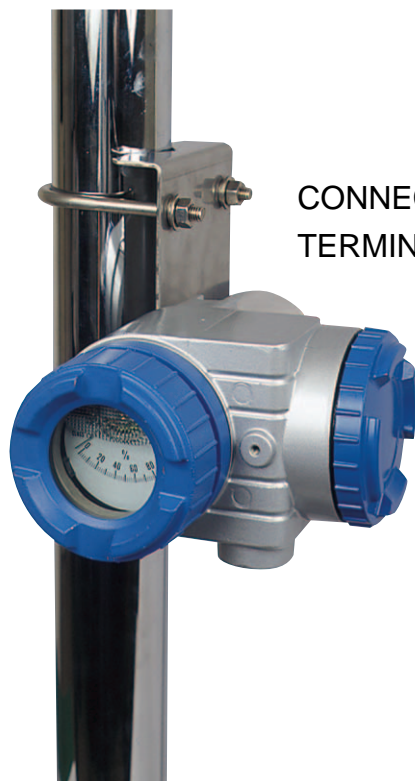




Instruction Manual

WATER LEVEL TRANSMITTER

TYPE: FQK



CONNECTOR
TERMINAL



DETECTOR

PREFACE

Thank you for purchasing Fuji Water Level Transmitter (type: FQK).

- Before attempting to use this level transmitter, read this instruction manual carefully to understand installation, operation and maintenance procedures for the transmitter. Improper handling may result in an accident or a failure.
- The specifications for the transmitter given herein are subject to change without notice.
- Modification of this transmitter without consulting Fuji Electric in advance is prohibited. Fuji is not responsible for any trouble that may result from modification.

Manufacturer : Fuji Electric Instrumentation Co., Ltd.
Type : Described in nameplate on main frame (see page vi)
Date of manufacture : Described in nameplate on main frame
Country of manufacture : 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.




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Issued in November, 2004

CAUTION ON SAFETY


First of all, read this “Caution on safety” carefully to ensure correct operation of the instrument.

The hazard warnings given here are of great importance to safety and therefore should be followed without fail. Those hazard warnings are classified into ranks “DANGER,” “PROHIBITION” and “CAUTION.”

 DANGER	Indicates a wrong handling which may result in a dangerous situation where there is a risk of death or serious injury.
 PROHIBITION	Indicates an action prohibited for avoiding a danger.
 CAUTION	Indicates a wrong handling which may invite a dangerous situation, in which there is a possibility of medium-level trouble and slight injury or only physical damage is predictable.

Even a wrong handling under ‘ CAUTION’ may lead to a serious result depending on circumstances. Because every hazard warning pertains to an important subject, its negligence is not allowed in any case.

- The alert heading for a notice is described below.

 INDICATION	Gives a general instruction on user’s action.
---	---

Caution on Handling



DANGER

- This transmitter is not of explosion-proof specifications. Do not use it in an atmosphere of explosive gas. Otherwise a serious accident such as explosion or fire may result.



CAUTION

- Install the transmitter in a place that meets the service conditions listed in the “Instruction Manual” of the transmitter.
- 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.
- Be sure to close the cover of the connector terminal securely after installing the transmitter. Otherwise rainwater may enter into the equipment, thus resulting in a failure or malfunction.

Wiring



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.

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CAUTION ON USE

- **Storage for long period**
Store the level transmitter in a dry room at normal temperature and humidity.
- **For installation, select an appropriate place**
Select a location with minimal vibration and corrosive gas.
- **At a place allowing an adequate space for checkup when pulled up**
Select a location large enough to allow maintenance and checking.
- **Other**
Besides the above, be sure to observe the cautions given in this manual.

CONFIRMATION OF NAMEPLATE

The nameplate as shown below is attached to the case of the connector terminal. Make sure before use that the contents of the nameplates agree with your specifications.

Tag No.			
WATER LEVEL TRANSMITTER		<input type="radio"/>	
Type	_____		
<input type="radio"/> Range	_____		
Power Supply	24V DC		
Output	4-20mADC		
Span Limit	_____		
Ser.No.	_____	Mfd.	_____
Fuji Electric Systems Co.,Ltd.		Made in Japan	

The contents of the nameplate are explained below:

- Type : Type of this transmitter
- Range : Measuring range
- Span limit : Maximum measuring range
- Ser. No. : Serial No.
- Mfd. : Manufacturing date

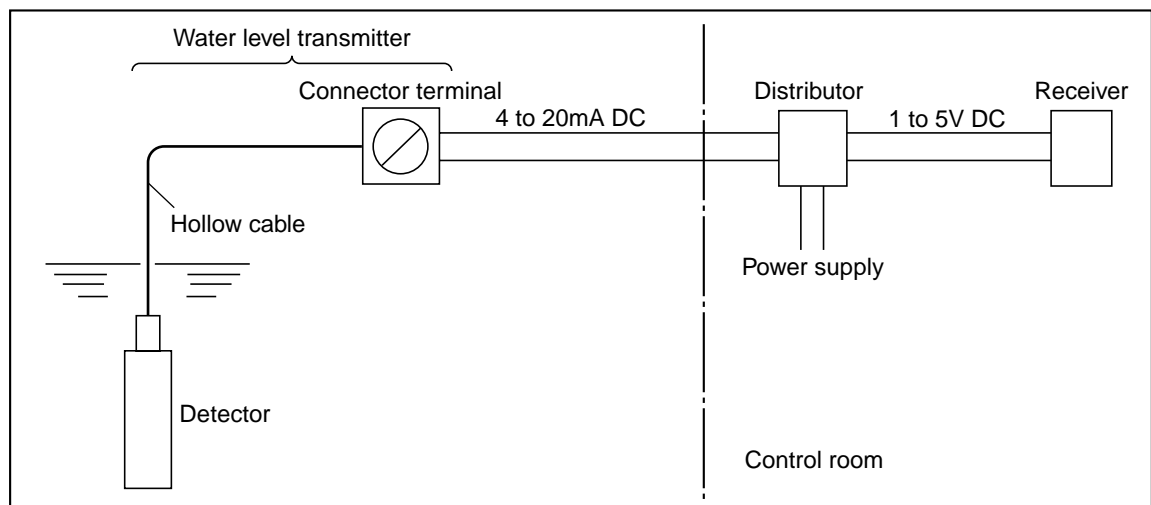
1. OUTLINE

The water level transmitter can be immersed in ground water, a storage tank, or the river, or installed on the bottom of water to detect water level as water head pressure, convert it to 4 to 20mA DC current signals, and transmit them.

The transmitter consists of a detector and a connector terminal, which are connected with a hollow cable housing a hollow pipe for introducing atmospheric pressure into the detector.

Zero adjustment and span adjustment can be performed from the connector terminal, and remote adjustment using a hand held communicator (HHC) can also be performed.

System configuration (Example)



2. NAME AND DESCRIPTION OF EACH PART

2.1 Detector

(1) Hollow cable

A cable with a built-in hollow pipe for introduction of atmospheric pressure into the pressure sensor of the detector unit.

(2) Fixing nut

A screw-in nut that fastens the transmission unit and sensor case.

Loosen and remove the fixing nut, and the case can be disassembled and the transmission unit can be taken out.

(3) Transmission unit

Amplifier unit that converts a signal measured by the detecting unit into the output signal.

(4) Detecting unit

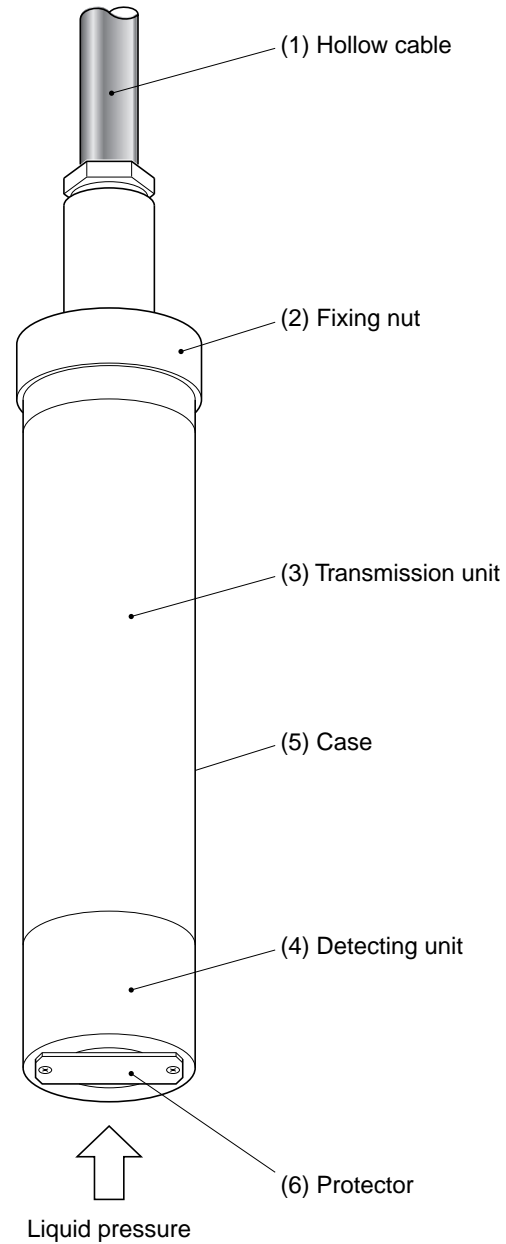
Pressure sensor unit consisting of a capacitance type pressure sensor

(5) Case

An enclosure that houses the detector unit and the transmission unit.

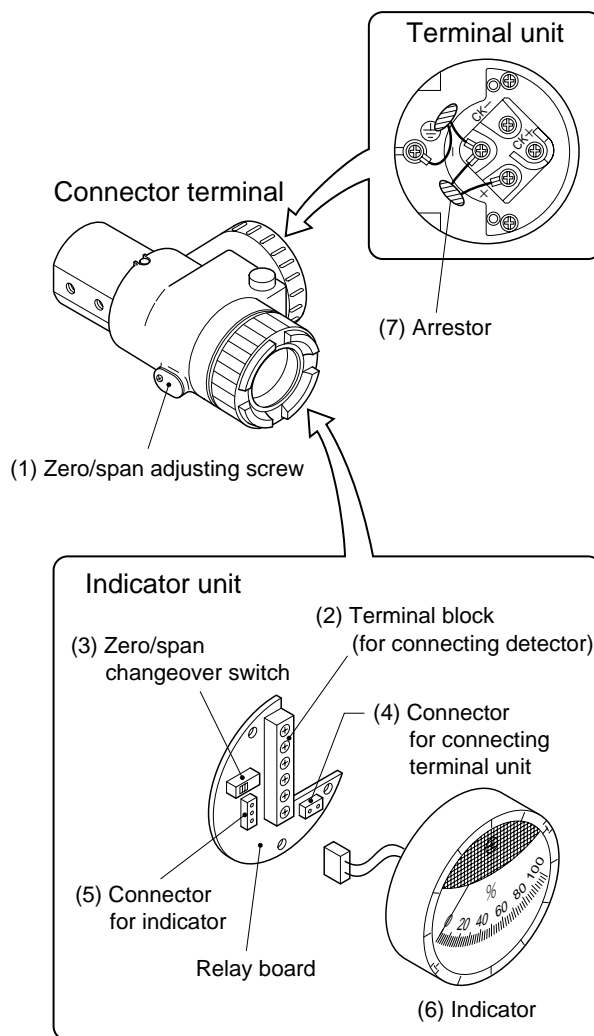
(6) Protector

A filter for removing contaminants.




2.2 Connector terminal

- (1) Zero/span adjustment screw
An adjusting screw for zero adjustment and span adjustment
- (2) Terminal block (for connecting the detector)
A terminal block where signal lines from the detector are connected
- (3) Zero/span changeover switch
A switch used to change between zero adjustment and span adjustment. Select zero adjustment or span adjustment using this switch, and then carry out an adjustment with the adjusting screw in (1).
- (4) Connector for terminal connection
A connector that connects the lead wire from the terminal unit
- (5) Connector for indicator
Connector that connects the indicator
- (6) Indicator
A meter that displays water level measurement value
- (7) Arrestor
A protective element against lightning surge



Terminal unit


+ , -	Output cable connection terminal
CK + , CK -	Output current check terminal
	Ground connection terminal

3. ADJUSTMENT

3.1 Adjustment from connector terminal

3.1.1 Zero/span adjustment

Connect an instrument (such as a digital voltmeter shown in the figure at right) to the terminal unit of the connector terminal, and adjust the output current value by turning the adjusting screw.

 CAUTION	When the cover of the connector terminal is closed, the output may fluctuate temporarily because the internal pressure increases, but the original value is restored in a short time.
---	---

Zero point adjustment

Open the cover of the indicator unit, and you can see the zero/span changeover switch on the relay board located at the back of the indicator. (See figure at right.)

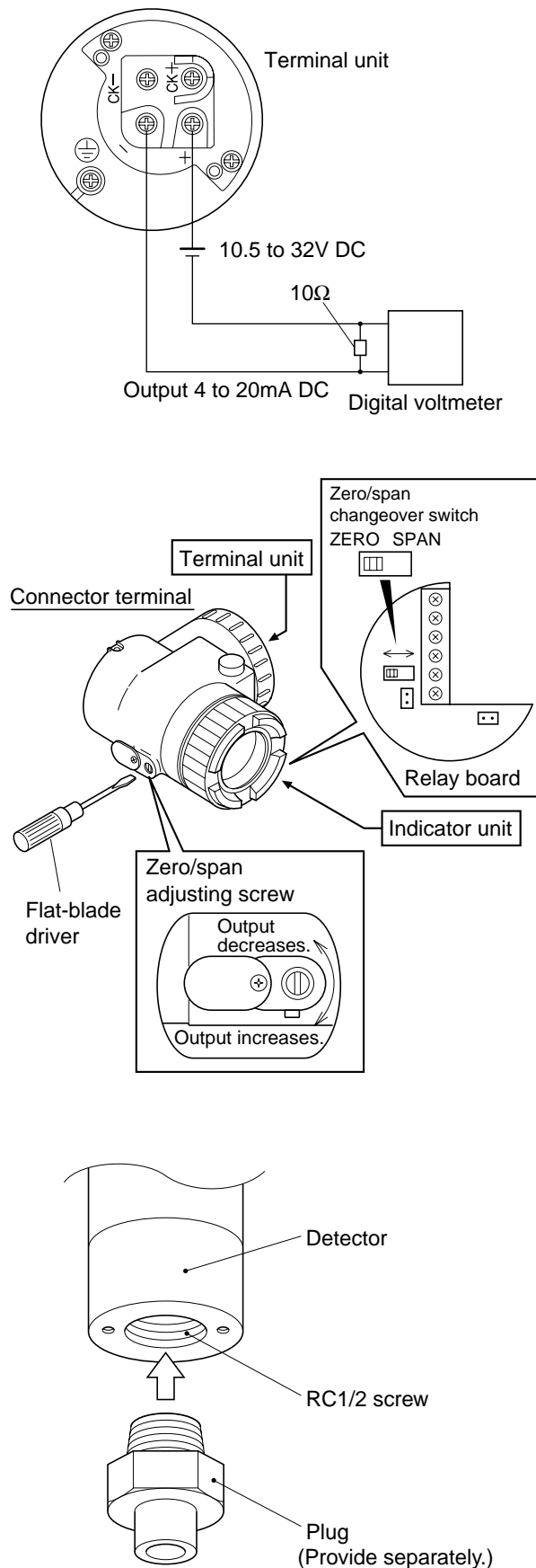
Set the changeover switch to Zero position. In a state where the pressure equivalent to 0% is applied to the detector (open to the atmospheric pressure normally), adjust the output current to 4mA by turning the zero/span adjusting screw of the connector terminal.

Span adjustment

Remove the protector at the bottom of the detector unit, insert the plug for applying pressure into the G1/2 female screw, and apply pressure equivalent to 100%.

Set the zero/span changeover switch to Span position, and adjust the output current to 20mA by turning the zero/span adjusting screw.

Be sure to return the zero/span changeover switch back to zero position after adjustment.



3.1.2 Changing the range

When measurement range is changed, perform adjustment following the same procedure as span adjustment.

- (1) Set the zero/span changeover switch to Span position.

In a state where pressure equivalent to 100% is applied to the detector, adjust the output current to 20mA by turning the zero/span adjusting screw.

- (2) Perform fine adjustment of zero point and span following the description of section 3.1.1.

Note 1: The range can be changed in 10% to 100% range of the maximum measuring range. (See right.)

Note 2: Zero point can be changed up to $\pm 35\%$ of the maximum measuring range. Be sure to check the span after zero point is moved.

Maximum measuring range

Type FQK1.....	13m
Type FQK2.....	50m

3.2 Adjustment by HHC

Setting can be made using Hand Held Communicator (HHC) as shown below. Refer to the instruction manual of the HHC for startup and operation of the HHC.

The HHC of version 6.0 or later can be used.

3.2.1 Functions supported by HHC

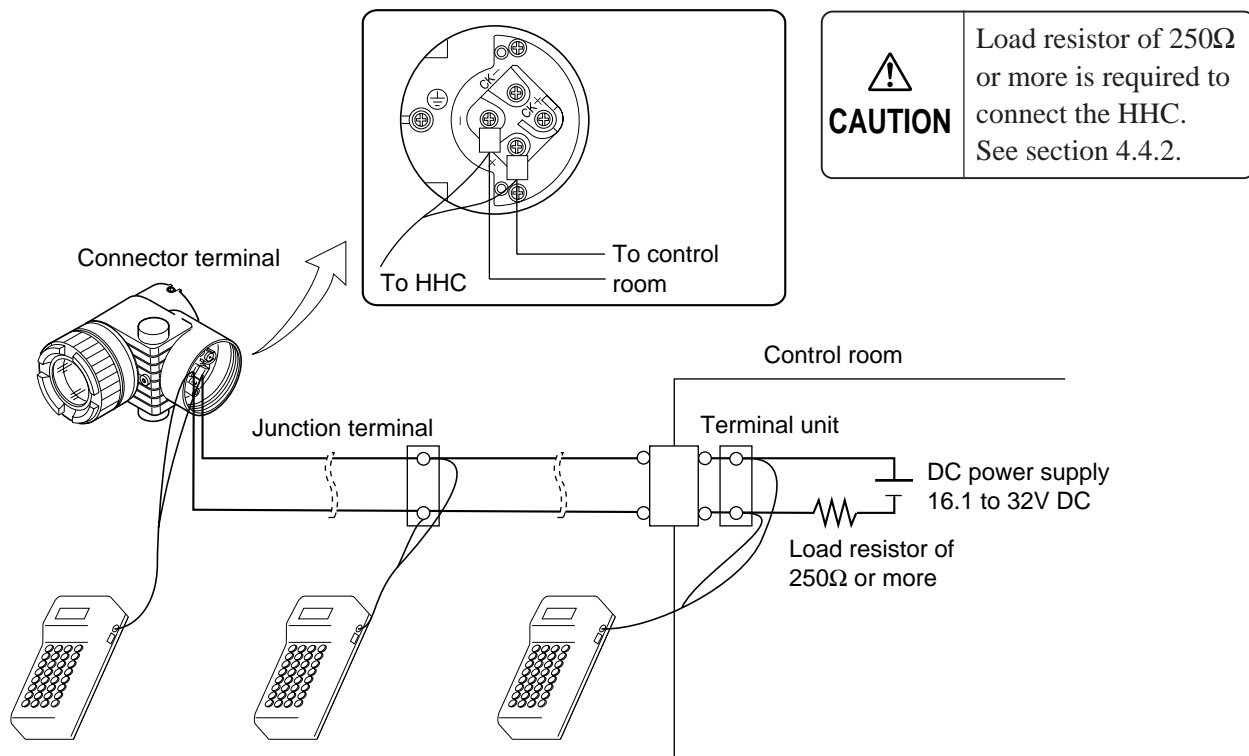
The following functions are supported by HHC.

No.	Item	Dis-play	Set	Description
1	Tag No.	○	○	Alphanumeric, 26 digits
2	Type	○	○	Type of device
3	Serial No.	○	—	Serial No. of device
4	Engineering unit	○	○	Setting of engineering unit
5	Range limit	○	—	Display of Max value of range
6	Measuring range	○	○	Measuring range setting, resetting
7	Damping	○	○	Setting within range of 0 to 32 sec
A	Zero/span adjustment	○	○	Zero/span adjustment
C	Data measurement	○	—	Data display
D	Self-diagnosis	○	—	Failure in device or amplifier

Nos. represent menu Nos. of the HHC.

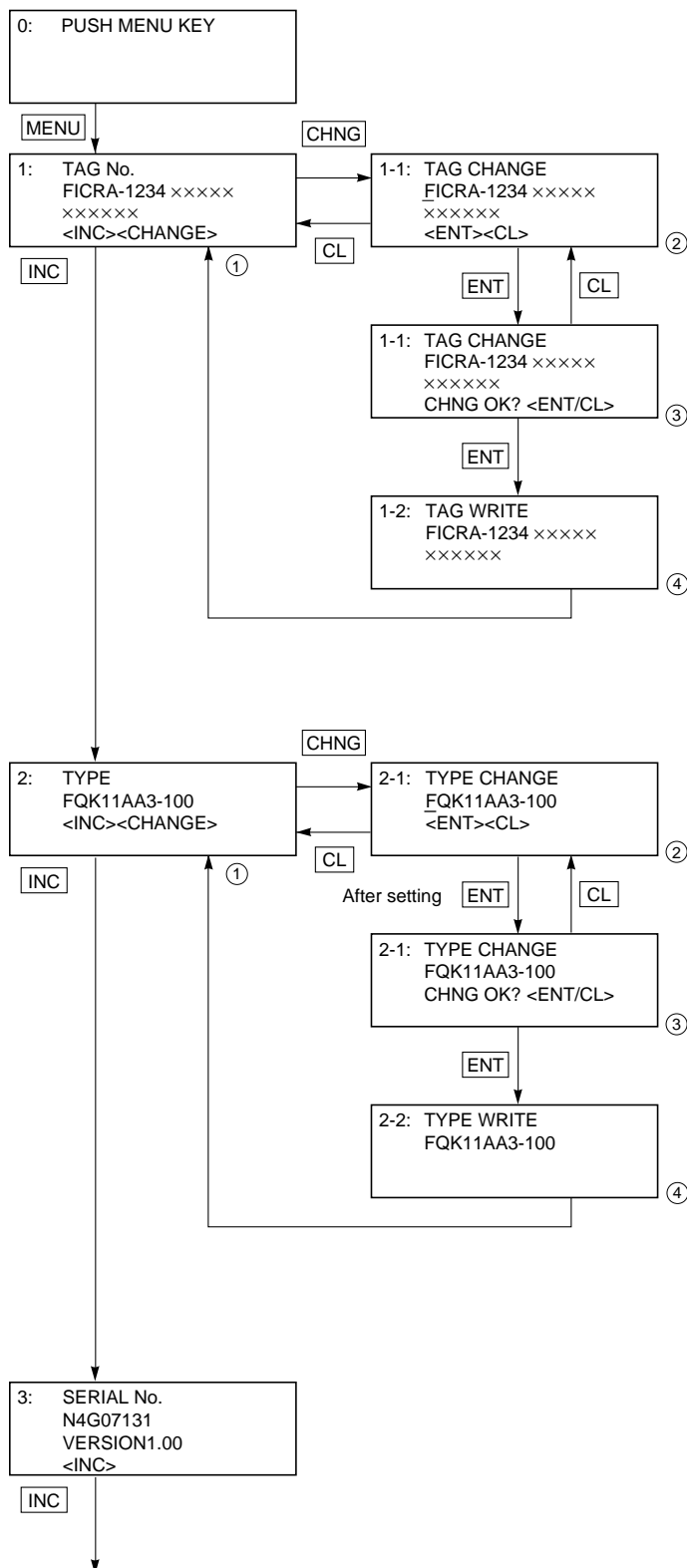
3.2.2 Connecting the HHC

The HHC can be connected to the connector terminal, junction terminal, and the terminal of the control room.



- If the protector key on the right side of the HHC is set to OFF, the setting, changing, or adjustment of the field device cannot be made. Be sure to set it to ON.
- To properly record the result of the adjustment, be sure to keep the water level transmitter in energized state for about 10 seconds after adjustment.

3.2.3 Operating procedure

**TAG NO.**

Set the TAG No. of the device as follows.

Up to 26 alphanumeric characters can be entered as TAG No.

- Press <CHNG> in display ①, and the cursor appears 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.

- ③ appears for confirmation of the setting.
- ④ displays registered TAG No.

TYPE

Display and change the type of the device as follows.

- Press <CHNG> in display ①, and the cursor “_” appears ②).
- Set the alphanumeric keys as necessary under display ②).

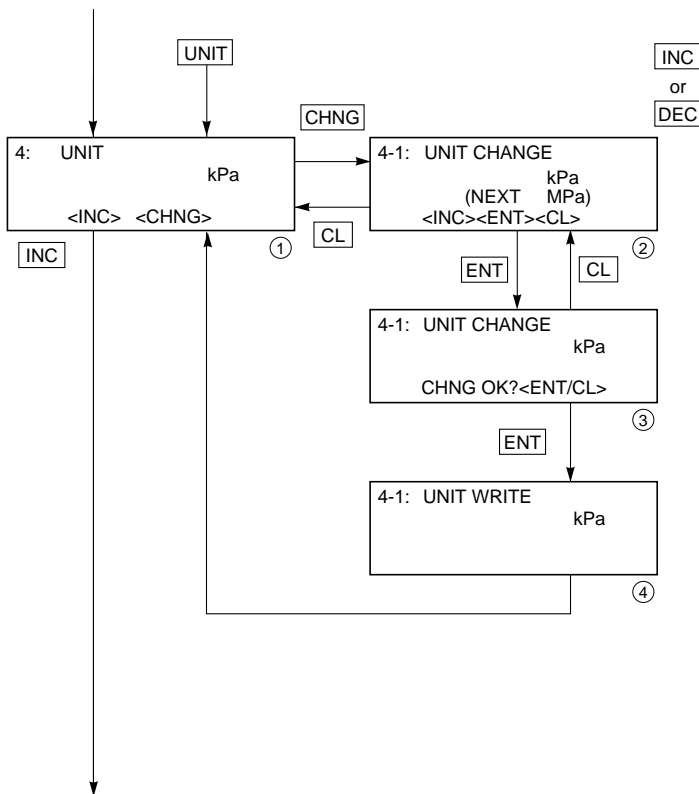
To set the alphabet, press the <CHNG ALHA> key first.

Using <◀><▶> keys, cursor position can be moved.

- (3) appears for confirmation of the setting.
- (4) displays registered type.

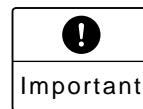
Display of SERIAL NO.

SERIAL No. and software version of the transmitter are displayed as shown by the example at left.



Industrial value unit

- When pressing <CHNG> under display ①, the display ② for changing the unit of industrial value 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.



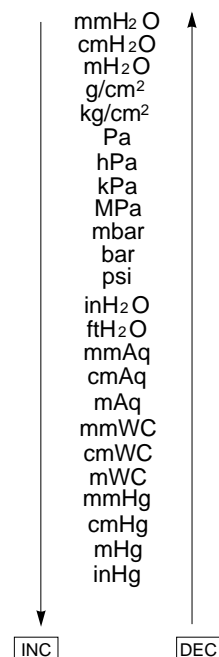
The unit of industrial value is set according to the range as ordered, but the display resolution lowers depending on the unit being set.

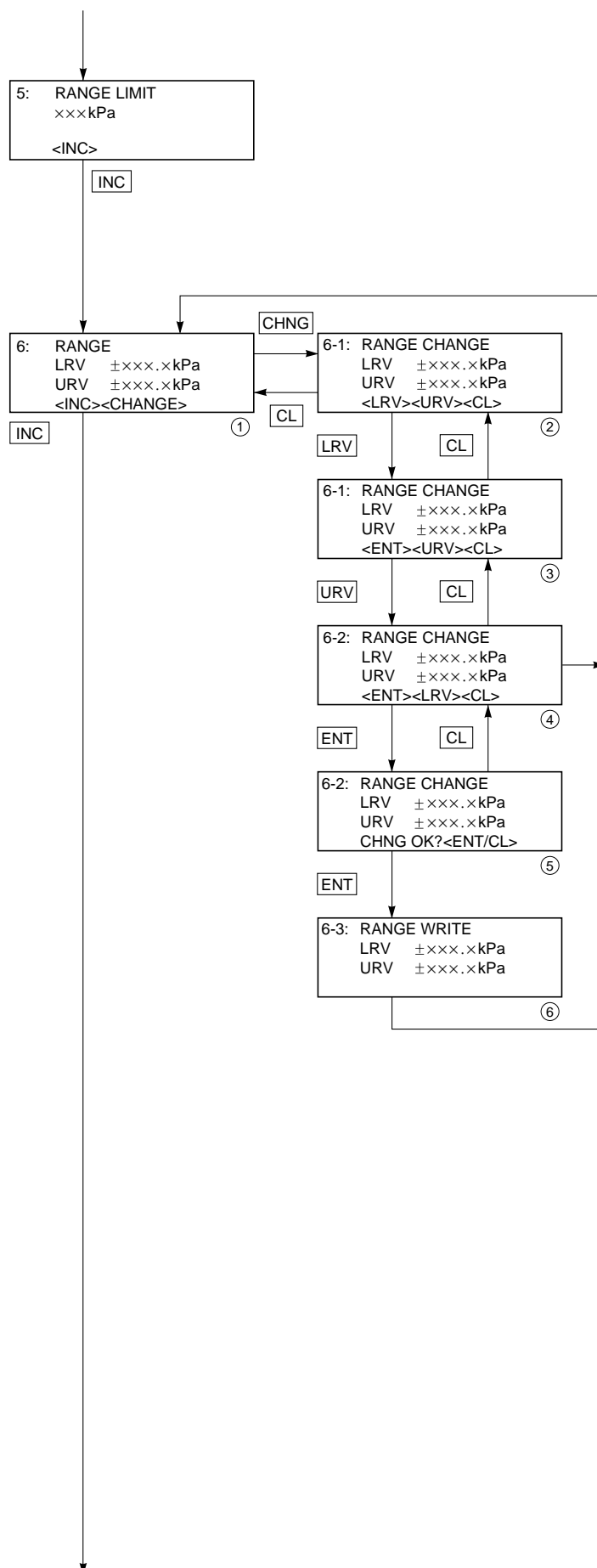
When

```
4-1:UNIT CHANGE
      Pa
NOT SUITABLE
UNIT<CL>
```

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)

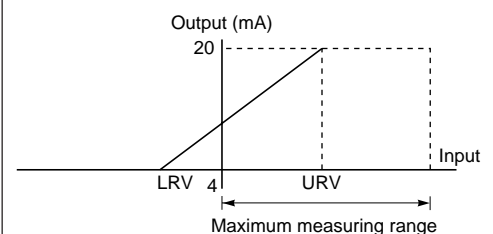
LRV: Lower range value (0% point)
URV: Upper range value (100% point)

- When pressing <CHNG> under display ①, display changes to the LRV and URV selection screen.

Press <LRV> to display ③, where zero point range can be set. Press <URV> to display ④, where 100% point can be set.

- Enter zero point and 100% point pressure value in displays ③ and ④ respectively (engineering value). Pressing the <±> key allows you to enter negative values. (See the following figure.).

Selectable setting range



LRV: -100% to +90% of the maximum measuring range

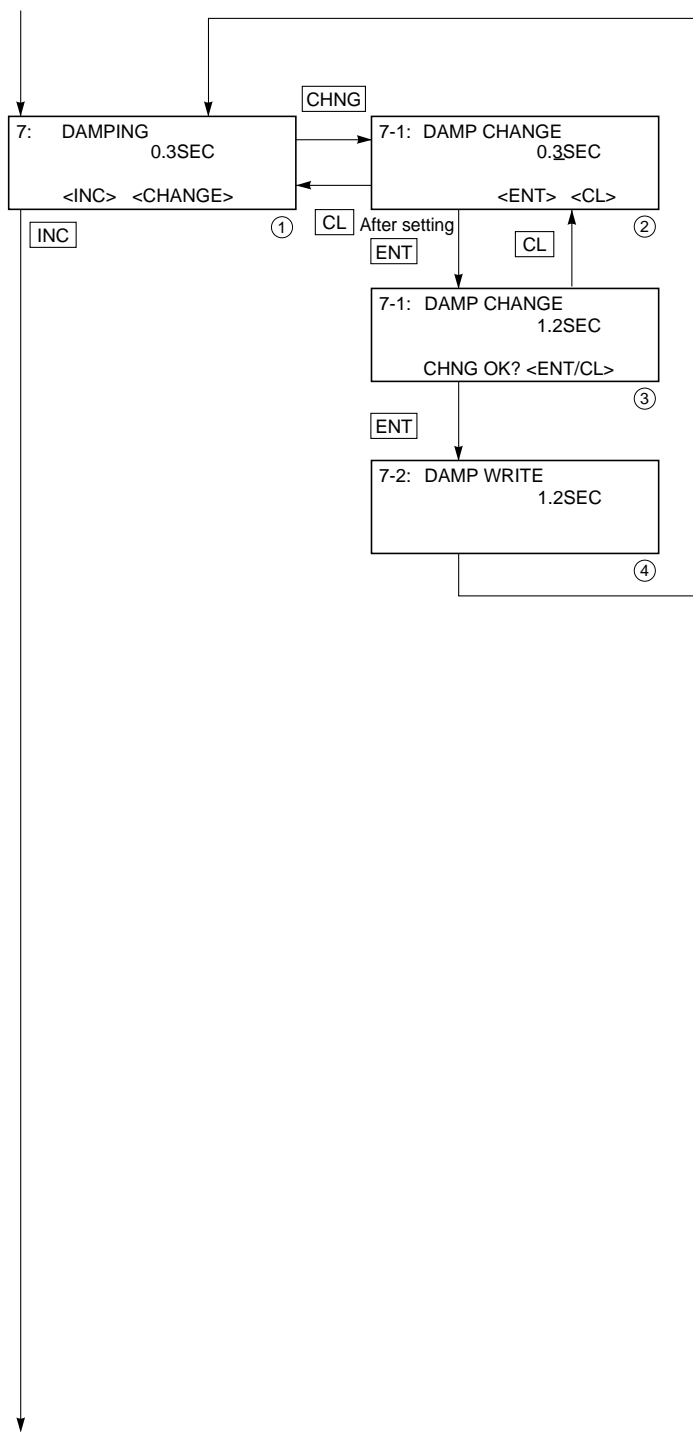
Span (URV-LRV):

10% to 100% of the maximum measuring range. Measurement range specifications should not be exceeded.



Important

When the range of the transmitter provided with an analog indicator of actual scale specifications is changed, replace the indicator. Otherwise the value cannot be displayed on correct scale.



Damping adjustment

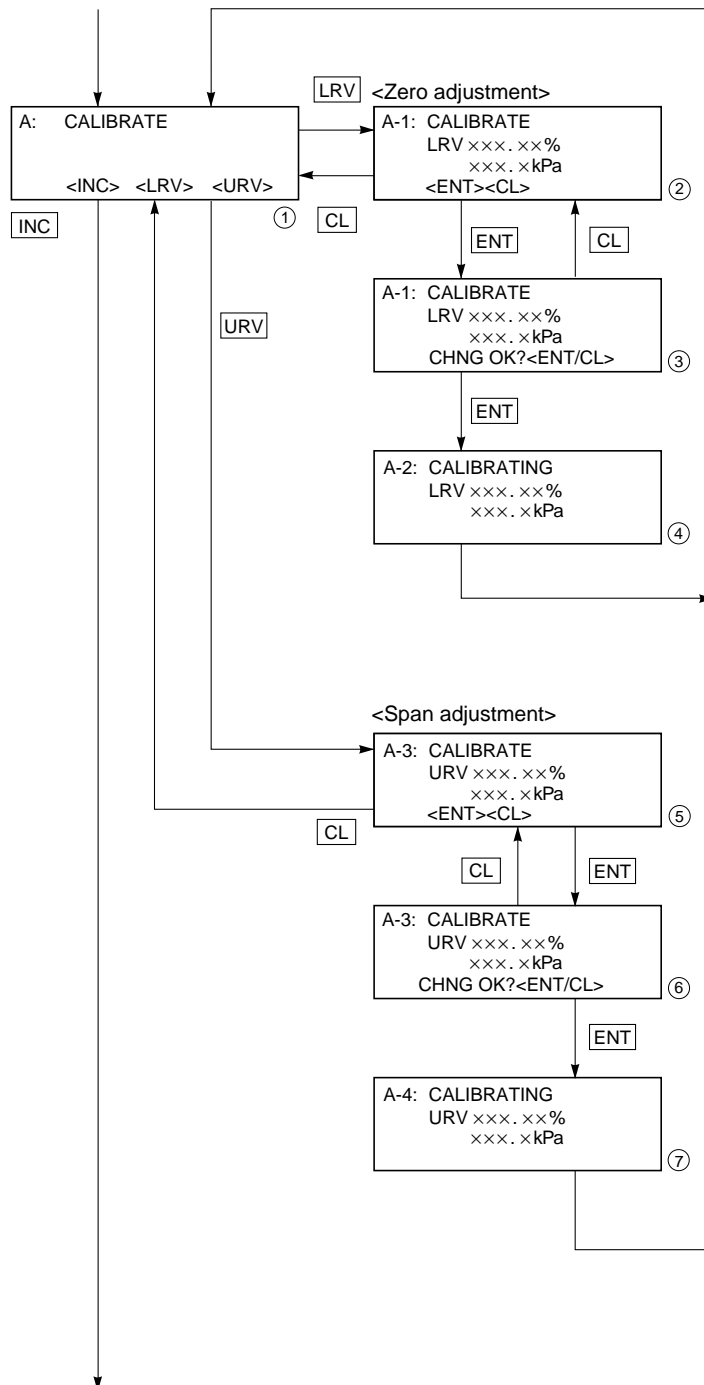
If output fluctuation is large under the condition where pressure fluctuation or vibration of the installation site is large, setting appropriate damping time constant is effective to control the output fluctuation.

Changing damping time constant

Enter numeric characters and decimal point in display ② to set or change damping time constant.

Selectable time constant value:

0 to 32 sec



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

- Span adjustment should be performed after zero adjustment is completed.
- When the actual input exceeds the adjustable range, [NOT CALB <CL>] is displayed.

Adjustable range

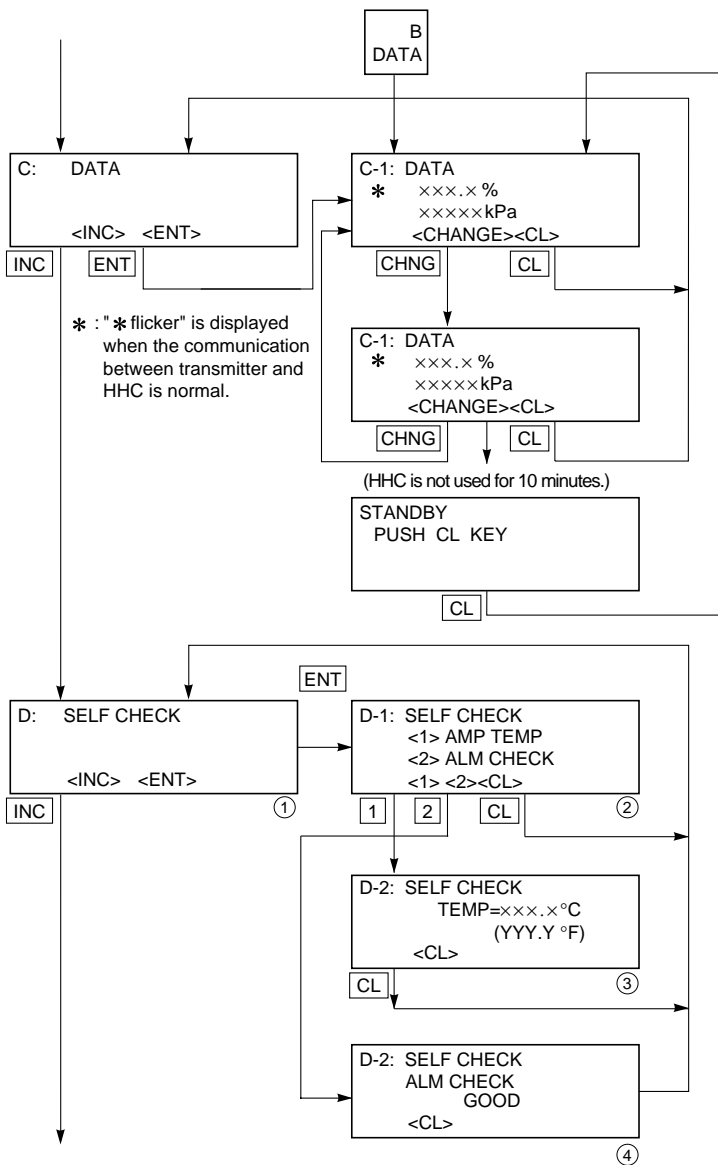
Zero adjustment:

Within $\pm 35\%$ of maximum span

Span adjustment:

Within $\pm 20\%$ of calibrated span

- Change the range to make the setting exceeding the adjustable range.



Indication of measured data

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

Self-diagnosis

Details of a failure are displayed. <1>AMP TEMP represents the temperature within the detector. Press <2> on display ② to perform alarm check (ALM CHECK) diagnosis.

Result of diagnosis

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	Cause	Remedy
CELL FAULT(C1) } CELL FAULT(C9)	Error of detecting unit	Check wiring between detecting unit and transmitter. Replace detecting unit if symptom persists.
EEPROM (AMP) FLT	EEPROM error on amplifier side	Replace amplifier
EEPROM (CELL) FLT	EEPROM error on cell side	Replace detecting unit
XMTR FAULT	Amplifier error	Replace amplifier
OVER	Input pressure is 105% or higher of setting range.	Ensure proper input pressure.
UNDER	Input pressure is -1.25% or lower of setting range.	Ensure proper input pressure.

4. INSTALLATION

4.1 Extending hollow cable


The hollow cable, which is connected to the detector and the connector terminal, can be extended with the hollow cable disconnected from the connector terminal.


(1) Disconnecting the hollow cable

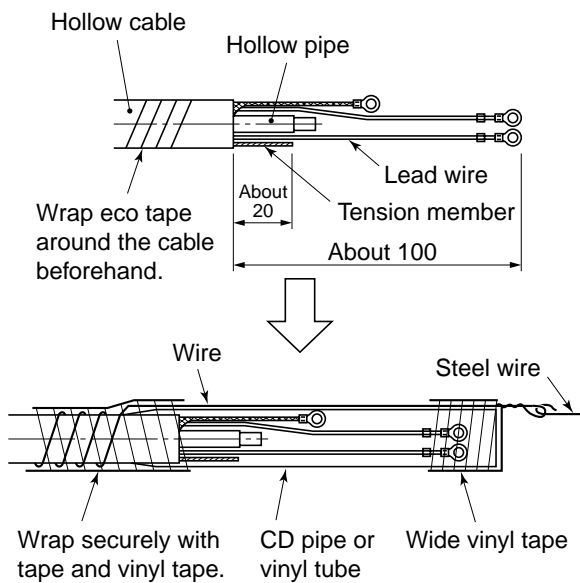
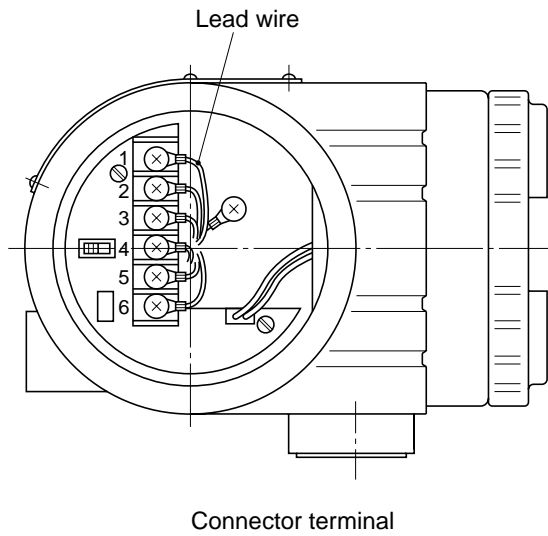
- Remove the lead wires of the connector terminal (6 signal wires and 1 ground wire) shown at right.
- Loosen the cable gland that fastens the hollow cable at the back of the connector terminal, and remove the hollow cable.

(2) Terminal treatment

When extending the cable, provide the terminal unit with protective and waterproof treatment as shown by the figure at right.

 CAUTION	<ul style="list-style-type: none"> • To prevent water from entering the cable terminal, provide terminal treatment before extending the cable. • When large tensile force is required, wrap the wire around the tension member before pulling.
---	--

 CAUTION	<ul style="list-style-type: none"> • If there is a possibility that flowing or falling matter may touch the cable, protect the cable by providing a protective cover or placing the cable within a protective tube. • Be careful not to let the cable be rubbed against concrete surface, etc. during extending work or after installation.
---	---

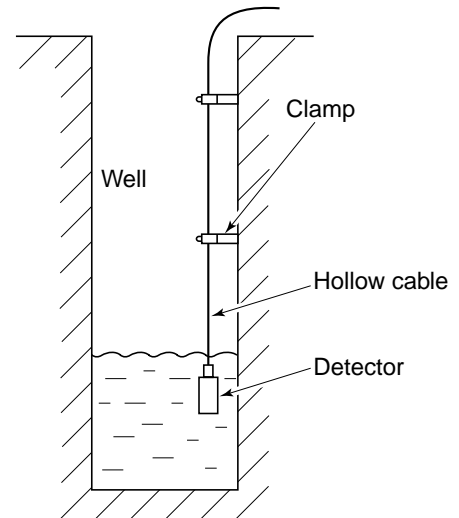


Protect the cable with CD pipe or vinyl tube, and wrap both ends with tape to make it waterproof. Wrap the end of the wire around the cable, and wrap them together with tape to fasten them.

4.2 Installation for detector

How to install in deep well

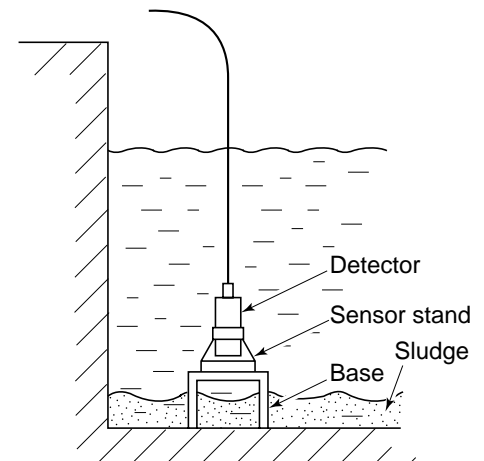
When the level transmitter is vertically installed, being suspended in a deep well, fix it to the midpoint of a wall by a clamp to protect the cable from undue force.



How to install in dam or river

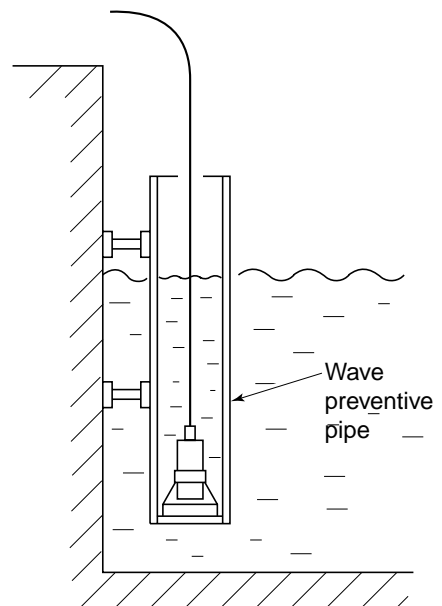
(still water)

Install the level transmitter vertically in the same method as above or install it with a sensor stand.



How to install in flowing water

Use a wave preventive pipe, in which the level transmitter should be installed.



CAUTION

If the transmitter is buried in sludge or the detector surface is covered with sludge, a difference in density between water and sludge may generate an error. Install the transmitter in water free from sludge.

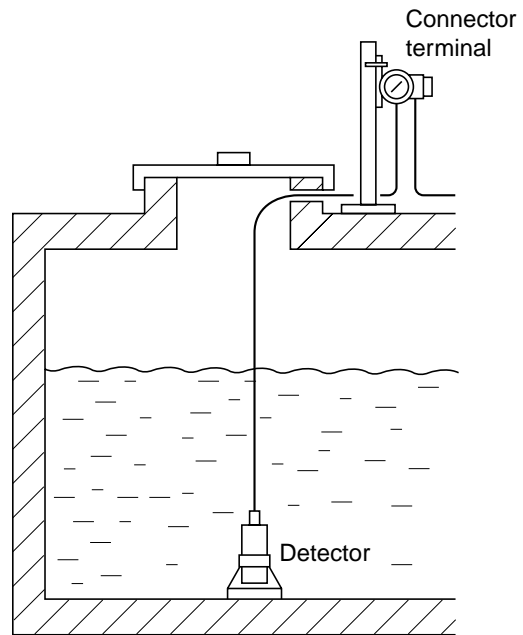
Installation in a storage tank

The transmitter can be installed at the bottom of a tank. Allow sufficient bending radius of the hollow cable. (Minimum bending radius: 200mm).



CAUTION

- Avoid installing the transmitter in a place subject to severe water flow or vibration. Otherwise a detector failure may result.
- Avoid installing the transmitter around the place where chemical is injected or where seawater and freshwater are mixed. Otherwise corrosion may result.



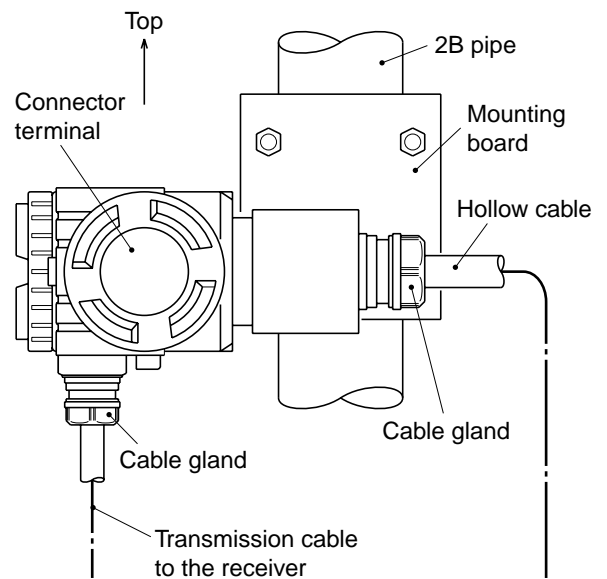
4.3 Installing the connector terminal

- (1) Connecting the hollow cable
If the hollow cable is installed disconnected from the connector terminal, reinsert the hollow cable into the connector terminal and connect them.



- Match the number on the terminal block and that of the lead wire when connecting them.
- Fasten the hollow cable with the cable gland.

- (2) Connecting the connector terminal
Mount the connector terminal to 2B pipe as shown by the figure at right. Securely fasten the connector terminal with a U bolt.
- (3) Connecting the transmission cable
Introduce the cable through the cable connection port of the connector terminal. Fasten the cable using the cable gland.
Note: Cable gland is not supplied.



DANGER

This transmitter is not of explosion-proof specifications. Do not use it in an atmosphere of explosive gas.



CAUTION


Mount the connector terminal in the orientation shown by the above figure. Since the hollow pipe in the hollow cable is introduced to the atmosphere via the connector terminal case, installing it upside down may result in intrusion of water into the hollow pipe.


4.4 Wiring

Caution on wiring

- Application of voltage exceeding 32 V DC or 23 V AC between “+” and “-” terminals may result in damage to the transmitter.
- Use a shielded cable for the transmission line where possible.
- Avoid installation of signal cable and power cable in same conduit or cable relay in order to prevent increased noise. Also, do not bring the signal cable close to large electrical equipment.


4.4.1 Wiring

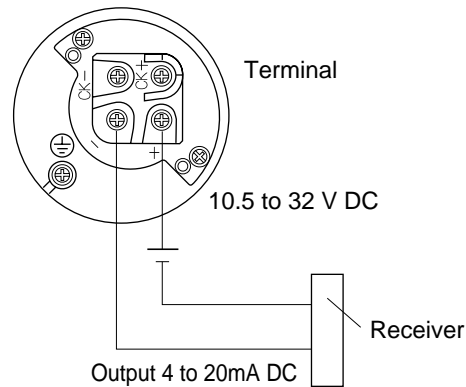
 DANGER	<ul style="list-style-type: none"> • Before making wiring work, be sure to turn OFF the main power to prevent electric shocks. • Use wiring materials of correct rating to prevent fire accidents. • After installing the connector terminal, firmly close the covers of the amplifier unit and terminal box. If not, rain water enter the transmitter which may result in trouble or incorrect operation.
--	---


 CAUTION	<p>A lightning arrester is connected to the terminal unit. Do not perform insulation resistance or withstand voltage tests.</p>
---	---

Tighten the terminal screws (M4 × 10) to a torque of approximately 1.5 N·m so that the wires will not loosen.

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


 Important	<p>Make terminal connections, paying attention not to connect to improper polarity.</p>
---	---




 CAUTION	<p>When using a power supply not provided with overcurrent protective circuit, connect a load resistor of 250Ω or more between the connector terminal and the power supply (overcurrent protection).</p>
---	--

4.4.2 Power voltage and load resistance

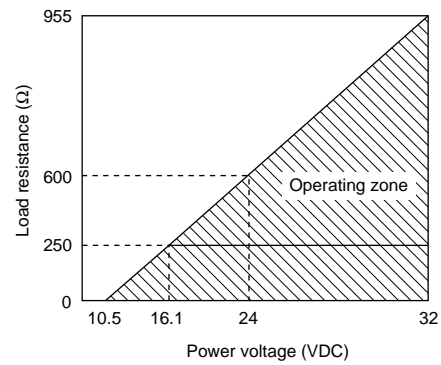
Make sure the load resistance of the wiring connected to the loop is within the range shown below.

 CAUTION	<p>Connect power source of correct rating. Use of power source in excess of the rating may cause a fire.</p>
---	--

4.4.3 Grounding

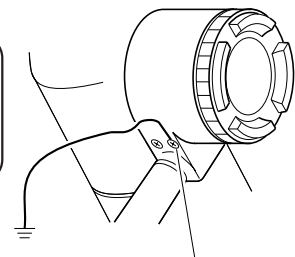
 CAUTION	<p>Transmitter must be grounded. Otherwise, it may cause electric shocks or incorrect operation.</p>
---	--

Grounding terminals are provided at two places (at the inside of terminal box and on the side of conduit connection).
 Perform class D or higher grounding (grounding resistance of 100Ω or lower) by one of the methods shown at right.



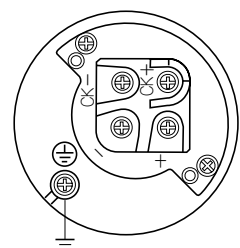
Note: For communication with HHC, minimum load resistance of 250Ω required.

Grounding of transmitter casing



External grounding terminal

Grounding from ground terminal



5. OPERATION

5.1 Check of operation status

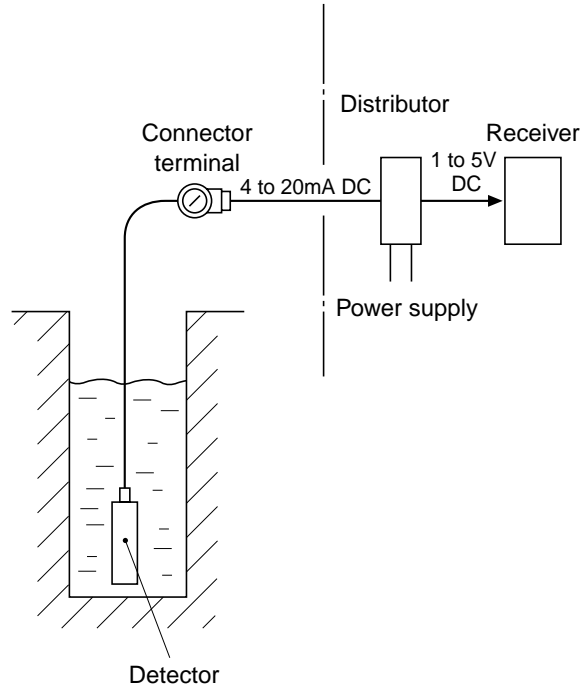
After wiring is completed, turn on the power and check that the output from the transmitter is transmitted to the receiver.

5.2 Damping adjustment

Output variation due to liquid pulsation can be suppressed by adjusting the damping. Set damping with HHC by following the description in section 3.2.2.

5.3 Stop

To stop the connector terminal, turn OFF the power.



6. MAINTENANCE AND CHECK

6.1 Check of operation status

To maintain accuracy and prevent unexpected failure, be sure to perform the following maintenance and inspection at proper intervals (once every 1 to 2 years).

Appearance check

- Check the cable for scratch, damage, etc.
- Check the connector terminal for corrosion.
- Pull out the detector and check the enclosure for corrosion and the pressure detector unit for attachment of dirt.

Zero point check

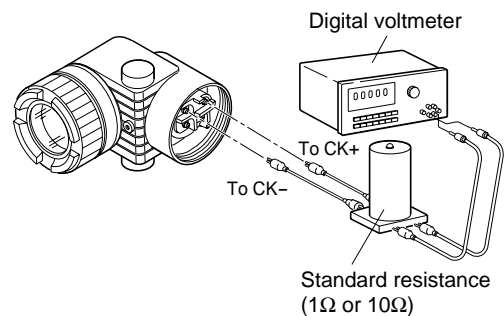
Pull out the detector and check zero point output. If deviation is found, perform zero adjustment. (Refer to Chapter 3.)

Check of arrester

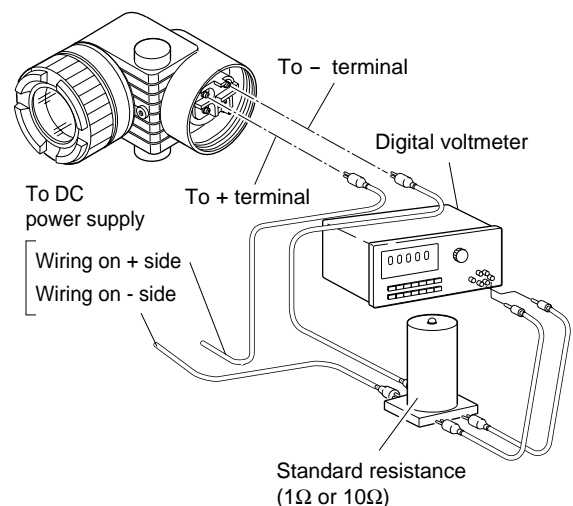
- Measure output current from the transmitter check terminals and output current to flow into transmitter (see figure below). When current is measured with an ammeter connected to CK+ and CK- terminals, the internal resistance of the ammeter should be 12Ω or less.
- If the measured two output current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

<Checking arrester>

Measuring output with check terminal



Measuring output with external terminal



6.2 Replacing parts and units

Replacing the arrester

Follow the procedure shown below to replace the arrester connected to the connector terminal unit (Z-TRAP ENC820D-14A).

- Turn off the power and remove the external power supply.
- Loosen and remove the spacer, and then remove the arrester.
- Mount a new arrester.
- Then check the current again following the description in the previous section.

If the situation cannot be improved even if the arrester within the connector terminal is replaced, the arrester on the detector* must be replaced.

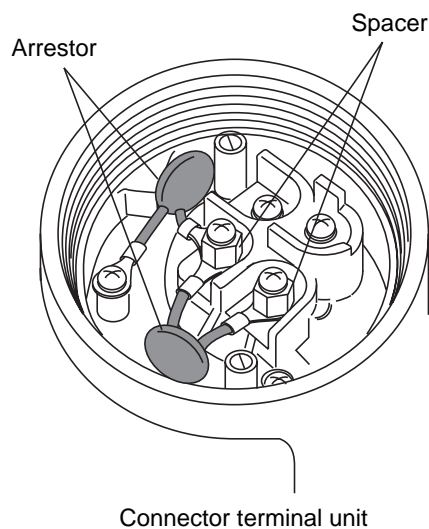
* 3YVJ-90J1 (manufactured by SANKOSHA)

... Repair in the factory is recommended.

Replacing the detector and the connector terminal

The detector or the connector terminal only can be replaced (the detector provided with cables only).

Be sure to perform zero adjustment and span adjustment after replacing the detector or the connector terminal.



7. TROUBLESHOOTING

Symptom	Causes	Remedy
Output current is off-scale (exceeds 20 mA).	(1) Zero point or span has not been adjusted properly.	Readjust. (See Chapter 3.)
	(2) Water level exceeds the measurement range.	Review and adjust measuring range. (See Chapter 3.)
	(3) Power supply voltage is not correct.	Adjust to proper value.
	(4) Cable insulation failure	Check the distribution cable and take appropriate measures.
	(5) Detector failure	Repair the detector.
Output current is not obtained (3.8 mA or lower).	(1) Power supply is opposite in polarity.	Connect to proper polarity.
	(2) Power supply voltage or load resistance is not correct.	Adjust to proper value.
	(3) Cable insulation failure	Check the distribution cable and take appropriate measures.
	(4) Detector failure	Repair the detector.
Error is large.	(1) Zero point or span has not been adjusted properly.	Readjust. (See Chapter 3.)
	(2) Cable insulation failure	Check the distribution cable and take appropriate measures.
	(3) Arrestor performance degradation	Replace the arrestor. (Repair in the factory recommended.)
	(4) Clogging of pressure detector	Clean the detector.
	(5) Detector failure	Repair the detector.

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