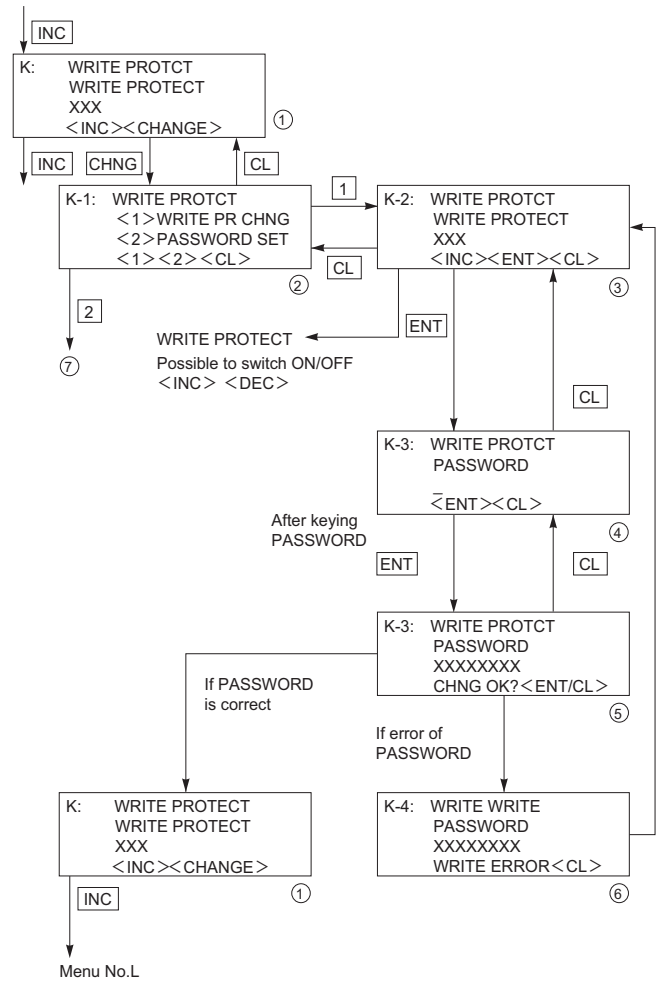
Write protect

Write protect is settable by setting a PASSWORD

When the write protect is ON by this function, the write protect can not be cancelled by 3-push button of local configurator unit with LCD display.

Refer to "K Write protect" of Local configurator unit with LCD display for details.

* The target of write protect is same as the protect function of set value by 3-push button.



History information

Display of ZERO/SPAN adjustment data for users

It is displayed by selecting <1> on the display 1 .

ZERO means ZERO adjustment value.

SPAN means SPAN adjustment value.

Clear of ZERO/SPAN adjustment data for users

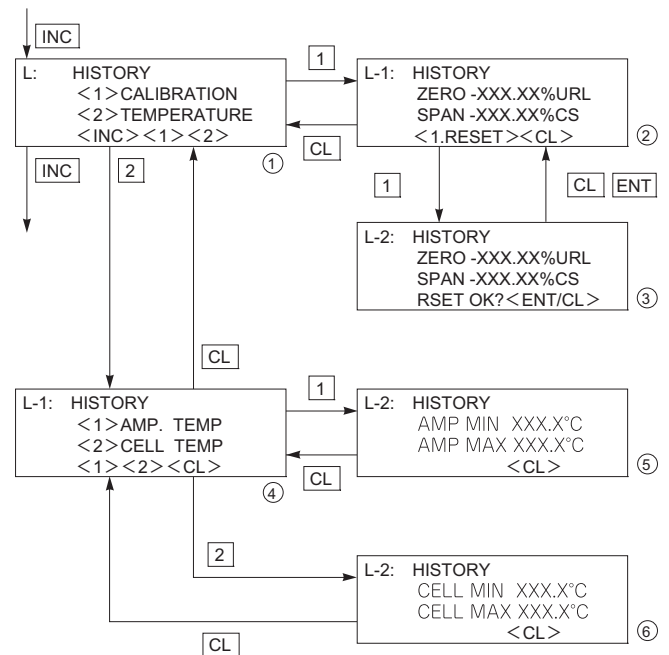
It is cleared by selecting <1> on the display 2 .

Display of history information of AMP temperature (MIN/MAX)

Displaying the min/max value of history information of AMP temperature.

Display of history information of CELL temperature (MIN/MAX)

Displaying the min/max value of history information of CELL temperature (display 6).



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).

5.1 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 if 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 non wetted parts of the transmitter.
Protect or replace the transmitter if necessary.

5.2 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:

Symptom	Cause	Remedy
Output current overshoots scale (The value is more than the upper limit of the saturation current.).	(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 amplifier unit is wrong. (7) Zero and span or fixed output current(4, 20mA) are not adjusted. (8) Amplifier 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 chapter 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 chapter 7.2. (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.) → Readjust according to chapter 4. → Replace the amplifier unit according to chapter 5.3.
No output current (The value is less than the lower limit of the saturation current.).	(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) Zero and span or fixed output current(4, 20mA) are not adjusted. (6) Amplifier unit is faulty.	→ Correct wiring according to chapter 7.1. → Make arrangement to obtain proper values. (For power supply voltage and load resistance, refer to chapter 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 chapter 7.2.) (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.) → Readjust according to chapter 4. → Replace the amplifier unit according to chapter 5.3.
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, span or fixed output current (4, 20mA) has deviated. (6) Amplifier unit is faulty.	→ Correct the piping. → Vent or drain the transmitter. → Perform density compensation. → Minimize the temperature change. → Readjust according to chapter 4. → Replace the amplifier unit according to chapter 5.3.
When the indicator is abnormal.	(1) An error display is appeared.	→ P28 capital to "contents of message"

If remedy is impossible, contact Klay Instruments service department.

5.3 Replacement of defective parts

It's necessary to use new spare parts according the new updated list available on our website at: www.klay.nl

If the transmitter requires a replacement part, drain process fluid from the transmitter, disconnect The main parts of the transmitter are the amplifier unit and the measuring cell.



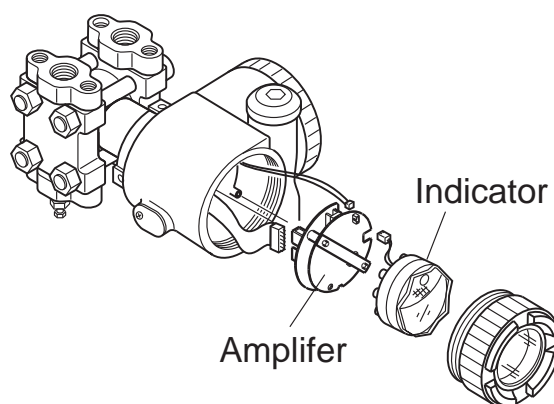
When removing an explosion-proof transmitter, turn OFF the main power, then disconnect the piping and wiring. Do not remove it when the power is ON to prevent serious accident such as explosion, fire, etc...

Identification of faulty parts

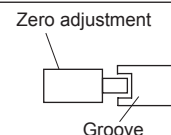
Replace first the amplifier unit to find out if the failure reason comes from the amplifier unit or the measuring cell. Run the function "Self Check" with the HHC to find out the faulty part. When the failure is detected, please replace the concerned part. Refer to the spare parts drawing at the end of the instruction manual

Replacement of amplifier

- (1) Turn off the power supply.
- (2) Remove the indicator.
- (3) Remove the amplifier.
Unplug each connector.
- (4) Assemble a new amplifier unit in the electronics housing and connect the connectors.
Assemble all parts
in the reversing way than described before.
Check that
all the screws are correctly tightened, and assemble the electronics housing cover on the transmitter



When installing the electronics unit, make sure that the zero adjust screw end is in front of the groove in the amplifier unit.

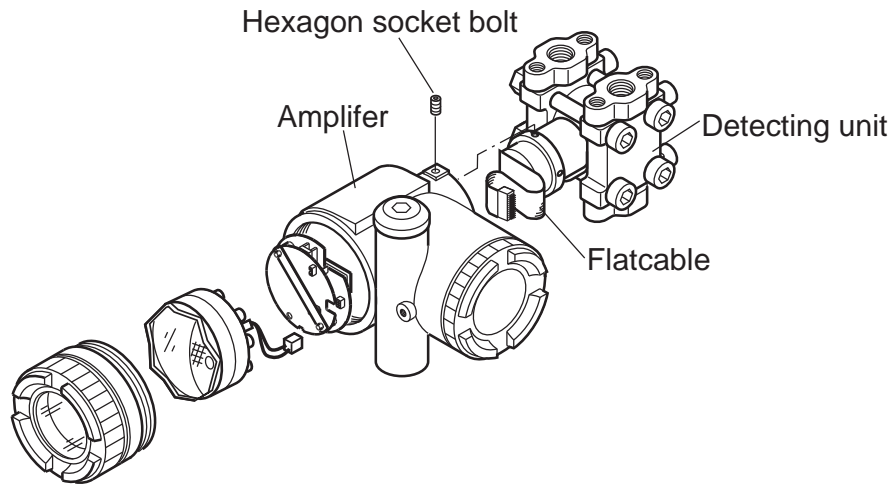


- (5) After completion of replacement, perform zero and span adjustments.



The electronics unit should be removed carefully so as not to damage the internal wiring.

Replacement of detecting unit



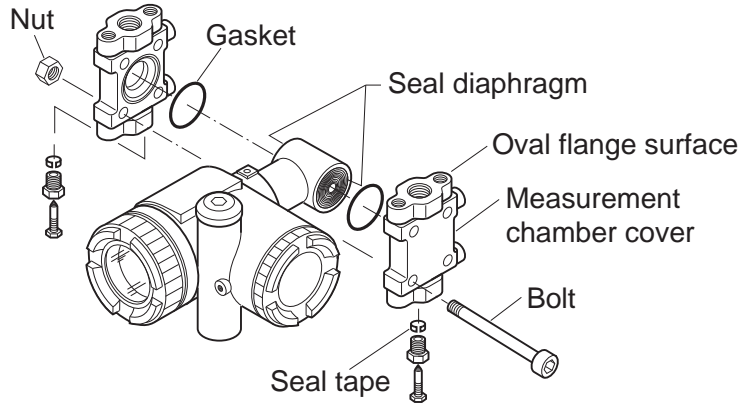
- (1) Remove the electronics unit according to "Replacement of electronics unit"
- (2) Remove the 2 hexagon socket bolts from the electronic housing.
Pull the electronics housing straight forward and away from the detecting unit.
- (3) Replace the detecting unit with a new one of the same type.
- (4) Check if the O ring of the cell neck and all the surfaces in contact between the electronics housing and the cell neck are not damaged. Assemble measuring cell and electronics housing. Tighten the 2 screws
- (5) Connect each connector of the electronics unit and attach it to the transmission unit.
- (6) After connecting all the connectors, assemble the amplifier unit in the electronics housing.

PRECAUTION

- Ensure that replacement detector unit has the same specification as the original by comparing nameplates.
- When removing the transmitter case, pay attention not to damage the flatcable.

Replacement of the internal parts of detecting unit

In case of differential and flow transmitter (code symbol: FKC)



- (1) Remove the 4 hexagon socket head bolts.
- (2) The process covers, the O ring and the bolts and nuts can now be removed.
- (3) After disassembly, replace the faulty part with a new ones.
- (4) Before reassembling, clean carefully the O ring groove of the process cover with a soft cloth immersed with water, alcohol, Freon TF or similar.
- (5) Reassemble the detecting unit by reversing the disassembling procedure.

Please check the correct position of the process covers to avoid that the diaphragms of the measuring cell are damaged. The torque for the bolts of the process covers are indicated in the following table.

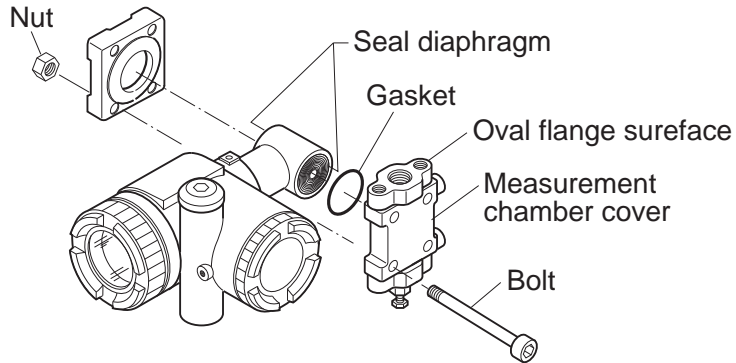
Bolt size	Bolt material	Tightening torque	Maximum working pressure
M10	Cr-Mo steel	50 N.m	420 bar
M10	SUS 316	30 N.m	100 bar
M10	SUS 630	50 N.m	420 bar
M12	Cr-Mo steel	60 N.m	420 bar
M12	SUS 660	60 N.m	420 bar
M16	SUS 660	110 N.m	500 bar
M20	SUS 660	260 N.m	1035 bar

- (6) After assembly, carry out a pressure test. Apply a pressure equal to 150% of the maximum working pressure to both high pressure (H) and low pressure (L) measurement chambers of the transmitter simultaneously during 15 minutes, and make sure that there is no leakage.



To avoid any damage of the measuring cell, do not exceed the test pressure of the different cells (please refer to the technical datasheets of the concerned transmitter)

In case of absolute and gauge pressure transmitter (FKA and FKG)



- (1) Remove four hexagon sockets head bolts with a torque wrench, etc..
- (2) Disassembly gives access to the casing cover, O-ring (or gasket) and hexagon socket head bolts.
- (3) After disassembly, replace the faulty part with a new one.
- (4) Before reassembly, clean the O-ring face of casing cover with the soft cloth immersed in water, alcohol, or similar.
- (5) Reassemble the detecting unit by reversing the disassembling procedure. The casing cover should be assembled carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.


In case of absolute pressure transmitter FKA :

Bolt size	Bolt material	Tightening torque	Maximum working pressure
M10	Cr-Mo steel	50 N.m	30 bar
M10	SS 316	30 N.m	30 bar
M10	SS 630	50 N.m	30 bar

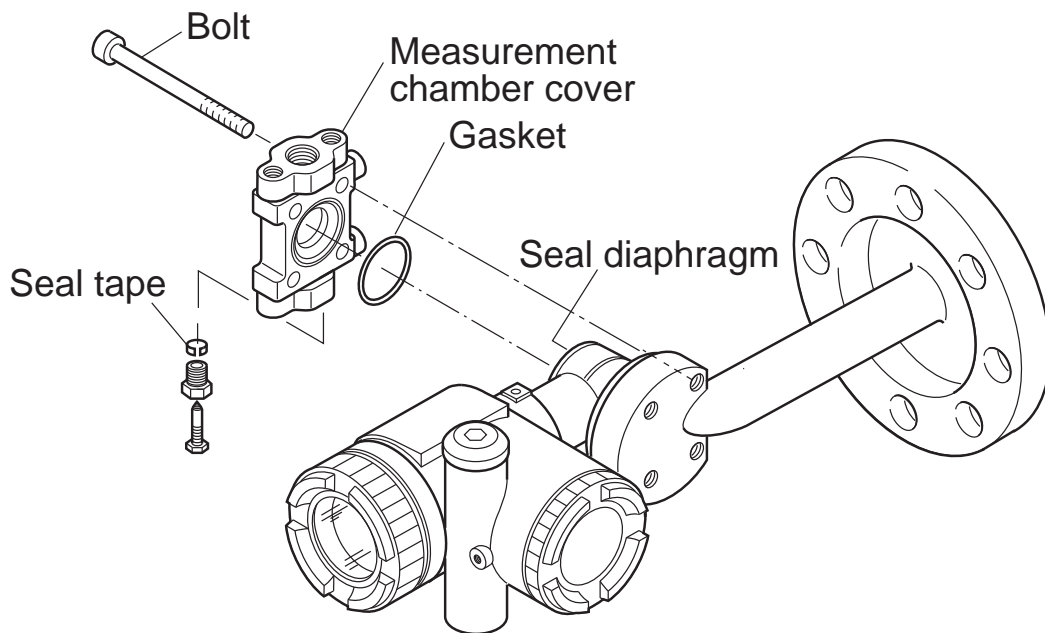
In case of gauge pressure transmitter FKG :

Bolt size	Bolt material	Tightening torque	Maximum working pressure
M10	Cr-Mo steel	50 N.m	500 bar
M10	SS 316	30 N.m	100 bar
M12	Cr-Mo steel	60 N.m	500 bar
M12	SS 660	60 N.m	500 bar
M16	SS 660	110 N.m	500 bar

- (6) After assembly, carry out a pressure test. Apply a pressure equal to 150% of the maximum working pressure to both flange side, high pressure side (HP) and low pressure (LP) measurement chamber of the transmitter simultaneously for 15 minutes, and make sure there is no leakage.

 Caution Remember !	To avoid any damage of the measuring cell, do not exceed the test pressure of the different cells (please refer to the technical datasheets of the concerned transmitter)
--	---

In case of level transmitter (FKE)



- (1) Remove four hexagon socket head bolts with a torque wrench, etc..
- (2) Disassembly gives access to the casing cover, O-ring (or gasket) and hexagon socket head bolts.
- (3) After disassembly, replace the faulty part with a new one.
- (4) Before reassembly, clean the O-ring face of casing cover with the soft cloth immersed in water, alcohol, or similar.
- (5) Reassemble the detecting unit by reversing the disassembling procedure. The casing cover should be assembled carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.

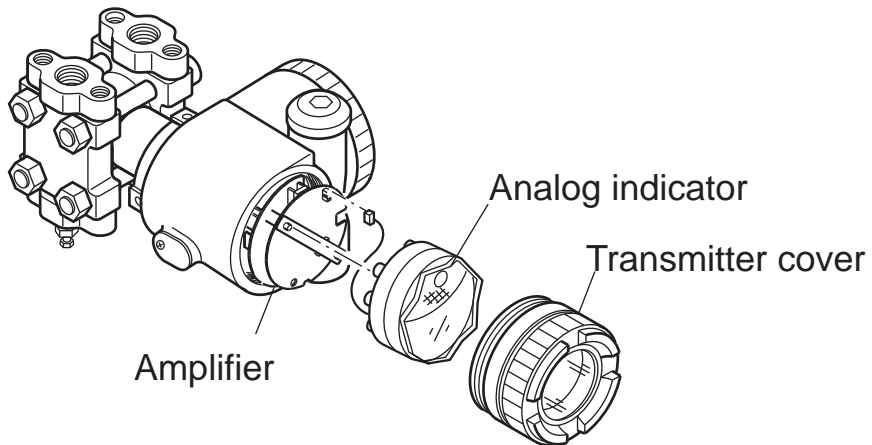
Bolt size	Bolt material	Tightening torque	Maximum working pressure
M10	Cr-Mo steel	50 N.m	Up to rated flange pressure
M10	SS 316	30 N.m	Up to rated flange pressure
M10	SS 630	50 N.m	Up to rated flange pressure

- (6) After assembly, carry out a pressure test. Apply a pressure equal to 150% of the maximum working pressure to both flange side, high pressure side (HP) and low pressure (L) measurement chamber of the transmitter simultaneously for 15 minutes, and make sure there is no leakage.

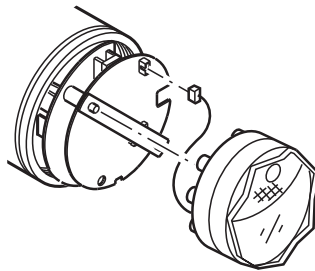


To avoid any damage of the measuring cell, do not exceed the test pressure of different cells (please refer to the technical datasheets of the concern transmitter)

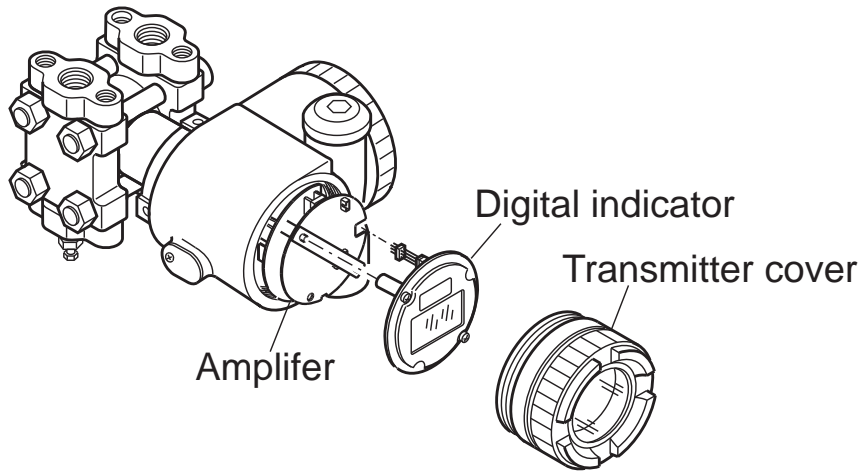
Replacement of the analog indicator



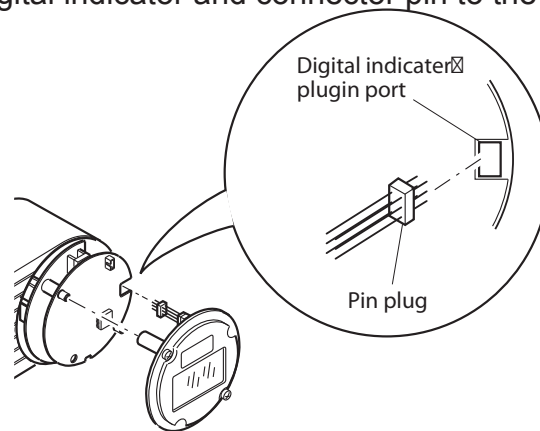
- (1) Unscrew the electronics housing cover on indicator side.
- (2) Remove the analog indicator.
- (3) Pull out the connector extending from the analog indicator.
- (4) Connect the connector of a new analog indicator to the electronics section.
(See the figure below.)
- (5) Then, mount the analog indicator at the electronics section.
- (6) Assemble the electronics housing cover.



Replacement of the digital indicator

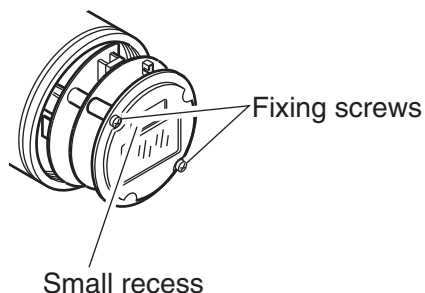


- (1) Unscrew the electronics housing cover on indicator side.
- (2) Remove the two fixing screws which fasten the digital indicator and separate the indicator.
- (3) Remove the connector pin connecting the digital indicator and the amplifier unit. However, if you replace only the digital indicator, you need not remove the connector pin.
- (4) Connect a new digital indicator and connector pin to the amplifier unit.



- (5) Fasten the digital indicator to the electronics section by tightening two fixing screws.

Before tightening, make sure a small recess on the surface is positioned at the top as shown below.



- (6) Assemble the electronics housing cover.

5.4 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 HHC.

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

No.	Item	Display symbol of local configurator unit with LCD display (Relevant page)	Display symbol of HCC (Relevant page)	Contents of setting adjustment
1	TAG No.	1: TAG (P22)	1: TAG No. (P50)	Set the previous data before replacement of amp unit.
2	Model code	2: TYPE (P23)	2: TYPE (P50)	Set the previous data before replacement of amp unit.
3	Serial No.	3-1: SERIAL No. 3-2: VER (P24)	3: SERIAL No. (P51)	Not necessary for operation
4	Engineering unit	4: UNIT (P25)	4: UNIT (P51)	Set the previous data before replacement of amp unit.
5	Range limit	5: URL (P25)	5: RANGE LIMIT (P52)	Not necessary for operation
6	Measuring range	6-1: LRV 6-2: URV (P26)	6: RANGE (P52)	Set the previous data before replacement of amp unit.
7	Damping	7: DAMP (P28)	7: DAMPING (P53)	Set the previous data before replacement of amp unit.
8	Output mode	8-1: OUT Md 8-2: CUT Pt 8-3: CUT Md (P29)	8: OUTPUT MODE (P54)	Set the previous data before replacement of amp unit.
9	Burnout direction	9-1: BURNOUT 9-2: OVER 9-3: UNDER (P31)	9: BURNOUT (P55)	Set the previous data before replacement of amp unit.
10	Zero/span calibration	A-1: ZERO A-2: SPAN (P33)	A: CALIBRATE (P56)	Implement span calibration after zero calibration.
11	Calibration output circuit	b-1: 4mAAdj b-2: 20mAAdj b-3: FIXcur (P35)	B: OUTPUT ADJ (P57)	Loop check & calibrate fixed output current (4mA,20mA)
12	Measurement data	(Normal mode) (P36)	C:DATA (P58)	Check the measurement data.
13	Self-diagnosis	d1: AMPTMP d2: ALMCHK (P36)	D: SELF CHECK (P58)	Check, if it is necessary.
14	Printer function	-	E: PRINT (P59)	In case of HHC with printer option, print if it is necessary.
15	Lock of adjustment functions	F: LOCK (P37)	F: XMTR EXT.SW (P59)	Set the previous data before replacement of amp unit
16	Indication of digital indicator	G-1: LDV G-2: UDV G-3: DP G-4: LcdUnit G-5: LcdOpt (P38)	G: XMTR DISPLAY (P60)	Set the previous data before replacement of amp unit.
17	Programmable linearization function	-	H: LINEARIZE (P62)	Set the previous data before replacement of amp unit.
18	Input-output range adjustment	I-1: LRVAdj I-2: URVAdj (P41)	I: RERANGE (P64)	Adjust the input-output range (RERANGE) as required.
19	Change of saturation current	J-1: SAT LO J-2: SAT HI J-3: SPEC (P43)	J: SATURE CUR (P65)	Set the previous data before replacement of amp unit.
20	Protective function of set value	K: GUARD (P45)	K: WRITE PROTCT (P66)	Set the previous data before replacement of amp unit.
21	History information	L-1: His ZERO L-2: His SPAN L-3: His CLEAR L-4: His AMP L-5: His CELL (P46)	K: WRITE PROTCT (P67)	Check data as necessary

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

1	Zero/span calibration	A-1: ZERO A-2: SPAN (P33)	A: CALIBRATE (P56)	Implement span calibration after zero calibration
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Type	Ambient temperature limit	Process temperature limit	Span limit	Static pressure limit	Technical datasheets
Differential pressure	-40 to 85°C	-40 to 120°C	10 mbar	-1 to 32 bar	EDSF6-134
			60 mbar	-1 to 100 bar	
			320 mbar	-1 to 160 bar (option : 420 bar)	
			1300 mbar	-1 to 160 bar (option : 420 bar)	
			5 bar	-1 to 160 bar (option : 420 bar)	
			30 bar	-1 to 160 bar (option : 300 bar)	
			200 bar	-1 to 300 bar	
Gauge Pressure	-40 to 85°C	-40 to 120°C	1,3 bar	1,3 bar	EDSF5-92
			5 bar	5 bar	
			30 bar	30 bar	
			100 bar	100 bar	
			500 bar	500 bar	
Absolute Pressure	-40 to 85°C	-40 to 120°C	0,16 bar abs	0,16 bar abs	EDSF5-91
			1,3 bar abs	1,3 bar abs	
			5 bar abs	5 bar abs	
			30 bar abs	30 bar abs	
			100 bar abs	100 bar abs	
Level and remote seal(s)	-40 to 85°C	-40 to 150°C (max 400°C option) see note*	320 mbar	According PN/lbs of remote seal	EDSF6-05 EDSF7-68
			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 Klay Instruments.

! 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.

6.1 Installation

During the unpacking of the transmitter, check the conformity of the transmitter and all the accessories.

Before installation, the customer must check the compatibility of the wetted parts for the application. The possibility of a modification of the process has to be taken in account by the customer.

The transmitter can be installed on a 2" tube or wall mounted.

The level transmitter FKE has a remote seal and can be installed directly on a counter flange.

Note :

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



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



If the transmitter is not used soon after delivery, then leave it packed and store it in a room at the normal temperature and humidity (25°C <77°F>, 60% RH).

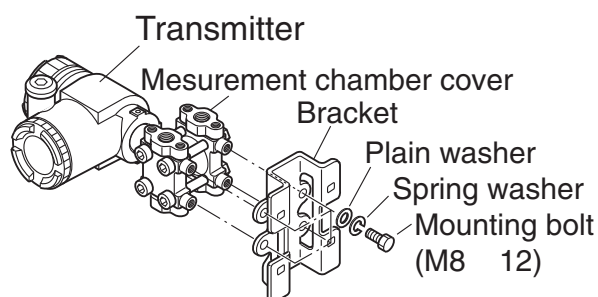


- The transmitter is heavy. Be careful when handling it.
- The indicated installation and the wiring conditions of the transmitter must be strictly followed.
- A wrong manipulation can be the reason of a disfunction of the transmitter.
- During installation, make sure that no part which could be the reason of the disfunction or a danger is located inside the electronics housing.
- When the transmitter is installed in a flame proof area :
The local indicator position must not be changed
The position of the electronics housing must not be changed
- The isolating valves and manifold must correspond to the maximum pressure in the pipe. If the valves and the connections do not correspond to the max pipe pressure, there will be a risk of gas leakage or dangerous fluid.
- The pipes need to be according the temperature and the pressure standards.

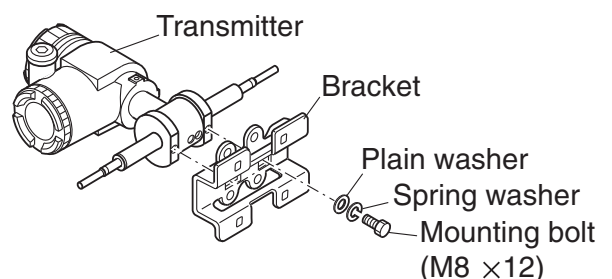
Bracket mounting

Mount the bracket on the transmitter as shown below.

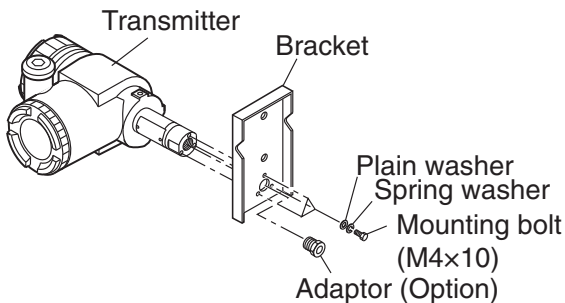
FKC, FKG and FKA models



FKD, FKB and FKM models



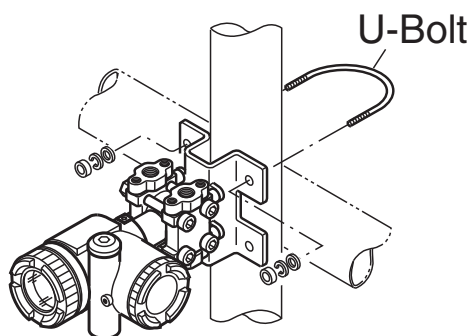
FKP and FKH models



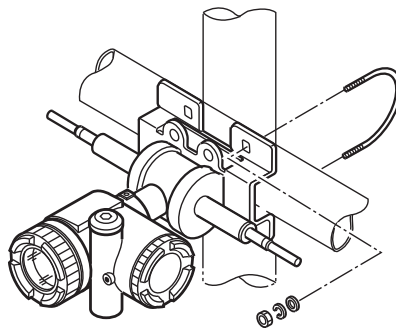
Mounting

Pipe mounting

FKC, FKG and FKA models



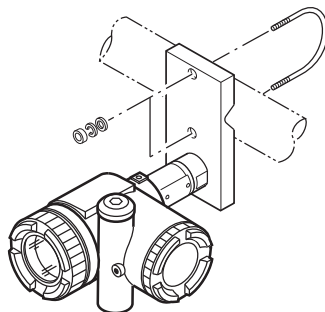
FKD, FKB and FKM models



Wall mounting

Fasten the transmitter to the wall with M8 bolts.

FKP and FKH models



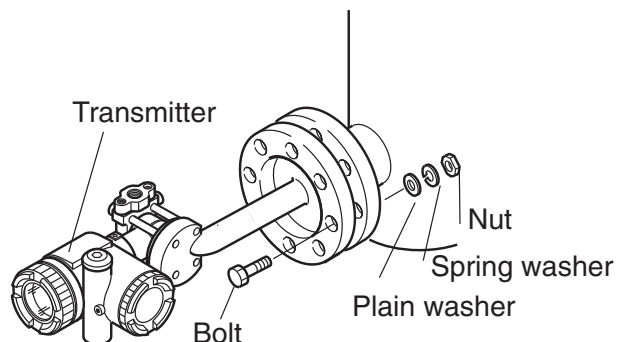
(1) Fasten the transmitter to a vertical or horizontal pipe using the supplied U-bolt (Tightening torque approximately 15 Nm (1.5 kgfm)<11ft-lb>).

(2) Use a pipe of outside diameter $\varnothing 60.5\text{mm}$

Flange mounting

Position the remote seal of the transmitter in front of the counter flange.

Fix the transmitter to the flange using the adapter boltings



Change of electronics housing position



Avoid the following procedure in an explosionproof area.

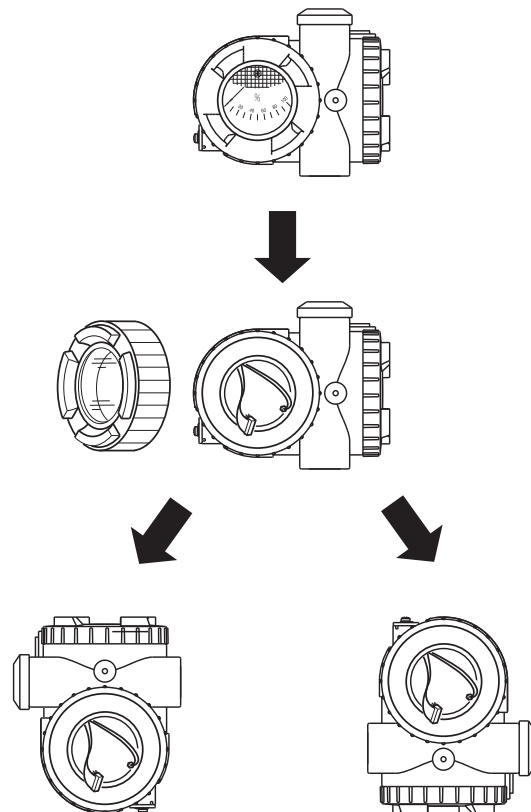
The wiring and the access to do so, can be difficult according the position of the transmitter. The electronics housing position can be modified by turning it by steps of 90 or 180 degrees.

The electronics housing is fixed by hexagonal socket bolts (M6 x 12). Loosen the bolts and turn the electronics housing to the right or left hand side; fasten the fixing screws after this operation again



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

If the transmission unit has been turned excessively without removing the electronics unit, straighten the flat cable which connects the electronics unit in the transmission unit and the detecting unit, and set the transmission unit again.

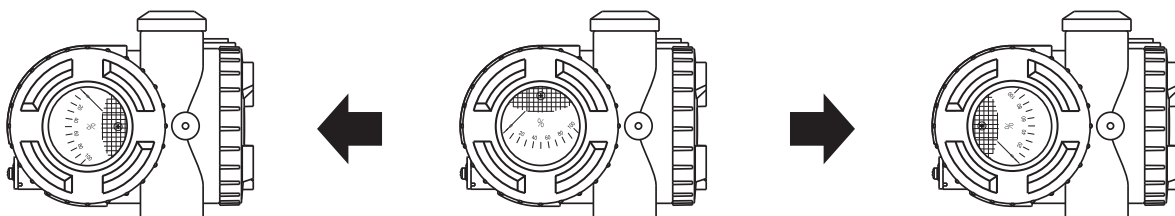


Change of indicator angle



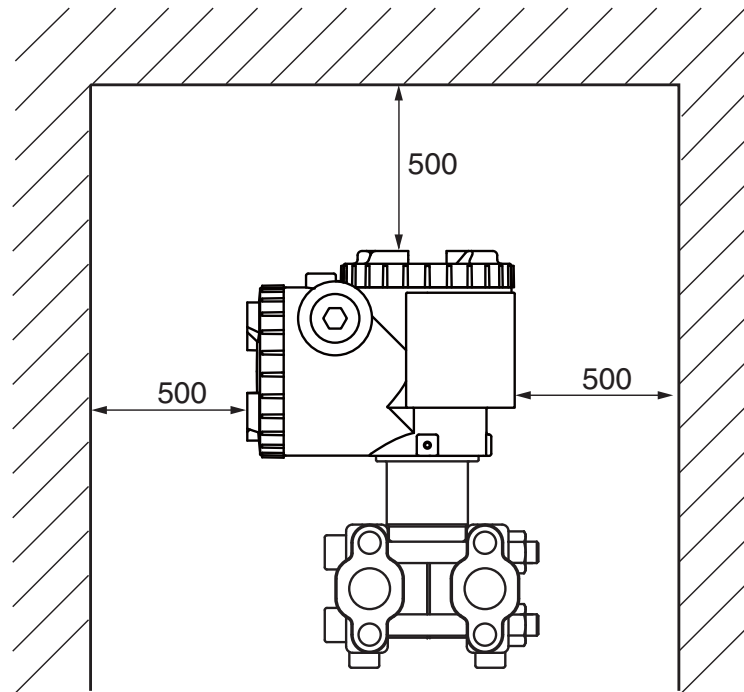
Avoid the following procedure in an explosionproof area.

The analog or digital indicator can be turned $\pm 180^\circ$ in 90° increments because it is connected with a pin plug.



Check space

Ensure a space of about 500mm against the cover in order to facilitate check, adjustment, etc.



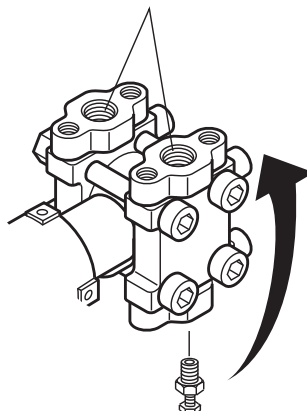
Change of vent/drain plug position

Grasp the hexagon part of vent/drain plug and rotate it to remove.

Bind vent/drain plug's thread with new seal tape and mount vent/drain plugs to new process connections.

Tightening torque : 25N·m (2.5kgf·m) <18ft·lb>

Process connection



6.2 Piping

It is generally recognized that there are appropriate positioning relationship between the transmitter and main process piping for accurate measurement to avoid harmful gas or liquid accumulation.

General recognitions are;

- 1) Mount transmitter below main process piping for liquid or steam measurement.
- 2) Mount transmitter above main process piping for gas measurement.

The standard style of FCX-A2 V5 serie transmitters correspond to the piping procedure ① mentioned above. Change the vent/drain plug to correspond to the piping procedure ② .

ATTENTION

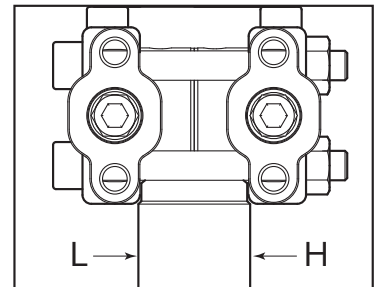
Main valve or manifold used for piping should be selected with the maximum pressure of the process taken into account (piping parts such as main valve, etc. should be furnished by user). If the main valve and other parts do not meet the rating, it may result in leakage of gas or liquid which could lead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

6.2.1 Piping of differential pressure and flow transmitters (type: FKC)

Check of high/low pressure sides of transmitter

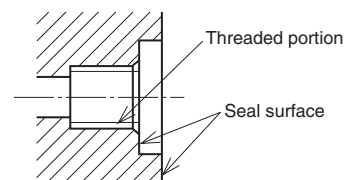
The detecting unit of the differential pressure transmitter bears symbols H and L which represent high and low pressure sides, respectively.

Also, vent/drain plugs are provided at the lower process connection, while impulse pipes are connected at the upper process connections.



Removal of protective cap

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



Connection of transmitter and impulse pipes

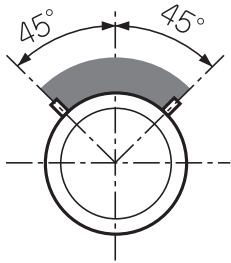
- (1) When using the manifold valve, it should be fixed to the transmitter by tightening four oval flange set bolts (7/16-20UNF), and then the impulse pipe should be connected to the manifold valve. Tightening torque of 7/16-20UNF mounting bolt should be 30 to 40 N·m (3 to 4 kgf·m).
- (2) If a manifold valve 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 N·m (3 to 4 kgf·m).

Position of process taps (Horizontal main process piping)

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

Note the following figures when planning and installing the piping.

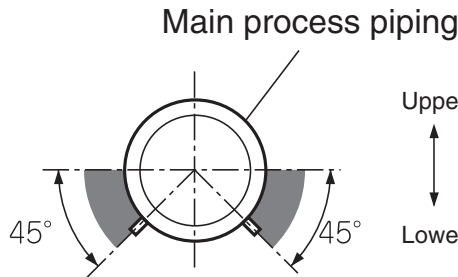
Gas measurement



Upper
↓
Lower

Pressure source is located upper side of main process piping

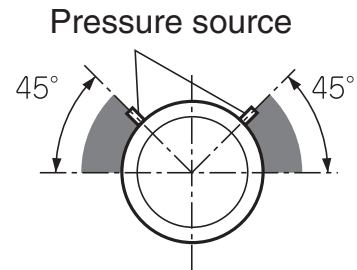
Liquid measurement



Upper
↓
Lower

Pressure source is located lower side of main process piping

Steam measurement

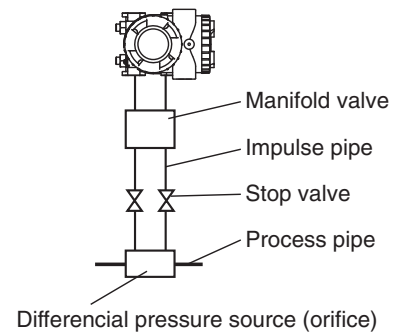


Pressure source is located upper side of main process pip

Typical examples of piping

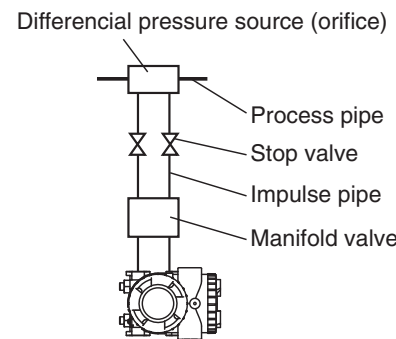
1- Flow measurement (in case of gas)

Place the transmitter above the differential pressure source.



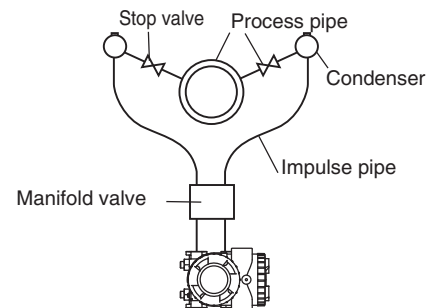
2- Flow measurement (in case of liquid)

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



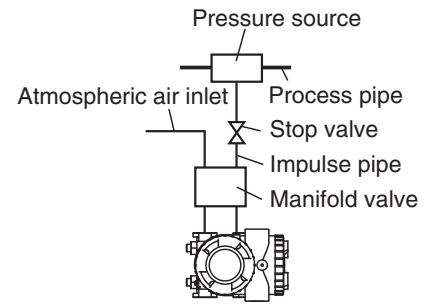
3- Flow measurement (in case of steam)

Set two condensers at the same height near the process tap. Fill the line between the condensers and transmitter with condensed water. Install a drain port as required.



4- Pressure measurement (in case of liquid)

Zero point can be checked with a manifold valve installed.



! ATTENTION

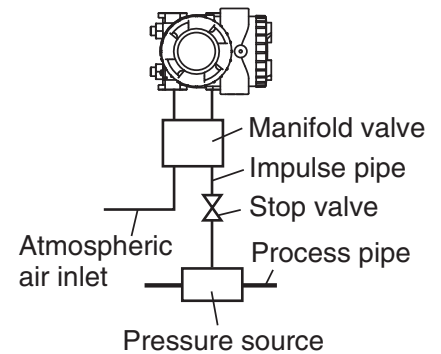
- (1) Protection is required to prevent dust from entering through the atmospheric air inlet after installation of the manifold valve.
- (2) If process pressure range is narrow (below 10kPa (1000mmH₂O)), the following should be considered.

- Pressure variation due to wind around atmospheric air inlet
- Temperature variation near process taps
- Difference in atmospheric pressure between process tap 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 (in case of gas)

Mount the transmitter above the process pipes to preventing moisture from entering the inside of transmitter.



6- Level measurement

- (1) In case of wet leg:

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

Level calculation formula

$$\text{LRV} : \rho H_2 - \rho_0 H_1$$

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

$$\text{Span } (\Delta P) : \rho_1 h$$

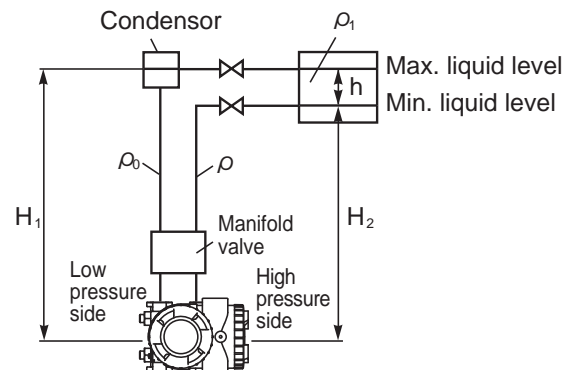
LRV : Low limit of measurement (0% point)

URV : High limit of measurement (100% point)

ρ_0, ρ, ρ_1 : Density

H_1, H_2 : Liquid level,

h : Liquid level change



(2) In case of dry leg:

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

Level calculation formula

$$\text{LRV: } \rho H_1$$

$$\text{URV: } \rho H_1 + \rho_1 h$$

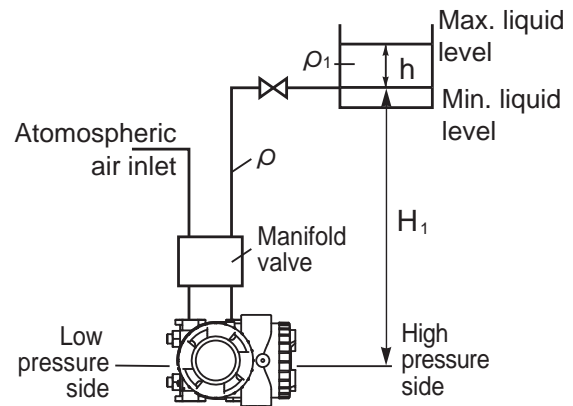
$$\text{Span (DP): } \rho_1 h$$

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



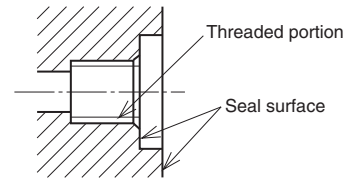
Cautions on impulse piping

- For liquid, the impulse pipes should have an upward 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 downward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of moisture, etc. in the detecting unit.
- Avoid any sharp bends in impulse pipe which may cause gas or moisture to accumulate in the impulse pipe.
- Do not apply an excessive force to the transmitter during its connection.
- Install condensed chambers and vent drain when impulse pipes can't 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.**
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.

6.2.2 Piping of gauge and absolute pressure transmitters (types: FKG and FKA)

Removal of protective cap

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



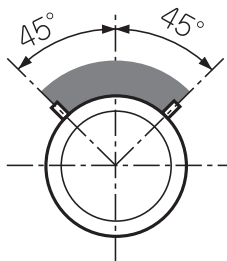
Connection of transmitter and impulse pipe

- Impulse pipe should be connected with an oval flange. Also, the pipe can directly be screwed into the transmitter. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 N·m (3 to 4 kgf·m).
- After connection, close the stop valve of transmitter in order to prevent foreign materials from entering the inside.

Position of process taps (horizontal main process piping)

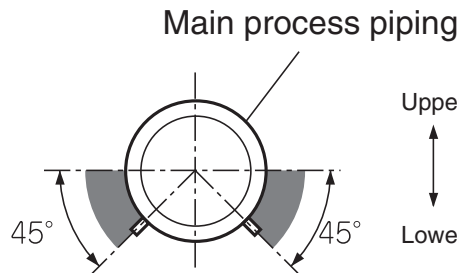
The position of the process tap is determined by the relationship between condition, characteristics and measurement point of process fluid. Note the following figures when planning and installing the piping.

Gas measurement



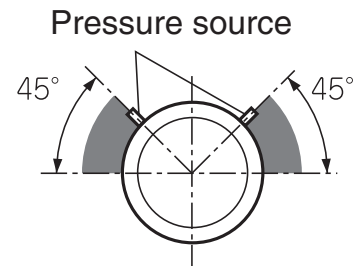
Pressure source is located upper side of main process piping

Liquid measurement



Pressure source is located lower side of main process piping

Steam measurement

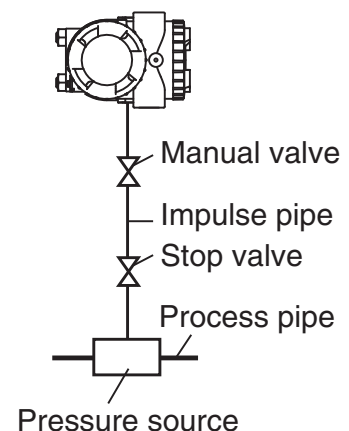


Pressure source is located upper side of main process piping

Typical examples of piping

1- Gas measurement

Place the transmitter above the pressure source.
If high temperature, use drain pot like for steam.

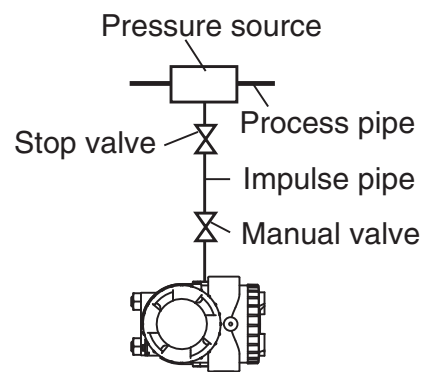


2- Liquide measurement

Place the transmitter above the pressure source.

The impulse pipes must be installed to not accumulate gas in the transmitter.

Connecting a tank gas may be useful.

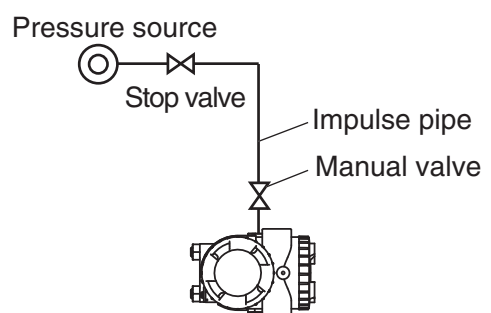


3- Steam measurement

A drain pot must be mounted between transmitter and pressure connect.

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 liquid, the impulse pipes should have an upward 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 downward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of moisture, etc. in the detecting unit.
- Avoid any sharp bends in impulse pipe which may cause gas or moisture to accumulate in the impulse pipe.
- Do not not apply an excessive force to the transmitter during its connection.
- Install condensed chambers and vent drain when impulse pipes can't 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 Heath.

• 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.

6.2.3 Piping of direct mount type absolute pressure and gauge pressure transmitters (FKH and FKP)

Removal of protective cap

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

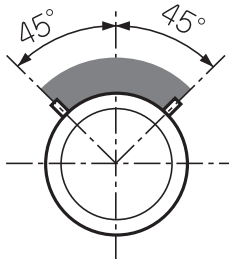
Connection of transmitter and impulse pipe

- Impulse pipe should be connected with an adapter. Also, the pipe can directly be screwed into the transmitter..
- After connection, close the stop valve of transmitter in order to prevent foreign materials from entering the inside.

Position of process taps (horizontal main process piping)

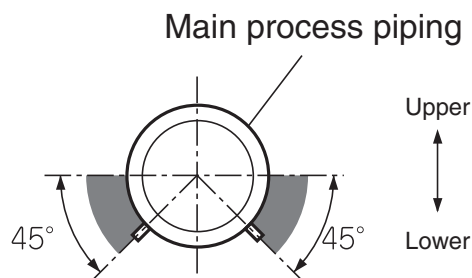
The position of the process tap is determined by the relationship between condition, characteristics and measurement point of process fluid. Note the following figures when planning and installing the piping.

Gas measurement



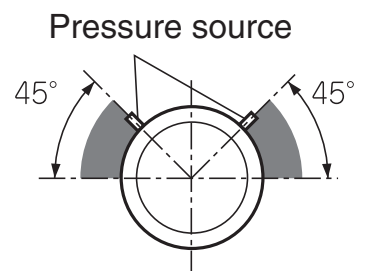
Pressure source is located upper side of main process piping

Liquid measurement



Pressure source is located lower side of main process piping

Steam measurement

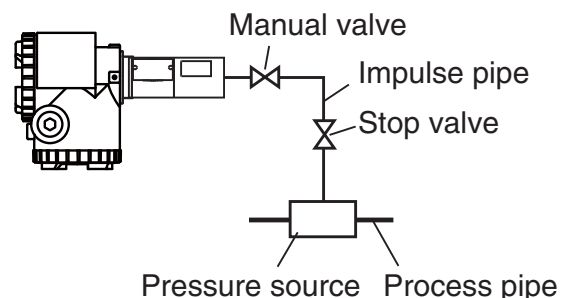


Pressure source is located upper side of main process piping

Typical examples of piping

(1) Gas measurement

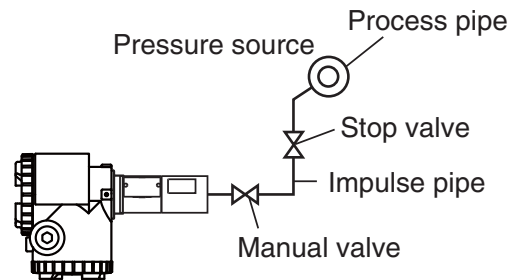
Place the transmitter above the pressure source.



(2) Liquid measurement

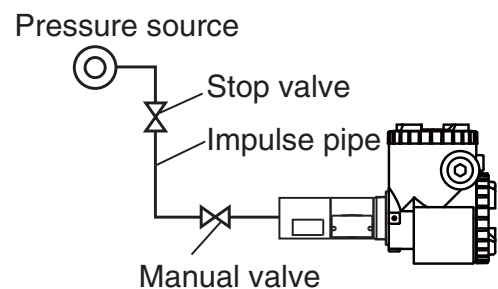
Place the transmitter below the pressure source.

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



(3) Steam measurement

Place the transmitter below the pressure source.



Cautions on impulse piping

- For liquid, the impulse pipes should have an upward 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 downward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of moisture, etc. in the detecting unit.
- Avoid any sharp bends in impulse pipe which may cause gas or moisture to accumulate in the impulse pipe.
- Do not not apply an excessive force to the transmitter during its connection.
- Install condensed chambers and vent drain when impulse pipes can't 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 Heath.

• 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.

6.2.4 Piping of level transmitter (type: FKE)

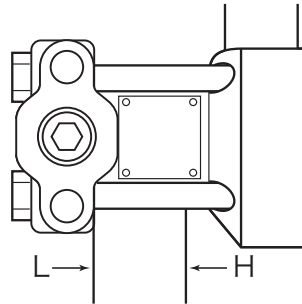
Check of high/low pressure sides of transmitter

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

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

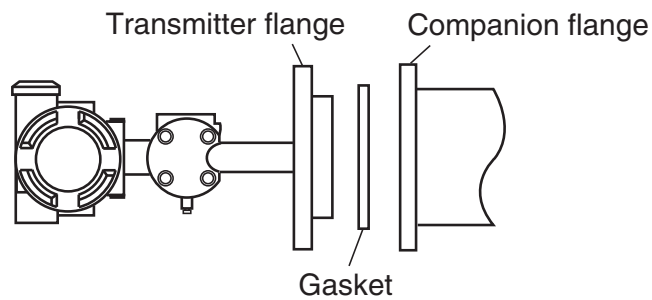
The low pressure side is equipped with a fitting process and a drain plug.

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

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"	Stainless steel : 73 special material : 89
DN100 / 3"	Stainless steel : 96 special material : 89

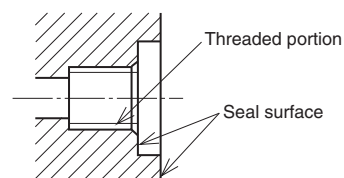
For others flanges, consult Klay Instruments.

Connecting method of the mounting flange

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

Removal of protective cap from process connection port

The process connection port on the low pressure side is fitted with a protective cap. Before piping, remove the cap carefully. When removing the cap, carefully protect the threaded portion and sealing face from damage.



Connection of transmitter and impulse pipe

- The pipe on the low pressure side can be connected with an oval flange. Also, the impulse pipe can directly be screwed into the transmitter. Tightening torque of 7/16-20UNF mounting bolt in an oval flange should be 30 to 40 N·m (3 to 4 kgf·m).
- After connection, close the stop valve of transmitter in order to prevent foreign materials from entering the inside.

Typical examples of piping

(1) Level measurement on open tank

Leave the low pressure side of transmitter open to atmosphere.

Level calculation formula:

$$\text{LRV: } \rho H_1$$

$$\text{URV: } \rho (H_1 + h)$$

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

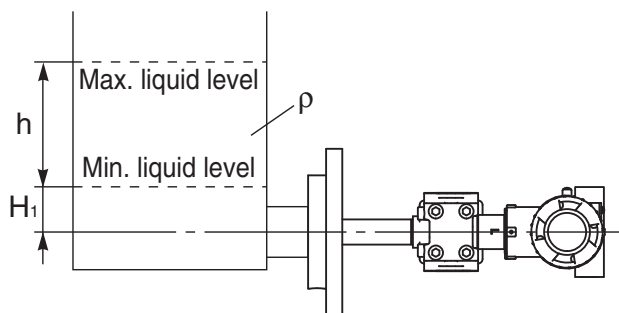
LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ : Measuring liquid density

H_1 : Liquid level

h : Liquid level change



(2) Level measurement on close tank

1- In case of wet leg

Connect the highest liquid level tapping of tank to the low pressure side of transmitter, and the lowest liquid level tapping of tank to the high pressure side (flange side) of transmitter.



Level calculation formula:

LRV: $\rho H_1 - \rho_0 H_2$

URV: $\rho (H_1 + h) - \rho_0 H_2$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

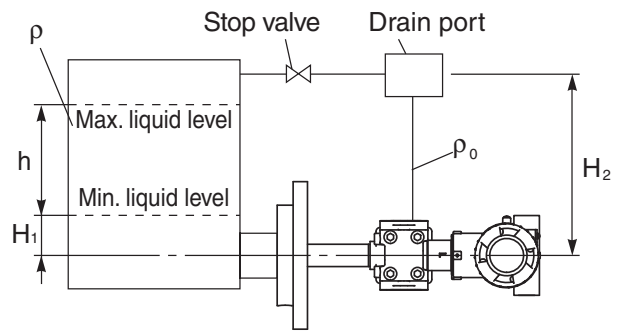
URV: High limit of measurement (100%)

ρ : Measuring liquid density

ρ_0 : Seal liquid density

H_1 : Liquid level

h : Liquid level change



2- In case of dry leg

Connect the highest liquid level tapping of tank to the low pressure side of transmitter, and the lowest liquid level tapping of tank to the high pressure side (flange side) of transmitter.

Level calculation formula

LRV: ρH_1

URV: $\rho (H_1 + h)$

Span (ΔP): ρh

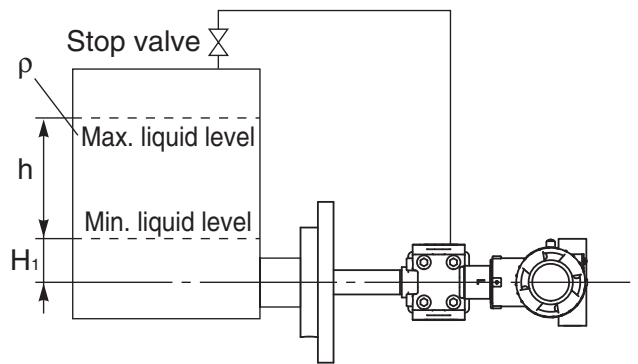
LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ : Measuring liquid density

H_1 : Liquid level

h : Liquid level change



Cautions on installation

- Restriction on H_1

Liquid level is not proportional to the transmitter output at some points inside the seal diaphragm.

Therefore, H_1 should be set higher than the value shown in the table below.

- 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.
- Do not shock the seal diaphragm by hitting hard object against it, for example.
- Do not apply an excessive force to the flange during connection.

• 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).

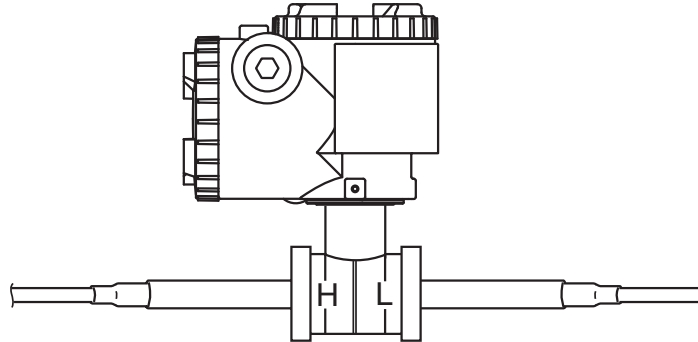
Even when the installations shut down the heat must be maintained, if not the transmitter and impulse pipes must be drained to prevent freezing.

6.2.5 Piping of remote seal(s) type transmitter (types: FKB, FKD and FKM)

(1) Piping of remote seal type differential pressure transmitter (type: FKD)

Check of high/low pressure sides of transmitter

The detecting unit of the remote seal type differential pressure transmitter bears symbols H and L which represent high and low pressure sides, respectively. Both high and low pressure sides employ flange connection.



Seal on mounting flange face

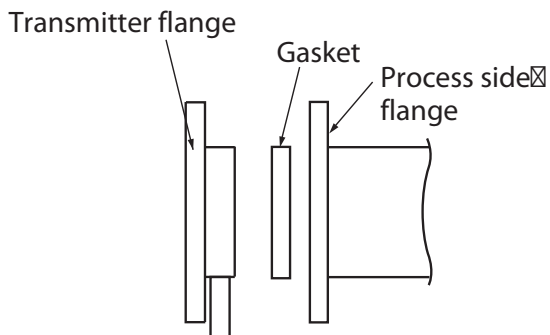
When mounting the flange on the high pressure side, a gasket should be inserted as follows. The seal must be chosen according type flange mounted on the transmitter. The internal diameter must be greater or equal the diaphragm seal to not press it and effect the measure.

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 / 3"	ISS : 96
	Special material : 89

For others flanges, consult Klay Instruments.



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

(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:

Zero: $\rho E + \rho' h'$

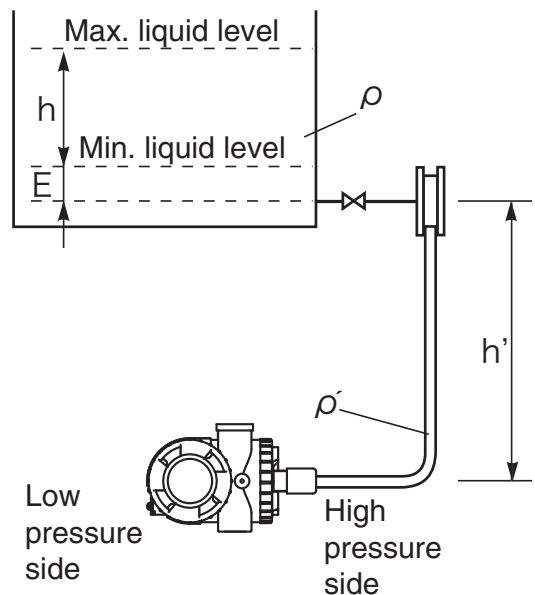
Span: $\rho(E + h) + \rho' h'$

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ : Measuring liquid density

ρ' : Seal liquid density



(2) Level measurement on closed tank

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:

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

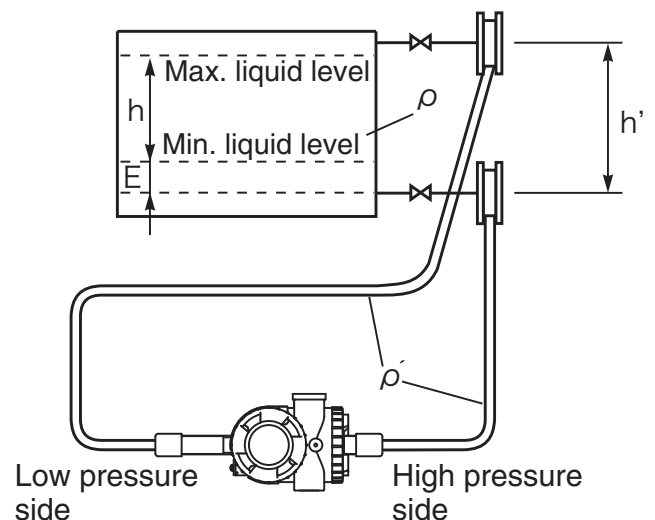
Span: $(-h' \cdot \rho') + \rho(E + h)$

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ : Measuring liquid density

ρ' : Seal liquid density



PRECAUTION

The transmitter body should be installed below any pressure receiving unit. This is mandatory where process pressure may become vacuum due to application.

Better accuracy for fill fluid density can be obtained from Klay Instruments.
 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

Caution when vacuum measurement



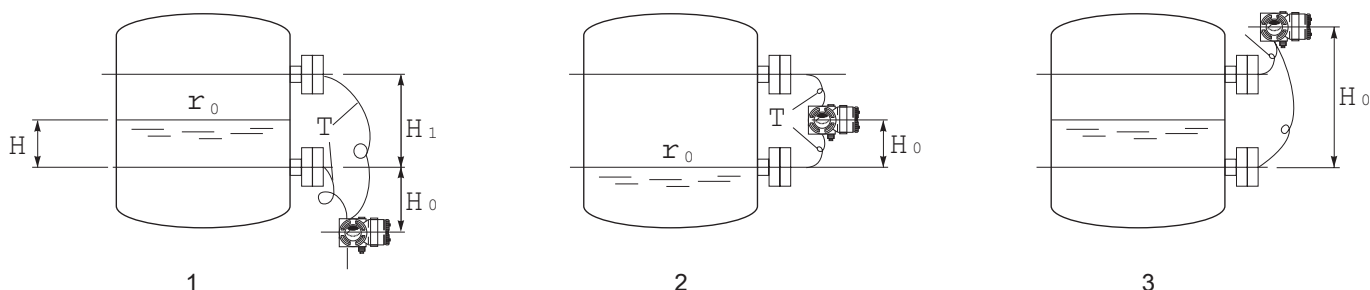
PRECAUTION

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 additional 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 Klay Instruments.



Caution on installation

- 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.
- For minimizing the influence by a difference in the ambient temperature, the capillaries on the high and low pressure sides should be laid together.
- Do not shock the seal diaphragm by hitting a hard object against it, for example.
- Water head pressure due to difference in the height of flange

When there is a difference (h') in flange mounting position between the high-pressure side and the low-pressure side, a water pressure head ($-\rho' \cdot h'$) is applied to the transmitter, so a zero point shift for the water head pressure ($-\rho' \cdot h'$) due to difference in height of flange is required at range setting as shown in the example of typical piping.

On the FCX-A2 V5 series transmitter, it is made by setting LRV, URV and ($-\rho' \cdot h'$) with HHC (for details, refer to Item 4 "Adjustment", 4.1 Adjustment with HHC and operation procedure, range change).

6.2.6 Piping of remote seal type absolute and gauge transmitter (FKB and FKM)

Seal on mounting flange face

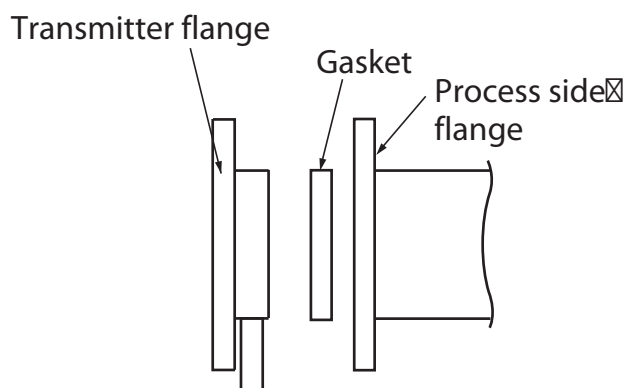
When mounting the flange on the high pressure side, a gasket should be inserted as follows. The seal must be chosen according type flange mounted on the transmitter. The internal diameter must be greater or equal the diaphragm seal to not press it and effect the measure.

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 / 3"	ISS : 96 Special material : 89

For others flanges, consult Klay Instruments.



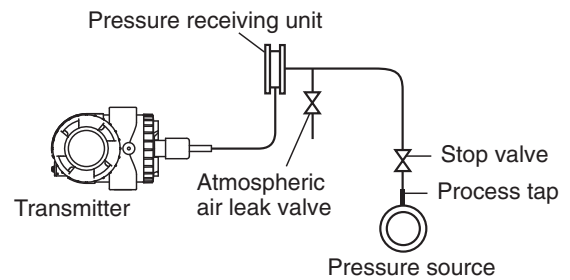
Connecting method of the mounting flange

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

Typical examples of piping

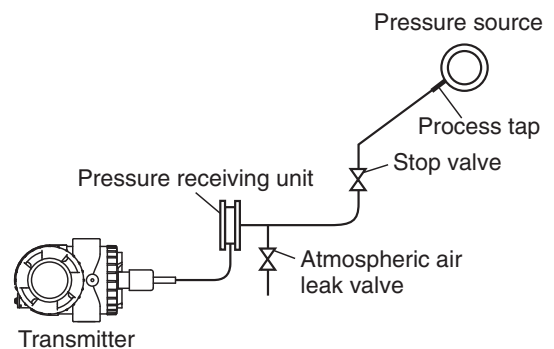
(1) Gas measurement

Locate the process tap above the pressure source



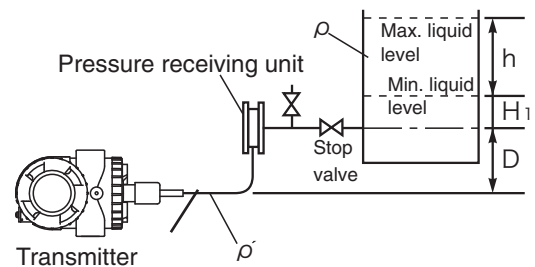
(2) liquid measurement

Locate the process tap below the pressure source



(3) 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.



PRECAUTION

It's recommended 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.

**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**

- 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 V DC or 40 V AC (exceeding 33 V DC or 23 V AC 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.

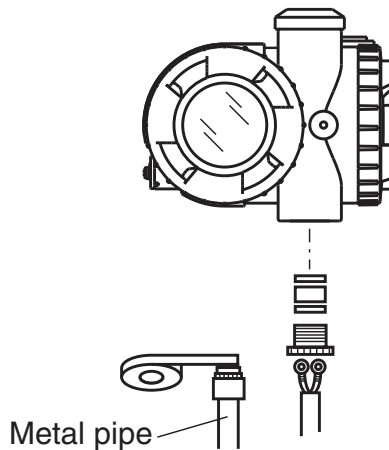
7.1 Wiring procedure:

Sealing of conduit connection

Use sealing tape, if using metal pipe screw coupling or rubber gasket and fastening gland in the case of cable to ensure airtightness of the connection box.

! INDICATION

1. If the connection box is located above the transmitter when using a protective tube for the wiring, then moisture may enter the protective tube and have an adverse effect on the transmitter. So maintaining airtightness of the connection box is an important practice.
2. The thread of conduit tube should meet the selected size and a seal fixture should be used.

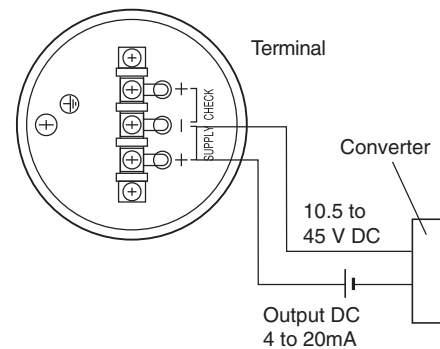
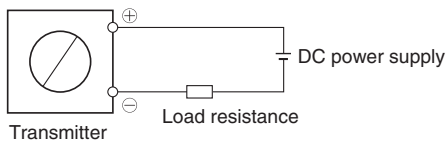


Terminal connection diagram

Tighten the terminal screws (M4 x 10) to a torque of approximately 1.5 Nm (15 kgf·cm) <11ft·lb> so that the wires will not loosen.

After connection, fasten the cover until it does not turn.

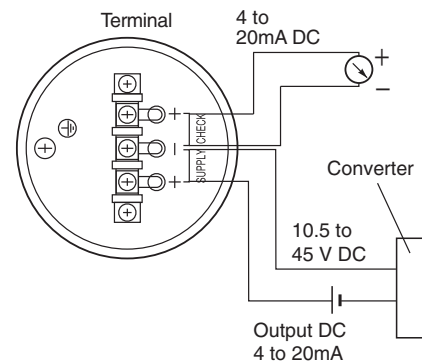
Wiring diagram



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.



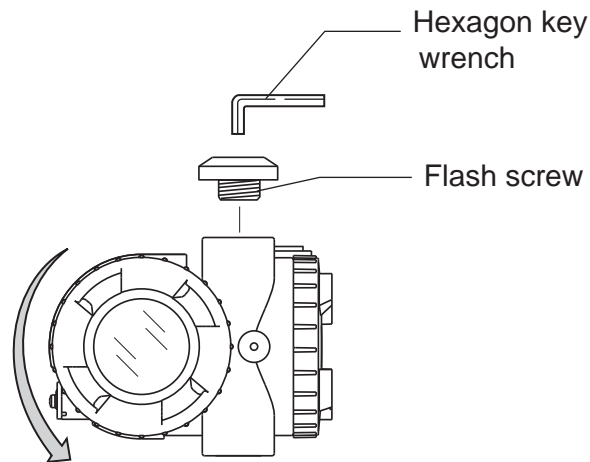
! INDICATION

The polarity of the power supply must be respected

Things convenient to know before wiring

Two conduit connection are available and one is closed. For wiring from the top conduit, use the following procedure:

- (1) Remove the screw plug of the top conduit connection.
- (2) Screw the removed screw plug into the bottom conduit connection.
- (3) Insert the cable from the top and connect it.

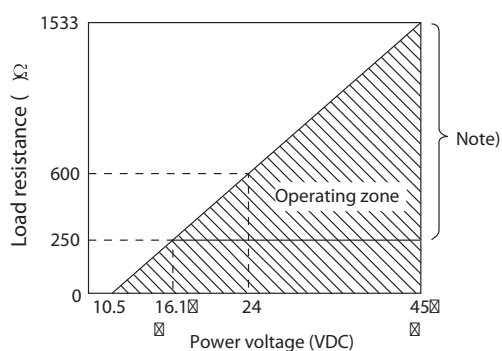


DANGER

- The unused conduit connection is of great importance to flame proofing and moisture prevention. So be sure to tighten the flush screw and packing into the connection.
- When performing an insulation check after wiring, use a Megger (insulation resistance meter) of 250 V DC or less and avoid applying a high voltage. If an arrester is equipped, avoid the insulation resistance test and the dielectric strength measurement.

7.2 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 Hand Held Communicator (HHC) mini of 250Ω is required

7.3 Grounding

The transmitter must be grounded as below:

1- Standard location use

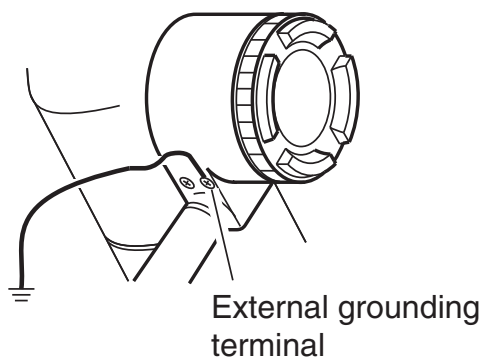
Grounding terminals are provided at two places (at the inside of terminal box and on the side of conduit connection).

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).

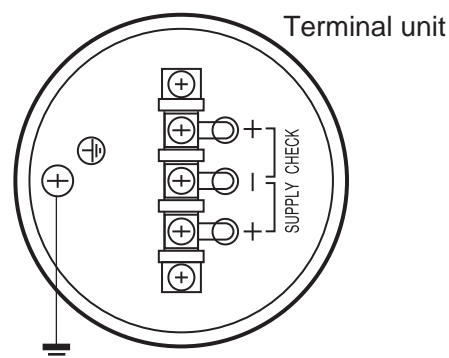
2- Hazardous location use

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

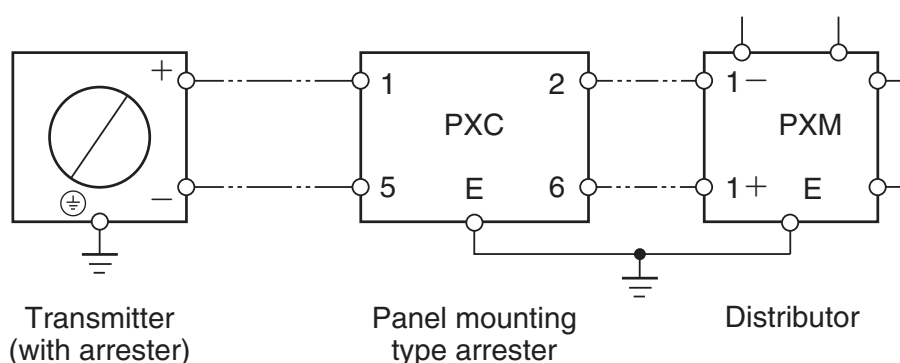


An arrester is used to protect a transmitter or receiver from an abnormal voltage such as lightning surges induced into signal lines. A built-in type arrester is mounted behind the terminal unit.

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

Installation

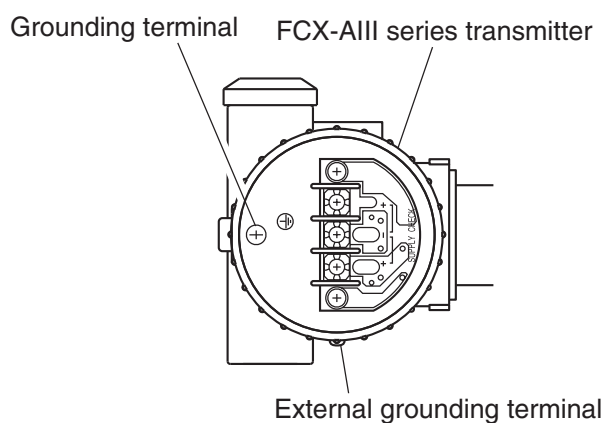
If surges are likely to appear on the loop 4 - 20 mA, for example because of lightning, it is advisable to install a built-in arrester should be used in combination with panel mounting type arrester (type PXC) for distributor protection



Grounding

Since transmitter and arrester groundings are internally connected together, user have only to connect the external grounding terminals to ground.

Grounding terminal must be used, in case of the explosion proof or intrinsic safety type transmitter.



! INDICATION

Grounding resistor should be 100Ω.
 Avoid common grounding with a lightning rod.
 In case of a transmitter with arrester, maximum power supply is 32 V DC.

Maintenance

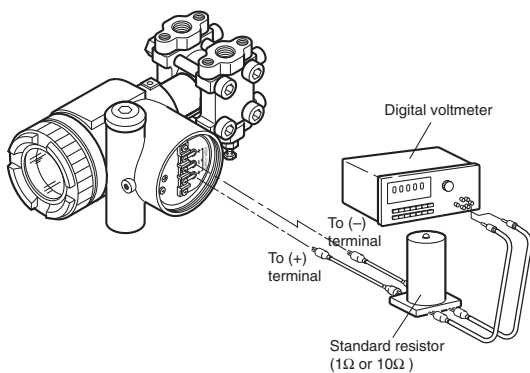
Check of arrester :

- Measure output current from the transmitter check terminals and output current to flow into transmitter (see figure below).
When current is measured with an ammeter connected to CK+ and CK– terminals, the internal resistance of the ammeter should be 12Ω or less.
- If the measured two output current are the same, the arrester is normal.
- In case the measured values have a difference of 0.1% (0.016mA) or more, the arrester is not functioning.
- In the above case, the arrester unit (terminal unit) should be replaced with a new one.

Limitation of insulation resistance and dielectric strength test

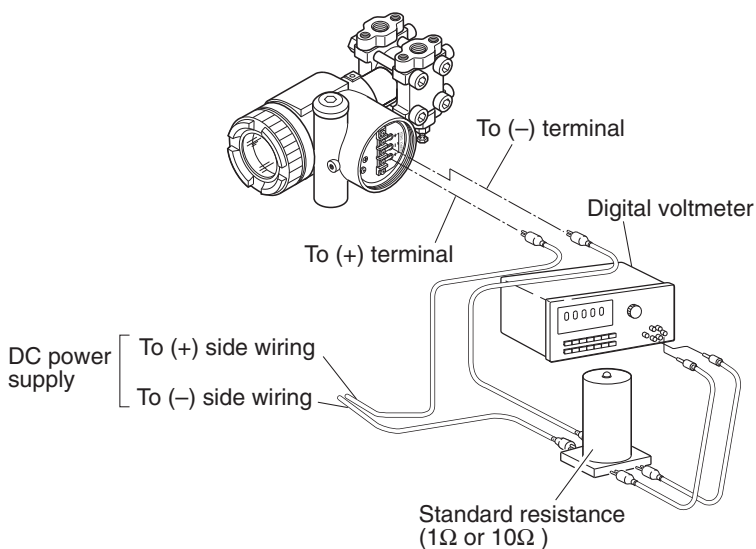
An insulation resistance and dielectric strength test should be avoided as a rule, since it may damage the arrester.

Output measurement at check terminals



Output measurement outside transmitter

- * Disconnect the wire from the – (minus) terminal and connect the measurement device as shown below.



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.
- Power supply: DC power supply (24 V DC) or Klay Instruments FC series power supply unit
- Load resistor: Standard resistor 250 W (within $\pm 0.0125 \Omega$)
- Measuring device: Digital voltmeter (capable of measuring transmitter output with an accuracy better than 0.1%)
 - * Use meter having a 5-digit display.
- Hand Held Communicator (HHC) type FXW

Measurable range

Differential pressure range

FKC...5 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)
500~20000 (5000~200000)

Pressure range

FKG...5 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...5 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)
100~10000 (1~100)

Differential pressure range with remote seals

FKD...F model kPa (mbar)
0,32~32 (3,2~320)
1,3~130 (13~1300)
5~500 (50~5000)
30~3000 (300~30000)
200~20000 (2000~200000)

Pressure range with remote seal

FKB...F 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 pressure range with remote seal

FKM...F model kPa abs (bar abs)
1,6~16 (0,016~0,16)
1,3~130 (0,013~1,3)
5~500 (0,05~5)
30~3000 (0,3~30)
100~10000 (1~100)

Level pressure range

FKE...F model kPa (mbar)
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 with direct mounting

FKP...F model kPa (mbar)
8,125~130 (81,25~1300)
31,25~500 (312,5~5000)
187,5~3000 (1875~30000)
625~10000 (6250~100000)

Pressure range with direct mounting

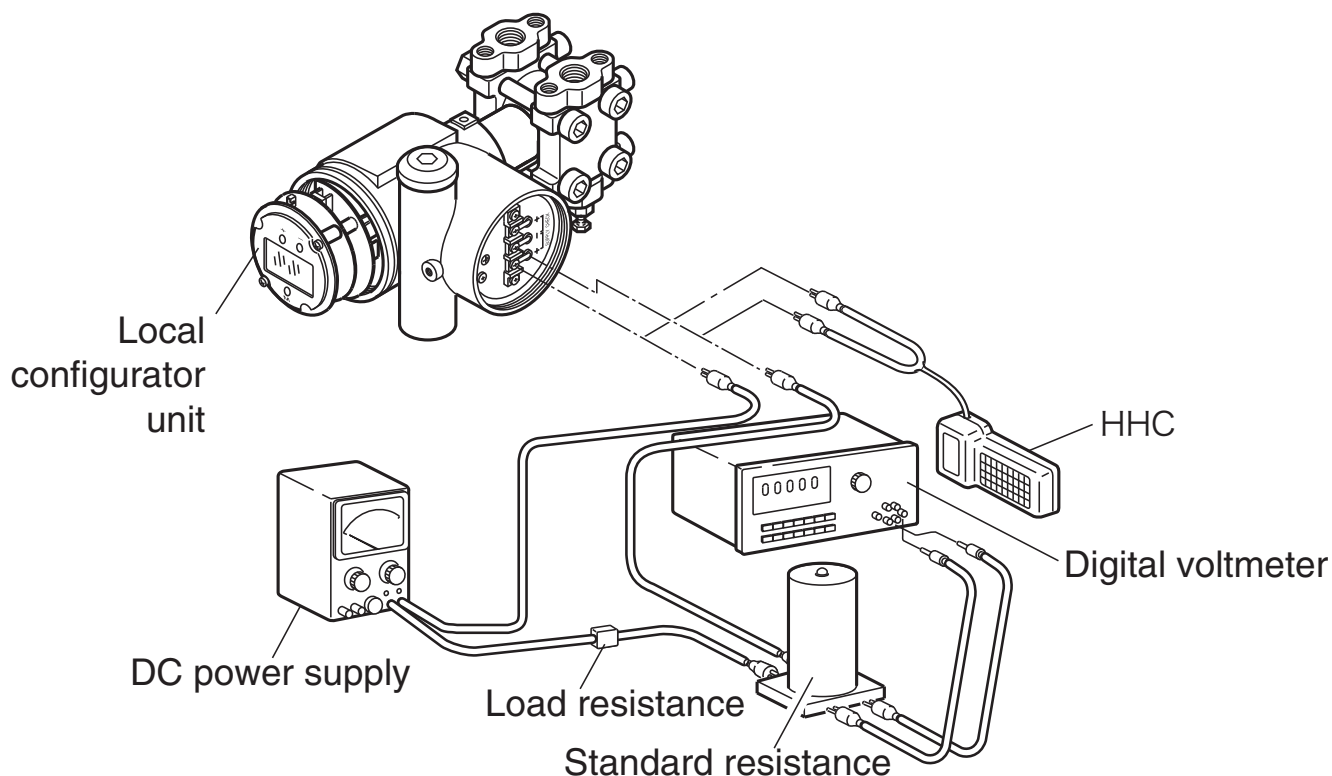
FKH model kPa (mbar)
8,125~130 (81,25~1300)
31,25~500 (312,5~5000)
187,5~3000 (1875~30000)

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

For communicate correctly with the hand held communicator (HHC), a load resistor of 250Ω mini is required.

(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.

Local configurator with LCD display : Calibrate with reference to "Output circuit calibration" in "Adjustment" in Chapter 4.

HHC: Calibrate with reference to "Calibration of output circuit"

(3) Zero/span adjustment::

Local configurator with LCD display : Calibrate with reference to "Zero/span calibration" in "Adjustment" in Chapter 4.

HHC: Calibrate with reference to "Zero/span adjustment"

(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 resistor 250Ω + digital voltmeter (measuring device).

Measurement category	Reference value	Accuracy (according type)	
		Accuracy : 0,065%	Accuracy : 0,2%
Percent display %	0, 25, 50, 75, 100	±0,065	±0,2
Current measurement (mA)	4, 8, 12, 16, 20	±0,0112	±0,032
Voltage measurement (V) on load resistor of 250 Ω	1, 2, 3, 4, 5	±0,0028	±0,008

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 HHC.

N°	Item	contents of parameter
1	Damping value (time constant)	0,06sec
2	External adjustment function of the transmitter	Adjustable (ENABLE)
3	Current output mode	Linear (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	Hold (note 3)
7	Polygonal line correction	Not corrected (INVALID)
8	Saturation current	Normal specification (NORMAL)
9	Protective function of set value (write protect)	Canceled (OFF)

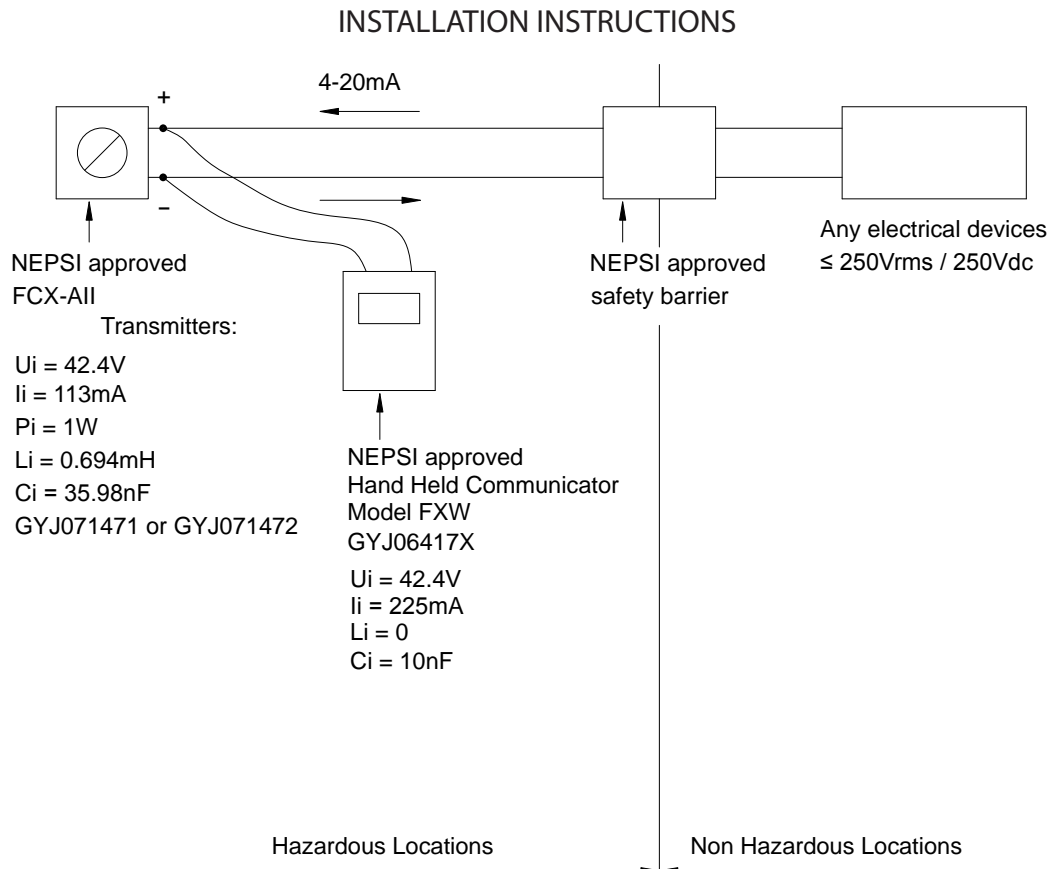
Note 1) Use the HHC or the local configurator unit with LCD display to change the setting of all the items except "7: Polygonal line correction," which can be changed only by the HHC.

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

Note 3) "Hold" is selected for "Burnout" unless otherwise specified by the order.

This appendix contains documents that present installation instruction for the FCX-AII V5 Serie Transmitters in a hazardous location, refer to instructions manual (HD FCX AII 102) Refer to the figures or the instruction manual when installing or servicing a transmitter mounted in a hazardous location.

When installed, the apparatus must be provided with a voltage limiting device which will prevent the rated voltage of 45V being exceeded.



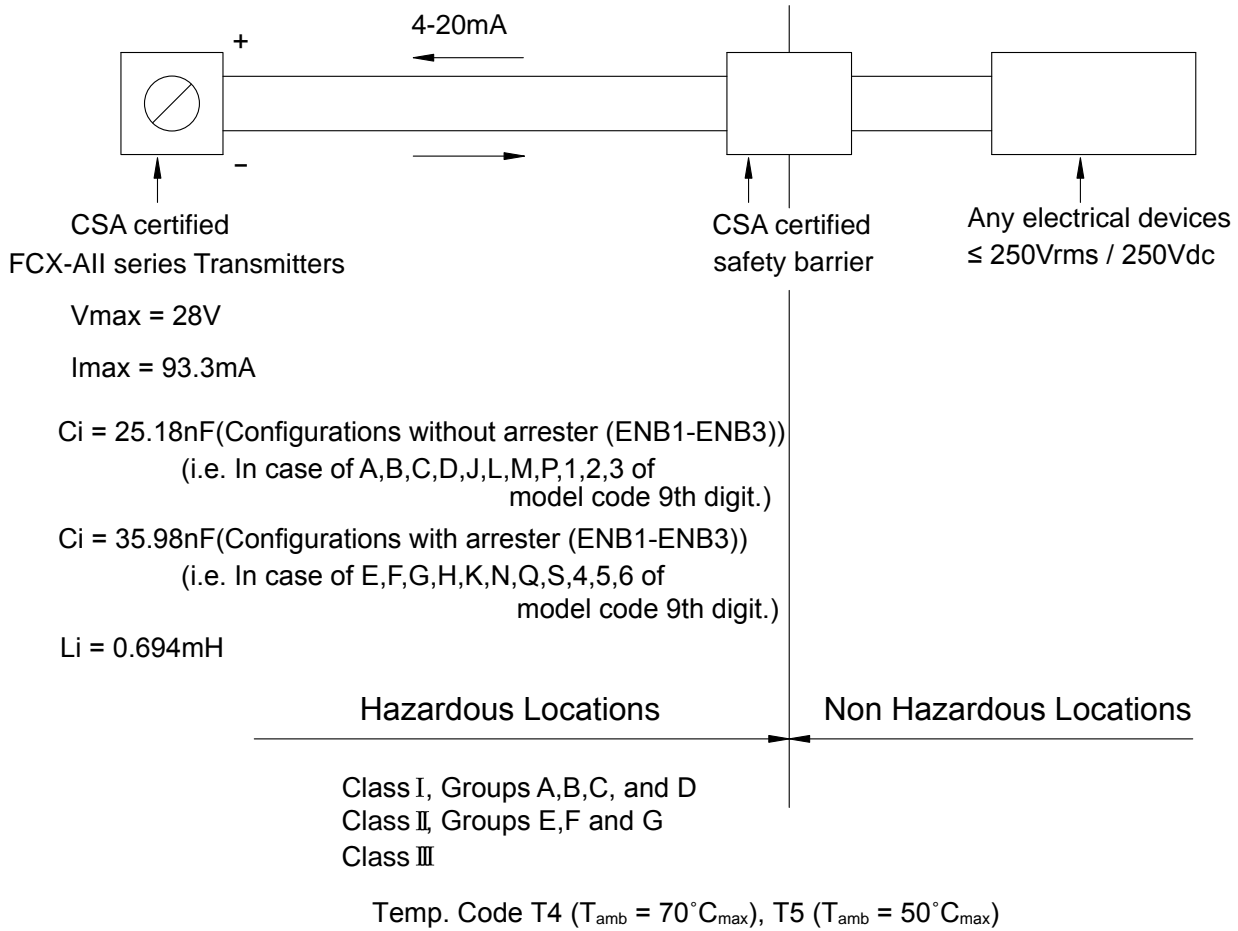
Note:

- 1) The Intrinsic Safety Entity concept allows the interconnection of NEPSI Approved Intrinsically safe devices with entity parameters not specifically examined in combination as a system when:
 $U_o \leq U_i$ $I_o \leq I_i$ $P_o \leq P_i$ $C_o \geq C_i + C_c$ $L_o \geq L_i + L_c$
- 2) The Hand Held Communicator, Model FXW may be connected at any point between the transmitter and the safety barrier, Provided the hand held communicator is a NEPSI Approved model.
- 3) Control equipment connected to the Associated Apparatus must not use or generate more than 250Vrms or Vdc.
- 4) The configuration of associated Apparatus must be NEPSI Approved under Entity Concept.
- 5) Hand Held Communicator and Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
- 6) No revision to drawing without prior NEPSI Approval.

Contents on this page are based on TC522834

Figure 1. FCX-AII V5 Series transmitter, Intrinsically Safe Installation for NEPSI

INSTALLATION INSTRUCTIONS
(FCX-All V5 series Transmitter Intrinsically Safe, Entity for Hazardous Location)



Note:

- 1) Barriers must be installed in accordance with manufacturer's instructions.
- 2) Barrier parameters must meet the following requirements:
 - $V_{oc} \leq V_{max}$
 - $I_{sc} \leq I_{max}$
 - $C_a \geq C_i + C_{cable}$
 - $L_a \geq L_i + L_{cable}$
- 3) Maximum non-hazardous area voltage must not exceed 250Vrms.
- 4) Installation must be performed in accordance with Canadian Electrical Code, Part I.

Contents on this page are based on TC522873 rev. a

Figure 2. FCX-All V5 Series transmitter, Intrinsically Safe Installation for CSA

1. HART[®] communication function

1.1 HART[®] communication

The FCX-All V5 smart type transmitters are used for communication with Klay Instruments HHC (Handheld Communicator) or HART[®] ¹⁾ master device such as HART[®] communicator. For details, refer to the instruction manual for HART[®] master device.

Note1) HART[®] (Highway Addressable Remote Transducer) is a trademark of Rosemount Inc.

1.2 HART[®] Universal Handheld communicator

The HART[®] universal handheld communicator (hereinafter referred to as HART[®]) is a communicator capable of using for communication with various type of HART[®] field devices. A user in possession of HART[®] master device is ready for communication with the FCX-All V5 transmitters. For details, refer to the instruction manual for HART[®] communicator.

1.3 DD (Device Description)

Device Description (DD) is a program to pick up features of a field device having HART[®] communication functions. By saving DD in the memory of HART[®] communicator, the functions of each field device can be used for communication.

Even when FCX-All series / FCX-All V5 series DD is not saved in the memory of HART[®] communicator, it can be used in Generic mode ²⁾.

For details, refer to the instruction manual for HART[®] communicator.

Note2)

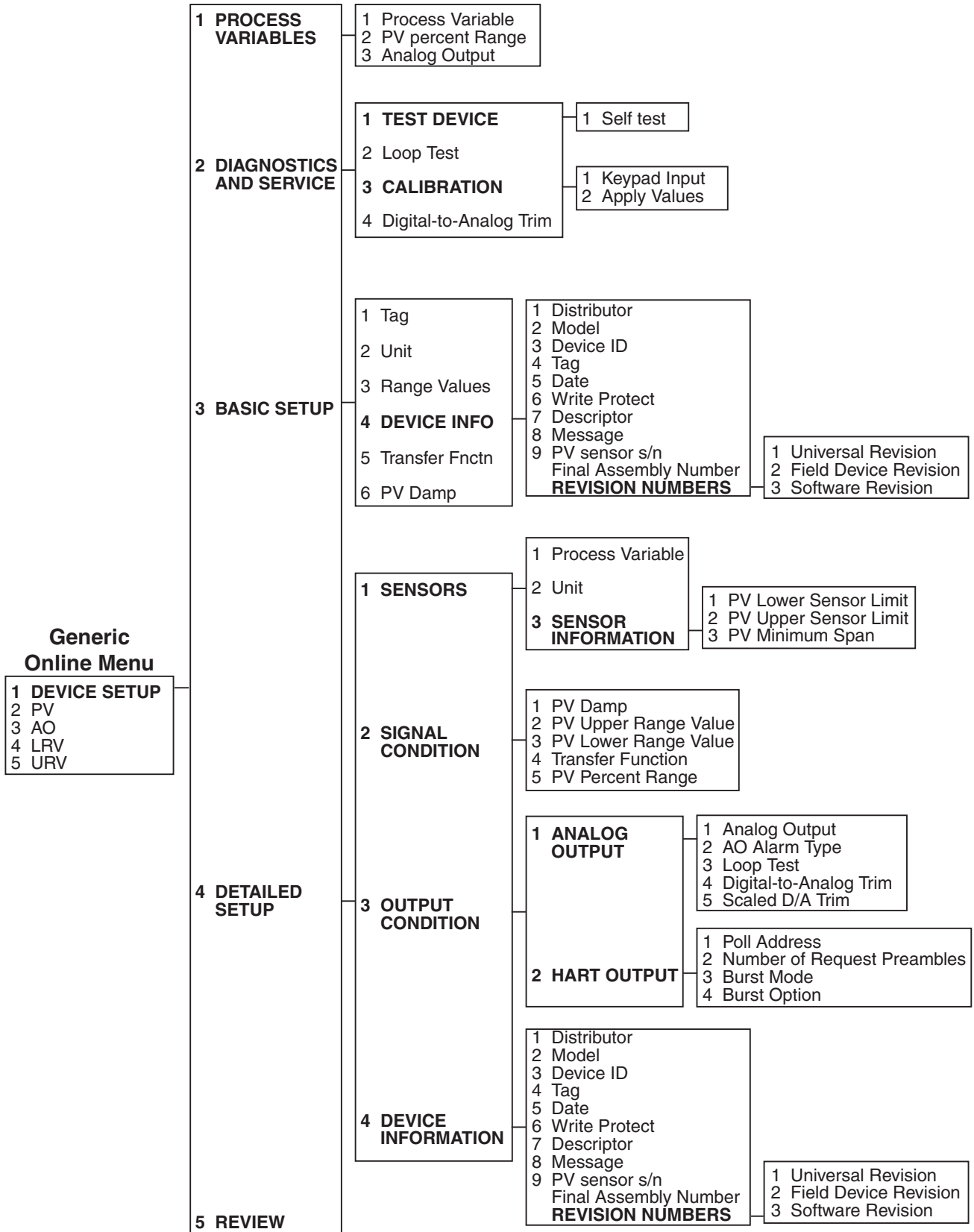
The Generic mode is used to start communication when a field device DD is not installed in HART[®] communicator. In this mode, functions which can be used are limited to general-use functions.

3. Function and operation (example)

3.1 HART® Communicator Menu Tree

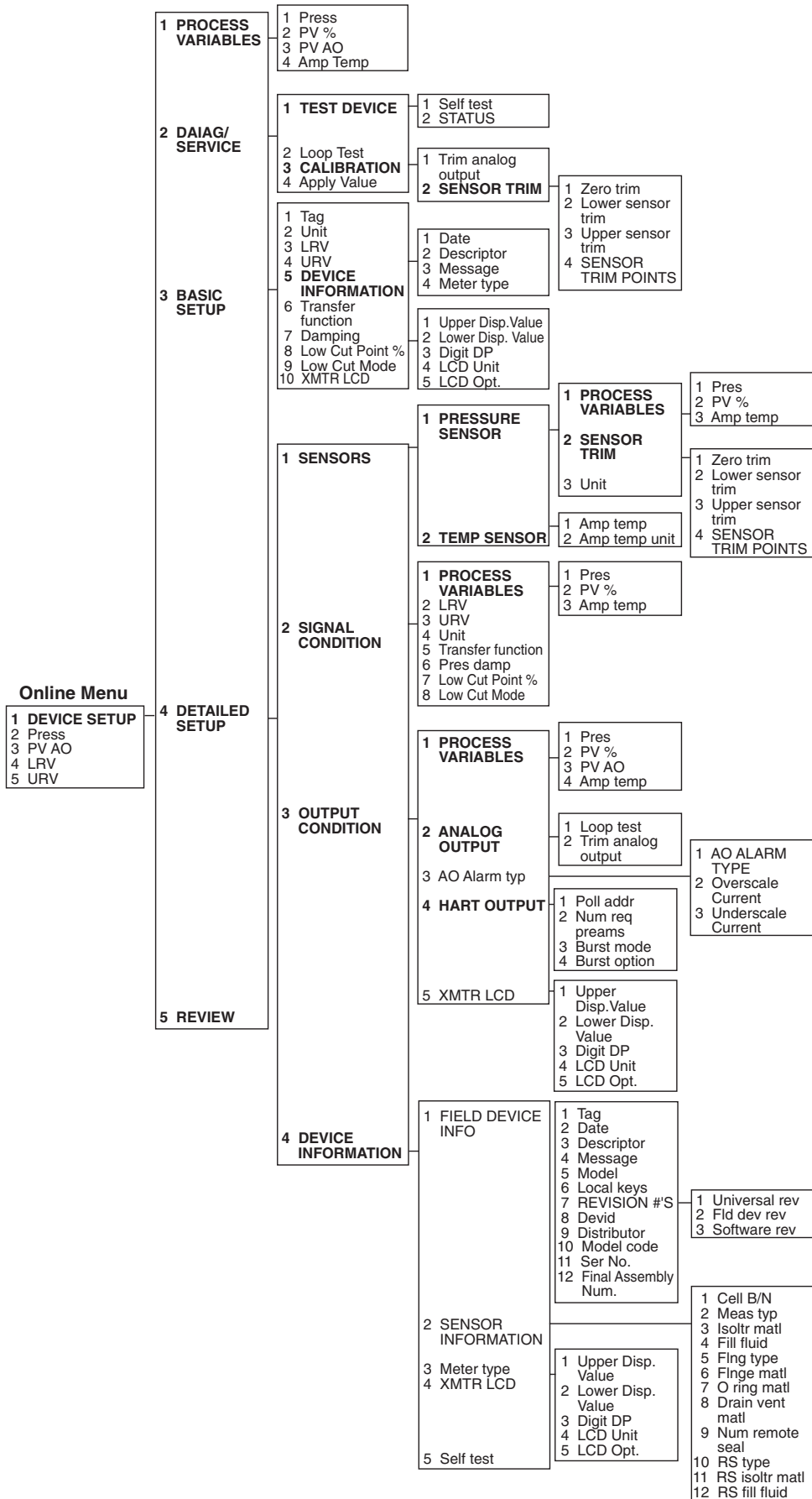
3.1.1 Menu Tree 1 - Generic -

Example on HC-375 Handheld communicator



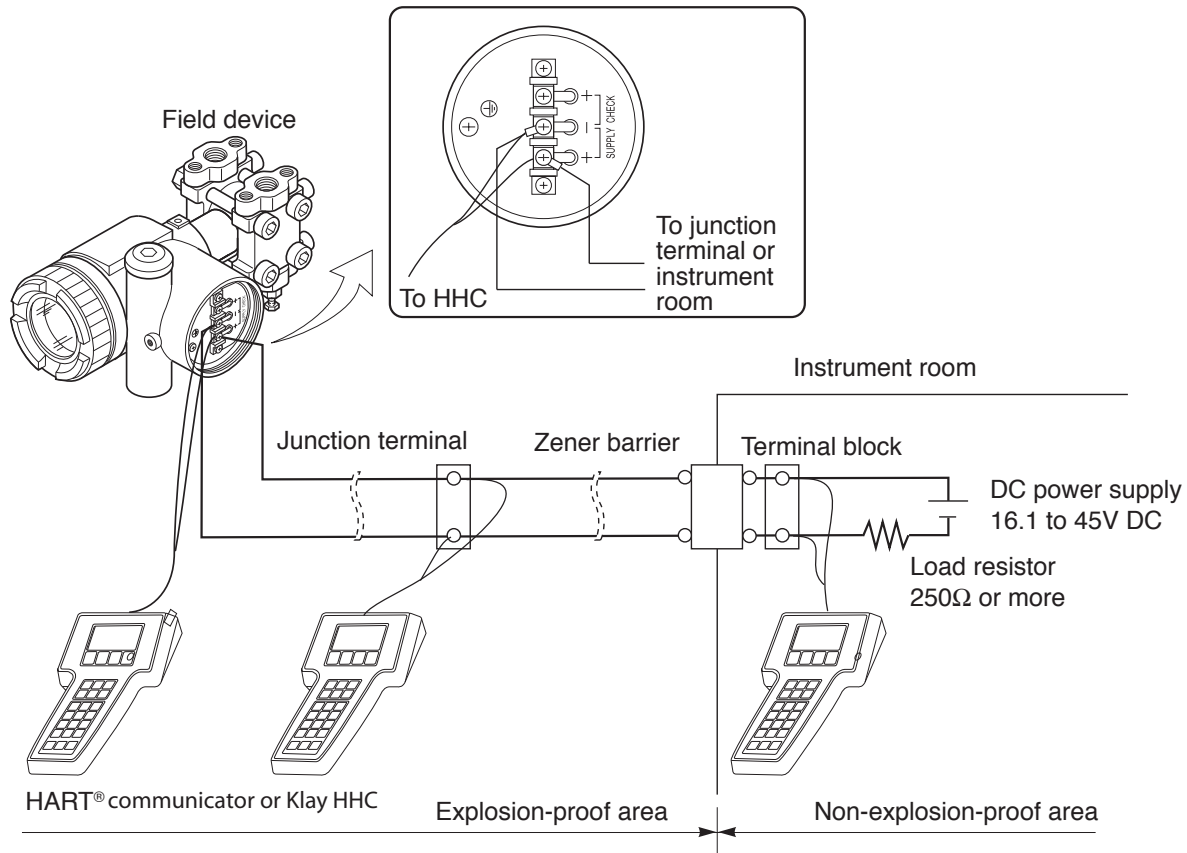
3.1.2 Menu Tree 2 - Use of DD for FCX-All series transmitters -

Example on Rosemount HC-275 Handheld communicator



2. Connection

Connection of HC-375 hand held communicator (example)



PRECAUTION

Klay HHC and HART[®] communicator can not be used at the same time.
Be sure to connect individually.

When using Klay HHC and HART[®] communicator alternately, turn OFF the power for communicator after changing from one to another, then restart the communication. At this time, old data may be left in the communicator.

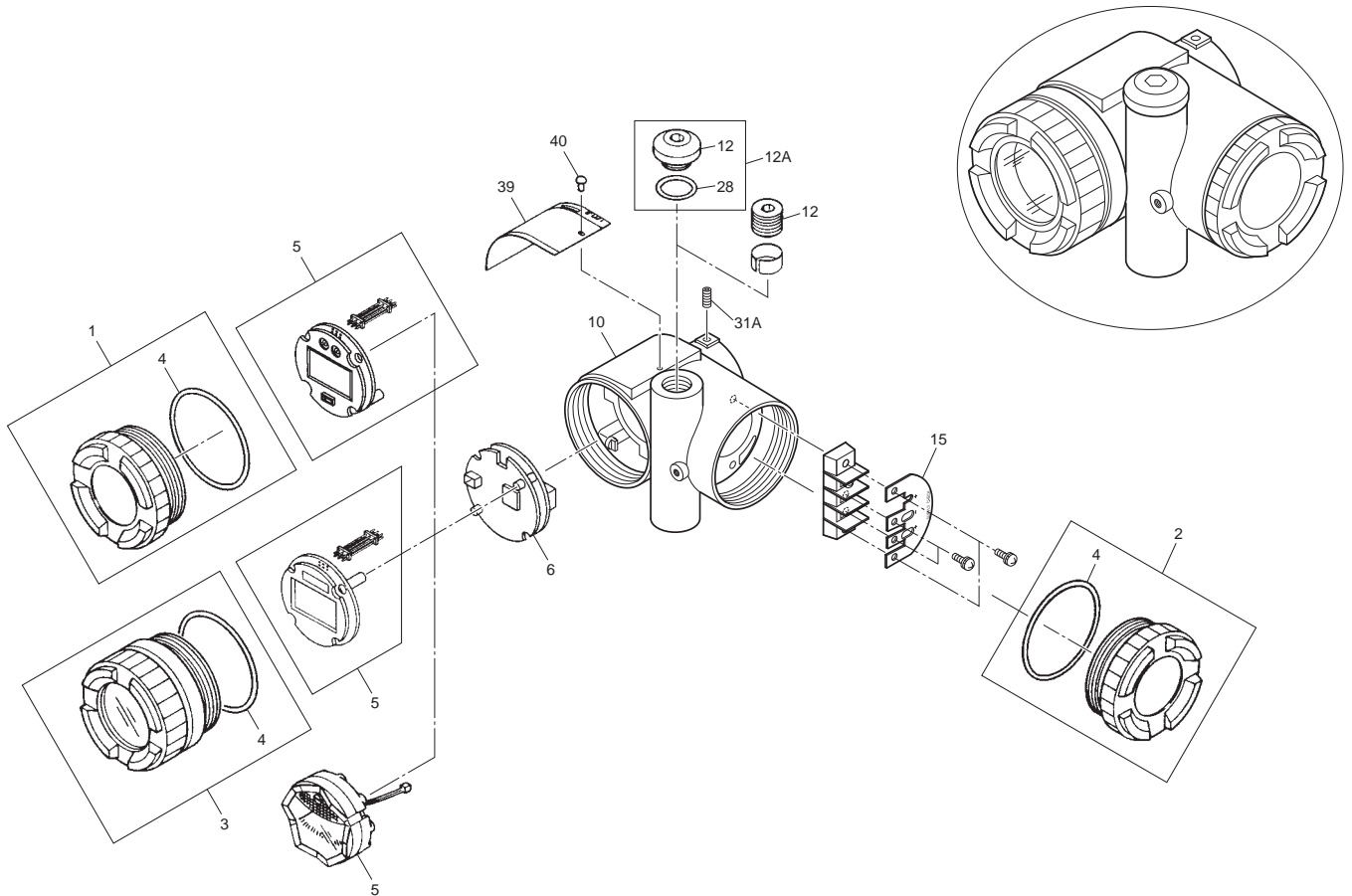


DANGER

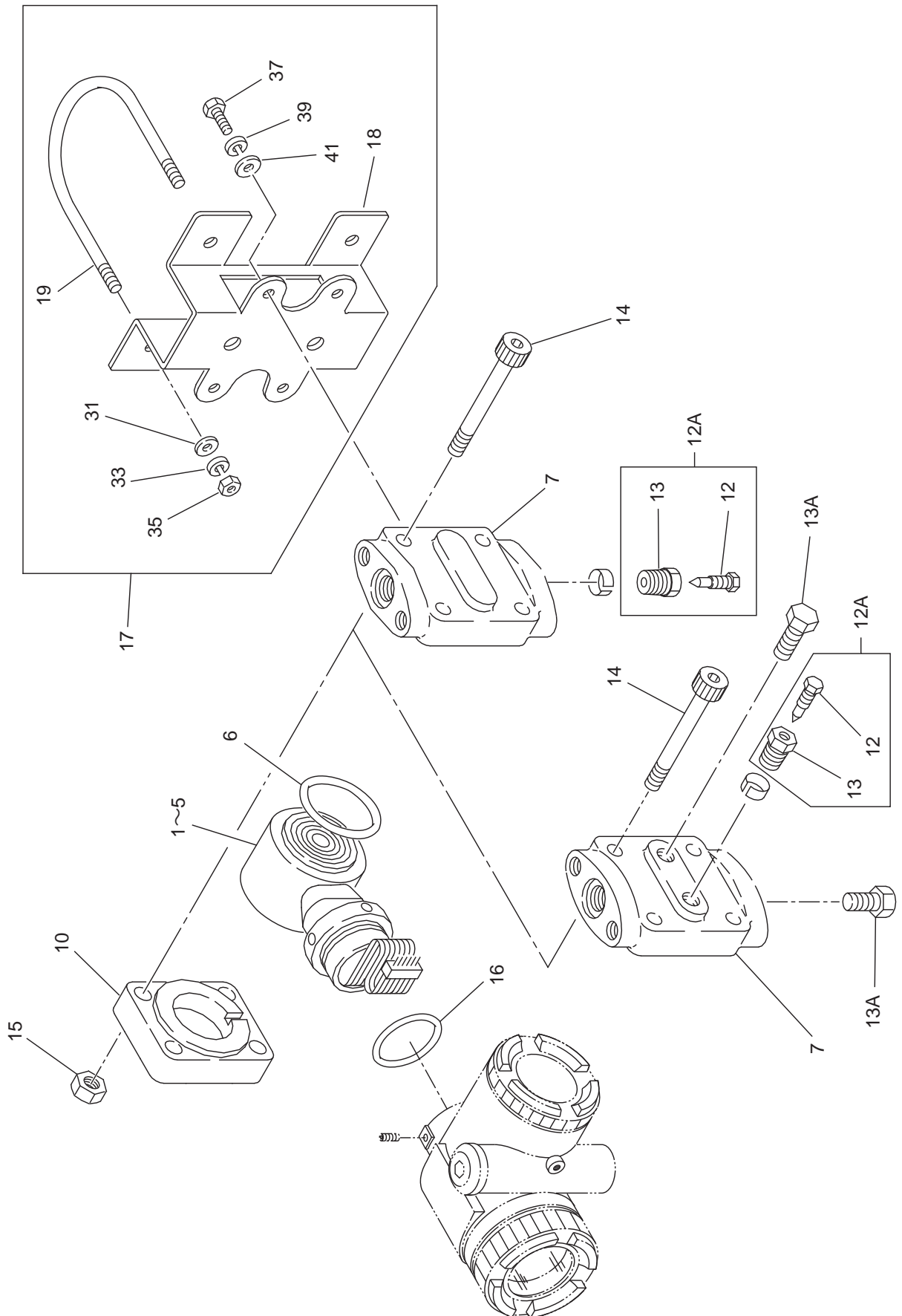
When using flame-proof transmitter, do not connect HHC to the transmitter terminal and junction terminal in an explosion-proof area.

For more details about these parts contact our office

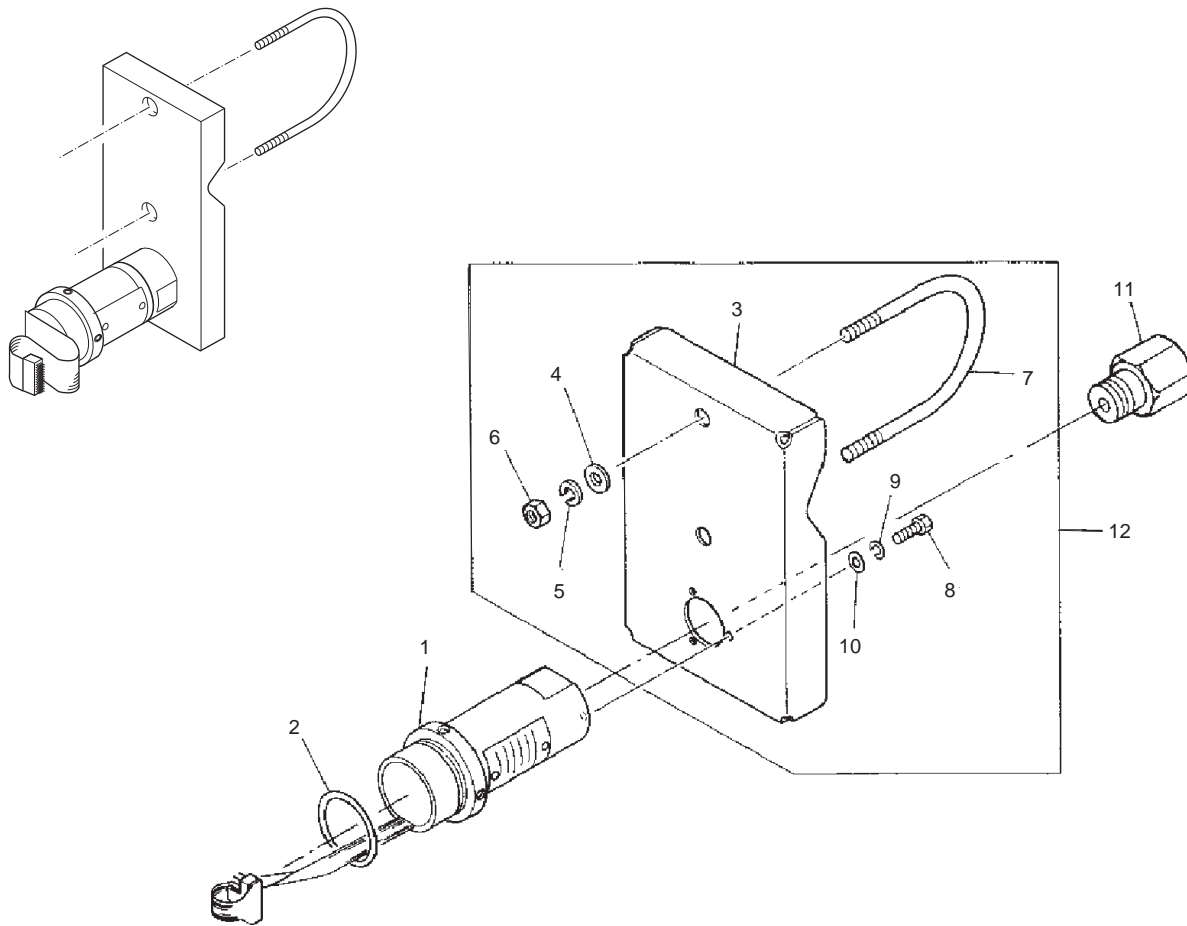
BLOCK A Amplifier assembly



BLOCK C & D : FKG & FKA Pressure and Gauge transmitter detector ass'y



BLOCK P : FKP & FKH Gauge and Absolute pressure transmitter detector ass'y ... direct mount type





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