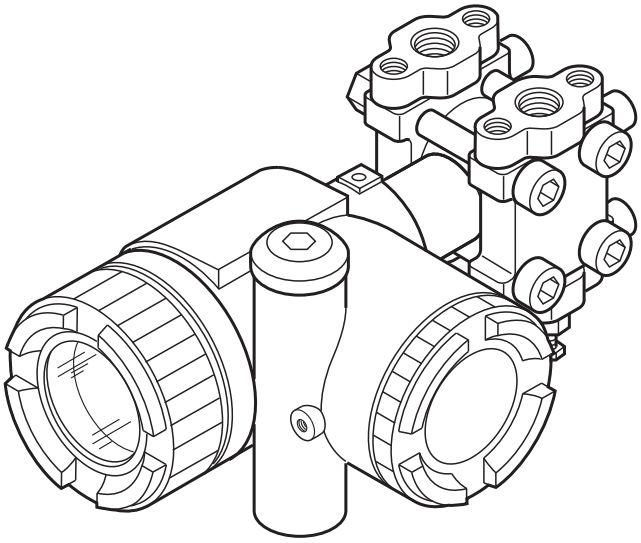
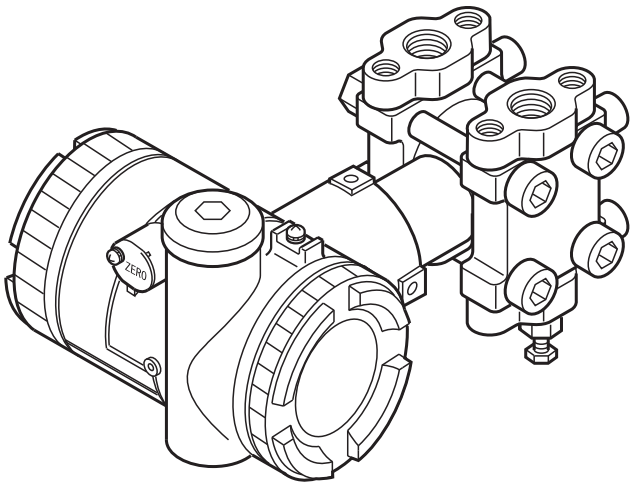
Instruction Manual

FCX-AIII SERIES TRANSMITTERS

TYPE:

FKA	**FKP**
FKB	**FKH**
FKC	
FKD	
FKE	
FKG	





Fuji Electric Co., Ltd.

INF-TN5FCXA34a-E

INTRODUCTION

Thank you very much for your purchase of the Fuji FCX-AIII Series Transmitter.

- First read this instruction manual carefully until an adequate understanding is required, and then proceed to installation, operation and maintenance of the FCX-AIII 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. Fuji 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 furnished separately.

The product conforms to the requirements of "the Electromagnetic compatibility Directive 2004/108/EC" and "Equipment and protective systems intended for use in potentially explosive atmospheres Directive 94/9/EC". For detail, refer to EMC CONFORMITY on the next page. The applicable standards used to demonstrate compliance are :

EN 61326 -1: 2006 Class A

EN 61326 -1: 2006 Table 2

Manufacturer:	Fuji Electric France S.A.S. Fuji Electric Co.,Ltd.
Type:	Described in nameplate on main frame (see Page v)
Date of manufacture:	Described in nameplate on main frame
Product nationality:	France, Japan

Request

- Transcription of a part or the whole of this manual without permission is prohibited.
- The contents of this manual are subject to change without prior notice.

Issued in NOV, 2014
Revised (Rev. a) in APR, 2015

Product Warranty and Maintenance

1. Scope of application

To use this product, the following conditions must be met:

- the use of the product incurs no risk of a serious accident even if a failure or malfunction occurs on the product, and
- in case of product failure or malfunction, safety measures such as redundant design, prevention of malfunction, fail safe system, and foolproof mechanism are provided outside of the product.

Be sure to use this product under the conditions or environment mentioned in this instruction manual. Please consult us for specifications for the following applications:

Nuclear power plants, radiation-related facilities, aerospace/aircraft facilities, or other usages which may have large impact on lives, bodies, property, or other rights or interests.

2. Operating conditions and environment

For the operating conditions and environment, refer to "A4. HAZARDUS LOCATION INSTALLATION INFORMATION".

3. Precautions and prohibitions

Refer to "Caution on safety".

4. Warranty

4.1 Period of warranty

(1) Warranty period for this product including accessories is one year after delivery.
(2) Warranty period for the parts repaired by our service providers is six months after the completion of repair.

4.2 Scope of warranty

(1) If any failure or malfunction attributable to Fuji Electric occurs in the period of warranty, we shall provide the product after repairing or replacing the faulty part for free of charge at the place of purchase or delivery. The warranty does not apply to failure or malfunctions resulting from:
   a) inappropriate conditions, environment, handling or usage that is not instructed in a catalog, instruction book or user's manual, or overuse of the product,
   b) other devices not manufactured by Fuji Electric,
   c) improper use, or an alteration or repair that is not performed by Fuji Electric,
   d) damages incurred during transportation or fall after purchase,
   e) any reason that Fuji Electric is not responsible for, including a disaster or natural disaster such as earthquake, thunder, storm and flood damage, or inevitable accidents such as abnormal voltage.
(2) Regardless of the time period of the occurrence, Fuji Electric is not liable for the damage caused by the factors Fuji Electric is not responsible for, opportunity loss of the purchaser caused by malfunction of Fuji Electric product, passive damages, damage caused due to special situations regardless of whether it was foreseeable or not, and secondary damage, accident compensation, damage to products that were not manufactured by Fuji Electric, and compensation towards other operations.

5. Failure diagnosis

Regardless of the time period of the occurrence, if any failure occurs, the purchaser shall perform a primary failure diagnosis. However, at the purchaser's request, Fuji Electric or our service providers shall provide the diagnosis service for a fee. In such a case, the purchaser shall be charged for the service.

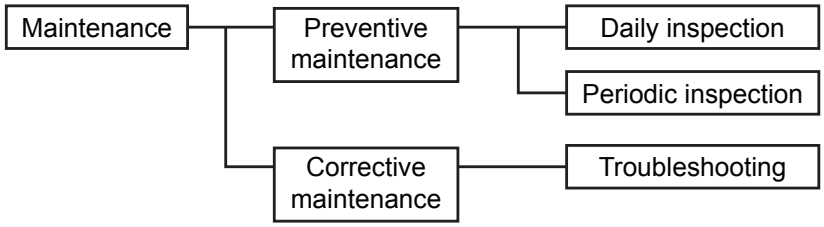
6. Service life

This product is designed for a service life of 10 years under general operating conditions (with an average ambient temperature of 30°C).

The service life may be shortened depending on operating conditions and environment. To ensure the service life, it is important to perform planned maintenance of the product.

7. Maintenance plan

Maintenance can be divided into "preventive maintenance" and "corrective maintenance". Preventive maintenance can further classified into "daily inspection" and "periodic inspection". Preventive maintenance is achieved through systematic implementation of "daily inspection" and "periodic inspection".



(1) Periodic inspection

Periodic inspection is to replace limited-life parts before their service lives are over, thus preventing failure. Recommended inspection interval is 12 months. If you are using the product under harsh environment, we recommend you to shorten the inspection interval. For the specific items of periodic inspection, refer to Chapter “5. Maintenance".

(2) Corrective maintenance

Corrective maintenance is a measure to be taken after a trouble has occurred. Refer to “5.2 Troubleshooting”. If the measures mentioned in this instruction manual do not solve the problem, please contact one of our sales offices or service offices.

8. Limited-life parts and consumable parts

This product uses the limited-life parts such as gaskets which may affect the service life of the product itself. Estimate the lifetime of those parts according to your operating environment, and replace them at appropriate time.

(Refer to “5.3 Replacement of parts”.)

9. Spare parts and accessories

Refer to "Confirmation of your specification" and "Confirmation of delivered product" for spare parts and accessories.

10. Period for repair and provision of spare parts after product discontinuation (maintenance period)

The discontinued models (products) can be repaired for five years from the date of discontinuation. Also, most spare parts used for repair are provided for five years from the date of discontinuation. However, some electric parts may not be obtained due to their short life cycle. In this case, repair or provision of spare parts may be difficult even in the above period.

Please contact one of our sales offices or service offices for further information.

EMC CONFORMITY

EMC CONFORMITY OF FCX-AIII

EMC Directive (2004/108/EC)

Emission limits:
EN 61326-1: 2006 Class A (Industrial location)

Frequency range	Limits	Reference standard
30 to 230 MHz	40 dB(µv/m) quasi peak, measured at 10m distance	EN 55011:1998 +A1:1999 +A2:2002 (Group 1 class A)
230 to 1000 MHz	47 dB(µv/m) quasi peak, measured at 10m distance	

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

Phenomenon	Test value	Basic standard	Performance criteria
Electrostatic discharge	4kV (Contact) 8kV (Air)	EN 61000-4-2:1995 IEC 61000-4-2 +A1:1998 +A2:2001	B
Electromagnetic field	10V/m (80 to 1000 MHz) 3V/m (1.4 to 2.0GHz) 1V/m (2.0 to 2.7GHz) 80% AM(1kHz)	EN 61000-4-3:2002 IEC 61000-4-3 +A1:2002	A
Rated power frequency magnetic field	30A/m 50/60Hz	EN 61000-4-8:1993 IEC 61000-4-8 +A1:2001	A
Burst	2kV	EN 61000-4-4:2004 IEC 61000-4-4	B
Surge	1kV line to line 2kV line to ground 1.2/50µs (Voltage) 8.0/20µs (Current)	EN 61000-4-5:1995 IEC 61000-4-5 +A1:2001	B
Conducted RF	3V 150kHz to 80MHz 80% AM (1kHz)	EN 61000-4-6:1996 IEC 61000-4-6	A

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

CAUTION ON SAFETY

First of all, read this "Caution on Safety" to ensure correct operation of the transmitter.

- The cautionary descriptions listed here contain important information about safety, so they should be observed without fail. Those safety precautions are classified into ranks "DANGER" and "CAUTION".

⚠ **DANGER**	Wrong handling may cause a dangerous situation, in which there is a risk of death or heavy injury.
⚠ **CAUTION**	Wrong handling may invite a dangerous situation, in which there is a possibility of medium-level trouble or slight injury or only physical damage is predictable.

On items listed under "⚠ **CAUTION**", they may also lead to serious accidents depending on circumstances, and must be fully observed.

- The signs of prohibition and indication are explained in the following.

⊘ **PROHIBITION**	General items which pertain to prohibition (DO NOT)
● **INDICATION**	General items which pertain to user's action

Installation and Piping

⚠ DANGER

- Non-explosion-proof transmitter must not be used in a place with explosive gases to prevent serious accidents such as explosion, fire, etc.

⚠ CAUTION

- The transmitter is heavy. Be careful when handling it.
- The transmitter should be installed in a place that meets the operating conditions shown in DS sheet or this instruction manual.
- Install the transmitter according to the instruction manual. Improper installation may lead to the cause of fall, trouble or incorrect operation.
- When installing, make sure that the transmitter interior is free from cable chips and other foreign objects to prevent fire, trouble, or incorrect operation.
- When power is ON, do not change the position of the amplifier unit in an explosion-proof area.
- When power is ON, do not change the angle of the indicator.
- Main valve 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 hazard.
- Pressure pipes to be used must meet the temperature/pressure rating.

CAUTION ON SAFETY

Wiring

⚠ DANGER

- On explosion-proof type transmitter, its wiring work must be performed according to the required laws and regulations. Incorrect wiring may cause explosion, fire or other serious accidents.

⚠ CAUTION

- Before making wiring work, be sure to turn OFF the main power to prevent electric shocks.
- Use wiring materials of correct rating to prevent fire accidents.
- Connect a power source of correct rating to prevent fire accidents.
- The transmitter should be grounded as specified to prevent electric shocks or incorrect operation.
- After installing the transmitter, firmly close the covers of the amplifier unit and terminal box. If not, rain water enter the transmitter which may result in trouble or incorrect operation.

Adjustment

⚠ DANGER

- When using a flame-proof transmitter, do not connect HHC to the transmitter terminals and junction terminals in hazardous area.
- Do not open the cover from amplifier case with active DC power supply in hazardous area.

Replacement of Maintenance Parts

⚠ DANGER

- 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.

CAUTIONS ON USE

Be sure to observe the following instructions

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 checkup

Site at location large enough to allow maintenance and checking.
(See "Check space" in Section 6.1.)

Mounting angle

Mount to a pipe horizontally or vertically.

Attention to overload

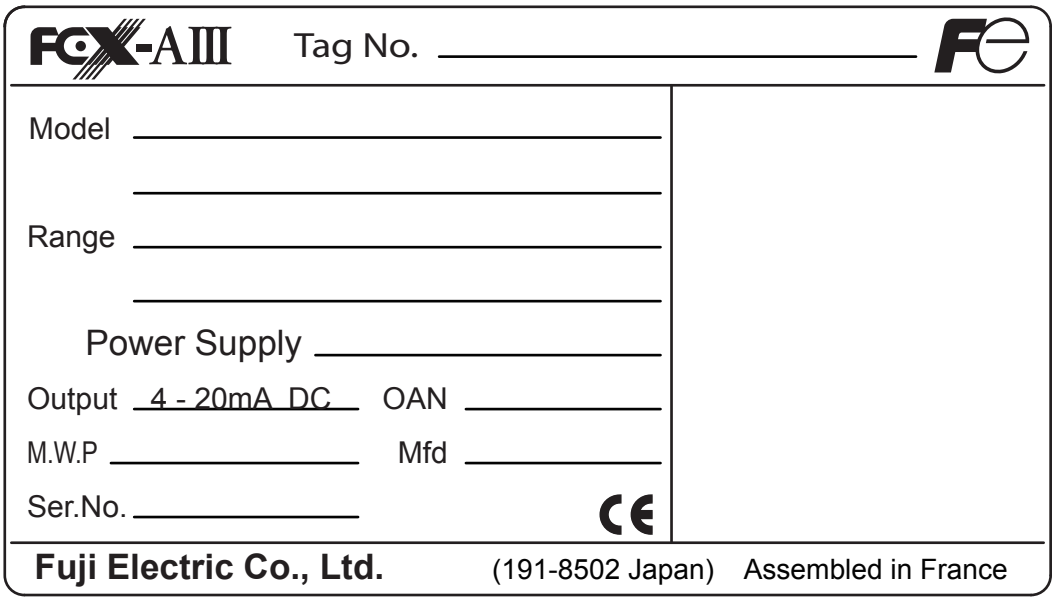
Do not apply a pressure outside the specified range.

Other

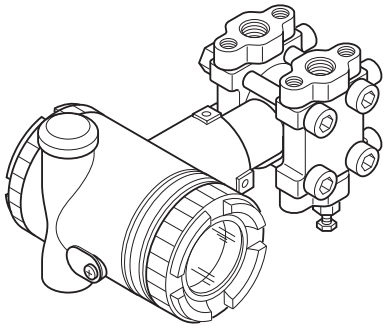
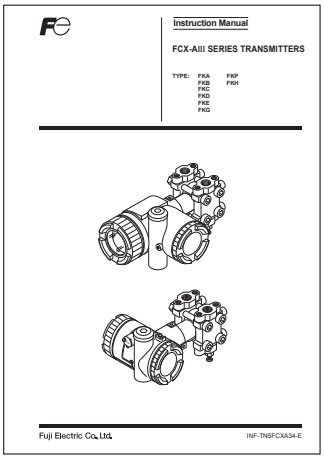
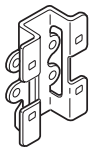
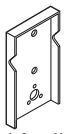
Besides the above, be sure to observe the cautions given in this manual.

CONFIRMATION OF YOUR SPECIFICATION

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



CONFIRMATION OF DELIVERED EQUIPMENT

• Transmitter body (1 set) (An example of a differential pressure transmitter is shown in the figure on the right.)	
• Instruction manual (One copy) This manual (to be supplied when the instruction manual is required)	
• Mounting bracket (One set) (To be supplied when mounting bracket is required)	 or  Used for direct mount type

CONTENTS

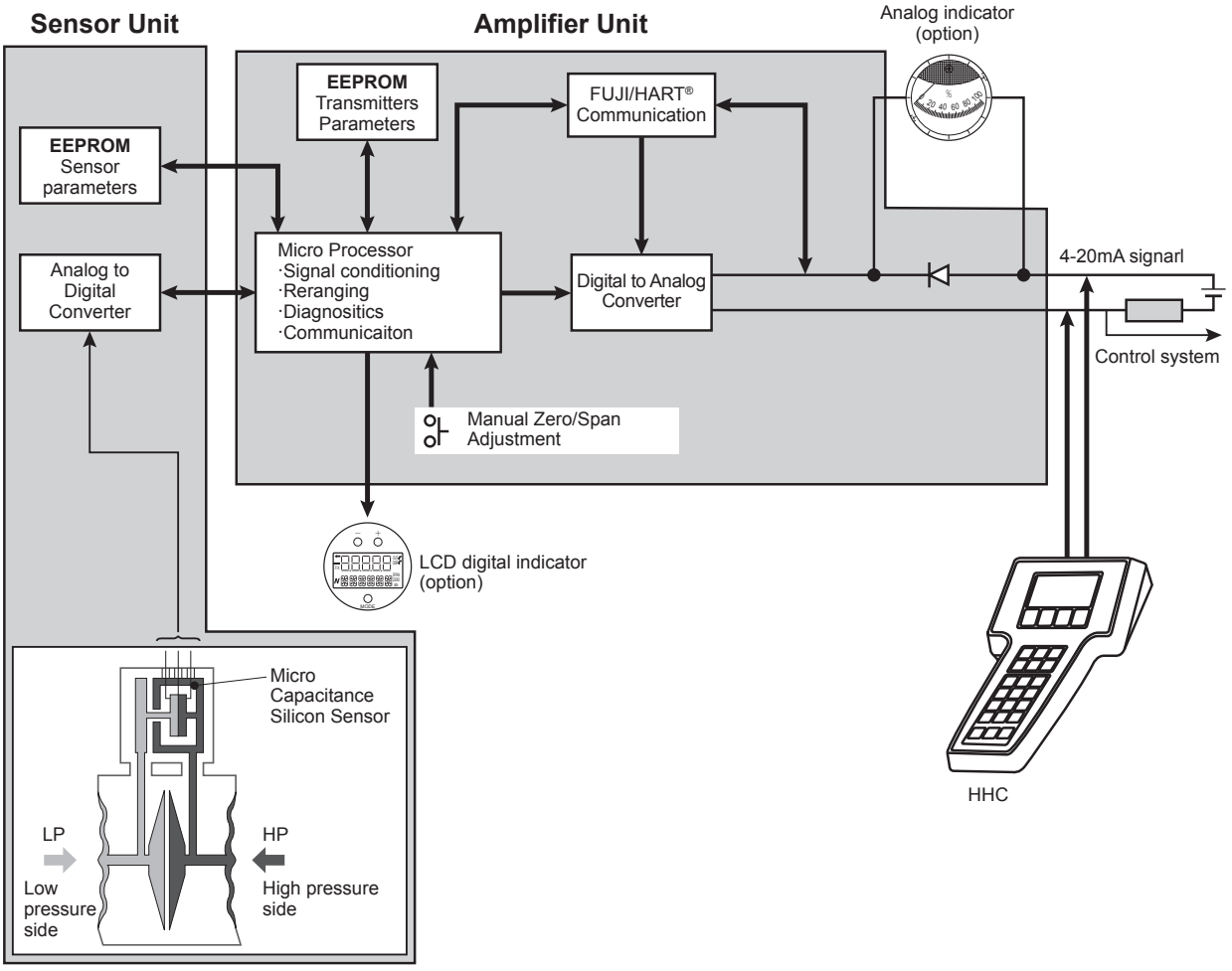
CONTENTS

1. OUTLINE

The FCX-AIII series transmitter detects the differential pressure or pressure of various fluids, converts it into a current signal of 4 to 20mA DC and transmits it.
All the adjustment functions are incorporated in the amplifier unit for making adjustments easily and exactly.
Transmitter settings (such as range, damping time constant and self-diagnosis, etc.) can be changed from an HHC (Hand Held Communicator) or a local configurator unit with LCD display.

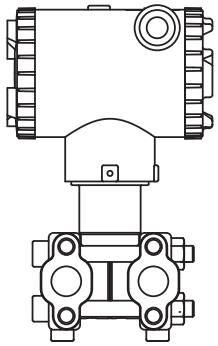
Principle

The operating principle of the FCX-AIII series transmitter is shown in the block diagram below.
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 amplifier unit, and is then output as a current of 4 to 20mA DC.

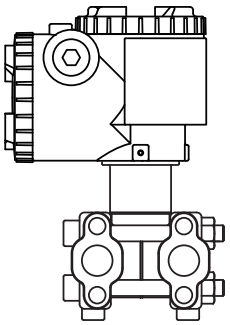


Type of electronics unit

There are two types of the electronics unit for the FCX-AIII series transmitter. One is T type (the 4th digit in the code symbol is 5, 6. 7, 8 or 9) and the other is L type (the 4th digit is S, T, V, W or X).



T type



L type

*) Explanation in this instruction manual is based on the L type.

Measuring range

Model	Type	Measurable range
Absolute pressure	FKA	1.6-3000 (kPa abs)
	FKH	8.125-3000 (kPa abs)
Pressure	FKG, FKB (*1)	1.3-50000 (kPa)
	FKB (*2)	50-10000 (kPa)
	FKP	8.125-10000 (kPa)
Differential pressure	FKC	0.1-3000 (kPa)
	FKD (*1)	0.32-500 (kPa)
	FKD (*2)	3-500 (kPa)
Level	FKE (*1)	0.32-500 (kPa)
	FKE (*2)	3-500 (kPa)

*1 Flange size, 3B (3 inches) 80A or more.

*2 Flange size, 2B (2 inches) 50A or below.

Environmental protection

IP67 (JIS C0920, IEC60529) and NEMA 6/6P

Dielectric voltage

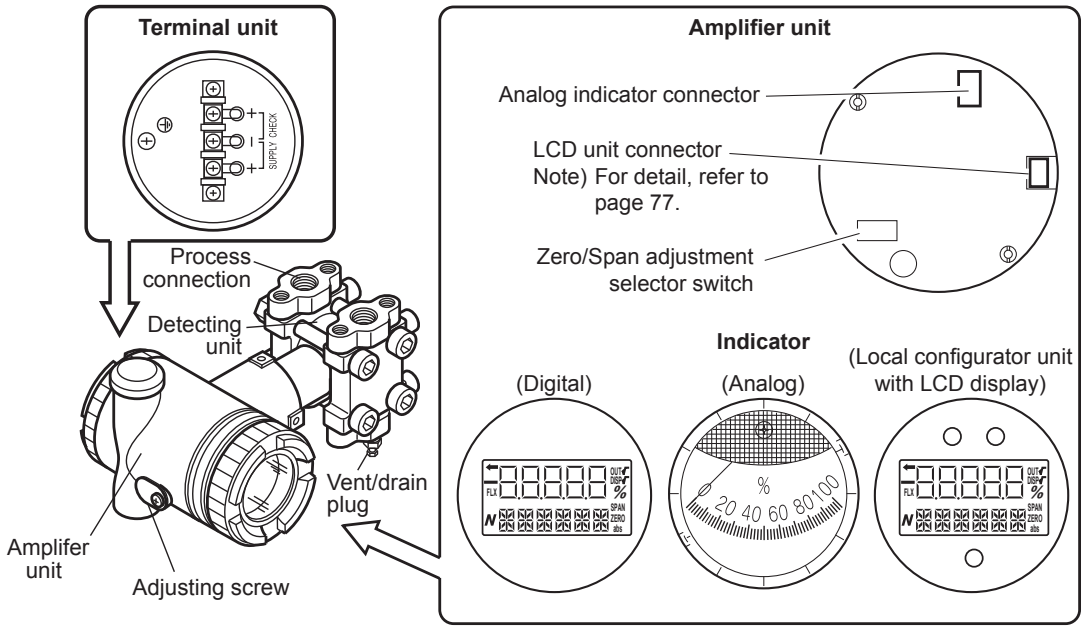
Power supply 500V AC

Between output circuit and earth 50/60Hz 1min.

Leak current 5 mA or less

2. OPERATING PARTS AND THEIR FUNCTIONS

FCX-AIII Series transmitter



Description of FCX-AIII Series transmitter

Part name	Description
Detecting unit	Detects pressure, differential pressure or level of fluid.
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.
Adjusting screw	Used for adjustment (see Section 3.1).
Terminal unit	External terminal unit to connect an input-output line and ground wire

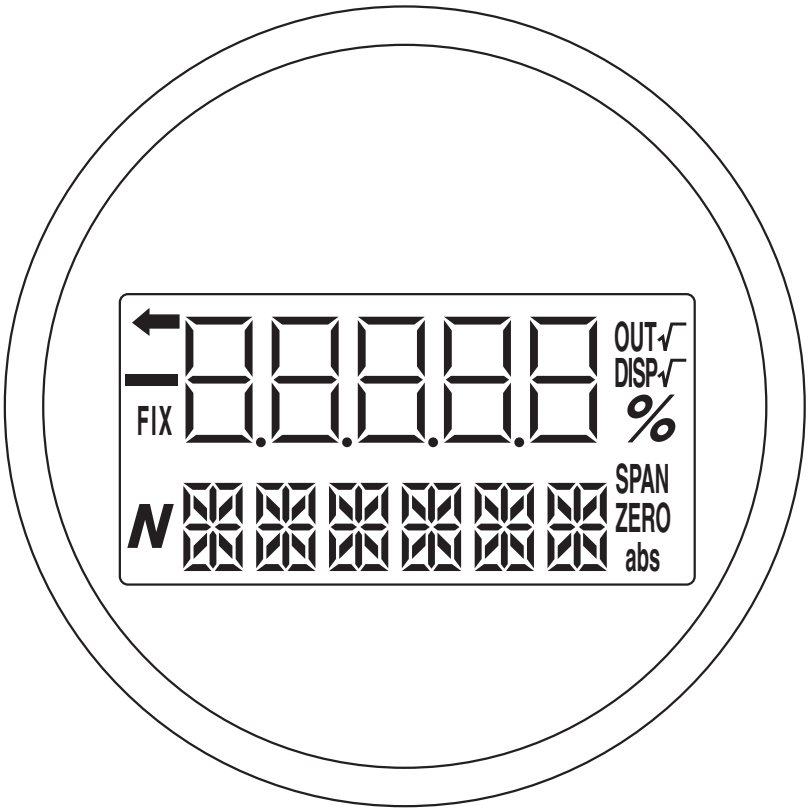
Amplifier unit

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
− + SUPPLY	Connects the output cable.
+ − CHECK	Used for checking the output current or connecting a separated indicator. (Note). Note) Impedance of indicator must be less than 12 Ω (Ohm).
⏚	An external terminal used for grounding.

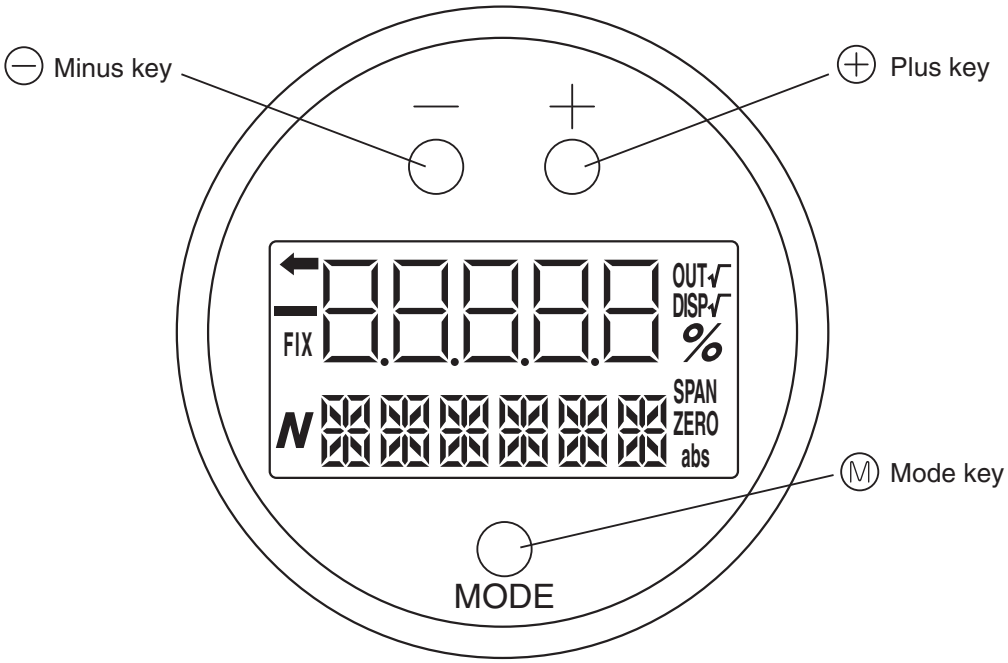
Mode indicating function of digital indicator



Mode indication

Mode	When indicated	When not indicated
%	% output	Actual scale
ZERO	External zero adjustment possible	External zero adjustment impossible
SPAN	External span adjustment possible	External span adjustment impossible.
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)	

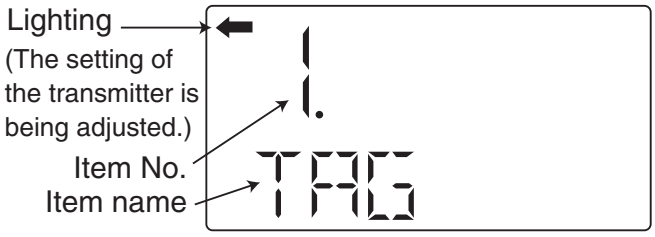
Modes of the local configurator unit with LCD display and functions of the 3 push button key switches



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.

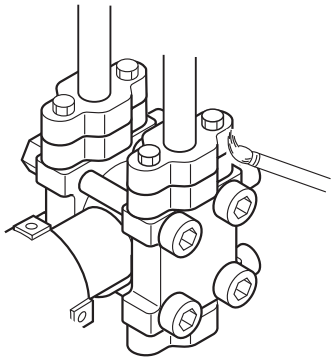
* Refer to Section 4.2 "Adjustment procedure by the local configurator unit with LCD display" for details.

3. OPERATION AND SHUTDOWN

3.1 Preparation for operation

Before operating the transmitter, be sure to perform the following checks and procedures. While adjusting the explosion-proof transmitter in a hazardous area, do not open the covers of the transmitter and terminal.

Preparation procedure



(1) Check for liquid or gas leakage from the process connection, etc. by applying soapy water or the like.
(2) Check the signal wiring according to the "Terminal block connection diagram" shown in 7.1.
(3) Vent gas from the transmitter in the case of liquid measurement.

Important

When the plant requires chemical cleaning at the start of operation, be sure to close the valve of the transmitter to prevent entry of cleaning liquid into the pressure receiving unit.

(4) Perform zero point adjustment.

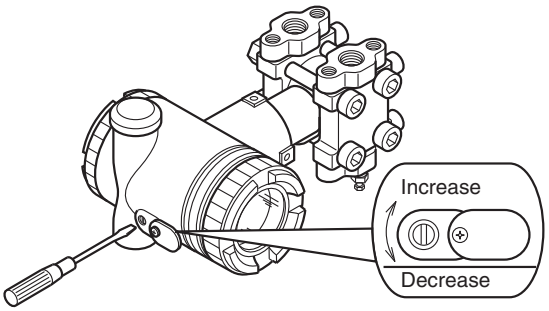
Zero point check

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 to 4 mA (zero adjustment).
(See below.)

Zero adjustment

(1) Adjustment by zero adjustment screw
Adjust zero point of the transmitter to 4 mA by turning the zero adjustment screw.

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



* Refer to "Zero adjustment" in Section 4.1 "Adjustment procedure using the external adjusting screw" for details.
(2) If using the local configurator unit with LCD display, refer to "A: Zero/span adjustment" in Section 4.2.1 "Menu list" in Section 4.2 "Adjustment procedure by the local configurator unit with LCD display."
(3) Adjustment by HHC
Refer to "Zero/span calibration" in section 4.3 "Adjustment wiht HHC".

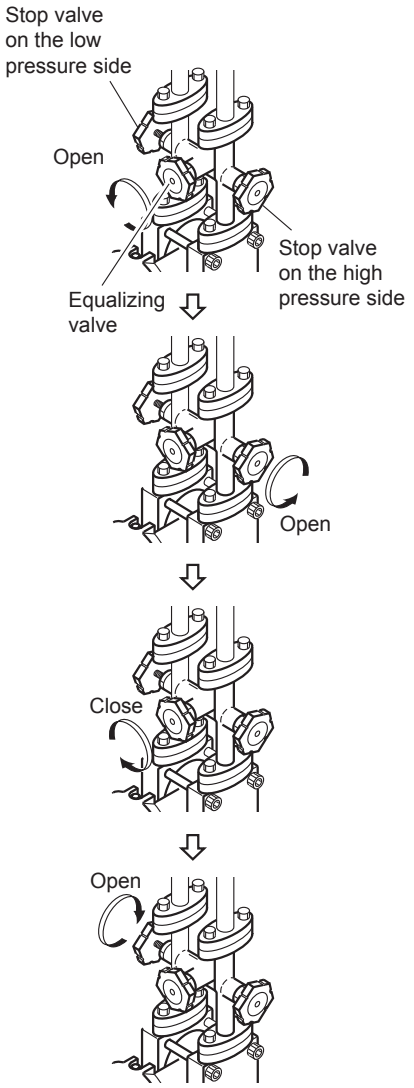
Important

1. After adjustment of the transmitter, it should be kept energized for about 10 seconds to write the adjustment results into memory.
2. Use a blade-edge screwdriver for adjusting the zero adjustment screw.

3.2 Operation

(1) Operation of differential pressure transmitter

Set the operating status by manipulating the equalizing valve.



Make sure the equalizing valve is open.

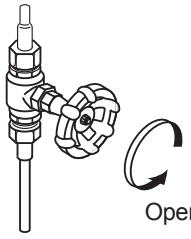
Open the stop valve on the high pressure side slowly.

Close the equalizing valve.

Finally, open the stop valve on the low pressure side slowly.

(2) Operation of pressure transmitter

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

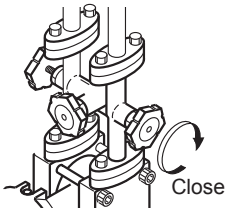


Check of operating status

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

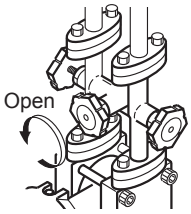
3.3 Shutdown

(1) Shutdown of differential pressure transmitter
Set the shutdown status by manipulating the equalizing valve.
Turn off power supply.



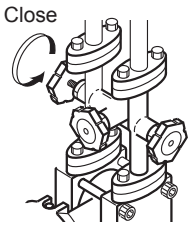
Close the stop valve on the high pressure side (H side) slowly.

⇩



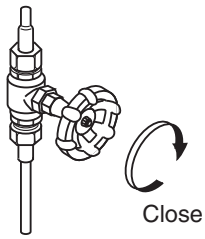
Open the equalizing valve.

⇩



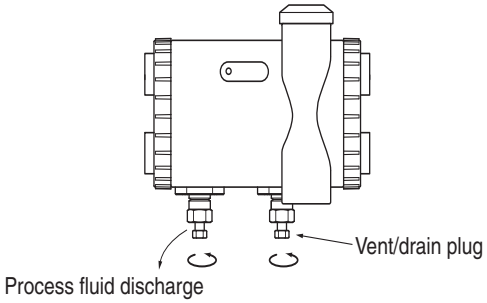
Close the stop valve on the low pressure side (L side) slowly.

(2) Shutdown of pressure transmitter
Close the valve slowly to stop applying a pressure. The transmitter is set in the measurement stop status.



Important

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



4. ADJUSTMENT

4.1 Adjustment procedure using the external adjusting screw

⚠ DANGER	Do not open the cover from amplifier case to make following adjustments with active DC power supply in hazardous area.

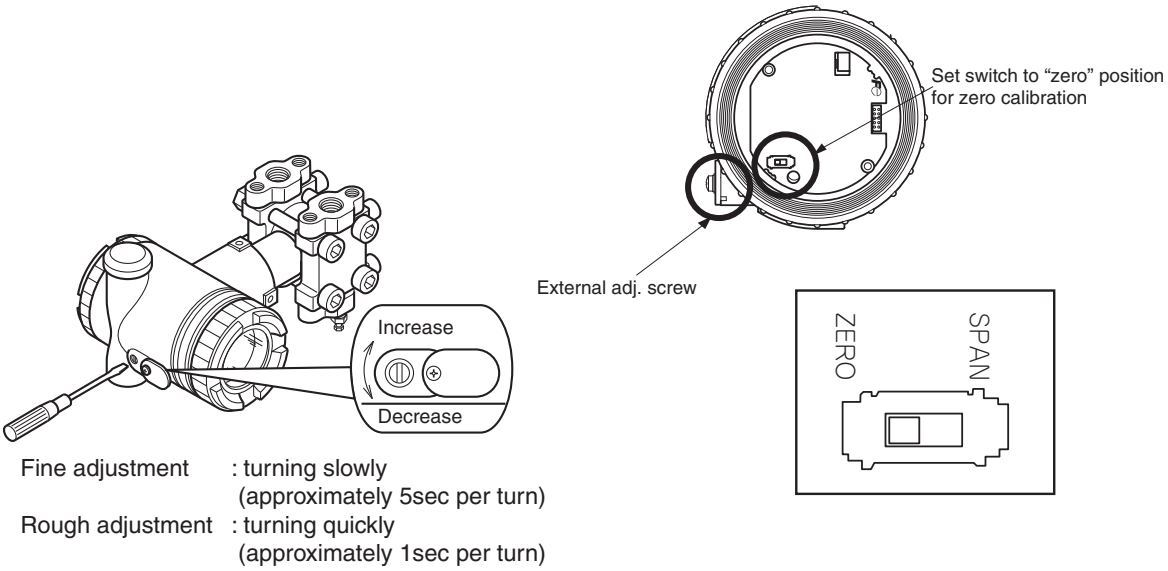
For changing the measuring range, carry out zero adjustment first, and span adjustment next. (If zero adjustment is performed after span adjustment, the 100% point may not be adjusted correctly.) Accordingly, the zero point (LRV) or span (URV-LRV) of the measuring range is changed. To confirm the changed values, display the measuring range (LRV, URV) by the HHC or the LCD unit with three push buttons after this operation.

Zero adjustment

To adjust the zero point of the transmitter, set the selector switch to "ZERO" and adjust the zero point by the external adjusting screw.

⚠ CAUTION	Before touch the selector switch, touch the metallic part of the case to prevent electrostatic discharge.

(1) Set the selector switch to "ZERO."
(2) Apply standard input pressure corresponding to new Lower Range Value.
(3) Adjust output signal to 4.00mA by turning the external adj. screw.



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

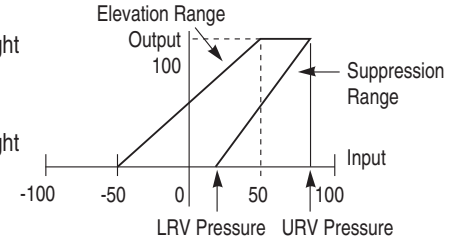
Important	1. After adjustment, the transmitter should be kept energized for about 10 seconds to write the adjustment results into memory. 2. If the lock function is effective (see p. 30) the transmitter cannot be adjusted by the external adjusting screw.

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.

Remarks

Suppression Range:
See the diagram at right

Elevation Range:
See the diagram at right



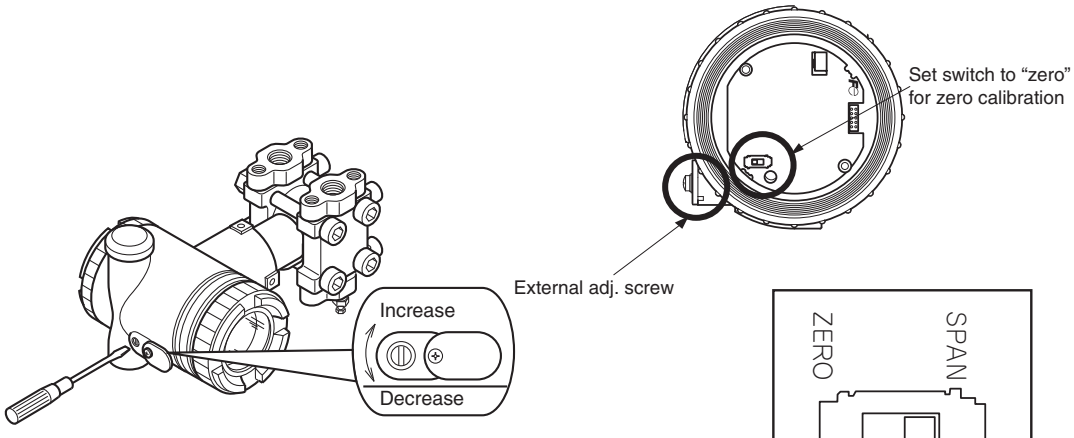
Note) This diagram indicates normal action.

Span adjustment

The measuring range for each transmitter is determined according to its type.
To adjust the span, set the selector switch to "SPAN" and adjust the span by the external adjusting screw.

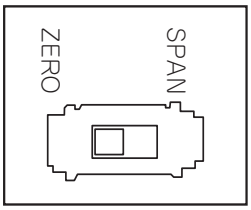
⚠ CAUTION	Before touch the selector switch, touch the metallic part of the case to prevent electrostatic discharge.

(1) Set the selector switch to "SPAN."
(2) Apply the standard input pressure.
(3) Adjust output to 20.00mA by turning the external adj. screw.
(4) Set the pressure back to the minimum measuring pressure and check that the output is 4 mA.



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

After adjusting the span as mentioned above, set the selector switch back to “Zero” before using the transmitter.



Important

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

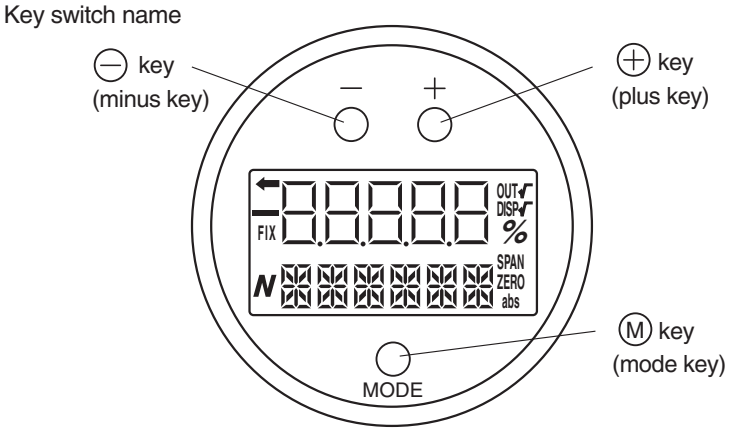
4.2 Adjustment procedure by local configurator unit with LCD display

⚠ DANGER	Do not open the cover from amplifier case to make following adjustments with active DC power supply in hazardous area.

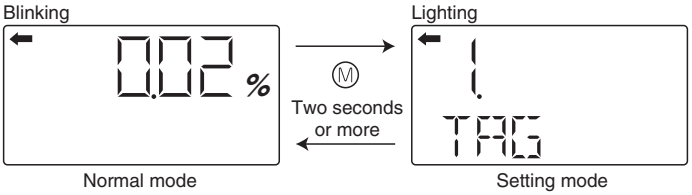
You can use various functions of the FCX- AIII series transmitter with 3 push button key switches by installing the local configurator unit with LCD display in the transmitter.

Cautions for operation

⚠ DANGER	To change the set value, check that the control loop of the host system (such as an instrumentation system) can be performed manually.



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	Relevant page
1	TAG No.	1. TAG	Display and setting of TAG No. (*1)	15
2	Model code	2. TYPE	Display and setting of type (*1)	16
3	Serial No.	3-1. SERIAL N	Display of serial No.	17
		3-2. VER	Display of transmitter software version	17
4	Engineering unit	4. UNIT	Display and change of engineering unit (*1)	18
5	Range limit	5. URL	Display of maximum measuring range	18
6	Measuring range	6-1. LRV	Change of LRV (lower range value of measuring range = 0% point) (*1)	19
		6-2. URV	Change of URV (upper range value of measuring range = 100% point) (*1)	20
7	Damping	7. DAMP	Change of damping time constant (*1)	21
8	Output mode	8-1. OUT Md	Change of output mode (*3) (*1)	22
		8-2. CUT Pt	Setting of low flow rate cut point (*3) (*1)	22
		8-3. CUT Md	Setting of low flow rate cut mode (*3) (*1)	23
9	Direction and value of burnout	9-1. BURNOT	Change of burnout direction (*1)	24
		9-2. OVER	Chang of output value when burnout direction = OVERSCALE (*4) (*1)	24
		9-3. UNDER	Chang of output value when burnout direction = UNDERSCALE (*5) (*1)	25
A	Zero/span calibration	A-1. ZERO	Zero calibration (*6) (*2)	26
		A-2. SPAN	Span calibration (*6) (*2)	27
B	Output circuit calibration	b-1. 4mAAdj	4 mA calibration (*8) (*2)	28
		b-2. 20mAAdj	20 mA calibration (*8) (*2)	28
		b-3. FIXcur	Constant current output (*8)	28
D	Self-diagnosis	d-1. AMPTMP	Display of internal temperature of transmitter	29
		d-2. ALMCHK	Display of self diagnosis.	29
F	Locking of adjustment functions	F. LOCK	Locking and unlocking of the adjusting screw and the adjustment function in the setting mode (*1)	30
G	LCD display range setting	G-1. LDV	LDV (Lower Display Value) setting (*1)	31
		G-2. UDV	UDV (Upper Display Value) setting (*1)	32
		G-3. DP	DP (number of digit after Decimal Point) setting (*1)	32
		G-4. LcdUnit	LcdUnit (LCD Unit Code) setting (*1)	33
		G-5. LcdoOpt	LcdOpt (LCD Option) setting (*1)	34
I	Input-output range adjustment	I-1. LRVAdj	Zero adjustment by range (LRV) change (*6) (*2)	35
		I-2. URVAdj	Span adjustment by range (URV) change (*6) (*2)	36
J	Value and specification of saturation current	J-1. SAT LO	Change of saturation current value (lower limit) (*7) (*1)	38
		J-2. SAT HI	Change of saturation current value (upper limit) (*7) (*1)	39
		J-3. SPEC	Selection (Nomal specification/expanded specification) of specifications of burnout & saturation current (*1)	39
K	Protective function of set value	K. GUARD	Setting and cancellation of set value protection (write protect) (*9)	40
L	History information	L-1. HisZERO	Display of zero calibration data for users	41
		L-2. HisSPAN	Display of span calibration data for users	41
		L-3. HisCLEAR	Clearing of zero/span calibration data (*1)	41
		L-4. HisAMP	Display of min/max of amplifier temperature history information	42
		L-5. HisCELL	Display of min/max of cell temperature history information	42

*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.

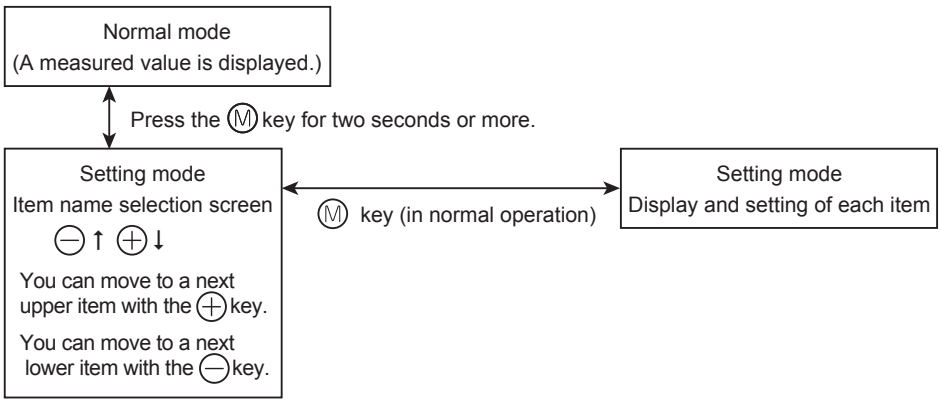
4.2.2 Switching menus

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

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

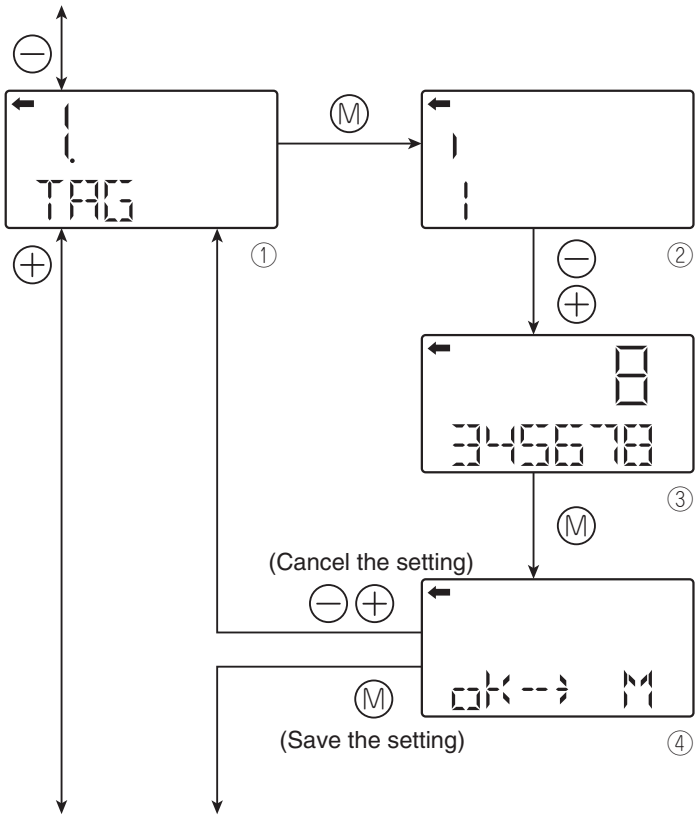
Press the Ⓜ key for a few seconds to switch the setting mode (item name selection screen) to the normal mode.

After selecting an item with the ⊖/⊕ keys, press the Ⓜ) 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. Chang of output value when burnout direction = OVERSCALE
9-3. UNDER	↑	↓	→	9-3. Chang 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



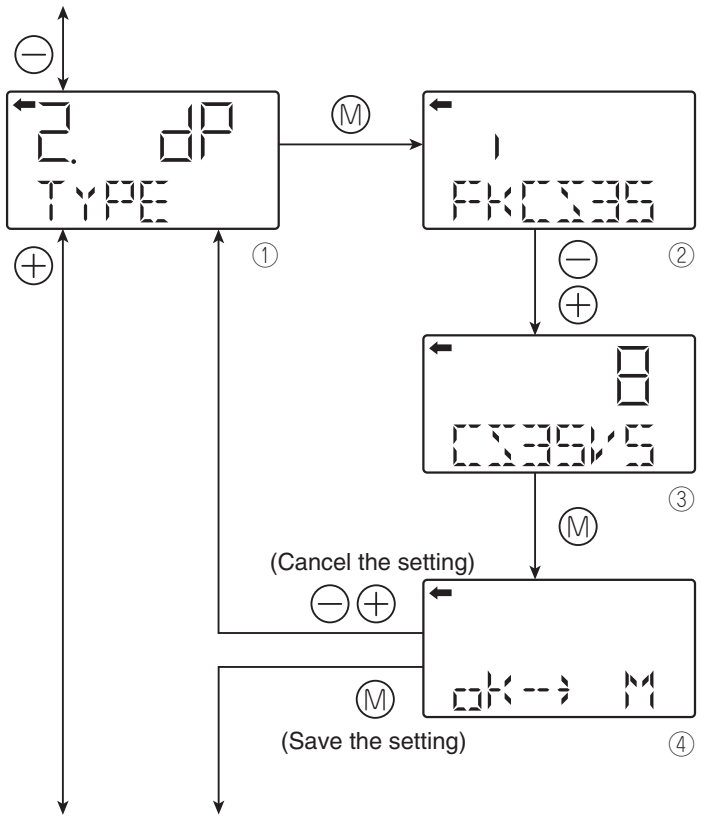
TAG NO.

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 Ⓜ 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 → 2 → 3 ... → 26 → 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 Ⓜ key to save the TAG No. setting.
  Press the ⊖ or ⊕ key to cancel the setting.



Model code (TYPE)

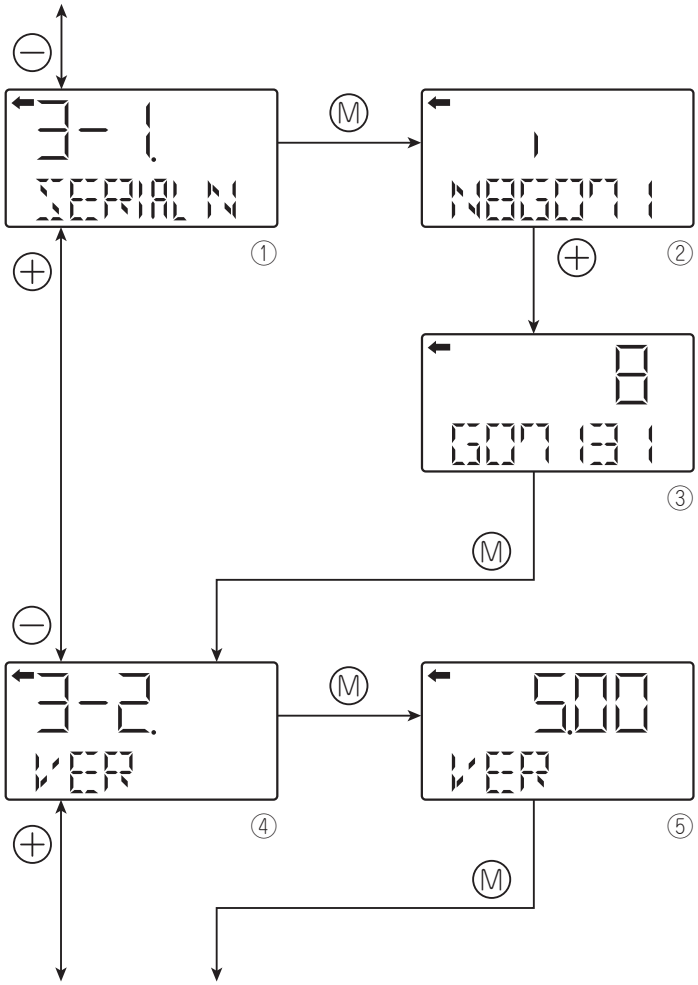
Model code of field device is displayed and changed (example of differential pressure transmitter).

- Press the Ⓜ 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 Ⓜ 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)
  dP : Differential pressure transmitter
  GP : Pressure (gauge pressure) transmitter
  AP : Absolute pressure transmitter



SERIAL NO.

SERIAL NO.(8 letters) and transmitters software version are displayed.

Display of SERIAL No.

- Press the Ⓜ key on the screen ① to display the SERIAL No.(②)

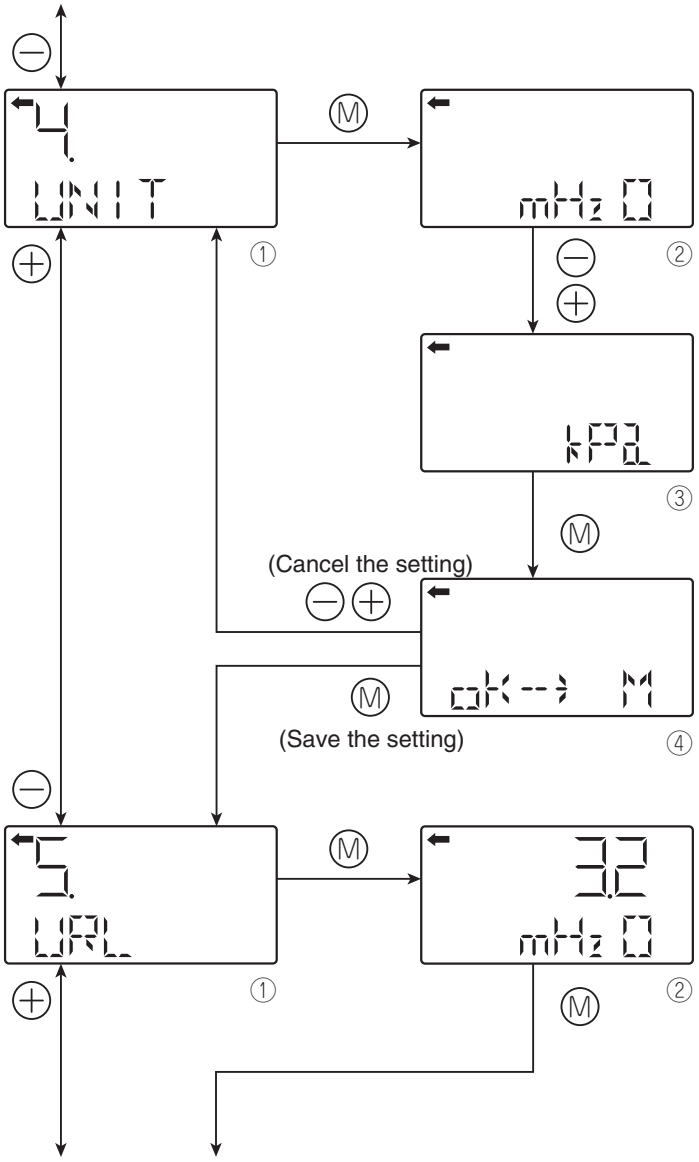
  Note) Characters other than numerical characters, capital letters of the alphabet, space, and "–" are displayed as "*."

  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 (⑤), press the Ⓜ key on the screen ④.



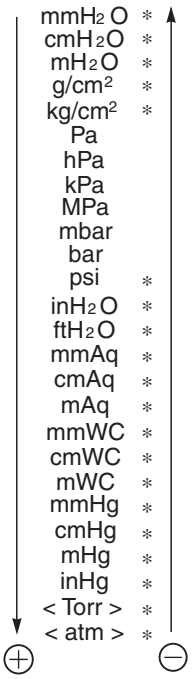
Engineering unit

- To display the screen for changing the engineering unit (②), press the Ⓜ key on the screen ①.
- Select an engineering unit with the ⊖ and ⊕ keys on the screen ②.

Important

The engineering unit is set according to the range as ordered, but the display resolution lowers depending on the unit being set.

Available unit for FCX-AIII
(The units with * cannot be used because they are not legal units in Japan.)

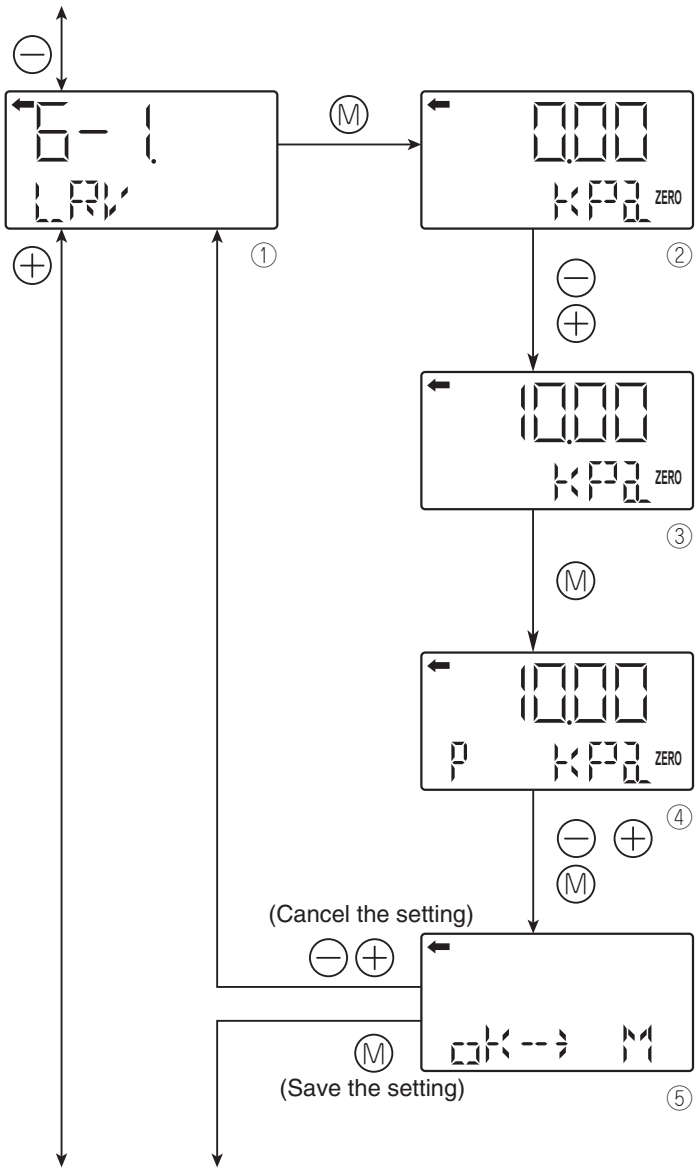


Note: The mark < > is settable for absolute pressure transmitter only.

Range limit

Indicates the maximum measuring range of this transmitter.

- To display the range limit value (②), press the Ⓜ key on the screen ①.
  Note) If "UUUUU" is displayed as a URL value, the unit is not supported.

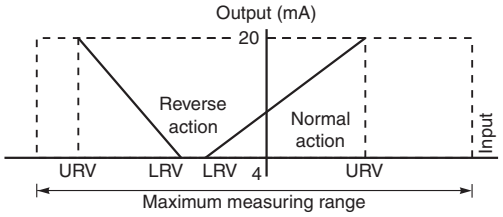


Measuring range (LRV, URV)

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 Ⓜ key on the screen ① to display the screen for setting the zero point range (②).
- Input the numerical values with the ⊖ and ⊕ keys on the screen ②.

Functions of the keys:

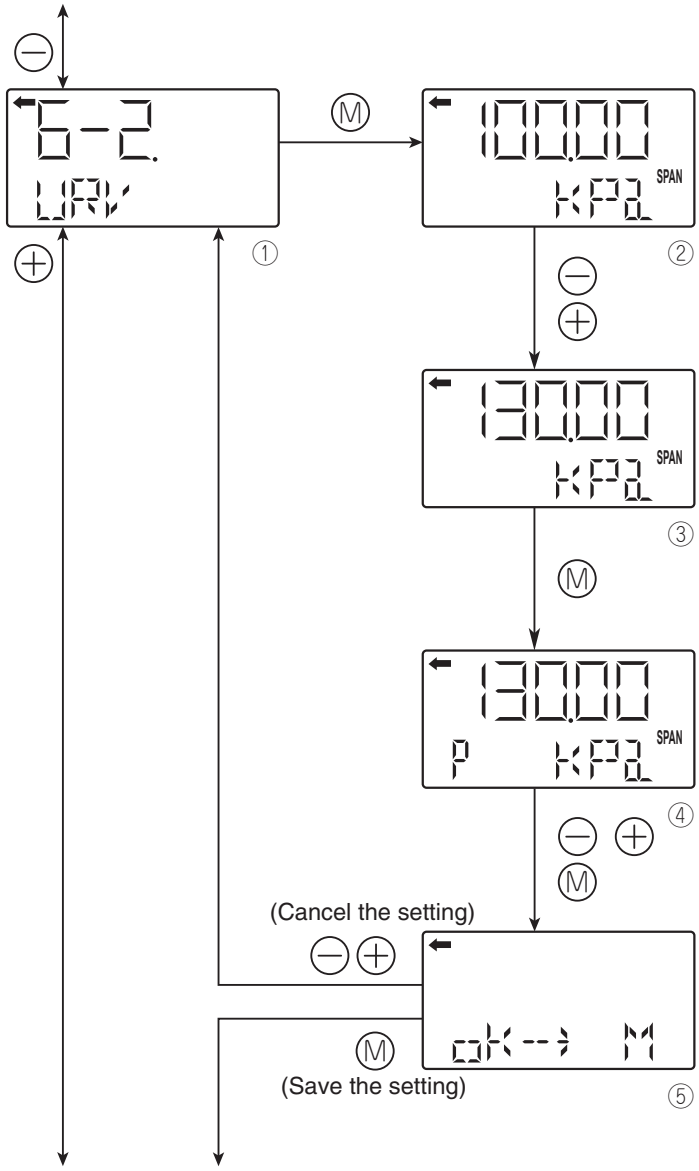
⊖ key: To decrease the value.
⊕ key: To increase the value.
Range: –99999 ≤ LRV ≤ 99999
Note) If "UUUUU" is displayed as a LRV value, the unit is not supported.

- To set the decimal point position, press the Ⓜ key on the screen ③. "P" is displayed at the left of the unit name (④) 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

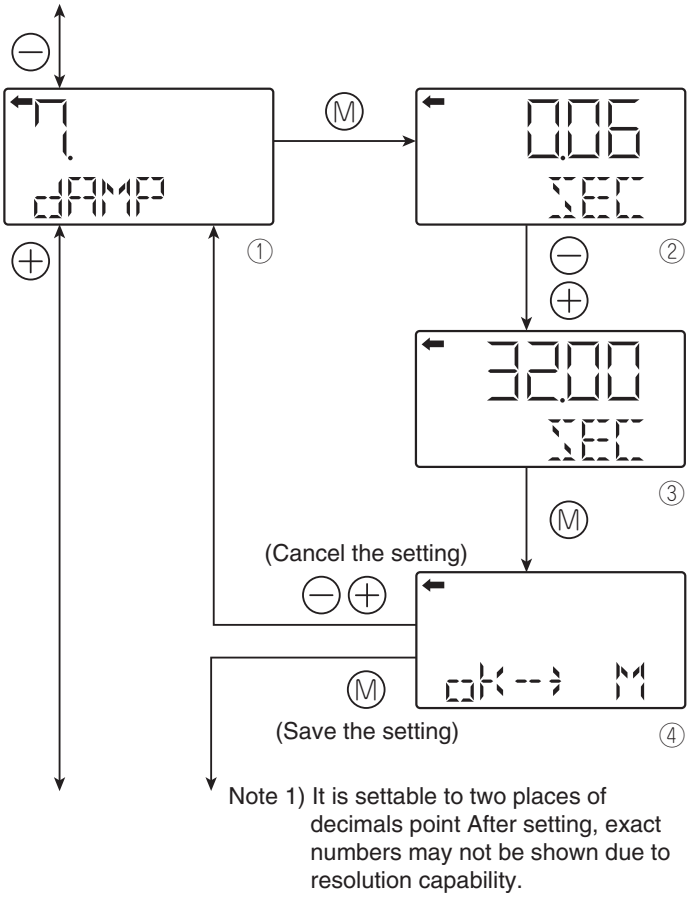
- Select whether the LRV setting is saved on the screen ⑤.

Press the Ⓜ key to save the zero point range setting.
Press the ⊖ or ⊕ key to cancel the setting.



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

- Press the Ⓜ key on the screen ① to display the screen for setting the 100% point (②).
- Input the numerical values with the ⊖ and ⊕ keys on the screen ②.
  Functions of the keys:
  ⊖ key: To decrease the value.
  ⊕ key: To increase the value.
  Range: –99999 ≤ URV ≤ 99999
  Note) If "UUUUU" is displayed as a URV value, the unit is not supported.
- To set the decimal point position, press the Ⓜ key on the screen ③. "P" is displayed at the left of the unit name (④) 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 ⑤.
  Press the Ⓜ 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 Ⓜ key on the screen ① to display the screen for changing the damping time constant (②).
- Input the damping time constant with the ⊖ and ⊕ keys on the screen ②. Press the ⊖ key to decrease the value and press the ⊕ key to increase the value.
  Settable range: 0.06 to 32.0 sec Note 1)
- Select whether the damping time constant setting is saved on the screen ④.
  Press the Ⓜ 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.

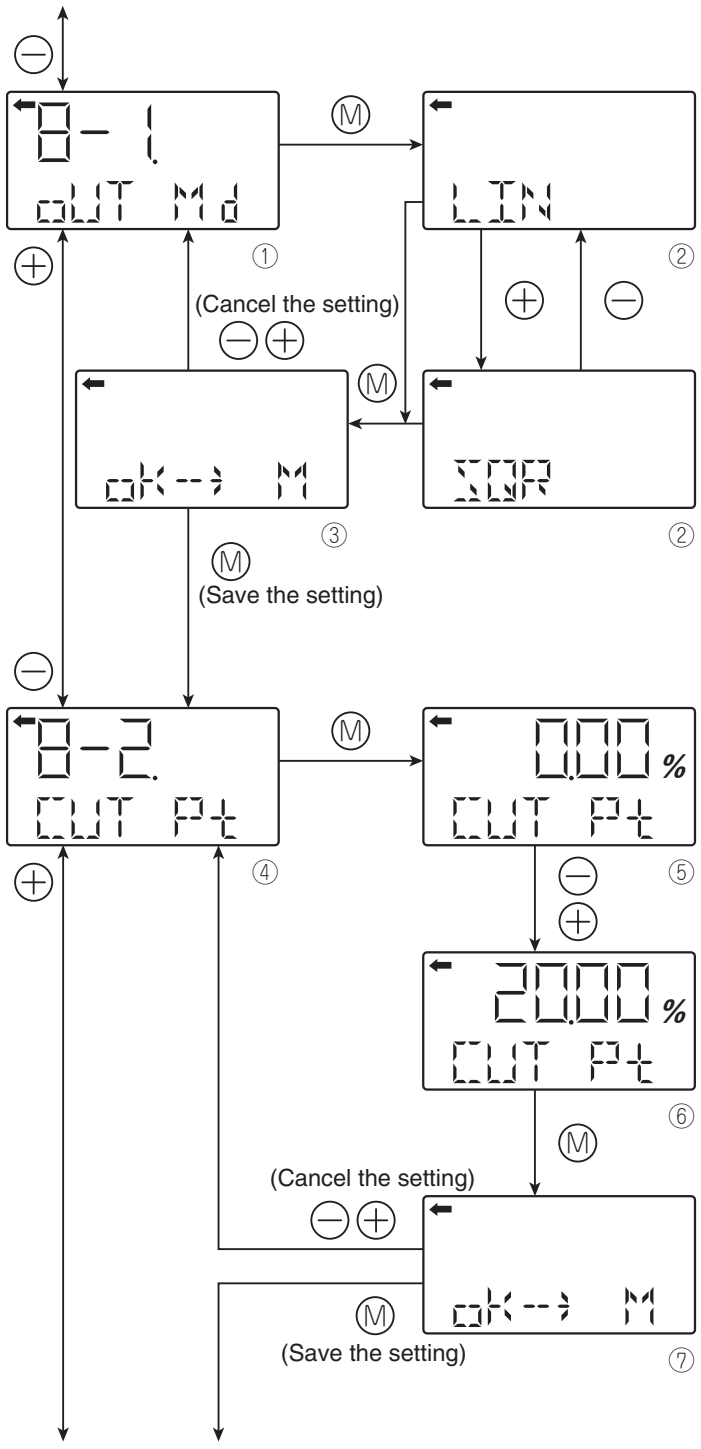
   Oscillation frequency: 10 to 150 Hz
   Within ±0.25% of URL/(9.8m/s^2)

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

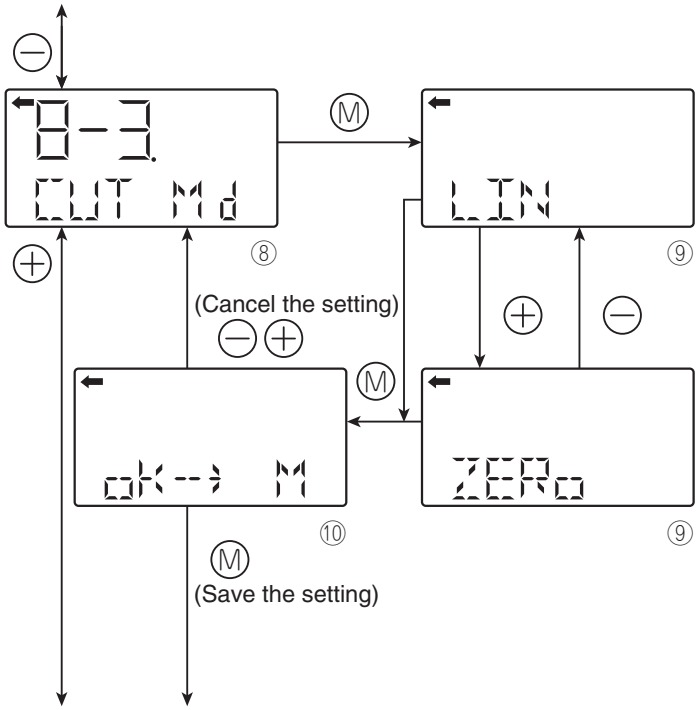
- Press the Ⓜ key on the screen ① to display the screen for changing output mode (②).
- You can select the proportional or square root extraction mode on the screen ②.
  Select LIN (proportional mode) or SQR (square root extraction mode) with the ⊖ or ⊕ key and press the Ⓜ key.
- Select whether the output mode setting is saved on the screen ③.
  Press the Ⓜ 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 Ⓜ key on the screen ④ to display the screen for setting the low cut point (⑤).
- You can set and change the low cut point by inputting the numerical values with the ⊖ and ⊕ keys on the screen ⑤.
  Settable range: 0.00 to 20.0%
- Select whether the cut point setting is saved on the screen ⑦.
  Press the Ⓜ key to save the cut point setting.
  Press the ⊖ or ⊕ key to cancel the setting.



Low cut mode setting

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).

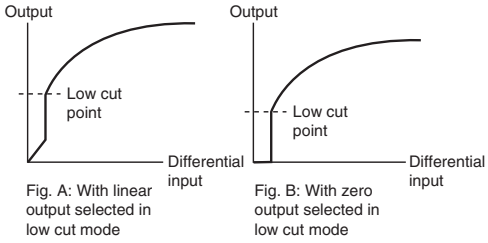
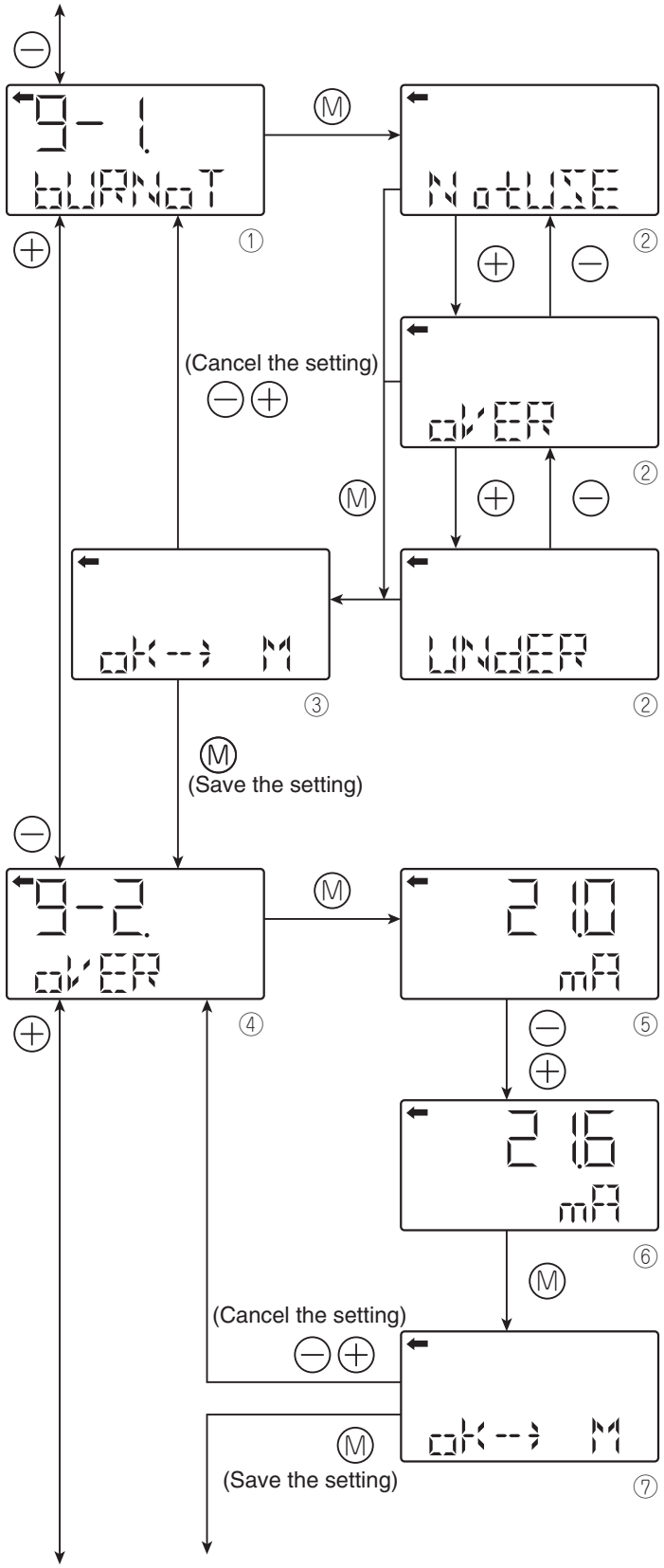


Fig. A: With linear output selected in low cut mode

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

- Press the Ⓜ key on the screen ⑧ to display the screen for changing the outputs below the cut point (⑨).
- Select LIN (linear) or ZERO on the screen ⑨ with the ⊖ or ⊕ key and press the Ⓜ key.
- Select whether the low cut point setting is saved on the screen ⑩.
  Press the Ⓜ key to save the low 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

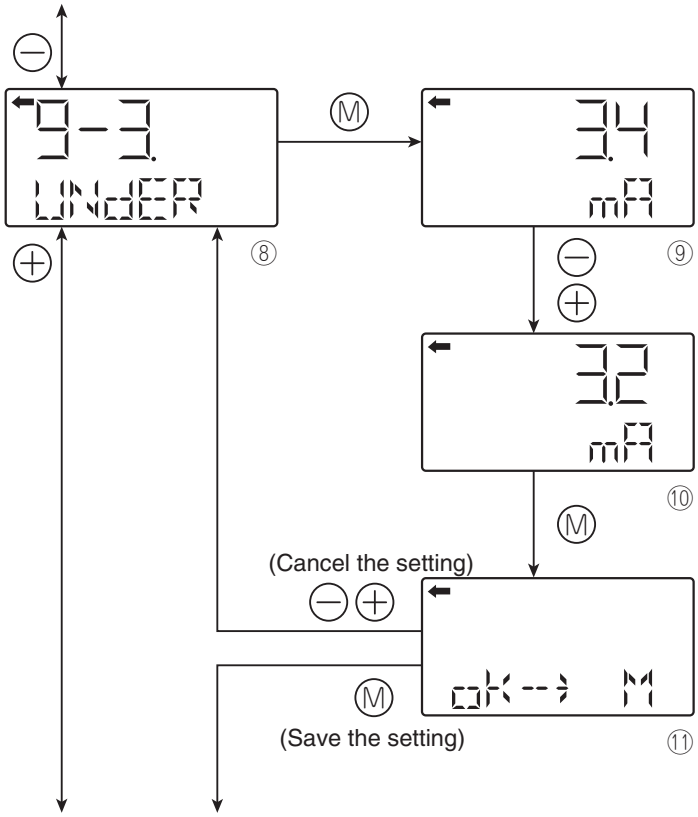
UNDER → UNDERSCALE

- Press the Ⓜ key on the screen ① to display the screen for changing the burnout direction (②).
- Select NotUse, OVER or UNDER on the screen (2) with the ⊖ or ⊕ key and press the Ⓜ key.
- Select whether the burnout direction setting is saved on the screen ③.
  Press the Ⓜ 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 Ⓜ key on the screen ④ to display the screen for changing the burnout current for OVERSCALE (⑤).
- You can change the burnout current with the ⊖ and ⊕ keys on the screen ⑤.
  Settable range:
  Saturation current value (upper limit) ≤ Burnout (OVER) ≤ 22.5 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 ⑦.
  Press the Ⓜ key to save the burnout current setting for OVERSCALE.
  Press the ⊖ or ⊕ key to cancel the setting.

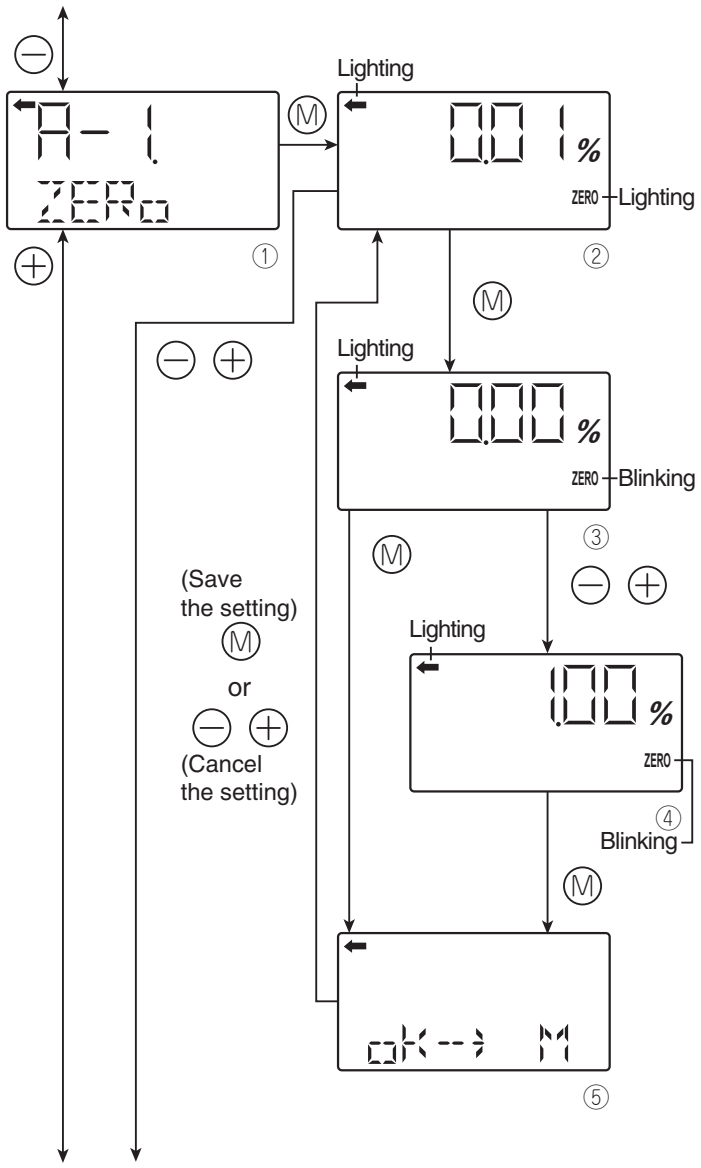


Change of burnout current when UNDERSCALE is selected for the burnout direction

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

- Press the Ⓜ 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 ⊖ and ⊕ keys on the screen ⑨.
  Settable range:
  3.2 mA ≤ Burnout (UNDER) ≤ Saturation current value (lower limit)
- Select whether the burnout current setting is saved on the screen ⑪.
  Press the Ⓜ key to save the burnout current setting for UNDERSCALE.
  Press the ⊖ or ⊕ 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 actual pressure.

Important

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 ±40% of the maximum span
   Span calibration: within ±20% of the set span

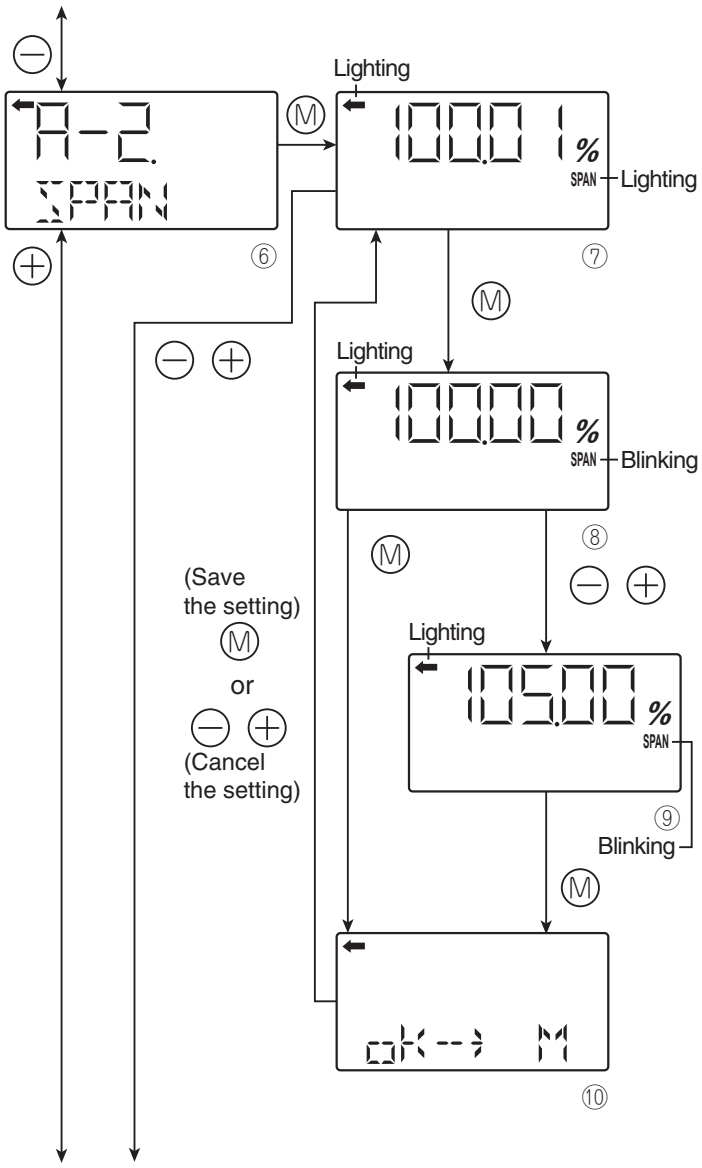
Zero calibration

- Press the Ⓜ key on the screen ① to select the zero calibration mode.
  The measured value and unit on the screen (②) are the same as those in the normal mode and "←" and "ZERO" light up.
- Apply the actual input pressure on the screen ②. After checking the measured value, press the Ⓜ key.
- "ZERO" blinks on the screen ③. Press the Ⓜ key on the screen ③ 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 (%) (④) with the ⊖ and ⊕ keys, and press the Ⓜ key.
  Settable range:

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

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

  * 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 ⑤.
  Press the Ⓜ key to save the zero calibration value setting and return to the screen ②.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ②.
- Check that the zero calibration was performed as intended.
  Press the Ⓜ key to perform a zero calibration again.
  Press the ⊖ or ⊕ key to move to the next screen for item name selection.



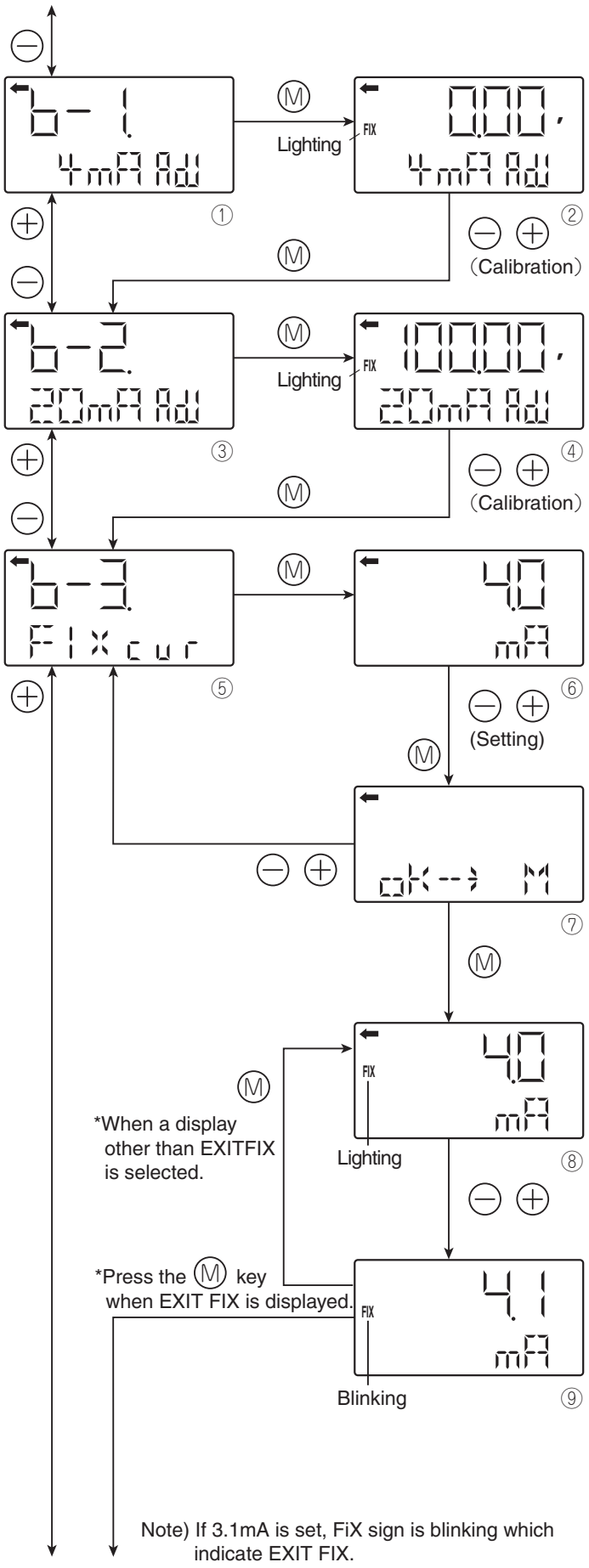
Span calibration

- Press the Ⓜ key on the screen ⑥ to select the span calibration mode.
  The measured value and unit on the screen (⑦) are the same as those in the normal mode and "←" and "SPAN" light up.
- Apply the actual input pressure on the screen ⑦. After checking the measured value, press the Ⓜ key.
- "SPAN" blinks on the screen ⑧. Press the Ⓜ key on the screen ⑧ 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 (%) (⑨) with the ⊖ and ⊕ keys, and press the Ⓜ key.
  Settable range:
  0.000%CS ≤ PH ≤ Saturation current (upper limit) set value (%CS)

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

- Select whether the span calibration value setting is saved on the screen ⑩.
  Press the Ⓜ key to save the span calibration value setting and return to the screen ⑦.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ⑦.
- Check that the span calibration was performed as intended.
  Press the Ⓜ 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 Ⓜ key on the screen ① to display the screen for calibrating the constant current mode 4 mA (②).
- Perform a calibration for 4 mA on the screen ② with the ⊖ and ⊕ keys.
- After the calibration, press the Ⓜ key to move to the screen for calibration of 20 mA.

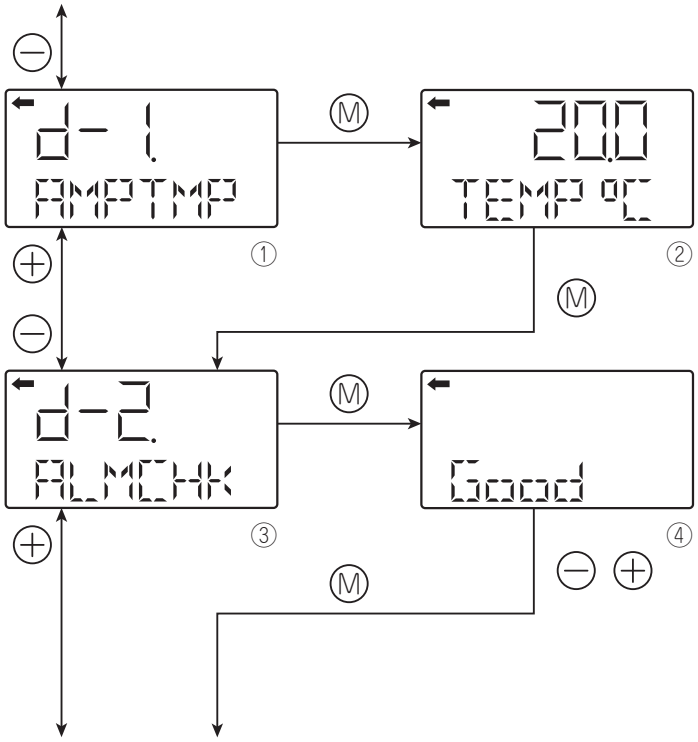
20 mA adjustment

- Press the Ⓜ key on the screen ③ to display the screen for calibrating the constant current mode 20 mA (④).
- Perform a calibration of 20 mA on the screen ④ with the ⊖ and ⊕ keys.
- After the calibration, press the Ⓜ key to move to the constant current output screen.

Constant current output

- Press the Ⓜ key on the screen ⑤ to display the screen for performing a constant current output (⑥).
- Input a current to be output on the screen ⑥ with the ⊖ and ⊕ keys.
  Output value range
  3.2 mA ↔ 21.6 mA ↔ EXITFIX (cancelation) ↔ 3.2 mA
- Press the Ⓜ key on the screen ⑦ to output the input current value and the screen ⑧ appears.
  Press the ⊖ or ⊕ key to cancel the input and return to the screen ⑤.
- Press the ⊖ or ⊕ key on the screen ⑧. FIX blinks and you can reset the constant current output value (⑨). Input a set value with the ⊖ and ⊕ keys, press the Ⓜ key to return to the screen ⑧, and output the reset current.
- Select EXITFIX on the screen ⑨ and press the Ⓜ 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 ⑨ in the items of "6-3. FIX cur" and press the Ⓜ 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 Ⓜ key on the screen ① to display the screen of internal temperature of the transmitter (②).
  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

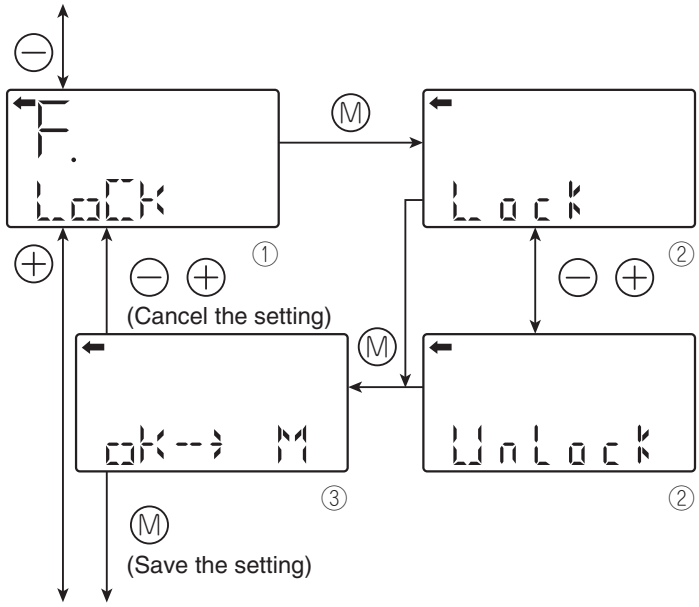
- Press the Ⓜ key on the screen ③ to show the self-diagnosis results (④).
  Press the ⊖ and ⊕ keys to display errors sequentially.

  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

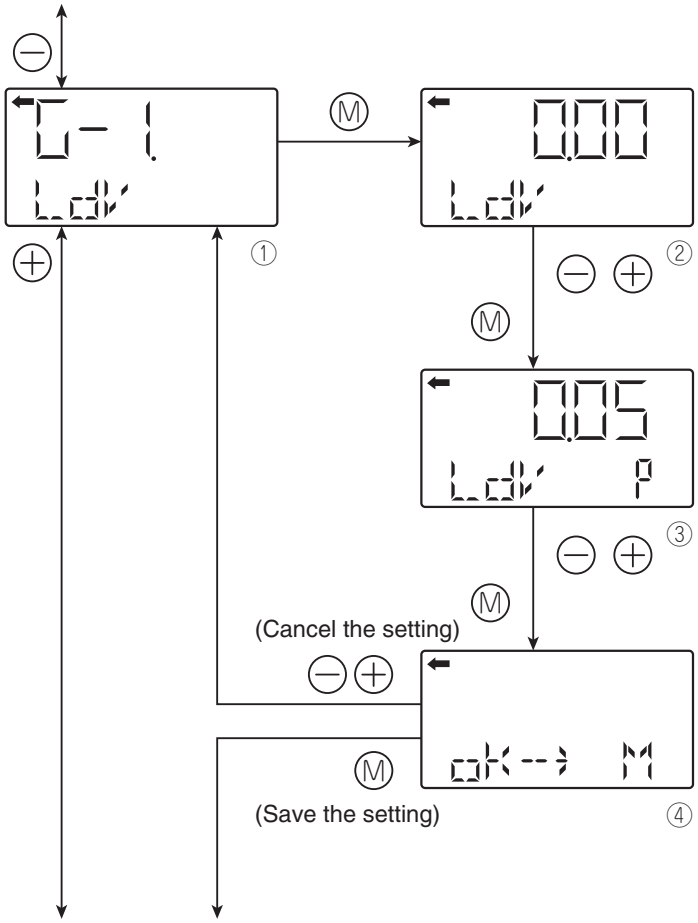
You can lock/unlock the adjustment function of the local configurator unit as follows.

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

- Press the Ⓜ key on the screen ① to display the lock selection screen of adjusting functions (②).
- Select the locking/unlocking of the adjustment functions on the screen ② 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 configrator unit with LCD display.
- Select whether the locking/unlocking of the adjustment functions are saved on the screen ③.
  After selecting the locking/unlocking, press the Ⓜ key to save the setting.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ①.

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



Setting of LCD display range

You can set the indicated value corresponding to 0% (4 mA) and 100% (20 mA) for the actual scale display of the LCD unit.

LDV (Setting of the indicated value of 0% (4 mA))

- Press the Ⓜ key on the screen ① to display the screen for setting the indicated value corresponding to 0% (②).
- Input the indicated value corresponding to 0% of the actual scale on the screen ② with the ⊖ and ⊕ keys.
  Functions of the keys:
  ⊖ key: To decrease the value
  ⊕ key: To increase the value
- To set the decimal point position, press the Ⓜ key on the screen ②. "P" is displayed at the right of the unit name (③) 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 indicated value setting of 0% is saved on the screen ④.
  Press the Ⓜ key to save the indicated value setting.
  Press the ⊖ or ⊕ key to cancel the setting.

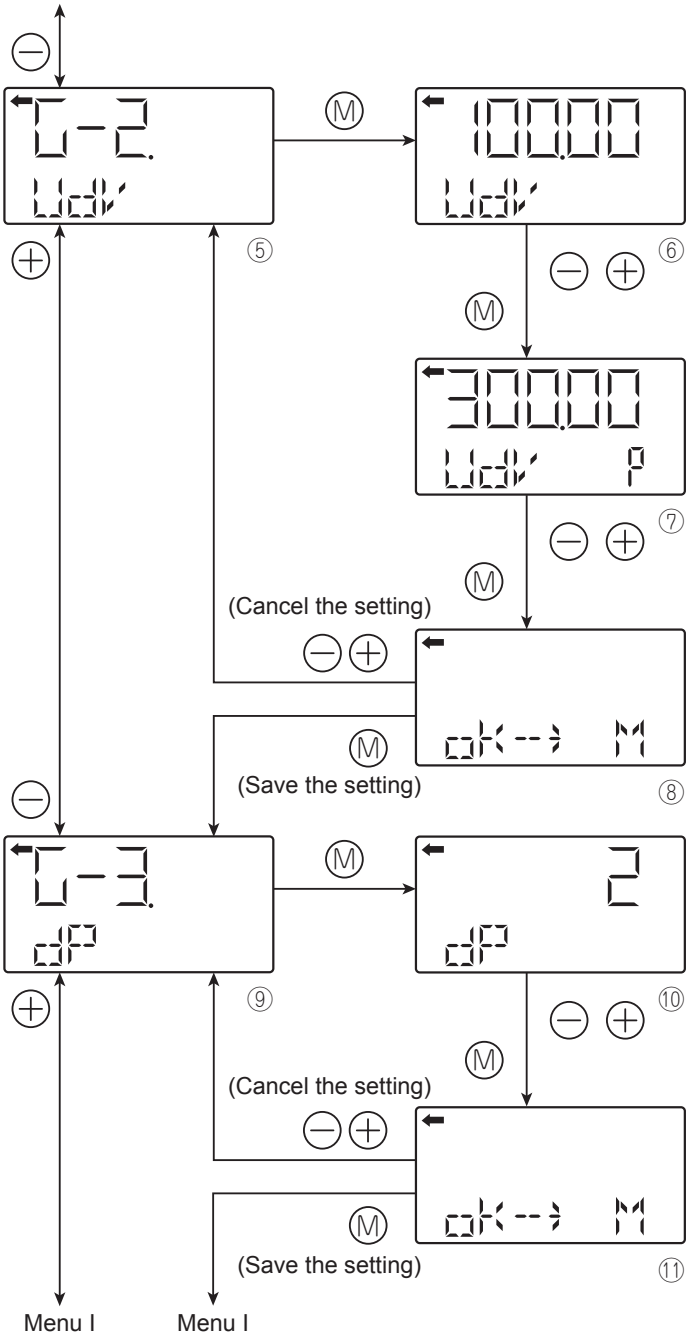
Actual scale value setting conditions

① | Saturation current value (Lower limit) without decimal point | ≤ 99999

② | Saturation current value (Upper limit) without decimal point | ≤ 99999

③ 0 < | (value corresponding to 100% without decimal point) – (value corresponding to 0% without decimal point) | ≤ 20000

④ When decimal point is used for values corresponding to 0% and 100% respectively, the number of digits after the decimal point should be the same.



Actual scale value setting conditions

① | Saturation current value (Lower limit) without decimal point | ≤ 99999

② | Saturation current value (Upper limit) without decimal point | ≤ 99999

③ 0 < | (value corresponding to 100% without decimal point) – (value corresponding to 0% without decimal point) | ≤ 20000

④ When decimal point is used for values corresponding to 0% and 100% respectively, the number of digits after the decimal point should be the same.

UDV (Setting of the indicated value of 100% (20 mA))

- Press the Ⓜ key on the screen ⑤ to display the screen for setting the indicated value corresponding to 100% (⑥).
- Input the indicated value corresponding to 100% of the actual scale on the screen ⑥ with the ⊖ and ⊕ keys.
- Functions of the keys:
  ⊖ key: To decrease the value
  ⊕ key: To increase the value
- To set the decimal point position, press the Ⓜ key on the screen ⑥. "P" is displayed at the right of the unit name (⑦) 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 indicated value setting of 100% is saved on the screen ⑧.
  Press the Ⓜ key to save the indicated value setting.
  Press the ⊖ or ⊕ key to cancel the setting.

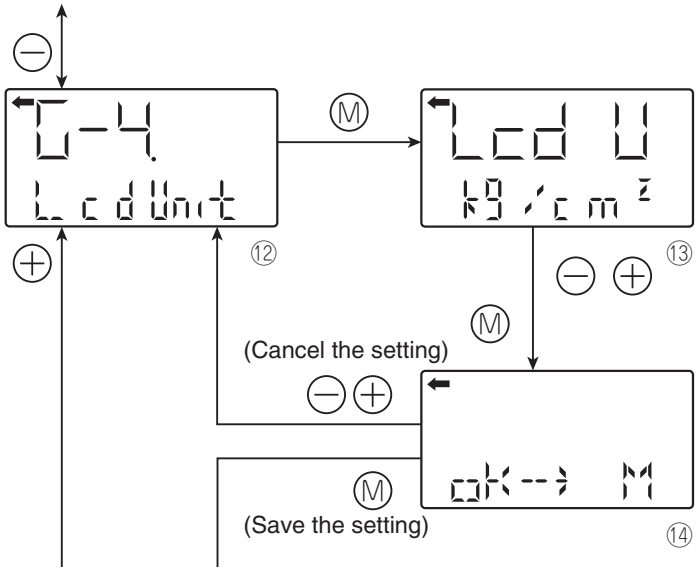
DP setting (number of digits after Decimal Point))

Set the number of digits after decimal point for the LCD indicated value.

- Press the Ⓜ key on the screen ⑨ to display the screen for setting the DP (⑩).
- Input the DP on the screen (10) with the ⊖ and ⊕ keys.
  Setting range:
  $0 \leq DP \leq 4$

	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 ⑪.
  Press the Ⓜ key to save the DP setting.
  Press the ⊖ or ⊕ key to cancel the setting.



LCD Unit (Setting of the actual scale unit)

- Press the Ⓜ 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 Ⓜ key to save the unit setting.
  Press the ⊖ or ⊕ key to cancel the setting.

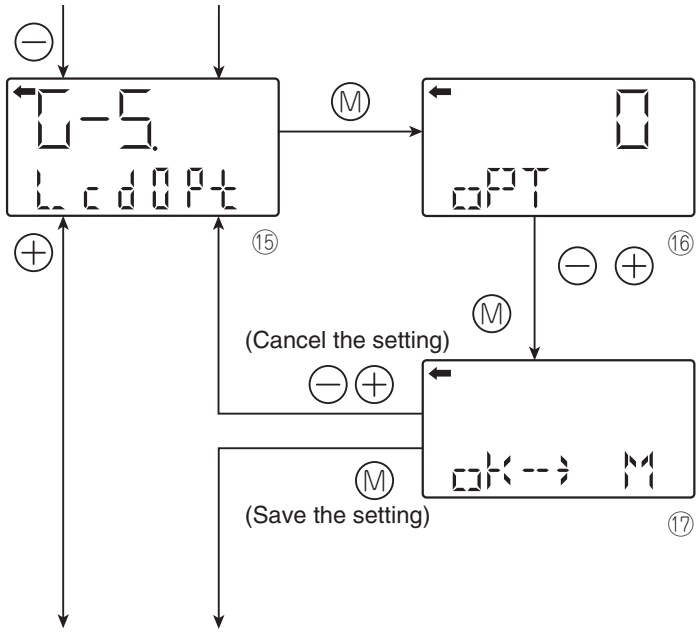
Available unit for FCX-AIII

(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^3/s
kPa	in *	Nm^3/min
hPa	ft *	Nm^3/h
Pa		Nm^3/d
bar		m^3/s
mbar		m^3/min
kg/cm^2 *		m^3/h
g/cm^2 *		m^3/d
mmH_2O *		Nl/s
cmH_2O *		Nl/min
mH_2O *		Nl/h
inH_2O *		Nl/d
ftH_2O *		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.



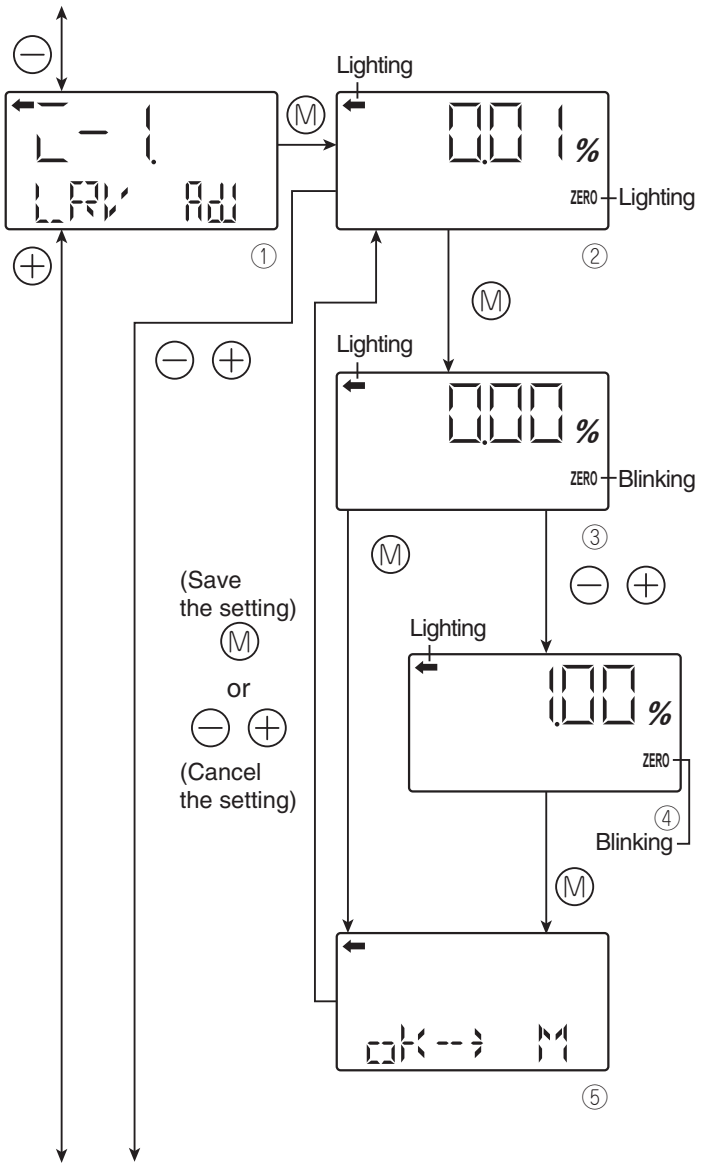
LCD Option

- Press the Ⓜ 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 Ⓜ key to save the option setting.
  Press the ⊖ or ⊕ key to cancel the setting.



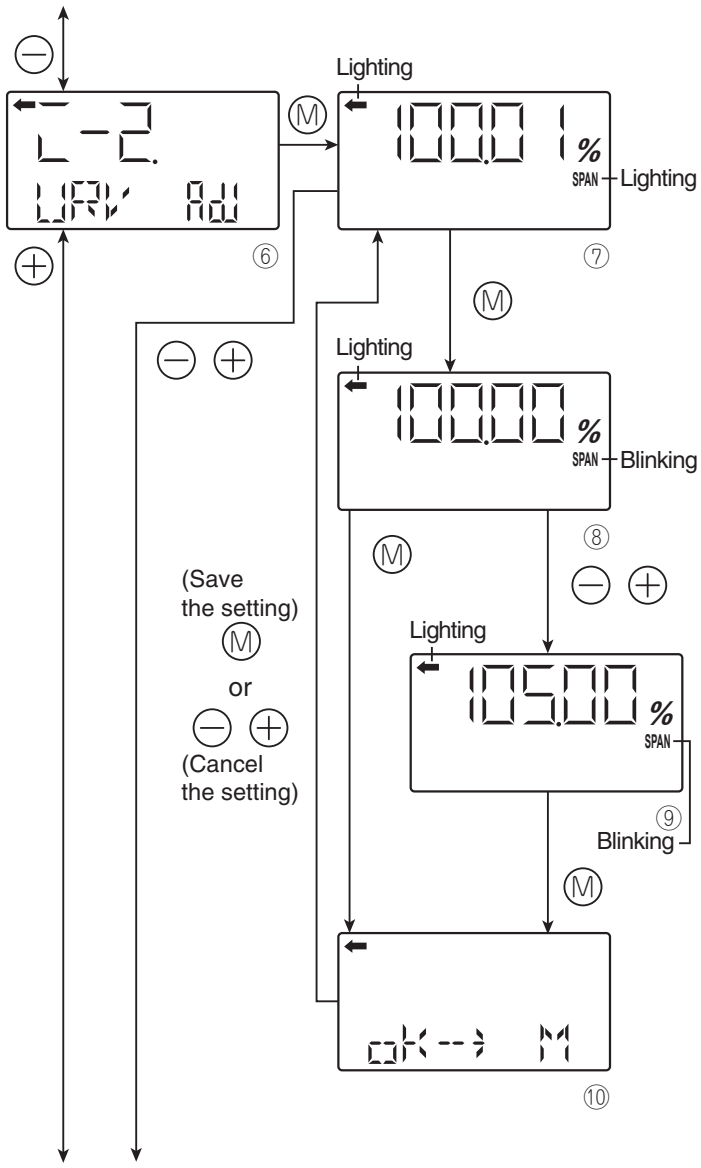
Input-output range adjustment (Rerange: adjustment by LRV/URV change)

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

The input-output range adjustment enables you to change the measurement range by re-adjusting 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 Ⓜ key on the screen ① to select the LRV adjustment mode.
  The measured value and unit on the screen ② are the same as those in the normal mode and "←" and "ZERO" light up.
- Apply the actual input pressure on the screen ②. After checking the measured value, press the (M) key.
- "ZERO" blinks on the screen ③. Press the Ⓜ key on the screen ③ 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 (%) (④) with the ⊖ and ⊕ keys. Press the Ⓜ 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 ⑤.
  Press the Ⓜ key to save the LRV adjustment value setting and return to the screen ②.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ②.
- Check that the zero adjustment (LRV) was performed as intended on the screen ②.
  Press the Ⓜ 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 Ⓜ key on the screen ⑥ to select the URV adjustment mode.
  The measured value and unit on the screen ⑦ are the same as those in the normal mode and "←" and "ZERO" light up.
- Apply the actual input pressure on the screen ⑦. After checking the measured value, press the Ⓜ key.
- "SPAN" blinks on the screen ⑧. Press the Ⓜ key on the screen ⑧ 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 (%) (⑨) with the ⊖ and ⊕ keys. Press the Ⓜ key to set the new measurement range appropriate for the input pressure.
  Settable range:
  0.00% ≤ URV (Note 2) ≤ 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 ⑩.
  Press the Ⓜ key to save the URV adjustment value setting and return to the screen ⑦.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ⑦.
- Check that the span adjustment (URV) was performed as intended on the screen ⑦.
  Press the Ⓜ key to perform a span adjustment again.
- Press the ⊖ or ⊕ key to move to the next screen for item name selection.

CAUTION

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% ≤ LRV (Note 1) ≤ 100.00%

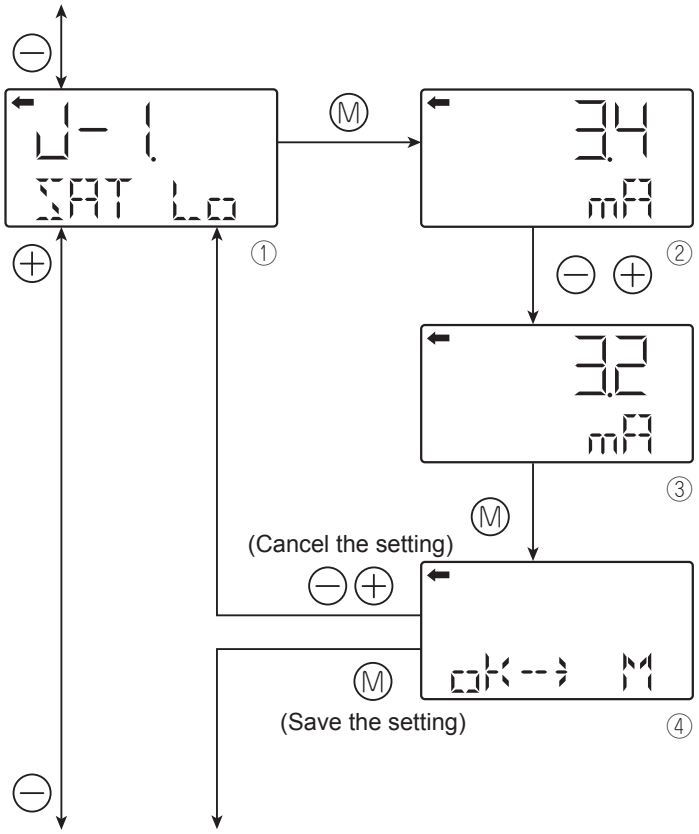
0.00% ≤ URV (Note 2) ≤ Saturation current value (upper limit)

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

⚠ **CAUTION**

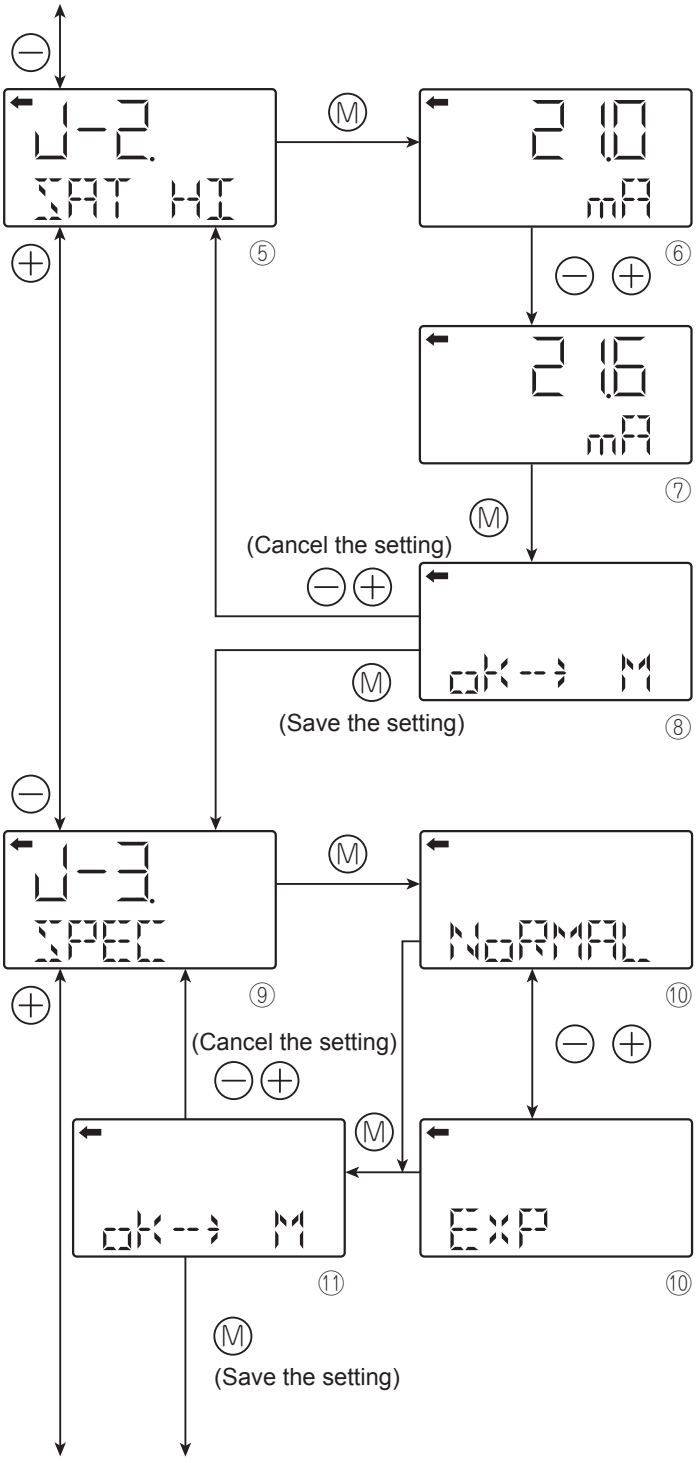
1) You cannot change the saturation current setting if "NoRMAL (normal specification)" is selected at menu "J-3". To change the saturation current setting, select "EXP (expanded specification)" at menu "J-3" first.
2) Relation between "Burnout current" and "Saturation current" is as following.
   3.2mA ≤ Burnout current (UNDER) ≤ Saturation current (lower limit) ≤ 4.0mA
   20.0mA ≤ Saturation current (upper limit) ≤ Burnout current (OVER) ≤ 22.5mA
   Example-1) Setting "Saturation current (lower limit)" into 3.2mA
   Please set "Burnout current (UNDER)" into 3.2mA at menu "9-3" first, then set "Saturation current (lower limit)" in to 3.2mA secondary.
   Example-2) Setting "Saturation current (upper limit)" into 22.5mA
   Please set "Burnout current (OVER)" into 22.5mA at menu "9-3" first, then set "Saturation current (upper limit)" in to 22.5mA secondary.



Value and specification of saturation current

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

- Press the Ⓜ key on the screen ① to display the screen for setting the lower limit of the saturation current (②).
- Input the lower limit on the screen ② with the ⊖ and ⊕ keys.
  Setting range:
  3.2 mA ≤ Burnout current (UNDER) ≤ Saturation current (lower limit) ≤ 4.0 mA
- Select whether the lower limit setting of the saturation current is saved on the screen ④.
  Press the Ⓜ key to save the lower limit setting.
  Press the ⊖ or ⊕ key to cancel the setting.



	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 22.5 mA

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

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

- Press the Ⓜ key on the screen ⑤ to display the screen for setting the upper limit of the saturation current (⑥).
- Input the upper limit on the screen ⑥ with the ⊖ and ⊕ keys.
  Setting range:
  20.0 mA ≤ Saturation current (upper limit) ≤ Burnout current (OVER) ≤ 22.5 mA
- Select whether the upper limit setting of the saturation current is saved on the screen ⑧.
  Press the Ⓜ key to save the upper limit setting.
  Press the ⊖ or ⊕ key to cancel the setting.

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

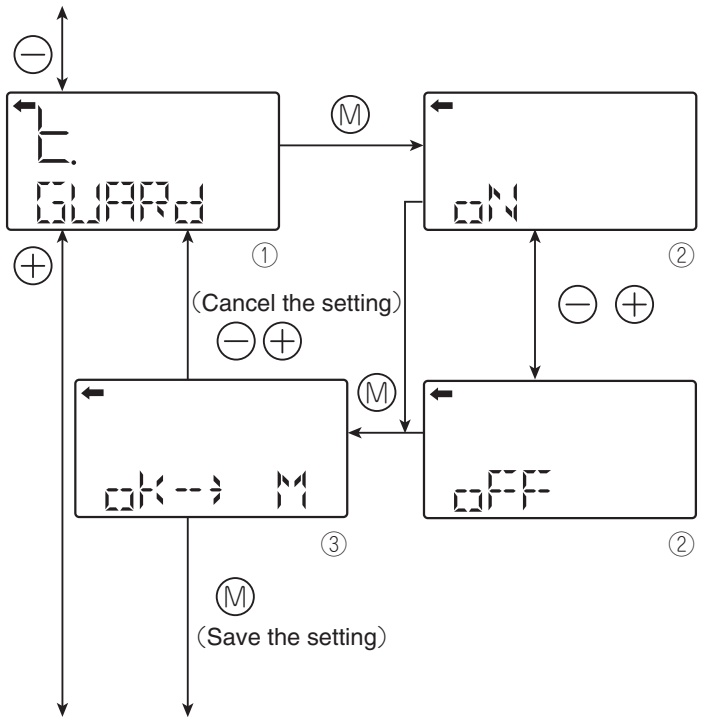
Selection of the burnout & saturation current value specification (normal specification/expanded specification)

- Press the Ⓜ key on the screen ⑨ to display the screen for selecting the burnout & saturation current value specification (⑩).
- Select "NoRMAL (normal specification)" or "EXP (expanded specification)" on the screen ⑩ 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 22.5 mA Settable in increments of 0.1 mA

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

- Select whether the NoRMAL/EXP setting is saved on the screen ⑪.
  Press the Ⓜ key to save the NoRMAL/EXP setting.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ⑨.

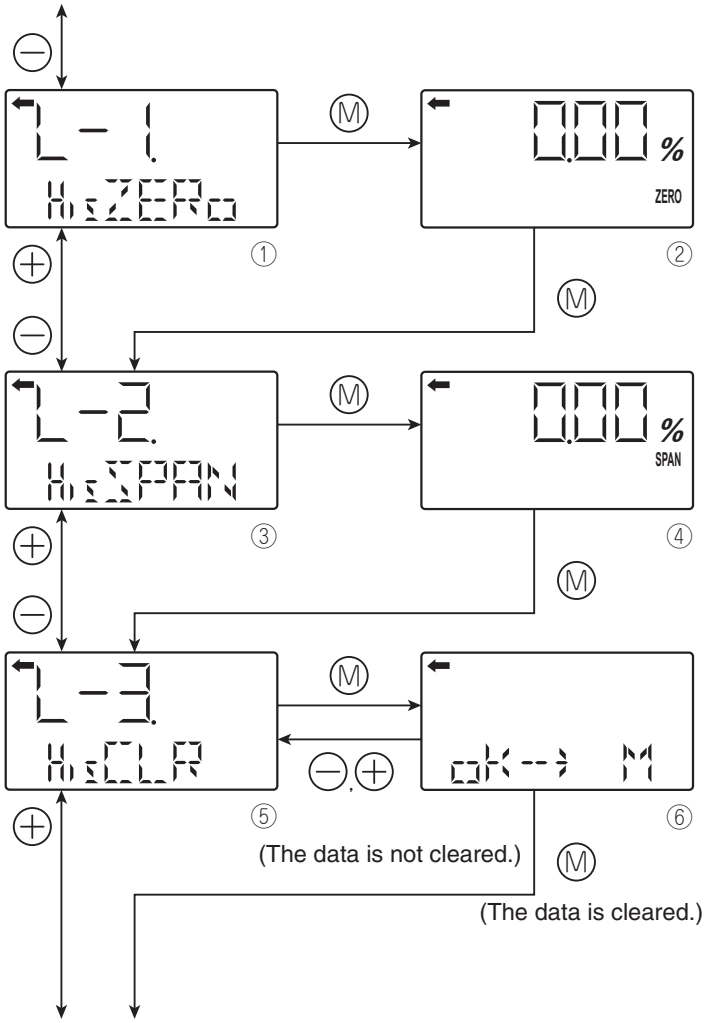


Protective function of set value (Write protect)

- Press the Ⓜ key on the screen ① to display the screen for setting/canceling write protect (②).
- Select oN (setting)/oFF (canceling) on the screen ② with the ⊖ and ⊕ 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 ③.
  After selecting oN/oFF, press the Ⓜ key to save the setting.
  Press the ⊖ or ⊕ key to cancel the setting and return to the screen ①.

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 Ⓜ key on the screen ① to display the zero calibration value (②).
- Press the Ⓜ key on the screen ② to move to "Display of span calibration data for users."

Display of span calibration data for users

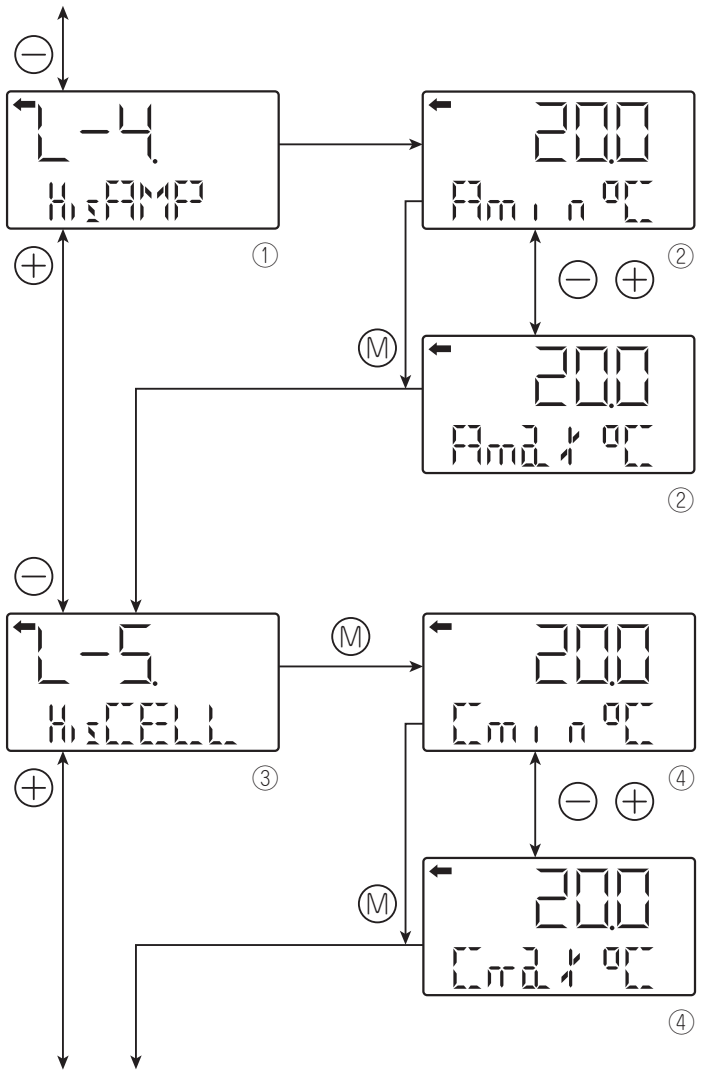
- The span calibration value at the time is displayed.
- Press the Ⓜ key on the screen ③ to display the span calibration value (④).
- Press the Ⓜ key on the screen ④ to move to "Clearing of zero/span calibration data."

Clearing of zero/span calibration data

- The zero/span calibration value at the time is cleared.
- Press the Ⓜ key on the screen ⑤ to display the screen for confirming the zero/span calibration value (⑥).
- Press the Ⓜ key on the screen ⑥ to clear the zero/span calibration data.
  Press the ⊖ or ⊕ key to return to the screen ⑤ without clearing the data.

CAUTION

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 Ⓜ key on the screen ① to display the min/max values of amplifier temperature (②).
- Select and display the min/max values on the display ② 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 Ⓜ key on the screen ② to move to “Display of min/max of cell temperature history information.”

Display of min/max of cell temperature history information

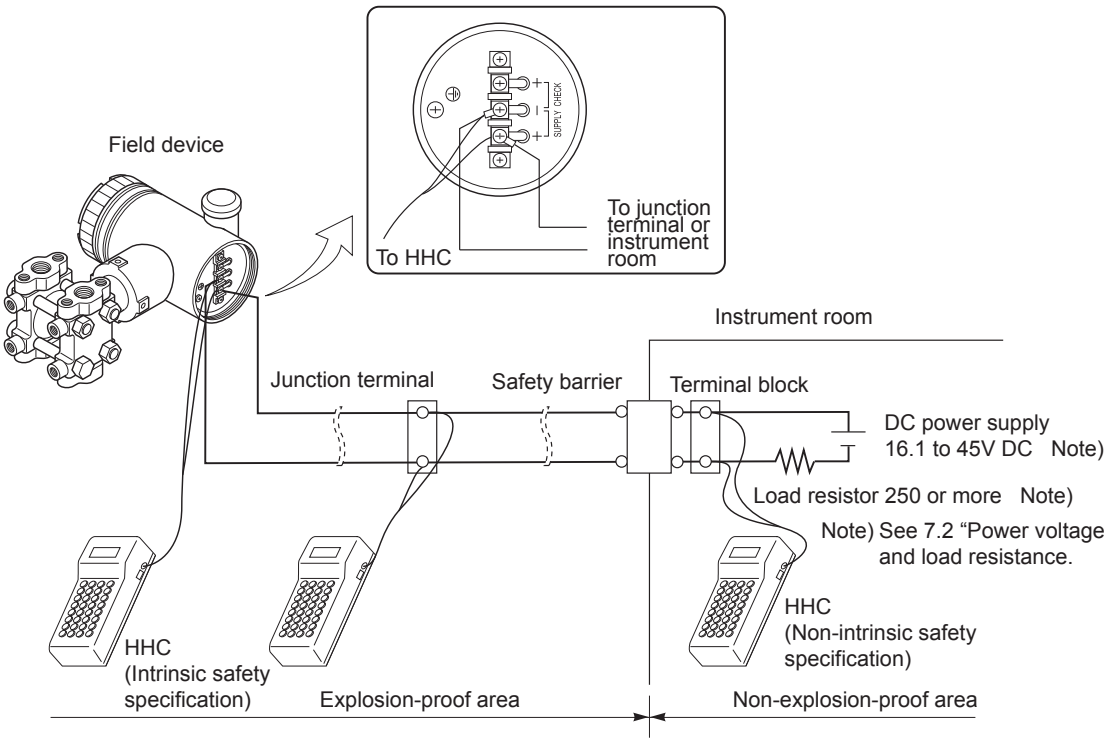
- The min/max values of the cell temperature history are displayed.
- Press the Ⓜ key on the screen ③ to display the min/max values (④).
- Select and display the min/max values on the display ④ with the ⊖ and ⊕ keys.
  Select “Cmin” to display the min value of the cell temperature history.
  Select “Cmax” to display the max value of the cell temperature history.
- Press the Ⓜ key on the screen ④ to return to “TAG No.”

4.3 Adjustment with HHC

To operate the FCX-AIII series transmitter, the HHC is used for each adjustment.
Startup and usage of the Hand Held Communicator (HHC) are detailed in the instruction manual for HHC. Please refer to this manual before commencing adjustment.

4.3.1 Connection of HHC

The HHC can be connected to the transmitter, junction terminal or the terminals in the instrument room.



⚠ DANGER	In the case of a explosion-proof transmitter, never connect the HHC to the terminal block of the transmitter in hazardous area installations.

Cautions for operation

⚠ DANGER	To change the set value, check that the control loop of the host system (such as an instrumentation system) can be performed manually.

Important

- To set, change, adjust the field device, set the protector key on the right side of the HCC to ON. The above operations cannot be performed when the key is OFF.
- When "Write protect setting" of the transmitter is ON, changing parameter and calibrating are disable. For changing parameter and calibrating, please set "Write protect setting" of the transmitter into OFF first.
- After adjustment of the transmitter, it should be kept energized for about 10 seconds to write the adjustment results into memory.

4.3.2 Outline of HHC operation

The following shows the flow of key operations, explained for FXW Version 7.1 (FXW□□-□□ 1-□4).

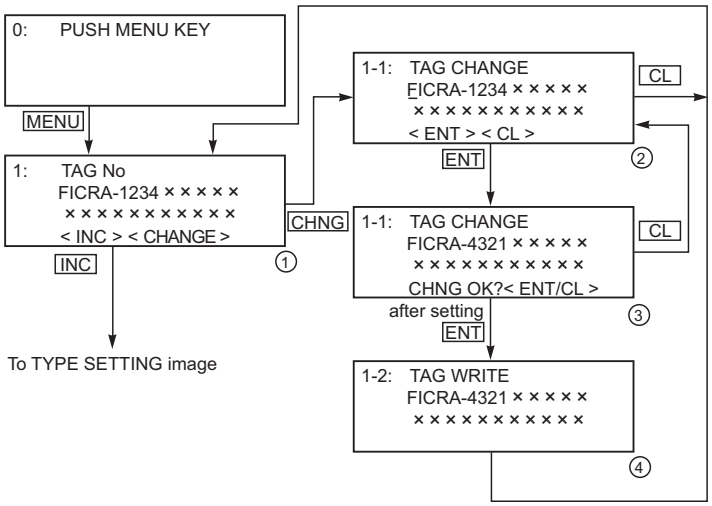
FXW prior to Version 6.* are not available of operation of FCX-AIII sereis transmitter.

In this case, the user is requested to contract our office for ROM Version Up.

Classification			Display symbol	Key symbol	Referential page
1	TAG No.	INC	1: TAG No.	MENU	45
2	Type	INC	2: TYPE	MENU ⇨ INC	46
3	Display of serial No.	INC	3: SERIAL No.	MENU ⇨ INC ⇨ INC	46
4	Industrial value unit	INC	4: UNIT	UNIT	47
5	Range limit	INC	5: RANGE LIMIT	UNIT ⇨ INC	48
6	Range change (LRV,URV)	INC	6: RANGE	RANG	48
7	Damping adjustment	INC	7: DAMPING	DAMP	49
8	Output mode and value	INC	8: OUTPUT MODE	LIN / √	50
9	Burnout direction	INC	9: BURNOUT	LIN / √ ⇨ INC	51
A	Zero/span adjustment	INC	A: CALIBRATE	CALB	52
B	Calibration of output circuit	INC	B: OUTPUT ADJ	OUT	53
C	Indication of measured data	INC	C: DATA	DATA	54
D	Self-diagnosis	INC	D: SELF CHECK	DATA ⇨ INC	54
E	Printer function	INC	E: PRINT	DATA ⇨ INC ⇨ INC	55
F	Lock of adjustment functions	INC	F: XMTR EXT. SW	DATA ⇨ INC ⇨ INC ⇨ INC	56
G	Indication of digital indicat	INC	G: XMTR DISPLAY	DATA ⇨ INC ⇨ INC ⇨ INC ⇨ INC	57
H	Programmable linearization function	INC	H: LINEARIZE	DATA ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC	60
I	Rerange (Set LRV/URV calibration)	INC	I: RERANGE	DATA ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC	62
J	Saturation current value and specification	INC	J: SATURATE CUR	DATA ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC	63
K	Write protect	INC	K: WRITE PROTCT	DATA ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC	64
L	History information	INC	L: HISTORY	DATA ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC ⇨ INC	66

4.3.3 Operating procedure

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



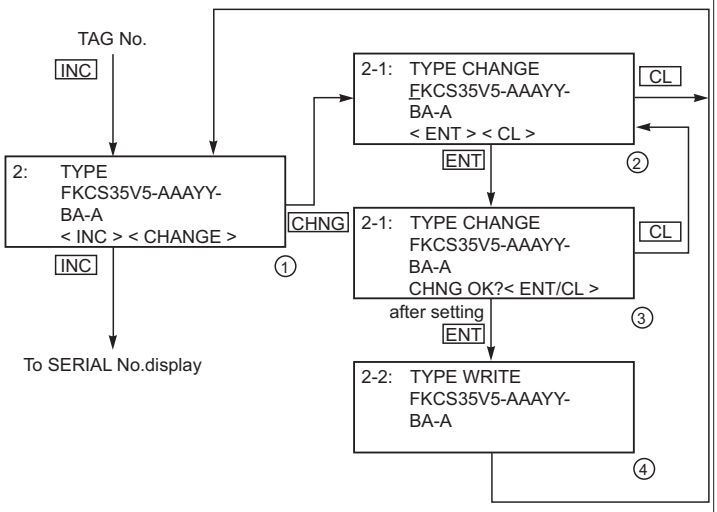
TAG NO.

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.

Available characters are as below.

Numbers: 0 - 9
Alphabets: A - Z (Capital letter only)
Period
Space
Minus (Hyphen)

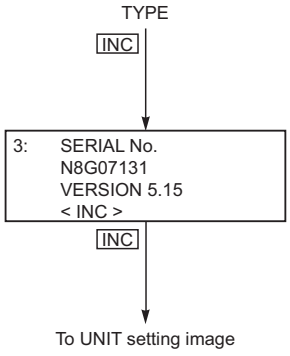
- After PUSH MENU KEY is displayed, press the <MENU> key to display TAG NO.
- To make changes press the <CHNG> key and the cursor will be displayed under display ①.
- Set the alphanumeric keys as necessary under display ②.
  To set the alphabet, press the <CHNG ALHA> key first.
  Using < ◁ >< ▷ > keys, cursor position can be moved.
- At the completion of setting, press the <ENT> key and a prompt is displayed check entry under display ②.
- If the entry is correct, press the <ENT> key to input it to the field device under display ③ and ④ and the initial image ① is displayed.
- To display TYPE display, press the <INC> key under display ①.



TYPE

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

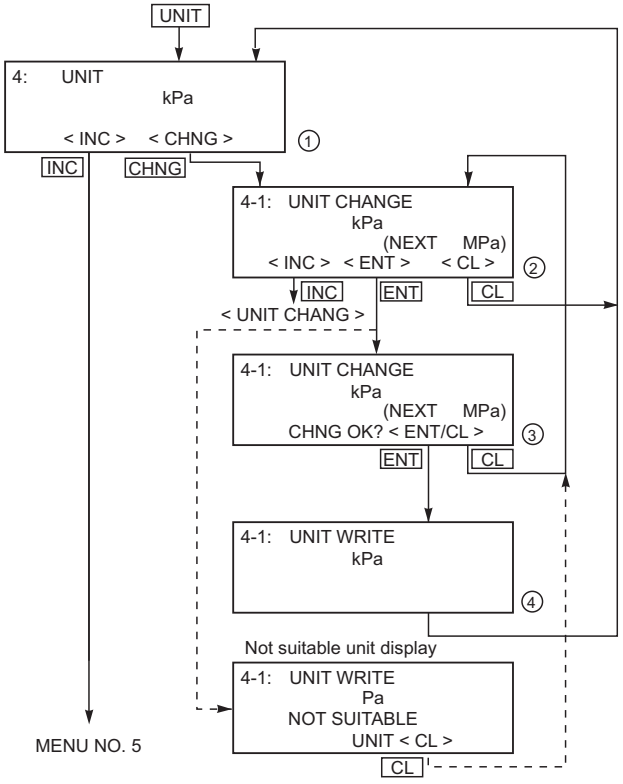
- After TAG NO. is displayed, press the <INC> key to display TYPE image.
- To make changes press the <CHNG> key under display ① and the cursor will be displayed under display ②.
- Set the alphanumeric keys as necessary under display ②.
  To set the alphabet, press the <CHNG ALHA> key first.
  Using < ◁ >< ▷ > 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 NO., press the <INC> key under display ①.



Display of SERIAL NO.

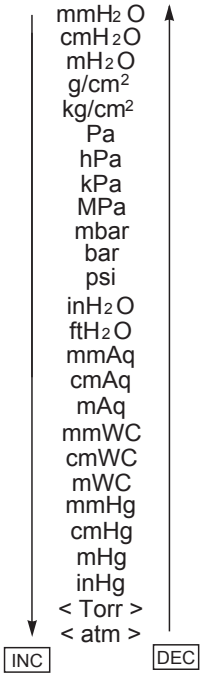
SERIAL NO. and transmitters software version are displayed.

- After setting TYPE, press the <INC> key to display SERIAL NO. and software version of transmitter.
- By pressing the <INC> key, UNIT setting image is displayed.



Industrial value unit

Available unit for FCX-AIII



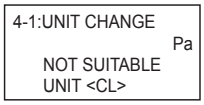
Note: The mark < > is settable for absolute pressure transmitter only.

- 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.

Important

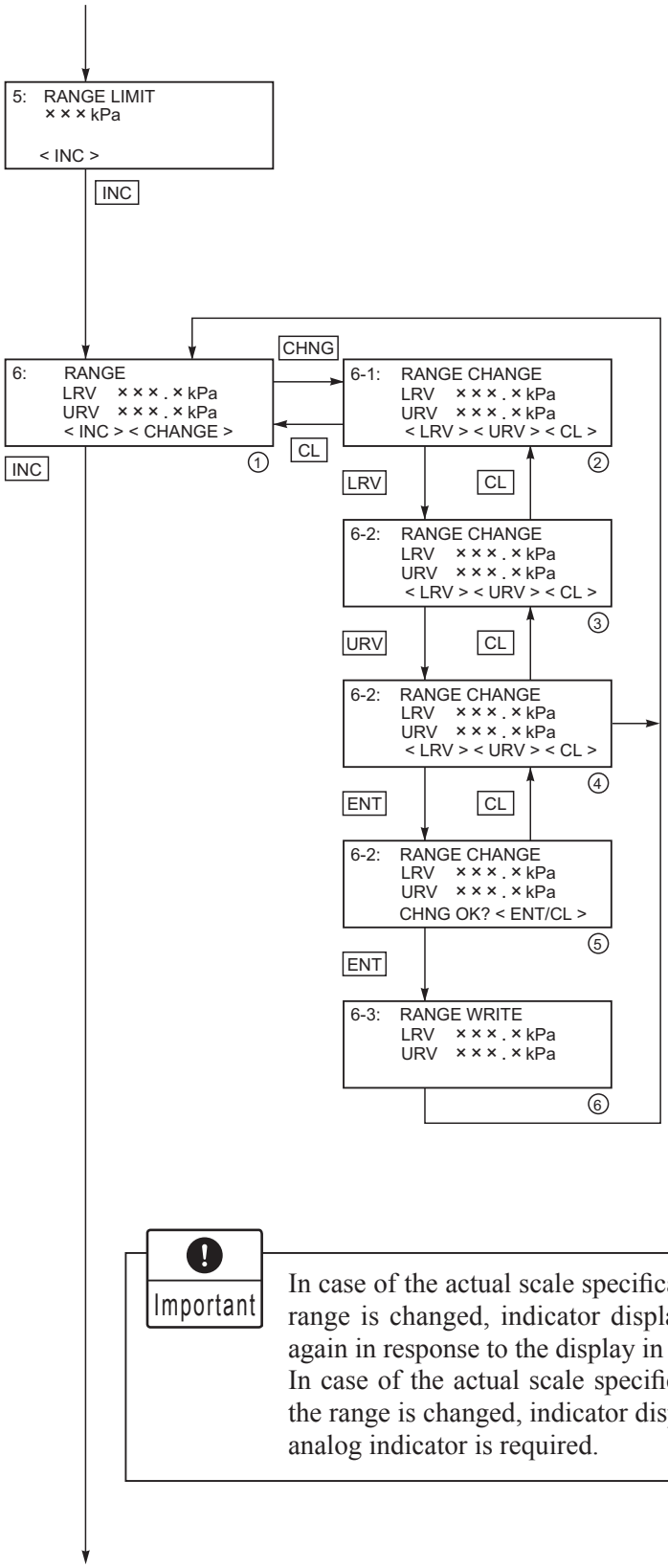
The unit of industrial value is set according to the range as ordered, but the display resolution lowers depending on the unit being set.

When



is displayed upon changing the unit of industrial value, output cannot be displayed in the engineering unit selected.

In this case, press the CL key and change the engineering unit to a different one.



Range limit

Indicates the maximum measuring range of this transmitter.

Range change (LRV, URV)

LRV: Lower range value (0% point)

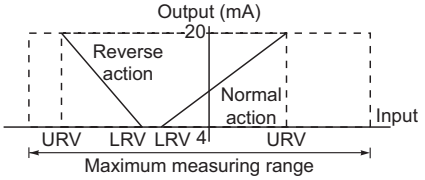
URV: Upper range value (100% point)

- 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.

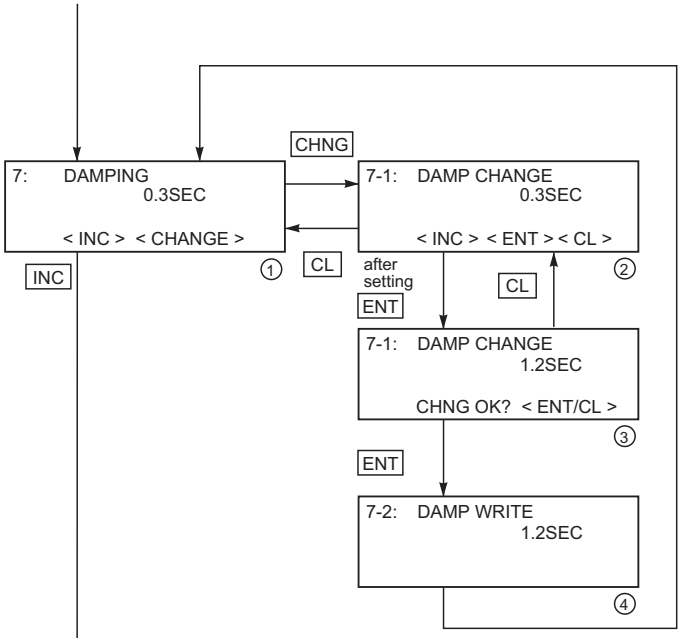
- When pressing <+/–> under display ③, ④, negative value is available.

Selectable setting range



Important

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

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.

Input time constant value under display ②, time constant can be changed.

Selectable time constant value:
0.06 to 32 sec (two significant figure)

Note 1) In the case of FCX-AIII series transmitters, when there are no damping, then 0.12 sec is appeared on HHC.

Note 2) The above damping constants are used only for the electronics unit. The detecting unit has its own constants independent of the electronics unit (for details, refer to the data sheet).

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.

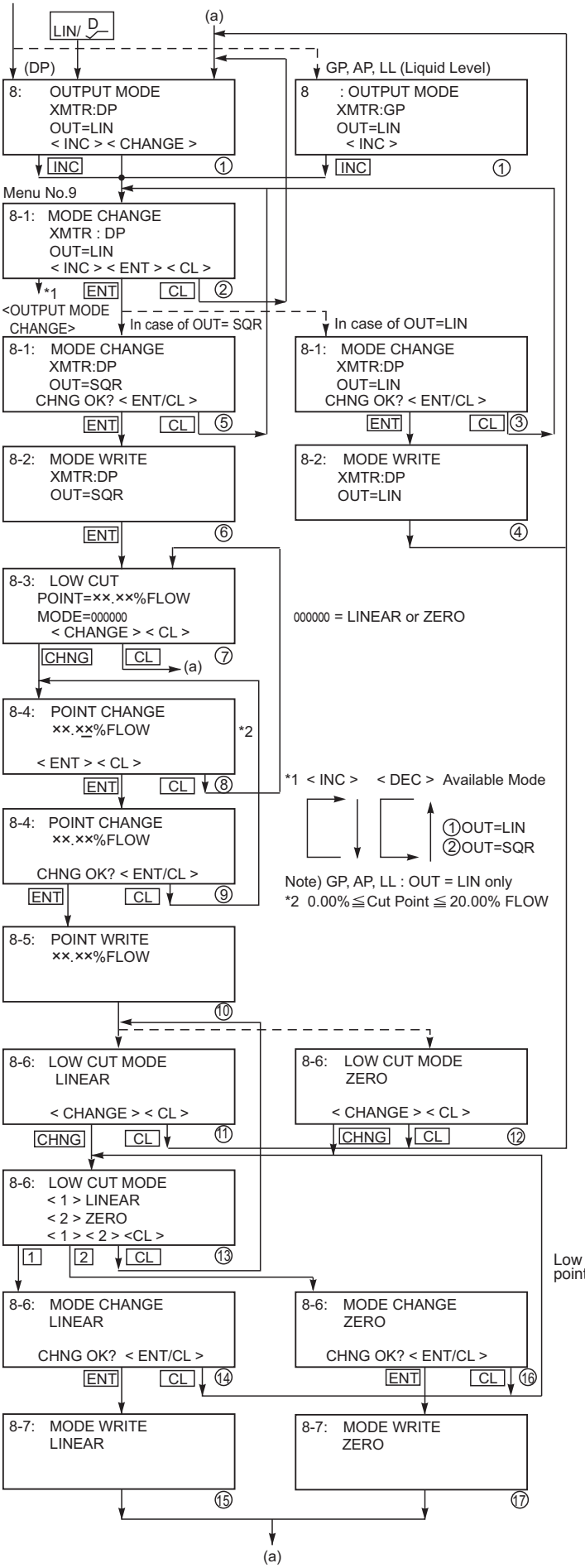
   Oscillation frequency: 10 to 150 Hz
   Within ±0.25% of URL/(9.8m/s^2)

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	1/10 or lower	

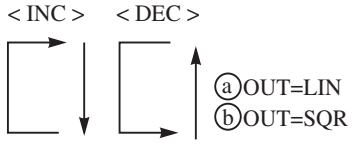
Note) In the oscillation range from 10 to 150Hz, the output fluctuation (oscillation) becomes the maximum at 10Hz, that is, the lowest frequency.



Output mode

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



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%. 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. 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).

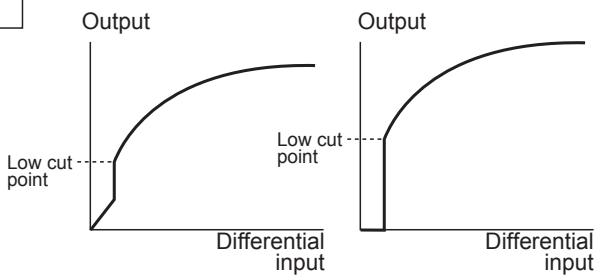
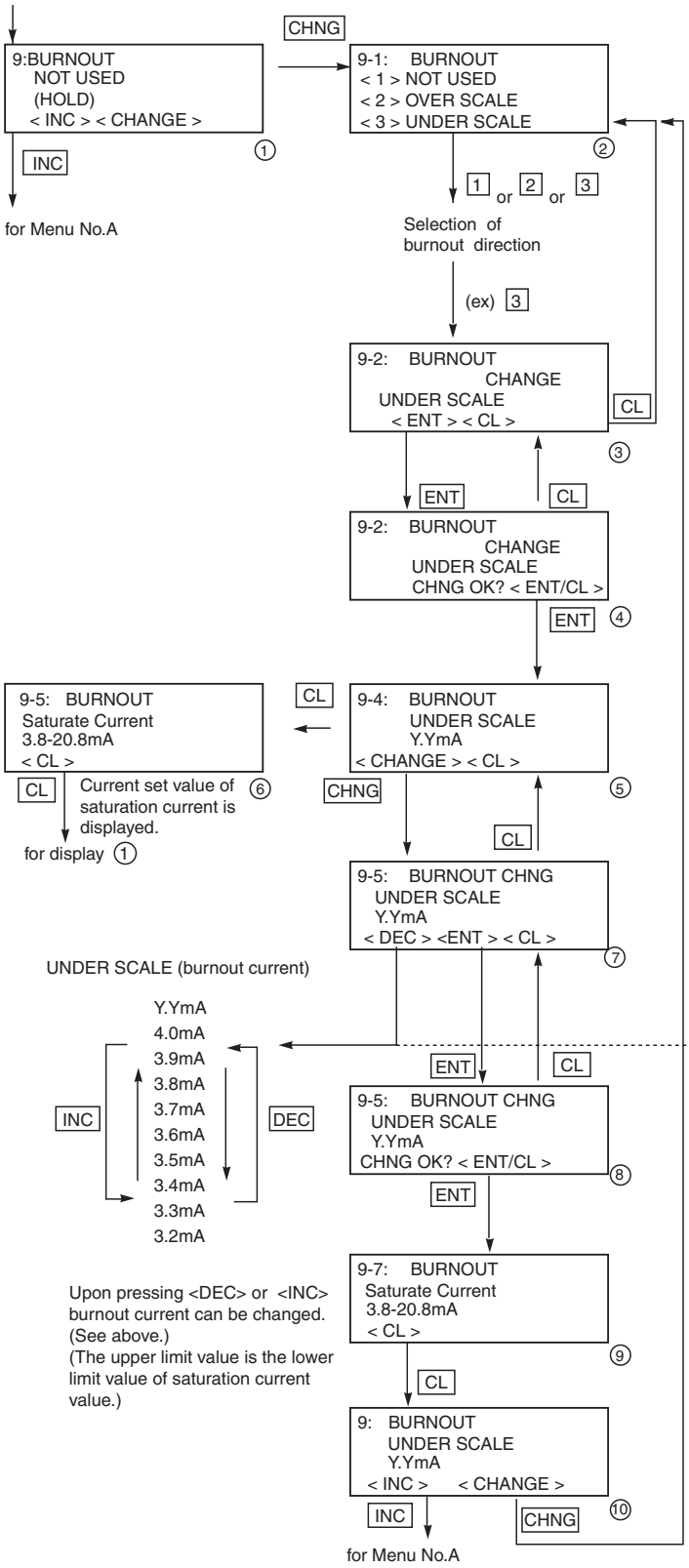


Fig. A: With linear output selected in low cut mode

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 and value

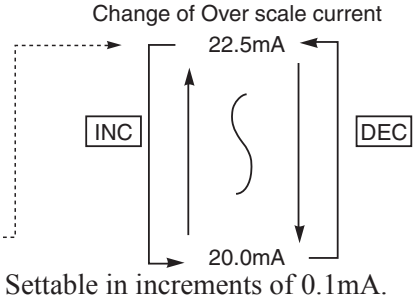
Used for selecting output at occurrence of a fault in the detecting unit. Burnout direction is selectable under display ②.

- 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 = Current set value

  Note) Output value just before the occurrence of trouble is given in the output hold mode.
- OVER SCALE → Over scale (Output saturation current value to 22.5mA)
  Saturation current = Current set value
- UNDER SCALE → Under scale (Output 3.2mA to saturation current value)
  Saturation current = Current set value



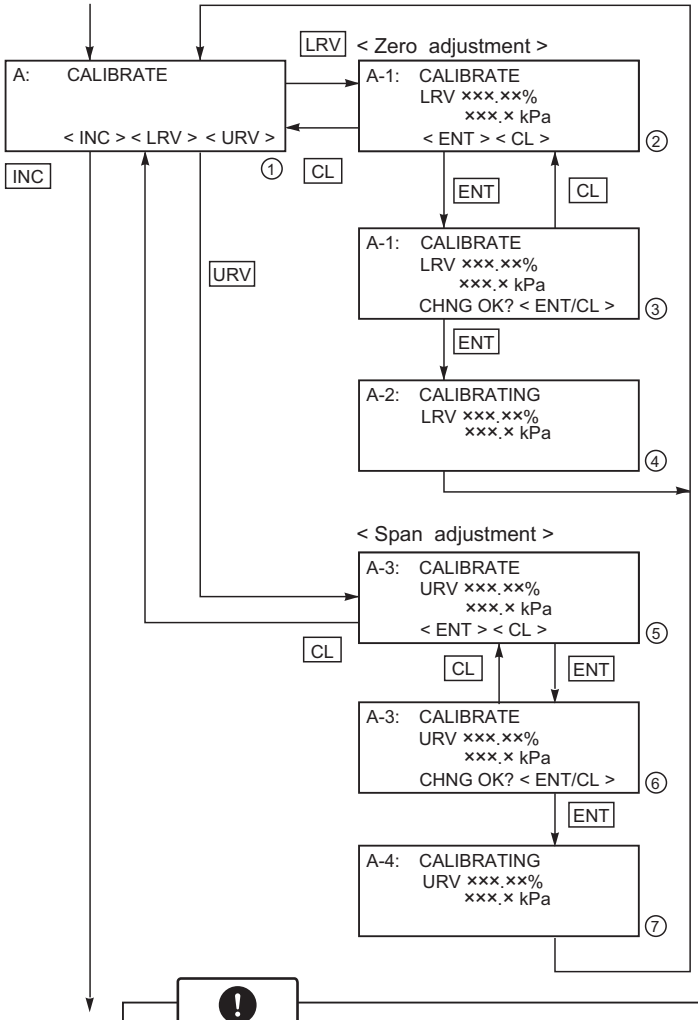
Settable in increments of 0.1mA.

(Lower limit value is the upper limit value of saturation current value.)

*Specification of the saturation current value (Upper limit, Lower limit) is changeable according to the "J. Saturation current value and specification setting".

The lower limit value of saturation current value is settable up to 4.0mA at extended specifications. (3.2mA to 4.0mA)

Display symbol of Menu No.9 is "9: BURNOUT EXP." at extended specifications.



Zero/span adjustment

Zero and span are adjustable by applying an actual pressure.

When pressing <LRV> under display ①, the screen for zero adjustment ② appears, and that for span adjustment ⑤ appears when pressing <URV>.

Under display ②, after applying actual pressure equal to zero point, press <ENT> two times. Zero adjustment will be over.

When adjustment is made at any point other than zero, input the pressure value at that point at the display of ②, then press the <ENT> key at the display of ③ while applying a corresponding pressure to the transmitter.

Under display ⑤, after applying actual pressure equal to desired span, press <ENT> two times. Span adjustment will be over.

When adjustment is made at any point other than span, input the pressure value at that point at the display of ⑤, then press the <ENT> key at the display of ⑥ while applying a corresponding pressure to the transmitter.

Important

Press LRV or URV at display of ①.

When the following is displayed, it means that calibration can not be made because Menu No. H: LINEARIZE is effective. In this case, set INVALID on the panel of No. H: LINEARIZE.

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

1. Span adjustment should be performed after zero adjustment is completed.
2. When the actual input exceeds the adjustable range, [NOT CALB <CL>] is displayed. In this case, adjustment is required again.

Adjustable range

Zero adjustment: Within ±40% of maximum span
Span adjustment: Within ±20% of calibrated span

3. When the adjustment point does not meet the following condition, [SETTING ERR<CL>] is displayed. In this case, adjustment is required again.

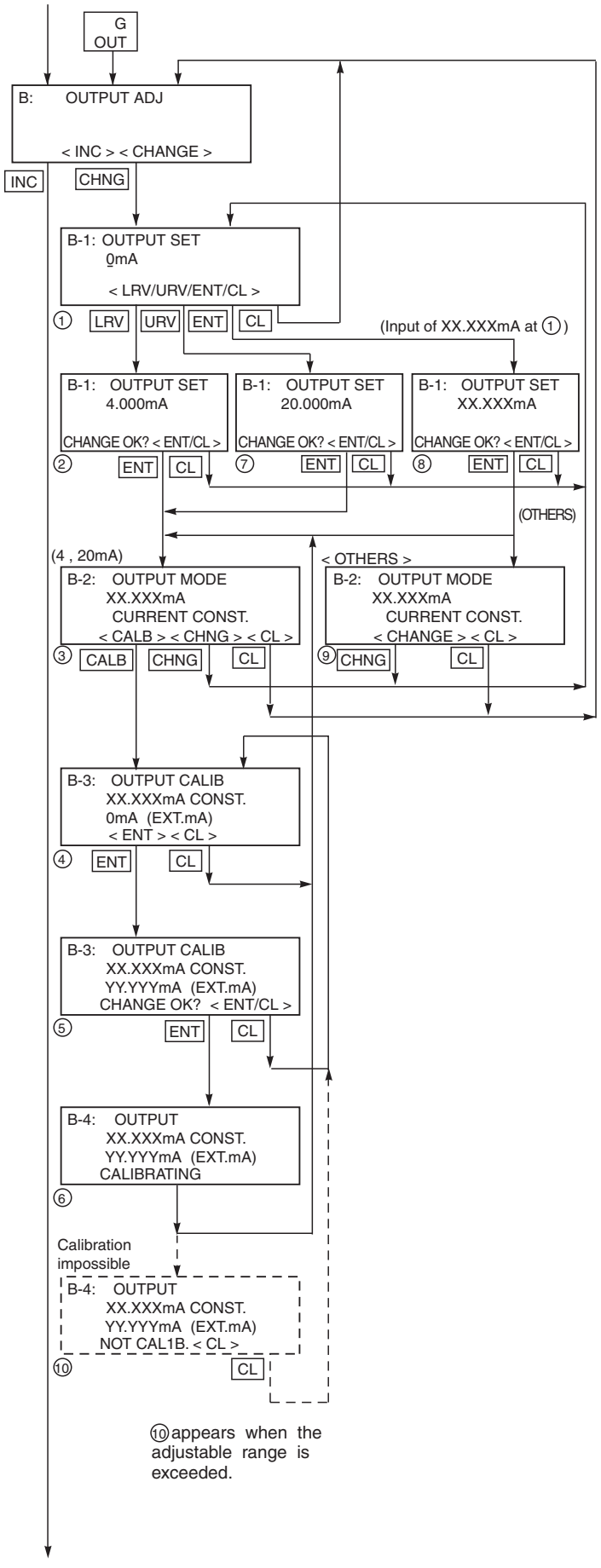
Adjustment point setting condition

$-1.000\%CS^{(*)} \leqq PL \leqq 100.000\%CS^{(*)}$ $\quad 0.000\%CS^{(*)} \leqq PH \leqq 105.000\%CS^{(*)}$

$$PL = \frac{\text{(Lower adjustment point)} - LRV}{URV - LRV} \times 100$$

$$PH = \frac{\text{(Higher adjustment point)} - LRV}{URV - LRV} \times 100$$

(*) : CS (Calibrated Span) is equal to measuring 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 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 3.2 to 22.5mA 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 ⑤, the output circuit is calibrated when pressing <ENT>.

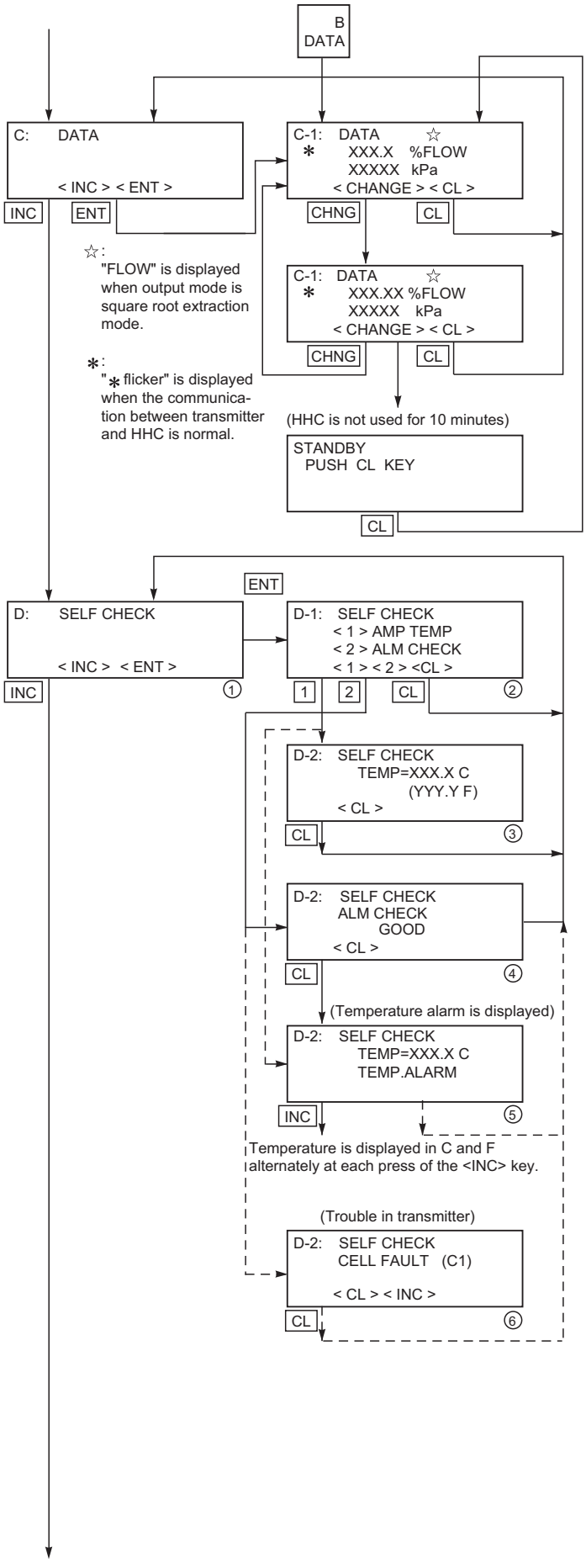
Important

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

```
B:    OUTPUT ADJ

      <INC>  <CHANGE>
```

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.

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= ×××.×˚C

     <CL>
```

When temperature alarm is detected:

```
D-2: SELF CHECK
        TEMP= ×××.×˚C
        TEMP. ALARM
     <CL>
```

When no error has occurred:

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

When an error has occurred:

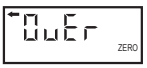
```
D-2: SELF CHECK
     CELL FAULT (C1)

     <CL>  <INC>
```

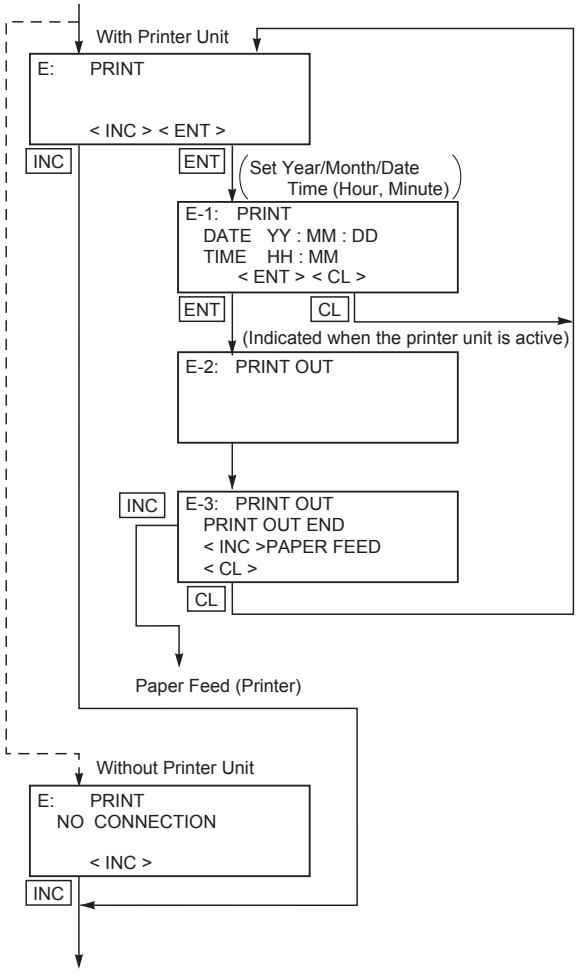
For contents of error, refer to "Contents of message" on the next page.

[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.

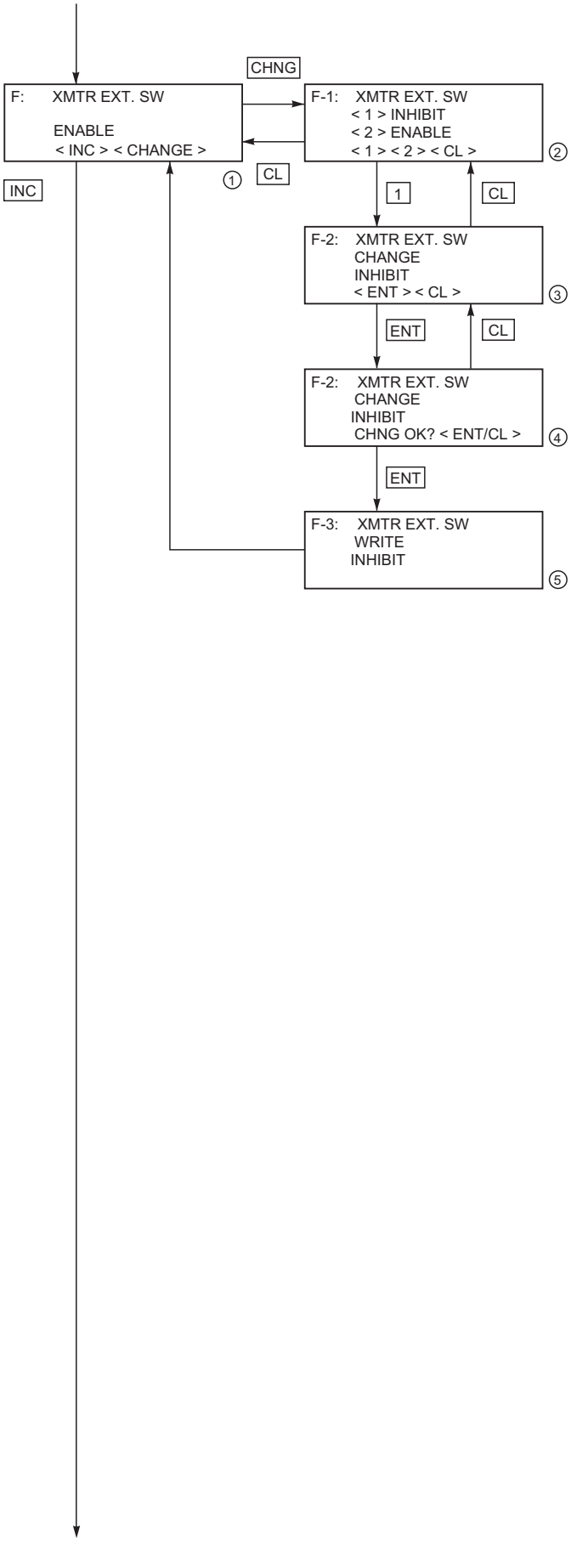
Message	Indication on digital indicator	Cause	Remedy
CELL FAULT (C1) ⟨ CELL FAULT (C9)	FL-1	Error of detecting unit	Replacement of detecting unit
EEPROM (AMP) FLT	FL-2	EEPROM error on amplifier side	Replacement of amplifier
EEPROM (CELL) FLT	FL-3	EEPROM error on cell side	Replacement of detecting unit
TEMP. ALARM	T.ALM (*1) 	Transmitter temperature is not within the allowable range (–50 to 95°C).	Transmitter temperature is notrmalized.
XMTR FAULT	FL-1	Amplifier error	Replacement of amplifier
	OVER (*1) 	Input pressure is saturation current value (upper limit)	• Properly controlled. • Set measuring range (LRV, URV) properly.
	Under (*1) 	Input pressure is saturation current value (lower limit)	• Properly controlled. • Set measuring range (LRV, URV) properly.

(*1) Real indication



Printer function

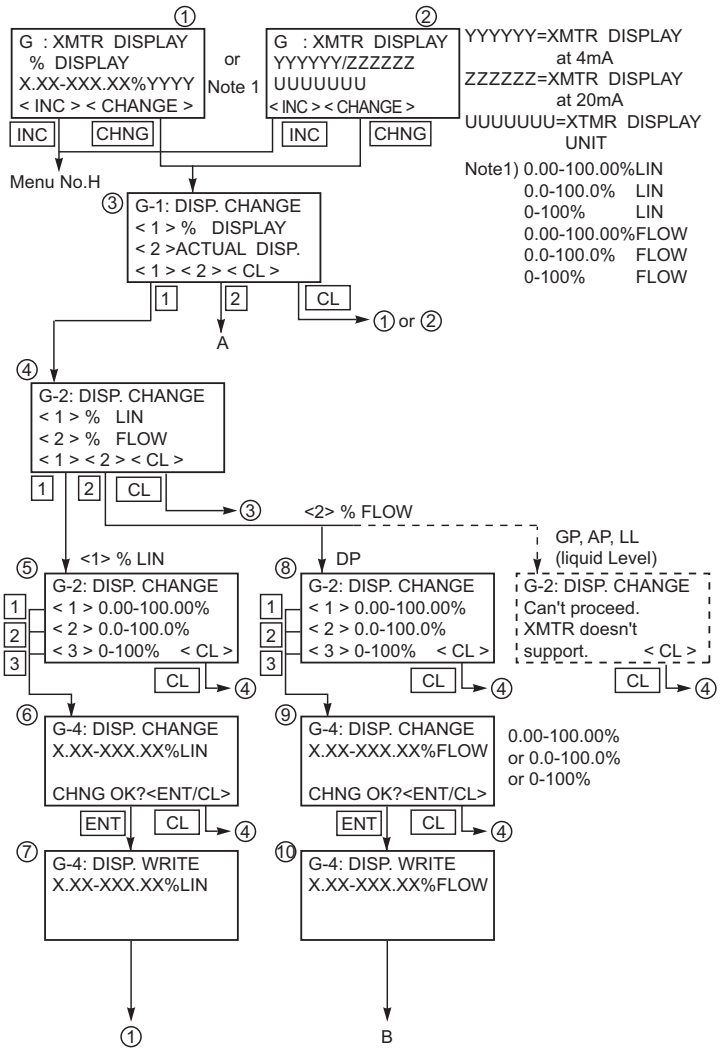
Usable only when a printer is connected.



Lock of adjustment function

The adjustment function by screw at the transmitter body and the adjustment function by local configurator unit with LCD display can be locked.

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



Indication of digital indicator

For digital indicator, either % display or actual-scale display is selectable. In display on the actual scale, display values corresponding to 0% (4mA) and 100% (20mA) are settable.

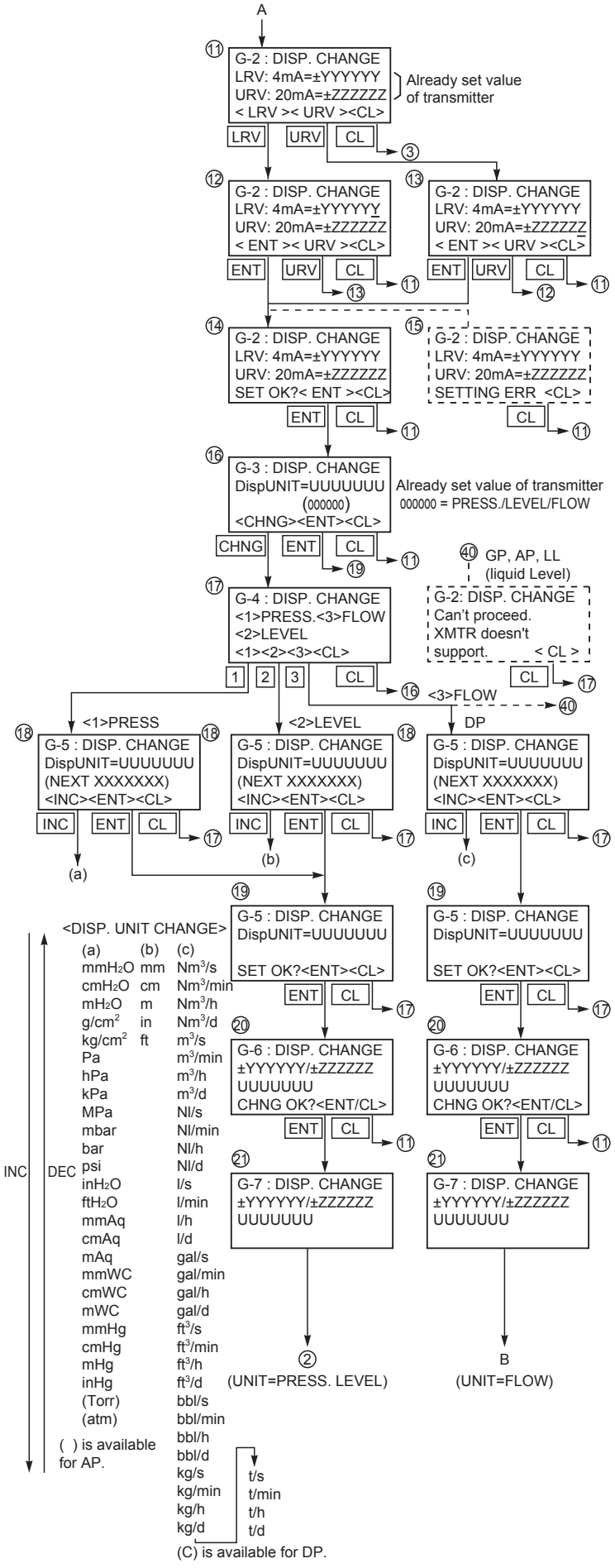
In setting % display, proportional mode and square root extraction mode is selectable as shown in ④.

In ④,

<1> %LIN is displayed in % in the proportional mode

<2> %FLOW is set by % in the square root extraction mode (proportional to flow)

In case of pressure transmitter, absolute pressure transmitter and level transmitter, <2> % FLOW cannot be set in ④.



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 cannot be set as shown in ⑰.

After making sure of the setting of the actual-scale display ⑳, enter the [ENT] and then data is written in the transmitter.

[In case of FCX-AIII series transmitters]
Actual scale value setting conditions

① | Saturation current value (Lower limit) without decimal point | ≤ 99999

② | Saturation current value (Upper limit) without decimal point | ≤ 99999

③ 0 < | (value corresponding to 100% without decimal point) – (value corresponding to 0% without decimal point) | ≤ 15000

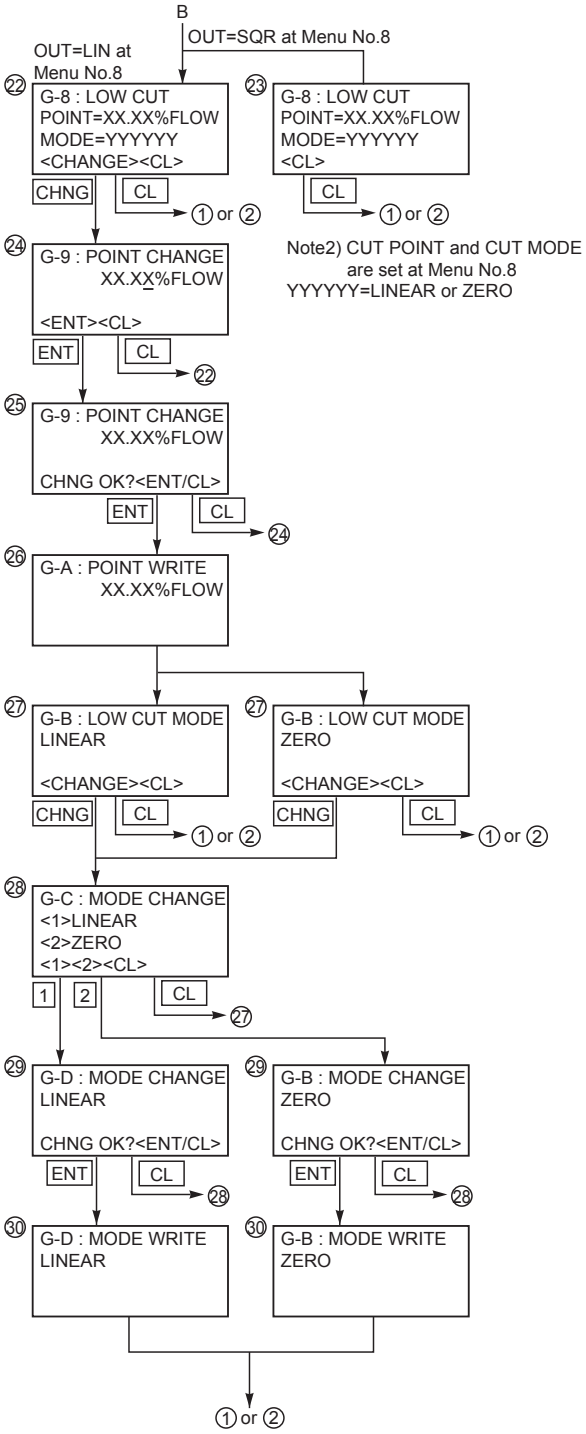
④ When decimal point is used for values corresponding to 0% and 100% respectively, the number of digits after the decimal point should be the same.

[Example] 0.0 to 500 : Not settable
0.0 to 500.0 : Settable

If SETTING ERR <CL> is displayed, press CL key and then set it again to meet the requirement.

⚠ CAUTION

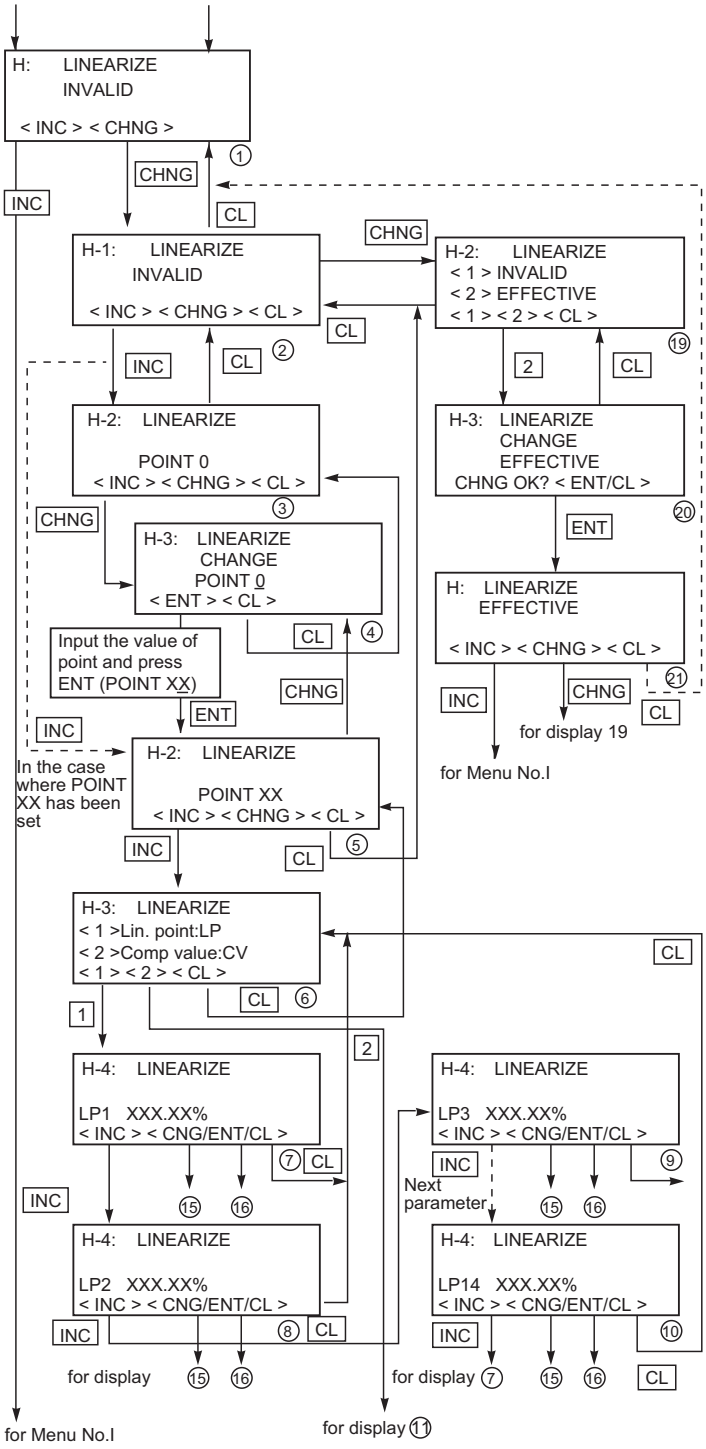
Indication of the transmitter digital indicator may have ±1 digit error against the setting by HHC.



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 No. 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.



Important

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.

Programmable linearization function

User can set output compensation against the input using 14 compensation points, (X_1, Y_1), (X_2, Y_2)…(X_{14}, Y_{14}). Each compensation value between (Xn, Yn) and (Xn+1, Yn+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 ⑥ for selection of <1> Lin. point: LP and <2> Comp. value:CV.

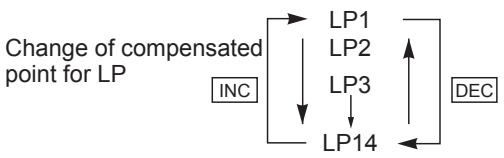
Select <1> Lin. point: LP at display of ⑥ and input XXX.XX% to each point (LP1-LP□).

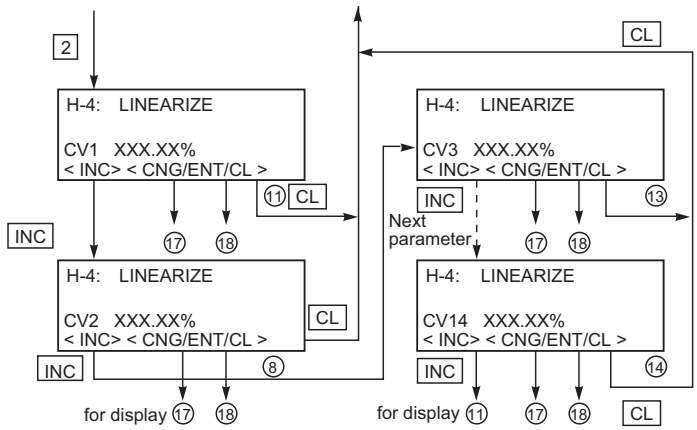
At the completion of input to all the compensated points, press ENT twice and the write of LP will be finished.

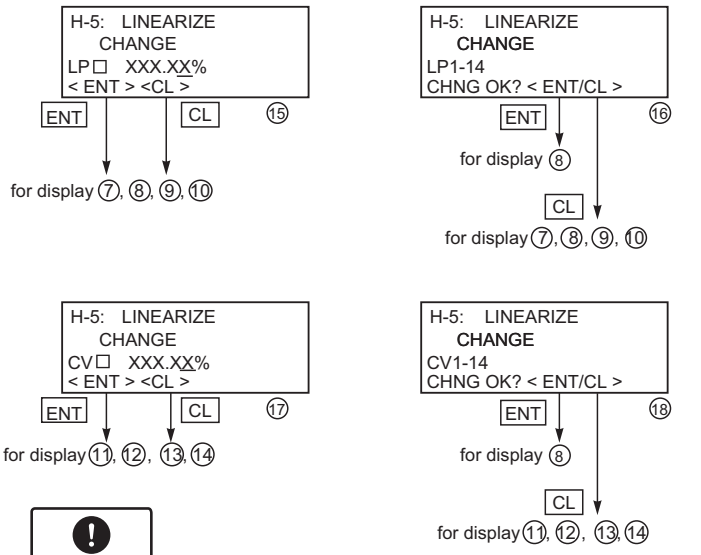
At this time, the display is shifted to ⑥.

Select <2> Comp. point: CV at display of ⑥ and input XXX. XX% to each point (CV1-CV□) in the same manner 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 ⑲. At display of ⑲, press <2> and the display will be changed to EFFECTIVE.







Important

When ENT is pressed at display of ⑳ 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. (Note 1)
3. If LPa =LPb, then it must be CVa= CVb. (Note 1)

   Note 1) a, b show next numeral such as a=1 b=2 or a=2 b=3 or ……a=13 b=14.
4. The compensate value CV_1 and CV_n corresponding to start point LP_1 and last point LP_n, should be set as below;

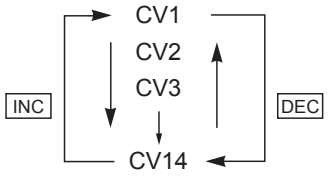
   CV_1=0.00% CV_n=0.00%

   or

   the following is displayed.

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

Change of compensated point for CV



Important

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
LP□         150.01%
SETTING ERR <CL>
```

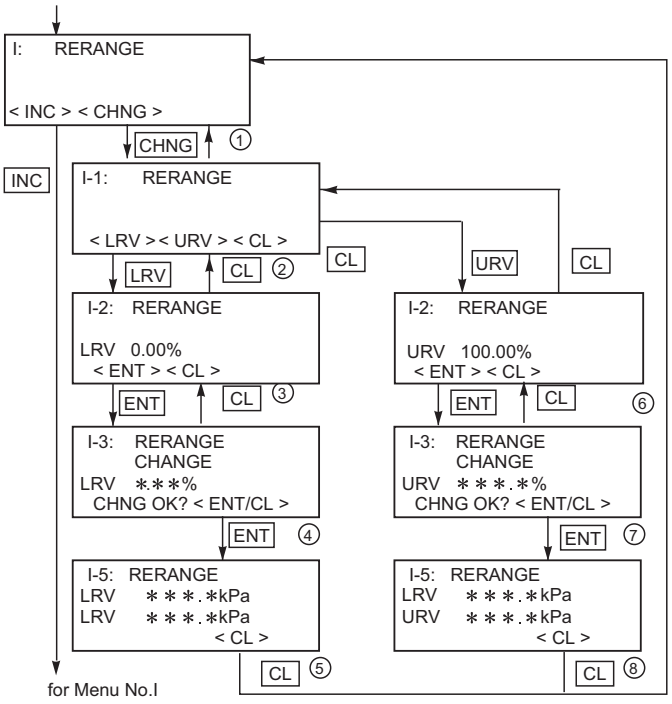
Requirement of setting
Saturation current value (Lower limit) ≤ LP1 ≤ LP2…≤ LP14 ≤ Saturation current value (Upper limit)

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

```
H-5: LINEARIZE
      CHANGE
CV□         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.



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 HHC(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 No. 4:UNIT.

Important

Adjustment point setting condition
-1.00%≤LRV (Note 1)≤100.00%
0.00%≤URV (Note 2)≤Saturation current value (Upper limit)

Note 1)
LRV: Output value (%) corresponding to the input pressure when RERANGE → LRV was implemented.

Note 2)
URV: Output value (%) corresponding to the input pressure when RERANGE → URV was implemented.

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 ①, the following is displayed.

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

This means that RERANGE cannot be made because MENU No. H: LINEARIZE is set in EFFECTIVE. In this case, press the CL key and set in INVALID on the panel of No. H: LINEARIZE.

⚠ CAUTION

This rerange function adjusts input and output by range change.
Upon implementation of rerange, the measurement range changes as follows.

If RERANGE → LRV is implemented:
➡ Measurement range (LRV and URV) changes. However, span remains unchanged.

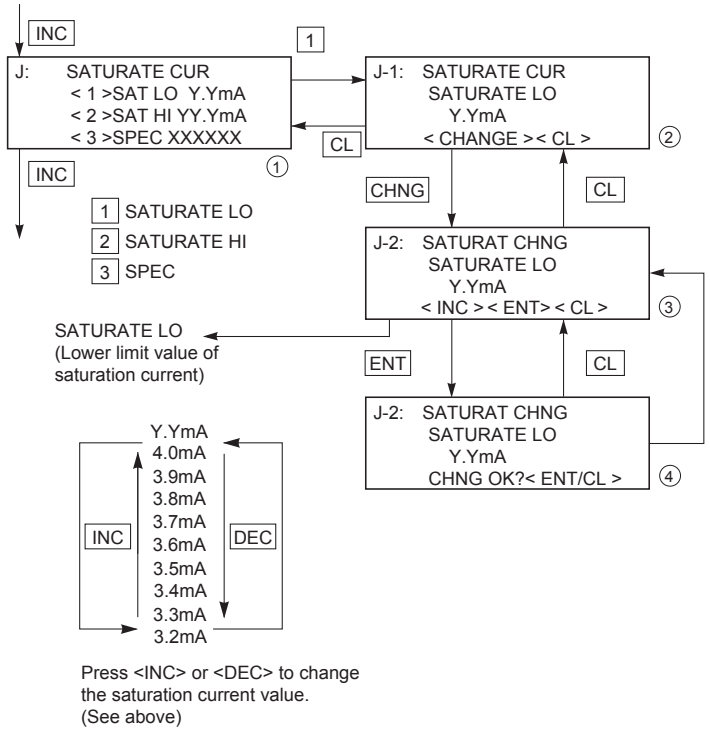
If RERANGE → URV is implemented:
➡ Only URV (span) of measurement range changes. Zero point (LRV) remains the same.

Saturation current value and specification

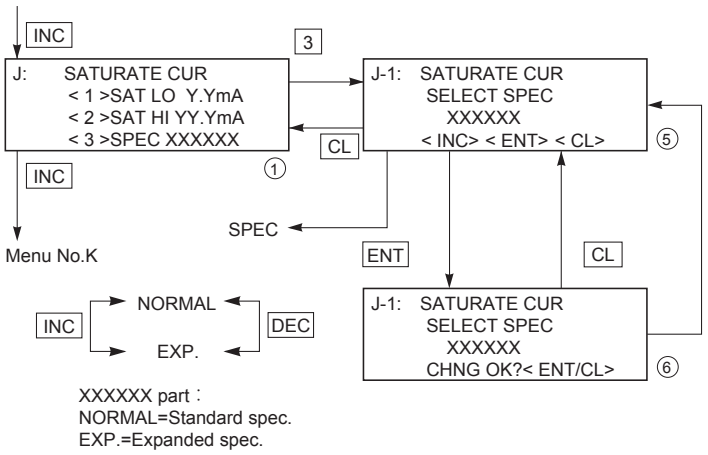
Saturation current value (Lower limit value=SAT LO, Upper limit value=SAT HI) and specification (NORMAL= Existing specification, EXP.=Extended specification) are settable.

⚠ CAUTION

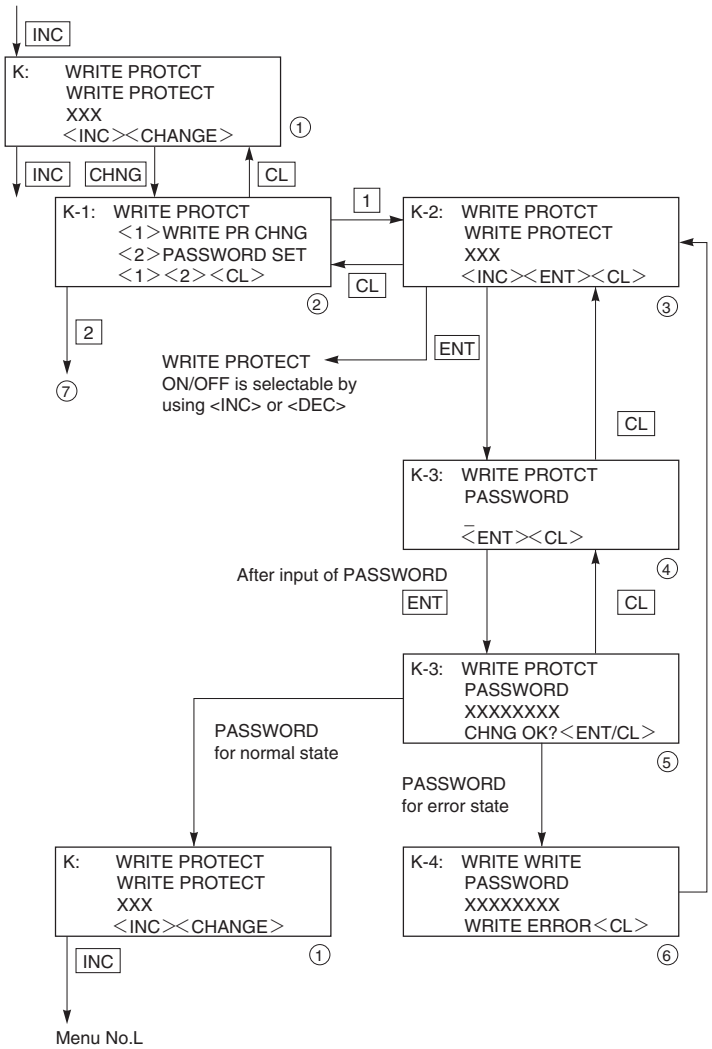
1) When the setting of specification (SPEC) is for "NORMAL (standard specification)", saturation current is not be settable. When change the setting of saturation current, "EXP. (Expanded specification) should be set for the SPEC setting first.
2) Relation between "Burnout current" and "Saturation current" is as following.
   3.2mA ≤ Burnout current (UNDER) ≤Saturation current (lower limit) ≤ 4.0mA
   20.0mA ≤ Saturation current (upper limit) ≤ Burnout current (OVER) ≤ 22.5mA
   Example-1) Setting "Saturation current (lower limit)" into 3.2mA
   Please set "Burnout current (UNDER)" into 3.2mA at menu "9-3" first, then set "Saturation current (lower limit)" in to 3.2mA secondary.
   Example-2) Setting "Saturation current (upper limit)" into 22.5mA
   Please set "Burnout current (OVER)" into 22.5mA at menu "9-3" first, then set "Saturation current (upper limit)" in to 22.5mA secondary.



- 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.
  3.2m Burnout current (UNDER SCALE) ≤ Saturation current (Lower limit value) ≤ 4.0mA
- 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.
  20.0mA ≤ Saturation current (Upper limit value) ≤ Burnout current (OVER SCALE) ≤ 22.5mA
  *Burnout current is settable according to "9. Burnout direction and value".



- Change of the specification
  "Standard specification" or "Expanded specification" is selectable.
  Refer to "J-3" in "J. Saturation current value and specification" of a local configurator unit with LCD display for details.



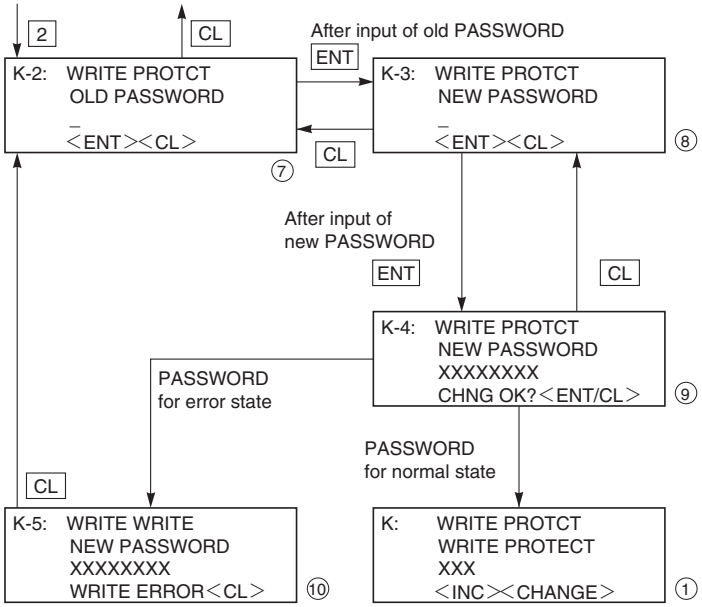
Write protect

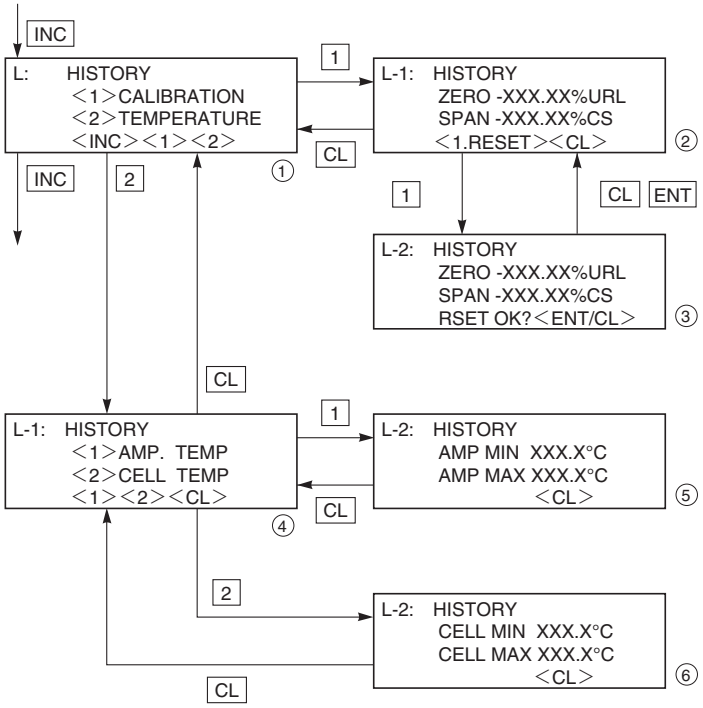
Write protect is settable by setting a PASSWORD

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.


2
CL
After input of old PASSWORD
ENT
K-2: WRITE PROTCT
OLD PASSWORD
_
<ENT><CL>
K-3: WRITE PROTCT
NEW PASSWORD
_
<ENT><CL>
⑧
⑦
CL
After input of
new PASSWORD
ENT
CL
K-4: WRITE PROTCT
NEW PASSWORD
XXXXXXXX
CHNG OK?<ENT/CL>
⑨
PASSWORD
for error state
PASSWORD
for normal state
CL
K-5: WRITE WRITE
NEW PASSWORD
XXXXXXXX
WRITE ERROR<CL>
⑩
K: WRITE PROTCT
WRITE PROTECT
XXX
<INC><CHANGE>
①



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)

5. MAINTENANCE

5.1 Periodic inspection

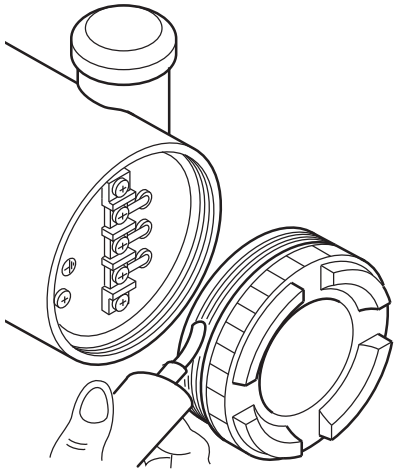
In order to ensure the measurement accuracy and long life of the transmitter, it is essential to inspect the transmitter periodically according to the operating conditions. (approximately once per year)

Visual inspection

Visually inspect each part of the transmitter for damage, corrosion, etc.
If you detect any material which may cause corrosion, it should be cleaned off.

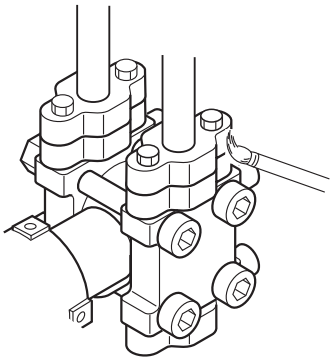
Check of covers of transmitter and terminal and O-ring

The transmitter has a water and dust-proof construction.
Make sure the O-rings of the case covers, etc. are not damaged or deteriorated.
Carefully prevent foreign materials from sticking to threads.
Before attaching the covers of the transmitter and terminal, apply grease to them.



Piping leakage check

Using soapy water or the like, check the all process connections for leakage of process fluid.
If necessary, drain the moisture which has accumulated in the transmitter and process pipe.



5.2 Troubleshooting

If an abnormality occurred in the process or transmitter, action should be taken with reference 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 equalizing valve does not open/close normally.	Repair the valve so that it opens/closes normally.
	(2) Pressure leak is occurring.	Repair a leak.
	(3) Process piping is improper.	Make correct piping.
	(4) Process pipe is clogged.	Eliminate the cause of clogging.
	(5) Power supply voltage and/ or load resistance is improper.	Make arrangement to obtain proper values. For power supply voltage and load resistance, refer to 7.2. (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.)
	(6) Voltage between the external connection terminals of amplifier unit is wrong.	Check for faulty cable, insulation, etc. and repair as needed. For power supply voltage and load resistance, refer to 7.2. (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.)
	(7) Zero and span or fixed output current(4, 20mA) are not adjusted.	Readjust according to chapter 4.
	(8) Amplifier unit is faulty.	Replace the amplifier unit according to 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.	Correct wiring according to 7.1.
	(3) Power supply voltage and/ or load resistance is improper.	Make arrangement to obtain proper values. (For power supply voltage and load resistance, refer to 7.2.) (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.)
	(4) Voltage between the external connection terminals is wrong.	Check for faulty cable, insulation, etc. and repair as needed. (For power supply voltage and load resistance, refer to 7.2.) (For intrinsically safe installations, the power supply voltage should be 16.1 to 26V DC.)
	(5) Zero and span or fixed output current(4, 20mA) are not adjusted.	Readjust according to chapter 4.
	(6) Amplifier unit is faulty.	Replace the amplifier unit according to 5.3.
Output current error.	(1) Process piping is improper.	Correct the piping.
	(2) Gas or solution is mixed in.	Vent or drain the transmitter.
	(3) Liquid density changes.	Perform density compensation.
	(4) Ambient temperature changes widely.	Minimize the temperature change.
	(5) Zero, span or fixed output current(4, 20mA) has deviated.	Readjust according to chapter 4.
	(6) Amplifier unit is faulty.	Replace the amplifier unit according to 5.3.
When the indicator is abnormal.	(1) An error display is appeared.	P28 capital to “contents of message”

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

5.3 Replacement of parts

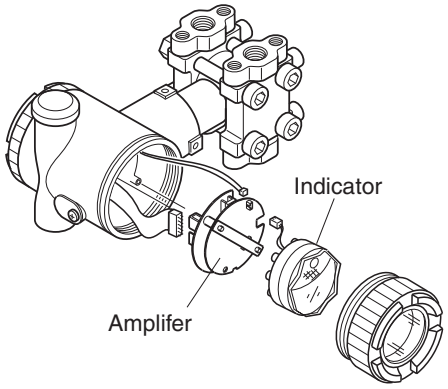
If the transmitter requires a replacement part, drain process fluid from the transmitter, disconnect it from the process and carry out replacement in an instrument room.

⚠ **DANGER**	Do not change the parts of the explosion-proof transmitter and replace the unit by customer. When replacement is required, please contact Fuji Electric Co., Ltd. When power is ON at the place where explosion-proof transmitter is installed, removing unit may cause exprosion,fire,and any or all serious accident .

To identify faulty part

Replace the transmitter with a spare in order to determine whether it is the detecting unit or transmitter which is faulty.
When the faulty unit is identified, it should be replaced with a new one.
Refer to “Separate volume: Parts list” for main replacement parts.

Replacement of amplifier unit

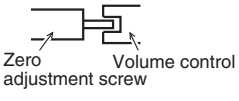


— Replacing procedure —

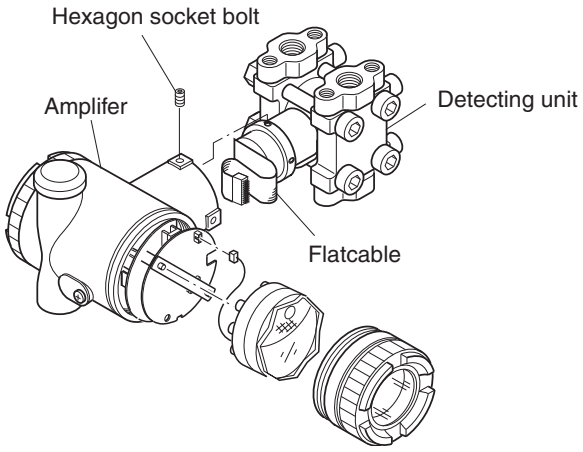
(1) Turn off the power supply.
(2) Remove the indicator.
(3) Remove the amplifier unit.
(4) Unplug each connector.
(5) Replace the amplifier unit with a new one and assemble it by reversing the above procedure from (4) to (1).

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

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

Important	When installing the amplifier unit, make sure that the zero adjust screw and the volume control are positioned as shown the right. 

Replacement of detecting unit



— Replacing procedure —

(1) Remove the amplifier unit according to “Replacement of amplifier unit.”

(2) Remove three hex. 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) Fit the amplifier unit to the detecting unit and tighten it.

(5) Connect each connector to the amplifier unit in the transmitter case and assemble them.

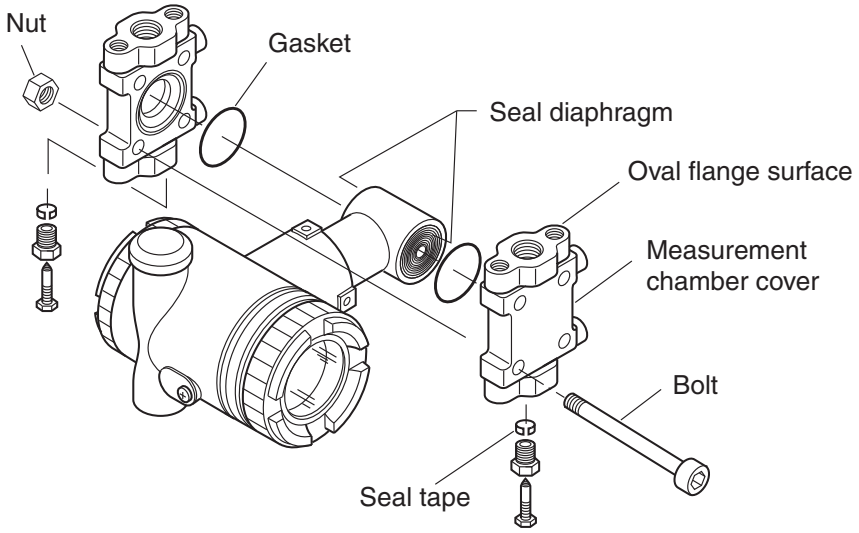
(6) After reassembly, carry out zero and span adjustments.

Important

- Ensure that replacement detector unit is the same specification as the original by comparing dataplates.
- 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)



— Replacing procedure —

(1) Remove four hexagon socket head bolts with a torque wrench, etc..

(2) Disassembly gives access to the casing covers, gasket, hexagon socket head bolts and nuts.

(3) After disassembly, replace the faulty part with a new one.

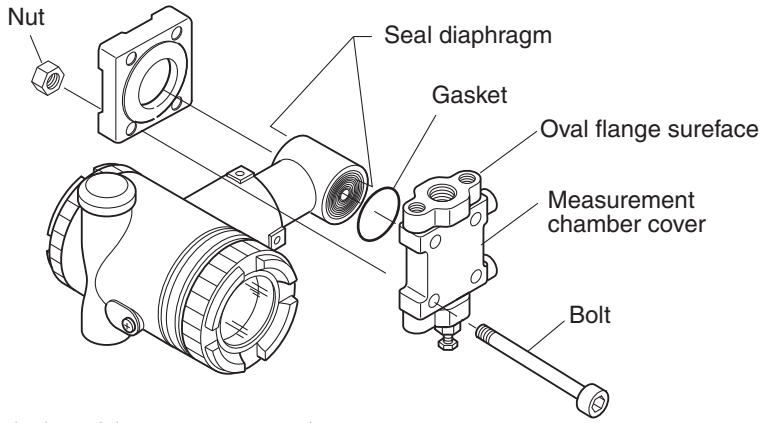
(4) Before reassembly, clean the gasket face of casing cover with the soft cloth immersed in water, alcohol, or similar detergent.

(5) Reassemble the detecting unit by reversing the disassembling procedure. The casing covers should be assembled so as to be symmetrical with each other in the left-right direction and carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.

Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>
M10	Carbon steel	50±2.5 (5±0.25) <36±1.8>
M10	316SS	30±1.5 (3±0.15) <22±1.1>
M10	660SS	50±2.5 (5±0.25) <36±1.8>
M12	Carbon steel	60±3.0 (6±0.30) <43±2.1>
M12	660SS	60±3.0 (6±0.30) <43±2.1>

(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 for 15 minutes, and make sure there is no leakage.

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



(1) Remove four bolts with a torque wrench, etc..

(2) Disassembly gives access to casing covers, gasket, bolts and nuts.

(3) After disassembly, replace the faulty part with a new one.

(4) Before reassembly, clean the gasket face of casing cover with the soft cloth immersed in water, alcohol, or similar detergent.

(5) Reassemble the detecting unit by reversing the disassembling procedure. The casing covers should be assembled so as to be symmetrical with each other in the left-right direction and carefully so as not to damage the seal diaphragm. Tightening torque should follow the table below.

In case of absolute pressure transmitter (FKA)

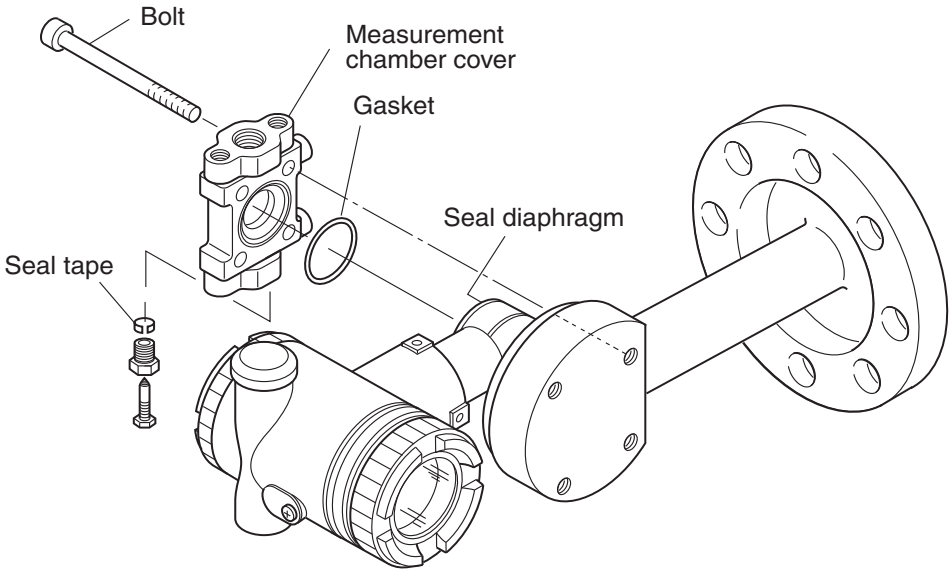
Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>
M10	Carbon steel	50±2.5 (5±0.25) <36±1.8>
M10	316SS	30±1.5 (3±0.15) <22±1.1>

In case of gauge pressure transmitter (FKG)

Bolt size	Bolt material	Tightening torque [N·m] (kgf·m) <ft-lb>
M10	Carbon steel	50±2.5 (5±0.25) <36±1.8>
M10	316SS	30±1.5 (3±0.15) <22±1.1>
M10	660SS	50±2.5 (5±0.25) <36±1.8>
M12	Carbon steel	60±3.0 (6±0.30) <43±2.1>
M12	660SS	60±3.0 (6±0.30) <43±2.1>

- After assembly, carry out a pressure test.
  Apply the maximum allowable pressure to the test chamber on the high-pressure side of the transmitter for 15 minutes to check that there is no leakage.

In case of level transmitter (code symbol: FKE)



(1) Remove four hexagon socket head bolts with a torque wrench, etc..

(2) Disassembly gives access to the casing cover, gasket and hexagon socket head bolts.

(3) After disassembly, replace the faulty part with a new one.

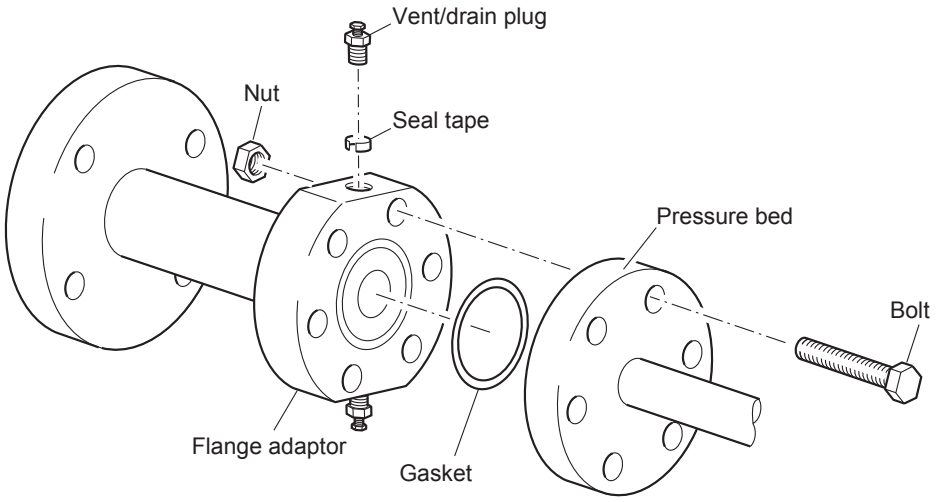
(4) Before reassembly, clean the gasket face of casing cover with the soft cloth immersed in water, alcohol, or similar.

(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 [N·m] (kgf·m) <ft-lb>	Application
M10	Carbon steel	50±2.5 (5±0.25) <36±1.8>	Up to rated flange pressure
M10	316SS	30±1.5 (3±0.15) <22±1.1>	

(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) and low pressure (L) measurement chamber of the transmitter simultaneously for 15 minutes, and make sure there is no leakage.

Removing and mounting the flange adaptor for small size flange type transmitter.



(1) The flange adaptor is fitted to the pressure bed with six M8 bolts. Loosen the bolts and remove the adaptor.

(2) It is disassembled into flange adaptor, gasket, bolts and nuts.

(3) After disassembling, replace damaged parts with new ones.

(4) Before reassembling, clean the flange adaptor, the pressure bed and the gasket with a soft cloth moistened with water or alcohol.

(5) Assemble all the parts in reverse order of disassembly.
When assembling, care should be taken not to damage the seal diaphragm at the pressure bed. Tighten the M8 bolts (SCM435) to 10±0.5N·m (1±0.05kgf·m) <7±0.35ft·lb> torque using a torque wrench.

(6) After assembly, carry out a pressure test (leak test). Apply a pressure (150% of rated flange pressure) to the flange adaptor for 15 minutes and confirm that it is free from leakage.

Maintenance parts list

(1) Gasket for measurement chamber cover

When the measurement chamber cover of the transmitter is removed, replace the following gasket.

Subject product	Subject model	Item name	Drawing No.	Quantity
Differential pressure transmitter	FKC□33V5, FKC□35V5, FKC□36V5, FKC□33W5, FKC□35W5, FKC□36W5, FKC□33J5, FKC□35J5, FKC□36J5	Gasket	TK7N0785P1	2 pieces/set
	Differential pressure transmitter other than above models (FKC)	Gasket	TK7K7545P1	2 pieces/set
Pressure transmitter	FKG□01V5, FKG□02V5, FKG□03V5, FKG□04V5, FKG□05V5, FKG□01W5, FKG□02W5, FKG□03W5, FKG□04W5, FKG□05W5, FKG□01J5, FKG□02J5, FKG□03J5, FKG□04J5, FKG□05J5	Gasket	TK7N0785P1	1 piece/set
	Pressure transmitter other than above models (FKG)	Gasket	TK7K7545P1	1 piece/set
Absolute pressure transmitter	FKA□01V5, FKA□02V5, FKA□03V5, FKA□04V5, FKA□05V5	Gasket	TK7N0785P1	1 piece/set
	Absolute pressure transmitter other than above models (FKA)	Gasket	TK7K7545P1	1 piece/set
Level transmitter	FKE□□3V5, FKE□□5V5, FKE□□6V5, FKE□□3J5, FKE□□5J5, FKE□□6J5, FKE□□3C5, FKE□□5C5, FKE□□6C5, FKE□□3D5, FKE□□5D5, FKE□□6D5, FKE□□3E5, FKE□□5E5, FKE□□6E5	Gasket	TK7N0785P1	1 piece/set
	Level transmitter other than above models (FKE)	Gasket	TK7K7545P1	1 piece/set

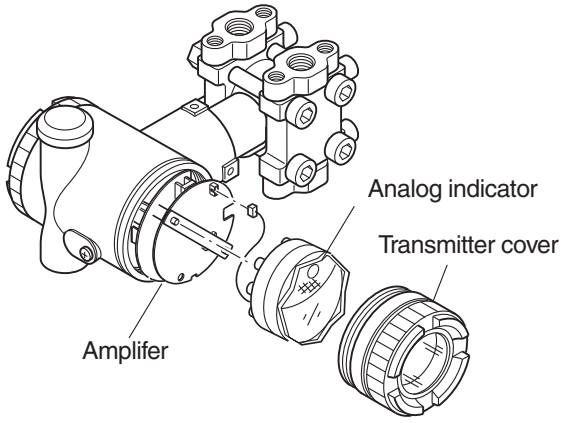
(2) Gasket for flange adaptor

When the flange adaptor is removed from the small flange remote seal type transmitter, replace the following gasket.

Subject product	Subject model code specification	Item name	Drawing No.	Quantity
Remote seal type differential pressure transmitter (FKD)	- Flange size, 2B (2 inches) 50A or below. - Model code 7th digit (special application and fill fluid for the diaphragm) in the remote seal part, “standard”.	Gasket	TK7J0114P1	2 pieces/set
Remote seal type differential pressure transmitter (FKD)	- Flange size, 2B (2 inches) 50A or below. - Model code 7th digit (special application and fill fluid for the diaphragm) in the remote seal part, “High temperature specification”.	Gasket	TK7J0115P1	2 pieces/set
Remote seal type pressure transmitter (FKB)	- Flange size, 2B (2 inches) 50A or below. - Model code 7th digit (special application and fill fluid for the diaphragm) in the remote seal part, “standard”.	Gasket	TK7J0114P1	1 piece/set
Remote seal type pressure transmitter (FKB)	- Flange size, 2B (2 inches) 50A or below. - Model code 7th digit (special application and fill fluid for the diaphragm) in the remote seal part, “High temperature specification”.	Gasket	TK7J0115P1	1 piece/set

Replacement of field indicator

1. Replacement of analog indicator



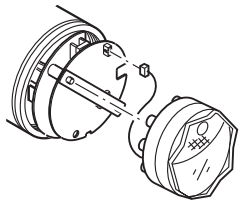
— Replacing procedure —

(1) Detach the transmitter cover.

(2) Remove the analog indicator.

(3) Pull out the connector extending from the analog indicator.

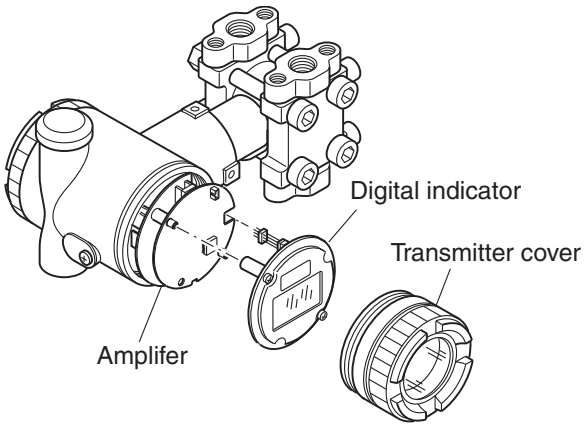
(4) Connect the connector of a new analog indicator to the electronics section. (See the figure below.)



(5) Then, mount the analog indicator at the electronics section.

(6) Attach the transmitter cover.

2. Replacement of digital indicator



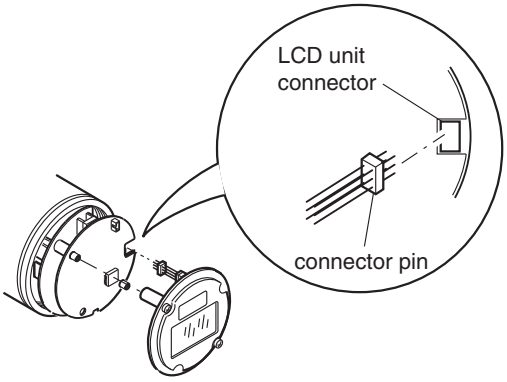
— Replacing procedure —

(1) Detach the transmitter cover.

(2) Remove two fixing screws which fasten the digital indicator and remove the indicator.

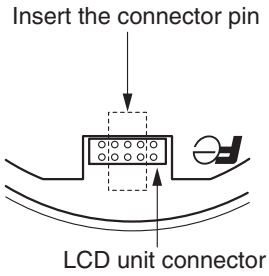
(3) Remove the connector pin connecting the digital indicator and the amplifier unit.
However, if you replace only the digital indicator, you need not remove the connector pin.

(4) Connect a new digital indicator and connector pin to the amplifier unit.



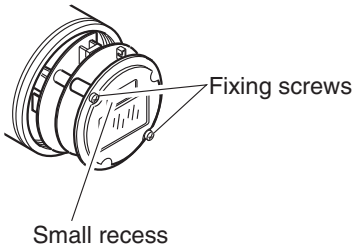
⚠ **CAUTION**

While the digital indicator connector has 6 pins, the LCD unit connector on the amplifier unit has 10 pins. Insert the connector pin into the six pins in the center (see below).
If the connector pin is inserted into the pins on the right or left side, proper display cannot be achieved.



Since the connector of the local configurator unit with LCD display has ten pins, connect it to the LCD unit connector as it is.

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



(6) Attach the transmitter cover.

5.4 Adjustment after replacement of unit

Adjustment

After completion of the assembly work mentioned above, use the following procedures for adjustment and setting. Adjustment should be performed using the local configurator unit with LCD display or the HHC.

(1) After replacement of amplifier 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)	Contens of setting adjustment
1	TAG No	1 : TAG (P 15)	1 : TAG No. (P 45)	Set the previous data before replacement of amp unit.
2	Model code	2 : TYPE (P 16)	2 : TYPE (P 46)	Set the previous data before replacement of amp unit.
3	Serial No.	3-1 : SERIAL No (P 17) 3-2 : VER	3 : SERIAL No (P 46)	Not necessary for operation
4	Engineering unit	4 : UNIT (P 18)	4 : UNIT (P 47)	Set the previous data before replacement of amp unit.
5	Range limit	5 : URL (P 18)	5 : RANGE LIMIT (P 48)	Not necessary for operation
6	Measuring range	6-1 : LRV (P 19) 6-2 : URV	6 : RANGE (P 48)	Set the previous data before replacement of amp unit.
7	Damping	7 : DAMP (P 21)	7 : DAMPING (P 49)	Set the previous data before replacement of amp unit.
8	Output mode	8-1 : OUT Md (P 22) 8-2 : CUT Pt 8-3 : CUT Md	8 : OUTPUT MODE (P 50)	Set the previous data before replacement of amp unit.
9	Burnout direction	9-1 : BURNOUT (P 24) 9-2 : OVER 9-3 : UNDER	9 : BURNOUT (P 51)	Set the previous data before replacement of amp unit.
10	Zero/span calibration	A-1 : ZERO (P 26) A-2 : SPAN	A : CALIBRATE (P 52)	Implement span calibration after zero calibration.
11	Calibration output circuit	b-1 : 4mAAdj (P 28) b-2 : 20mAAdj b-3 : FIXcur	B : OUTPUT ADJ (P 53)	Loop check & calibrate fixed output current (4mA,20mA).
12	Measurement data	(Normal mode)	C : DATA (P 54)	Check the measurement data.
13	Self-diagnosis	d1 : AMPTMP (P 29) d2 : ALMCHK	D : SELF CHECK (P 54)	Check, if it is necessary.
14	Printer function	_____	E : PRINT (P 55)	In case of HHC with printer option, print if it is necessary.
15	Lock of adjustment functions	F : LOCK (P 30)	F : XMTR EXT.SW (P 56)	Set the previous data before replacement of amp unit
16	Indication of digital indicator	G-1 : LDV (P 31) G-2 : UDV G-3 : DP G-4 : LcdUnit G-5 : LcdOpt	G : XMTR DISPLAY (P 57)	Set the previous data before replacement of amp unit
17	Programmable lineari-zation function	_____	H : LINEARIZE (P 60)	Set the previous data before replacement of amp unit
18	Input-output range adjustment	I-1 : LRVAdj (P 35) I-2 : URVAdj	I : RERANGE (P 62)	Adjust the input-output range (RERANGE) as required.
19	Change of saturation current	J-1 : SAT LO (P 38) J-2 : SAT HI J-3 : SPEC	J : SATURATE CUR (P 63)	Set the previous data before replacement of amp unit.
20	Protective function of set value	K : GUARD (P 40)	K : WRITE PROTCT (P 64)	Set the previous data before replacement of amp unit.
21	History information	L-1 : His ZERO (P 41) L-2 : His SPAN L-3 : His CLEAR L-4 : His AMP L-5 : His CELL	L : HISTORY (P 66)	Check data as necessary

(2) After replacement of detecting 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)	Contens of setting adjustment
1	Zero/span calibration	A-1 : ZERO (P 26) A-2 : SPAN	A : CALIBRATE (P 52)	Implement span calibration after zero calibration.

6. INSTALLATION AND PIPING

6.1 Installation

After unpacking, check the delivered items.
This transmitter can be mounted on a pipe or on a wall.
(However, level transmitters (types: FKE) require flange mounting).
Install the transmitter according to the figure below.

⚠ CAUTION	• The transmitter is heavy. Be careful when handling it. • The transmitter should be installed in a place that meets the operating conditions shown in DS sheet or instruction manual. • Install the transmitter according to the instruction manual. Improper installation may lead to the cause of fall, trouble or incorrect operation. • When installing, make sure that the transmitter interior is free from cable chips and other foreign objects to prevent fire, trouble or incorrect operation.

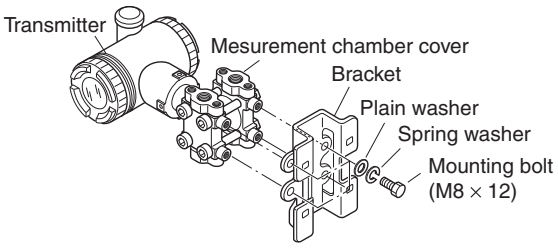
⚠ DANGER	• Non-explosion-proof transmitter must not be used in a place with explosive gas to prevent serious accidents such as explosion, fire, etc.

❗ Important	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).

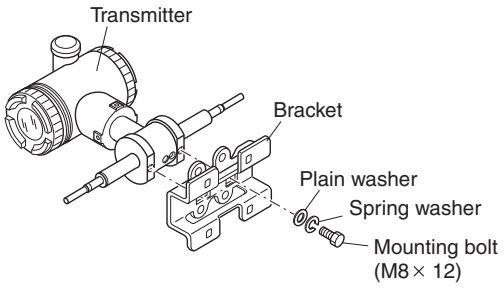
Bracket mounting

Mount the bracket to the transmitter.
The bracket should be mounted to the process cover as shown below.

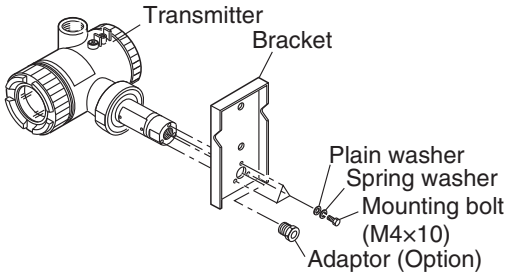
(Differential pressure/flow transmitters, pressure transmitters, and absolute pressure transmitters, types: FKC, FKG, FKA)



(Remote seal type transmitters, types: FKD, FKB)



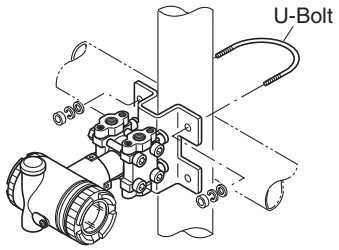
(Piping of direct mount type absolute pressure and guage pressure transmitters types: FKP, FKH)



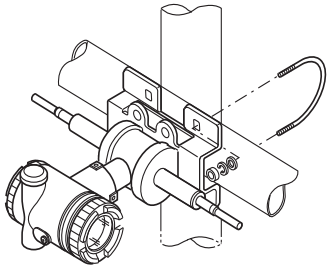
Mounting

Pipe mounting

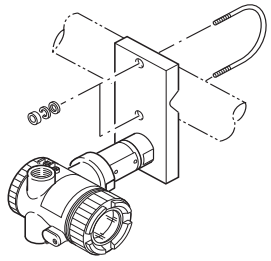
(Differential pressure/flow rate transmitter, pressure transmitter, absolute pressure transmitter)



(Remote seal type transmitter)



(Direct-mount type pressure transmitter)



(1) Fasten a vertical or horizontal pipe with nuts (M8) and the provided U-bolt (tightening torque: 15 ±0.8 N·m).

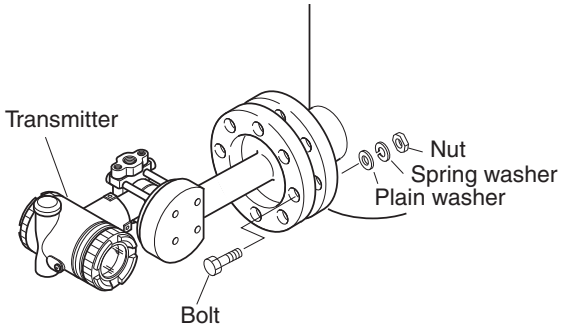
(2) Select a pipe of 50A (2B, outside diameter: Ø60.5).

Wall mounting

(1) Fasten to wall face by M8 bolt utilizing the U-bolt holes.

Flange mounting

(Level transmitter)



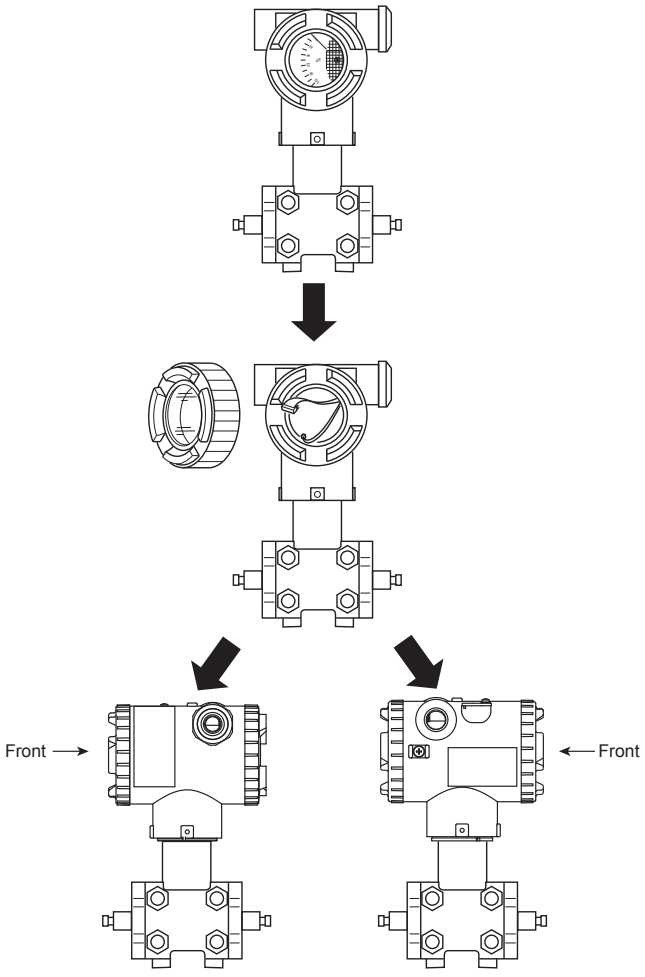
Fasten the pressure receiving flange and the flange of the tank with bolts.
Mounting bolt, nut, and packing are not included as the delivered equipment.

Change of transmitter position

⚠ CAUTION	Avoid the following procedure in an explosion-proof area when applying current.

Wiring is sometimes difficult depending on the installation location. In such a case, it is convenient to carry out the following.

Before rotating the transmitter, remove the amplifier unit.
The transmitter is secured by 3 hex socket bolts.
Loosen the bolts, rotate the transmitter clockwise or counterclockwise by 90˚ or 180˚ and fix it by the screws. Then, carry out wiring.



Rotate the transmitter clockwise by 90°.

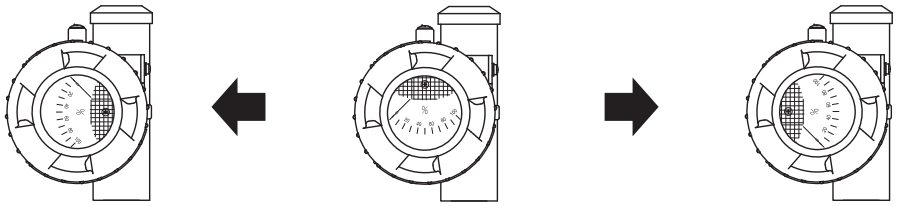
Rotate the transmitter counterclockwise by 90°.

Important	If you rotate the transmitter by 360° or more without removing the amplifier unit, the flat cable that connects the amplifier unit in the transmitter and the detecting unit may be twisted. If that happens, straighten the twist and reassemble it.

Change of indicator angle

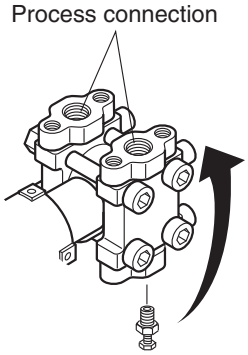
⚠ CAUTION	Avoid the following procedure in an explosionproof area.

In case of an analog indicator, it can be turned ±180˚ in 90˚ increments because it is connected with a pin plug.



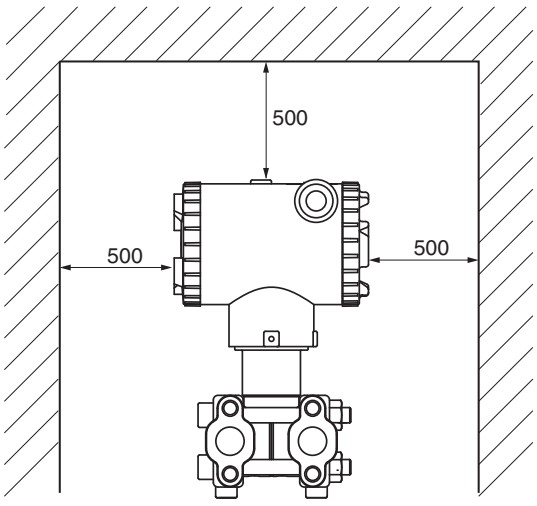
Change of vent/drain plug position

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 : 25±1.3N·m (2.5±0.13kgf·m) <18±0.9ft·lb>
If the vent/drain plug is reattached, check the airtightness by applying pressure.

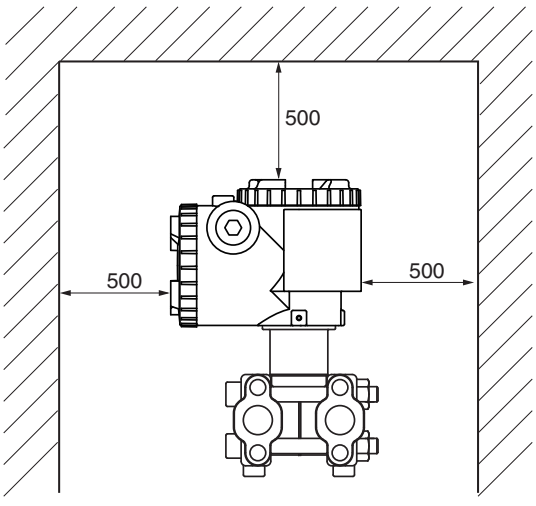


Check space

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



(T-shape amplifier case)



(L-shape amplifier case)

Unit: mm

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 recognizations are;

① Mount transmitter below main process piping for liquid or steam measurement.

② Mount transmitter above main process piping for gas measurement.

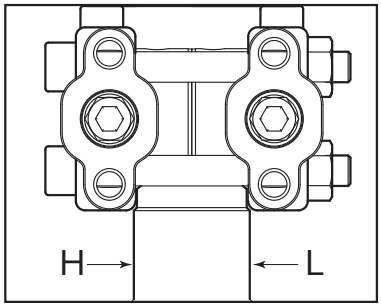
The standard style of FCX-AⅢ series transmitter correspond to the piping procedure ① mentioned above. Change the vent/drain plug to correspond to the piping procedure ②.

⚠ CAUTION	Main valve 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.

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

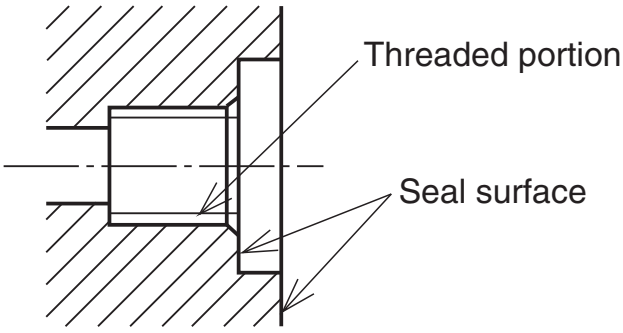
Check of high/low pressure sides of transmitter

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



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

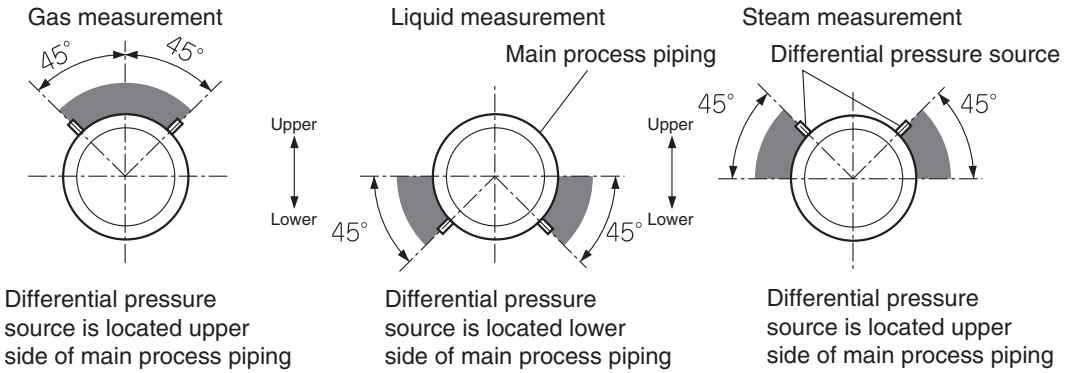
(1) When using the manifold valve, it should be fixed to the transmitter by tightening four oval flange setbolts (7/16-20UNF), and then the impulse pipe should be connected to the manifold valve. Tightening torque of 7/16-20UNF mounting bolt should be 35±5 N·m (3.5±0.5 kgf·m) <26±4 ft·lb>.

(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 35±5 N·m (3.5±0.5 kgf·m) <26±4 ft·lb>.

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.

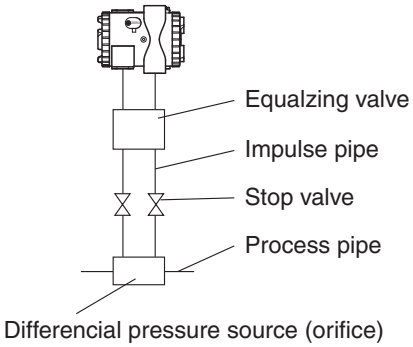
Note the following figures when planning and installing the piping.



Typical examples of piping

(1) Flow measurement (in case of gas)

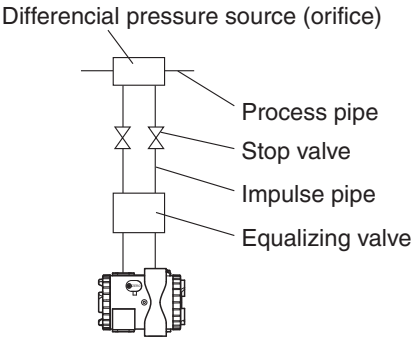
Place the transmitter above the differential pressure source.



(2) Flow measurement (in case of liquid)

Place the transmitter below the differential pressure source.

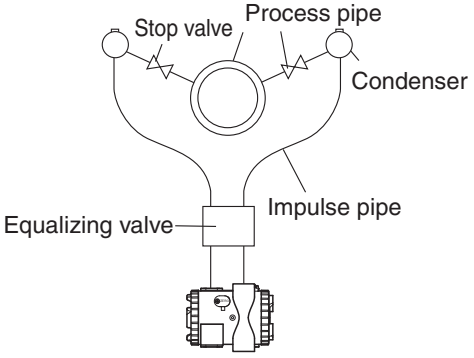
Make piping so that gas in the impulse pipe is not delivered to the transmitter, and incorporate gas reservoirs as required.



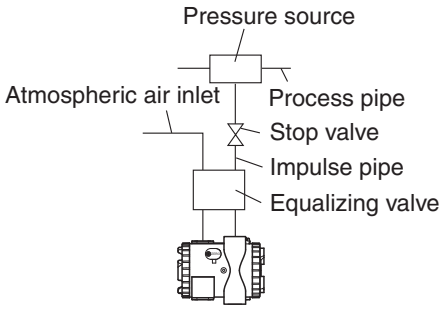
(3) Flow measurement (in case of steam)

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.



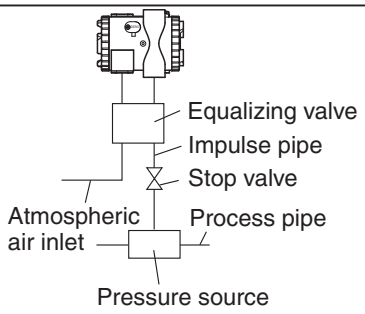
(4) Pressure measurement (in case of liquid)
Zero point can be checked with a equalizing valve installed.



Important

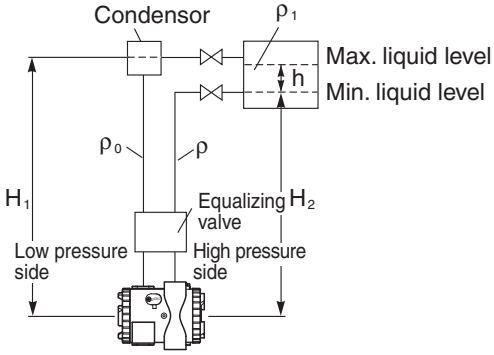
- Protection is required to prevent dust from entering through the atmospheric air inlet after installation of the equalizing valve.
- When measuring a small pressure of 10 kPa or lower, pay attention to the pressure fluctuation by wind near the atmosphere inlet. It is effective to attach a throttle to the atmosphere inlet and to put the atmosphere inlet and the transmitter in the container.

(5) Pressure measurement (in case of gas)
Mount the transmitter above the process pipes to preventing moisture from entering the inside of transmitter.



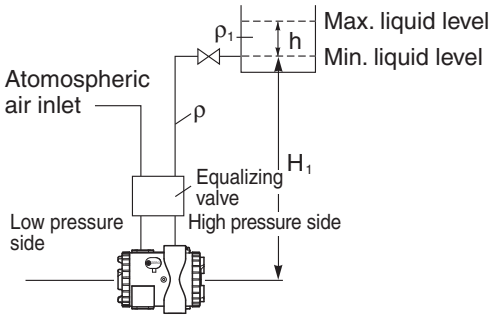
(6)Level measurement

(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
LRV : $\rho H_2 - \rho_0 H_1$
URV : $\rho H_2 + \rho_1 h - \rho_0 H_1$
Span (ΔP): $\rho_1 h$
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
LRV: ρH_1
URV: $\rho H_1 + \rho_1 h$
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

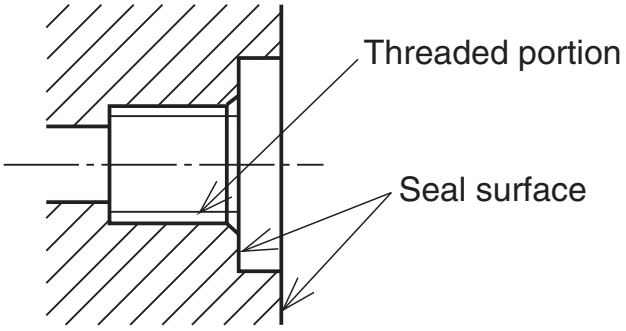
Cautions on impulse piping

- 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.
- Do not perform piping work, for example bending the impulse pipes near the terminals of differential pressure detection such as an orifice, which causes gas or drain to accumulate in the impulse pipes.
- Be sure to check the airtightness after installing the piping.
- Take care not to apply an excessive force to the transmitter during its connection.
- The impulse pipes used should be suitable for the working temperature, pressure, etc.
- 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.

Piping of pressure and absolute pressure transmitters (types: FKG, 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.



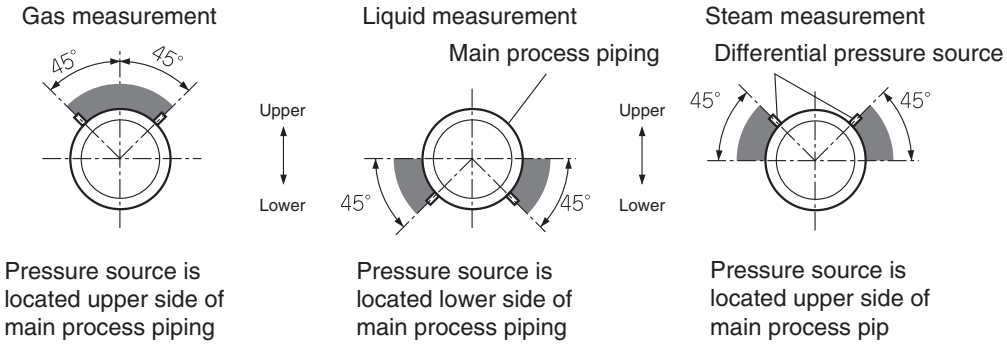
Connection of transmitter and impulse pipe

Impulse pipe should be connected with an oval flange. Also, the pipe can directly be screwed into the transmitter.

After connection, close the stop valve of transmitter in order to prevent foreign materials from entering the inside.

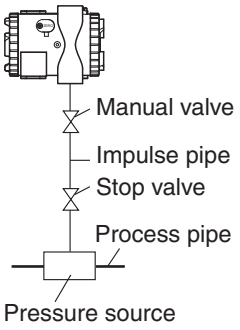
Position of process taps (Horizontal main process piping)

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.

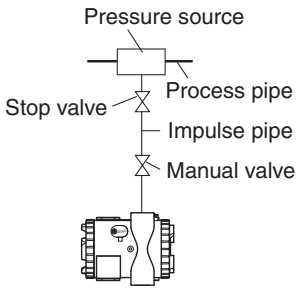


Typical examples of piping

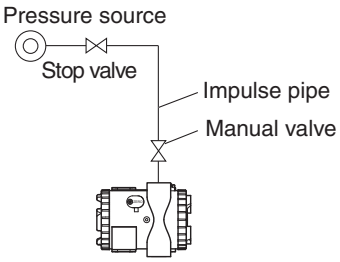
(1) Gas measurement
Place the transmitter above the pressure source.



(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 pipe should have an upward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of gas, etc. in the detecting unit.
- For gas, the impulse pipe should have a downward slope of 1/10 or more between 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.
- Take care not to apply an excessive force to the transmitter during its connection.

⚠ CAUTION	The impulse pipe used should be suitable for the working temperature, pressure, etc.

- Be sure to check the airtightness after installing the piping.
- 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.

Piping of direct mount type absolute pressure and guage pressure transmitters

(type: FKP, FKH)

Removal of protective cap

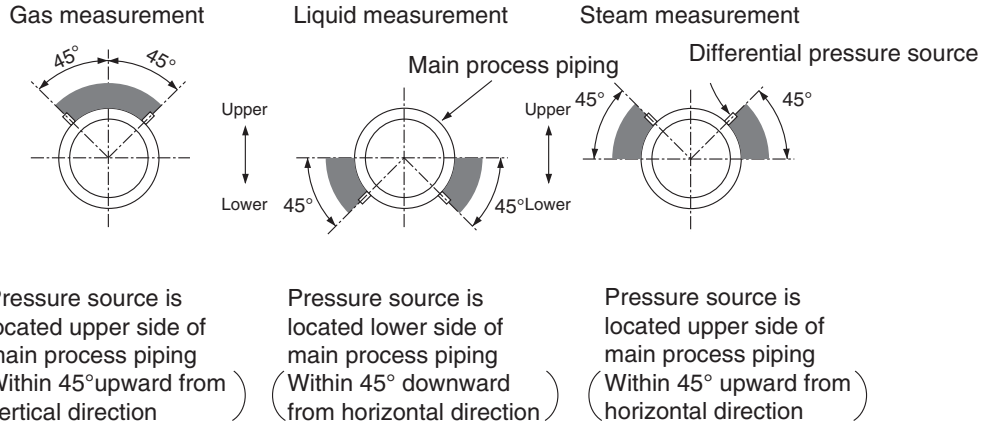
The process connection port of the transmitter is fitted with a protective cap. Before piping, remove the cap carefully. When removing the cap, carefully protect the threaded portion and sealing face from damage.

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)

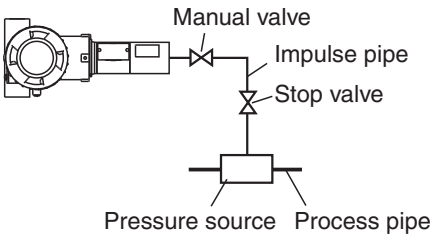
The position of the process tap is determined by the relationship between condition, characteristics and measurement point of process fluid. Note the following figures when planning and installing the piping.



Typical examples of piping

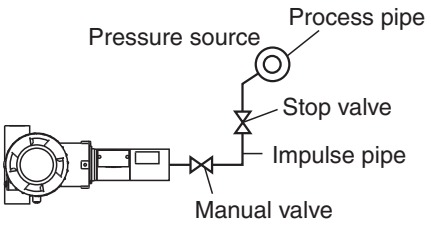
(1) Gas measurement

Place the transmitter above the pressure source.



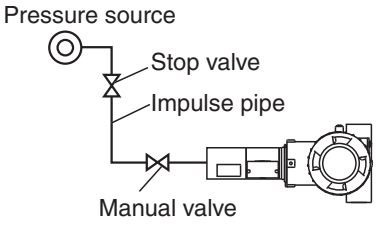
(2) Liquid measurement

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 pipe should have an upward slope of 1/10 or more between the process connection and transmitter to prevent accumulation of gas, etc. in the detecting unit.
- For gas, the impulse pipe should have a downward slope of 1/10 or more between 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.
- In order to prevent vibration of the transmitter body from interfering with output, the transmitter body should be installed at a vibration-free place.
- Take care not to apply an excessive force to the transmitter during its connection.

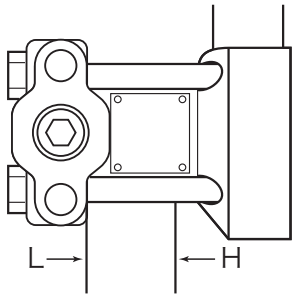
⚠ CAUTION	The impulse pipe used should be suitable for the working temperature, pressure, etc.

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

Piping of level transmitter (type: FKE)

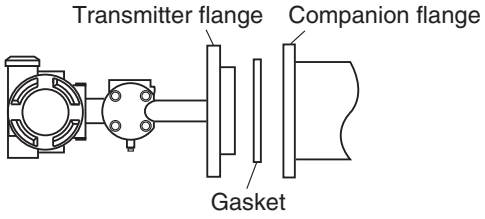
Check of high/low pressure sides of transmitter

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



Seal on mounting flange face

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



Important

On the flush flange type, be sure to use a gasket with an internal diameter larger than shown in the table below, to prevent the gasket from touching the seal diaphragm.
On the 80A (3B) type particularly, it should be noted that the 80A (3B) gasket available from the market is such that its inside diameter is smaller than the size shown below. If it is used, it touches the seal diaphragm and cause errors in measurements.

Minimum internal diameter of flush flange type gasket

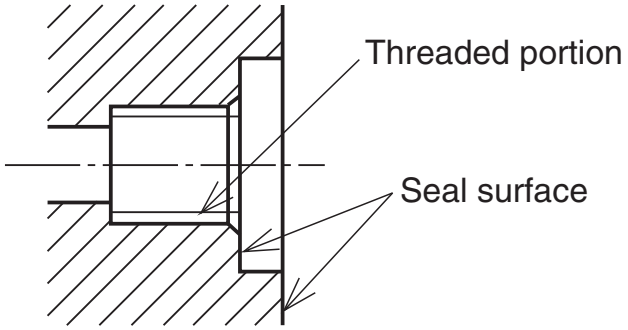
Flange size	Minimum internal diameter of gasket
40A (1½B), 50A (2B)	49mm
80A (3B), 100A (4B)	100mm

Important

It should be noted that leakage of fluid from the wetted parts would affect the performance due to the progress of corrosion.

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 35±5 N·m (3.5±0.5 kgf·m) <26±4 ft·lb>.
- After installing the piping, close the stop valve of the impulse pipe and the vent/drain plug of the transmitter in order to prevent foreign materials from entering the transmitter.

If an order is placed for a level transmitter fitted with a Teflon membrane, the following items are supplied.

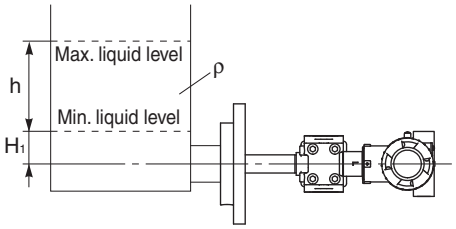
- Teflon membrane
- Oil for attaching a Teflon diaphragm (Fluorinated oil)

Please refer to the attached document TN55704-E as to how to mount it.

Typical examples of piping

(1) Level measurement of open tank

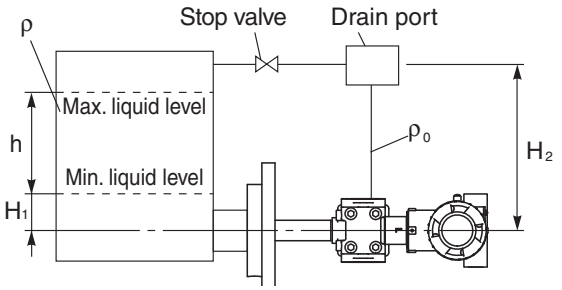
Leave the low pressure side of transmitter open to atmosphere.



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 (Refer to “Cautions on installation”)
h: Liquid level change

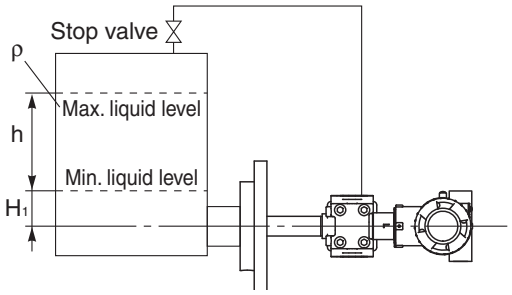
(2) Level measurement of enclosed tank

(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 (Refer to "Cautions on installation")
h: Liquid level change
H_2: Seal liquid level

(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 (Refer to "Cautions on installation")
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.

  Minimum value of H_1

Flange size type	Flush flange type	Extension flange
40A (1½B)	30mm	——
50A (2B)	30mm	30mm
80A (3B)	55mm	40mm
100A (4B)	55mm	55mm

- Do not shock the seal diaphragm by hitting hard object against it, for example.
- Take care not to apply an excessive force to the flange during connection.
- When the measuring fluid is likely to freeze in the cover of the low pressure measurement chamber, the cover needs to be warmed up with steam or a heater.
- After piping, be sure to check airtightness.

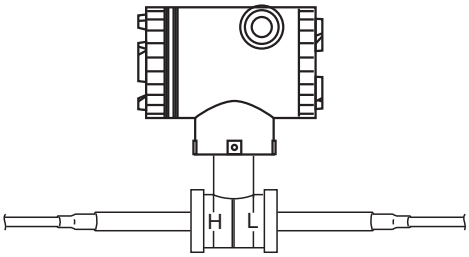
Piping of remote seal type transmitter (types: FKD)

(1) Piping of remote seal type differential pressure transmitter

Check of high/low pressure sides of transmitter

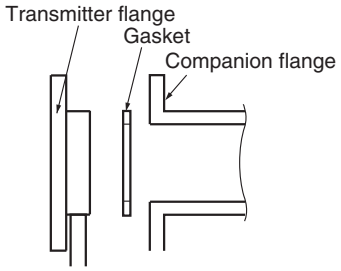
The detecting unit of the remote seal type differential pressure transmitter bears symbols H and L which represent high and low pressure sides, respectively.

For the capillary of the remote seal, provide 100mm or more for minimum bending radius.



Seal on mounting flange face

When mounting the flange, a gasket should be inserted as follows.



Important

On the flush flange type, be sure to use a gasket with an internal diameter larger than shown in the table below, to prevent the gasket from touching the seal diaphragm.
On the 80A (3B) type particularly, it should be noted that the 80A (3B) gasket available from the market is such that its inside diameter is smaller than the size shown below. If it is used, it touches the seal diaphragm and cause errors in measurements.

Minimum internal diameter of flush flange type gasket

Flange size	Minimum internal diameter of gasket
40A (1½B), 50A (2B)	49mm
80A (3B), 100A (4B)	100mm

Important

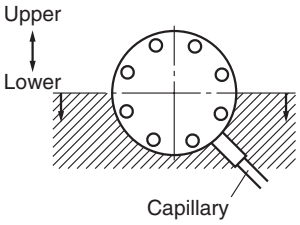
When measuring a highly corrosive process fluid, care should be taken as corrosion may occur if the fluid leaks past wetted parts.

Connecting method of the mounting flange

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

Important

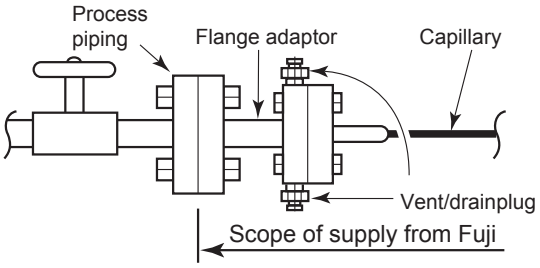
When mounting the flange, make sure that the capillary connecting portion is below the center line of flange.



Piping for small flange transmitter with flange adaptor

When connecting the flange adaptor to the process piping, make sure that the 2 vent/drain plugs fitted to the adaptor are positioned up and down, respectively.

Gaskets, bolt and nuts used for connecting the process piping are not supplied from Fuji, and should be prepared by user.

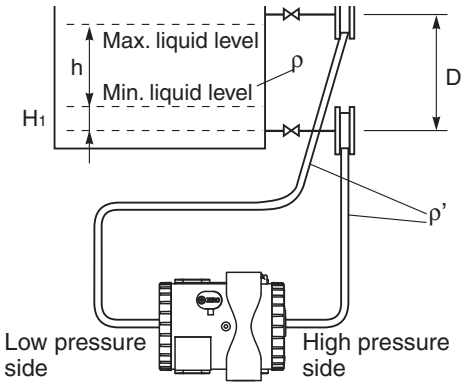


Typical examples of piping

(1) Level measurement

Open tank

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



Level calculation formula

LRV: $\rho H_1 - \rho' D$

URV: $\rho (H_1 + h) - \rho' D$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

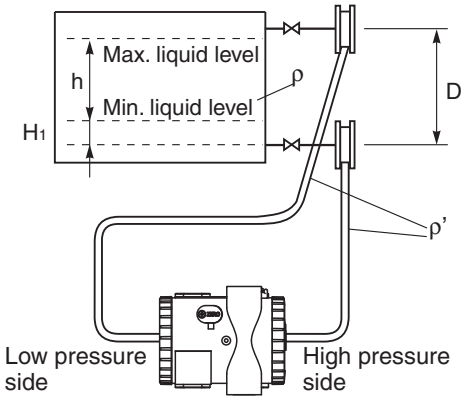
ρ': Seal liquid density

H_1: Liquid level (Refer to "Cautions on installation")

h: Level change

Enclosed tank

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



Level calculation formula
LRV: $\rho H_1 - \rho' D$
URV: $\rho (H_1 + h) - \rho' D$
Span (ΔP): ρh
LRV: Low limit of measurement (0%)
URV: High limit of measurement (100%)
ρ: Measuring liquid density
ρ': Seal liquid density
H_1: Liquid level (Refer to "Cautions on installation")
h: Level change

* The seal liquid density ρ' is a value at 25°C.

13th digit of type code	Density (g/cm^3)	Description
Y, G	0.96	For general measurement (silicone oil)
W, A, D	1.9	For oxygen and chlorine measurement (fluorine-group oil)
U, S, K	1.07	For high temperature, high temperature and vacuum, and high temperature and high vacuum (silicone oil)
X, T	1.09	

Important

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

Cautions on installation

- Restriction on H_1
  Liquid level is not proportional to the transmitter output at some pints inside the seal diaphragm. Therefore, H_1 should be set higher than the value shown in the table below.

Flange size type	Flush flange type	Extension flange
40A (1½B)	30mm	——
50A (2B)	30mm	30mm
80A (3B)	55mm	40mm
100A (4B)	55mm	55mm

- 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

- Water pressure head due to the difference in height of the flanges

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

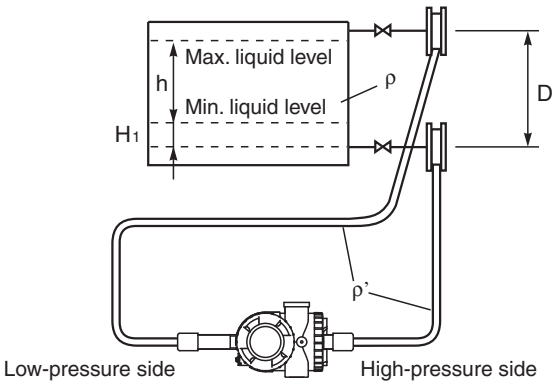
<Example of water head pressure due to difference in the height of flange>

For the remote seal type differential pressure transmitter, take care so that the head difference does not exceed the maximum range. The following relation is established in the figure shown below.

Zero point (minimum liquid level) = $\rho H_1 - \rho' D$

100% point (maximum liquid level) = $\rho(H_1+h) - \rho' D$

For example, in the case of head difference D = 4m, ρ' = 0.96 (silicon oil) and $H_1 = 0$, pressure of $-\rho' D = -38.4$kPa ($3.84 mH_2O$) is always applied to a transmitter. Accordingly measurement cannot be taken for a product whose maximum range is 32kPa ($3.2 mH_2O$). Also density of an inner fill fluid shall be considered. For fluorinated oil, as ρ' = 1.9, $-\rho' D = -76$kPa ($7.4 mH_2O$). Therefore the range of 130kPa ($13 mH_2O$) shall be selected.



The zero point shift can be made by the following methods.

(1) You can use any of the following three methods to change the zero point.

(2) Rerange with the HHC or Input-output range adjustment with the local configurator unit with LCD display.

(3) Zero adjustment with the external adjustment screw

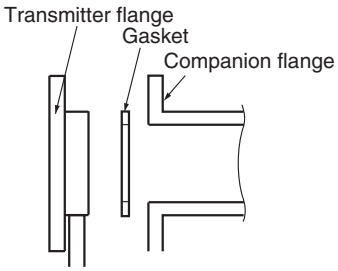
For details of the necessary procedure, refer to the relevant item.

- After piping, be sure to check airtightness.

Piping of remote seal type pressure transmitter (type: FKB)

Seal on mounting flange face

When mounting the flange, a gasket should be inserted as follows.



Important

On the flush flange type, be sure to use a gasket with an internal diameter larger than shown in the table below, to prevent the gasket from touching the seal diaphragm.
On the 80A (3B) type particularly, it should be noted that the 80A (3B) gasket available from the market is such that its inside diameter is smaller than the size shown below. If it is used, it touches the seal diaphragm and cause errors in measurements.

Minimum Minimum internal diameter of flush flange type gasket

Flange size	Minimum internal diameter of gasket
40A (1½B), 50A (2B)	49mm
80A (3B), 100A (4B)	100mm

Important

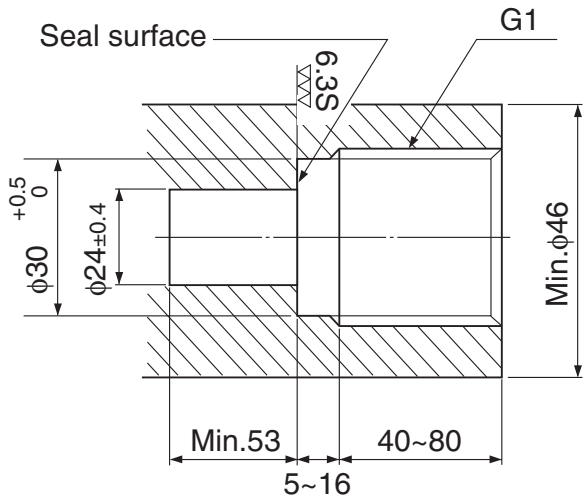
When measuring a highly corrosive process fluid, care should be taken as corrosion may be aggravated if the fluid leaks out of wetted parts.

Connecting method of the mounting flange

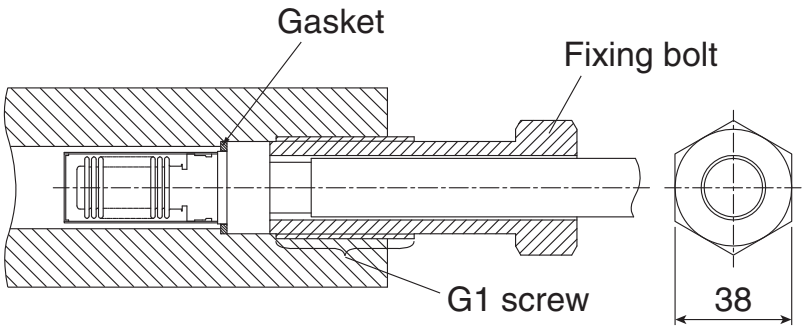
When mounting the transmitter flange on the companion flange, tighten the bolts in a diagonal order in about three cycles to prevent uneven clamping.

Mounting method of screw-in type pressure receiving unit

(1) The pressure receiving unit of this transmitter is of G1 screw-in type. The process tap should be made as shown at the right. Also, care should be taken to the sealing face.



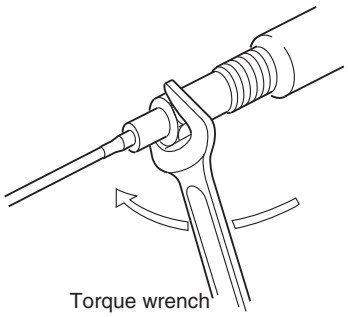
(2) Install the furnished gasket.



(3) Apply lubricant on the G1 screw of the fixing bolt so that friction is decreased and the specified torque can be received.

(4) Tighten the fixing bolt by hands after confirming that the supplied gasket is inserted. Then, tighten the fixing bolt using the torque wrench following the proper tightening torque table below.
The minimum value of the tightening torque differs depending on the working pressure. When you want to unify the tightening torque for the whole working pressure range, 315 ± 10N·m torque is recommended. Mounting is performed using the large tightening torque. (The tightening torque becomes 315N·m when the wrench of length 1m is used and 315N (approximately 32kgf) force is applied.)
Take into consideration the intensity of pipe, the tools to be used for tightening such as wrench and secure enough site space.

Width across flat of the fixing bolt: 38mm

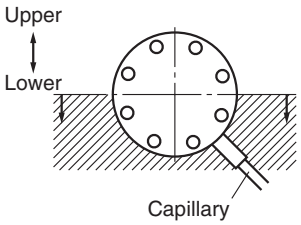


Working pressure	Minimum value	Upper limit
10MPa or less	110 N·m	325 N·m
10MPa to 20MPa	160 N·m	
20MPa to 30MPa	210 N·m	
30MPa to 40MPa	260 N·m	
40MPa to 50MPa	305 N·m	

Proper tightening torque for the fixing bolt (G1 screw)

Important

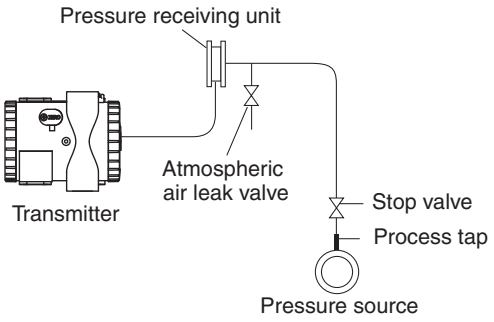
When mounting the flange, make sure that the capillary connecting portion is below the center line of flange.



Typical examples of piping

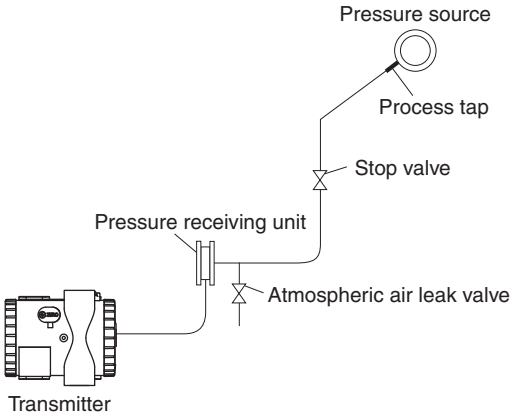
(1) Gas measurement

Locate the process tap above the pressure source.



(2) Liquid measurement

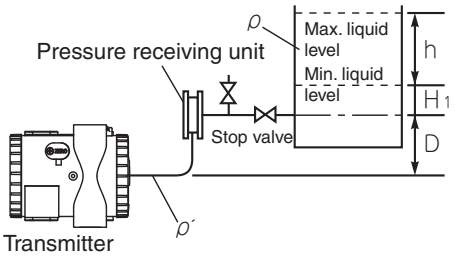
Locate the process tap below the pressure source.



(3) Level measurement

Open tank

An open tank should be connected on the lowest liquid level tapping point.



Level calculation formula

LRV: $\rho H_1 + \rho' D$

URV: $\rho (H_1 + h) + \rho' D$

Span (ΔP): ρh

LRV: Low limit of measurement (0%)

URV: High limit of measurement (100%)

ρ: Measuring liquid density

ρ': Seal liquid density

H_1: Liquid level (Refer to "Cautions on installation")

h: Liquid level change

Important

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

Cautions on process piping

- Restriction on H_1

  Liquid level is not proportional to the transmitter output at some pints inside the seal diaphragm. Therefore, H_1 should be set higher than the value shown in the table below.

  Minimum value of H_1

Flange size type	Flush flange type	Extension flange
40A (1½B)	30mm	——
50A (2B)	30mm	30mm
80A (3B)	55mm	40mm
100A (4B)	55mm	55mm

- 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.
- After piping, be sure to check airtightness.

7. WIRING

Cautions on wiring

(1) Application of a voltage exceeding 45 V DC or 32 V AC (exceeding 32 V DC or 23 V AC when arrester equipped) between "+" and "–" terminals may result in 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.

⚠ DANGER	In case of an explosionproof arrangement, wiring shall be made in accordance with the relevant regulations to ensure the explosionproofing.

Effect of cellular phone

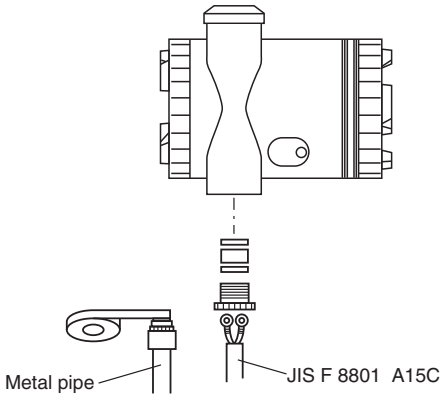
The use of a cellular phone near the transmitter or the cables may adversely affect the output of the transmitter. Do not use a cellular phone within 20cm of the transmitter or the cables.

7.1 Wiring procedure

⚠ CAUTION	• Before making wiring work, be sure to turn OFF the main power to prevent electric shocks. • Use wiring materials of correct rating to prevent fire accidents. • After installing the transmitter, firmly close the covers of the transmitter and terminal box. If not, rain water enter the transmitter which may result in trouble or incorrect operation.

Sealing of conduit connection

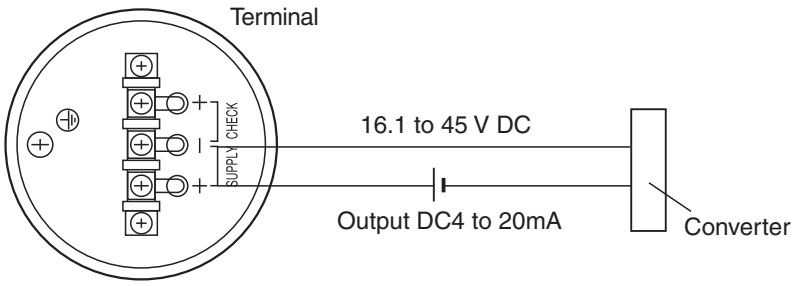
Use sealing tape, if using metal pipe screw coupling or rubber gasket and fastening gland in the case of cable (outside diameter ø11) <0.43"> to ensure airtightness of the connection box.



Important	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 block connection diagram

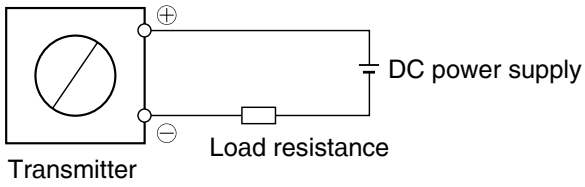
Tighten the terminal screws (M3.5 × 10) to a torque of approximately 1.5 N·m (15 kgf·cm) <11ft-lb> so that the wires will not loosen.
After connection, fasten the cover until it does not turn.



Important

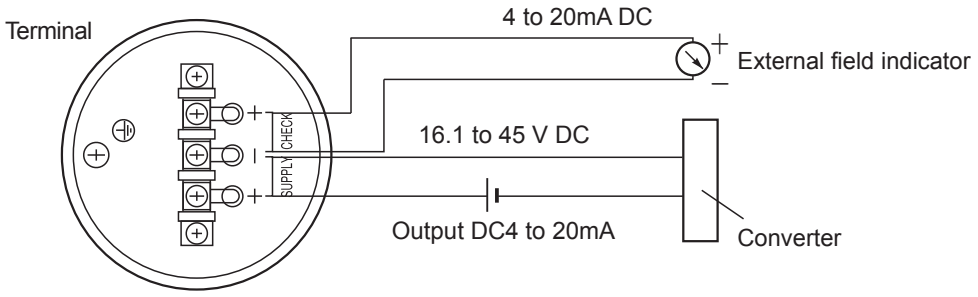
Take care not to mistake + for – when connecting the terminals.

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 CHECK terminals (+ and –) of the transmitter as shown below.
Use an external field indicator with internal resistance of 12Ω or less.



Things convenient to know beforehand

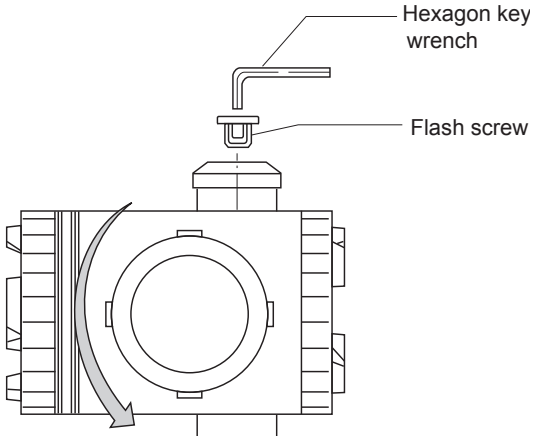
When using conduit connection at the top

For wiring from the top conduit connection, 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.



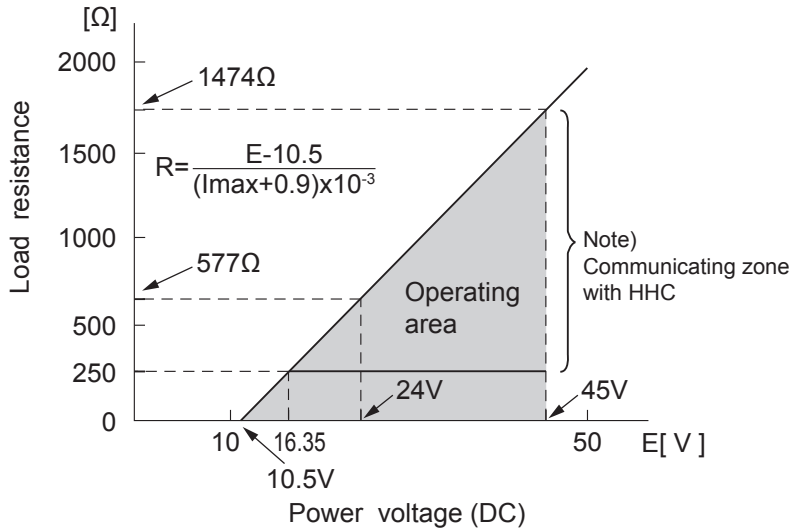
Important

- The unused conduit connection is of great importance to flameproofing 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.

⚠ CAUTION	Connect power source of correct rating. Use of power source in excess of the rating may cause a fire.



Note) Imax is the bigger one, either upper saturation current [mA] or upper burnout current [mA]. When Imax is from 20mA to 21.6mA, calculate load resistance using Imax of 21.6mA. And when Imax is from 21.7mA to 22.5mA, calculate load resistance using the formula in the figure.

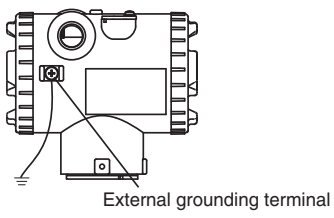
7.3 Grounding

⚠ CAUTION	The transmitter must be grounded. Otherwise, it may cause electric shocks or incorrect operation.

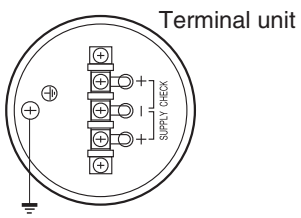
Grounding terminals are provided at two places (at the inside of terminal box and on the side of conduit connection).

By any of the methods given below, ground the transmitter in compliance with the relevant stipulation in the standard on explosionproof installation (for example, grounding resistance 100 Ω or less by one of the methods given below). In case of intrinsically safe and flameproof installation, be sure to use the ground terminal for grounding.

Grounding of transmitter casing



Grounding from ground terminal



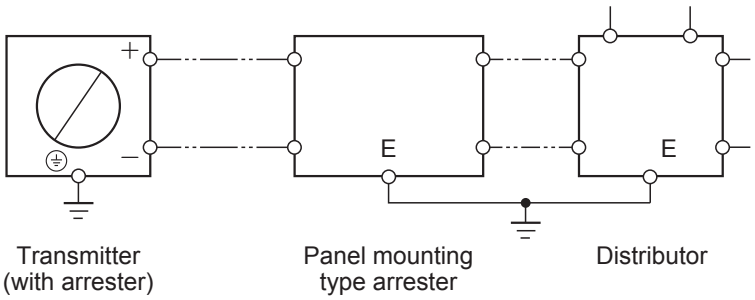
A1 BUILT-IN ARRESTER

General

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 name-plate marked “with arrester” is attached to the terminal unit of transmitter with a built-in arrester.

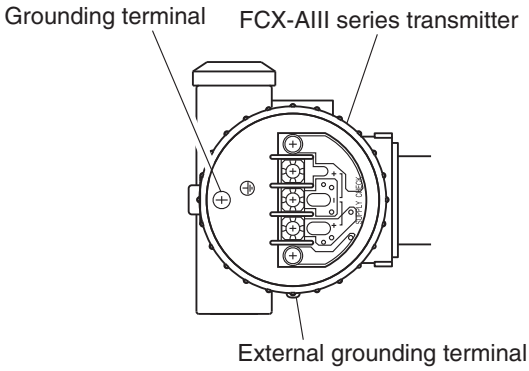
Installation

The built-in arrester should be used in combination with panel mounting type arrester for distributor protection.



Grounding

Ground the transmitter as shown in the figure below.
There are grounding terminals inside the terminal box and on the side of the cable port.
Perform class D or higher grounding (grounding resistance: 100Ω or less) by one of the following method.
If the transmitter is intrinsic safety or explosion-proof type, be sure to use the grounding terminals.



Important

1. Grounding resistance should be 100Ω or less.
2. Avoid common grounding with a lightning rod.

Maintenance

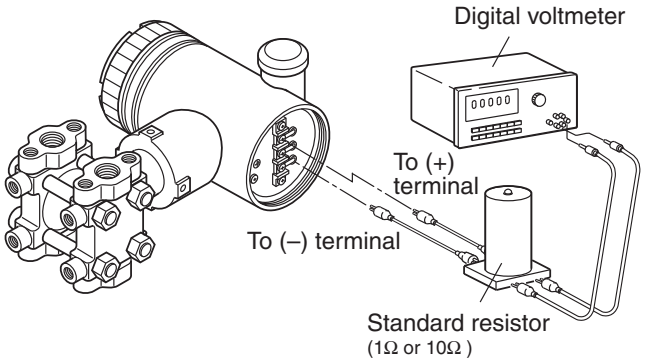
Check of arrester

- 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 CHECK terminals (+ and –), 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 0.016mA or more, the arrester is not functioning.
  In the above case, the arrester unit (terminal unit) should be replaced with a new one. (Drawing No.: TK7N5932C1)

Limitation of insulation resistance

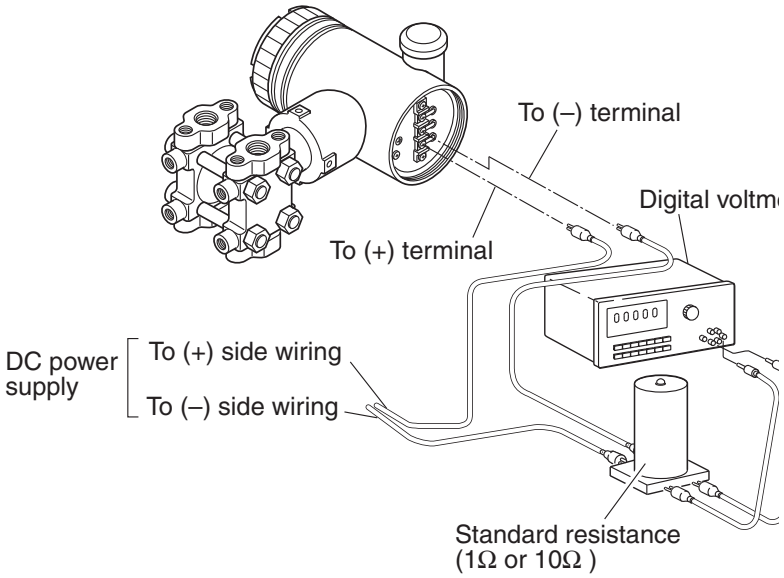
An insulation resistance test should be avoided as a rule, since it may damage the arrester.

Output measurement at check terminals



Output measurement outside transmitter

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



Preparation for calibration

The transmitter should be calibrated in a calibration room.
For the calibration room, refer to "JIS Z 8703 Standard condition of 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)
  * Measurable ranges are listed in the table below.
- Power supply: DC power supply (24 V DC) or Fuji Electric FC series power supply unit (type PXJ)
- Load resistor: Standard resistor 250 Ω (within ±0.0125 Ω)
- 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 of FKC

Differential pressure range [kPa] {mbar} <inH$_2$O>
0.1 to 1 {1 to 10} <0.4 to 4>
0.1 to 6 {1 to 60} <0.4 to 24>
0.32 to 32 {3.2 to 320} <1.25 to 12.5>
1.3 to 130 {13 to 1300} <5.2 to 520>
5 to 500 {50 to 5000} <0.7 to 70psi>
30 to 3000 {300 to 30000} <4.3 to 430psi>

Pressure range of FKG

Pressure range [kPa] {bar} <psi>
1.3 to 130 {0.013 to 1.3} <0.2 to 20>
5 to 500 {0.05 to 5} <0.7 to 70>
30 to 3000 {0.3 to 30} <4.3 to 430>
100 to 10000 {1 to 100} <15 to 1500>
500 to 50000 {5 to 500} <70 to 7000>

Pressure range of FKA

Pressure range [kPa abs] {bar•abs} <inHg abs>
1.6 to 16 {0.016 to 0.16} <0.46 to 4.6>
1.6 to 130 {0.16 to 1.3} <0.46 to 38>
5 to 500 {0.05 to 5} <0.7 to 70psi abs>
30 to 3000 {0.3 to 30} <4.3 to 430psi abs>

Differential pressure range of FKD
Flange size 3B(3 inches) 80A or more

Differential pressure range [kPa] {bar} <inH$_2$O>
0.32 to 32 {0.0032 to 0.32} <1.25 to 125> 1.3 to 130 {0.013 to 1.3} <5.2 to 520> 5 to 500 {0.05 to 5} <0.7 to 70psi>

Pressure range of FKB
Flange size 3B(3 inches) 80A or more

Pressure range [kPa] {bar} <psi>
1.3 to 130 {0.013 to 1.3} <0.2 to 20> 5 to 500 {0.05 to 5} <0.7 to 70> 30 to 3000 {0.3 to 30} <4.3 to 430> 100 to 10000 {1 to 100} <15 to 1500> 500 to 50000 {5 to 500} <70 to 7000>

Differential pressure range of FKE
Flange size 3B(3 inches) 80A or more

Differential pressure range [kPa] {mbar} <inH$_2$O>
0.32 to 32 {3.2 to 320} <1.25 to 125> 1.3 to 130 {13 to 1300} <5.2 to 520> 5 to 500 {50 to 5000} <0.7 to 70psi>

Differential pressure range of FKD
Flange size 2B(2 inches) 50A or below

Differential pressure range [kPa] {mbar} <inH$_2$O>
3 to 32 {30 to 320} <12 to 125> 13 to 130 {130 to 1300} <52 to 520> 50 to 500 {500 to 5000} <200 to 2000>

Pressure range of FKB
Flange size 2B(2 inches) 50A or below

Pressure range [kPa] {bar} <psi>
50 to 500 {0.5 to 5} <7 to 70> 300 to 3000 {3 to 30} <43 to 430> 1000 to 10000 {10 to 100} <150 to 1500>

Differential pressure range of FKE
Flange size 2B(2 inches) 50A or below

Differential pressure range [kPa] {mbar} <inH$_2$O>
3 to 32 {30 to 320} <12 to 125> 13 to 130 {130 to 1300} <52 to 520> 50 to 500 {500 to 5000} <200 to 2000>

Direct mount type, pressure range of FKP

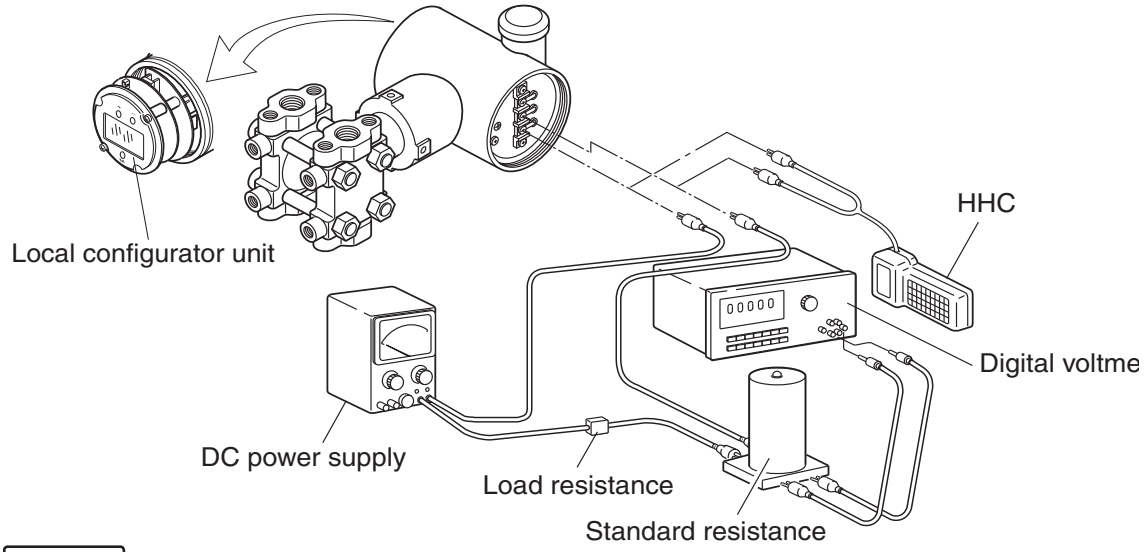
Pressure range [kPa] {bar} <psi>
8.125 to 130 {0.08125 to 1.3} <1.2 to 20> 31.25 to 500 {0.3125 to 5} <4.5 to 70> 187.5 to 3000 {1.875 to 30} <27 to 430> 625 to 10000 {6.25 to 100} <90 to 1500>

Direct mount type, pressure range of FKH

Pressure range [kPa abs] {bar abs} <psi abs>
8.125 to 130 {0.08125 to 1.3} <1.2 to 20> 31.25 to 500 {0.3125 to 5} <4.5 to 70> 187.5 to 3000 {1.875 to 30} <27 to 430>

Calibration procedure

(1) Make wiring according to the diagram below.
Connect the DC power supply, digital voltmeter, HHC, standard resistance, and load resistance.
When current is measured with an ammeter connected to CK+ and CK – terminals, the internal resistance of the ammeter should be 12Ω or less.



Important

For communication with the HHC, a load resistor of 250Ω is necessary.

(2) Calibration of output circuit (D/A)
Local configurator unit with LCD display: Calibrate with reference to “Output circuit calibration” in the section 4.2 “Adjustment procedure by local configurator unit with LCD display”.
HHC: Calibrate with reference to “Calibration of output circuit” in the section 4.3 “Adjustment with HCC”.

(3) Zero/span calibration
Local configurator unit with LCD display: Calibrate with reference to “Zero/span calibration” in the section 4.2 “Adjustment procedure by local configurator unit with LCD display”.
HHC: Calibrate with reference to “Zero/span adjustment” in the section 4.3 “Adjustment with HCC”.

(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 (example)	
		Accuracy:0.065%	Accuracy:0.2%
Percent display (%)	0, 25, 50, 75, 100	±0.065% ± 1 digit	±0.2
Current measurement (mA)	4, 8, 12, 16, 20	±0.0104	±0.032
Voltage measurement (V)	1, 2, 3, 4, 5	±0.0026	±0.008

A3 PARAMETER SETTING PRIOR TO DELIVERY

The damping value (time constant), function of zero/span adjusting screw, output current mode, indicator scale, cut point, modes below cut point, burnout, polygonal line correction, saturation current, and write protect were set at the factory as shown in the following.

No.	Item	Contents of parameter
1	Damping value (time constant)	0.06s(min)
2	External adjustment function of the transmitter	Adjustable (ENABLE)
3	Current output mode	Linear (Note 2)
	Digital indicator scale (9th digit of code symbols)	To be set by designating type 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.

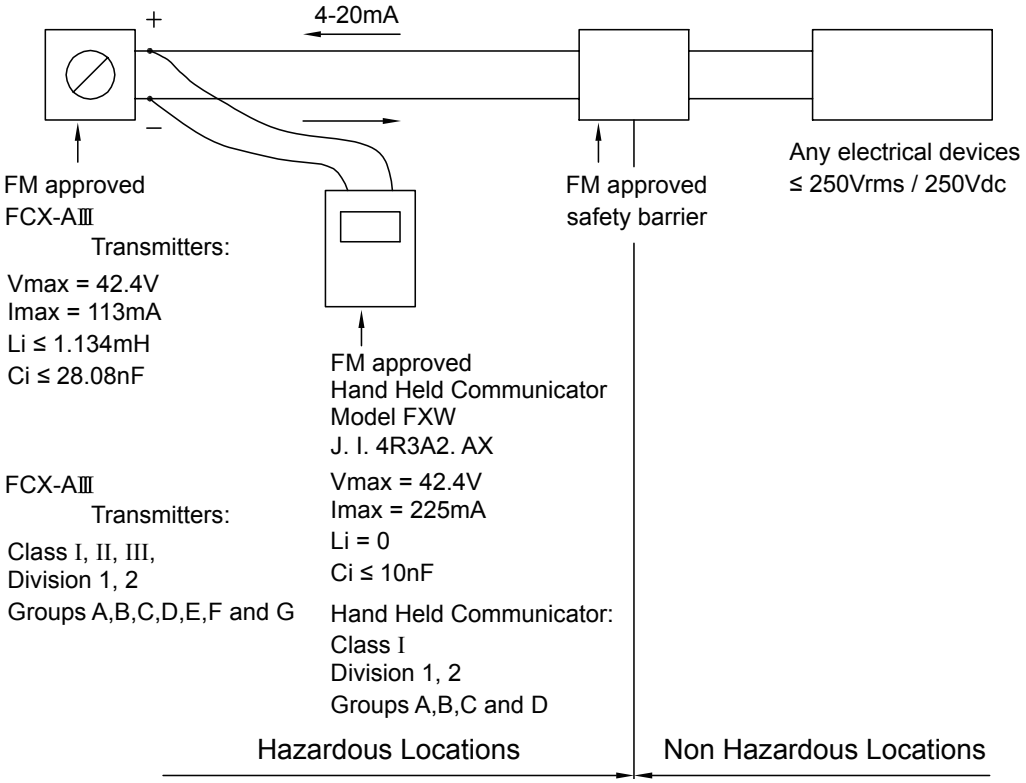
Note 2) In both the differential pressure transmitter (Type: FKC) and remote seal type (Type: FKD), the output current mode is set in linear unless it is designated.

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

A4 HAZARDOUS LOCATION INSTALLATION INFORMATION

This appendix contains documents that present installation instruction for the FCX-AIII Series Transmitter in a hazardous location. 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:

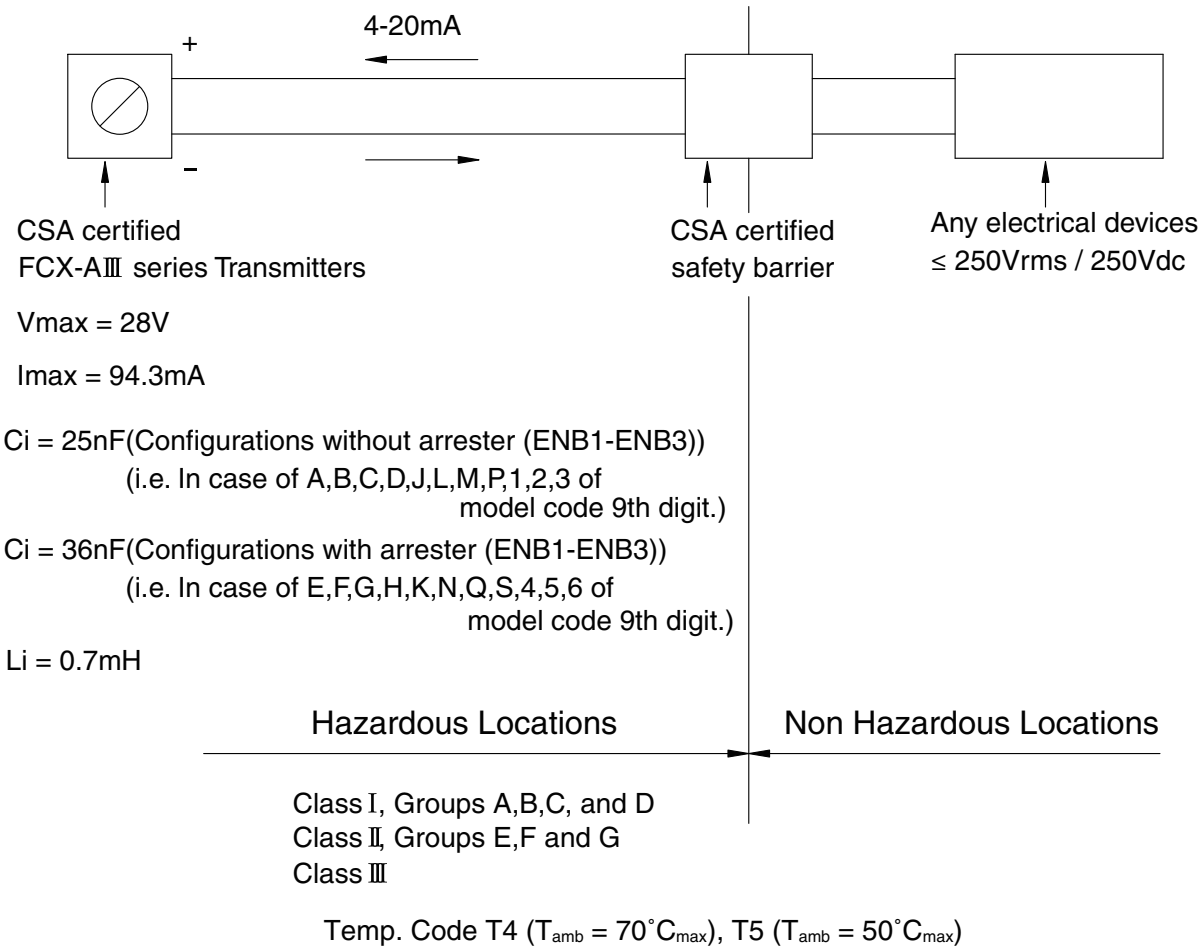
1) The Intrinsic Safety Entity concept allows the interconnection of FM Approved Intrinsically safe devices with entity parameters not specifically examined in combination as a system when: Uo or Voc or Vt ≤ Vmax, Io or Isc or It ≤ Imax, Ca or Co ≥ Ci + Ccable, La or Lo ≥ Li + Lcable, Po ≤ Pi.
2) The 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 FM Approved model.
3) Dust-tight conduit seal must be used when installed in Class II and Class III environments.
4) Control equipment connected to the Associated Apparatus must not use or generate more than 250Vrms or Vdc.
5) Installation should be in accordance with ANSI/ISA RP12.6 “Installation of intrisically Safe Systems for Hazardous (Classified) Locations” and the National Electrical Code® (ANSI/NFPA70) Sections 504 and 505.
6) The configuration of associated Apparatus must be Factory Mutual Research Approved under Entity Concept.
7) Hand Held Communicator and Associated Apparatus manufacturer’s installation drawing must be followed when installing this equipment.
8) AEx ib is suitable only for Class I, Zone1, Hazardous (Classified) Locations and is not suitable for Class I, Zone0, or Class I, Division 1 Hazardous (Classified) Locations.
9) No revision to drawing without prior Factory Mutual Research Approval.
10) Simple Apparatus is defined as a device that neither generates nor stores more than 1.2V, 0.1A 20uJ or 25mW.

Contents on this page are based on TC522195 Rev.a

Figure 1. FCX-AⅢ Series transmitter, Intrinsically Safe Installation for FM

INSTALLATION INSTRUCTIONS

(FCX-AⅢ 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:
   - Voc ≤ Vmax
   - Isc ≤ Imax
   - Ca ≥ Ci + C cable
   - La ≥ Li + 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-AⅢ Series transmitter, Intrinsically Safe Installation for CSA

INSTRUCTIONS FOR ATEX and IECEX

For the safe use of transmitters intended for use in potentially explosive atmospheres

INTRODUCTION

- First, carefully read this manual. It contains essential information for the safe use of transmitters in potentially explosive atmospheres.

- Any modification of the transmitter without the permission of Fuji Electric is strictly prohibited. Fuji Electric will not bear any responsibility for trouble caused by such a modification.

FCX series electronic pressure transmitters (FCX-AIII Type) have been designed and built for the groupe IIC in compliance with the basic requirements of the directive 94/9/EC as well as with the standards:
- EN 60079-0 (2006-07), EN 60079-1 (2007-07),
- EN 60079-11 (2007-01), EN 60079-15 (2005-10),
- EN 60079-26 (2007-03), EN 60529(1991-10),
- EN 60529/A1(2000-02), EN 61241-0 (2006-12),
- EN 61241-1 (2004-06) + C1(2006-12),
- IEC 60079-0 (Ed.4.0), IEC 60079-1 (Ed.5.0),
- IEC 60079-11 (Ed.5.0), IEC 60079-15 (Ed.3.0),
- IEC 60529 (Ed.2.1), IEC 61241-1-1 (Ed.2.0).

These transmitters are manufactured :

Fuji Electric France S.A.S.
46, rue Georges Besse, ZI du Brézet,
F-63039 Clermont, Ferrand Cedex 2
France

Only these two companies are entitled to repair the FCX series transmitters.

1. BEFORE OPERATION

It is vital to ensure that the equipment supplied exactly meets your needs and that it is certified for safe use in your expected operating conditions.

1.1 For a use in Zone 0 :

Ensure that the following information appears on the nameplate fastened on the amplifier enclosure :

MODEL NUMBER

Model Nr **Faaaaaab-acaaa-aa**

b) Version of the transmitter
= 5

c) Safety approvals
= K : ATEX Intrinsic Safety
= T : IECEx Intrinsic Safety
= M : ATEX Combination Ex d and Ex ia
= N : IECEx Combination Ex d and Ex ia

SAFETY MARKING

II 1 G (*For ATEX only*)

Ex ia IIC T4 ; Ta= -40°C to +70°C
Ex ia IIC T5 ; T= -40°C to +50°C ;
Ui ≤ 28 Vdc Ii ≤ 94.3 mA Pi ≤ 0.66 W
Ci = 26 nF / 36 nF Li = 0.6 mH / 0.7 mH
IP66/67

Remark :
"ia" equipment can also be used in Zone 1 and Zone 2.

1.2 For a use in Zone 1 (or 21) :

Ensure that the following information appears on the nameplate fastened on the amplifier enclosure :

MODEL NUMBER

Model Nr **Faabaaac-adaaa-aa**

b) Cable entry
= 6, T or P : 1/2-14 NPT
= 8, W, M or R : M20 × 1, 5

c) Version of the transmitter
= 5

d) Safety approvals
= X : ATEX Flameproof per enclosure
= R : IECEx Flameproof per enclosure
= M : ATEX Combination Ex d and Ex ia
= N : IECEx Combination Ex d and Ex ia

SAFETY MARKING

II 2 GD (*For ATEX only*)

Ex d IIC T6 ; Ta= -40°C to +65°C
Ex d IIC T5 ; Ta= -40°C to +85°C ;
T°C cable 90°C (for T5)
DIP/Ex tD A21 IP66/67 T 100°C
DIP/Ex tD A21 IP66/67 T 85°C

Remark :
"d" equipment can also be used in Zone 2 or 22.

1.3 For a use in Zone 2 :

Ensure that the following information appears on the nameplate fastened on the amplifier enclosure :

MODEL NUMBER

Model Nr **Faaaaaab-cdaaa-aa**

b) Version of the transmitter
= 5

c) .....Indicator.....Arrester

= A :	No	No
= E :	No	YES
= L :	Digital	No
= P :	Digital	No
= M :	Digital	No
= Q :	Digital	YES
= S :	Digital	YES
= N :	Digital	YES
= 1 :	Local configurator unit	No
= 2 :	Local configurator unit	No
= 3 :	Local configurator unit	No
= 4 :	Local configurator unit	YES
= 5 :	Local configurator unit	YES
= 6 :	Local configurator unit	YES

d) Safety approvals
= P : ATEX Type n
= Q : IECExType n

SAFETY MARKING

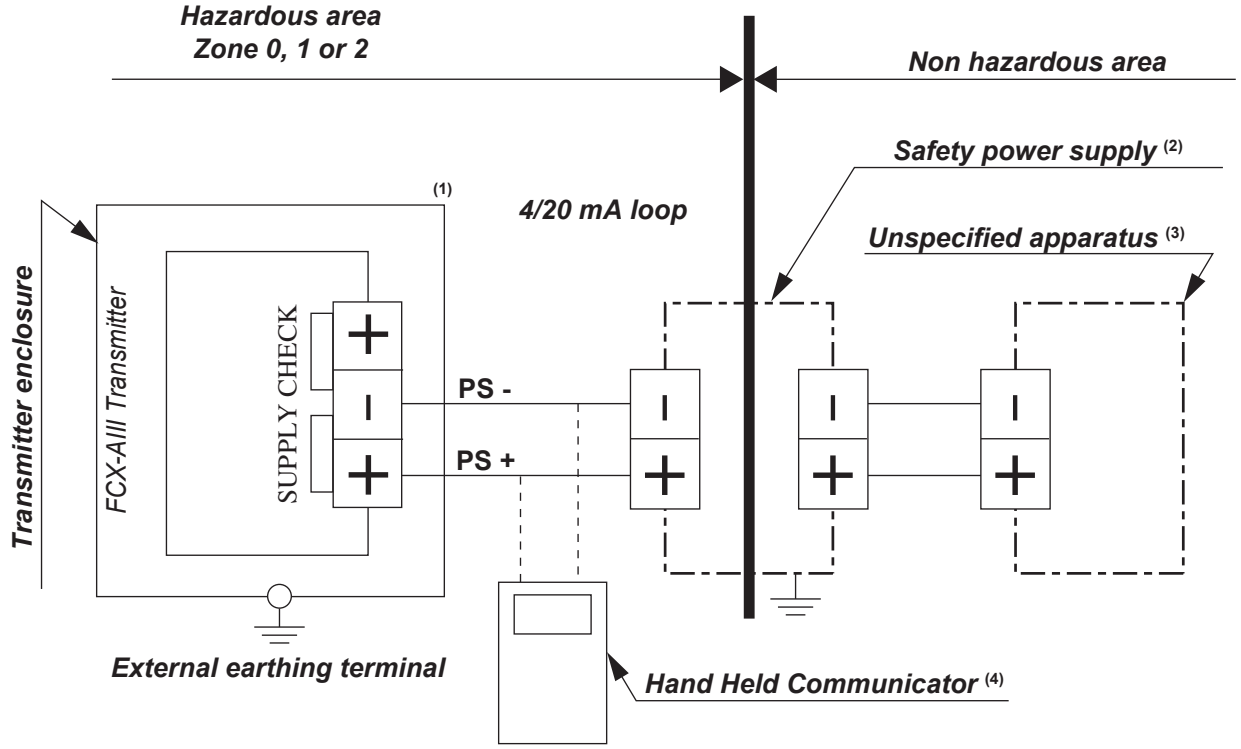
II 3 G (*For ATEX only*)

Ex nA II T5 ; Ta= -40°C to +70°C
IP66/67

2. INSTALLATION AND PIPING

2.1. Ex “ia” equipment (ref. § 1.1) :

SCHEMATIC DIAGRAM



ELECTRICAL DATA

(1) The input parameters of FCX-AIII transmitter are:
Ui ≤ 28 Vdc Ii ≤ 94.3 mA Pi ≤ 0.66 W
Ci = 26 nF Li = 0.6 mH
- With optional arrester:
Ci = 36 nF
- With optional Analog Indicator:
Li = 0.7 mH
These instruments must only be associated to an [ia] or [ib] certified type equipment, this association has to be intrinsic safety compatible.

(2) For these instruments the power supply must be a certified intrinsic safety type whose output parameterts are:
Uo_{Max} : 28 Vdc Io_{Max} : 94.3 mA
Po_{Max} : 0.66 W
Internal resistance : $Rz_{min}= Uo_{Max} / Io_{Max}$
Example :
- If Uo_{Max} = 28V, Rz_{min} = 28/0.0943= 296.9Ω
- If Uo_{Max} = 24V, Rz_{min} = 24/0.0943= 254.5Ω

(3) Do not apply the power source with ground voltage over than 250Vrms/250Vdc (under the normal or abnormal conditions) to this apparatus.

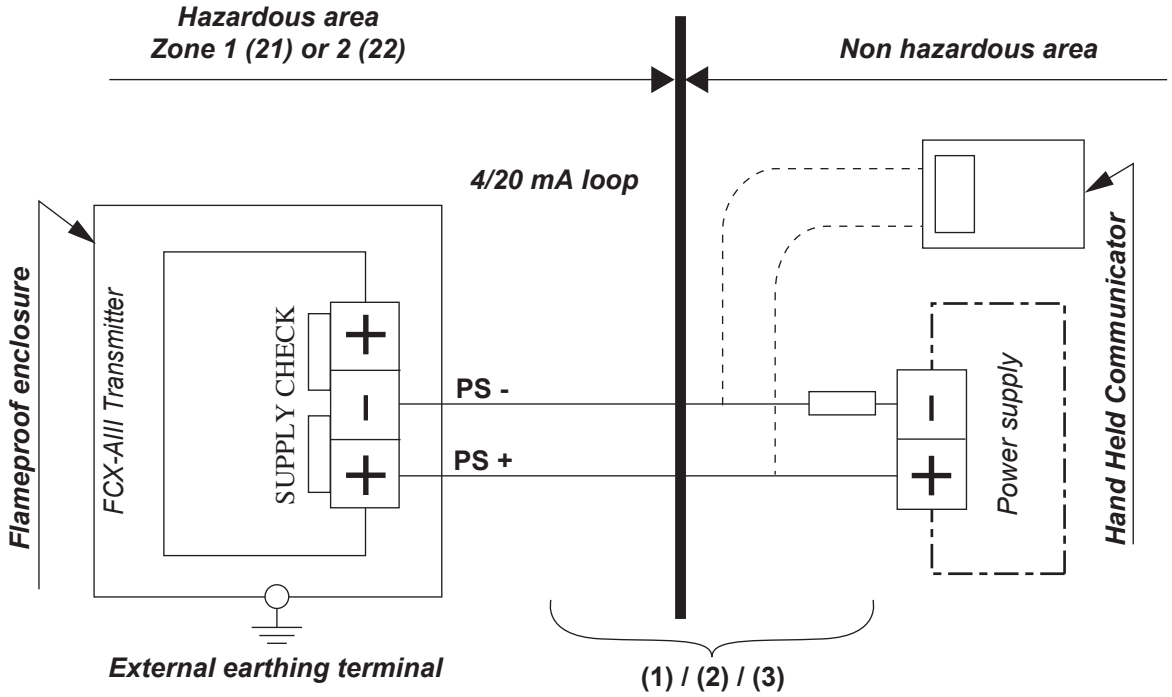
(4) Any Hand Held communicator or other certified device whose electrical parameters are in compliance with intrinsic safety requirements of the complete 4/20 mA loop.
Especially, total values of Li and Ci of this device (4), the FCX transmitter (1), and cables must be compatible with the selected safety power supply (2).

2.2. Ex “d”, “DIP/Ex tD” equipment (ref. § 1.2)

:

CAUTION
IN POTENTIALLY EXPLOSIVE ATMOSPHERE NEVER DISMOUNT OR OPEN THE TRANSMITTER WHILE ENERGISED

SCHEMATIC DIAGRAM



ELECTRICAL DATA

Power supply (+ and -)

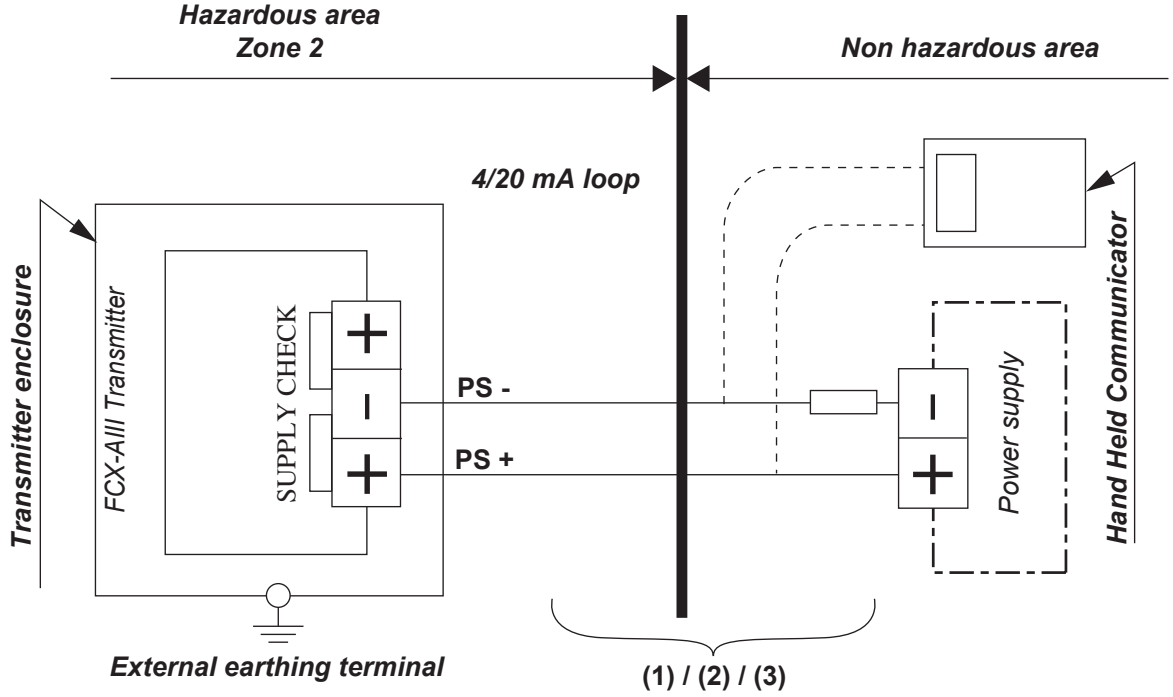
Supply voltage : 10.5 to 45 Vdc
Output current : 3.2 to 21.6 mAdc

Notes:

(1) Install in accordance with the IEC 60079-14,
(2) For Ta ≥ 70°C use a cable Temp. 90°C,
(3) The cable diameter must comply with the selected cable gland,
(4) Ex d and IP 66/67 cable glands and/or plugs are required then, they must be tightened in accordance with supplier’s instructions.
For more details, refer to Chapter 7.of the Instruction Manual.

2.3. Ex “nA” equipment (ref. § 1.3) :

SCHEMATIC DEAGRAM



ELECTRICAL DATA

Power supply (+ and -)

Supply voltage : 10.5 to 45 Vdc
Output current : 3.2 to 21.6 mAdc
Remark: Optipnal Analog Indicator is not available with this protection type.
For more details, refer to Chapter 7. of the Instruction Manual.

3. ADJUSTMENT

3.1. Ex “ia” & Ex “nA” equipment (§ 1.1 & § 1.3) :

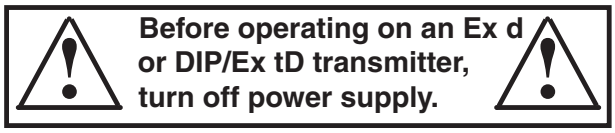
Before connecting a Hand Held Communicator (“HHC”), be sure that the sum of capacitors and inductances (including HHC) are in accordance with the limit values of the selected safety power supply.

3.2. Ex “d”, “DIP/Ex tD” equipment (ref. § 1.2) :

NEVER CONNECT A HAND HELD COMMUNICATOR ("HHC") DIRECTLY ON TO THE TERMINAL UNIT OF THE TRANSMITTER IN A POTENTIALLY EXPLOSIVE ATMOSPHERE.

For more details, refer to Chapter 4. of the Instruction manual.

4. SAFETY CAUTIONS



Take care :

- to never damage threads of covers and enclosure,
- to never damage the connection between Cell and enclosure (cylinder bore),
- to always be sure that covers are tightened to a stop on the enclosure and the shroud has been mounted before turning ON power supply (for “Exd” only),
- that O-rings, necessary to keep tight the enclosure, are undamaged,
- that the process temperature, inside the process covers of the transmitter’s measuring cell, never exceed 85°C for a use with the class T6, or never exceed 100°C for a use with the class T5 (for “Exd” only).

All operations must be done by persons allowed to work on equipment used in potentially explosive atmospheres.

Spare parts must only be genuine parts supplied by Fuji Electric.

In case of use of instruments with the double marking (Ex d and Ex ia), identify the protection mode which will be used when installing the transmitter, by putting a cross in the square case provided on the certification label, in order to avoid to install it for an other mode.

5. SPECIAL CONDITIONS FOR SAFE USE

5.1. Ex “ia” & Ex “nA” equipment (§ 1.1 & § 1.3) :

Measured process pressure temperature are limited for each specific installation in order to assure that the design ratings are not exceeded in any application. The application process temperature in conjunction with ambient temperature of the application does not elevate the temperature inside the enclosure above the maximum ambient temperature rated for the transmitter which is 70°C for temperature code T4 and 50°C for temperature code T5 this for protection type Ex ia, it is 70°C for temperature code T5 for the protection type Ex nA.
Suitable rated cable glands or plugs shall be used to assure IP66/67 rating of the final installation.
Installations for models incorporating the Arrester Board shall consider that these models do not assure electrical insulation of minimum 500 Vac between the input circuitry and enclosure.

5.2. Ex “d”, “DIP/Ex tD” equipment (ref. § 1.2) :

In accordance with section 5.2.2 ofIEC60079-1, the constructional gap (ic), being less than those required by table 1, have been specified in drawings TC305618 and TC305619 (Flame paths drawing).

A5 HART COMMUNICATION FUNCTION

1. HART communication function

1.1 HART communication

The FCX-AIII series transmitters can communicate with HART[1)] master devices such as HART communicator.

Note1) HART (Highway Addressable Remote Transducer) is a registered trademark of the HART Communication Foundation.

1.2 HART communicator

The HART communicator can communicate with various types of HART field devices.
A user who has a HART communicator or a HART master device is ready for communication with the FCX-AIII transmitters.

1.3 DD (Device description)

Device Description (DD) is configuration information of each field device having HART communication functions.
Please check that the DD for the FCX-AIII transmitters is installed into the HART communicator or the HART master device to be used.
Make sure to use DD for the FCX-AIII transmitters with the following specification:

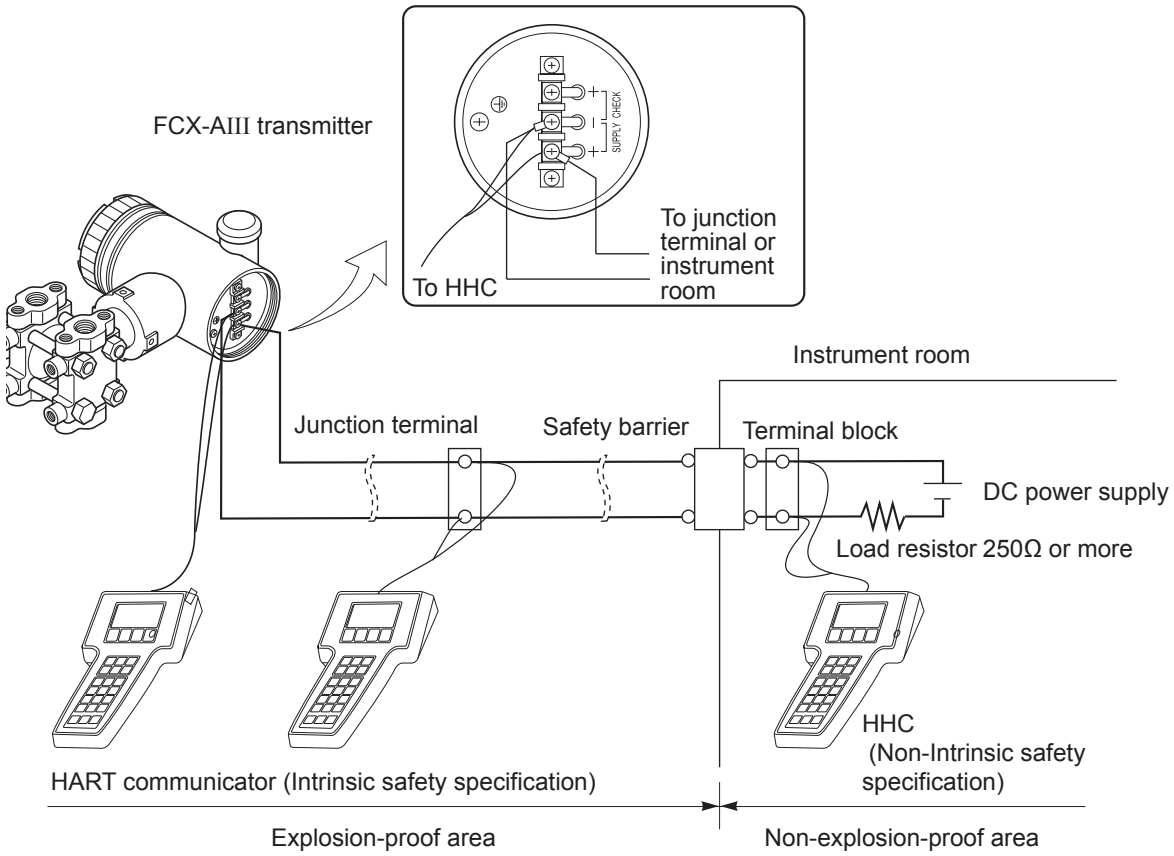
HART information of the FCX-AIII series transmitters:

HART protocol version	5
Manufacture ID	000015
Device Type	0002

HART communication function is fully available when the DD for the FCX-AIII transmitters is installed into the HART communicator or the HART master device to be used.
If the DD is not installed into these devices, the function of HART communication is not fully supported, although they can communicate with the FCX-AIII series transmitters in generic mode.

2. Connection

Connection of HART communicator (Example, Rosemount 375/475)



⚠ **CAUTION**	Fuji HHC and HART communicator cannot be used at the same time. Be sure to connect individually.

⚠ **CAUTION**	When using Fuji 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.

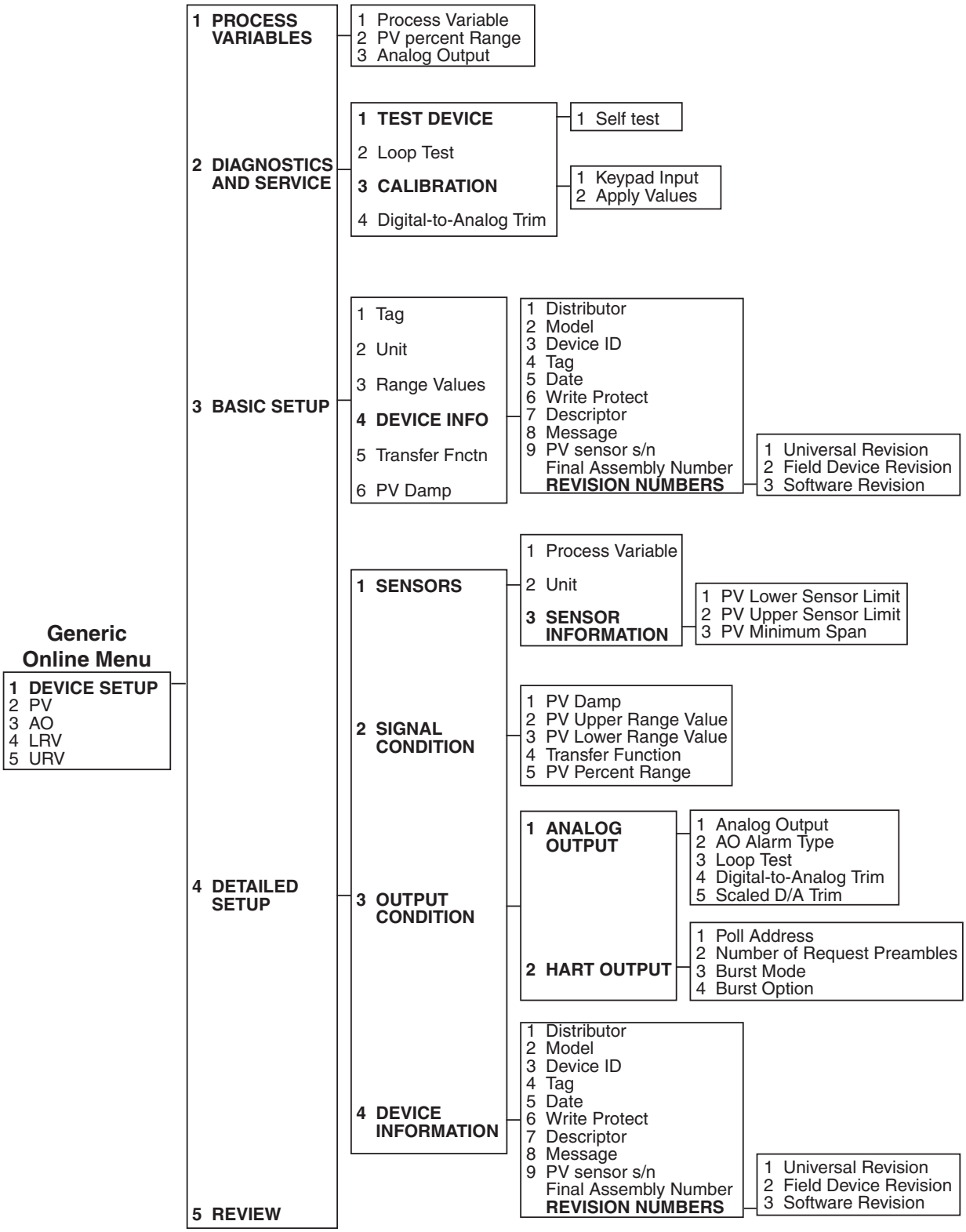
⚠ **DANGER**	When using flame-proof transmitter, do not connect HHC to the transmitter terminal and junction terminal in an explosion-proof area.

3. Function and operation (example)

3.1 HART Communicator Menu Tree

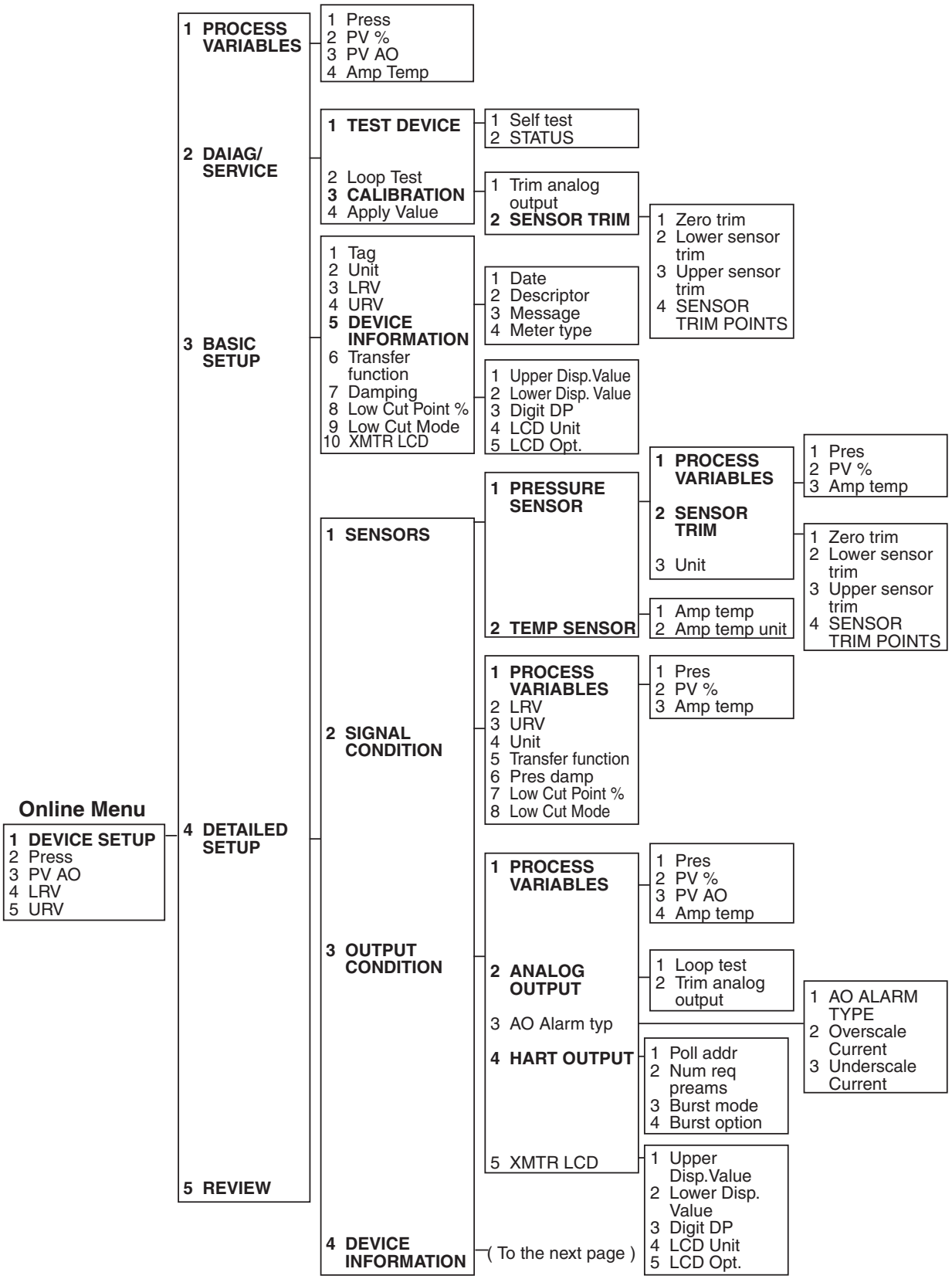
3.1.1 Menu Tree 1 - Generic -

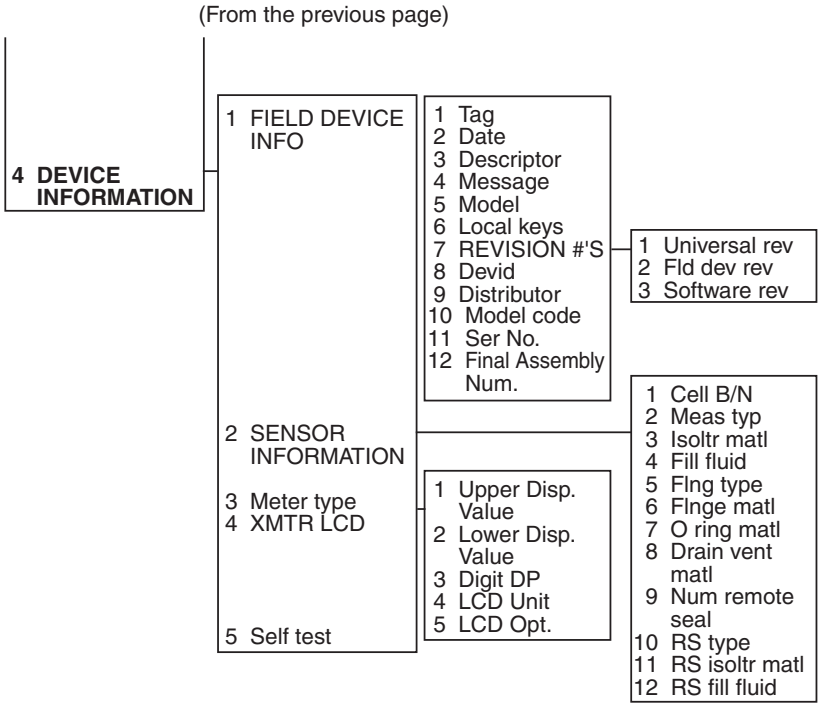
Example on HART communicator (Rosemount 375/475)



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

Example on HART communicator (Rosemount 375/475)




(From the previous page)
4 DEVICE INFORMATION
1 FIELD DEVICE INFO
1 Tag
2 Date
3 Descriptor
4 Message
5 Model
6 Local keys
7 REVISION #'S
8 Devid
9 Distributor
10 Model code
11 Ser No.
12 Final Assembly Num.
1 Universal rev
2 Fld dev rev
3 Software rev
2 SENSOR INFORMATION
1 Cell B/N
2 Meas typ
3 Isoltr matl
4 Fill fluid
5 Flng type
6 Flnge matl
7 O ring matl
8 Drain vent matl
9 Num remote seal
10 RS type
11 RS isoltr matl
12 RS fill fluid
3 Meter type
4 XMTR LCD
1 Upper Disp. Value
2 Lower Disp. Value
3 Digit DP
4 LCD Unit
5 LCD Opt.
5 Self test

A6 USE IN SAFETY INSTRUMENTED SYSTEM

Using the FCX-AIII series transmitters in safety instrumented system

⚠ CAUTION	The FCX-AIII series transmitters (hereinafter referred to as "AIII transmitters") can be applied to Safety Instrumented System (SIS) based on IEC61508/IEC61511. If you use the AIII transmitters in SIS, please observe the instructions below to ensure the safety performance.

Overview

This section describes the rules, items to be configured and checked, proof test, and maintenance work for using the AIII transmitters in SIS.

Safety integrity

Safety integrity of the AIII transmitters is ±2%. This means that the AIII transmitters are treated as being failure when the error due to failure of electronic components exceeds ±2%.

Note 1) The safety integrity is not equal to the accuracy rating.

Configuration check and calibration

By using a Fuji HHC (Type: FXW), a HART communicator (for example, Meriam MFC4150), or the local configurator unit with LCD display, carry out the configuration check and calibration of input/output characteristics, specifically as follows:

1) Configuration check
   - Pressure range (LRV, URV)
   - Pressure unit (kPa, etc.)
   - Output mode (linear (LIN), square root (SQR))
   - Low flow rate cut point for square root output (SQR) and low flow rate cut mode (zero / linear below cut point)
   - Burnout direction, burnout current, and saturation current

   Note 2) Set the direction of burnout to either of Overscale or Underscale.

   Note 3) Set the saturation current and burnout current as follows:

   When the burnout direction is set to Overscale:

   Saturation current (upper limit): 20.0 mA to 20.8 mA

   Burnout current (Over): 20.9 mA to 22.5 mA

   When the burnout direction is set to Underscale:

   Saturation current (lower limit): 3.8 mA to 4.0 mA

   Burnout current (Under): 3.2 mA to 3.7 mA

   Note 4) Check that the burnout current (upper or lower limit) is set to the value which matches to the host device (such as DCS) communicating with the transmitter.
2) Check of fixed current output value (4 mA fixed current output, 20 mA fixed current output) and calibration (if necessary)
3) Check of burnout current value
4) Check of input characteristics and calibration (if necessary)
   (Zero calibration with 0% input, span calibration with 100% input)
5) Check of indicated values and output current (4 to 20 mA) with input of 0%, 50%, 100%

Proof test

A proof test is necessary to check that the AIII transmitter works properly with no problem for safety function.
Proof tests should be performed, according to the safety calculation of SIS using AIII transmitter, at specified interval or with more frequency than that.

By using a Fuji HHC (Type: FXW), a HART communicator (for example, Meriam MFC4150), or the local configurator unit with LCD display, carry out a proof test and, if necessary, calibration.

Proof test items

1) Confirmation fixed current output value (4 mA fixed current output, 20 mA fixed current output)
2) Confirmation burnout current value
3) Confirmation indicated values and output current (4 to 20 mA) with input of 0%, 50%, 100%

Please keep the record of these test data for safety management.

Maintenance

1) Periodic inspection
   In order to keep a good accuracy and service life of the transmitter, carry out periodic inspection according to the operating condition.
   (We recommend annual inspection.)
   Especially, we recommend you to perform periodic inspection of gasket and o-ring of the detector.
   For the work procedure of periodic inspection, refer to “5.1 Periodic inspection”.

2) Maintenance, repair and replacement
   Set the transmitter offline before performing maintenance, repair and replacement.
   For the detail, refer to “5.2 Troubleshooting”, “5.3 Replacement of parts”, and “5.4 Adjustment after replacement of unit” in this manual.

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