YAMATAKE

ST3000 Ace
Smart Transmitter
Electronic Differential Pressure / Pressure transmitter

Model: JTD, JTG, JTA, JTC, JTE, JTH, JTS

User's Manual

Yamatake Corporation

CM2-DST800-2001
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Introduction

Thank you for your purchasing of out ST3000 Ace series Smart Transmitter.

The ST3000 series is a high-accuracy, high-performance product that has been installed in over 500,000 locations since it was introduced to the market in 1983. The ST3000 was the world's first smart transmitter and continues to be used by manufacturers worldwide.

Users can easily perform most operations, from start of measurement, to reading measured data, to displaying and changing internal settings, values and states. A hand-held Smart Field COmmunicator (SFC) is also available that connects quickly to all Ace transmitters, for a faster solution to any problem at hand.

Applicability

The ST3000 Ace series is available, in the following configurations.

ST3000 Ace series	
Differential pressure transmitter	JTD910A, JTD920A, JTD930A, JTD921A, JTD931A, JTD960A, JTD961A
Gauge pressure transmitter	JTG940A, JTG960A, JTG980A
Absolute pressure transmitter	JTA922A, JTA940A
Flange differential pressure/ pressure transmitter	JTC929A, JTC940A
Remote-seal differential pressure transmitter	JTE929A, JTE930A
Remote-seal pressure transmitter	JTH920A, JTH940A, JTH960A
Remote-seal absolute pressure transmitter	JTS922A, JTS940A

Safety precautions

Introduction

Correct installation and operation and periodic maintenance are essential to safe operation of your differential pressure transmitter. Read the safety instructions contained in this manual before operating, maintaining or starting the transmitter. These instructions provide a comprehensive guide to safe operation.

Inspection

Check that the equipment specifications match your ordering information. If any damage is found upon receipt of the transmitter, immediately contact with your Yamatake representative. Keep the model name and serial number which are marked on the equipments nameplate, at hand. The nameplate is mounted on the top of the equipment enclosure.

This equipment has been tested under strict quality controls, before shipping.

Precautions

In this manual, the following symbol marks are used to safely operate this product.

⚠ WARNING
Warnings are indicated when mishandling this product might result in death or serious injury to the user.

⚠ CAUTION
Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

Always observe safety instructions. Read the next page. Yamatake Corporation or any of its affiliates or representatives shall assume no responsibility, or offer any guarantee with respect to any failure resulting from violation of these instructions.

Safety rules

Installation

⚠ WARNING

- When installing the transmitter, ensure that the transmitters gaskets do not protrude from the process connection parts, such as flanges contacting the process pipes.
- Never use the transmitter in applications that are outside the rated pressure or temperature range. Always observe connection specifications. Damage to the transmitter, or leakage, may endanger plant, equipment or human safety.
- In areas designated as explosion-proof, apply to any cabling work the methods specified in the explosion-proofing guidelines.

⚠ CAUTION

- After installation, do not step on the transmitter as this may damage it, or cause physical injury.
- The glass indicator may break if hit with a tool or other object, and cause physical injury.
- Install the transmitter correctly. Incorrect installation may lead to output errors or violate applicable regulations.
- This transmitter is heavy. During installation, please ensure that your footing is safe, and always wear safety shoes.

Electrical wiring

⚠ WARNING

- To avoid electric shocks, dry hands completely before performing wiring work and turning the power OFF. Wear gloves over dry hands.

⚠ CAUTION

- Before startup, study the specifications carefully and ensure that the wiring is correct. Wiring errors may cause hardware damage or other malfunctions.
- Provide a power supply that matches the specifications of the transmitter. Incorrect power supply may cause hardware damage.

Maintenance

⚠ WARNING

- Before disconnecting the transmitter from the process for any reason including maintenance, wait for safe levels in residual pressure, fluid or gas. Extreme caution should be taken to avoid fluid eruption.
- Prevent burns. Check venting or draining direction, and keep plant personnel out of the way of vented gas or drained fluid.
- When operational, never open the cover in an explosion-proof area. Avoid explosions or other combustion accidents.

⚠ CAUTION

- Strict product controls were exercised during the manufacture of this transmitter. Never modify the transmitter in any way. In-plant modifications may result in damage to the transmitter or to property and human safety.

Communication equipment

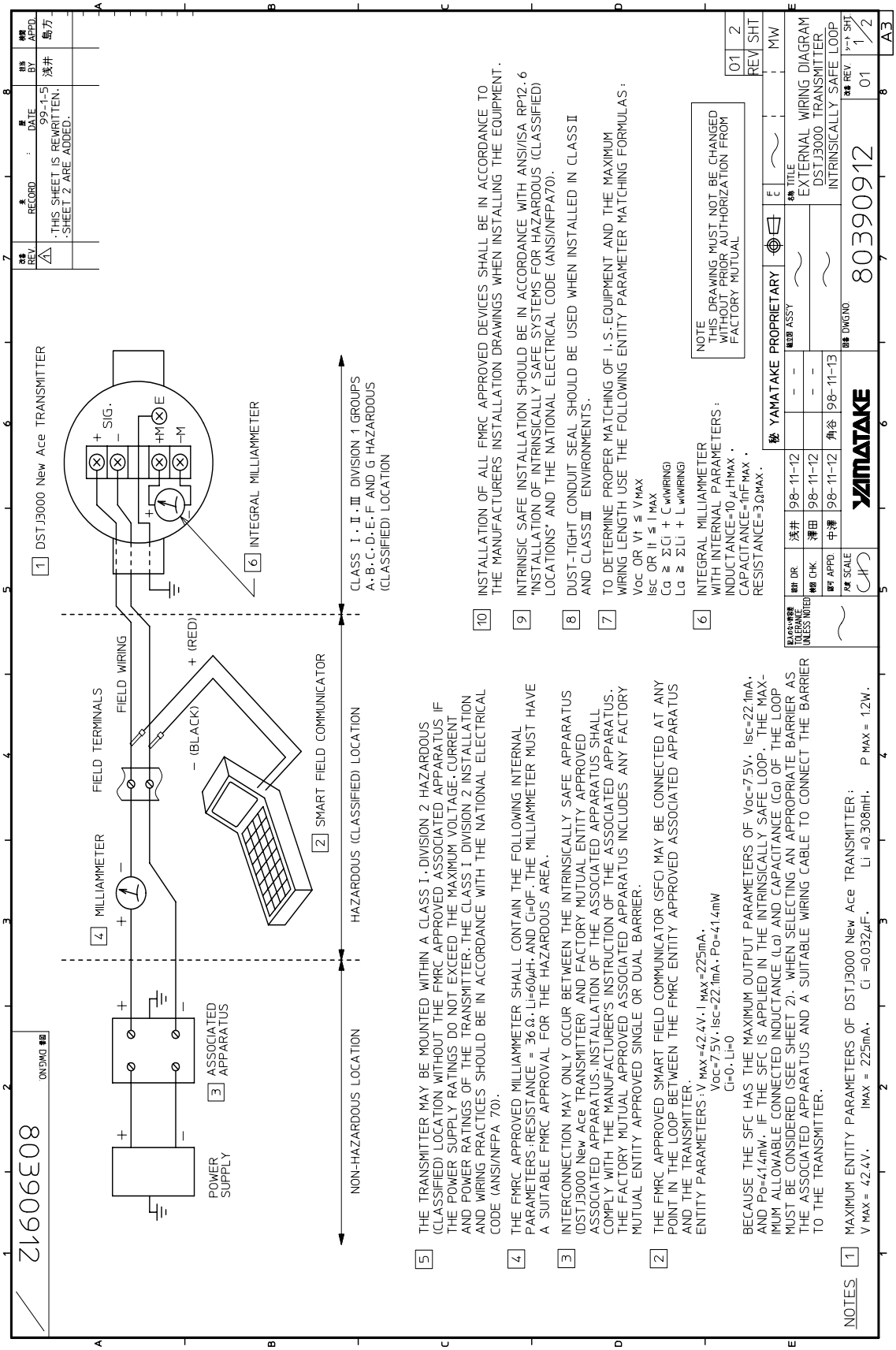
⚠ CAUTION

- Avoid use of communication equipment near this transmitter. Interference from such equipment as a transceiver, a cellular phone, a PHS, a beeper may result in malfunction (at some transmission frequencies). In any case, observe the following precautions:

  Check in advance of using any such equipment, the clearance required to ensure safe operation of the transmitter. When using communications equipment, always maintain a distance at least equal to this distance, between the communication equipment and the transmitter.

  Close transmitter cover before using communication equipment.

FM Approval Control Drawing



DWG.NO 80390912

CONSIDERATION OF AN INTRINSICALLY SAFE LOOP BASED ON ENTITY PARAMETERS

THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION.

BASICALLY, THE MAXIMUM UNPROTECTED CAPACITANCE (Ci) AND INDUCTANCE (Li) OF THE INTRINSICALLY SAFE APPARATUS, INCLUDING INTERCONNECTING WIRING PARAMETERS (Lw, Cw), MUST BE EQUAL OR LESS THAN THE CAPACITANCE (Ca) AND INDUCTANCE (La) WHICH CAN BE SAFELY CONNECTED TO THE ASSOCIATED APPARATUS. ALSO, THE MAXIMUM OUTPUT PARAMETERS (Voc, Isc, Po) OF THE ASSOCIATED APPARATUS MUST BE EQUAL OR LESS THAN THE MAXIMUM ENTITY PARAMETERS (V_{MAX}, I_{MAX}, P_{MAX}) OF THE INTRINSICALLY SAFE APPARATUS.

IF THE SFC IS CONNECTED TO THE INTRINSICALLY SAFE LOOP, FURTHER CONSIDERATION MUST BE TAKEN AS SHOWN BY THE FOLLOWING EXAMPLES.

EXAMPLE 1. La

MAXIMUM OUTPUT CURRENT (Isum) TO THE LOOP IN THE WORST SITUATION IS THE SUM OF THE DELIVERED CURRENT (Isc) BY THE BARRIER AND THAT (Isc) BY THE SFC.
IF Isc OF THE BARRIER IS 93mA,

Isum = 93mA + 22.1mA = 115.1mA.

THEN, BY APPLYING 120mA (THE NEXT HIGHER VALUE OF THE RESULTING Isum) TO THE RIGHT TABLE, La FOR GROUP A/B IS DETERMINED : La=2.50mH.

THE ABOVE OBTAINED La VALUE MUST SATISFY THE BELOW RELATIONSHIP,

La ≧ Li (TRANSMITTER) + Lw (WIRING) + Li (SFC).

ACCORDINGLY, THE WIRING INDUCTANCE NEVER EXCEEDS THE VALUE
La - Li (TRANSMITTER) - Li (SFC), i.e.

Lw ≦ 2.50mH - 0.308mH - 0 = 2.192mH

NOTE: IF THE ABOVE Lw VALUE IS SMALLER THAN THE INDUCTANCE OF A CABLE, ANOTHER BARRIER WITH A SMALLER Isc VALUE SHOULD BE SELECTED.

EXAMPLE 2. Ca

MAXIMUM OUTPUT VOLTAGE (Vsum) TO THE LOOP IN THE WORST SITUATION IS THE SUM OF THE DELIVERED VOLTAGE (Voc) BY THE BARRIER AND THAT (Voc) BY THE SFC.

IF Voc OF THE BARRIER IS 28V,

Vsum = 28V + 7.5V = 35.5V.

THEN, BY APPLYING 36V (THE NEXT HIGHER VALUE OF THE RESULTING Vsum) TO THE RIGHT TABLE, Ca FOR GROUP A/B IS DETERMINED : Ca=0.08μF.

THE ABOVE OBTAINED Ca VALUE MUST SATISFY THE BELOW RELATIONSHIP,

Ca ≧ Ci (TRANSMITTER) + Cw (WIRING) + Ci (SFC).

ACCORDINGLY, THE WIRING CAPACITANCE NEVER EXCEEDS THE VALUE
Ca - Ci (TRANSMITTER) - Ci (SFC), i.e.

Cw ≦ 0.08μF - 0.032μF - 0 = 0.048μF.

NOTE: IF THE ABOVE Cw VALUE IS SMALLER THAN THE CAPACITANCE OF A CABLE, ANOTHER BARRIER WITH A SMALLER Voc VALUE SHOULD BE SELECTED.

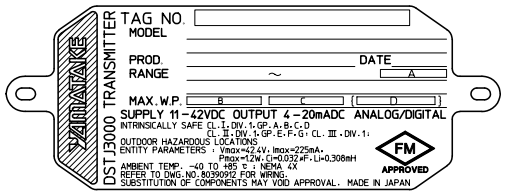
Isum = Isc (ASSOCIATED APPARATUS) + Isc(SMART COMMUNICATOR)
Vsum = Voc (ASSOCIATED APPARATUS) + Voc (SMART COMMUNICATOR)

Isum (MILLI AMPERES)	La (MILLI HENRYS) A/B	C	D
20	90.00	330.00	700.00
21	82.00	300.00	635.30
23	68.00	250.00	530.10
25	58.00	210.00	449.00
28	46.00	170.00	358.40
30	40.00	150.00	312.40
32	36.00	135.00	274.80
35	31.00	110.00	229.90
40	23.00	87.00	176.30
45	19.00	70.00	139.40
50	15.00	56.00	113.10
55	12.00	48.00	93.50
57	11.00	43.00	87.10
60	10.00	40.00	78.70
62	9.50	37.00	73.70
65	8.80	34.00	67.10
70	7.50	28.00	57.90
75	6.70	25.00	50.50
80	6.00	22.00	44.40
85	5.50	20.00	39.30
90	5.00	18.00	35.10
100	4.00	15.00	28.50
110	3.00	12.00	23.60
120	2.50	10.00	19.80
130	2.00	9.00	16.90
140	1.60	8.00	14.60
150	1.30	7.00	12.70
160	1.00	6.20	11.20
170	0.80	5.50	9.90
180	0.60	5.00	8.80
200	0.50	4.00	7.20
220	0.40	3.20	5.90

Vsum (VOLTS)	Ca (MICROFARADS) A/B	C	D
5	91.97	275.91	735.77
10	3.21	9.64	25.69
15	0.78	2.35	6.26
20	0.34	1.01	2.7
22	0.26	0.78	2.09
24	0.21	0.63	1.67
26	0.17	0.51	1.37
28	0.14	0.43	1.14
30	0.12	0.36	0.97
32	0.11	0.32	0.84
34	0.09	0.28	0.73
36	0.08	0.24	0.65
38	0.08	0.22	0.58
40	0.06	0.19	0.52
42	0.06	0.18	0.47

改番 REV.	来歴 RECORD : 歴 DATE	担当 BY	検閲 APPD.
1	99-1-5 ・THIS SHEET IS ADDED.	浅井	島方

LABEL



改	ITEM
001	

秘 YAMATAKE PROPRIETARY

記入のない許容差 TOLERANCE UNLESS NOTED					
設計 DR.	浅井	99-1-7		組立図 ASS'Y	名称 TITLE: EXTERNAL WIRING DIAGRAM DSTJ3000 TRANSMITTER INTRINSICALLY SAFE LOOP
検図 CHK.					
認可 APPD.					
尺度 SCALE	YAMATAKE			図番 DWG.NO. 80390912	改番 REV. 01 / シート SHT. 2 / A3

Unpacking the transmitter

This transmitter is precision equipment. Handle it carefully to prevent an accident and damage.

Checking accessories

In the package you receive from Yamatake or our representative, is included the main unit of a transmitter and the following accessories:

- One 3-inch L-shaped wrench

Checking specifications

The specifications are marked on the transmitter nameplate. The specifications on this nameplate should agree exactly with your order. Especially, check the following:

- Tag No. (TAG No.)
- Model No. (MODEL)
- Production No. (PROD No.)
- Low and high limits of set range (RANGE)
- Supply voltage (SUPPLY)
- Explosion-proofing conformance (mark is applicable only to explosion-proof model)

Inquiry

Direct any inquiries about this transmitter to our nearest branch office or representative (listed at the end of this manual).

When marking an inquiry, have handy a copy of the details marked on the nameplate:

- Model No. (MODEL)
- Production No. (PROD No.)

Storage

Storage over long periods requires special procedures, to avoid damage to this instrument. Always store the transmitter:

- Indoors and at normal temperature and humidity
- In a location subject to minimum vibrations and shocks
- Before unpacking, not after

Structure and Contents of the User's Manual

Structure and contents

This user's manual explains the structure of this transmitter and provides operating instructions, in the following order:

Chapter 1: Functions, Configurations, and Structure of ST3000 Ace and SFC

This section covers the basic functions, structures, and configurations of a ST3000 Ace series Smart Transmitter and a Smart Communicator (SFC). First-time users of this transmitter are asked to read this section in advance of operation.

Chapter 2: Installation

Instructions for installing, piping, and cabling this transmitter. Important items related to installation (grouped by type of measurement data).

People in charge of installation, piping, and cabling are required to read this section.

Chapter 3: Operation

Provides instructions for connecting an SFC to this transmitter, and basic instructions for key operations.

Includes procedures for setting a tag number and checking transmitter specifications.

Except for basic instructions for operating an SFC, instructions are grouped by the type of measurement data.

Read this before actually starting measurement.

Chapter 4: Using SFC

Explains operations that can be executed using an SFC. Refer to this section for basic operating instructions and procedures for starting operation, displaying measured data during operation, printing transmitter data, and changing transmitter settings.

Chapter 5: Maintenance and Troubleshootings

Provides maintenance and trouble shooting instructions.

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List of Figures & Tables

Chapter 1: Functions, Configurations, and Structures of ST3000 Ace and SFC

Overview

Basic functions, structures, and configurations of a Smart Transmitter and Smart Communicator (SFC). First-time user of a ST3000 Ace transmitter are asked to first gain basic understanding of the functions and structures of the transmitter. They should read this section before performing any advanced configuration functions.

1-1: Function and configuration of the transmitter

1-1-1: Function and configuration of the transmitter

Introduction

This transmitter offers a range of functions that assist in the measurement of differential pressure. A differential pressure sensor is mounted on a composite, semiconductor sensor for the transmission of flow rate, pressure, and liquid level data.

A composite semiconductor sensor includes a static pressure sensor and a temperature sensor for the measurement of changes in static pressure and ambient temperature. These changes can affect accurate differential pressure measurement. By measuring static pressure and ambient temperature data, the transmitter compares the measured differential pressure against a true differential pressure, stored in memory. The sensors are installed in the meter body along with a multiplexer, an A/D converter, a microprocessor in the transmitter unit, carious storage devices, and a D/A converter.

Function and configuration

The following illustration shows the basic functions and configuration of this transmitter:

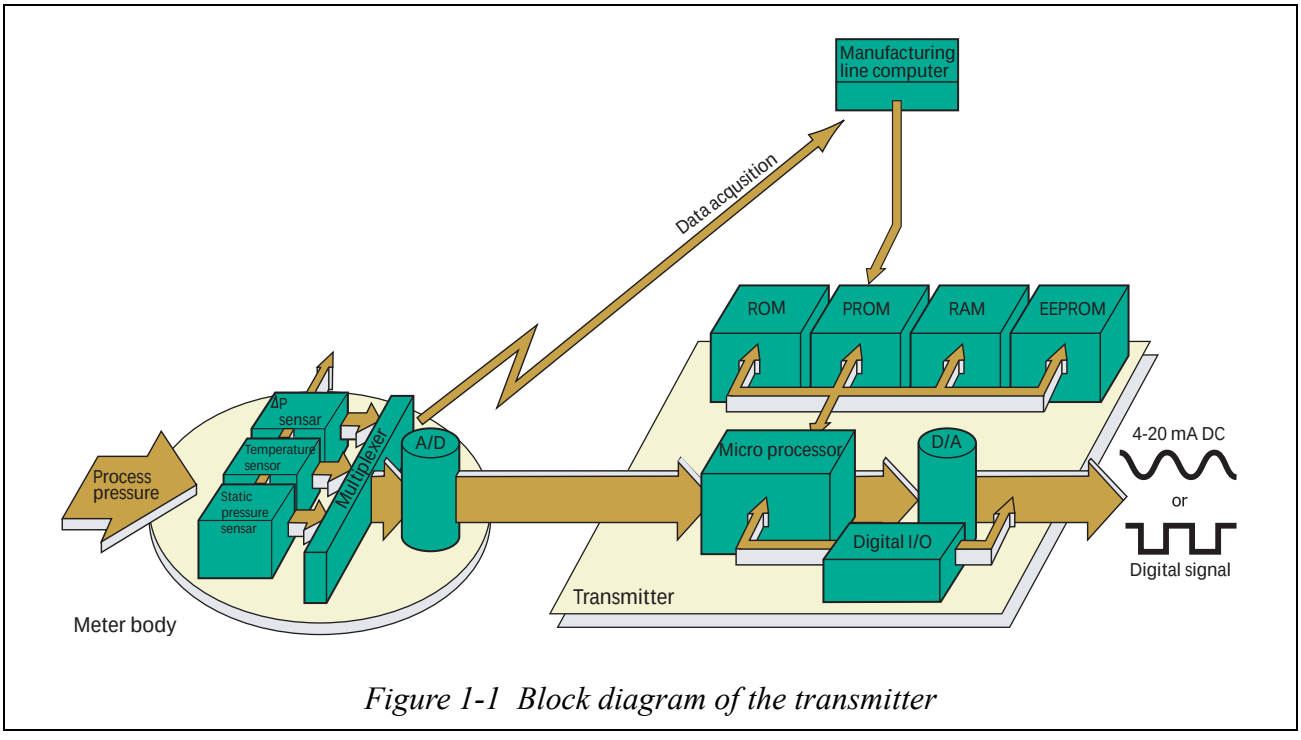


Figure 1-1 Block diagram of the transmitter

Flow rate, pressure, and liquid level of the process fluid are transmitted to the differential pressure sensor on the composite semiconductor chip, in the meter body.

The sensor output is converted from analog to digital signals simultaneously with the temperature and static pressure that are sensed with the temperature sensor.

The A/D converted signals are processed in the microprocessor, and output (after conversion to 4-20 mA DC analogue signals corresponding to the set range.)

PROM : The data stored in this memory includes the input/output, temperature, and static pressure characteristics of the meter body, the model, and the valid range of range settings.

EEPROM : This is a nonvolatile memory that retains various setting data of the transmitter even during the power-off state.

A/D : This converter converts analog signals to digital signals.

D/A : This converter converts digital signals to analog signals.

1-1-2: Parts names of the transmitter

Introduction

This transmitter consists mainly of a terminal board, an electronics module, a transmitter unit case, an indicator, and a center body.

Structure and parts names

The following illustration shows the structure and parts names of this transmitter:

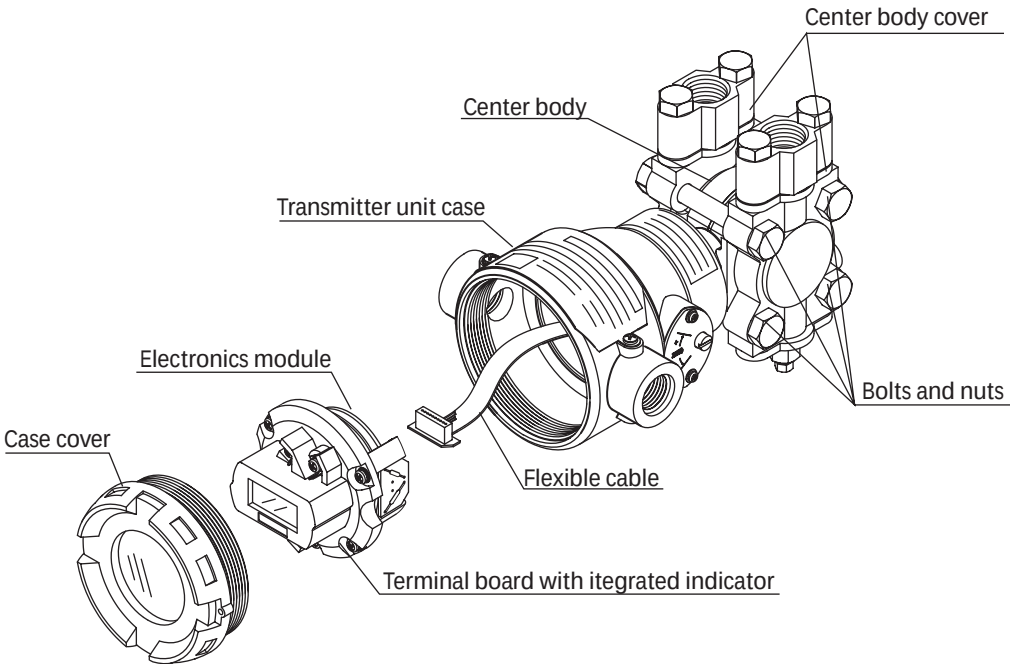


Figure 1-2 Structure of the transmitter (model JTD)

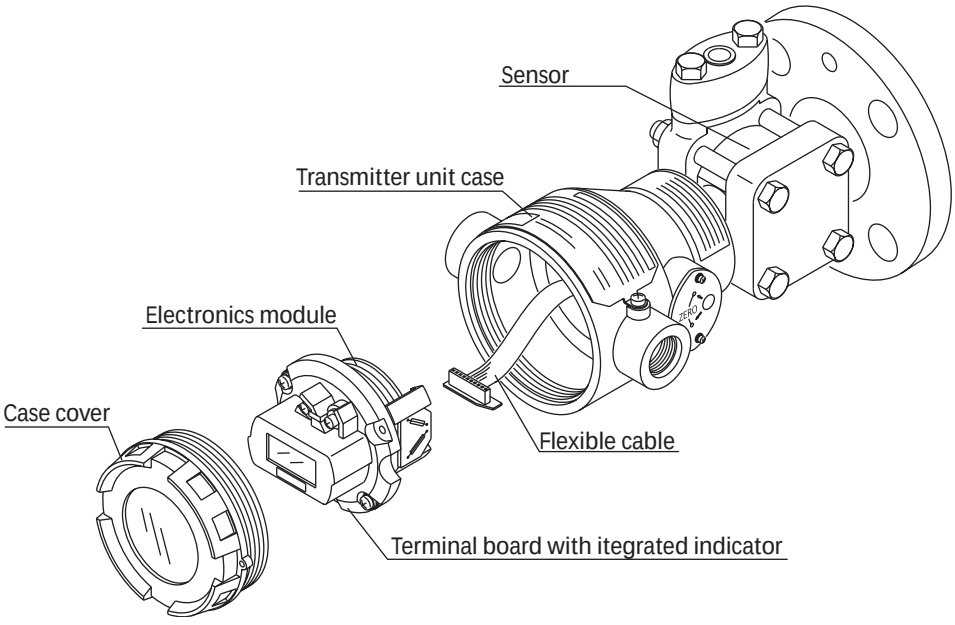


Figure 1-3 Structure of the transmitter (model JTC)

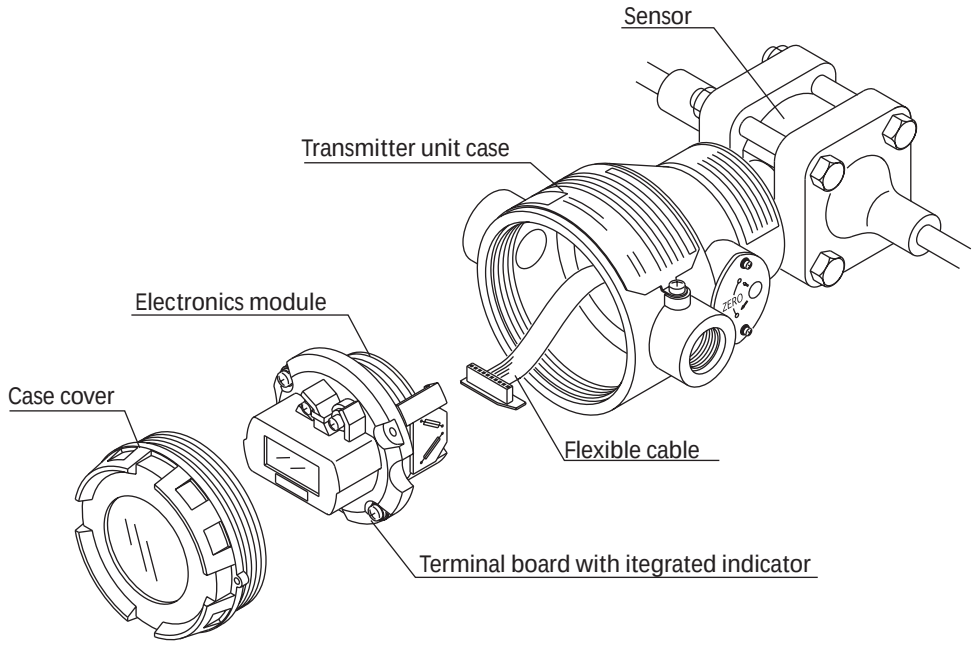


Figure 1-4 Structure of the transmitter (model JTE)

Parts name	Description
Center body	Consists of a composite semiconductor sensor, a pressure diaphragm, an excessive pressure protection mechanism, etc.
Center body cover	Two center body covers sandwich the center body. Connect a connecting pipe to this part.
Bolts and nuts	Fixing the center body between covers, are a series of bolts and nuts.
Sensor	It consists of a composite semiconductor sensor, a pressure receiving diaphragm, a flange, a capillary tube, etc.
Electronics module	COnsists of electronic circuits having functions for processing differential pressure and other signals, and transmitting them.
Transmitter unit case	Housing the electronics module and the terminal board.
Case cover	Encloses the transmitter unit case.
Terminal board with integrated indicator	Derives electric signals from within the instrument. Connect an SFC to this terminal board. Integrated with the terminal board is an optional digital indicator that displays an analogue output.

1-1-3: Indicator (Option)

Display unit of indicator

The display unit of an indicator consists of the following:

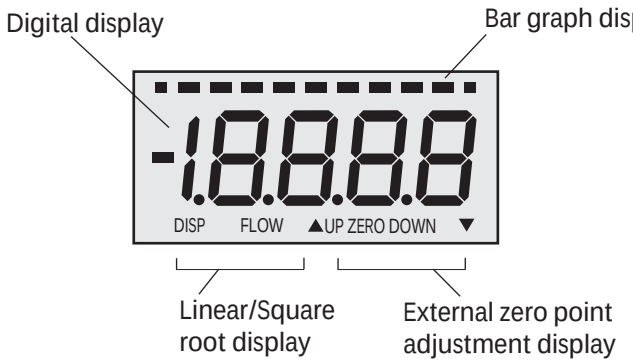
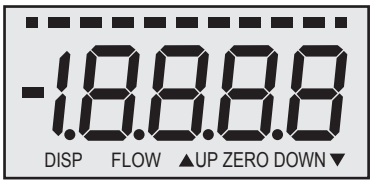


Figure 1-5 Display unit of indicator

Digital display

The indicator displays the output value of a transmitter in % or any engineering unit in the digital mode. The display unit is a 4.5-digit 7-segment LCD.

Indicates a value outside the display range by flashing as shown below.



- When the display value is within either of the following ranges, the limit value flashes.

Range of display value	Display
Display value < -19999	-1999
Display value > 19999	1999

- In some cases, a transmitter failure is indicated by the following display.

The response action is outlined in "5-7-4: Self-diagnosis by indicator (option)" on page 5-56.

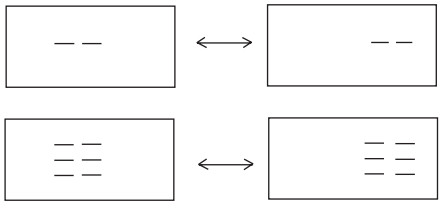
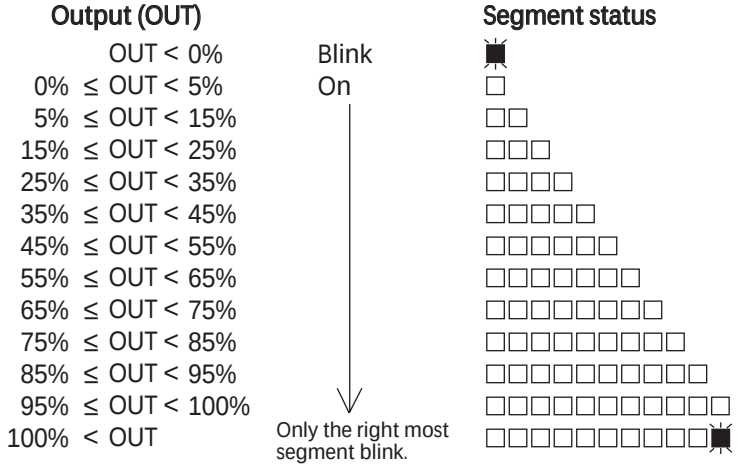


Figure 1-6 Failure display on indicator

Analog bar graph display

The output value of a transmitter is displayed in a 11-segment analog bar graph. The relationship between the output value and the segment display status (on and blinking) is as show, below.



In the constant current mode, the entire bar graph blinks.

In this case, the bar graph and digital display blink alternately.

Linear / Square root display

Read the display to judge whether the transmitter output and the indicator display are linear (differential pressure) or the result of extracting square root (flow rate).

The judgement criteria based on the display are shown below:

Table 1-1 Linear / Square root display status

Display	Output	Display status	Category
Linear (Differential pressure)	Linear (Differential pressure)	None	Linear
Square root (Flow rate)	Linear (Differential pressure)	DISP FLOW	Display flow rate (Display square root)
Square root (Flow rate)	Square root (Flow rate)	FLOW	Flow rate (Square root)

External zero adjustment display

The operation status of the external zero adjustment function (option) is displayed.

The judgement criteria based on the display are shown below:

ZERO stays on for a transmitter with the external zero adjustment function.

Table 1-2 External zero adjustment display status

Adjustment status	Display	
Running	ZERO	
Output is increasing	▲ UP ZERO	
Output is decreasing	ZERO DOWN ▼	
Error	ZERO (blinking)	

In the event of an error, take the necessary action, referring to "5-7-4: Self-diagnosis by indicator (option)" on page 5-56.

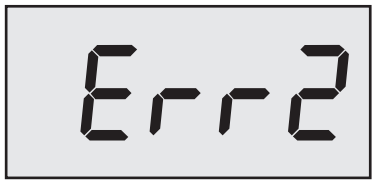
For the adjustment procedure, refer to "3-10: External zero adjustment (option)" on page 3-54.

Self-diagnosis display on indicator

Turn on the power and check that the indicator is in the normal status.

If the cable has an abnormality, the indicator does not light up.

If the indicator has an error, Error No. corresponding to the error type is displayed.



Error detected by self-diagnosis (ROM error)

Figure 1-7 Self-diagnosis result display on indicator

- When the transmitter itself is not functioning properly, the indicator display will be as shown in " Digital display" on page 1-6.

In the event of an error, take the necessary action, referring to "5-7-4: Self-diagnosis by indicator (option)" on page 5-56.

Engineering unit label

Use the engineering unit label sheet (included) to indicate the display area on the engineering unit.

* If you specify an engineering unit at the time of ordering, the equipment will be shipped with the specified label already attached. Change the engineering unit label by the following procedure when necessary.

* Pointer labels for analog bar graphs are provided on the engineering unit label sheet. Use them for monitoring in the field.

1. Select a unit label or a pointer label and remove it from the sheet.
2. Attach the label to the designated position as illustrated below.

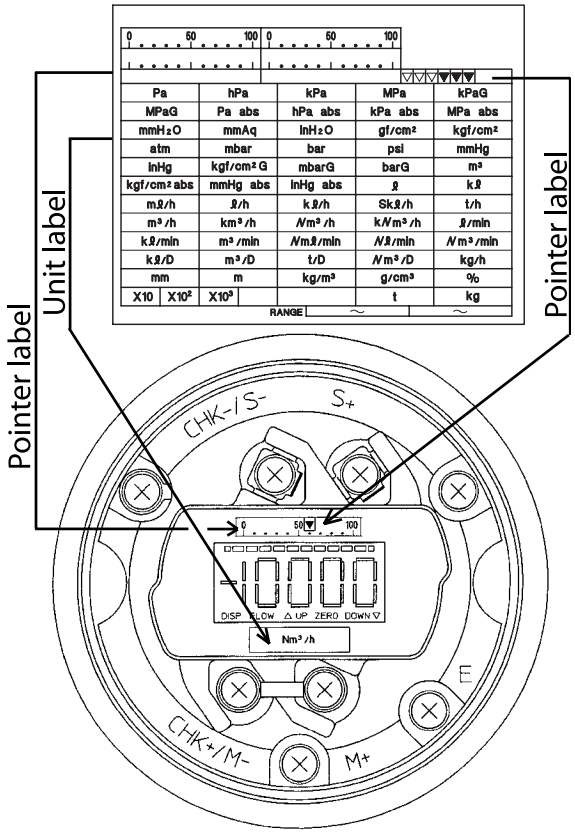


Figure 1-8

1-2: Function and configuration of SFC

1-2-1: Function of SFC

Introduction

An SFC is provided for communications with this transmitter via signal cables. The SFC has functions for reading measured data, displaying and changing data, and displaying the details of self-diagnostics. The display screen data can be printed if an optional printer is included.

Information on the SFC provided in this manual is applicable to software version 7.1 or later. SFC is available in English and Japanese.

The English version has English notations on the keyboard and displays and prints data in English. Both versions are operated with one set of procedures.

Instructions on a Japanese SFC are provided in “Chapter 4: Operation using SFC” of this manual.

Details on operation of the English version are included in a separate manual;

⚠ WARNING

- Always switch to manual control the process loop, before starting communications between this transmitter and the SFC.
- Communications in the automatic process control state may be affected by sudden changes in output, and result in hazardous operation.

  Note that above warning does not apply to the combination of a transmitter and an SFC of the analog overlay type.
- Choose a general-type SFC or an intrinsically-safe type, depending on the operation environment.

  Explosion-proof atmospheres require the use of an SFC that has an explosion-proof conformance mark. NEVER use a non-conformant SFC in explosive atmospheres.
- Never replace internal parts or change cabling. This may compromise the intrinsically safe performance.
- Recharging of the SFC must never be performed in explosive atmospheres.

⚠ CAUTION

- Colon (:) displayed in the data display window means low voltage. Recharge the SFC.
- Recharge according to the instructions in “4-1-7: Charging SFC” on page 4-17. In some cases, over-discharge may shorten battery life.

Function of SFC

An SFC is used mainly in the following situations:

Read measured data, display:

- Transmitter input (differential pressure, sensor temperature)
- Transmitter output (%)

Display or change settings:

- Tag number
- Output format (linear or flow rate)
- High- and low-limit of the setting range
- Damping time constant
- Engineering unit of differential pressure
- Low flow cutoff value
- Software version of SFC and transmitter

Maintain or replace the transmitter (refer to Chapter 5)

- Save and resend data to the transmitter

Display a transmitter / SFC error

- Display a self-diagnostic message

Print data (applicable to an SFC with a printer)

- Print stored data stored or status data in a batch format. This function is called maintenance printing.
- Printing this transmitter's response to an instruction from an SFC (This function is called action printing.)

1-2-2: Configuration of SFC

Parts names

The following illustration shows the structure and parts names of an SFC:

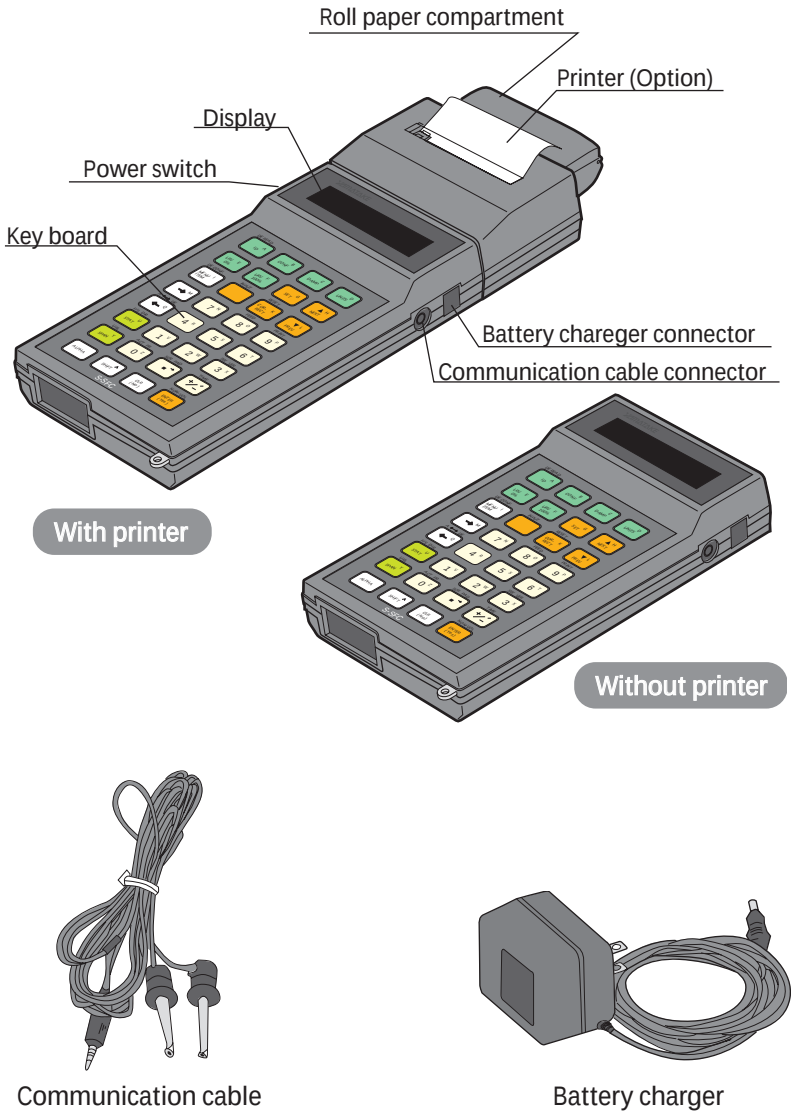


Figure 1-9 Parts names of an SFC

Parts names and functions

The following table shows the functions and structures of SFC parts:

Table 1-3 Standard parts names and functions

Parts name	Description
Power switch	• The SFC automatically starts self-diagnostic checks when this switch is turned ON. • Turn OFF switch to end an operation of changing a setting.
Key board	• Use 32 touch keys. • Key are color-coded for ease of use. Detailed instructions in Chapter 4.
Screen	• Communication data is displayed in 16 characters × 2 lines.
Communication cable	• Use cable for connecting an SFC to a transmitter.
Communication cable connector	• Connect the plug of the communication cable to this connector.
Battery charger	• Use this charger for recharging an SFC. • Charge the SFC if colon (:) displayed on the screen.
Battery charger connector	• Connect the plug of the battery charger to this connector.

Table 1-4 Optional parts names and functions

Parts name	Description
Printer	• This printer prints setting data and measured data.
Rolled paper case	• Rolled printing paper is housed in this case.

Chapter 2: Installation

Overview

Instructions for the installation of pipes and cables associated with this transmitter. Also covers installation of the transmitter. For users that are responsible for installation work.

2-1: Installation environment

2-1-1: General environmental conditions

Introduction

Install under environmental conditions specified here, to fully exploit transmitter performance over long periods.

Always install an explosion-proof transmitter where regulations demand such precautions.

Environmental conditions

Select a location to meet the following conditions:

- Temperature fluctuations should be as small as possible.
- Avoid installing in locations that are exposed to radiated heat from other plant equipment.
- Insulate against freezing in the measured fluid or sealing liquid.
- Avoid installing in corrosive atmospheres.
- External zero-adjustment function is an option that may be subject to output fluctuations if installed near to sources of strong magnetic interference. Install such models at least 1 m remote from plant equipment producing strong magnetic interference as over 10 gauss measured where a motor or a pump is installed.

2-1-2: Environmental conditions for explosion-proof transmitter

Explosion-proof transmitter installation precautions

Explosion-proof transmitters have passed inspections at a public organization in compliance with Japanese Labor Safety and Hygiene Laws. As specified, use explosion-proof transmitters in hazardous locations. Smart Transmitters are available in two types of explosion-proof specifications: flameproof, special explosion-proof specifications and intrinsically-safe specifications.

Explosion-proof transmitters have a conformance mark that provides required information for explosion-proof performance. Install explosion-proof transmitters correctly, and follow the information on the name plate.

Environmental conditions for explosion-proof transmitter

Install a explosion-proof transmitter in locations that meet the following explosion class, ignition temperature, and hazardous environment class conditions:

- Explosion class and ignition temperature of gas:
  IICT4 (IIC: All types of gas and steam; T4: Gas and stem whose ignition temperature is 135°C or higher.)
- Hazardous environment class
  Class 1 location or Class 2 location
  Installation in a Class 0 location prohibited.
- Temperature
  Select a location where the temperature always stays under high limits specified by the conformance mark. AMBIENT TEMP refers to the ambient temperature of the transmitter and METER BODY TEMP refers to the temperature of the meter body that is in contact with the liquid. The low limit is -20°C for both ambient temperature and meter body temperature

Temperature precautions

The transmitters explosion-proof performance cannot be guaranteed outside these temperature limits. If temperature should exceed the high limits, install insulation and ventilation, to maintain the effective operating temperature.

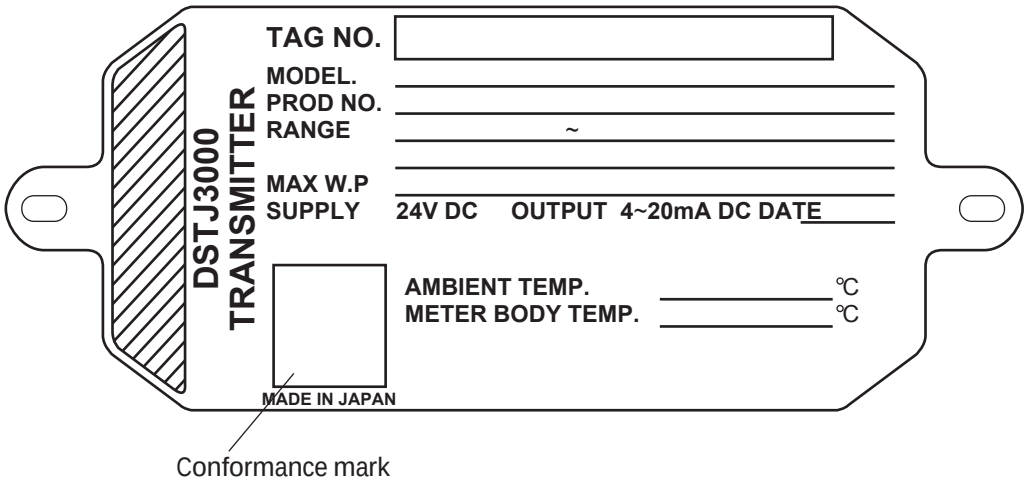


Figure 2-1 Name plate and conformance mark

Preference document

Industrial Safety Institute of the Japanese Ministry of Labor, New Explosion-Proof Guidelines for Plant Electrical Facilities (Gas Explosion-Proof 1985)

2-1-3: Environmental conditions for intrinsically-safe transmitter

Environmental conditions for intrinsically-safe transmitter

Install and intrinsically-safe transmitter at a location meeting the following explosion class, ignition temperature, and hazardous environment class conditions:

- Explosion class and ignition temperature of gas:
  3aG4 (3a: Gases and steam of explosion class 2 including hydrogen; G4: Gas and steam whose ignition temperature is 135°C or higher.)
- Hazardous environment class
  Class 0 location, Class 1 location, Class 2 location
- Temperature
  Select a location where the temperature always remains inside the high limits specified by the conformance mark. AMBIENT TEMP refers to the ambient temperature of the transmitter and METER BODY TEMP refers to the temperature of the meter body that is in contact with the liquid. The low limit is -10°C for both ambient temperature and meter body temperature. (For information on the conformance mark, refer to Figure 2-1.)

Reference document

Industrial Institute of the Japanese Ministry of Labor, New Explosion-Proof Guidelines for Plant Electrical Facilities (Gas Explosion-Proof 1985)

Remarks

The following instructions are especially important for use of intrinsically-safe transmitters.

- Cabling and installation
  For cabling work, follow the Explosion-proof Guidelines. For detailed information, refer to “2-4-3: Wiring transmitter - Intrinsically safe”.
- Maintenance
  Changing parts or internal cabling may result in the loss of explosion-proof performance. Repair a transmitter by replacing its complete printed circuit board.

2-2: Installation

2-2-1: Installation dimensions

Refer to the external dimensions in specification sheets.

2-2-2: Installation environment

Refer to “2-1-1: General environmental conditions” on page 2-2.

2-2-3: Installing the transmitter

Before installing the transmitter

Prepare the following items

- 2-inch pipe
- Mounting bracket (U-bolt, nu, mounting bolt) (Option)

The transmitter can be installed by the following two methods:

- Installation with pipe stanchion (Refer to Figure 2-2).
- Installation with by line mounting (Refer to Figure 2-3).

In the both cases, fix the transmitter to a vertical or horizontal 50 mm pipe with a U-bolt using a mounting bracket. Mount the transmitter on a bracket using the four bolt holes on the reverse side of the pressure receiving part. Fix the pipe firmly to the foundation and make sure that it is stable. When you choose the line mounting method, provide equipment to be used for connecting a 2-inch pipe to the line pipe.

~Note *As for the procedure for mounting a transmitter on the 2-inch pipe, note that the sequence of assembling the transmitter, the bracket, and the 2-inch pipe depends on the installation direction.*

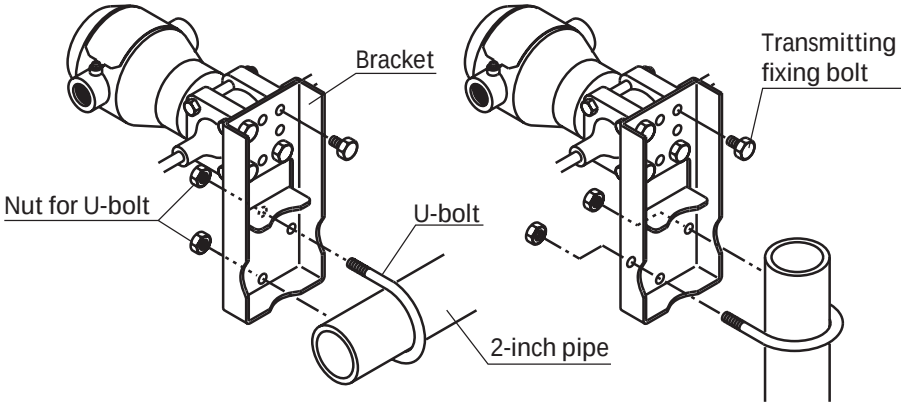


Figure 2-2 Installing the transmitter

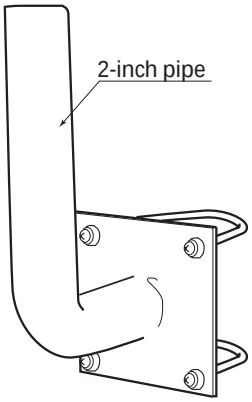


Figure 2-3 Equipment for line mounting

2-2-3-1: [Remarks] Remarks related to installation

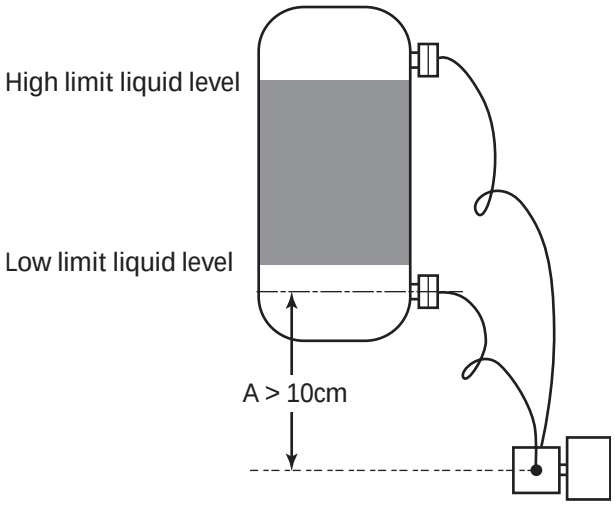
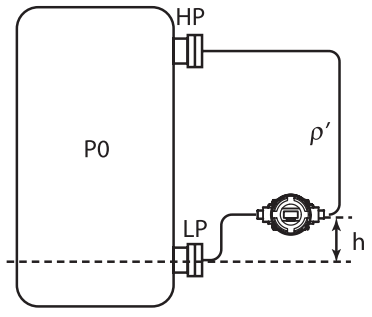


Figure 2-4 Example of liquid level measurement in a closed tank

~Note
1. *Mount the transmitter at least 10 cm below the tank nozzle position. If it cannot be mounted below this level, refer to "Installation position of remote sealing type transmitter on closed tank".*
2. *If the liquid to be measured contains hydrogen, consult with us concerning the handling method.*
3. *In case of the high temperature and high vacuum model, the response speed of the transmitter will be low if the measurement temperature and the ambient temperature are 10°C or lower. Make sure that the ambient temperature of the capillary tube and the center body is always higher than 10°C.*

2-2-3-2: Installation position of remote sealing type transmitter on closed tank

In installing the transmitter main unit above the lose flange of a closed tank, the following conditions must be satisfied. The installation position of a remote sealing type transmitter is studied on an assumption that the tank is empty.



P0: Pressure in the tank (Absolute pressure: kPa abs.)
ρ': Specific gravity of liquid sealed in the capillary
h: Height from the lower flange of the tank to the transmitter

Figure 2-5

When a transmitter is installed as illustrated above, negative pressure attributed to the head pressure of the sealed liquid in the capillary is applied to the diaphragm of the transmitter main unit (lower flange side) besides the inner pressure of the tank.

The pressure applied to the diaphragm surface should be equal to or higher than the low limit allowable pressure value P (kPa abs.) of the transmitter main unit. The conditions for meeting this requirement are specified below.

An application in which the pressure in the tank is vacuum requires special care because greater negative pressure is applied to the diaphragm of the transmitter main unit of the lower flange side.

$$P0 + (-\rho' h/102) \geq P1 \text{ kPa} = 102 \text{ mmH}_2O$$

$$h \leq (P0 - P) \times 102/\rho'$$

	Specific gravity of sealed liquid ρ'	Low limit of allowable pressure P (kPa abs.)	Range of liquid contact temperature °C
Regular type	0.935	2	-40 to 40
High temperature service	1.07	2	-5 to 90
High temperature / vacuum service	1.07	0.133	-5 to 100
High temperature / high vacuum service	1.09	0.133	10 to 250
Oxygen use, chlorine service	1.87	53	-10 to 40

Remarks:
1. The lo limit of allowable pressure changes if the liquid contacting temperature exceeds the above range. In such a case, refer to the specifications.
2. The range of ambient temperature is the range of liquid contacting temperature in the above table or the normal operation range of ambient temperature whichever is narrower.

Example:

Use a general use remote sealing type transmitter model JTE to a vacuum application.

Liquid contacting temperature: Normal temperature

Low limit of allowable pressure (P): 2 kPa abs. (15 mmHg abs.)

Specific gravity of sealed liquid (ρ'): 0.935

Therefore, the following condition must be met to satisfy the transmitter specifications:

$$P0 + (-\rho' h/102) > P1 \text{ kPa} = 102 \text{ mmH}_2O$$

If the internal pressure (P0) of the tank falls to 3 kPa abs., the allowable range of "h" is expressed with the following formula:

$$h < (P0 - P) \times 102/\rho'$$

in which $P = 3$, $P = 2$, $\rho' = 0.935$

$$h < (3 - 2) \times 102/0.935 = 109 \text{ mm}$$

Therefore, the transmitter position must not be higher than 109 mm above the lower flange of the tank.

Remarks: If the above condition is not met, the diaphragm surface will be pulled by negative pressure exceeding the allowable range. As a result, the sealed liquid will be gasified due to pressure exceeding the standard vapour pressure. If the negative pressure further increases, the diaphragm can be destroyed due to buckling. We recommend to mount a transmitter main unit at least 10 cm above the lower flange because these conditions are not always clearly determined by customers.

2-2-4: Transmitter main unit installation position

No special restriction is imposed on the installation position, it is the best to install the transmitter main unit in such a way as to set the pressure receiving diaphragm vertically. After installation, calibrate the zero point by the following procedure.

Perform zero point calibration by the following procedure:

Fix the high pressure and low pressure side diaphragms at the same height and make sure that the input pressure to the transmitter is uniform.

Turn off the sealed liquid temperature correction function for the calibration work.

Refer to "4-5-15: Displaying an changing sealed liquid temperature correction function" for changing the temperature correction function.

Zero point calibration using SFC

Check that the input and the output are 0 kPa and 0%, responsively .

Step	Key	Description	SFC screen
1	NON-VOL ENTER (Yes)	Turn ON the power switch of the SFC. After making sure that the process is in the manual control mode, press the NON-VOL ENTER (Yes) key.	LOOP IN MANUAL? PRESS ID
2	DE READ ID A	Press the DE READ ID A key.	DSTJ TAG NO. LIN DP FIT-1234
3	SHIFT ^ INPUT OUT- PUT J	Press the SHIFT ^ and INPUT OUT- PUT J keys in that order.	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 0.0000 kPa

Step	Key	Description	SFC screen
4	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key.	OUTPUT FIT-1234 WORKING... OUTPUT FIT-1234 0.00 %

If the SFC screen display is not 0 kPa and 0% in steps 3 and 4, respectively, perform zero calibration by steps 5 to 9.

If 0.005 kPa is displayed in step 3, perform calibration by the following procedure:

Step	Key	Description	SFC screen
5	SHIFT ^ INPUT OUT- J PUT	Press the SHIFT ^ and INPUT OUT- J PUT keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 0.005 kPa
6	RESET COR- K RECT	Press the RESET COR- K RECT key.	INPUT FIT-1234 ZERO INPUT?
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	INPUT ARE YOU SURE!?
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 INPUT ZEROED

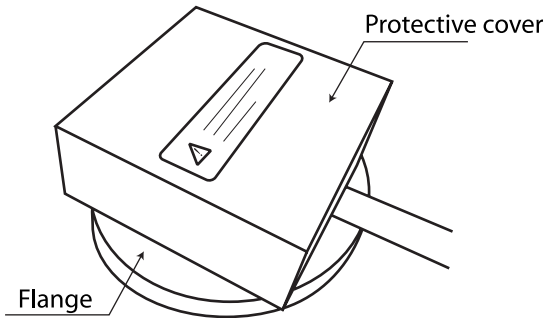
Step	Key	Description	SFC screen
9		Repeat <step 3> and <step 4> and make sure that 0.00 is displayed. Zero point calibration is completed.	

If the SFC screen display differs from the above, refer to “Chapter 5: Maintenance and trabouleshooting” and take the necessary action.

2-2-5: Installation of process (Models JTC/JTE/JTH/JTS)

⚠ CAUTION

Before installing the transmitter, remove the "Protective cover".



Example: Remote seal type

Installation method

Referring to Figure 2-6, mount the flange on the process.

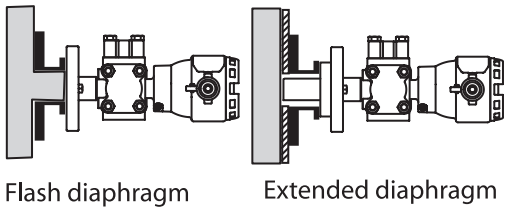


Figure 2-6 Connection to a tank

For the adaptor flange tightening torque, refer to Table 2-1.

Table 2-1 Adaptor flange tightening torque

Material	Tightening torque (N•m)
SNB7	20 ±1
SUS304	10 ±1

Piping

Liquid level measurement in an open tank (models JTC929/940)

Connect the pipe as shown in Figure 2-7.

Liquid level measurement in closed tank connecting pipe gas sealing (dry leg) (models JTC929/940)

Connect the pipe as shown in Figure 2-8.

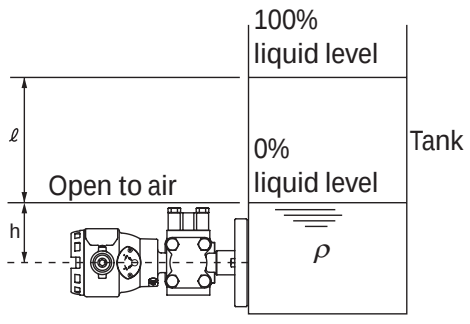


Figure 2-7

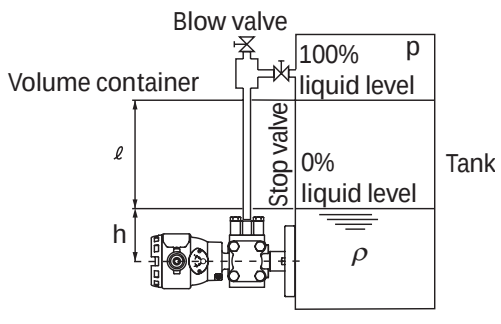


Figure 2-8

Installation mehod

Step	procedure
1	Mount the flange on the process side flange using bolts and a gasket (*). Tighten the bolts evenly and firmly to prevent leakage. Bundle the capillary tubes of the high pressure and low pressure sides together to decrease the influence of ambient temperature difference. FIx the capillary tubes so that they may not be moved by wind or vibration. (You are advised to loosely wind surplus tubes and fix them.) *: *The process user is asked to provide a flange gasket. If you use a semi-metal or rubber gasket, select a gasket of an appropriate shape so that it may not contact the transmitter diaphragm.*
2	In case of liquid level measurement of an open container, fix the flange firmly where is not exposed to great temperature fluctuations or any vibration. Protect the seal diaphragm to prevent damage. Make sure that neither drain, nor dust is accumulated on it. Remarks: 1. Don't twist the capillary tubes. 2. In unwinding a capillary tube, hold the flange part and unwind the large loop of the tube. 3. You are advised to mount the capillary tubes below the horizontal plane. 4. Don't turn the capillary tubes in such a way that it twists the root of the flange. 5. You are advised to fix the capillary tubes to prevent vibration.
3	Gasket selection for the flange (3 inches flush mount type) The instructions for selecting a gasket for the flange are provided below. Since the diaphragm diagram is 95 mmϕ, a commercially available 3 inches gasket will contact the diagram to cause a measurement error. Select an appropriate material according to the liquid, operating pressure and temperature and select a gasket of an appropriate inner diameter. (Its diameter must be appropriate so that the gasket never contacts the diaphragm even if it is misaligned or crushed.) Remarks: 1. Select a gasket of an appropriate inner diameter. (The diaphragm diameter is 95 mmϕ.) The diameter of a commercially available 3 inches gasket is inappropriate for this purpose. (80 to 90 mmϕ) 2. A gasket should never contact the diaphragm even if it is crushed or deformed. • A gasket made of a soft material can be deformed by being tightened. • Vertical gasket mounting can cause problems such as falling and misalignment. Align the gasket accurately. 3. In case of a flange with a FEP protection film, observe the following instruction besides 1 and 2. • Excessive tightening can destroy the protection film. • Mount the protection film according to "FEP protection film mounting procedure". • Excessive grease or gasket misalignment is suspected if the zero point shift greatly after mounting the pressure receiving unit.

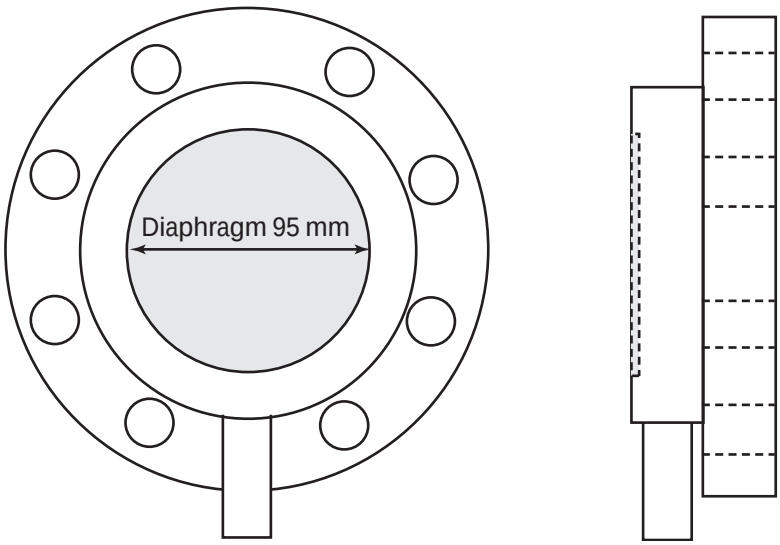


Figure 2-9 Exterior view of pressure receiving part

Example of selection

Fluid:	Sea water
Temperature:	Normal temperature
Pressure:	300 kPa max.
FEP protection film	
Flange:	3BJIS10K

Material:	Asbestos (Non-asbest
Ecxternal dimension:	134 mm
Inner diameter:	98 +2/-0

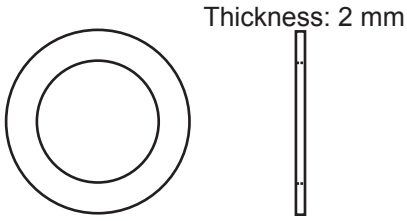


Figure 2-10 Exterior view of gasket

Mounting the flange for liquid level measurement (model JTE)

Remarks: Take enough care because the positional requirement of the high pressure side flange of the transmitter depends on the tank type (open tank or enclosed tank). In case of an open tank, mount the high pressure side flange on the lower flange of the tank. In case of an enclosed tank, mount the high pressure side flange on the upper flange of the tank.

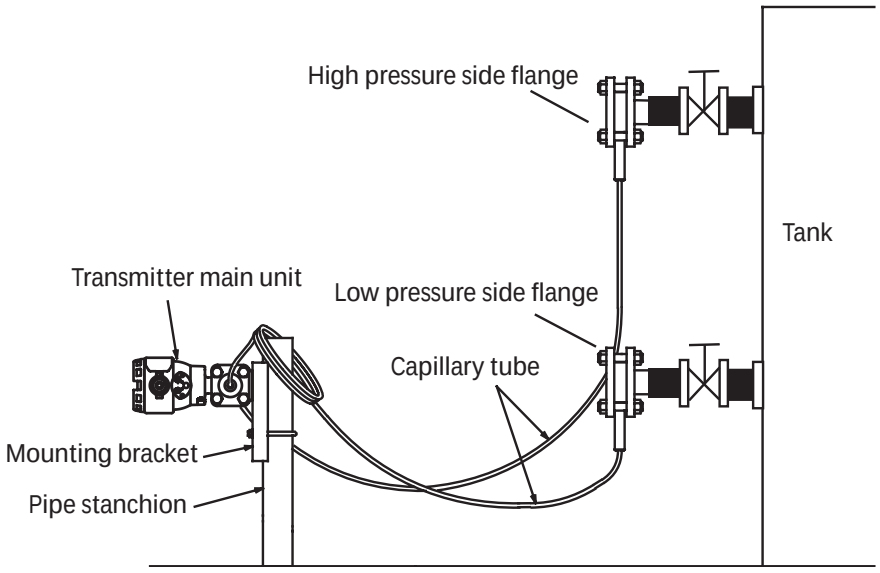


Figure 2-11 Mounting on an enclosed tank

Mounting the flange for liquid level measurement (model JTH/JTS)

An example of transmitter installation for measuring the liquid level in an open tank is shown below.

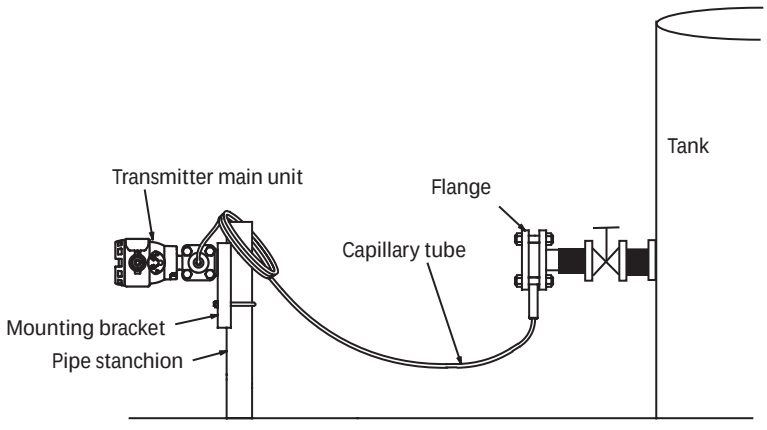


Figure 2-12 Mounting on an open tank

2-2-6: Mounting FEP protection film

3 inches flange

Perform the following work immediately before mounting the flange of the pressure receiving part:

1. Hold the transmitter in such a way that the diaphragm of the pressure receiving flange faces upward.
2. Apply about 15 g of diaphram grease to the diaphragm surface and spread it thinly on the whole surface with a finger.

   (The average grease thickness on the diaphragm is about 2 mm.) (Refer to Figure 2-13.)
3. Engage the FEP protection film into the rased face surface of the diaphragm. (refer to Figure 2-14.)
4. Push the center of the diaphragm so that grease comes out to the outside.

   Push slowly so that no air is left between the diaphragm and the FEP protection film.

   Squeeze out grease so that almost no grease remains on the raised face part.

   If you squeeze out about 5 to 7 g, the average grease thickness on the diaphragm surface will be about 0.5 mm. Work carefully enough so that the diaphragm may not be deformed by excessive force. (Refer to Figure 2-15.)
5. Lay asbestos (non-asbestos) on the flange of the pressure receiving part and mount it on the process flange. Tighten the bolts and nuts at about 20 N.m.
6. If zero point fluctuations disable normal operation, collect input data using the SFC before and after tightening the flange. Make sure that the fluctuation is about 0.1 kPa. Repeat the work if the fluctuation is greater because great fluctuations can cause zero point shifting.

~Note *A considerable skill is required for grease application to suppress zero point fluctuations to a low level. If you find it difficult, ask our serviceman.*

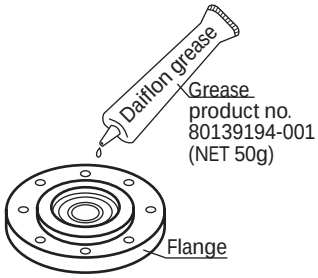


Figure 2-13

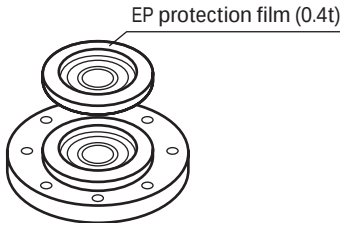


Figure 2-14

Figure 2-15

1½, 2 inches flange

Perform the following work immediately before mounting the pressure receiving flange of the instrument on the process flange:

1. Hold the transmitter in such a way that the diaphragm of the pressure receiving flange faces upward.
2. Apply about 10 g (about 1/4 of one tube) of diaphram grease (No. DG-203, Daikin Kogyo) to the diaphragm surface and the gasket contact surface of the flange and spread it thinly on the whole surface with a finger so that the average grease thickness on the gasket may be about 0.5 mm.) (Refer to Figure 2-16.)

   ~Note *1:Don't deform the diaphragm by applying excessive force to it during grease application.*
   2:Don't leave any air (foam) in the grease.
3. Engage the FEP protection film into the diaphragm of the flange. Lift one side and engage it quietly from the opposite direction without leaving air. (Refer to Figure 2-17.)

   ~Note *1:Make sure that the FEP protection film tightly contacts the metallic diaphragm.*
   2:The wavy part of the FEP protection film should not be convex.
4. After mounting the FEP protection film, be sure that no air is left between the diaphragm and the FEP protection film. Remaining air lowers the measurement accuracy in some cases. If remaining air is found, push out air from the center toward the outside by pressing with a finger. (Refer to Figure 2-18.)
5. Lay a FEP covered gasket or an asbestos gasket on the pressure receiving flange and mount it on the process flange.
   The recommended tightening torque for bolts and nuts is shown in Table 2-2 (for reference).

   ~Note *1:Tighten the bolts with even torque.*

Table 2-2

Flange rating	Tightening torque (N.cm)
JIS 10K - 50 mm	30
JIS 10K - 40 mm	20
ANSI/JPI 150# - 2 inches	28
ANSI/JPI 150# - 1.5 inches	20

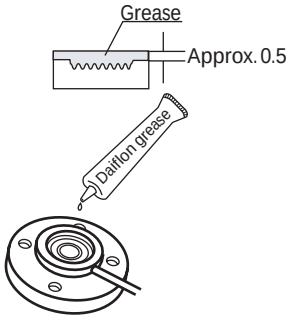


Figure 2-16

Figure 2-17

Figure 2-18

2-2-7: Direct mount type installation (patent pending)

(model JTE)

Outline

The direct mount type is an installation kit (adaptor, tube clamp) for a remote sealing type transmitter that was developed to enable easy instrumentation for tank level measurements. The direct mount type eliminates the need for a stanchion for installing the transmitter main unit. Combined with the Yamatake's unique temperature correcting function for sealed liquid and capillary tube bundling, it achieves outstanding temperature characteristic.

Figure 2-19 Example of direct mount type installation

Figure 2-20 Remote sealing type transmitter and direct mount type installation kit

Features

Simple and easy instrumentation

- A transmitter can be mounted directly on a tank using an adaptor. There is no more need for a stanchion. It saves the space around the tank.
- The capillary tubes are bundled and fixed in an orderly manner using the tube clamp. A product of the most suitable capillary length can be obtained as long as the distance between tank flanges is known.

Outstanding ambient temperature characteristic

- Yamatake's remote sealing type transmitter has a temperature correction function for sealed liquid (patent announcement completed) which minimizes the influence of ambient temperature changes on sealed liquid pressure applied as head pressure. It greatly decreases zero point shifting. (Influence of seasonal temperature change: 1/5 to 1/10 compared with the conventional model.)
- Zero shifting due to the capillary temperature difference is decreased to 2 compared with the conventional model by bundling the capillary tubes with a special tube clamp.

Specifications

The specifications of the direct mount type installation kit that comes with a remote sealing type transmitter are presented here. For the specifications of a remote sealing type transmitter to be combined with this kit, refer to Specification sheets.

<Specifications of direct mount type installation kit>

Material:

Adaptor : SCS13 (equivalent to SUS304)

Adaptor fixing bolt: SUS304 (M8)

Tube clamp : Brass + Nickel plating

Adaptor mounting:

Instrument side : Mount with 4 adaptor fixing bolts

Flange side : Mount with 4 adaptor fixing bolts

Tube clamp : Bundle the both sides of a folded capillary tube and clamp them.

Weight: Approx. 600 g

Combinable transmitters

Models: JTE929□

- The direct mount type installation kit can be combined only with general use remote sealing type differential pressure transmitters of the above models. It cannot be combined with high temperature / high temperature vacuum / high temperature, high vacuum use transmitters.

Installation method

(1) Installation dimensions

Figure 2-21, Figure 2-22, and Figure 2-23 show an adaptor assembly mounted on a process, an exterior view of an adaptor, and the adaptor length of the installation kit, respectively. For the other dimensions, refer to the external dimensions in “1. Overview”.

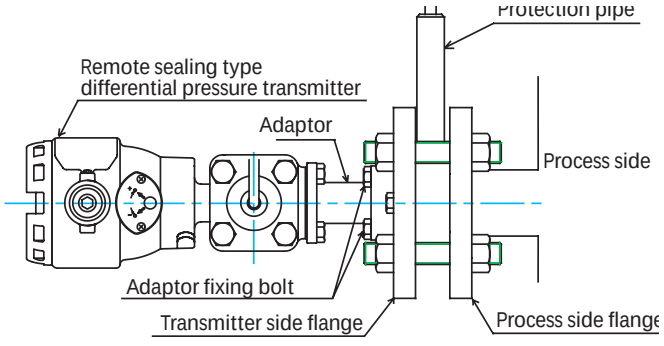


Figure 2-21 Adaptor assembly drawing (model JTE)

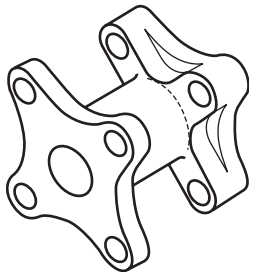


Figure 2-22 Exterior view of adaptor

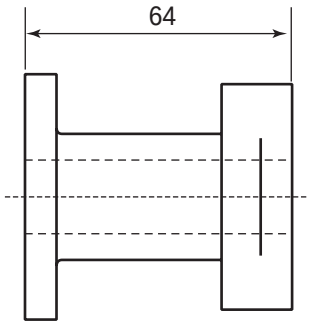
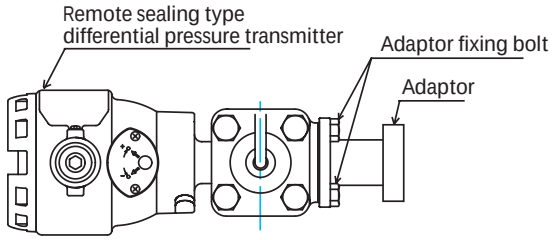


Figure 2-23 Adaptor length

(2) Installation environment

Refer to the remarks in "2-2-1: Installation dimensions" on page 2-6.

(3) Installation procedure

Step	Procedure
1	Fix the adaptor on the transmitter main unit. Make sure that the adaptor is firmly fixed to the transmitter main unit with four bolts. If it is not firmly fixed, fix it firmly. (Refer to Figure 2-24)  *Figure 2-24 Mounting adaptor on transmitter*
2	Mounting the transmitter flange (transmitter fixing side) on the process side flange. Mount the transmitter flange (*1) (transmitter fixing side) on the process side flange before fixing it to the other end of the adaptor fixed to the transmitter. (Refer to Figure 2-25.) *1: A transmitter can be fixed to the high pressure and the low pressure side flange. **⚠ CAUTION** • In measure the liquid level in an enclosed tank using a transmitter other than model JTE929 □, be sure to mount the high pressure side flange (HP) in the upper part of the process.

Step	Procedure

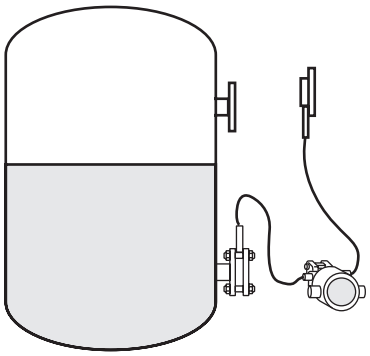


Figure 2-25 Mounting the process side flange No.1

① Mounting on the process flange
Mount the transmitter flange on the process flange using bolts and a gasket.

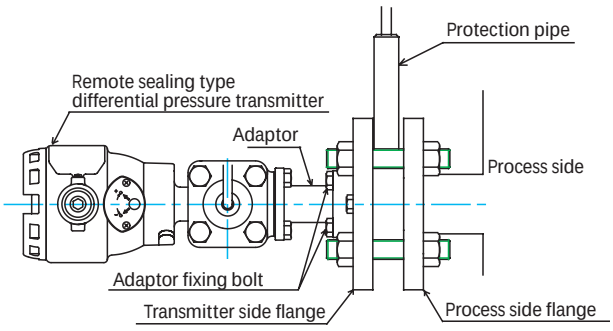
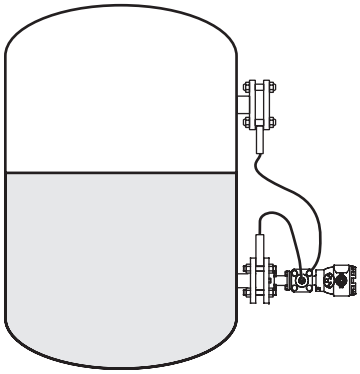
⚠ CAUTION

- In measure the liquid level in an enclosed tank using a transmitter other than model JTE929 □, be sure to mount the high pressure side flange (HP) in the upper part of the process.

② Gasket selection for the flange
The process user is asked to provide a gasket for the flange.
Select a gasket of an appropriate shape so that it may not contact the diaphragm.
Select an appropriate material according to the liquid, operating pressure and temperature and select a gasket of an appropriate inner diameter.

⚠ CAUTION

- The flange of the 3 inches flush mount type has a diaphragm diameter of 95 mmϕ. Therefore, don't use a commercially available 3 inches gasket (inner diameter 80 to 90 mmϕ) for it. A 3 inches commercially available gasket may contact the diaphragm to cause a measurement error because its inner diameter is small.
- Select a gasket of an appropriate inner diameter so that it never contacts the diaphragm even if it is misaligned or crushed. A gasket made of a soft material can be deformed by being tightened.
- Align the gasket accurately. Vertical gasket mounting can cause problems such as falling and misalignment.
- In case of a flange with a FEP protection film, out it according to the instructions in "FEP protection film mounting procedure". Never tighten it excessively to prevent destruction of the protection film.
-

Step	Procedure
	• The inner pressure of a tank must be the atmospheric pressure or higher to mount a transmitter main unit on the upper flange of the process. If the inner pressure is lower than the atmospheric pressure, be sure to mount it on the lower flange of the process.
3	Mount a set of transmitter main unit and adaptor on the transmitter side flange. Firmly fix the set of transmitter main unit and adaptor checked in “1” on the transmitter side flange mounted in “2” with four bolts. (Refer to Figure 2-26)  *Figure 2-26 Mounting transmitter flange*
4	Mounting the other transmitter side flange on the process flange. Mounting the transmitter side flange that has not been mounted on the process on the process flange. (Refer to and in Figure 2-27.)  *Figure 2-27 Mounting the process side flange No.2*
5	Bundling capillary tubes with a tube clamp Bundle the capillary tubes using the tube clamp. Fix the tube clamp firmly, but not forcefully enough to smash the capillary tubes. (Refer to Figure 2-28.)

Step	Procedure

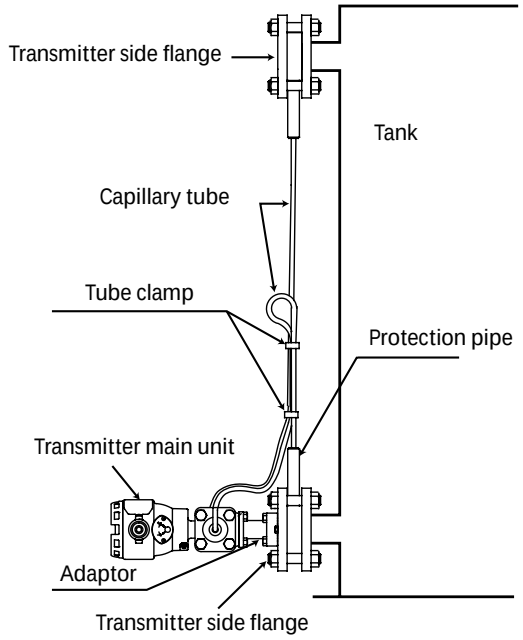


Figure 2-28 Mounting tube clamp

Remarks related to capillary tube handling

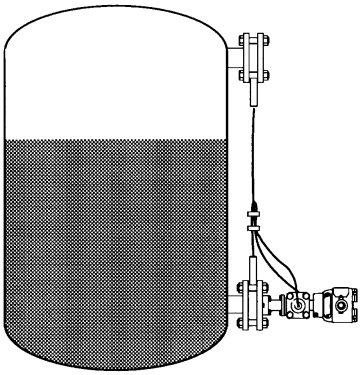
- Don't twist the capillary tubes.
- In unwinding a capillary tubes, hold the flange part and unwind the large loop of the tube.
- In folding a capillary tube, don't apply unnecessarily great force.

  The minimum bending radius (diameter) is about 5 cm. Don't repeat bending and unbending.
- Don't turn the capillary tubes in such a way that it twists the root of the flange.
- You are advised to fix the capillary tubes in the middle position to prevent vibration.

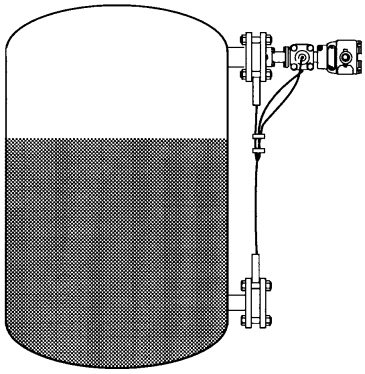
⚠ CAUTION

- The inner pressure of a tank must be the atmospheric pressure or higher to mount the folded part of the capillary tube above the upper flange of the process as shown in Figure 2-25. If the inner pressure is lower than the atmospheric pressure, be sure to mount it below the lower flange of the process.
- In taking up a capillary in the upward direction, be sure to specify olefinic covering for the capillary tubes.
- If a capillary tube has no olefinic covering, make sure that the capillary take-out direction is below the horizontal plane. Otherwise, rainwater can be accumulated in the protection pipe at the capillary take-out port.

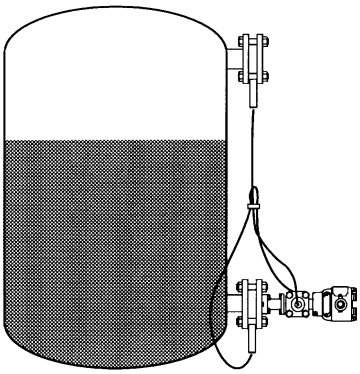
Step	Procedure
6	Zero adjustment After installing a transmitter on the tank, adjust the zero point. For the zero point adjustment procedure, refer to “3-5: Measurement with model JTC”, “3-6: Measurement with model JTE” or “3-9: Zero-span adjustment with input pressure equivalent to range”.
7	Setting the sealed liquid temperature correction function Set the height between flanges using the SFC. For the setting procedure and the function, refer to “4-5-15: Displaying an changing sealed liquid temperature correction function”. This function minimizes the influence of ambient temperature changes to greatly improve the zero shift performance.
8	Others ① Remarks related to an open tank **⚠ CAUTION** • The low pressure side flange of the transmitter that is not connected to the process should be fixed firmly where it not exposed to vibration or great temperature changes. Damage on the seal diaphragm or drain or dust accumulation can cause an error. ② Installation by condition Refer to Figure 2-29.



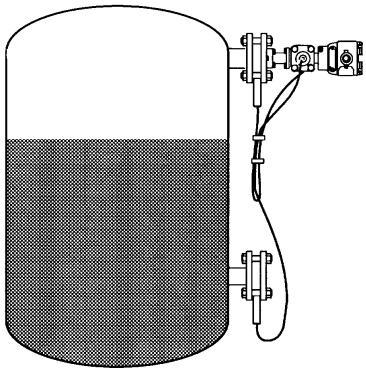
Inner pressure of tank: Atmospheric pressure
Mounted at the bottom of the tank
Capillary tube with olefinic covering



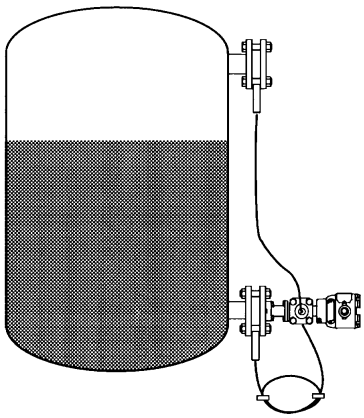
Inner pressure of tank: Atmospheric pressure
Mounted at the top of the tank
Capillary tube with olefinic covering



Inner pressure of tank: Atmospheric pressure
Mounted at the bottom of the tank
Capillary tube without olefinic covering



Inner pressure of tank: Atmospheric pressure
Mounted at the top of that tank
Capillary tube without olefinic covering



Inner pressure of tank = Vacuum (below atmospheric pressure)

Figure 2-29 Example of installation by condition

2-2-8: 1/2 inch remote installation (model JTE/JTH)

Installation procedure

Step	Procedure
1	Installation dimensions Refer to the external dimensions in specification sheets.
2	Installation ① Fixing the adapter to the transmitter Make sure that the adapter is fixed to the end of the capillary tube securely with 4 sets of bolts and nuts. If it is not fixed, fix it securely. At this time, apply grease to the lock bolts. ② Mounting on the process Figure 2-30 shows an example of installation on a tank. For detailed information, refer to "2-2-5: Installation of process (Models JTC/JTE/JTH/JTS)" on page 2-13.

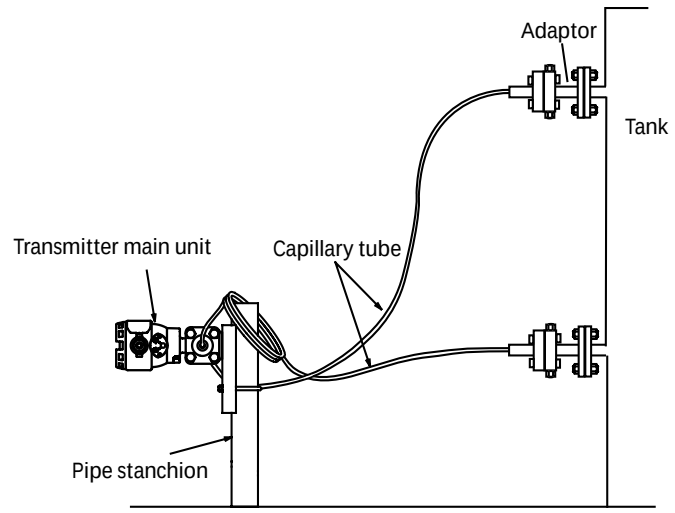


Figure 2-30 Installation for tank level measurement (Example)

⚠ CAUTION

- In bending the capillary tube, do not twist it.
- The minimum bending radius (diameter) of the capillary tube is about 5 cm. Do not bend it forcefully to a smaller radius.
- A fluid of some properties becomes solidified inside the adapter to disable smooth measurement. In such a case, sufficiently warm the outside of the adapter to prevent solidification of the fluid.

2-3: Piping

2-3-1: Flow rate measurement - Piping (model JTD)

2-3-1-1: Piping considerations

Introduction

Piping method depends on such conditions as transmitter position and pipe-line installation. It is generally sufficient to use a 3-way manifold valve and connect an extension pipe.

Since the model JTD has separate connector ports for high and low pressure, distinguish them correctly for installation work. A 3-way manifold valve is optional.

3-way manifold valve (option)

A regular, 3-way manifold valve is shown in the following illustration:

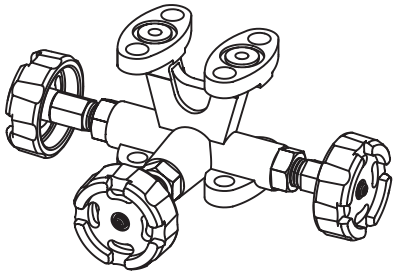


Figure 2-31 3-way manifold valve

Extension pipe (option)

Both straight extension pipe and union extension pipe shown below, are available.

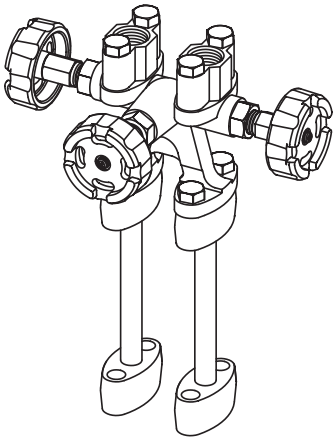


Figure 2-32 Extension pipe

High-pressure marking

H indicates high pressure on the centerbody. Check the mark to ensure correct installation, during piping work. The low pressure side has no mark.

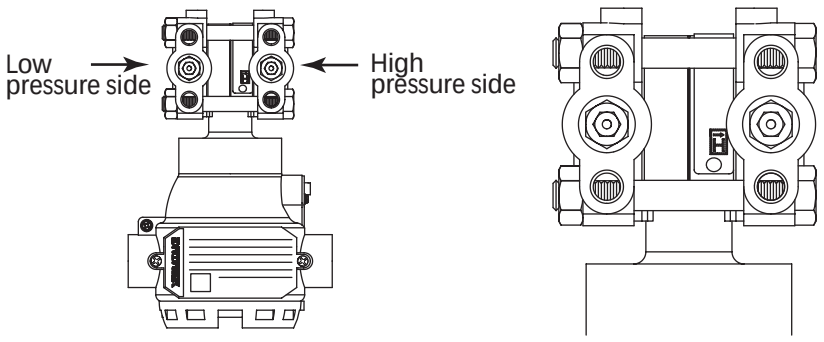


Figure 2-33 High pressure marking on center body

Pipe selection

Select a schedule number and nominal thickness for the connecting pipe leading from a process, based on such conditions as process pressure.

For example, use a 1/2 inch, steel pipe with a schedule number 80.

Materials and requirements

Prepare in advance the following parts and always refer to the illustration.

- 3-way manifold valve
- Pipe
- Main valve
- Union or flange
- Tee
- Drain valve
- Drain plug
- Vent plug
- Seal pot (for steam flow rate measurement only)

2-3-1-2: Piping for liquid or gas flow rate measurement

Recommended piping - Example 1

The illustration shows a typical example of piping. This transmitter is located below the differential pressure output port of the process pipe.

The following apply:

Grade the pipe at the differential pressure output part.

Inclination symbol in illustration: Low level High level

After piping work, ensure that the connecting pipe, the 3-way manifold valve, and the transmitter have no pressure leak.

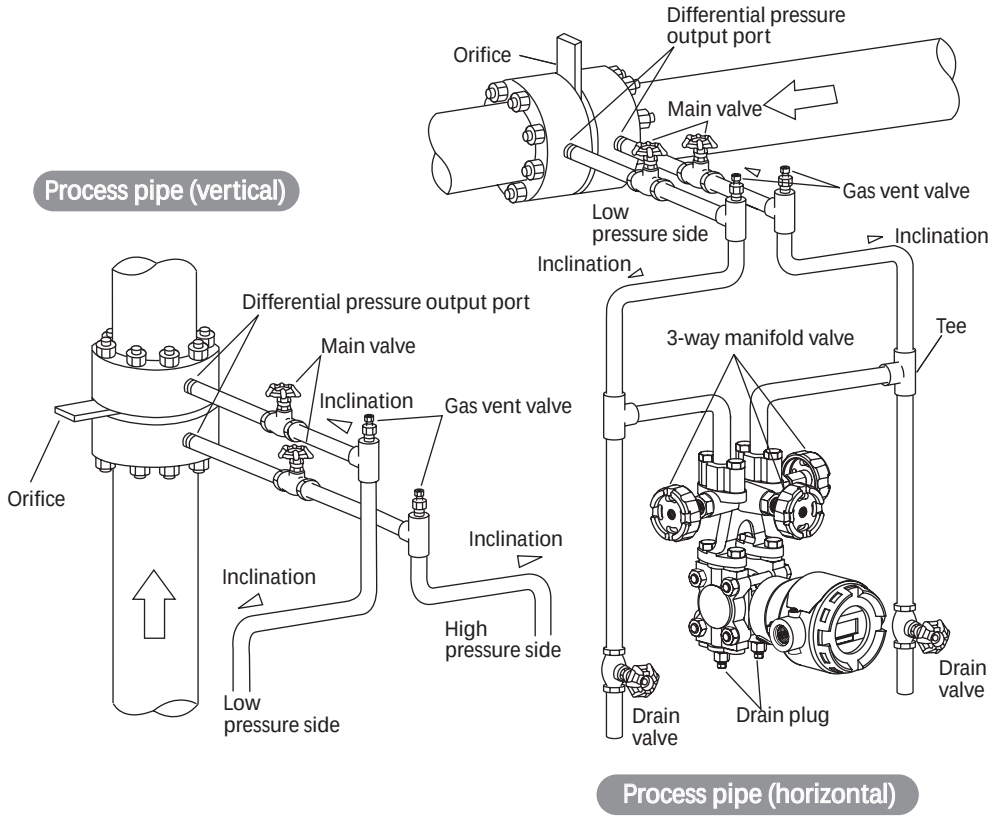


Figure 2-34 Piping for liquid or gas flow rate measurement (Example-1)

This transmitter is located underneath the differential pressure output port of the process pipe.

Recommended piping - Example 2

The illustration shows a typical example of piping. This transmitter is located above the differential pressure output port of the process pipe.

The following apply:

Grade the pipe at the differential pressure output part.

Inclination symbol in illustration: Low level High level

After piping work, ensure that the connecting pipe, check for pressure leaks around the 3-way manifold valve, and the transmitter.

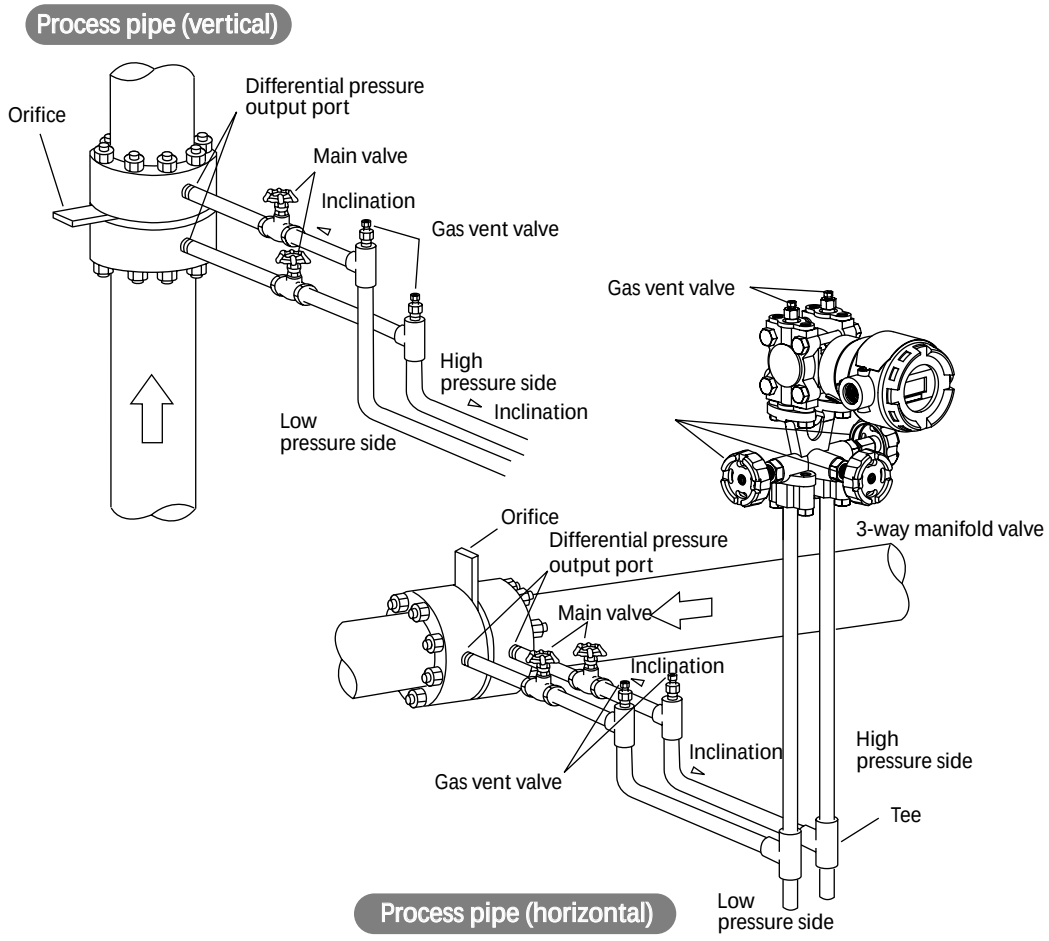


Figure 2-35 Piping for liquid or gas flow rate measurement (Example-2)

This transmitter is located above the differential pressure output port of the process pipe.

2-3-1-3: Piping for steam flow rate measurement

Recommended piping - Example

The illustration shows a typical example of piping. Recommended for a transmitter located below the differential pressure output port of the process pipe.

The following apply:

Grade the pipe at the differential pressure output part.

Inclination symbol in illustration: Low level High level

After piping work, ensure that the connecting pipe, the 3-way manifold valve, and the transmitter have no pressure leak.

If the process pipe is vertically mounted, mount seal ports at different levels to prevent zero drift. But in this case, you cannot apply the previously-used zero adjustment

procedure (using a 3-way manifold valve). For zero shift occurring at different levels, use an SFC.

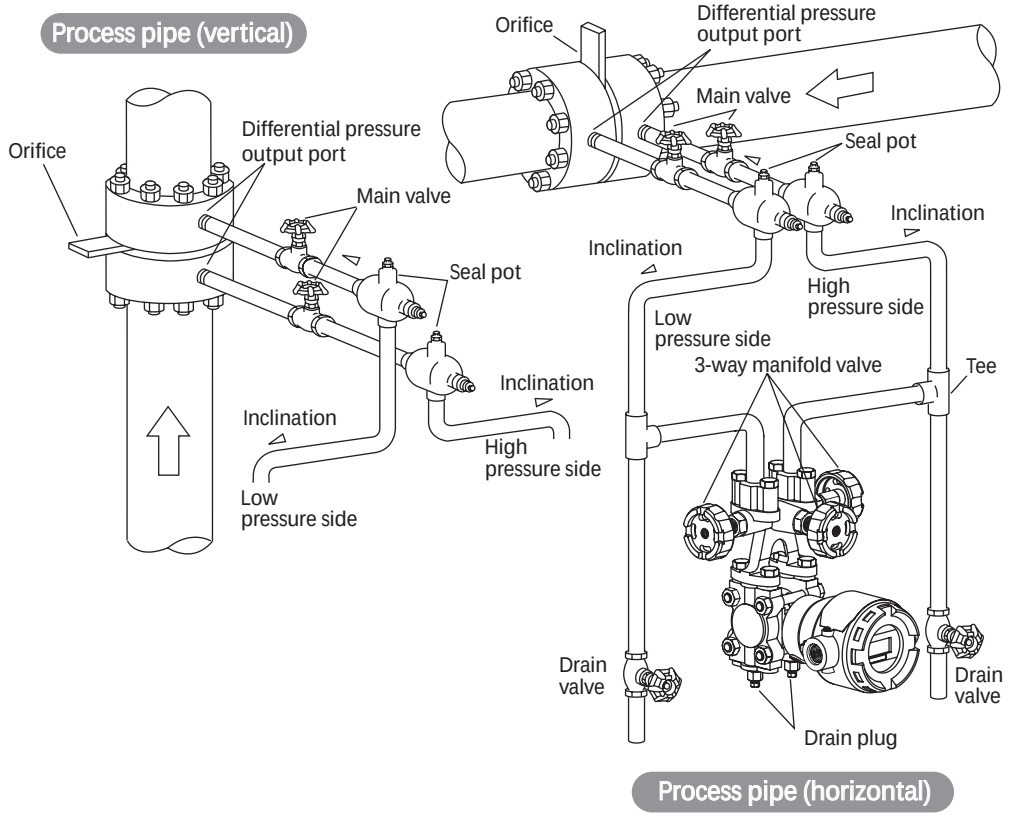


Figure 2-36 Piping for steam flow rate measurement (Example)

This transmitter is located under the differential pressure output port of the process pipe.

2-3-2: Pressure measurement - piping (model JTD/JTG/JTA)

2-3-2-1: Piping

Introduction

Connect the high-pressure side of this transmitter to the process pipe. Open the low-pressure side to the air.

High-pressure mark

H indicating high pressure is marked on the center body of this transmitter.

Check the mark during piping work. The low-pressure side has no mark.

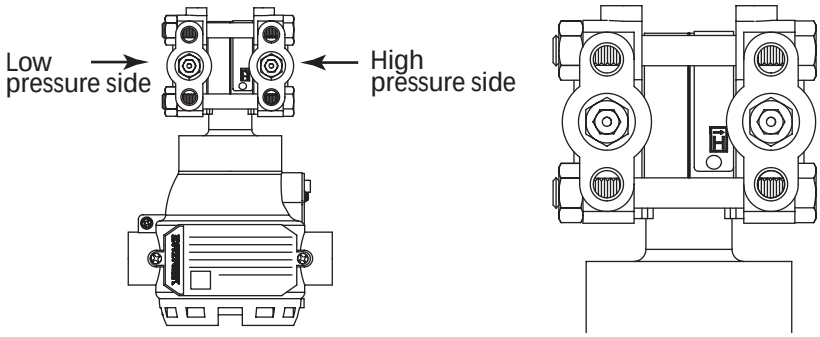


Figure 2-37 High-pressure mark on center body

Before installing the transmitter

Prepare the following parts. Refer to the illustration for piping example.

- Pipe
- Main valve
- Union or flange
- Tee
- Drain valve
- Drain plug
- Gas vent plug

2-3-2-2: Pressure measurement - Piping

Recommended piing - Example

For gas pressure measurement, piping should be performed following the typical example shown here. Always observe these points:

At the differential pressure output, make pipe vertical.

After completing piping work, check for pressure leaks around connecting pipe and transmitter

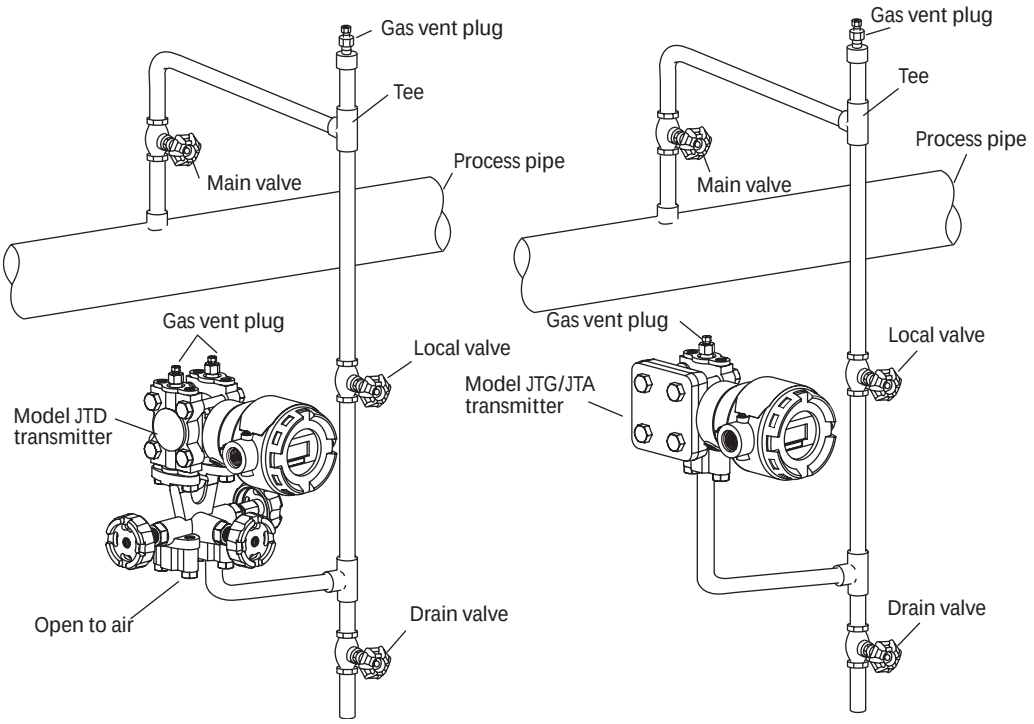


Figure 2-38 Gas pressure measurement - Piping

Piping method

The piping method for the fluid to be measured depends on the meter installation position and the pipe line state. Typical examples of piping are shown in Figure 2-6.

Connect pipes by the following procedure:

(1) Use a T-shaped joint for the connecting pipeline.

(2) Install a main valve between the entrance of the connecting pipe and the T-shaped joint.

(3) If the process is a horizontal line, tilt the pipe to allow draining from the pressure line.

~Note *In case of a high pressure process, select a joint of appropriate specifications and shape and a pipe of appropriate shape and material with care.*

(4) Determine the connecting pipe schedule number and the nominal thickness of the connecting pipe from the process based on conditions such as the process pressure.

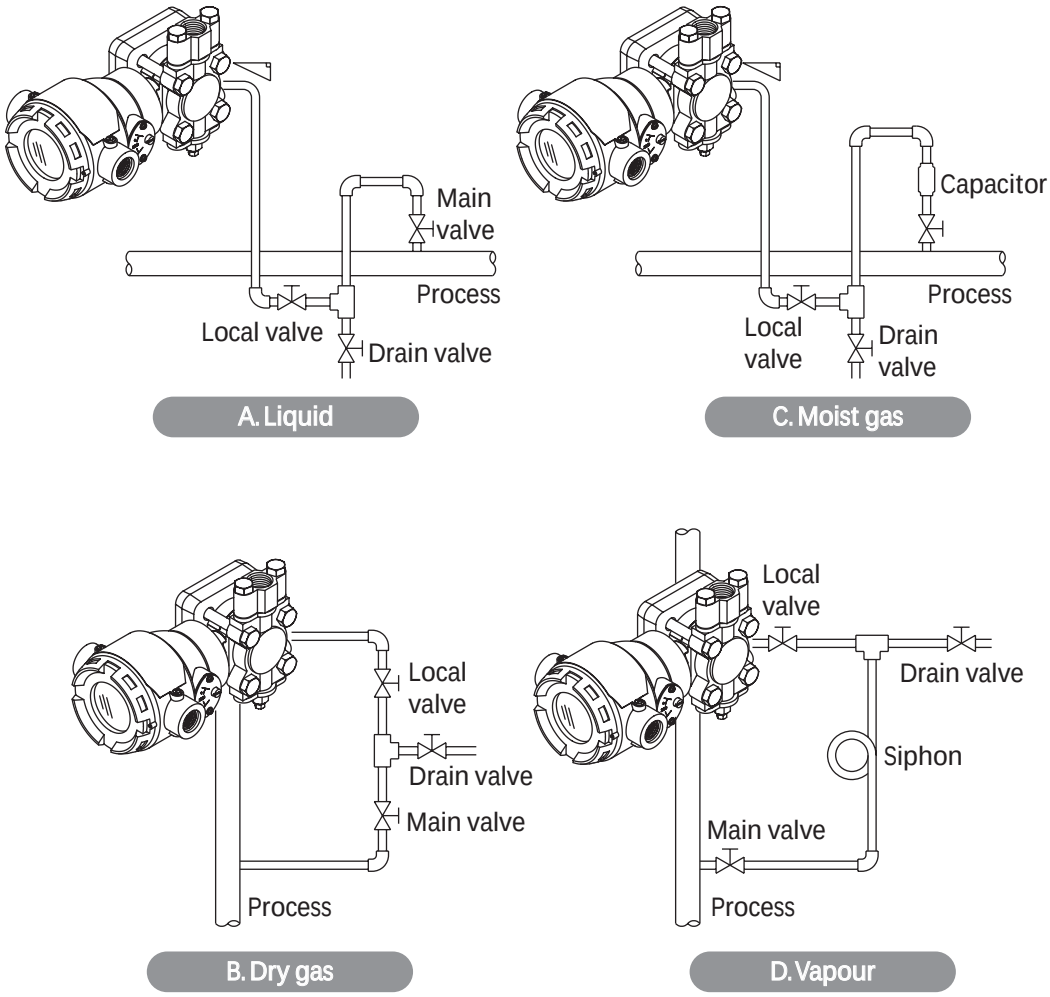


Figure 2-39 Example of piping

Auxiliary equipment

(1) Oil sealing and air purging

If the pressure medium (such as suspension, high viscosity, and corrosive fluid) should not be led directly to the element, avoid it by means of sealing or purging. Various sealing and purging methods are available. Consult with us for each case.

(2) Preventing pulsations

If the process has serious pulsations or great pressure fluctuations, provide a throttle valve in the middle of the connecting pipe to prevent pulsations.

2-3-3: Liquid level measurement - Piping (model JTD/JTG)

2-3-3-1: Piping

Introduction

For measurement by model JTD of liquid level in a tank, piping method depends on whether the tank is open or enclosed. For enclosed tanks, piping is modified according to whether you use the gas sealing method (dry leg) or the liquid sealing method (wet leg).

For measurement by model JTD of liquid level in a tank, piping method usually depends on the tank is open.

High-pressure mark (model JTD)

H indicating high pressure is marked on the center body of this transmitter.

Check the mark during piping work. The low-pressure side has no mark.

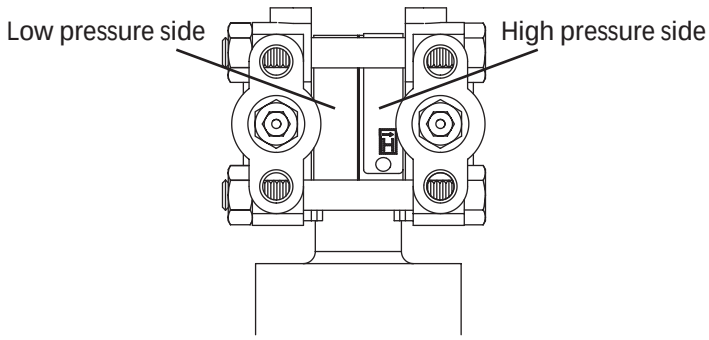


Figure 2-40 High pressure mark on center body

Before starting

The following parts are requirements for piping work. Refer to illustration.

- 3-way manifold valve
- Pipe
- Main valve
- Union or flange
- Tee
- Drain valve
- Drain plug
- Seal pot (for enclosed tank and wet-leg only)

2-3-3-2: Open tank - Piping

Recommended piping - Example

For open tanks, connect the high pressure side of this transmitter to the lower part of the tank. Open the low pressure side to the air.

After completing piping work, check for pressure leaks around the connecting pipe, the transmitter, and the 3-way manifold valve. The illustration shows a typical installation.

Connect the high pressure side of this transmitter to the lower part of the tank.

Install this transmitter below the lowest liquid level to be measured.

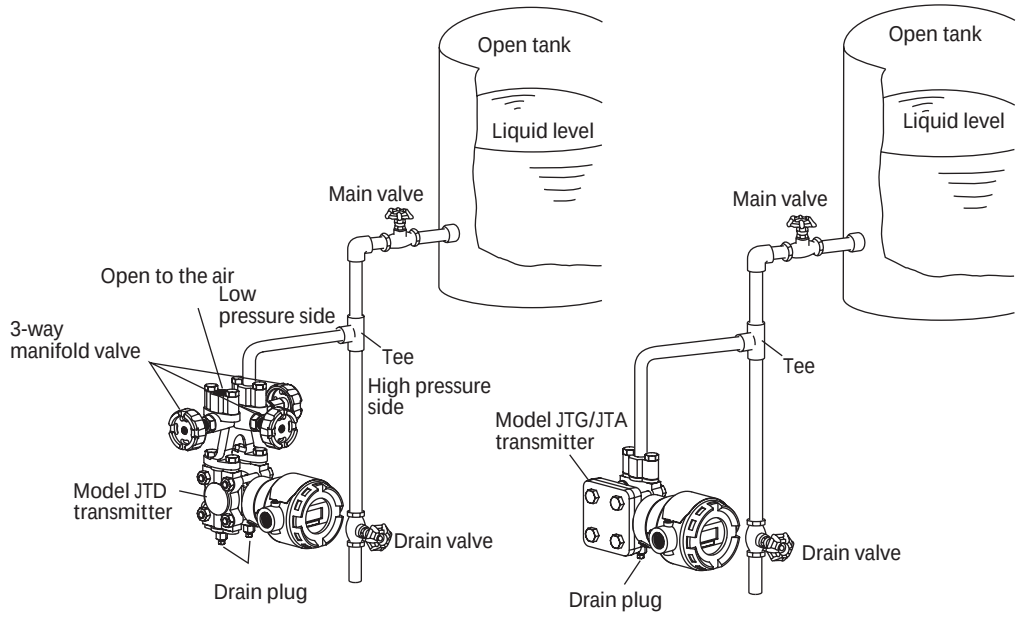


Figure 2-41 Open tank - Piping example

Recommended piping for dry leg - Example

When using the dry-leg method, connect the high pressure side of this transmitter to the lower part of the tank. Connect the low pressure side to the gas-sealing pipe of the tank.

After completing piping work, check for pressure leaks around the connecting pipe, the transmitter, and the 3-way manifold valve. The following shows a typical installation.

Always connect the high pressure side of this transmitter to the lower part of the tank.

Install this transmitter below the lowest liquid level to be measured.

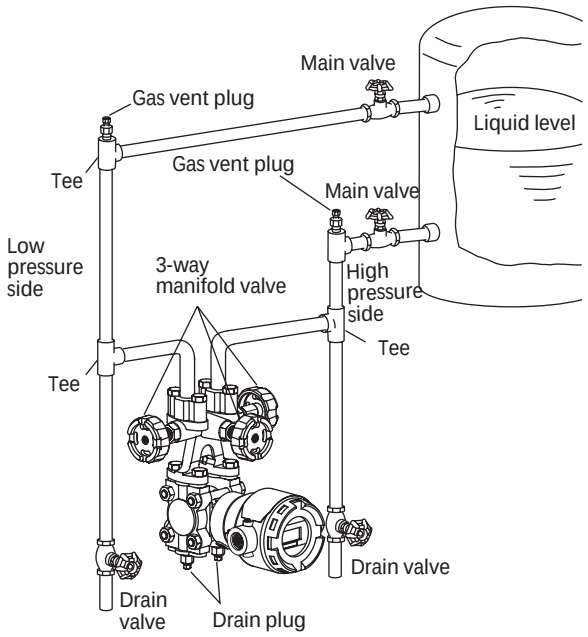


Figure 2-42 Enclosed tank - Piping (dry-leg sealing example)

Recommended piping for wet leg - Example

When using the wet-leg method, connect the high pressure side of this transmitter to the sealing pipe of the tank. Connect the low pressure side to the lower part of the tank.

After completing piping work, check for pressure leaks around the connecting pipe, the transmitter, and the 3-way manifold valve. The illustration shows a typical installation.

Be sure to connect the low pressure side of this transmitter to the lower part of the tank.

Install this transmitter below the lowest liquid level to be measured.

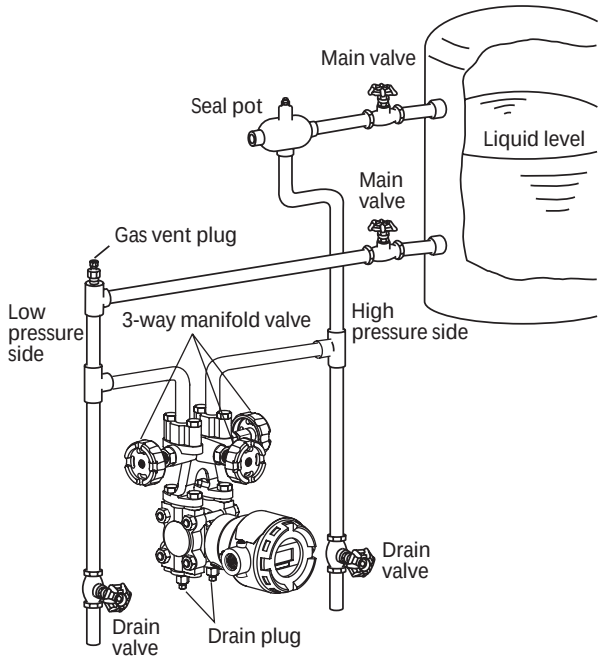


Figure 2-43 Enclosed tank - Piping (wet-leg sealing example

2-4: Electrical wiring

2-4-1: Wiring for transmitter - Regular model

Introduction

Following wiring instructions when no explosionproof standards apply.

As well as the following, during wiring and cabling of an explosionproof transmitter, refer to the instructions for flameproof special explosionproof and intrinsically safe transmitter (provided later).

Wiring

Wire and cable this transmitter as shown in the illustrations.

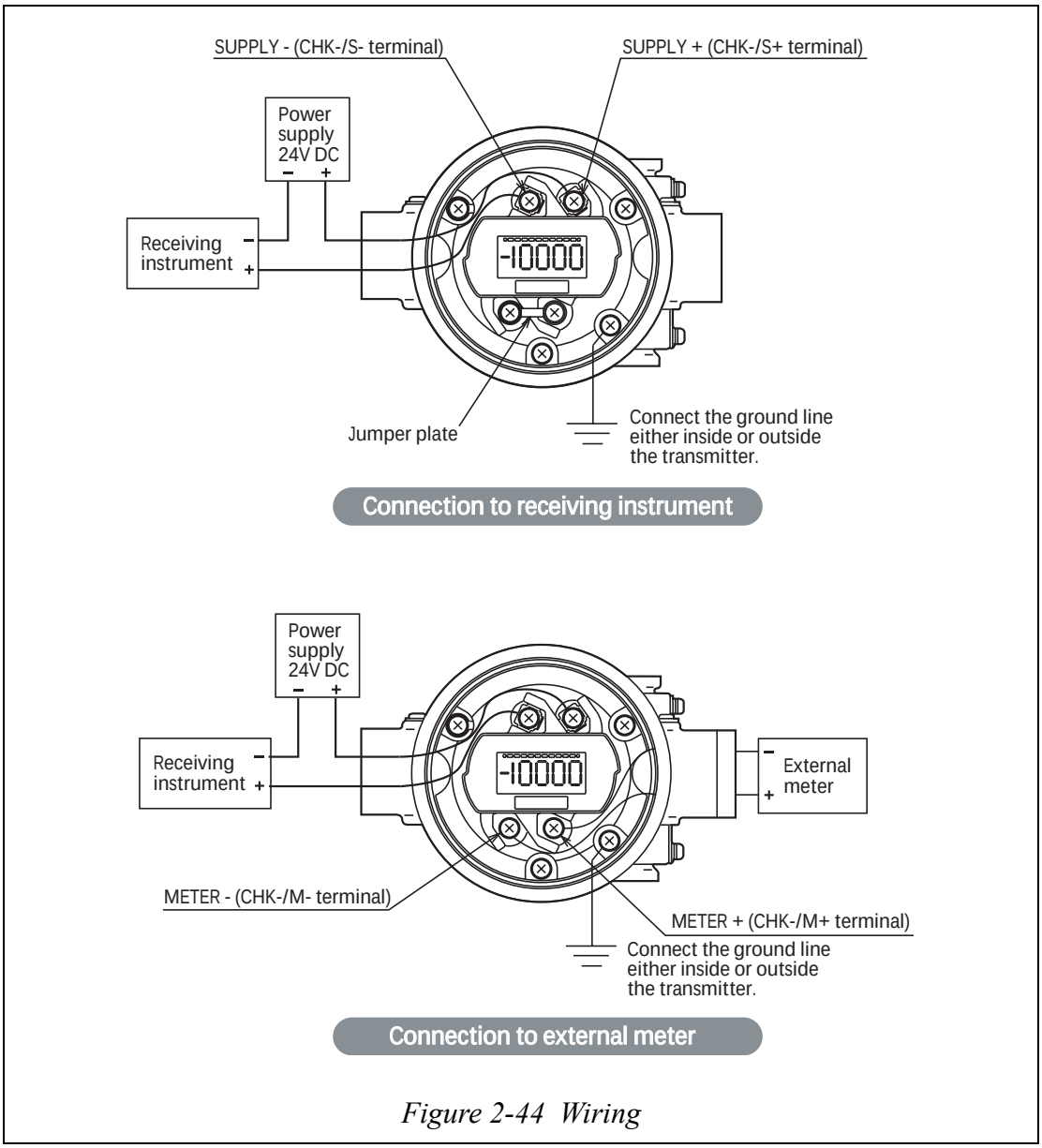


Figure 2-44 Wiring

~Note *1.External load resistance of at least 250 required for communications with an SFC. If total load resistance of the receiving instrument is less than 250, insert the necessary resistance to the loop.*

2.In using Yamatakes field type indicator (model NWS300, NWS35), check that the model number of the transmitter has B7 for a field meter (high load resistance) indicates the optional specification. If not B7, remake this transmitter according to 5-3-4.
For detailed instructions, refer to the meters documentation.

Conduit pipe for cables

Lead cables into the transmitter case, as follows:

Mount a conduit pipe in the conduit hole (G1/2 female thread) provided on the side of a transmitter, and lead cables through the pipe.

Seal the part that contacts with the conduit pipe. Use a sealing agent or a seal plug to positively prevent entry of water.

Install transmitter so that the cables lead into it, from the bottom.

If required, use a special elbow to change cabling direction (G1, G2, or G3 in the appendix).)

Grounding

Two ground terminals are provided. One terminal is on the terminal board, and the other is outside the transmitter. Ground either one.

Connect a ground terminal to a type-D ground (Ground resistance not higher than 100 Ω) or better ground.

Grounding is essential when installing explosionproof transmitters.

Welding in close proximity to transmitter.

Directly ground welding machine and transformer, for its power supply.

Never connect such equipment by the ground terminal to the stanchion pipe that holds a transmitter. Welding current may influence measurements.

Supply power and external load resistance

Confirm the relationship between the external load resistance and the supply voltage. As shown in the illustration, the relationship should be inside the shaded area.
External resistance: The total resistance connected to the output terminals of a transmitter (includes resistances of all cables in the loop plus the internal resistance of the instruments).
Horizontal axis represents supply voltage of a transmitter, and vertical axis represent external load resistance.

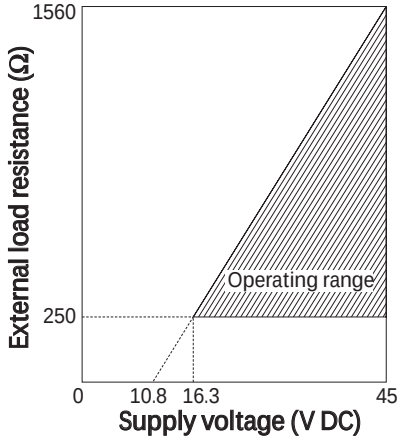


Figure 2-45 Supply voltage and external load resistance - relationship

2-4-2: Wiring for transmitter - flameproof special explosionproof

Guidelines

Flameproof special explosionproof construction requires special precautions and installation methods. Refer also to “2-4-1: Wiring for transmitter - Regular model” on page 2-40.

Detailed information is contained in New Explosionproof Guidelines for Plant Electrical Facilities (Gas Explosionproof 1985) published by Industrial Safety Institute of the Japanese Ministry of Labor.

⚠ WARNING

- Conformance is proven for the pressure resistant packing cable adapter (accessory) for connecting external cables. Conformance testing treats the adapter as an integral part of the transmitter. If any other cable adapter is used, explosionproof performance cannot be guaranteed.
- Tighten the case cover fully, to the end, and lock.
- Clearly delineate safety responsibilities in operating procedures. Especially, for an explosionproof transmitter, specify locking of the cover of the transmitter case.

Locking

Before cabling can be performed. USE a 3 mm hexagonal wrench to open the locking structure.

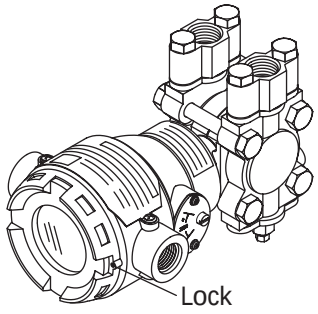


Figure 2-46 Unlock transmitter case

Leading-in external cables

Use a pressure resistant packing cable adapter (accessory) or a conduit pipe fitting, to complete lead-in of cables to a transmitter.

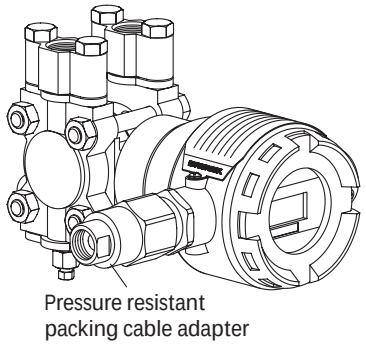


Figure 2-47 Pressure resistant packing cable adapter

2-4-3: Wiring transmitter - Intrinsically safe

Guidelines

Intrinsically safe construction requires special wiring precautions and installation methods. Also refer to “2-4-1: Wiring for transmitter - Regular model” on page 2-40. Detailed information is contained in New Explosionproof Guidelines for Plant Electrical Facilities (Gas/Steam Explosionproof 1979) published by the Japanese Industrial Safety Institute of the Ministry of Labor.

⚠ WARNING

- Protect transmitter from electrical or magnetic influence (such as mixing and induction) from other electrical circuits.
- Install a Zener barrier (8907/51-24/45) at a non-hazardous location and ground independently by type A grounding work.

Wiring

Intrinsically safe installation is achieved according to these instructions.

Inductance of external cables of the intrinsically safe circuit should not exceed 0.31 mH, and capacitance should not exceed 21 nF.

Ordinary equipment connected to the Zener barrier should not exceed 500V AC and 35 A.

Intrinsically safe system - Configuration

System configuration

The system configuration is shown, below. The diagram also shows the layout of an intrinsically safe system consisting of a transmitter, a portable setting display, a field type current indicator, and a Zener barrier. The system components must be designate equipment having conformance that is proved by relevant public organizations.

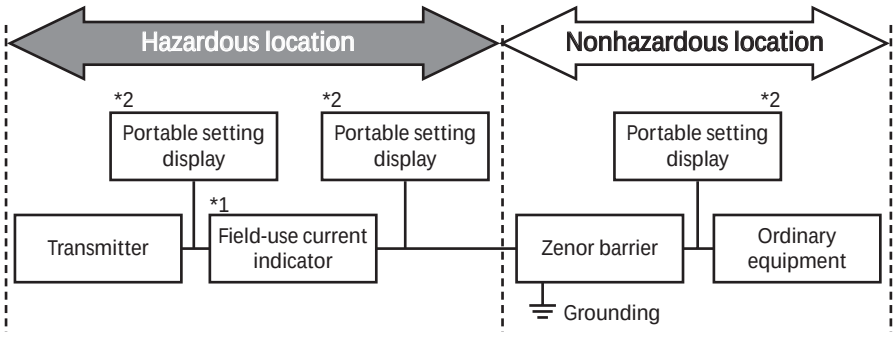


Figure 2-48 System configuration of intrinsically safe transmitter

System configuration
*1. A non-field-use current indicator may also be configured into the system.
*2. Connect non-field-use current indicator to either of the two positions. Some systems have no portable setting display.

2-5: Process connection port - Change port position

2-5-1: Bottom port to top port (model JTD/JTG/JTA/JTC)

Introduction

The process connection port is built on the transmitters (model JTD/JTG/JTA/JTC) center cover. The port position is included among the user specifications, but it may be changed at any time to suit your needs. Instructions for changing the process connection port from top to bottom are here.

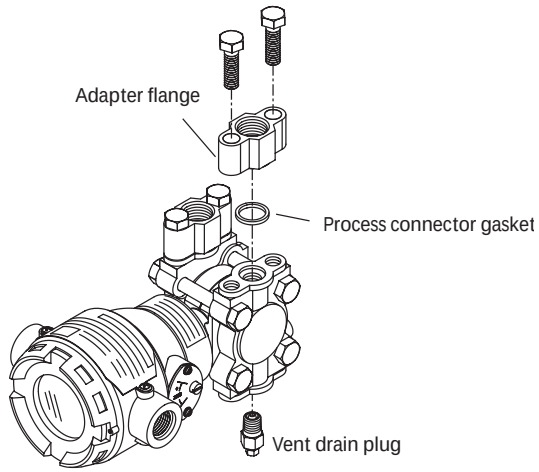


Figure 2-49 Change process connection port position

Procedure

Steps	Procedure
1	Remove four bolts fixing left and right adapter flanges.
2	Remove both (left and right) vent drain plugs.
3	Fix with bolts, both adapter flanges to the top of the transmitter. Tighten bolts to the specified torque. Specified torque:SNB 7, SUS630: 20 ±1 N.m SUS304: 10 ±5 N.m
4	Apply sealing tape around the screws of the vent drain plugs. Spray with lubricant.
5	Screw vent plugs into the bottom part of the transmitter. Tighten plugs to the specified torque. Specified torque: 5 ±0.3 N.m

Use the identical procedure to change the port position from top to bottom.

Chapter 3: Operate and stop the transmitter

Overview

Instructions for connecting an SFC to this transmitter.

Basic instructions for key pad operation.

Procedures for setting a tag number and checking the transmitters specifications.

Preparations and procedures for starting and stopping various measurements with the transmitter.

Instructions for stopping a transmitter for maintenance or replacement.

3-1: Preparation

3-1-1: Connecting SFC

SFC connection

The illustration shows how to connect an SFC to the transmitter.

Remarks: Connect the SFC communication cables to the transmitter terminals, as follows.

Red cable: Supply + terminal

Black cable: Supply - terminal

~Note *External load resistance must be at least 250 for communications with an SFC. If total load resistance of the receiving instrument is below 250 add the difference to the loops resistance.*

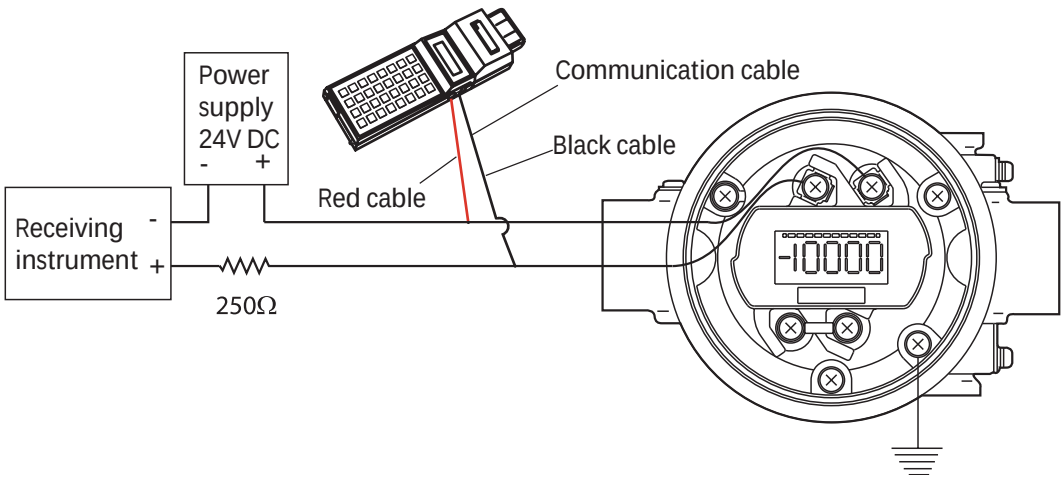


Figure 3-1 Connecting SFC

General key pad operations

Operate SFC keys with these points in mind:

- Press keys firmly and slowly. No response on the screen indicates input failure. In such a case, press the key again, slowly.
- If a key press makes no change on the screen, it may mean that the ky is not supported by the connected transmitter. You should find the correct key using the manual.
- Refer to Chapter 5 to start from the initial state.

3-2: Setting tag no. and checking specifications

3-2-1: Starting communications

Important

⚠ WARNING

- In some cases, communications between this transmitter and the SFC in the automatic mode cause sudden change in the output. Although this change is only temporary, it may result in a hazardous situation. Switch to manual the process control loop before starting communications between the transmitter and the SFC.

Procedure

This procedure starts communications between this transmitter and the SFC.

Step	Key	Description	SFC screen
1		Place in manual mode, the process.	No display
2		Refer to Figure 3-1 and connect the SFC to the transmitter	
3	NON-VOL ENTER (Yes)	Turn ON the SFC power switch. Press the NON-VOL ENTER (Yes) key.	LOOP IN MANUAL? PRESS ID
4	DE READ ID A	Press the DE READ ID A key. The default tag number is XXXXXXXX.	DSTJ TAG NO. LIN DP FIT-

3-2-2: Setting tag no.

Procedure

Start communications with the transmitter. Use this procedure, to set a tag no.:

The tag no. is displayed on the name plate of this transmitter.

The procedure for setting FIT-1234 for the tag no. is included, below.

Step	Key	Description	SFC screen
1	ALPHA URV F 100% DE CONF. MENU I ITEM 6 T	Press the ALPHA, URV F 100%, DE CONF. MENU I ITEM, and 6 T keys in that order.	DSTJ TAG NO. LIN DP FIT-
2	ALPHA TIME +/-	Press the ALPHA and TIME +/- keys in that order.	DSTJ TAG NO. LIN DP FIT-
3	1 V 2 W SW VER 3 X 4 R	Press the 1 V, 2 W, SW VER 3 X and 4 R keys in that order.	DSTJ TAG NO. LIN DP FIT-1234
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Tag No. FIT-1234 is set.	DSTJ TAG NO. WORKING... DSTJ TAG NO. LIN DP FIT-1234

Correct an input

Correct keying errors, using this procedure:

Press the  key to release alphabet mode. Press the  key to shift the cursor back by one column and press the  key again. input correct character.

Correct keying errors using this procedure:

Press the  key to shift the cursor back by one column. Input a correct number.

3-2-3: Checking output format

Procedure

Check the output format (linear / square root) of the transmitter, using this procedure.

To change the output format, refer to Chapter 4.

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM?
2	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	Square root output CONFORM SQUARE ROOT Linear output CONFORM LINEAR
3	CLR (No) (Twice)	Press the CLR (No) key twice.	DSTJ FIT-1234 READY...

3-2-4: Checking display setting

Procedure

Check the display setting (flow rate / linear / display flow rate) of the transmitter, using this procedure.

To change the setting, refer to Chapter 4.

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM?
2	▲ H NEXT	Press the ▲ H NEXT key.	DSTJ FIT-1234 DISPLAY?
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	Square root output DISPLAY CONF FLOW Linear output and linear display. DISPLAY CONF LINEAR Linear output and flow rate display. DISPLAY CONF DISPLAY FLOW
4	CLR (No) (Twice)	Press the CLR (No) key twice	DSTJ FIT-1234 READY...

3-2-5: Checking engineering unit of measured pressure

Procedure

Check the engineering unit of measured pressure, using this procedure.

Here, it is assumed that [kPa] is selected.

To change the engineering unit, refer to Chapter 4.

Step	Key	Description	SFC screen
1		Press the  key.	UNIT FIT-1234 kPa

3-2-6: Checking low and high limits of setting range

Procedure

Check the low and high limits of the setting range, using this procedure.

It is assumed that the following values are set:

- Low limit (LRV): 0.0000 kPa
- High limit (URV):50 kPa

To change the setting, refer to Chapter 4.

Step	Key	Description	SFC screen
1		Press the  key.	LRV FIT-1234 0.0000 kPa
2		Press the  key.	URV FIT-1234 50 kPa

3-2-7: Checking damping time constant

Procedure

Check the damping time constant using the following procedure.

Here, it is assumed that [1.0 second] set for the damping time constant.

To change the damping time constant, refer to Chapter 4.

Step	Key	Description	SFC screen
1		Press the  key.	DAMP FIT-1234 1.0 s

3-2-8: Checking sealed liquid temperature correction function setting

Procedure

Check that the sealed liquid temperature correction function is set by the following procedure.

This function is not set when the height display on the SFC screen is “0 m”.

For the procedure for changing the setting, refer to Chapter 4.

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM
2	▲ H NEXT ▼ L PREV	Press the ▲ H NEXT key three times. Or else, press the ▼ L PREV key four times.	DSTJ CONFIG HEIGHT?
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	HEIGHT 2 m
4	CLR (No) (Twice)	Press the CLR (No) key twice.	DSTJ FIT-1234 READY...

Sealed liquid temperature correction function

When the liquid level of a tank is measured using a remote sealing type differential pressure transmitter, the density of the sealed liquid in the capillary tube changes as the ambient temperature changes. This ordinarily causes about 4-5% zero shifting.

The model JTE has a composite semiconductor sensor with a function for correcting sealed liquid temperature by means of temperature measurement and arithmetic

operation with a microprocessor. This assures accurate level measurements. (The zero shift is reduced to 1/5 from the previous level.)

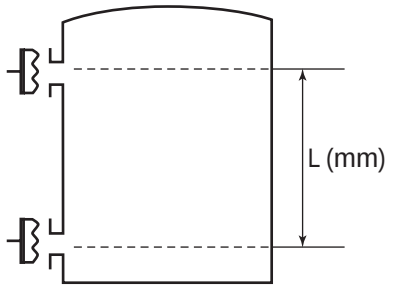


Figure 3-2

Example of zero shift
L (Difference between flanges): 2500 mm (2.5 m)
R (Measurement span): 2500 mm (2.5 m)
A (Temperature coefficient of sealed liquid): 0.001/°C
T (Ambient temperature change): 55°C

Zero shift = $\frac{A \times T \times L}{R} \times 100$ .....(1)

From (1)
Zero shift of a model without temperature correction:

$$\frac{0.001 \times 55 \times 2500}{2500} \times 100 = 5.5\,\%$$

(Conventional transmitter)
Zero shift of a model with temperature correction function ST3000: 1%

3-3: Measurement by model JTD

3-3-1: Flow rate measurement

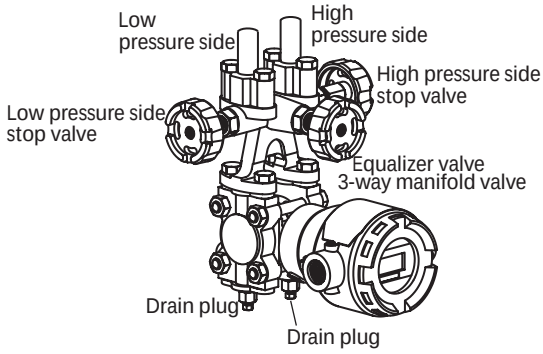
3-3-1-1: Preparation for measurement

⚠ WARNING

- Make sure that the process is in the manual control mode.
  If the automatic control mode obtains, switch to manual control before starting the following procedures.
- Drain poisonous fluids taking care, and making provisions to protect personnel.
- Always close the differential pressure output valve (main valve), the drain valve, the gas vent plug (refer to Figure 2-32 and Figure 2-33.

Procedure 1

Lead process pressure into the pressure receiving part of the transmitter, using this procedure:

Steps	Procedure
1	Gradually open the main valves of both the high pressure side and the low pressure side (Refer to Figure 2-32 and Figure 2-33). Lead process fluid into the connecting pipe.
2	Fill with process fluid, the pressure receiving part of the transmitter. • Gradually open the high pressure side stop valve. Close after the pressure receiving part has completely filled with process fluid. • Gradually open the low pressure side stop valve. Close after the pressure receiving part has completely filled with process fluid. 
3	Decrease to zero, the differential pressure applied to the transmitter. • Gradually open the high pressure side stop valve to lead process pressure into the pressure receiving part of the transmitter. • In this state, equal pressure is applied to the high pressure side and the low pressure side of the transmitter (equal pressure state).
4	Check for pressure leaks in the connecting pipe, the 3-way manifold valve, and the transmitter.

Procedure 2

Perform zero point calibration, using this procedure.

Zero point calibration by SFC operation.

Check that the transmitters input is 0 kPa and its output is 0%.

Step	Key	Description	SFC screen
1	NON-VOL ENTER (Yes)	Turn ON the power switch of the SFC. After making sure that the process is in the manual control mode, press the NON-VOL ENTER (Yes) key.	LOOP IN MANUAL? PRESS ID
2	DE READ ID A	Press the DE READ ID A key.	DSTJ TAG NO. LIN DP FIT-1234
3	SHIFT ^ INPUT OUT- PUT J	Press the SHIFT ^ and INPUT OUT- PUT J keys in that order.	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 0.0000 kPa
4	INPUT OUT- PUT J	Press the INPUT OUT- PUT J key.	OUTPUT FIT-1234 WORKING... OUTPUT FIT-1234 0.00 %

If the screen display is not 0 kPa in <step 3> or 0% in <step 4>, proceed to <step 5> to perform zero point calibration.

Assuming that 0.005 kPa was displayed in <step 3>, perform zero point calibration, using this procedure.

Step	Key	Description	SFC screen
5	SHIFT INPUT OUT- J PUT	Press the SHIFT and INPUT OUT- J PUT keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 0.005 kPa
6	RESET COR- K RECT	Press the RESET COR- K RECT key.	INPUT FIT-1234 ZERO INPUT?
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	INPUT ARE YOU SURE!?
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 INPUT ZEROED
9		Repeat <step 3> and <step 4> and make sure that 0.00 is displayed. Zero point calibration is completed.	

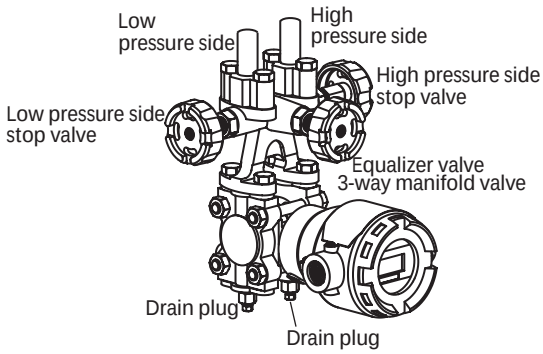
If the SFC displays a screen other than those shown above, refer to the relevant instructions in Chapter 5.

3-3-1-2: Starting measurement

Procedure

Apply the differential pressure of the process by operating valves, using this procedure. Display the measured value using the SFC.

How to apply process pressure.

Steps	Procedure
1	Ensure that the 3-way manifold valve is in the following state: • High pressure side stop valve: Fully open • Low pressure side stop valve: Fully closed • Equalizer valve: Fully open
2	• Close the equalizer valve. • Open the low pressure side stop valve gradually. 

How to display measured value

The following conditions are assumed:

Low limit of setting range: 0 kPa

High limit of setting range: 50 kPa

Input differential pressure of transmitter: 25 kPa

In this case, the output is 50%. (Linear output)

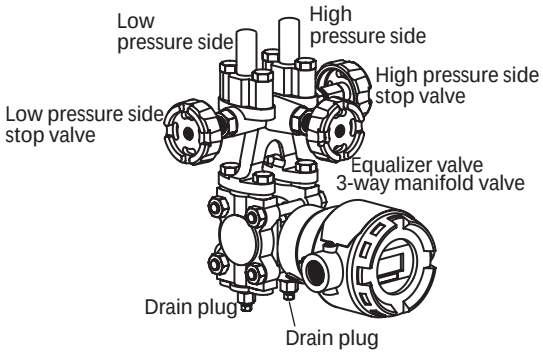
Step	Key	Description	SFC screen
3	SHIFT INPUT OUT- PUT J	Press the SHIFT and INPUT OUT- PUT J keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
4	INPUT OUT- PUT J	Press the INPUT OUT- PUT J key.	INPUT FIT-1234 50.00 %
5		At the completion of measurement, remove the clip from the communication cable. Switch the process to normal operation. **⚠ CAUTION** Securely close the cover of the transmitter case. Imperfect closure allows entry of water, and may damage internal terminals as well as the electronic module. Such damage may require parts replacement, possibly of the entire module.	

- If input and output values do not match, check the range and recalibrate. If after recalibration, they remain inconsistent, troubleshoot the transmitter as described in Chapter 5.
- If the displayed data value is unstable, adjust the damping time constant. Refer to Chapter 4.

3-3-1-3: Stopping measurement

Procedure

Stop the transmitter, using this procedure:

Steps	Procedure
1	Turn off the transmitter
2	Operate the 3-way manifold valve by the following procedure: Close the low pressure side stop valve. Open the equalizer valve. Close the high pressure side stop valve. 
3	Close the main valves on the high and low pressure sides. Refer to Figure 2-34 and Figure 2-35.

⚠ CAUTION

- If you plant to leave the transmitter OFF for a long period of time, always drain process fluid from the connecting pipe and the pressure receiving part.
- Leave the equalizer valve open.

3-3-2: Gas pressure measurement

3-3-2-1: Preparation for measurement

⚠ WARNING

- Ensure that the process is in the manual control mode.
  If the process is in automatic control mode, switch to manual before starting the procedure.
- Drain poisonous fluids taking care, and making provisions to protect personnel.
- Close the differential pressure output valve (main valve), the local valve, the drain valve, the gas vent plug. Refer to Figure 2-38.

How to measure gas pressure

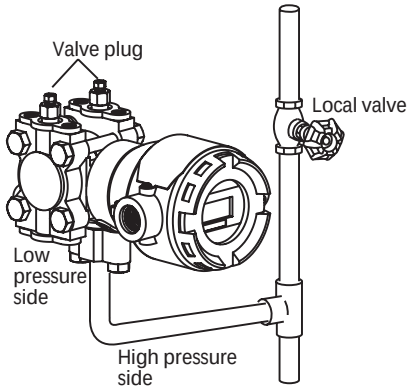
Perform zero point adjustment and introduce process pressure into the transmitter, using this procedure.

- Zero point adjustment

Steps	Procedure
1	Open both the high pressure side and lo pressure side vent plugs and open the pressure receiving part to the air.
2	Refer to “Procedure 2” on page 3-13 (3-3-1-1: Preparation for measurement). Perform zero point calibration.
3	After completing zero point calibration, close the high pressure side vent plug.

Introducing process pressure and venting air

Steps	Procedure
1	• Open the main valve (refer to Figure 2-38) to introduce process pressure into the connecting pipe. • Open the local valve gradually, to introduce process pressure into the pressure receiving part of the transmitter.

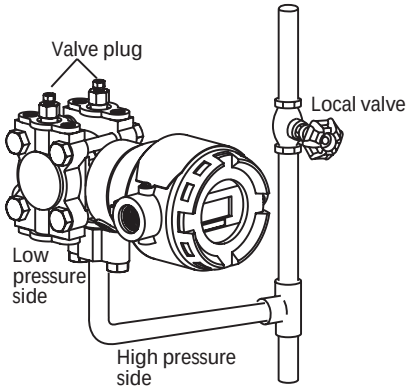
Steps	Procedure
2	• Open the high pressure side vent plug gradually, to vent air from the center body. • After venting air, close the vent plug and the local valve. 
3	Check for pressure leaks in the connecting pipe and the transmitter.

3-3-2-2: Starting measurement

Procedure

Operate the valves using this procedure, to apply process pressure to the transmitter and display the measured value by operating the SFC.

How to apply process pressure

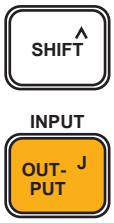
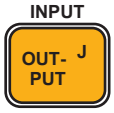
Steps	Procedure
1	Open the local valve gradually. 

How to display measured value

These conditions are assumed here:

- Low limit of setting range:0 kPa
- High limit of setting range:50 kPa
- Input differential pressure of transmitter: 25 kPa

In this case, the output is 50%

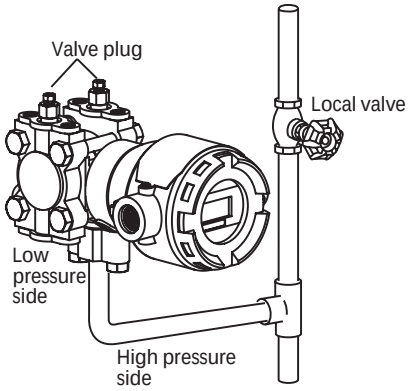
Step	Key	Description	SFC screen
2		Press the SHIFT and INPUT OUT- PUT J keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
3		Press the INPUT OUT- PUT J key.	INPUT FIT-1234 50.00 %
4		At the end of measurement, remove the clip of the communication cable and switch the process to ordinary operation. **⚠ CAUTION** Close securely the cover of the transmitter case. Failure to do so will result in entry of water, and cause damage to internal terminals and the electronics module.	

- If input and output values fail to match, check the range and recalibrate. If after recalibration, they remain in consistent, troubleshoot the transmitter as described in Chapter 5.
- If the displayed data value is unstable, adjust the damping time constant by referring to Chapter 4.

3-3-2-3: Stopping measurement

Procedure

How to stop the transmitter

Steps	Procedure
1	Turn off the transmitter.
2	Close the local valve 
3	Close the main valve. (Refer to Figure 2-38.)

⚠ CAUTION

- If you plant to leave the transmitter OFF for a long period of time, completely drain process fluid from the connecting pipe, and from the pressure receiving part.

3-3-3: Liquid level measurement of open tank and closed tank (dry leg)

3-3-3-1: Preparation for measurement

⚠ WARNING

- Place the process in the manual control mode.
  If the process is in the automatic control mode, switch to manual before performing work.
- Drain poisonous fluids carefully, taking provisions to protect workers.
- Check that the differential pressure output valve (main valve), the drain valve, the gas vent plug (refer to Figure 2-41 and Figure 2-42).

Calculating setting range

Calculate the setting range. Refer to "3-11: Set range calculation for liquid level measurement" on page 3-56.

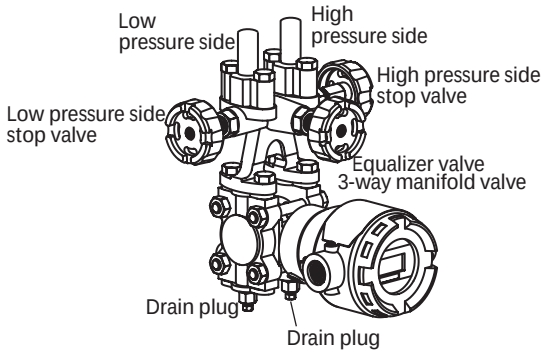
Procedure

Perform zero point adjustment and introduce process pressure into the transmitter by this procedure:

Zero point calibration

Steps	Procedure
1	Open the drain plugs and the stop valves of both the high pressure side and the low pressure side. Open the pressure receiving part to the air. If fluid remains in the pressure receiving part, blow it to drain.
2	Refer to "Procedure 2" on page 3-13 (3-3-1-1: Preparation for measurement), and perform zero point calibration.
3	After completing zero point calibration, close the high pressure side drain plug and the high pressure side stop valve.

Introducing process pressure

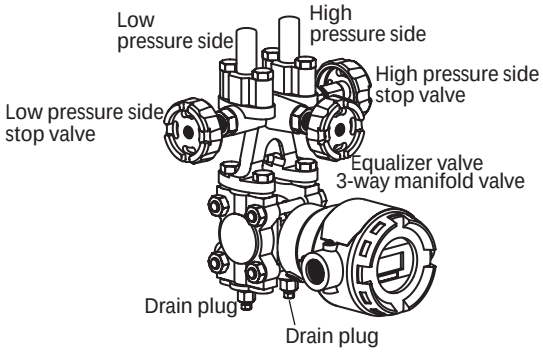
Steps	Procedure
1	• Open the main valve (refer to Figure 2-41) to introduce process pressure into the connecting pipe. • Open the high pressure side stop valve gradually to introduce process pressure. After introducing process pressure into the pressure receiving part of the transmitter, close the high pressure side stop valve. 
2	Check for pressure leaks in the connecting pipe, the 3-way manifold valve, and the transmitter.

3-3-3-2: Starting measurement

Procedure

Operate the valves with this procedure, to apply the differential pressure of the process to the transmitter. Display the measured value using operating the SFC.

How to apply process pressure

Steps	Procedure
1	Check that the 3-way manifold valve is in the following state: • High pressure side stop valve: Fully closed • Low pressure side stop valve: Fully open • Equalizer valve: Fully closed 
2	Open the high pressure side stop valve gradually.

Zero point adjustment during measurement

Refer to “3-8: Zero-point adjustment --- Based on actual liquid level” on page 3-50 to adjust the zero point during measurement.

How to display measured value

These conditions are assumed here:

• Low limit of setting range:0 kPa

  High limit of setting range:50 kPa

• Input differential pressure of transmitter: 25 kPa

In this case, the output is 50%. (Linear output)

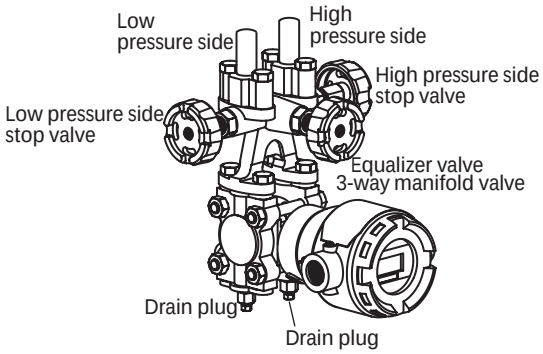
Step	Key	Description	SFC screen
3	SHIFT INPUT OUT- J PUT	Press the SHIFT and INPUT OUT- J PUT keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
4	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key.	INPUT FIT-1234 50.00 %
5		At the end of measurement, remove the clip of the communication cable and switch the process to regular operation mode. **⚠ CAUTION** Close securely the cover of the transmitter case. Failure to do so will enable entry of water, and cause damage to internal terminals and the electronics module.	

- If the input and output values do not match, check the range and recalibrate. If they remain inconsistent, troubleshoot the transmitter as described in Chapter 5.
- If the displayed data value is unstable, adjust the damping time constant. Refer to Chapter 4.

3-3-3-3: Stopping measurement

Procedure

How to stop the transmitter.

Steps	Procedure
1	Turn off the transmitter.
2	Operate the 3-way manifold valve using this procedure: Close the low pressure side stop valve. Open the equalizer valve. Close the high pressure side stop valve 
3	Close the main valve. Refer to Figure 2-42

⚠ CAUTION

- If you plan to leave the transmitter OFF for a long period, drain process fluid from the connecting pipe and the pressure receiving part.
- Leave the equalizer valve open.

3-3-4: Liquid level measurement of closed tank (wet leg)

3-3-4-1: Preparation for measurement

Important!

⚠ WARNING

- Place the process in the manual control mode.
  If the process is in the automatic control mode, change it to the manual control mode before performing this work.
- Drain poisonous fluids with enough care, making provisions for protecting workers.
- Make sure that the differential pressure output valve (main valve), the drain valve, the gas vent plug (refer to Figure 2-41) and the high pressure side and low pressure side stop valves of the 3-way manifold valve are closed. Also, make sure that the equalizer valve of the 3-way manifold valve is open.

Calculating setting range

For the procedure for obtaining the setting range by calculation, refer to “3-11: Set range calculation for liquid level measurement” on page 3-56.

Procedure

Perform zero point adjustment and introduce process pressure into the transmitter using this procedure:

Zero point calibration

Steps	Procedure
1	Feed sealing liquid from the seal pot to fill the connecting pipe with sealing liquid.
2	Gradually open the stop valves of both the high pressure side and the low pressure side, and the drain plugs, to fill the pressure receiving part of the transmitter with sealing liquid.
3	When sealing liquid flows out from the drain plugs, close the stop valves of both the high pressure side and the low pressure side and the drain plugs. In this state, the same pressure is applied to the high pressure side and the low pressure side of the transmitter (equal pressure state).
4	Referring to “Procedure 2” on page 3-13 (3-3-1-1: Preparation for measurement), perform zero point calibration.
5	After completing zero point calibration, close the equalizer valve. Open the stop valve and the drain plug of the low pressure side to drain sealing liquid. Close the stop valve and the drain plug of the low pressure side.

Introducing process pressure

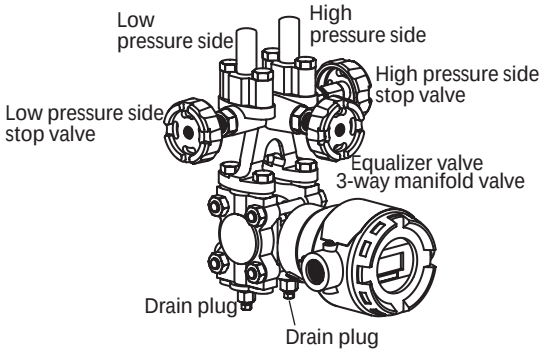
Steps	Procedure
1	Open the main valve (refer to Figure 2-43) to introduce process fluid into the connecting pipe.
2	Gradually open the low pressure side stop valve to introduce process fluid. After introducing process fluid into the pressure receiving part of the transmitter, close the low pressure side stop valve.
3	Make sure that the connecting pipe, the 3-way manifold valve, and the transmitter have no pressure leak.

3-3-4-2: Starting measurement

Procedure

Operate the valves by the following procedure to apply the differential pressure of the process to the transmitter and display the measured value by operating the SFC.

How to apply process pressure

Steps	Procedure
1	Make sure that the 3-way manifold valve is in this state: • High pressure side stop valve: Fully closed • Low pressure side stop valve: Fully closed • Equalizer valve: Fully closed
2	Fill the liquid sealing pipe with sealing liquid.
3	• Gradually open the high pressure side stop valve. • Gradually open the low pressure side stop valve. 

Zero point adjustment during measurement

Refer to “3-8: Zero-point adjustment --- Based on actual liquid level” to adjust the zero point during measurement.

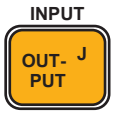
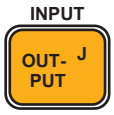
How to display measured value

The following conditions are assumed here:

- Low limit of setting range: 50 kPa

  High limit of setting range: 0 kPa
- Input differential pressure of transmitter: 25 kPa

In this case, the output is 50%

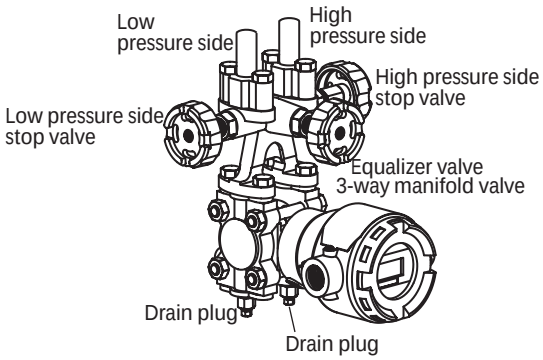
Step	Key	Description	SFC screen
4	 	Press the  and  keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
5		Press the  key.	INPUT FIT-1234 50.00 %
6		After completing measurement, remove the clip from the communication cable and switch the process to regular operation. **⚠ CAUTION** Close the cover of the transmitter case securely. Imperfect closing allows entry of water such as rain, damaging internal terminals and the electronics module.	

- If the input and output values are inconsistent, check the range and perform calibration again. If they are still inconsistent, use the troubleshooting procedure explained in Chapter 5.
- If the displayed data value is unstable, adjust the damping time constant by referring to Chapter 4.

3-3-4-3: Stopping measurement

Procedure

How to stop the transmitter

Steps	Procedure
1	Turn off the transmitter.
2	Operate the 3-way manifold valve by the following procedure. Close the low pressure side stop valve. Open the equalizer vale. Close the high pressure side stop valve. 
3	Close the main valve. (Refer to Figure 2-43.)

⚠ CAUTION

- To leave the transmitter off for a long period, drain process fluid from the connecting pipe and the pressure receiving part.
- Leave the equalizer valve open.

3-4: Measurement with model JTG/JTA

3-4-1: Pressure measurement

3-4-1-1: Before stating

⚠ WARNING

- Make sure that the process is in the manual control mode. If the process is in the automatic control mode, make sure that it has been changed to the manual mode.
- For hazardous fluids (poisons etc.) take any necessary actions to prevent physical hazard and ensure that work proceeds with adequate care.
- Before starting a measurement procedure, ensure closure of the pressure valve (main valve), the local valve, the drain valve, and the gas vent plug. (Refer to Figure 2-38)

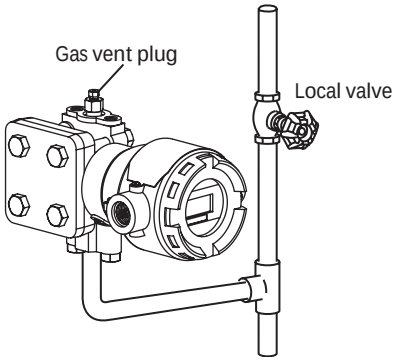
Gas pressure measurement

Perform zero-point calibration and introduce process pressure, with this procedure:

• Zero point calibration(Only for Model, JTG. In case of Model JTA, don't perform this procedure)

Steps	Procedure
1	Open the vent plug to release the pressure receiving part to the open air.
2	Referring to "2-2-4: Transmitter main unit installation position", perform zero-point calibration.
3	When calibration is complete, close the vent plug.

• Introducing process pressure and venting air

Steps	Procedure
1	• Introduce the process pressure into the connecting pipe by opening the main valve (Refer to Figure 2-38). If the process temperature is high, allow cooling time so that the connecting pipe is stable at a safe temperature, before starting work. • Open the local valve gradually to introduce the process pressure into the pressure receiving part of transmitter.
2	• Vent air from the center body by gradually opening the vent plug. • After venting air completely, close the plug and the local valve. 

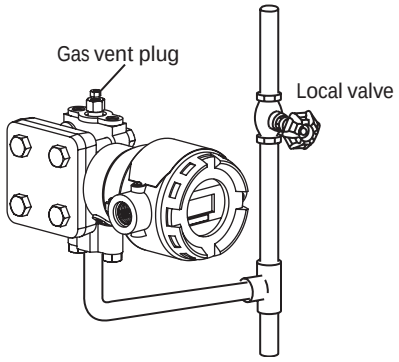
Steps	Procedure
3	Ensure zero leakage exists at the connecting pipe and transmitter.

3-4-1-2: Starting operation

Procedure

Operate the valve with the following procedure and apply the process pressure to transmitter. Display the measured value by operating the SFC keys.

Process pressure applying operation

Steps	Procedure
1	Open gradually the local valve. 

Measured value displaying operation

The following case is explained here:

- Low limit of setting range: 0 kPa
  High limit: 50 kPa
- Input pressure to the transmitter: 25 kPa

In this case, the output is 50%

Step	Key	Description	SFC screen
2	SHIFT ^ INPUT OUT- J PUT	Press the SHIFT ^ and INPUT OUT- J PUT keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa

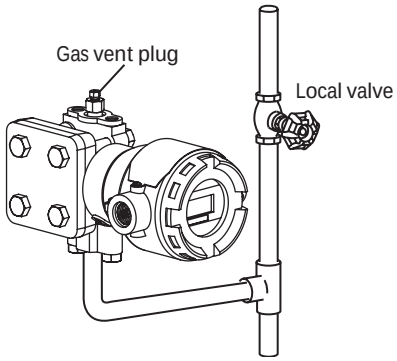
Step	Key	Description	SFC screen
3	INPUT / OUT- J PUT	Press the INPUT / OUT- J PUT key.	INPUT FIT-1234 50.00 %
4		After completing measurement, remove the clip of the communication cable and then switch the process to normal operation. **⚠ CAUTION** Close securely the case cover of the transmitter. Take precautions against moisture ingress into the transmitter body. Rainwater entering the transmitter will damage the internal terminals and the electronics module.	

- If the output value does not correctly reflect the input value, check again the range and calibrate the transmitter. If inappropriate output value persists for the input value, apply troubleshooting procedures (Chapter 5).
- If the displayed data value is unstable, adjust the damping time constant (Chapter 4).

3-4-1-3: Stopping operation

Procedure

Stop the operation of the transmitter by this procedure:

Steps	Procedure
1	Turn OFF the transmitter.
2	Close the local valve. 
3	Close the main valve. (Refer to Figure 2-38).

⚠ CAUTION
• When a long term shutdown is planned, completely drain all process fluid from the connecting pipe and from the pressure receiving part of transmitter.

3-4-2: Liquid level measurement

3-4-2-1: Before you start

⚠ WARNING
• Make sure that the process is in the manual control mode. If the process is in the automatic control mode, make sure that it has been changed to the manual mode. • For hazardous fluids (poisons etc.) take any necessary actions to prevent physical hazard and ensure that work proceeds with adequate care. • Ensure closure of the main valve, the drain valve, and the gas bent plug on the pipe (Refer to Figure 2-41)

Setting range calculation

In determining the setting range by calculation, refer to “3-11: Set range calculation for liquid level measurement” on page 3-56.

Liquid level measurement

Perform zero point calibration and introduce process pressure, by this procedure:

• Zero point calibration

Steps	Procedure
1	Open the drain plug to release the pressure receiving part to the open air. If fluid remains in the pressure receiving part, blow out fluid.
2	Referring to “2-2-4: Transmitter main unit installation position” on page 2-10, perform zero point calibration.
3	When calibration is complete, close the vent plug.

• Introducing process pressure and venting air

Steps	Procedure
1	• Open gradually the main valve (Refer to Figure 2-41) to introduce the process pressure into the connecting pipe. • After introducing the process pressure into the pressure receiving part of the transmitter, close the main valve.
2	Ensure zero leakage exists at the connecting pipe and transmitter

3-4-2-2: Starting operation

Procedure

Operate the valve with the following procedure and apply the process pressure to transmitter. DIsplay the measured value by operating the SFC keys.

• Process pressure applying operation

Steps	Procedure
1	Open gradually the main valve (Refer to Figure 2-41).

Zero point adjustment during measurement

When adjusting the zero point during measurement, refer to "3-8: Zero-point adjustment --- Based on actual liquid level" on page 3-50.

Measured value displaying operation

The following case is explained here:

• Low limit of setting range: 0 kPa
  High limit: 50 kPa

• Input pressure to the transmitter: 25 kPa

In this case, the output is 50%

Step	Key	Description	SFC screen
2	SHIFT ^ INPUT OUT- J PUT	Press the SHIFT ^ and INPUT OUT- J PUT keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
3	INPUT OUT- J PUT	Press the INPUT OUT- J PUT key.	INPUT FIT-1234 50.00 %
4		After completing measurement, remove the clip of the communication cable and then switch the process to normal operation. **⚠ CAUTION** Close securely the case cover of the transmitter. Take precautions against moisture ingress into the transmitter body. Rainwater entering the transmitter will damage the internal terminals and the electronics module.	

- If the output value does not correctly reflect the input value, check again the range and calibrate the transmitter. If inappropriate output value persists for the input value, apply trouble shooting procedure (Chapter 5).
- If the displayed data value is unstable, adjust the damping time constant (Chapter 4).

3-4-2-3: Shopping operation

Procedure

Stop the operation of the transmitter by this procedure:

Steps	Procedure
1	Turn OFF the transmitter
2	Close the main valve. (Refer to Figure 2-41)

⚠ CAUTION

- When a long term shutdown is planned, completely drain all process fluid from the connecting pipe and from the pressure receiving part of transmitter

3-5: Measurement with model JTC

3-5-1: Pressure measurement

3-5-1-1: Before you start

Checking minimum liquid level position (zero position) and zero point at equal pressure input

Set the zero point of the measured liquid level at the center of the seal diaphragm on the process connection flange surface of the transmitter. (Refer to Figure 3-3.) Measurement range H is from the flange center of the transmitter to the height of the specification range. Lower the liquid level in the measured tank to be below the lower end of the diaphragm on the process flange surface.

Always check the zero point after equalizing the pressure on the high and low pressure side diaphragms. For full checking procedure, refer to "2-2-4: Transmitter main unit installation position" on page 2-10.

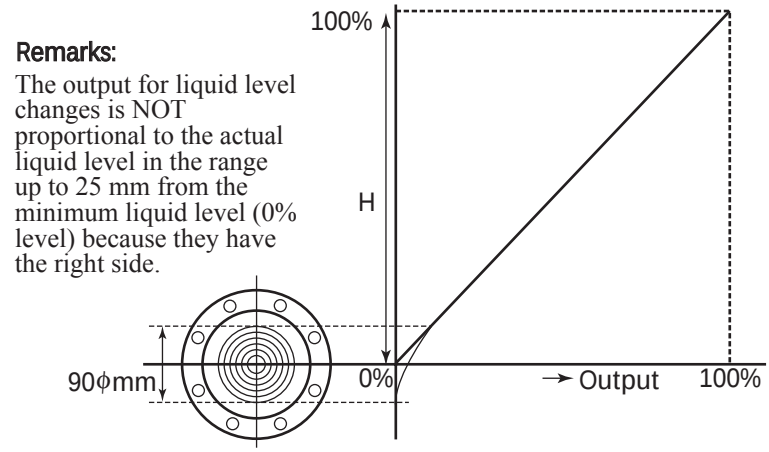


Figure 3-3 Minimum liquid level characteristic

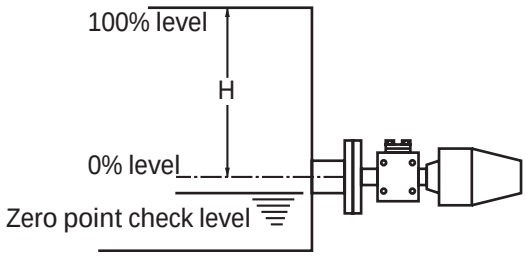


Figure 3-4 Determining the zero position

Zero adjustment

The zero point of the transmitter can be adjusted either by communicating with the SFC or using the external zero adjustment function (option).

Procedure

Steps	Procedure
1	When the liquid level in the tank can be lowered to the low limit value (0%) of the measurement range: • Procedure the SFC Refer to the procedure of 3-8: Zero-point adjustment --- Based on actual liquid level and the procedure of "3-9: Zero-span adjustment with input pressure equivalent to range". • Procedure using the external zero adjustment function (option) Refer to "3-10: External zero adjustment (option)".
2	When the liquid level in the tank cannot be lowered to the low limit value (0%) of the measurement range: • Procedure using the SFC Refer to the procedure of "3-8: Zero-point adjustment --- Based on actual liquid level". • Procedure using the external zero-adjustment function (option). Refer to "3-10: External zero adjustment (option)".

3-5-1-2: Starting operation

The transmitter is ready for operation when zero-point adjustment is completed. This procedure is described in the previous item. Before you start, always check these items:

(1) Check the correspondence between input and output values.
- If the output does not correctly reflect the input, check the range, check the flange position on the process, and calibrate the transmitter again. If an inappropriate output value persists for the input value, apply troubleshooting procedure (Chapter 5).

(2) Check the displayed data.
- If unstable value is displayed, adjust the damping time constant.

(3) Perform the following items carefully:
- Disconnect the SFC from the transmitter terminal. Ensure that the terminal is sufficiently tight, and not loose.
- Close the case cover. Screw in the cover firmly until it can no longer be turned.
- This transmitter has a locking structure. After closing the cover, tighten the lock using a hexagon wrench.

3-5-1-3: Stopping operation

Procedure

Turn off the transmitter

⚠ CAUTION
• When a long-term shutdown is planned, completely drain all process fluid from the connecting pipe and from the pressure receiving part of transmitter.

3-6: Measurement with model JTE

When starting operation, adjust the transmitter in its actual process state. The specific gravity of the sealed-in liquid is stated in the specifications in AppendiX A. Specific gravity changes with temperature at the rate of 0.0008/°C.

Use the temperature of the capillary tube for items related to specific gravity.

3-6-1: Pressure measurement

3-6-1-1: Before you start

Checking minimum liquid level position (zero position) and zero point at equal pressure input

Set the zero point of the measured liquid level at the center of the seal diaphragm on the process connection flange surface of the transmitter. (refer to Figure 3-5.) Measurement range H is from the flange center of the transmitter to the height of the specification range. Lower the liquid level in the measured tank to be below the lower end of the diaphragm on the process flange surface.

It is assumed that the low-pressure side diaphragm is mounted at a height identical to that of the high-pressure side diaphragm. Never allow any liquid to exert a head pressure on these elements, and always equalize the pressure on the lower- and high-side diaphragm when checking the zero point. For the checking procedure, refer to “2-2-4: Transmitter main unit installation position” on page 2-10.

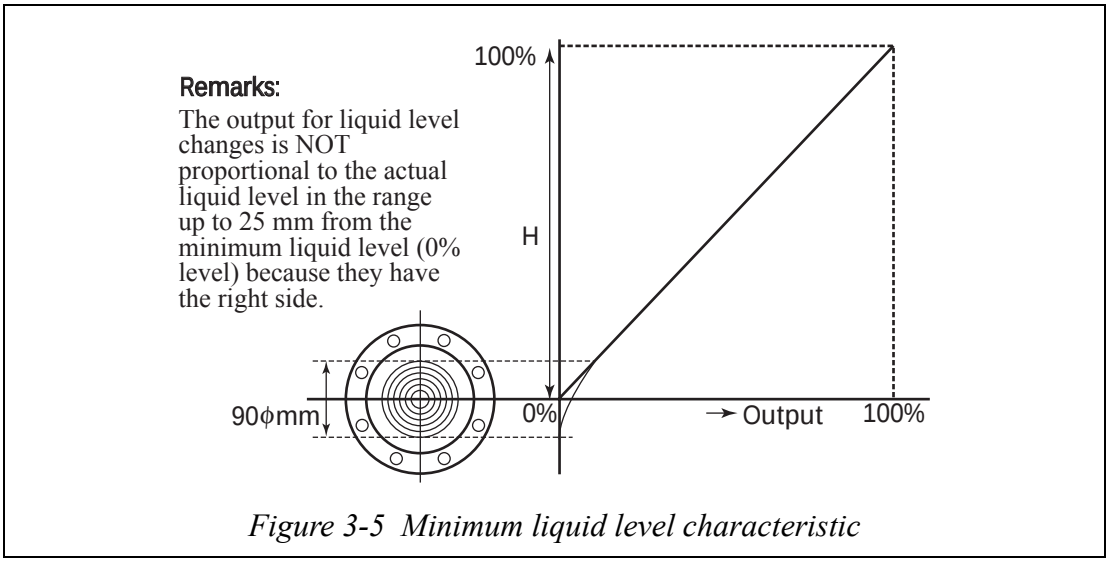


Figure 3-5 Minimum liquid level characteristic

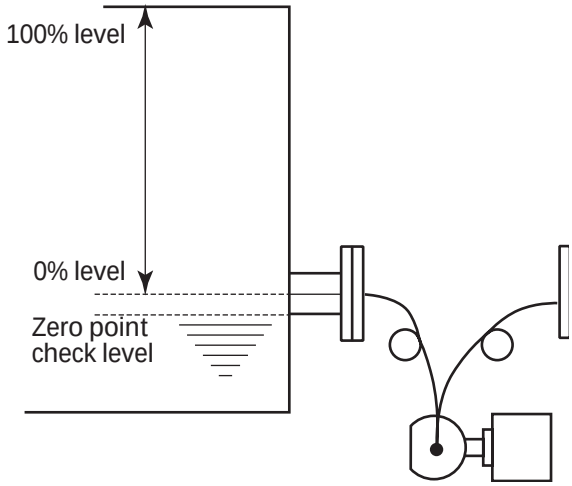


Figure 3-6 Determining the zero position

Zero adjustment

The zero point of the transmitter can be adjusted either by communicating with the SFC or using the external zero adjustment function (option).

Procedure

Steps	Procedure
1	When the liquid level in the tank can be lowered to the low limit value (0%) of the measurement range: • Procedure the SFC Refer to the procedure of zero adjustment based on the actual liquid level in "3-8: Zero-point adjustment --- Based on actual liquid level" on page 3-50 and the procedure of zero span adjustment based on the range equivalent input pressure in "3-9: Zero-span adjustment with input pressure equivalent to range" on page 3-52. • Procedure using the external zero adjustment function (option) Refer to "3-10: External zero adjustment (option)" on page 3-54.
2	When the liquid level in the tank cannot be lowered to the low limit value (0%) of the measurement range: • Procedure using the SFC Refer to the procedure of zero adjustment based on the actual liquid level in "3-8: Zero-point adjustment --- Based on actual liquid level" on page 3-50. • Procedure using the external zero-adjustment function (option). Refer to "3-10: External zero adjustment (option)" on page 3-54.

3-6-1-2: Starting operation

The transmitter is ready for operation when zero-point adjustment is completed. This procedure is described in the previous item. Before starting, always check these items:

(1) Check the correspondence between input and output values.
- If the output does not correctly reflect the input, check the range, check the flange position on the process, and calibrate the transmitter again. If an inappropriate output value persists for the input value, apply troubleshooting procedure (Chapter 5).

(2) Check the displayed data.
- If unstable value is displayed, adjust the damping time constant.

(3) Perform the following items carefully:
- Disconnect the SFC from the transmitter terminal. Ensure that the terminal is sufficiently tight, and not loose.
- Close the case cover. Screw in the cover firmly until it can no longer be turned.
- This transmitter has a locking structure. After closing the cover, tighten the lock using a hexagon wrench.

3-6-1-3: Stopping operation

Procedure

Turn off the transmitter

⚠ CAUTION

- When a long-term shutdown is planned, always dismount the transmitter flange from the tank, clean diaphragms with a soft brush, wash using a solvent, and store. Take care not to deform or damage the diaphragms.

3-6-2: Cautions related to flow rate measurement

Refer to the instructions on flange mounting for flow-rate measurement, to operate the transmitter for flowrate measurement.

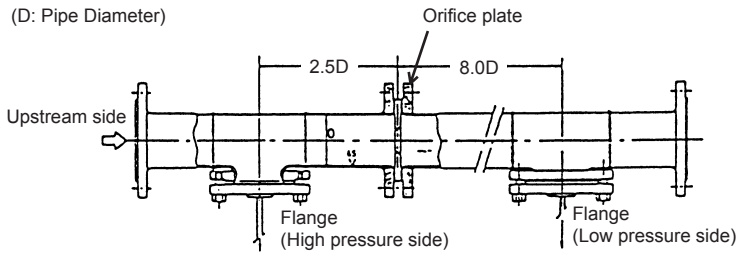
Always complete zero-point checking before introducing fluid to the pipe.

This precaution is warranted since the model JTE has a structural characteristic that prevents mounting of an equalizing valve or stop valve.

For vertical pipes with differential pressure take-out flange port, the high pressure side flange and the low pressure side flange exhibit a level difference. In this case, determine the zero point by setting LRV.

3-6-3: Mounting the flange for Flow rate measurement (Model: JTE)

Mount the flanges on the process referring to Figure 3-7.



Pipe diameter: larger than 3 inches
Δ P: higher than 10kPa
Diam. Ratio: 0.30 to 0.70

Figure 3-7 Installation for flow rate measurement with orifice plate

⚠ CAUTION

- Don't twist the capillary tubes.
- In unwinding capillary tubes, hold the flange part and unwind the large loop of the tube.
- Don't turn the capillary tubes in such a way that it twists the root of the flange.

3-7: Measurement with model JTH/JTS

When starting operation, adjust the transmitter in its actual process state. The specific gravity of the sealed-in liquid is stated in the specifications in Appendix A. Specific gravity changes with temperature at the rate of 0.0008/°C. Use the temperature of the capillary tube for items related to specific gravity, in this section.

3-7-1: Pressure measurement

3-7-1-1: Before you start

Minimum liquid level position for liquid level measurement (zero position)

Set the zero point of the measured liquid level at the center of the seal diaphragm on the process connection flange surface of the transmitter. (Refer to Figure 3-8.) Measurement range H is from the flange center of the transmitter to the height of the specification range. Lower the liquid level in the measured tank to be below the lower end of the diaphragm on the process flange surface.

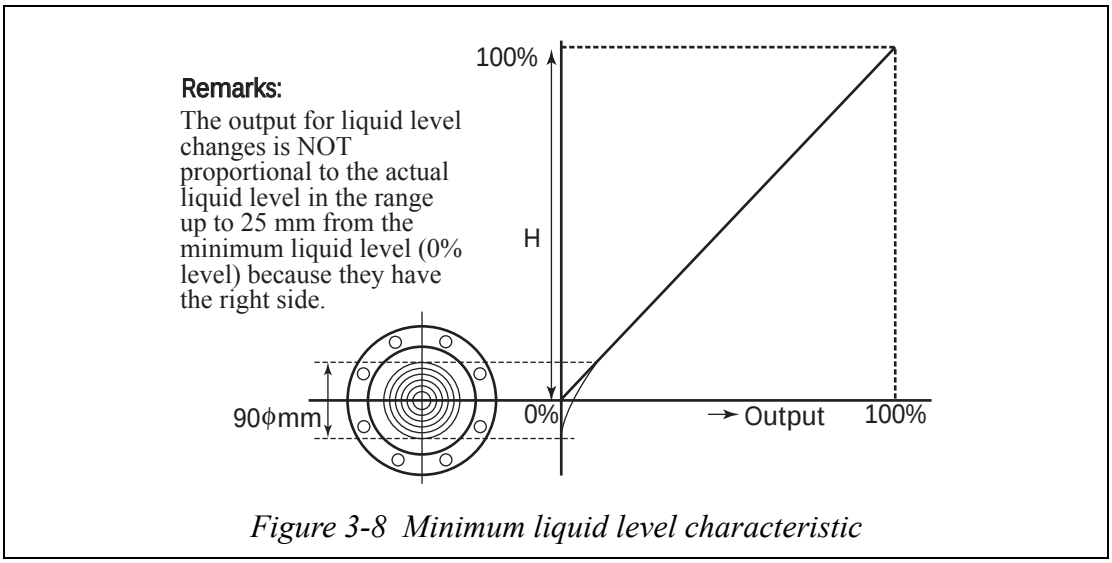


Figure 3-8 Minimum liquid level characteristic

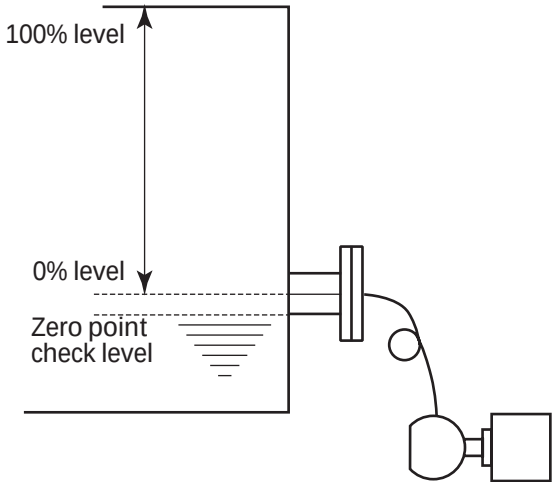


Figure 3-9 Determining the zero position

Zero adjustment

The zero point of the transmitter can be adjusted either by communicating with the SFC or using the external zero adjustment function (option).

Procedure

Steps	Procedure
1	When the liquid level in the tank can be lowered to the low limit value (0%) of the measurement range: • Procedure the SFC Refer to the procedure of zero adjustment based on the actual liquid level in "3-8: Zero-point adjustment --- Based on actual liquid level" on page 3-50 and the procedure of zero span adjustment based on the range equivalent input pressure in "3-9: Zero-span adjustment with input pressure equivalent to range" on page 3-52. • Procedure using the external zero adjustment function (option) Refer to "3-10: External zero adjustment (option)" on page 3-54
2	When the liquid level in the tank cannot be lowered to the low limit value (0%) of the measurement range: • Procedure using the SFC Refer to the procedure of zero adjustment based on the actual liquid level in "3-8: Zero-point adjustment --- Based on actual liquid level" on page 3-50. • Procedure using the external zero-adjustment function (option). Refer to"3-10: External zero adjustment (option)" on page 3-54.

3-7-1-2: Starting operation

The transmitter is ready for operation when zero-point adjustment is completed. This procedure is described in the previous item. Before starting, always check these items:

(1) Check the correspondence between input and output values.
- If the output does not correctly reflect the input, check the range, check the flange position on the process, and calibrate the transmitter again. If an inappropriate output value persists for the input value, apply troubleshooting procedure (Chapter 5).

(2) Check the displayed data.
- If unstable value is displayed, adjust the damping time constant. (Chapter 4)

(3) Perform the following items carefully:
- Disconnect the SFC from the transmitter terminal. Ensure that the terminal is sufficiently tight, and not loose.
- Close the case cover. Screw in the cover firmly until it can no longer be turned.
- This transmitter has a locking structure. After closing the cover, tighten the lock using a hexagon wrench.

3-7-1-3: Stopping operation

Procedure

Turn off the transmitter

⚠ CAUTION

- When a long-term shutdown is planned, always dismount the transmitter flange from the tank, clean diaphragms with a soft brush, wash using a solvent, and store. Take care not to deform or damage the diaphragms.

3-8: Zero-point adjustment --- Based on actual liquid level

Introduction

Zero point can be adjusted during liquid level measurement without actually lowering to zero the liquid level. The transmitter output can be adjusted to the actual level, based on the actual liquid level measured with a level gauge.

An example of liquid level measurement in a closed tank (by the wet leg method) is show, below.

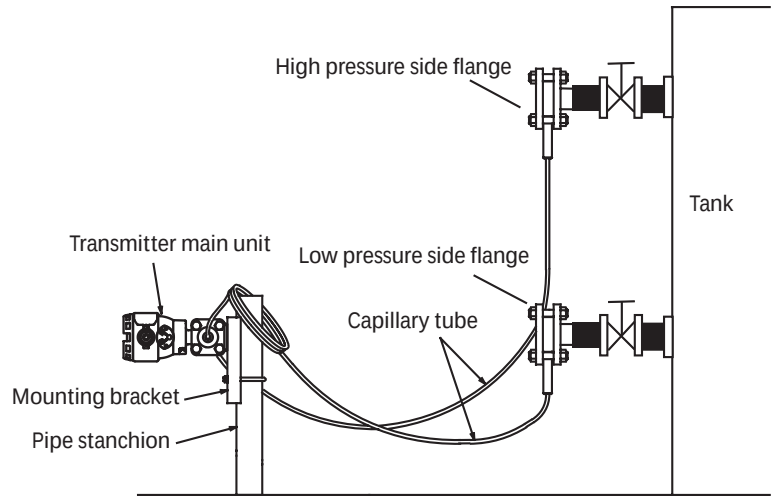


Figure 3-10 Zero adjustment during liquid level measurement

Procedure

Use these procedures to adjust the transmitter output value to the actual level during liquid level measurement, based on the actual liquid level.

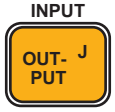
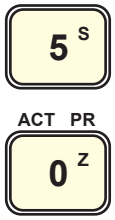
It is assumed that the zero point is adjusted under the following conditions:

Low limit : 1000 mm (0%)

High limit : 0 mm (100%)

Liquid level measured with level gauge: 500 mm (50%)

Display on SFC : 45%

Step	Key	Procedure	SFC screen
1		Press the  key. • The current output of the transmitter will be displayed. • Change the displayed value to 50% by the following steps.	INPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 45.00 %
2		Press the  key and  keys in that order.	OUTPUT FIT-1234 50.00 %
3		Press the  key. • The SFC asks whether or not to execute zero adjustment for 50% output.	OUTPUT FIT-1234 SET LRV?
4		Press the  key. • Zero adjustment has been completed.	OUTPUT FIT-1234 50.00 %

3-9: Zero-span adjustment with input pressure equivalent to range

Introduction

The LRV (input pressure for 0% output) and the URV (input pressure for 100% output) van be set based on the actual pressure by applying the pressure equivalent to the desired range. The LRV and URV are set automatically based on the desired liquid level or input pressure. Zero span adjustment is completed by this operation.

Procedure

Zero span adjustment procedure under the following conditions is explained below.

Desired LRV value : 1050 mm (0%)

Desired URV value : 50 mm (100%)

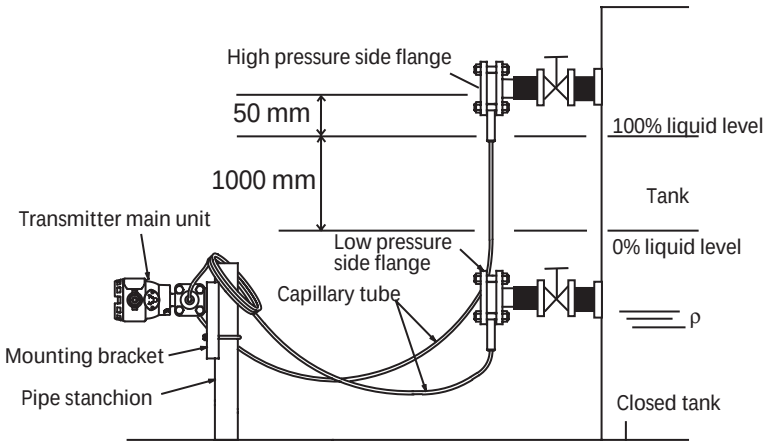


Figure 3-11

Procedure for setting LRV (input differential pressure at 0% output)

Step	Key	Procedure	SFC screen
1	LRV E 0%	Press the LRV E 0% key. • The current set value for LRV will be displayed.	LRV FIT-1234 1050 mmH_2O
2	G SET	Press the G SET key. • The SFC asks whether or not to set the LRV based on the current pressure.	LRV FIT-1234 SET LRV?

Step	Key	Procedure	SFC screen
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • The data will be loaded to the memory of the transmitter and the SFC and the new LRV value will be displayed.	LRV FIT-1234 WORKING... ↓ LRV FIT-1234 1050 mmH_2O

Procedure for setting URV (input differential pressure at 100% output)

Step	Key		SFC screen
1	URV F 100%	Press the URV F 100% key. • The current set value for LRV will be displayed.	URV FIT-1234 50 mmH_2O
2	G SET	Press the G SET key. • The SFC asks whether or not to set the URV based on the current pressure.	URV FIT-1234 SET LRV?
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • The data will be loaded to the memory of the transmitter and the SFC and the new URV value will be displayed.	URV FIT-1234 WORKING... ↓ URV FIT-1234 50 mmH_2O

3-10:External zero adjustment (option)

3-10-1:External zero adjustment

Introduction

A transmitter with external zero-adjustment function enables on-site zero point adjustment work without using an SFC.

A transmitter with both a digital meter and external zero-adjustment function displays ZERO in the display unit.

Adjustment range

Set to any value an output corresponding to the current input. Set within the range of -1.25% (3.8 mA) and +105% (20.8 mA).

Procedure

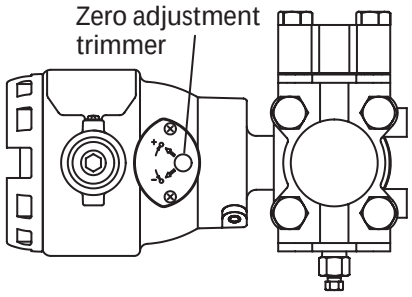


Figure 3-12 External zero adjustment

How to adjust zero point.

Steps	Procedure
1	Make sure that the differential pressure to be set is applied to the transmitter.

Steps	Procedure
2	Using a flat-blade screwdriver, turn the zero-adjustment trimmer to the desired direction (+ or -) until it stops while pushing it down. Adjusting operation will begin. Adjust it so that the output becomes the set value. • Procedure for increasing output: Turn the trimmer fully in the positive (+) direction while pushing it down. △UP is displayed on the digital meter. • Procedure for decreasing output: Turn the trimmer fully in the negative (-) direction while pushing it down. ▽DOWN is displayed on the digital meter. **⚠ CAUTION** • Turning the adjustment trimmer too far will break it. • Do not remove the cross-recessed screw. Adjusting unit may break and cause personal injury. • Zero point adjustment is interrupted by communications from the SFC. • During zero-point adjustment, only the set value and the setting status can be read by communications from the SFC.

Output adjustment value

The output adjustment value changes according to the period during which the adjustment trimmer is kept in the fully-turned state, as shown.

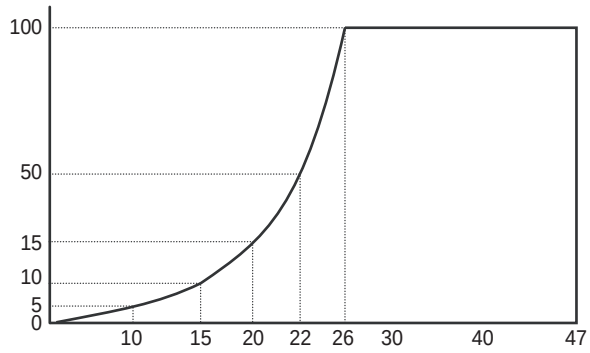


Figure 3-13 Output adjustment value and duration of trimmer operation

- The longer the duration, the larger the output adjustment value. (See illustration, above.)
- The longer the duration, the more quickly the adjustment value increases or decreases. (See illustration, above.)

Error diagnostics

Adjustment function, ZERO blinks on the indicator.

An error will result if the adjusting operation continues for about 50 seconds.

And, the set value is restored to its original value.

3-11:Set range calculation for liquid level measurement

3-11-1:Open tank or closed tank (dry leg) or remote seal set range calculation

Set range calculation (Ex. model JTD)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.

It is assumed that the density is fixed, during liquid level measurement.

ρ : Specific gravity of liquid in tank
ρ_0 : Specific gravity of liquid in high pressure side connecting pipe
l : Distance between 100% liquid level and 0% liquid level (measurement range)
h : Distance between 0% liquid and high pressure outlet port
d : Distance between high pressure outlet port and transmitter.

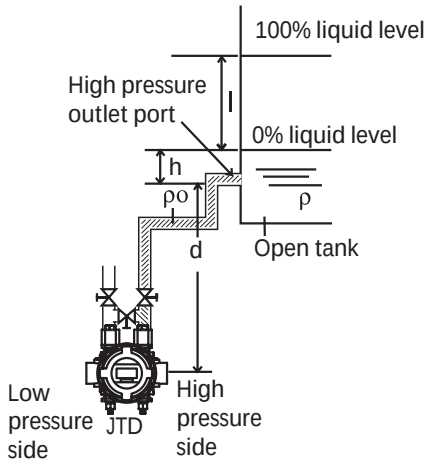


Figure 3-14 Open tank

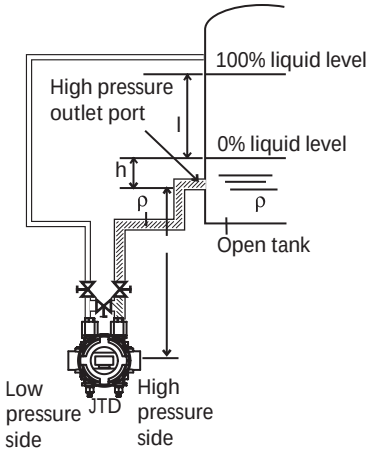


Figure 3-15 Closed tank

Differential pressure at 0% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $h\rho + d\rho_0$ = LRV

Differential pressure at 100% liquid level (Pressure on high pressure side - pressure on low pressure side) = $l\rho + h\rho + d\rho_0 = (l + h)\rho + d\rho_0$ = URV

Therefore, set the range as follows:
Low limit (LRV): $h\rho + d\rho_0$; High limit (URV): $(l + h)\rho + d\rho_0$

Example of calculation:
l = 1500 mm, h = 250 mm, d = 500 mm
ρ = 0.9, ρ_0 =1.0

If the above conditions are assumed, the following results are obtained:

Differential pressure at 0% liquid level = (250 × 0.9) + (500 × 1.0) = 725 mmH_2O = 7.110 kPa

Differential pressure at 100% liquid level = {(1500 + 250) × 0.9}+ (500 × 1.0) = 2075 mmH_2O = 20.35 kPa

Therefore, set the range as follows:
Low limit (LRV): 7.110 kPa {725 mmH_2O}, High limit (URV): 20.35 kPa {2075 mmH_2O}

Set range calculation (Example model JTG)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.
It is assumed that the density is fixed, during liquid level measurement.

- ρ : Specific gravity of liquid in tank
- ρ_0 : Specific gravity of liquid in connecting pipe
- l : Distance between 100% liquid level and 0% liquid level (measurement range)
- h : Distance between 0% liquid and high pressure outlet port
- d : Distance between high pressure outlet port and transmitter.

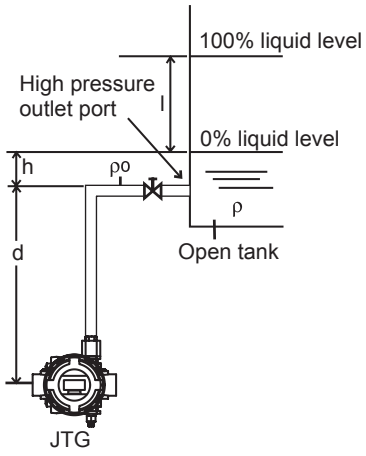


Figure 3-16

Pressure at 0% liquid level = $h\rho + d\rho_0$ = LRV

Pressure at 100% liquid level = $l\rho + h\rho + d\rho_0 = (l + h)\rho + d\rho_0$ = URV

Therefore, set the range as follows:
Low limit (LRV): $h\rho + d\rho_0$; High limit (URV): $(l + h)\rho + d\rho_0$

Example of calculation:
l = 1500 mm, h = 250 mm, d = 500 mm
ρ = 0.9, ρ_0 = 1.0
If the above conditions are assumed, the following results are obtained:

Differential pressure at 0% liquid level = (250 × 0.9) + (500 × 1.0) = 725 mmH_2O = 7.110 kPa
Differential pressure at 100% liquid level = {(1500 + 250) × 0.9} + (500 × 1.0) = 2075 mmH_2O = 20.35 kPa

Therefore, set the range as follows:
Low limit (LRV): 7.110 kPa {725 mmH_2O}, High limit (URL): 20.35kPa {2075 mmH_2O}

Set range calculation (Example model JTC)

Calculate the set range using these procedure:

The following symbols are used to express density and distance.

It is assumed that the density is fixed, during liquid level measurement.

ρ : Specific gravity of liquid in tank
l : Distance between 100% liquid level and 0% liquid level (measurement range)
h : Distance between 0% liquid and high pressure outlet port
d : Distance between high pressure outlet port and transmitter.t

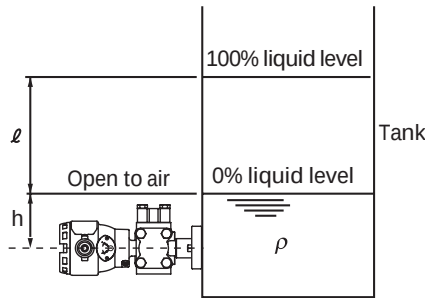


Figure 3-17 Open tank

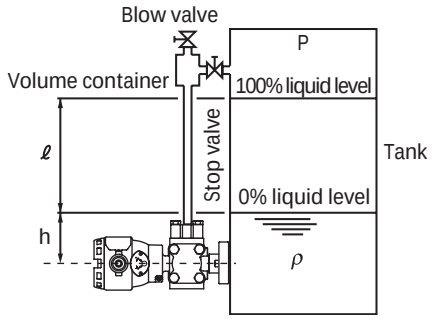


Figure 3-18 Closed tank

Differential pressure at 0% liquid level (Pressure on high pressure side - Pressure on low pressure side) = hρ = LRV

Differential pressure at 100% liquid level (Pressure on high pressure side - pressure on low pressure side) = lρ + hρ = (l + h)ρ = URV

Therefore, set the range as follows:
Low limit (LRV): hρ; High limit (URV): (l + h)ρ

Example of calculation:
l = 1500 mm, h = 250 mm,
ρ = 0.9

If the above conditions are assumed, the following results are obtained:

Differential pressure at 0% liquid level = 250 × 0.9 = 225 mmH_2O =2.206 kPa

Differential pressure at 100% liquid level = (1500 + 250) × 0.9= 1575 mmH_2O = 15.45 kPa

Therefore, set the range as follows:
Low limit (LRV): 2.206 kPa {225 mmH_2O}, High limit (URV): 15.45kPa {1575 mmH_2O}

Set range calculation (Example model JTE)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.
It is assumed that the density is fixed, during liquid level measurement.

ρ : Specific gravity of liquid in tank
ρ_0 : Specific gravity of sealed liquid
l : Distance between 100% liquid level and 0% liquid level (measurement range)
h : Distance between 0% liquid and high pressure outlet port
d : Distance between high pressure outlet port and transmitter.

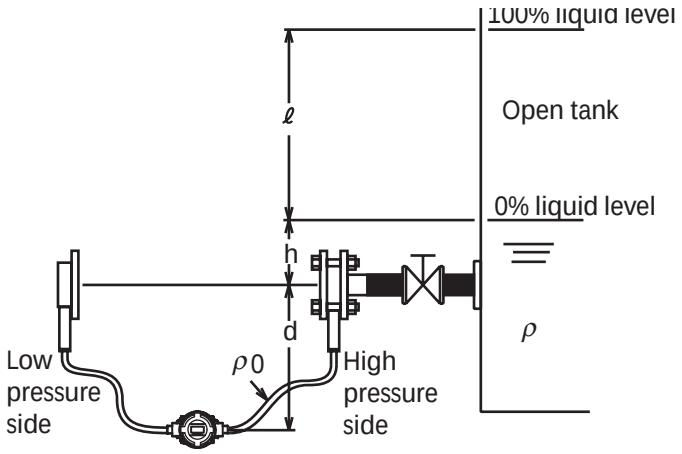


Figure 3-19 Open tank

Differential pressure at 0% liquid level (Pressure on high pressure side - Pressure on low pressure side) = hρ = LRV
Differential pressure at 100% liquid level (Pressure on high pressure side - Pressure on low pressure side) = lρ + hρ = (l + h)ρ = URV

Therefore, set the range as follows:
Low limit (LRV): hρ; High limit (URV): (l + h)ρ

Example of calculation:
l = 1500 mm, h = 250 mm, d = 500 mm
ρ = 0.9, ρ_0 = 0.935
If the above conditions are assumed, the following results are obtained:
Differential pressure at 0% liquid level = (250 × 0.9) = 225 mmH_2O = 2.206 kPa
Differential pressure at 100% liquid level = (1500 + 250) × 0.9 = 1575 mmH_2O = 15.45 kPa

Therefore, set the range as follows:
Low limit (LRV): 2.206 kPa, High limit (URL): 15.45 kPa

Set range calculation (example model JTH)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.
It is assumed that the density is fixed, during liquid level measurement.

ρ : Specific gravity of liquid in tank
ρ_0 : Specific gravity of sealed liquid
l : Distance between 100% liquid level and 0% liquid level (measurement range)
h : Distance between 0% liquid and high pressure outlet port
d : Distance between high pressure outlet port and transmitter.

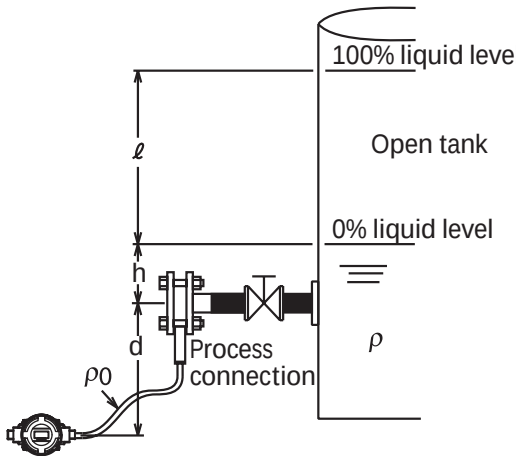


Figure 3-20 Open tank

Differential pressure at 0% liquid level = $h\rho + d\rho_0$ = LRV
Differential pressure at 100% liquid level = $l\rho + h\rho + d\rho_0 = (l + h)\rho + d\rho_0$ = URV

Therefore, set the range as follows:
Low limit (LRV): $h\rho + d\rho_0$; High limit (URV): $(l + h)\rho + d\rho_0$

Example of calculation:
l = 1500 mm, h = 250 mm, d = 500 mm
$\rho = 0.9$, $\rho_0 = 1.0$
If the above conditions are assumed, the following results are obtained:
Differential pressure at 0% liquid level = $(250 \times 0.9) + (500 \times 1.0) = 725$ mmH_2O = 7.110 kPa
Differential pressure at 100% liquid level = $\{(1500 + 250) \times 0.9\} + (500 \times 1.0) = 2075$ mmH_2O = 20.35 kPa

Therefore, set the range as follows:
Low limit (LRV): 7.110 kPa, High limit (URL): 20.35 kPa

3-11-2:Closed tank (wet leg or remote seal) --- set range

Set range calculation (example model JTD)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.
It is assumed that the density is fixed, during liquid level measurement.

ρ : Specific gravity of liquid in tank
ρ_0 : Specific gravity of sealing liquid
l : Distance between 100% liquid level and 0% liquid level (measurement range)
h : Distance between 0% liquid and high pressure outlet port
d : Distance between high pressure outlet port and transmitter.

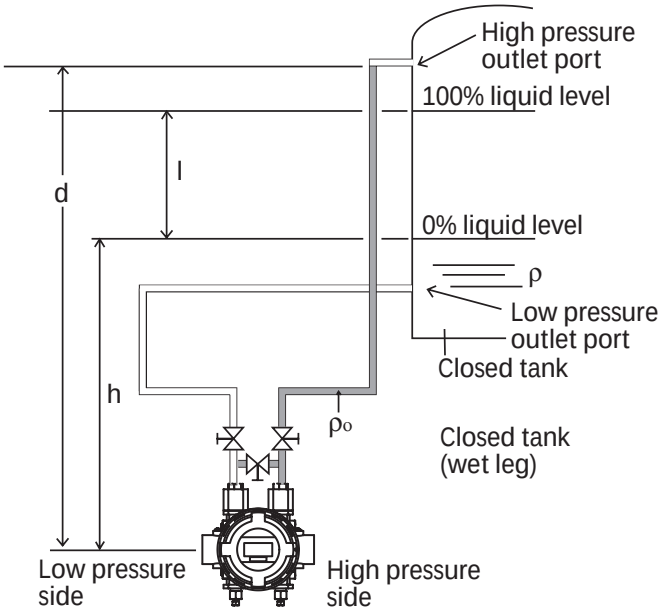


Figure 3-21 Closed tank (wet leg)

Differential pressure at 0% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $d\rho_0 - h\rho$ = LRV

Differential pressure at 100% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $d\rho_0 - (l + h)\rho$ = URV

Therefore, set the range as follows:
Low limit (LRV): $d\rho_0 - h\rho$; High limit (URV): $d\rho_0 - (l + h)\rho$

Example of calculation:
l = 1500 mm, h = 250 mm, d = 2000 mm
$\rho = 0.9$, $\rho_0 = 1.0$
If the above conditions are assumed, the following results are obtained:
Differential pressure at 0% liquid level = $(2000 \times 1.0) - (250 \times 0.9) = 1775$ mmH_2O = 17.41 kPa

Differential pressure at 100% liquid level = (2000 × 1.0) - (1500 + 250) × 0.9 = 425 mmH_2O = 4.168 kPa

Therefore, set the range as follows:
Low limit (LRV): 17.41 kPa {1775 mmH_2O}, High limit (URL): 4.168 kPa {425 mmH_2O}

Set range calculation (example model JTC)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.
It is assumed that the density is fixed, during liquid level measurement.

ρ : Specific gravity of liquid in tank
ρ_0 : Specific gravity of sealing liquid
l : Distance between 100% liquid level and 0% liquid level (measurement range)
h : Distance between 0% liquid and high pressure outlet port
d : Distance between high pressure outlet port and transmitter.

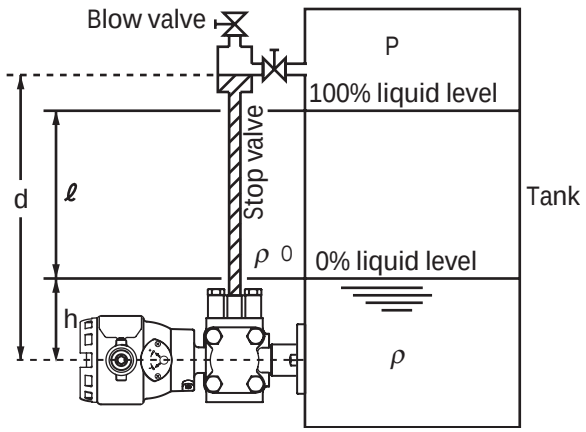


Figure 3-22 Closed tank (wet leg)

Differential pressure at 0% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $h\rho - d\rho_0$ = LRV

Differential pressure at 100% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $(l + h)\rho - d\rho_0$ = URV

Therefore, set the range as follows:
Low limit (LRV): $h\rho - d\rho_0$; High limit (URV): $(l + h)\rho - d\rho_0$

Example of calculation:
l = 1500 mm, h = 250 mm, d = 2000 mm
ρ = 0.9, ρ_0 = 1.0
If the above conditions are assumed, the following results are obtained:
Differential pressure at 0% liquid level =(250 × 0.9) - (2000 × 1.0) = -1775 mmH_2O = -17.41 kPa

Differential pressure at 100% liquid level = (1500 + 250) × 0.9 - (2000 × 1.0)= -425 mmH_2O = -4.168 kPa

Therefore, set the range as follows:
Low limit (LRV): -17.41 kPa {1775 mmH_2O}, High limit (URL): -4.168 kPa {425 mmH_2O}

Set range calculation (example model JTE)

Calculate the set range using these procedures:

The following symbols are used to express density and distance.
It is assumed that the density is fixed, during liquid level measurement.

- ρ : Specific gravity of liquid in tank
- ρ_0 : Specific gravity of sealed liquid
- l : Distance between 100% liquid level and 0% liquid level (measurement range)
- h : Distance between 0% liquid and high pressure outlet port
- d : Distance between high pressure outlet port and transmitter.

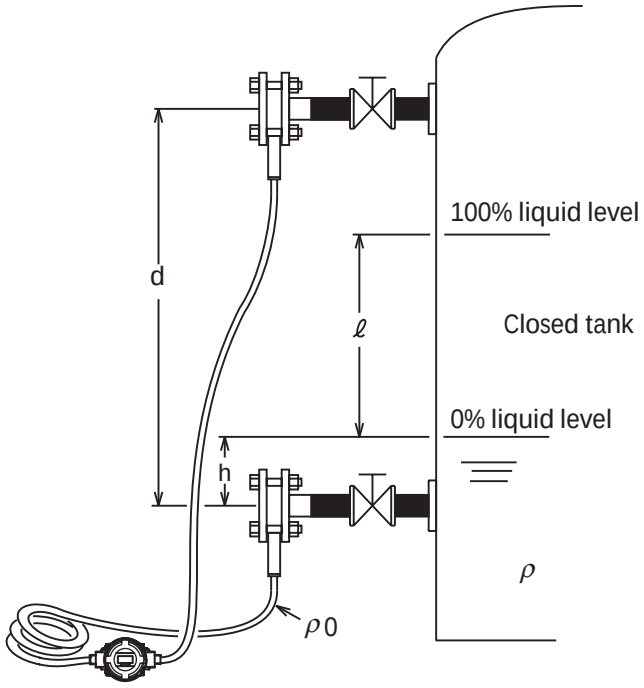


Figure 3-23 Closed tank (wet leg)

Differential pressure at 0% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $d\rho_0 - h\rho$ = LRV

Differential pressure at 100% liquid level (Pressure on high pressure side - Pressure on low pressure side) = $d\rho_0 - (l + h)\rho$ = URV

Therefore, set the range as follows:
Low limit (LRV): $d\rho_0 - h\rho$; High limit (URV): $d\rho_0 - (l + h)\rho$

Example of calculation:

l = 1500 mm, h = 250 mm, d = 2000 mm
$\rho = 0.9$, $\rho_0 = 0.935$
If the above conditions are assumed, the following results are obtained:
Differential pressure at 0% liquid level = (2000 × 0.935) - (250 × 0.9) = 1645 mmH_2O = 16.13 kPa
Differential pressure at 100% liquid level = (2000 × 0.935) - (1500 + 250) × 0.9 = 295 mmH_2O = 2.893 kPa

Therefore, set the range as follows:
Low limit (LRV): 16.13 kPa {1645 mmH_2O}, High limit (URL): 2.893 kPa {295 mmH_2O}

Chapter 4: Operation using SFC

Overview

Connect the SFC to this transmitter in order to perform checks on measured data and to change setting data.

This section deals with basic operating procedures for an SFC, such as communications with the transmitter.

For detailed information on an SFC, refer to SFC User's Manual (CM2-SFC100-2001).

4-1: Basic information

4-1-1: SFC functions

Introduction

Read the measured data of a transmitter and change its setting. Simply connect the SFC to the transmitter and manipulate the key-pad.

Start measurement

Start communications between the SFC and the transmitter.

Display measured data

An SFC displays a range of useful data:

- Display the differential pressure (engineering unit) applied to the transmitter
- Display the output (%) from the transmitter

Display self-diagnostic results

An SFC can display transmitter errors and SFC errors, using a variety of functions.

For detailed information, refer to Chapter 5

Printing

If fitted with a printer, these printing functions are available:

- Maintenance printing outputs the complete internal data of a transmitter.
- Action printing is a unique response to a key operation.

Display and change transmitter settings

An SFC has functions for displaying or changing:

- Tag number
- Output format
- Display format (flow rate / linear / display flow rate)
- Display format (engineering unit / % display)
- High and low limits of engineering quantity
- Low limit of set range
- High limit of set range
- Span of set range (display only)
- Engineering unit of measured pressure
- Damping time constant
- Low flow cutoff value
- Burnout direction (display only)
- Production number (display only)

- Software version (display only)
- Measurable maximum differential pressure (display only)
- Height between flanges

Saving set values and settings

After changing a set value or a setting, always save the new value in the transmitter using SFC operations.

Once input to the transmitter, a set value and a setting are automatically saved after a delay of about 30 seconds. Such data are not erased by turning off the transmitter.

Maintenance

The constant current source mode can be selected for loop checking of a transmitter.

Other functions

A scratch-pad function enables convenient recording of such information as a date and a name.

4-1-2: Key operation and display interaction

General instructions for key operation

Operate SFC keys according to the following instructions:

- Press keys securely and slowly. No response on the screen indicates a failure to input the key. Press the key again, slowly.
- If key-pad action makes no change on the screen, this key may have no functionality for the currently-obtaining operation stage. Or, the key may not be supported by the currently-connected transmitter.
- Start from the initial state, after operating a wrong key. Instructions in Chapter 4.

General rules for interaction with screen

Operate an SFC in the interactive mode.

Interact with the screen, following these basic rules:

- Press the NON-VOL ENTER (Yes) key to answer Yes to a question on the screen.

  If answer is Yes to a question on the screen, currently-obtaining SFC function proceeds to the next hierarchical level.
  If answer is Yes to EXIT?, currently-obtaining SFC function will return to the top hierarchical level.

- Press the CLR (No) key to answer No to a question on the screen.

  If answer is No to a question when performing a special-purpose function, currently-obtaining SFC function proceeds to the previous hierarchical level.
  If answer is No to EXIT?, the first screen of the currently-obtaining function appears.

- Press the ▲ H NEXT key or the ▼ L PREV key to select a different function in the same hierarchical level.

4-1-3: SFC keyboard

Appearance

Both Japanese and English language key-pads are available.

The following illustration shows an English key-pad.

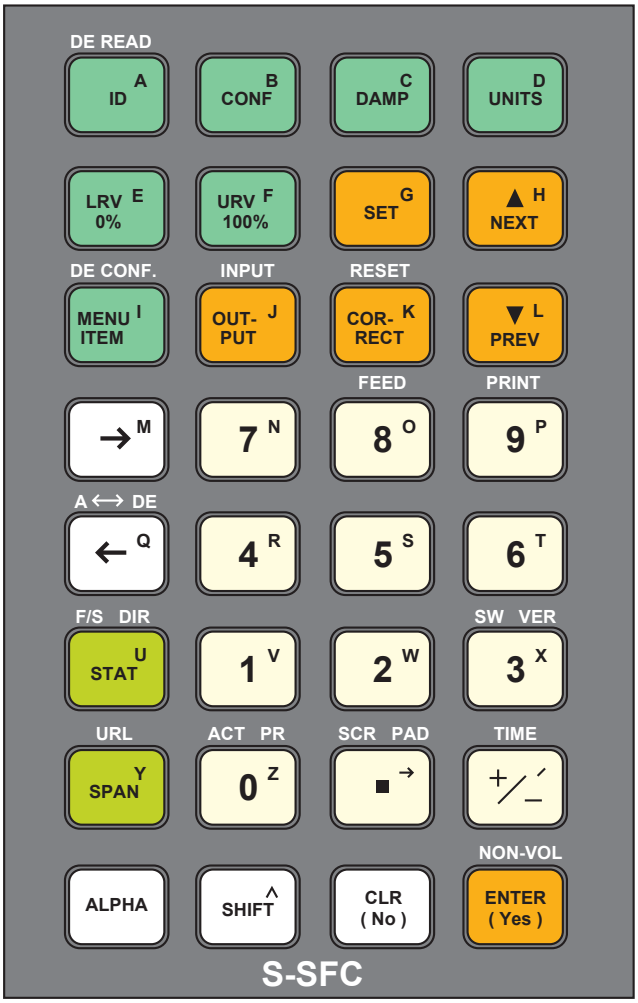


Figure 4-1 SFC key-board

4-1-4: Basic key input operations

Key input procedure

How to input alpha characters and end alpha-entry input:

Step	Procedure
1	Press the ALPHA (white) key. • A ■ cursor will blink in the data display window.
2	Press the desired character, to input. • The input character will be displayed. • Actual character for each key is shown in the top, right-hand corner of the key.
3	Press the ALPHA key again to end input.

How to input numbers, symbols, or a function (indicated at the center of a key):

Step	Procedure
1	Press the ALPHA key if a ■ cursor is blinking in the data display window. • A _ cursor will be displayed.
2	Press the key to input character or function.

How to input the function indicated immediately above each key:

Step	Procedure
1	Press the ALPHA key. • SHIFT _ cursor will be displayed in the data display window.
2	Press the key to input function.

4-1-5: Functions of SFC keys

Introduction

The SFC keys are grouped by major functions, indicated by colors.

An SFC has common functions, and dedicated functions. Common functions are applicable to other equipment besides this transmitter. Dedicated functions are applicable only to this transmitter.

Common functions can be selected using the 

, 

, alphanumeric keys.

(Some are selected by pressing the 

key first.)

Dedicated functions have a hierarchical structure and can be selected by pressing the 

key first.

Grouping by color

The 32 keys on the key-pad are classified into five color groups. Colors and their corresponding functions are shown, below.

Remarks:

Some keys are not used with a transmitter.

Key color	Major function
Light green	• Start communications with a transmitter • Enable selection of a dedicated function • Set or change measurement conditions • DIsplaying the set data of a transmitter • Select a menu
Orange	• Display measured data • Select a screen • Save data
Yellow	• Input a numeric value • Print data • Enable memo recording
Dark green	• Execute diagnostics • Check the span of the set range
White	• Move the cursor in the data display window • Change the function of a key of another color • Cancel the current setting

Key color	Major function
All colors	• Input an alpha character (Press the ALPHA key first.)

Functions of green keys

Different functions are executed by pressing a green key alone, or pressing a green key after pressing the SHIFT key.

Green keys have the following major functions:

- Start communications with a transmitter
- Enable selection of a dedicated functions
- Set or change measurement conditions
- Display the set data of a transmitter
- Select a menu

An alpha character can be displayed by first pressing the ALPHA key and then pressing the corresponding alphabet key.

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
DE READ A ID	ID: Press this key to start communications with the transmitter. Displays the tag no. of the transmitter. Change the tag no. from this screen by inputting a new number.	Used when the conversion output is DE. Has the same function as ID.
B CONF	CONF: Press this key to use a dedicated function. The dedicated functions have hierarchical structure. Refer to 5-1-6.	No function
C DAMP	DAMP: The current damping time constant is displayed. Change the damping time constant on this screen.	No function
D UNITS	UNIT: The current engineering unit is displayed. Change the engineering unit on this screen.	No function

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
LRV E 0%	LRV 0%: Displays the Lower Range Value (LRV) of the current set value. Change the LRV on this screen.	No function
URV F 100%	URV 100%: The Upper Range Value (URV) of the current set value is displayed. Change the URV on this screen.	No function
DE CONF. MENU I ITEM	MENU ITEM: Press this key to change the output format (linear / square root).	DE CONF: Used to display or select variables output in digital communication.

Functions of orange keys

Different functions executed by pressing an orange key only, or by pressing the SHIFT key first and then pressing an orange key.

Orange keys have the following major functions:

- Display measured data
- Select a screen
- Save data

Display an alpha character by first pressing the ALPHA key, and then pressing the corresponding alphabet.

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
SET G	SET: Press this key to set a desired output value for the current input value.	No function

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
▲ H NEXT	NEXT: Press this key to display a screen in the next hierarchical level of dedicated functions. Press this key after the C DAMP key to change the damping time constant. Press this key after the D UNITS key to change the engineering unit.	No function
▼ L PREV	PREV: Press this key to go back to the previous hierarchical level, for dedicated functions. Press this key after the C DAMP key to change the damping time constant. Press this key after the D UNITS key to change the engineering unit.	No function
INPUT OUT- PUT J	OUTPUT(INPUT): This key displays the output (%) from the transmitter. Press this key, input a numeric value, and press the NON-VOL ENTER (Yes) key. The transmitter will become a constant current source. It will output only the current value that corresponds to this value. This function is used for maintenance purposes.	INPUT: Displays the differential pressure being input to the transmitter.
RESET COR- RECT K	CORRECT: Press this key to calibrate the se range.	RESET: Initializes the transmitter to the delivery settings.

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
NON-VOL ENTER (Yes)	ENTER: Press this key to send data to the transmitter. (Yes): Press this key to answer Yes to a question on the data display window.	NON-VOL: Save data in the transmitter. Data not erased by turning off the transmitter.

Functions of yellow keys

Different function are executed by pressing a yellow key only, or by first pressing the SHIFT key. and then pressing a yellow key.

The yellow keys have the following major functions:

- Input a numeric value
- Print data
- Enable memo recording

Display an alpha character by pressing the ALPHA key and then pressing the corresponding alphabetic key.

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
PRINT 9 P	9: 9 (number) is input.	PRINT: An SFC with a printer starts printing. This is called maintenance printing.
FEED 8 O	8: 8 (number) is input.	FEED: The printing paper is fed by 1 line each time this key is pressed. Press the CLR (No) key to cancel this function.
7 N to 4 R	7 to 4: 7 to 4 (number) is input.	No function

Key mark	Explanation	
	Press a key	Press a key after [SHIFT] key
SW VER [3 X]	3: 3 (number) is input.	SW VER: When the SFC is connected to a transmitter, the software versions of both equipment units, are displayed. When the SFC is not connected to a transmitter, the software version the SFC is displayed.
[2 W] [1 V]	2, 1 2 or 1 (number) is input.	No function
TIME [+/−]	+/-: +/- is input /: press the [ALPHA] key and this key in that order to input /.	TIME: In the case of SFC with a printer, the current date and time are displayed.
SCR PAD [■ →]	• : A decimal point is input. →: press the [ALPHA] key and this key in that order to input a space.	SCR PAD: Press this key to record a memo.
ACT PR [0 Z]	0: 0 (number) is input.	ACT PR: The response from the transmitter is printed each time this key is pressed. This is called action printing. Press the [CLR (No)] key to end this function.

Function of dark-green keys

Differential functions are executed by pressing a dark-green key only, or by pressing the [SHIFT] key and then pressing a green key.

The dark-green keys have the following major functions:

- Execute diagnostics
- Check the span of the set range

An alpha character can be displayed by pressing the ALPHA key and then pressing the corresponding alphabetic key.

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
F/S DIR U STAT	STAT: Displays the self-diagnostic result of the transmitter.	F/S DIR: Displays the output signal processing direction, in the error status.
URL Y SPAN	SPAN: Display the current span.	URL: Display the maximum value of the differential pressure that can be measured with the transmitter.

Functions of white keys

The functions of the white keys are explained, below.

The white keys have the following major functions:

- Move the cursor in the data display window
- Change the function of a key of another color
- Cancel the current setting

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
→ M	→: The cursor moves forward by one position.	No function
A ↔ DE ← Q	←: The cursor is moved back by one position.	No function
ALPHA	ALPHA: Press this key immediately before inputting an alphabetic character (including /). Press again to release the function.	No function
SHIFT	SHIFT: Press this key to input the function that is indicated above a key.	No function

Key mark	Explanation	
	Press a key	Press a key after SHIFT key
CLR (No)	CLR: Press this key to clear the display. Set the SFC to standby status (waiting for input). (No): Press this key to answer No to a question.	Use this key to end a dedicated function.

4-1-6: Dedicated functions

Dedicated functions

An SFC has the following major dedicated functions:

- Display and change the output format
- Display and change the display format
- Save data
- Display and change the low-flow cutoff value
- Display sensor temperature
- Display PROM No.
- Displaying and changing sealed liquid temperature correction function

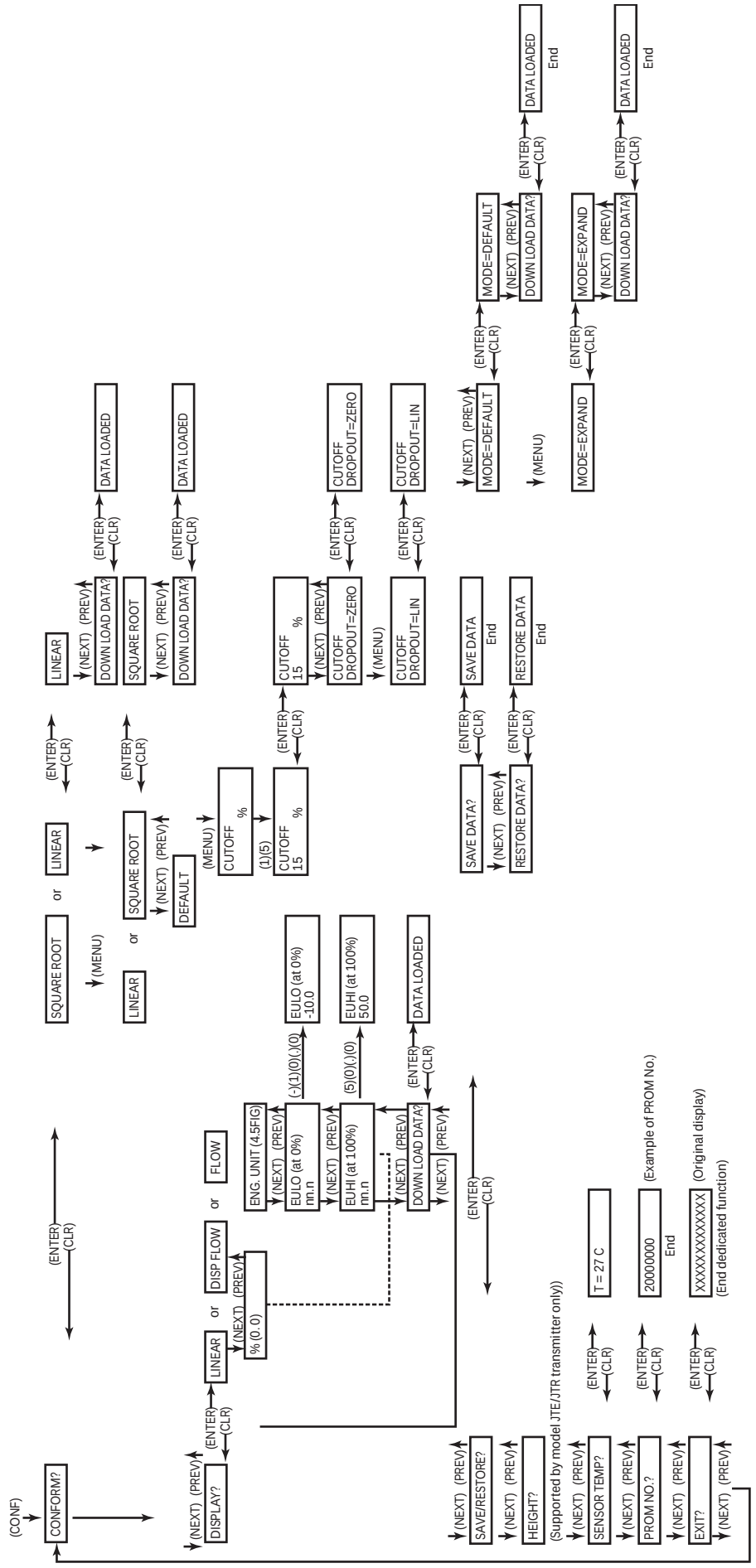
Hierarchical structure

The dedicated SFC functions have a hierarchical structure. First, press the 

key.

Then, follow the instructions displayed in the data display window.

Operation keys are shown in parentheses ( ). The display is shown in a rectangle □. The direction of processing is shown with an arrow →.


(CONF)
CONFORM?
(NEXT) (PREV)
DISPLAY?
(ENTER) (CLR)
LINEAR
or
DISP FLOW
or
FLOW
(NEXT) (PREV)
% (0. 0)
(ENTER) (CLR)
ENG. UNIT (4.5FIG)
(NEXT) (PREV)
EULO (at 0%)
nn.n
(NEXT) (PREV)
EUHI (at 100%)
nn.n
(NEXT) (PREV)
DOWN LOAD DATA?
(NEXT) (PREV)
(-)(1)(0).(.)(0)
(5)(0).(.)(0)
(ENTER) (CLR)
EULO (at 0%)
-10.0
EUHI (at 100%)
50.0
DATA LOADED
(ENTER) (CLR)
SQUARE ROOT
(MENU)
LINEAR
or
LINEAR
or
SQUARE ROOT
(NEXT) (PREV)
DEFAULT
(MENU)
CUTOFF %
(1)(5)
CUTOFF 15 %
(ENTER) (CLR)
LINEAR
(NEXT) (PREV)
DOWN LOAD DATA?
(ENTER) (CLR)
DATA LOADED
SQUARE ROOT
(NEXT) (PREV)
DOWN LOAD DATA?
(ENTER) (CLR)
DATA LOADED
CUTOFF 15 %
(NEXT) (PREV)
CUTOFF DROPOUT=ZERO
(MENU)
CUTOFF DROPOUT=LIN
(ENTER) (CLR)
CUTOFF DROPOUT=ZERO
(ENTER) (CLR)
CUTOFF DROPOUT=LIN
SAVE DATA
End
RESTORE DATA
End
(ENTER) (CLR)
SAVE DATA?
(NEXT) (PREV)
RESTORE DATA?
(ENTER) (CLR)
(NEXT) (PREV)
MODE=DEFAULT
(MENU)
MODE=EXPAND
(ENTER) (CLR)
MODE=DEFAULT
(NEXT) (PREV)
DOWN LOAD DATA?
(ENTER) (CLR)
DATA LOADED
End
MODE=EXPAND
(NEXT) (PREV)
DOWN LOAD DATA?
(ENTER) (CLR)
DATA LOADED
End
(ENTER) (CLR)
(NEXT) (PREV)
SAVE/RESTORE?
(NEXT) (PREV)
HEIGHT?
(Supported by model JTE/JTR transmitter only)
(NEXT) (PREV)
SENSOR TEMP?
(ENTER) (CLR)
T = 27 C
(NEXT) (PREV)
PROM NO.?
(ENTER) (CLR)
20000000
End
(Example of PROM No.)
(NEXT) (PREV)
EXIT?
(ENTER) (CLR)
XXXXXXXXXXXX
(End dedicated function)
(Original display)
(NEXT) (PREV)

4-1-7: Charging SFC

Timing and duration

Charge the SFC when: begins blinking in the data display window.

Approximate charging time required is shown, below:

- Non-explosionproof SFC: 6 hours
- Intrinsically safe SFC: 10 hours

Important item

Charge an SFC at a non-hazardous location.

Procedure

How to charge an SFC: USE the battery charger (included).

Step	Procedure
1	Turn off the power switch of the SFC.
2	Disconnect the communication cable from the transmitter.
3	Disconnect the communication cable plug from the SFC.
4	COnnect the plug of the battery charger cable to the SFC.
5	Connect the plug of the battery charger body to a commercial power receptacle. Charging will begin.
6	When the required charging time elapses, disconnect the battery charger, end charging.

4-2: Start measurement

Important!

Make sure that the process is in manual control mode before starting communications between the SFC and the transmitter.

Procedure

How to start measurement by SFC.

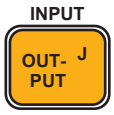
Step	Key	Description	SFC screen
1		Connect the communication cable of the SFC to the transmitter. • Connecting procedure is described in “3-1: Preparation” on page 3-2.	
2	NON-VOL ENTER (Yes)	Turn on the power switch of the SFC. After checking that the process is in manual control mode, press the NON-VOL ENTER (Yes) key.	LOOP IN MANUAL? ↓ PRESS ID
3	DE READ A ID	Press the DE READ A ID key.	DSTJ TAG No. LIN DP FIT-1234
4		Read the tag number (displayed in the data display window). Check whether the SFC is connected to the correct transmitter. • If not, connect the communication cable to the correct transmitter. Repeat from <step 2>.	DSTJ TAG No. LIN DP FIT-1234

4-3: Display measured data

4-3-1: Display input differential pressure

Procedure

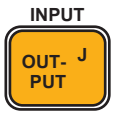
How to display the differential pressure being applied to the transmitter.

Step	Key	Description	SFC screen
1		Press the  key.	SHIFT -
2		Press the  key. • The right display indicates that the differential pressure being applied to the transmitter is 2,500 kPa	INPUT FIT-1234 25 kPa

4-3-2: Display transmitter output (%)

Procedure

Display the output being transmitted by the transmitter using this procedure:

Step	Key	Description	SFC screen
1		Press the  key. • This indicates that the transmitter output is 50%.	OUTPUT FIT-1234 50 %

4-4: Printing --- SFC with printer

4-4-1: How to print

Introduction

An SFC with a printer can print transmitter setting information at the beginning, or during, measurement. It can also print transmitter responses.

Maintenance printing and action printing

An SFC has two ways to point. Select either way using key operations.

- Maintenance printing
  This function enables printing of a transmitters internal data: tag number damping time constant, output range, differential pressure, and output value.
- Action printing
  This function enables printing of a transmitter's response to SFC key operation, after each key operation.

Overview of printer

The SFC internal is a thermal printer that prints 24 characters per line.

When an SFC is turned on, the print head stops after a two-way motion and becomes ready for printing. Paper feeds out to a distance of about 5 mm.

Feed recording paper

How to feed recording paper:

Step	Key	Description	SFC screen
1	SHIFT FEED 8 °	Press the SHIFT and FEED 8 ° key (in this order). • Recording paper is fed each time the FEED 8 ° key is pressed.	SHIFT - PRINTER FEED
2	CLR (No)	Press the CLR (No) key to release the paper feeding function. • PRINTER FEED disappears and the screen returns to the original display.	

4-4-2: Printing internal data --- Maintenance printing

Printed data

This function enables printing of internal data: tag number, damping time constant, output range, differential pressure, output value, and self-diagnosis result.

Use this function for recording the settings and failures of the transmitter.

Procedure

How to execute maintenance printing: Execute this operation even during measurements.

Step	Key	Description	SFC screen
1	CLR (No)	Hold down the CLR (No) key until the screen shown at right, is displayed.	DSTJ FIT-1234 READY...
2	SHIFT ^	Press the SHIFT ^ key.	SHIFT -
3	PRINT 9 P	Press the PRINT 9 P key. • Printing will begin.	DSTJ FIT-1234 WORKING... ↓ PRINTING...
4	CLR (No)	Press the CLR (No) key at the end of printing.	DSTJ FIT-1234 READY...

Maintenance printing - Example

An example of printed data is shown, below. The meanings of individual lines are explained.

Example printout	Meaning
’99-04-01 02:22	Date, time
TAG NO. FIT 1234	Tag number
TYPE : DIFF. PRESSURE	Type
ANA/DE : ANALOG XMTR	Output mode
FORM : LINEAR	Output format
(or SQUARE ROOT)	
PROM # : 2104695800	PROM number
SW VER : B.1	Software version
DAMP : 0.00 s	Damping time constant
SPAN : 70.00 kPa	Span
LRV : 10.00 kPa	Measured value corresponding to 0% output
URV : 80.00 kPa	Measured value corresponding to 100% output
URL : 99.64 kPa	Maximum value of set range
F/SAFE : DOWNSCALE	Burnout direction
HEIGHT : 0.0000m	Take flange height
DISPLAY	
CONF : DOSP FLOW	Display format
TYPE : ENG. UNIT	Display type
EULO : -10.000	Low limit of engineering quantity
EUHI : 50.00	High limit of engineering quantity
INPUT : 45.00 kPa	Input differential pressure to transmitter
OUTPUT : 50.0 %	Transmitter output (%)
SV : T = 25°C (77°F)	Temperature detected by temperature sensor
STATUS CHECK = OK	Self-diagnosis result of transmitter

Figure 4-2 Maintenance printing - example

4-4-3: Print data responses - Action printing

Printed data

This function enables printing of a transmitters responses to SFC key operations, each time a key is operated.

Use this function for printing responses of each key operation.

Procedure

How to print data: Execute this operation even during measurements.

Step	Key	Description	SFC screen
1	CLR (No)	Hold down the CLR (No) key until the screen shown at right, is displayed.	DSTJ FIT-1234 READY...
2	SHIFT ACT PR 0 Z	Press the SHIFT and ACT PR 0 Z keys, in that order.	SHIFT - DSTJ FIT-1234 ACTION PRINT?
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The following information is printed: * ACTION PRINT * START TAG. NO. FIT-1234 (Tag No.) 92.07.07 13:10 (Date and time)	PRINTING... DSTJ FIT-1234 READY...
4		Each time a key is operated, its details and the response are printed.	
5	SHIFT ACT PR 0 Z	Press the SHIFT and ACT PR 0 Z keys, in that order, to end printing session.	SHIFT - DSTJ FIT-1234 ACTION PRINT?

Step	Key	Description	SFC screen
6	CLR (No)	Press the CLR (No) keys. *ACTION PRINT * END is printed	PRINTING... DSTJ FIT-1234 READY...

Action printing - Example

An example of printed data corresponding to an operated key is shown, below.

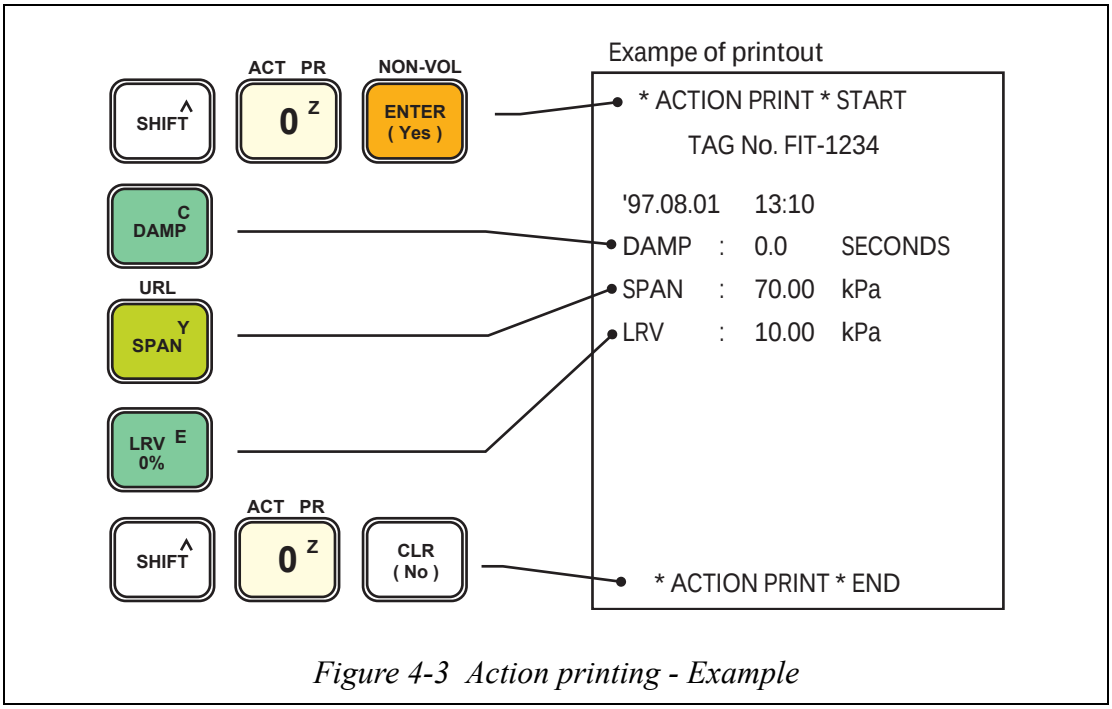


Figure 4-3 Action printing - Example

4-5: Display and change transmitter settings

4-5-1: Displaying and changing transmitter settings - overview

Applicable settings

The following settings (values and states) can be displayed or changed by operating SFC keys. This operation can be executed even during measurements.

○: Enabled —: Disabled

Item	Change	Display
Tag number	○	○
Output format	○	○
Display format	○	○
High and low limits of engineering quantity	○	○
Low limit of set range	○	○
High limit of set range	○	○
Span of set range	○	○
Engineering unit	○	○
Damping time constant	○	○
Low flow cutoff value	○	○
Burnout direction	—	○
PROM No.	—	○
Software version	—	○
Sensor temperature	—	○
Sealed liquid temperature correction function	○	○

Save settings

After changing settings (values and states), save settings using this procedure.

Remarks:

Settings (values and states) that are input to the transmitter are automatically saved after about 30 seconds. Not erased by switching OFF the transmitter.

Step	Key	Description	SFC screen
1		Press the SHIFT and ENTER (Yes) keys, in that order. • The data has been saved in the transmitter	SHIFT - DSTJ FIT-1234 READY... ↓ DSTJ FIT-1234 ACTION PRINT?

4-5-2: Displaying or changing tag number

Procedure

Display or change the tag number using this procedure.

Here, the procedure to change FIT-1234 to ACV-5678 as in this example.

Step	Key	Description	SFC screen
1	NON-VOL ENTER (Yes)	Turn ON the power switch of the SFC. Press the NON-VOL ENTER (Yes) key.	LOOP IN MANUAL? ↓ PRESS ID.
2	DE READ A ID	Press the DE READ A ID key. Branch: • If no change required to the tag number press the CLR (No) key.	TAG No. WORKING... DSTJ TAG No. LIN DP FIT-1234 DSTJ FIT-1234 READY...
3	ALPHA DE READ A ID B CONF C DAMP	Press the ALPHA, DE READ A ID, B CONF, and C DAMP keys, in that order. Remarks: After an input error, return the cursor by pressing the ALPHA and the A↔DE Q keys, in that order. Press the ALPHA key again and input the correct keys.	DSTJ TAG No. LIN DP ABC-1234

Step	Key	Description	SFC screen
4	ALPHA TIME +/−	Press the ALPHA and TIME +/− keys, in that order	DSTJ TAG No. LIN DP ABC-1234
5	5 S 6 T 7 N FEED 8 O	Press the 5 S, 6 T, 7 N and FEED 8 O keys, in that order.	DSTJ TAG No. LIN DP ABC-5678
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) keys.	DSTJ TAG No. WORKING... ↓ DSTJ TAG No. LIN DP ABC-5678
7	SHIFT ^ NON-VOL ENTER (Yes)	Press the SHIFT ^ and NON-VOL ENTER (Yes) keys, in that order. The data is saved in the transmitter	SHIFT - DSTJ TAG No. WORKING... ↓ DSTJ ABC-5678 DATA NONVOLATILE ↓ DSTJ ABC-5678 READY...

4-5-3: Display or change output format

Introduction

This function works for flow rate measurement.

Flow rate is proportional to the square root of the differential pressure arising at a contracting mechanism. Flow rate is also proportional to the transmitters output differential pressure. In the linear format, differential pressure is converted to electrical signals and output, without further processing. In the square root format, the square root of the differential pressure is calculated in the transmitter, and the result output.

Display or change the currently-selected format by key operation.

When square root is selected, set low-flow cutoff value, flow rate mode, and dropout format. Refer to 4-5-7:.

Procedure

Display or change the output format (linear/square root) of the transmitter using this procedure:

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM
2	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Display the currently selected output format (linear or square root).	CONFORM LINEAR (Linear) or CONFORM SQUARE ROOT (Square root)
3		**Branch:** • If no change required to the format, press the DE CONF. MENU / ITEM key and proceed to <step 4>. • If no change required to the format, press the CLR (No) key twice.	

Step	Key	Description	SFC screen
4		Press the  key.	CONFORM ENTERED IN SFC ↓ CONFORM LINEAR
5		Press  key.	CONFORM WORKING...
6		Press the  key. Changes the output format to linear or square root.	CONFORM WORKING ↓ CONFORM DATA LOADED!
7		Press  key.	DSTJ FIT-1234 WORKING...
8	 	Press the  and  keys in that order. • Saves the data in the transmitter.	SHIFT - DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE

4-5-4: Display or change indicator display format (Flow rate / Linear / Display flow rate)

Introduction

This function enables displaying or changing the display format, of the indicator.

- When the output format is square root, the display format is fixed to flow rate (FLOW).
- When the output format is LINEAR, select either LINEAR or DISP FLOW for the display format.

~Note *Display flow rate: In some cases, for processing by higher level equipment, the required output format of a transmitter is linear select flow rate can be selected for the indicator display format when the transmitter output format is linear.*

~Note *For detailed information on the indicator, refer to 3-8.*

Procedure

Display or change the display format (linear / display flow rate) of the transmitter indicator using this procedure:

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM
2	▲ H NEXT	Press the ▲ H NEXT key.	DSTJ CONFIG DISPLAY?
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	DISPLAY CONF FLOW (Output format: Square) DISPLAY CONF LINEAR or (Display format: Linear) DISPLAY CONF DISP FLOW (Display format: Display flow rate)
		Displays the currently-selected display format (flow rate, linear or display flow rate).	

Step	Key	Description	SFC screen
4	CLR (No) DE CONF. MENU I ITEM	Branch: If no change required to the format, press the CLR (No) key twice. To change to the format, press the DE CONF. MENU I ITEM key, and proceed to the next step. *1) When the output format is square root, the display format cannot be changed from flow rate (FLOW).	
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	DISPLAY CONF ENTERED IN SFC ↓ DISPLAY CONF DISP FLOW
6	▲ H NEXT	Press the ▲ H NEXT key several times, or press the CLR (No) key.	DISPLAY DOWN LOAD DATA?
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • Changes the display format to linear or display flow rate.	DISPLAY WORKING... DISPLAY DATA LOADED! DSTJ CONFIG DISPLAY?
8	CLR (No)	Press the CLR (No) key.	DSTJ FIT-1234 READY...

Step	Key	Description	SFC screen
9		Press the SHIFT and ENTER (Yes) keys in that order. • Saves the data in the transmitter.	SHIFT - ↓ DSTJ FIT-1234 WORKING... DSTJ FIT-1234 DATA NONVOLATILE DSTJ FIT-1234 READY...

4-5-5: Display or change indicator display format (Engineering unit / %)

Introduction

This function enables displaying or changing the display format (engineering unit or %) of the indicator.

Procedure

Display or change the display format (engineering unit / %) of the indicator using this procedure:

Step	Key	Description	SFC screen
1	B CONF ▲ H NEXT NON-VOL ENTER (Yes) ▲ H NEXT	Press the B CONF, ▲ H NEXT, NON-VOL ENTER (Yes) and ▲ H NEXT keys, in that order. Displays the currently selected display format (engineering unit or %)	DISPLAY TYPE % (0.0) or DISPLAY TYPE ENG. UNIT (4.5 FIG)
2	CLR (No) (Twice) DE CONF. MENU I ITEM	**Branch:** If no change required to the format, press the CLR (No) key twice. To change the format, press the DE CONF. MENU I ITEM key, and proceed to the next step.	
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	PLAY TYPE ENTERED IN SFC ↓ DISPLAY TYPE % (0.0)

Step	Key	Description	SFC screen
4	▲ H NEXT CLR (No)	Press the ▲ H NEXT key several times, or press the CLR (No) key.	DISPLAY DOWN LOAD DATA?
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Changes the display format to % or engineering unit.	DISPLAY WORKING... DISPLAY DATA LOADE! DSTJ CONFIG DISPLAY?
6	CLR (No)	Press the CLR (No) key	DSTJ FIT-1234 READY...
7	SHIFT NON-VOL ENTER (Yes)	Press the SHIFT and NON-VOL ENTER (Yes) keys, in that order. Saves the data in the transmitter.	SHIFT - ↓ DSTJ FIT-1234 WORKING... DSTJ FIT-1234 DATA NONVOLATILE DSTJ FIT-1234 READY...

4-5-6: Display or change high and low limits of engineering quantity

Introduction

This function is effective only when engineering unit is selected for the indicator display format. Enables setting of the high and low limits of flow rate display, in engineering quantity (engineering unit).

Procedure

Display or change the high and low limits of engineering quantity, which is displayed on the indicator, using this procedure:

Step	Key	Description	SFC screen
1	B CONF ▲ H NEXT NON-VOL ENTER (Yes) ▲ H NEXT	Press the B CONF, ▲ H NEXT, NON-VOL ENTER (Yes) and ▲ H NEXT keys, in that order. • Check that engineering unit is selected.	DISPLAY TYPE ENG. UNIT (4.5 FIG)
2	▲ H NEXT	Press the ▲ H NEXT key. • In <step 4> and <step 5>, set -10.0 for the low limit of engineering quantity.	EULO (at 0%) 0.0000

Step	Key	Description	SFC screen
3	TIME +/−, 1 V, ACT PR 0 Z, SCR PAD ■→, ACT PR 0 Z	Press the TIME +/−, 1 V, ACT PR 0 Z, SCR PAD ■→ and ACT PR 0 Z keys, in that order.	EULO (at 0%) -10.0
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • The low limit of engineering quantity (-10.0) has been set.	EULO (at 0%) ENTERED IN SFC ↓ EULO (at 0%) -10.0
5	▲ H NEXT	Press the ▲ H NEXT key • In <step 6> and <step 7>, set 50.0 for the high limit of engineering quantity.	EUHI (at 100%) 60.0
6	5 S, ACT PR 0 Z, SCR PAD ■→, ACT PR 0 Z	Press the 5 S, ACT PR 0 Z, SCR PAD ■→ and ACT PR 0 Z keys, in that order.	EUHI (at 100%) 50.0

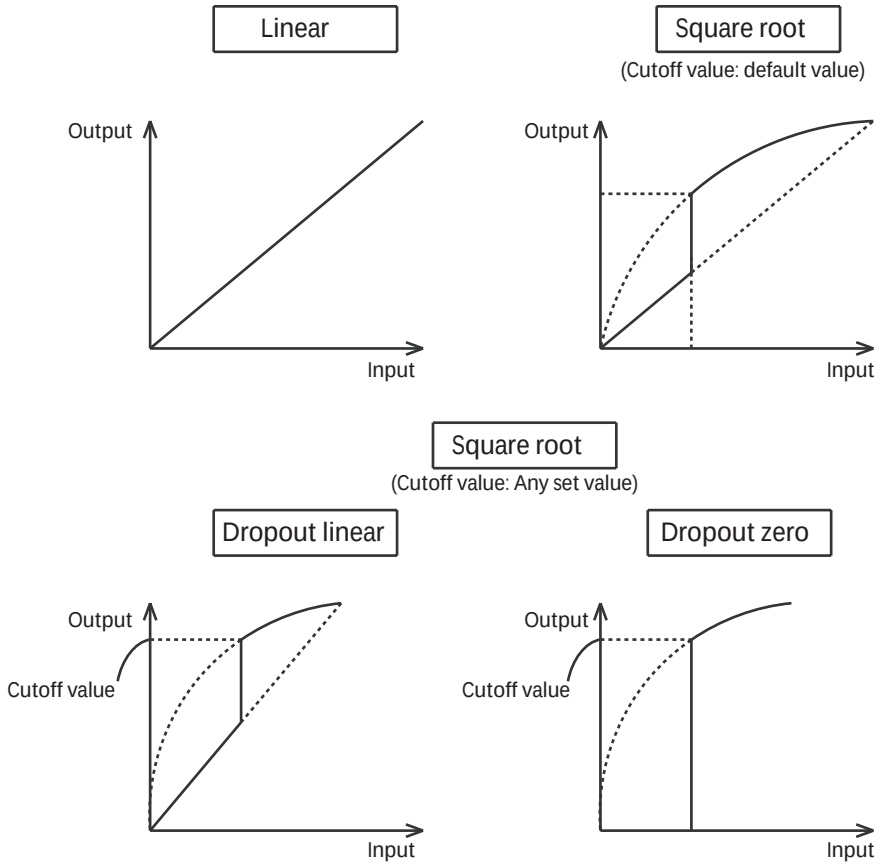
Step	Key	Description	SFC screen
7	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • Set the high limit of engineering quantity (50.0).	EUHI (at 100%) ENTERED IN SFC ↓ EUHI (at 100%) 50.0
8	▲ H NEXT NON-VOL ENTER (Yes)	Press the ▲ H NEXT key. Press the NON-VOL ENTER (Yes) key. • Changes the high and low limits of engineering quantity to the set values.	DISPLAY DOWN LOAD DATA? DISPLAY WORKING... ↓ DISPLAY DATA LOADED! DSTJ CONFIG DISPLAY?
9	CLR (No)	Press the CLR (No) key	DSTJ FIT-1234 READY...
10	SHIFT ^ NON-VOL ENTER (Yes)	Press the SHIFT ^ and NON-VOL ENTER (Yes) keys in that order. • Save the data in the transmitter.	SHIFT- DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE DSTJ FIT-1234 READY...

4-5-7: Display or change low flow cutoff value

Introduction

This function is effective only when square root is selected for the output format. When the flow rate falls below a fixed value (valid range of low flow cutoff value: 0 to 20%), the flow rate is processed as zero.

Also, a dropout format (linear/zero) and a flow rate mode (DEFAULT / EXPAND) can be selected.



Flow rate mode
DEFAULT: Ordinarily, this mode is selected, in most cases.
EXPAND: This mode is selected when the range is expanded. For example, when the range is set near the normal flow rate, or when reverse flow rate output must be obtained using a reversible orifice.

Figure 4-4 Relationship between input and output (%) determined by low flow cut-off value setting

~Note *Flow rate mode*

DEFAULT: Ordinarily, this mode is selected, in most cases.

EXPAND: This mode is selected when the range is expanded. For example, when the range is set near the normal flow rate, or when reverse flow rate output must be obtained using a reversible orifice.

Procedure

Set a low flow cutoff value, and select a dropout format (linear / zero) and a flow rate mode (DEFAULT / EXPAND) using this procedure:

Low flow cutoff value setting

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key	DSTJ CONFIG CONFORM?
2	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • Ensure that the currently selected output format is square root. • If the output format is linear, change it to square root, following the instructions in 5-5-3.	CONFORM SQUARE ROOT (Square root)
3	▲ H NEXT	Press the ▲ H NEXT key. • Display the current cutoff value (Default value (7.1%) or any set value.)	CUT OFF DEFAULT or CUT OFF 10.00 %
4		Branch: If no change is required to the value, press the CLR (No) key twice. To change the value, press the DE CONF. MENU ITEM key, and proceed to the next step. • To set the default value, proceed to <step 12>. To set a non-default value (15%) for the low flow cutoff value, proceed to <step 5> and <step 6>.	CUT OFF %
5	1 V 5 S	Press the 1 V and 5 S keys (numeric), in that order.	CUT OFF 15 %

Step	Key	Description	SFC screen
6	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • Set the low flow cutoff value (15%)	CUT OFF ENTERED IN SFC ↓ CUT OFF 15 %

Dropout format (linear or zero) setting procedure

How to select linear:

Step	Key	Description	SFC screen
7	▲ H NEXT	Press the ▲ H NEXT key. • Displays the currently selected dropout format.	CUT OFF DROPOUT = LIN or CUT OFF DROPOUT = ZERO
8	DE CONF. MENU I ITEM	• To change the format, press the DE CONF. MENU I ITEM key to display the setting screen. • If no change required to the format, go to <step 10>	CUT OFF DROPOUT = LIN
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • Set the dropout format (linear).	CUT OFF ENTERED IN SFC ↓ CUT OFF DROPOUT = LIN

Flow rate mode (DEFAULT or EXPAND) setting procedure

How to select DEFAULT:

Step	Key	Description	SFC screen
10	▲ H NEXT	Press the ▲ H NEXT key. • Displays the currently selected flow rate mode.	CUT OFF MODE = DEFAULT (Forward direction) or CUT OFF MODE = EXPAND (Both directions)

Step	Key	Description	SFC screen
11	DE CONF. MENU / ITEM	• To change the mode, press the DE CONF. MENU / ITEM key, to display the setting screen. • If no change required to the format, go to <step 13>	CUT OFF MODE = DEFAULT
12	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	CUT OFF ENTERED IN SFC ↓ CUT OFF MODE = DEFAULT
13	▲ H NEXT	Press the ▲ H NEXT key.	CUT OFF DOWNLOAD DATA?
14	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. Set the data.	CONFORM WORKING... ↓ DSTJ CONFIG CONFORM
15	CLR (No)	Press the CLR (No) key.	DSTJ FIT-1234 READY...
16	SHIFT ^ NON-VOL ENTER (Yes)	Press the SHIFT ^ and NON-VOL ENTER (Yes) keys in that order. Save the data in the transmitter.	SHIFT- DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE DSTJ FIT-1234 READY...

4-5-8: Display or change low/high limits and span of set range

Procedure

Display or change the differential pressure corresponding to the low/high limits and the span of the set range using this procedure.
Assumes the following current values and new values:
Low-limit value: Change 0.0000 kPa to 50.00 kPa.
High-limit value: Change 20.00 kPa to 60.00 kPa
Span: Change 50.00 kPa to 40.00 kPa.

Remarks:

Span is automatically determined by the low and high limit values. (Display only)

Always change the low limit value first.

How to display low/high limit values and span

Step	Key	Description	SFC screen
1	LRV E 0%	• Press the LRV E 0% key, to display the low limit value.	LRV FIT-1234 0.0000 kPa
	URV F 100%	• Press the URV F 100% key, to display the high limit value.	URV FIT-1234 50.00 kPa
	URL SPAN Y	• Press the URL SPAN Y key, to display the span.	SPAN FIT-1234 50.00 kPa
2	CLR (No)	If no change required to the displayed data, press the CLR (No) key.	

How to change low/high limit values

Step	Key	Description	SFC screen
3	URV F 100%	Press the URV F 100% key, to display the low limit value	LRV FIT-1234 0.0000 kPa

Step	Key	Description	SFC screen
4	2 W ACT PR 0 Z	Press the 2 W and ACT PR 0 Z keys (numeric), in that order.	LRV FIT-1234 20_ kPa
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • Set the low limit value to 20.00 kPa.	LRV FIT-1234 WORKING... ↓ LRV FIT-1234 20.00 kPa
6	URV F 100%	Press the URV F 100% key to display the high limit value.	URV FIT-1234 50.00 kPa
7	6 T ACT PR 0 Z	Press the 6 T and ACT PR 0 Z keys (numeric), in that order.	URV FIT-1234 60 kPa
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • The high limit value was set to 60.00 kPa.	URV FIT-1234 WORKING... ↓ URV FIT-1234 60.00 kPa
9	SHIFT ^ NON-VOL ENTER (Yes)	Press the SHIFT ^ and NON-VOL ENTER (Yes) keys, in that order. Saves the data in the transmitter.	SHIFT - DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE

4-5-9: Display or change engineering unit for measured pressure

Valid engineering units

The following engineering units are valid. They are displayed in this sequence (or in the reverse sequence) using key operation.

- kPa → MPa → hPa → Pa → mbar → bar → inH_2O → inHg → PSI → mmH_2O → mH_2O → kg/cm2 → g/cm2 → mmHg → kPa → .....

Remarks

When the engineering unit is changed, the displayed differential pressure and the output range are automatically changed to the corresponding values.

Procedure

How to display and change the engineering unit:

It is assumed that the currently selected unit is kPa.

Step	Key	Description	SFC screen
1	D UNITS	Press the D UNITS key, to display the low limit value	UNIT FIT-1234 kPa
2	▲ H NEXT D UNITS ▼ L PREV	To change the unit, press the ▲ H NEXT key or the D UNITS key, successively, until the desired value is displayed. Press the ▼ L PREV key to return to the previous unit. • Display after pressing the D UNITS key or the ▲ H NEXT key. • Display after pressing the ▼ L PREV key.	UNIT FIT-1234 MPa UNIT FIT-1234 mmHg

4-5-10:Display or change damping time constant

Introduction

If, due to pulsation of differential pressure under some flow conditions, the transmitter output is unstable and difficult to read, the output can be stabilized by increasing the damping time constant.

Valid damping time constants

The following damping time constants are valid. They are displayed in this sequence (or in the reverse sequence) using key operation. THe actual response time is lower than the value by about 0.4 second. The unit is second.

• 0.0 → 0.16 → 0.32 → 0.48 → 1.0 → 2.0 → 4.0 → 8.0 → 16.0 → 32.0

Procedure

How to display and change the damping time constant:

It is assumed that the currently set value is 1.0 second.

Remarks:

When changing the damping time constant, select the next higher value and check output fluctuations.

Step	Key	Description	SFC screen
1		Press the  key, to display the low limit value	DAMP FIT-1234 1.0 s
2	 	To change the unit, press the  key or the  key, successively, until the desired value is displayed. • Display after pressing the  key. • Display after pressing the  key	DAMP FIT-1234 WORKING... ↓ DAMP FIT-1234 2.0 s UNIT FIT-1234 0.48 s

Step	Key	Description	SFC screen
3		Press the SHIFT and ENTER (Yes) keys, in that order. Save the data in the transmitter.	SHIFT - DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE

4-5-11:Display burnout direction

Processing after error detection

Three types of burnout function are available to notify an abnormal state:

1. No burnout direction: The transmitter outputs an abnormal value.
2. Upscale: The transmitter increases the output to the high limit (regardless of the input value).
3. Downscale: The transmitter decreases the output to the low limit (regardless of the input value).

The standard specification for this transmitter is no burnout direction. When the transmitter goes into an abnormal state, its details can be displayed by operating the SFC. When it recovers to the normal state, it automatically outputs a normal value.

Select a non-standard burnout direction. Select the corresponding optional specification.

• U: Upscale

• D: Downscale

Transmitters keep outputting a burnout value even after recovery from an abnormal state.

Remarks:

When an abnormality occurs, a message is displayed on the SFC data display window regardless of the burnout type.

Procedure

How to display the burnout direction:

Step	Key	Description	SFC screen
1		Press the  key	SHIFT -
2		Press the  key. NON-B/O is displayed for the model of no burnout direction. Displays UPSCALE and DOWNSCALE for the corresponding models.	DSTJ FIT-1234 F/SAFE NON-B/O

4-5-12:Displaying PROM No.

Introduction

The PROM No. of this transmitter is marked on its name plate. The PROM No. can be confirmed using the SFC.

Procedure

How to check the PROM No.:

It is assumed that the PROM No. is 20000000000.

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key	DSTJ FIT-1234 CONFORM?
2	▼ L PREV (Twice)	Press the ▼ L PREV key twice.	DSTJ FIT-1234 PROM No.
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	PROM NO. 2000000000
4	CLR (No) (Twice)	After checking the PROM No., press the CLR (No) key twice.	DSTJ FIT-1234 READY...

4-5-13:Display sensor temperature

Introduction

Display the sensor temperature of this transmitter using the SFC.

Procedure

How to check the sensor temperature:

It is assumed that the sensor temperature is 27°C.

Step	Key	Description	SFC screen
1		Press the  key	DSTJ FIT-1234 CONFORM?
2	 (Four times)	Press the  key four times.	DSTJ FIT-1234 SENSOR TEMP?
3		Press the  key.	SENSOR TEMP WORKING... ↓ SENSOR TEMP T=27°C (80°F)
4	 (Twice)	After checking the temperature, press the  key twice.	DSTJ FIT-1234 READY...

4-5-14:Display software version

Introduction

Display the software versions of this transmitter and the SFC using the SFC.

Procedure

How to check the software versions:

It is assumed that the software versions are, as follows:

SFC: 7.3
Transmitter: B.1

Step	Key	Description	SFC screen
1		Press the  key.	SHIFT-
2		Press the  key. When the SFC is not connected to the transmitter. When the SFC is connected to the transmitter	S/W VER FIT-1234 SFC=7.3 S/W VER FIT-1234 SFC=7.3 XMTR=B.1
3		After checking the software versions, press the  key.	DSTJ FIT-1234 READY...

4-5-15:Displaying an changing sealed liquid temperature correction function

Introduction

Yamatake's unique sealed-liquid temperature correction function (patent pending) minimizes the influence of ambient temperature changes on transmitter performance.

Procedure

This function implemented by inputting the height between the flanges of the tank on which the transmitter is mounted. If no inter-flange height is specified in your order, "Height=0m" is assumed. In this case, the function is no implemented in your transmitter.

Check and set the sealed liquid temperature correction function using this procedure.

The height between flanges is changed from 1 m to 2 m, in this example.

Step	Key	Description	SFC screen
1	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM?
2	▲ H NEXT or ▼ L PREV	Press the ▲ H NEXT key three times. Or, press the ▼ L PREV key four times	DSTJ CONFIG HEIGHT?
3	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The currently set inter-flange height is displayed. If the height is 0, the correcting function is not executed.	DSTJ CONFIG WORKING... HEIGHT 1.000 m
4	2 W	Press the 2 W key.	HEIGHT 2 m

Step	Key	Description	SFC screen
5	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. The inter-flange height for temperature correction was changed to 2 m.	HEIGHT WORKING...
6	CLR (No)	After checking the setting, press the CLR (No) key twice.	DSTJ FIT-1234 READY...

4-6: Constant current source mode

4-6-1: Set constant current source mode

Introduction

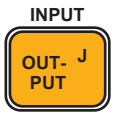
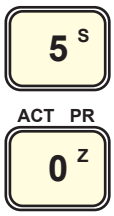
Set the transmitter to output constant current within the range of 4 mA (0%) to 20 mA (100%). This setting is called constant current source mode.

This function is convenient for loop checking.

Procedure

How to set the constant current source mode:

It is assumed that the output is fixed at 50% (12 mA).

Step	Key	Description	SFC screen
1		Press the  key. • Displays the current output.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 10.00 %
2		Press the  and  keys (numeric), in that order.	OUTPUT FIT-1234 50_
3		Press the  key. • The transmitter output 12 mA (50%). • The # mark indicates that the constant current source mode obtains.	OUTPUT FIT-1234 WORKING... OUTPUT FIT-1234 50.00 % #

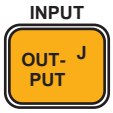
Remarks

Release the constant current source mode using this procedure. It is automatically released when no SFC is operated for more than 10 minutes.

4-6-2: Release constant current source mode

Procedure

How to release the constant current source mode:

Step	Key	Description	SFC screen
1		Press the  key. • Displays the current output.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 50.00 % #
2		Press the  key. Releases the constant current source mode. • Check that the # mark disappears.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 READY...

4-7: Wiring a memo

4-7-1: Recording in scratch pad 1

Introduction

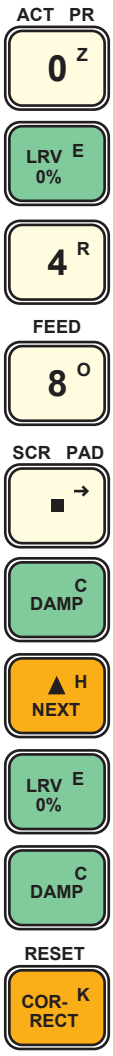
This function enables recording of memos in the SFCs scratch pad. Scratch pads 1 and 2 are available for notes from one technician to another, for specific instruments, for example. Scratch pads are common to most data acquisition systems.

Procedure

How to record memo in scratch pad 1:

Here, 99-4 ZERO CHECK (Zero point was checked in April 1999) is recorded.

Step	Key	Description	SFC screen
1		Press the SHIFT and SCR PAD keys, in that order.	SHIFT- DSTJ FIT-1234 WORKING... ↓ SCR PADS1 XXXXXXXXXXXXX
2		Press the PRINT 9 P, PRINT 9 P, TIME +/- and 4 R keys, in that order.	SCR PADS1 99-4 XXXXXXXXXXX

Step	Key	Description	SFC screen
3		Press the ALPHA and SCR PAD keys, in that order.	SCR PADS1 99-4 XXXXXXXXXXX SCR PADS1 99-4 XXXXXXXXXXX
4		Press the ACT PR 0 Z, LRV E 0%, 4 R, FEED 8 O, SCR PAD, C DAMP, H NEXT, LRV E 0%, C DAMP and RESET K COR- RECT keys, in that order.	SCR PADS1 99-4 ZERO CHECK
5		Press the NON-VOL ENTER (Yes) key. • Recording in scratch pad 1 has been completed.	SCR PADS WORKING... ↓ SCR PADS1 99-4 ZERO CHECK

Step	Key	Description	SFC screen
6		Press the  key to release scratch pad 1.	DSTJ FIT-1234 READY...

4-7-2: Recording in scratch pad 2

Procedure

How to record memo in scratch pad 2:

Step	Key	Description	SFC screen
1		Press the SHIFT and SCR PAD keys, in that order. Displays the contents of scratch pad 1.	SHIFT- DSTJ FIT-1234 WORKING... ↓ SCR PADS1 96-8 ZERO CHECK (or XXXXXXXXX)
2		Press the H NEXT keys.	SCR PADS2 XXXXXXXXXXXXXXX
3		Record information using the same procedure as scratch pad 1.	
4		Press the CLR (No) key to release scratch pad 2.	DSTJ FIT-1234 READY...

Chapter 5: Maintenance and traboulesshooting

Overview

This section explains the maintenance of the ST3000 Ace and a range of interesting ways to ensure that your transmitters performance goals may be continuously met during its operating life.

Instructions for saving data in this transmitter, disassembly and assembly procedures, output checking and calibration procedures, and troubleshooting procedures.

At the start of operation or during operation, deal with performance problems by following these procedures. If you cannot fix the problem, it is possible that there is a problem with the product itself and you should contact your Yamatake representative immediately.

5-1: Zero adjustment

5-1-1: Overview

Introduction

Zero adjustments can be classified as:

1. Calibrating the zero point based on the current input value
2. Setting the set range (LRV/URV) based on the current input value.

Items for adjustment

The two adjustment methods are clearly delineated, below. Explanations of these procedures are found, on subsequent pages.

Zero adjustment for use under uniform pressure (with SFC)

Balance adjustment using sealing liquid (with SFC)

Zero adjustment for use as a level gauge (with SFC)

Zero adjustment using an external zero adjustment mechanism (option)

5-1-2: Zero adjustment under uniform input pressure (with SFC)

Point

When a transmitter is used, change the applied input pressure to uniform pressure before performing zero adjustment. In some cases, factors such as the mounting posture of the transmitter prevent indication exactly at 0%. Perform zero adjustment using these procedures. However, the zero point may also be correctly adjusted by changing the transmitters orientation.

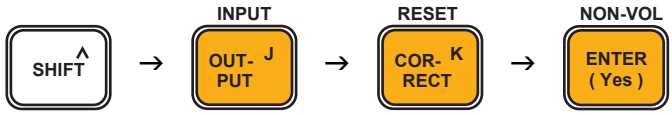
Procedure

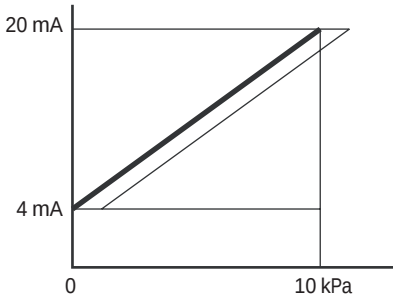
Calibrate the zero point based on the current input value.

The current input value as zero uniform pressure is the differential pressure that is applied to the sensor due to the influence of mounting posture, etc.

Rewrite the factory set zero point calibration data. This operation does not change the LRV or the URV. If the current input value exceeds 3.125% of the transmitters measurement range (URL-LRL), a warning message (*1) for this operation is displayed.

Key-pad operations:





Detailed procedures using an SFC as found in “3-3-1-1: Preparation for measurement” on page 3-12.

*1. Press the 

key after display of warning message Calibration value over OK?

Zero calibration normal # is displayed.

5-1-3: Zero adjustment based on input pressure corresponding to LRV (with SFC)

Point

Even if a transmitter itself has a correct zero point under uniform pressure, it sometimes does not output zero due to unbalanced sealing liquid in the connecting pipe. Adjust the balance using these procedures.

Perform this adjustment after ensuring that the sealing liquid level is sufficiently high for ordinary measurement state.

Procedure

Set the LRV (low limit of range corresponding to 0% output) based on the current input value

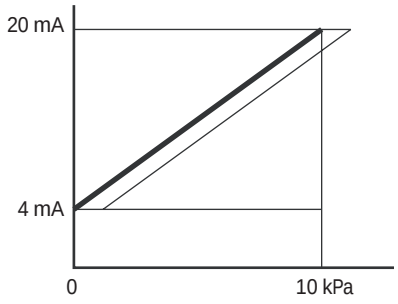
The current input value, which is the differential pressure applied to the sensor, should be set for the LRV. Without changing the span, this setting automatically changes the LRV and the URV. The factory set zero point calibration data is not rewritten.

(Example) Current input value = 0.025 kPa, LRV = 0 kPa, URV = 10 kPa

The result of the key-pad operation will be, as follows:

LRV = 0.025 kPa, URV = 10.025 kPa

Key-pad operations:



Detailed procedures using an SFC are found in “3-9: Zero-span adjustment with input pressure equivalent to range” on page 3-52.

5-1-4: Zero adjustment based on actual level (with SFC)

Point

When a differential pressure transmitter is used as a level gauge, the zero point can be adjusted by either one of two methods. In both cases, adjust the zero point by changing the LRV and the URV. Refer to 2 Setting the set range (LRV/URV) based on the current input value in “5-1-1: Overview”. The factory set zero point calibration data is not rewritten.

Method 1

Set the LRV by setting the current input value for 0%.

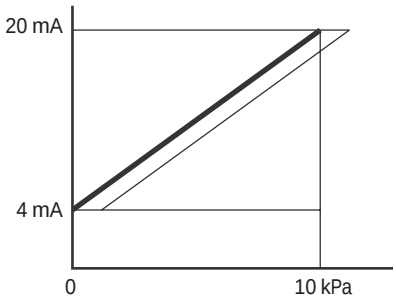
Maintain same liquid level for which 0% is the output. Set the zero point based on this input value.

Example: Current input value = 0.025 kPa, LRV = 0 kPa, URV = 10 kPa

The result of the key-pad operation will be as follows:

LRV = 0.025 kPa, URV = 10.025 kPa

Key-pad operations:



Detailed procedures using an SFC are found in “3-9: Zero-span adjustment with input pressure equivalent to range” on page 3-52.

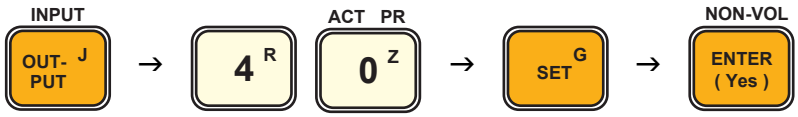
Method 2

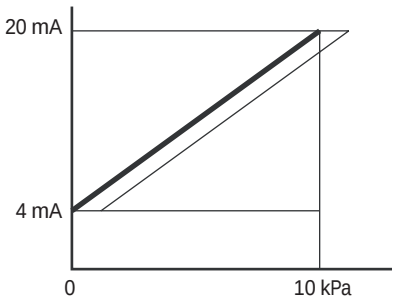
Set the LRV by setting the current input value for the specified value

Example: When the transmitter output is 35%, it can be adjusted to the current liquid level (e.g. 40%) obtained with a level gauge, using these key-pad operations.

LRV = 0 kPa, URV = 10 kPa are changed to LRV = 0.5 kPa, URV = 10.5 kPa

Key-pad operations:



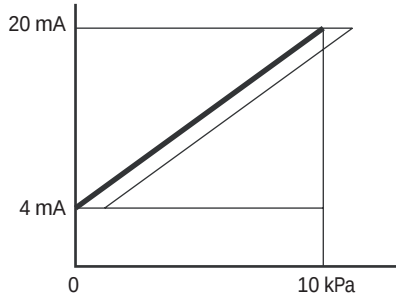


Detailed procedures using an SFC are found in “3-8: Zero-point adjustment --- Based on actual liquid level” on page 3-50.

5-1-5: Zero adjustment using external zero adjustment mechanism (option)

Point

2. Setting the set range (LRV/URV) based on the current input value in 5-1-1 Overview apply to zero adjustment using an external zero adjustment mechanism. Therefore, the LRV and the URV are automatically written by this operation. The factory set zero point calibration data is not rewritten.



The adjusting procedure is found in “3-10: External zero adjustment (option)” on page 3-54.

5-2: Saving and restoring data

5-2-1: Saving data

Introduction

Save the set values and states and other data stored in this transmitter to the SFC. Restore data to other transmitters.

This function is useful when replacing a transmitter. It saves input work and prevents key-pad errors.

An SFC has memory capacity for one transmitter only. Restore all data to a transmitter, before saving data from another transmitter.

Note that the data saved using this procedure is erased by turning off the SFC.

Always restore data to a target transmitter, before turning off the SFC.

Procedure

How to save data:

Step	Key	Description	SFC screen
1	DE READ A ID	Press the DE READ A ID key.	DSTJ TAG NO. LIN DP FIT-1234
2	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM?
3	▲ H NEXT	Press the ▲ H NEXT key to display the screen shown, on the right.	DSTJ CONFIG SAVE/RESTORE
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	SAVE/RESTORE SAVE DATA?

Step	Key	Description	SFC screen
5		Press the  key. • Saving has been completed. • Release the save mode by step 6.	SAVE DATA WORKING... ↓ SAVE DATA DATA SAVED ↓ DSTJ CONFIG SAVE/RESTORE?
6		Press the  keys. The save mode is released.	DSTJ FIT-1234 READY...

5-2-2: Restoring data

Procedure

How to restore data:

Step	Key	Description	SFC screen
1	DE READ A ID	Press the DE READ A ID key.	DSTJ TAG NO. LIN DP FIT-1234
2	B CONF	Press the B CONF key.	DSTJ CONFIG CONFORM?
3	▲ H NEXT	Press the ▲ H NEXT key to display the screen shown, on the right.	DSTJ CONFIG SAVE/RESTORE?
4	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	SAVE/RESTORE SAVE DATA?
5	▲ H NEXT	Press the ▲ H NEXT key.	SAVE/RESTORE RESTORE DATA?
6	CLR (No)	Press the CLR (No) keys. • The save mode is released. • Restoring has been completed. Release the restore mode by step 7.	RESTORE DATA WORKING... ↓ RESTORE DATA DATA RESTORED
7	CLR (No)	Press the CLR (No) keys twice. • The restore mode has been released.	DSTJ FIT-1234 READY...

5-3: Recovery of calibration data/ Status Record.(New functions)

Introduction

You can use the following functions by using the new communicator “CommPad”.

- These functions are effective later than Ver.B.6 of the transmitter’s software version.
- To operate these functions, please connect the CommPad.
- The following shows the methods of operating CommPad.

~Note *Please connect the Commpad by the method of “3-1-1: Connecting SFC” .*

Please refer to “CM2-CFN100-2001 Smart Field Communicator CommPad (Common Edition)User's Manual” and “CM2-CFN100-2002 Smart Field Communicator CommPad (Smart Transmitter Edition) to confirm the detailed starting and operation method”

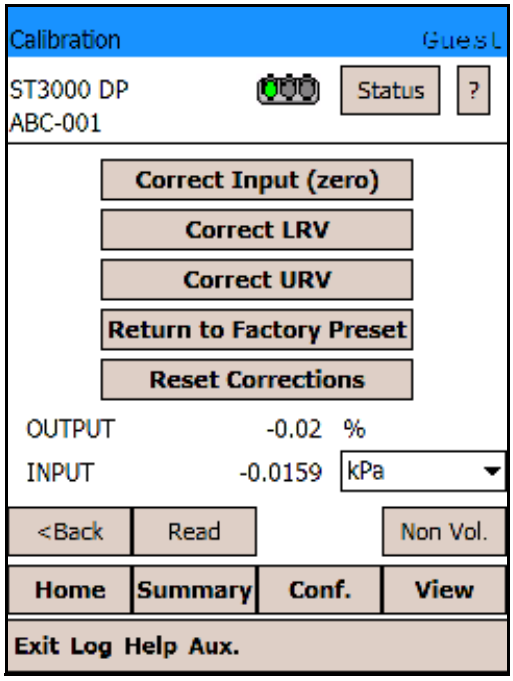
⚠ CAUTION

- Make sure that the controller in the control loop is in manual mode before starting communication.When you tap on "Start," the CommPad starts digital communication to the connected instrument by generating an alternating current signal (4 mA/20 mA). If a control valve is connected in the control loop, a malfunction may result. Please be extra careful.

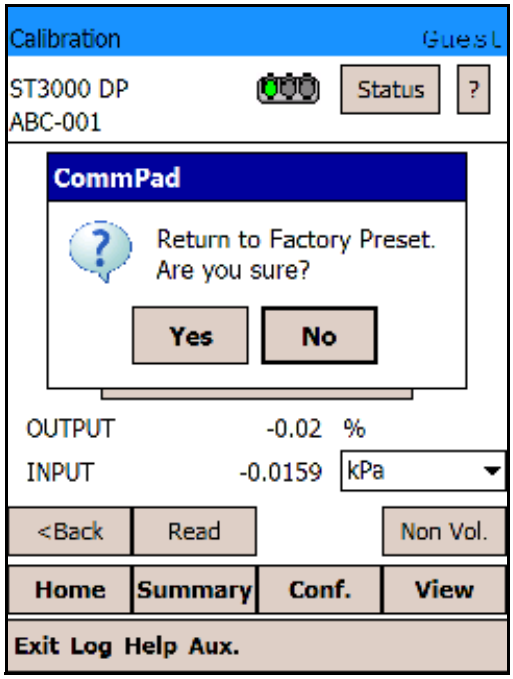
- Return to Factory Preset: Revert the caribrated data to the value calibrated at the factory.
- Status Record: Displays status record saved in the Transmitter.
- Load Zero Calibration Record: Displays the zero calibration record inside the CommPad saved when zero calibration of the Transmitter is performed on the CommPad.
- Zero Calibration Data in Device: Displays the zero point calibration data saved in the Transmitter.

5-3-1: Return to Factory Preset

(1) At the “Summary screen” of the CommPad, tap on “Return to Factory Preset” .



(2) The confirmation message appears. Tap on "Yes."



(3) Calibrated data is Retured to Factory Preset.

5-3-2: Status Record

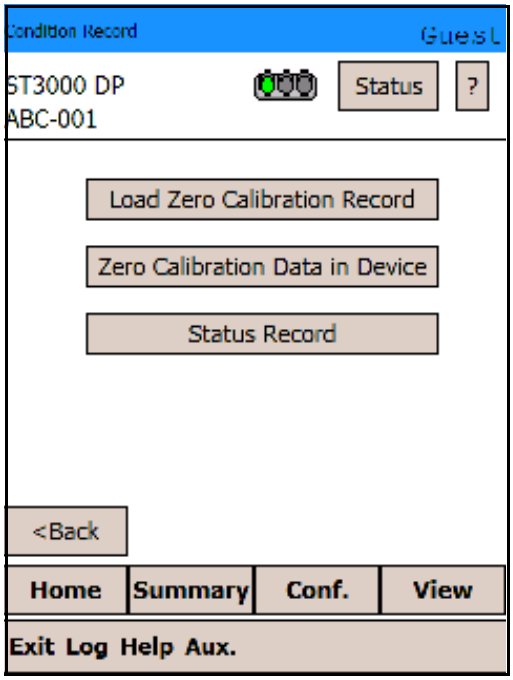
You can confirm the status message that occurved in the past. (It is displayed only the message, not displayed the number of times.)

Table 5-1 status message and meaning

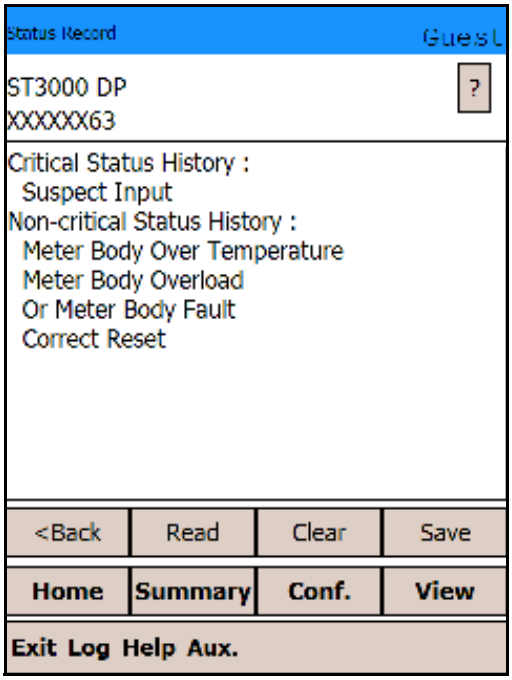
	Status message	Meaning
Status	Invalid database	Configuration data and/or calibration data is corrupt.
	Chara. PROM Fault	PROM Function Fault
	Suspect Input	- Input data error - Problem in the process - Transmitter Fault
	MDU/DAC Fault	Electronic parts fault
	NVM Fault	Electronic parts fault
	RAM Fault	Electronic parts fault
	ROM Fault	Electronic parts fault
Non-critical status	Meter Body Over Temperature	Meter body temperature is too high.
	Excess Zero Correct	The Zero correction factor is outside the acceptable limits for accurate operation.
	Excess Span Correct	The Span correction factor is outside the acceptable limits for accurate operation.
	Meter Body Overload or Meter Body Fault	- The input pressure exceeds two times the upper range limit of the transmitter. - The transmitter fault
	Correct Reset	Calibration data is initialized.
	External Switch Fault	External switch fault

At the “Summary screen” of the CommPad, tap on “Conf” → “Maintenance” → “Condition Record” , You can see the following display.

(1) To display the previous records of the status of the Transmitter, tap on the "Status Record" button.

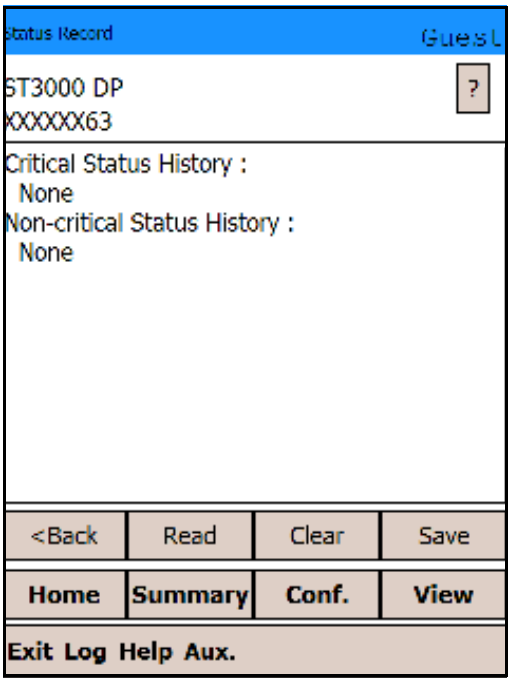


(2) The previous records of the status appear on the screen.

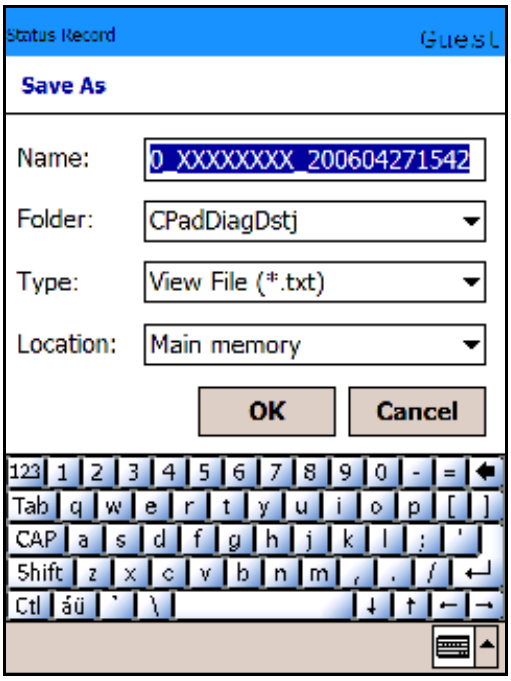


For more information on the messages, see "6: Troubleshooting."
Some of the messages in "6: Troubleshooting" will not be recorded as Status Record.

(3) If no critical failure or instrument status occurred in the past, "None" appears on the screen as below.



(4) By tapping on "Save," you can save the displayed data. The file to be saved is automatically named. Tap on "OK" without changing anything.



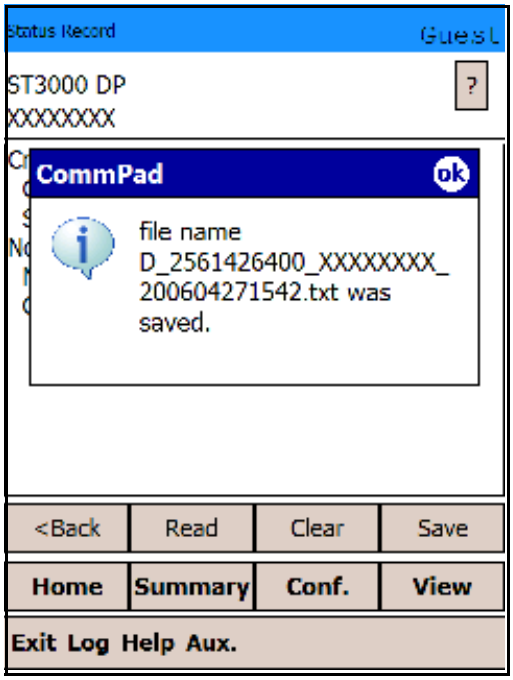
The name of an automatically-named saved file is composed as follows:

D_(PROMID)_(tag name)_(year/month/day/hour/minute).txt

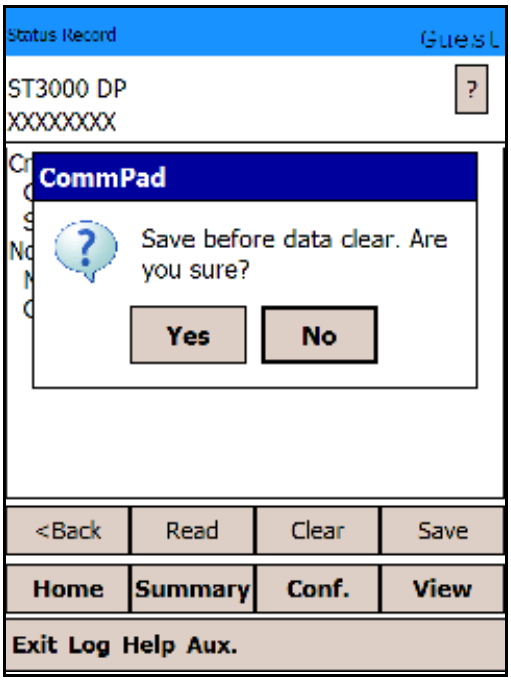
If either of the following 2 characters that cannot be used in a Windows file name is contained in the tag name, the character(s) will be converted automatically as follows:

" . " (dot) → " _ " (underscore)
" / " (slash) → " ~ " (tilde)

(5) Tap on "ok."



(6) To clear the status record, tap on the "Clear" button. The "Save" screen appears. If you need to save the data before clearing it, tap on "Yes." If you do not need to save the data, tap on "No." The confirmation message will appear. Tap on "Yes."



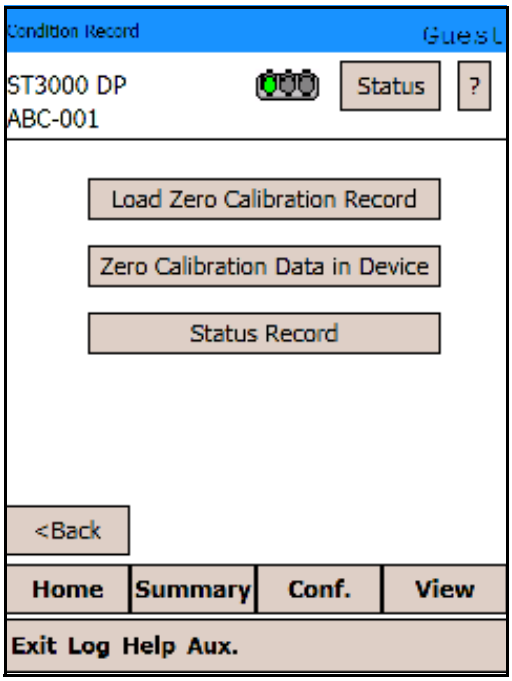
(7) The data of the saved list file can be copied to your PC and viewed on the PC. You can read the file with a text editor or other software.
The data will look like the example shown below.

```
Status Record
2006/05/19 08:38
Critical Status History:
    Chara. PROM Fault
    Suspect Input
    ROM Fault
    Invalid Database
Non-critical Status History:
    Meter Body Over Temperature
    Meter Body Overload
    Or Meter Body Fault
    Correct Reset
```

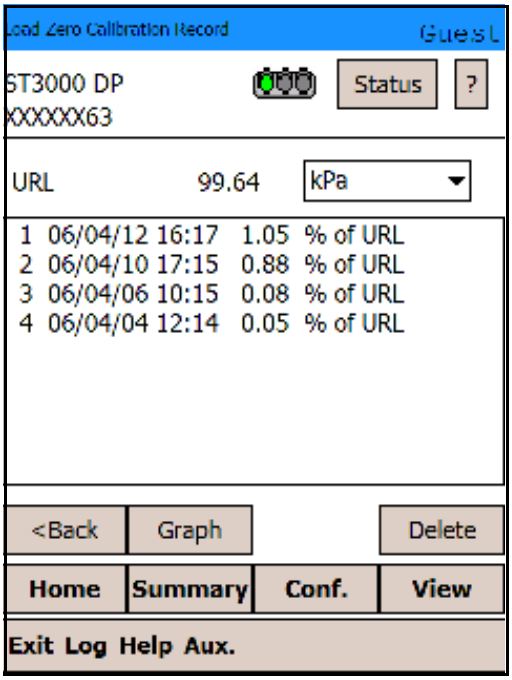
5-3-3: Load Zero Calibration Record

At the “Summary screen” of the CommPad, tap on “Conf” → “Maintenance” → “Condition Record” , You can see the following display.

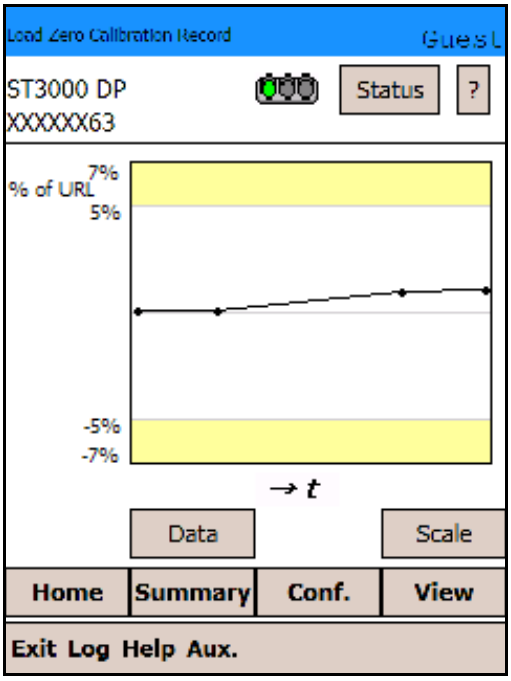
(1) To display the record of the zero calibration amounts saved inside the CommPad, tap on the "Load Zero Calibration Record" button.



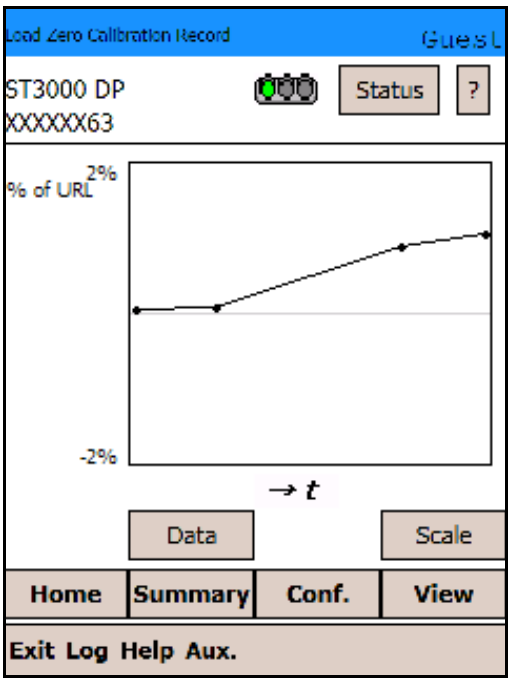
(2) Saved data appears on the screen. The calibrated amounts at the zero point against the maximum value of the set range (URL) for each instrument are displayed in percentage terms.
Each value shows how much the calibrated value shifted from the value at the factory.



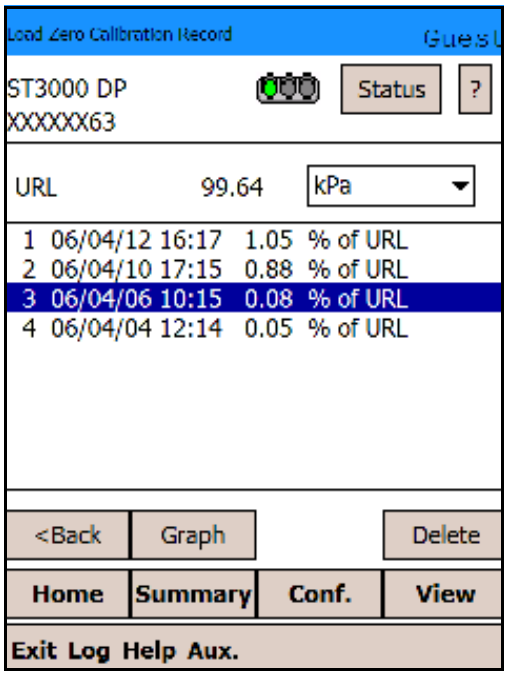
(3) To change the display to a graphical form, tap on the "Graph" button.



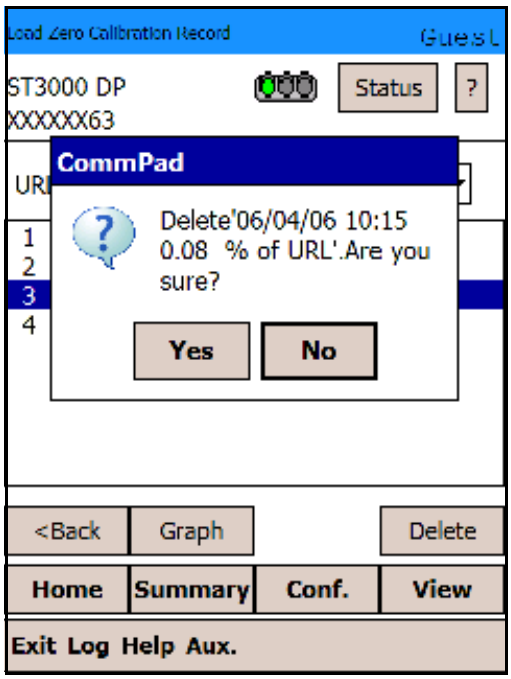
(4) Tapping on the "Scale" button will change the scale according to the maximum value of the data.



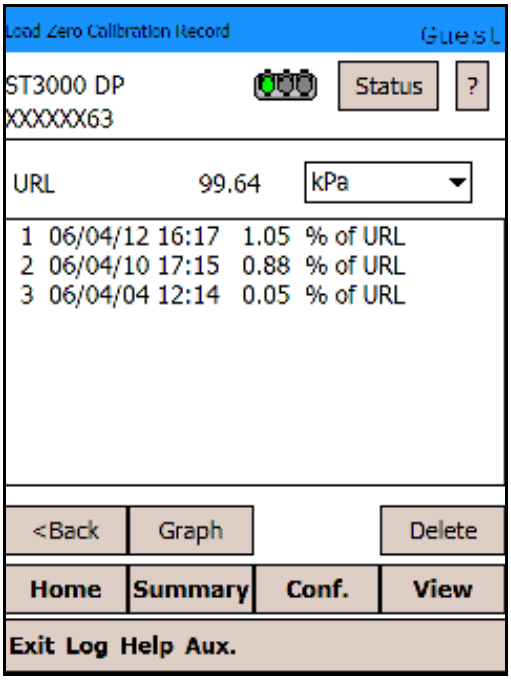
(5) You can delete data. Tap on the data you want to delete to highlight it, and tap on the "Delete" button.



(6) The confirmation message appears. Tap on "Yes."



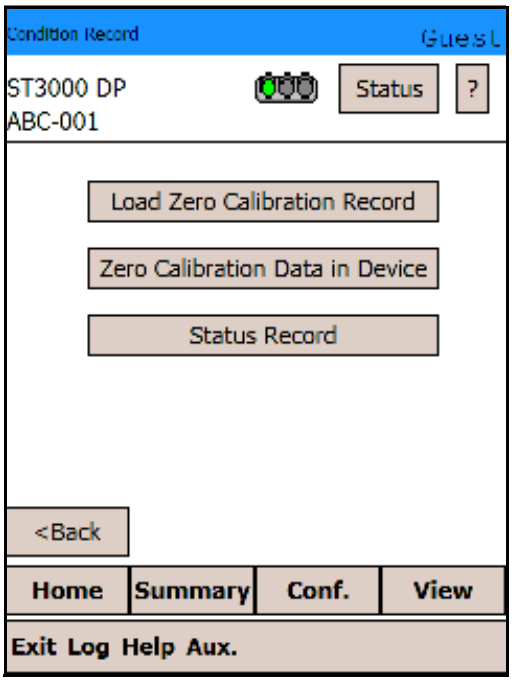
(7) The data is deleted.



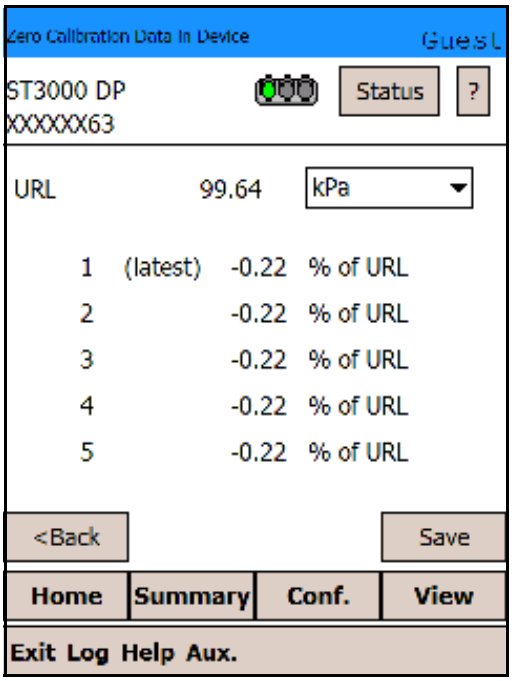
5-3-4: Zero Calibration Data in Device

At the “Summary screen” of the CommPad, tap on “Conf” → “Maintenance” → “Condition Record” , You can see the following display.

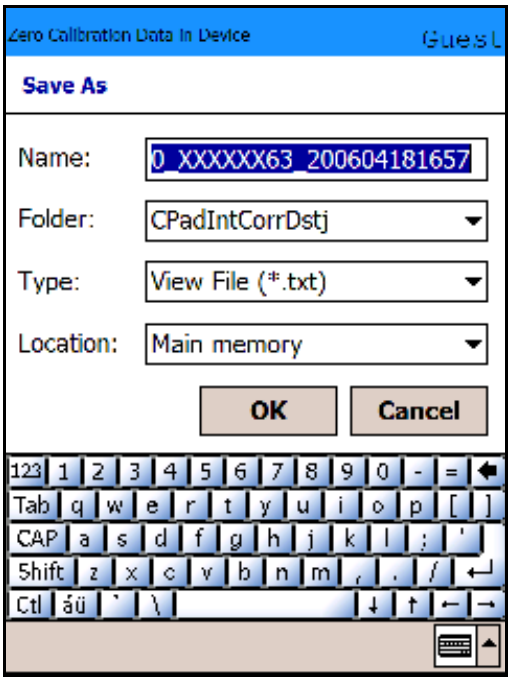
(1) To display the record of the zero calibration amounts data saved in the Transmitter, tap on the "Zero Calibration Data in Device" button.



(2) You can save up to five different data sets.



(3) By tapping on "Save," you can save the displayed data.
The file to be saved is automatically named. Tap on "OK" without changing anything.



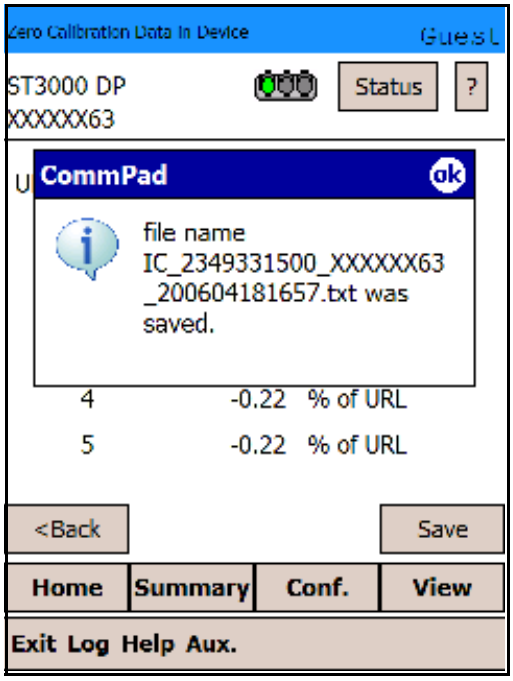
The name of an automatically-named saved file is composed as follows:

IC_(PROMID)_(tag name)_(year/month/day/hour/minute).txt

If either of the following 2 characters that cannot be used in a Windows file name is contained in the tag name, the character(s) will be converted automatically as follows:

" . " (dot) → " _ " (underscore)
" / " (slash) → " ~ " (tilde)

(4) Tap on "ok."



The data of the saved list file can be copied to your PC and viewed on the PC. You can read the file with a text editor or other software.
The data will look like the example shown below.

```
Zero Calibration Data in Device
2006/05/19 08:37
1(latest)   -0.21   % of URL
2           -0.21   % of URL
3           -0.23   % of URL
4           -0.23   % of URL
5           -0.22   % of URL
```

5-4: Disassembly and assembly

5-4-1: Before you start

⚠ WARNING

- Never open the case cover while this transmitter is ON in a hazardous location (specified in "2-1-2: Environmental conditions for explosion-proof transmitter" on page 2-3).
- Handle with special care explosion-proof pressure transmitter. If may lose its explosion-proofing performance due to corrosion, deformation, or damage of the case or the cover or damage to a screw or a joined part.
- The explosion-proofing performance of a explosion-proof pressure transmitter is not guaranteed unless it is LOCKED. Always tighten the case cover completely, and lock the case cover.

Dismount and mount the case cover

This transmitter has a locking structure. Before dismounting the case cover, unlock the mechanism using a hexagonal wrench (included).

When remounting, insert the case cover fully and lock it, using a hexagonal wrench.

⚠ CAUTION

- After mounting the case cover, ensure that no dust or rain gains ingress into the transmitter case.

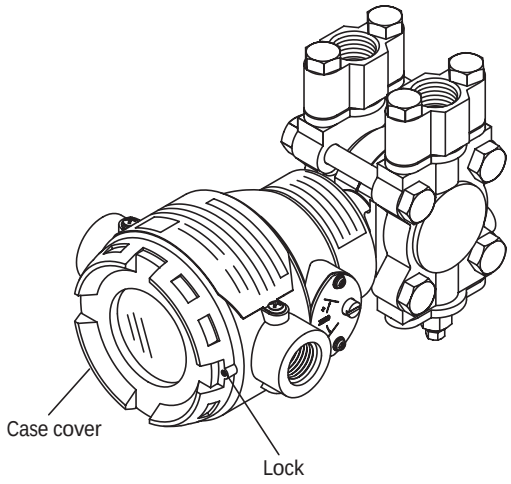


Figure 5-1 Locking case cover

5-4-2: Dismount/Mount Center body cover (Model JTD/ JTG/JTA/JTC)

Dismount cover

Remote the four sets of bolts and nuts, shown in the illustration.

Remarks:

After dismounting, handle the center body cover carefully. Avoid damage to the diaphragm.

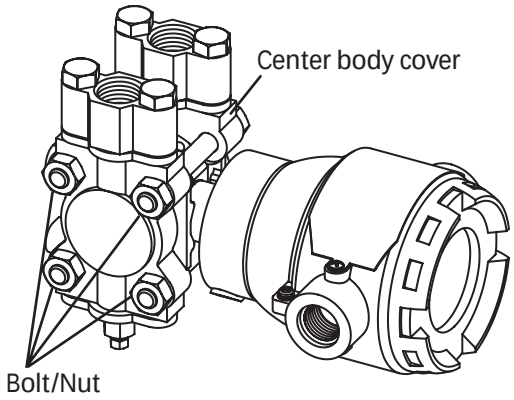


Figure 5-2 Center body cover fixing bolts

When mounting the center body cover, tighten the bolts to the following torque.

Replace the seal gasket, if it is damaged.

Mount cover

Cover bolts/nuts and tightening torque

Model No.	Bolts / Nuts	Bolts/nuts material	Bolts/nuts tightening torque (N.m)	
			When new gasket is used	When existing gasket is reused
JTD910A	M10	SUS304	15 ±1	10 ±1
JTD920A JTD930A	M10	Carbon steel SUS630	22 ±2	17 ±1
		SUS304	15 ±9	10 ±1
JTD960A	M12	Carbon steel SUS630	45 ±2	30 ±1.5
		SUS304	35 ±2	20 ±1

Model No.	Bolts / Nuts	Bolts/nuts material	Bolts/nuts tightening torque (N.m)	
			When new gasket is used	When existing gasket is reused
JTD921A JTD931A JTD961A	M16	Carbon steel SUS630	90±2	—
		SUS304	55 ±2	—
JTG940A JTG960A (Side, up/ down connection)	M10	Carbon steel SUS630	22 ±2	17 ±1
		SUS304	15 ±1	10 ±1
JTG980A (Side, Up/ down connection)	M16	Carbon steel SUS630	90 ±2	90 ±2
		SUS304	55 ±2	55 ±2
JTA922A JTA940A	M10	Carbon steel SUS630	22 ±2	17±1
		SUS304	15 ±1	10 ±1
JTC929A	M10	Carbon steel SUS630	22 ±2	17 ±1
		SUS304	15 ±1	10 ±1

5-4-3: Washing the sensor

Introduction

The transmitter and its mounting pipes must be kept clean to maintain transmitter accuracy and to assure satisfactory performance. Deposits accumulating in the pressure chamber of the transmitter will result in measurement errors.

Rinsing the center body (model JTD/JTG/JTA/JTC)

Rinse the center body following this procedure:

(1) Remove the hexagon head bolts from the center body and remove the cover.

(2) Wash the diaphragm and the inner surface of the cover with a solvent and a soft brush. Take sufficient care to avoid or damaging the diaphragm.

(3) When reassembling the center body, replace the cover gasket with a new gasket as necessary.

(4) Tighten the cover bolts to the specified tightening torque. (Refer to "5-4-2: Dismount/Mount Center body cover (Model JTD/JTG/JTA/JTC)")

Maintenance in cold region

If you stop the maintenance operation after measuring a liquid that can freeze such as water, drain water from the center body (by loosening the drain plug).

Maintenance of sensor

The sensor does not need any special routine maintenance/inspection. When the flange is removed during maintenance, wash the diaphragm using a soft brush and solvent. Take sufficient care to avoid damaging the diaphragm.

5-4-4: Remodelling for High-load resistance external meter

Introduction

Yamatake NW35, NWS300 is a high-load resistance external meter. When connecting an external meter of high-load resistance (not below 10 W and voltage drop not below 200 mV) to this transmitter, select a model number with

-B7 (optional specification).

If you model is no -B7, replace it with an indicator/terminal board assembly of -B7 specifications, or remodel the indicator/terminal board assembly.

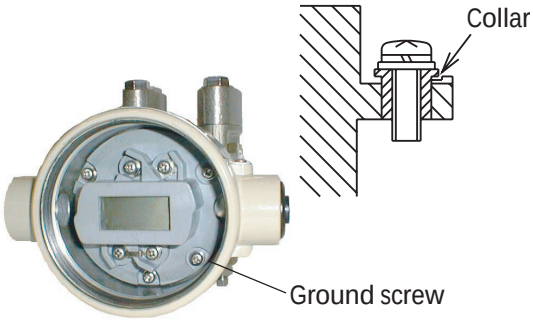
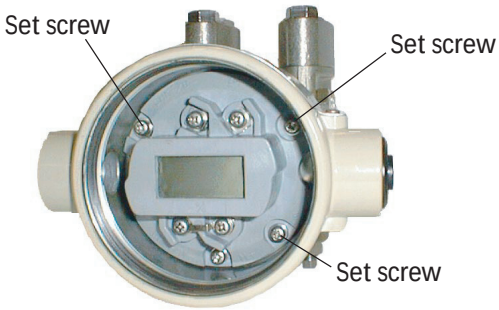
Replacement procedure

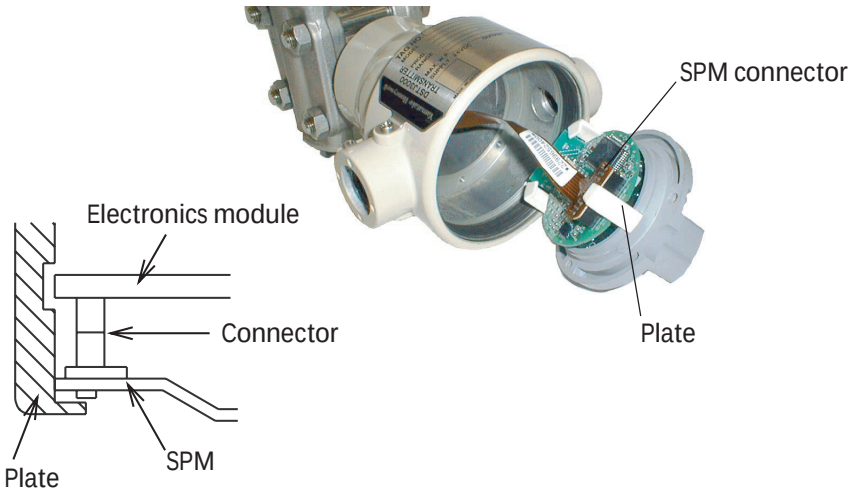
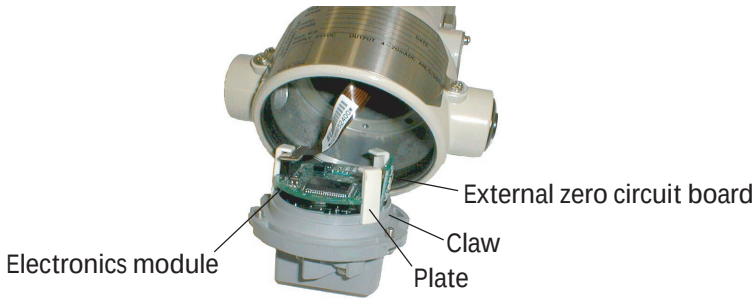
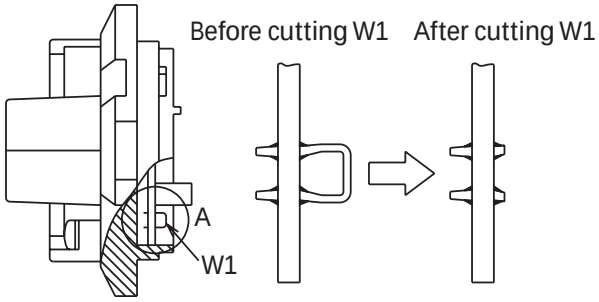
How to remodel or replace the indicator/terminal board assembly:

⚠ CAUTION

- Never touch electronic parts on the electronics module directly with hands. Electronic parts are easily damaged by electrostatic effect. If it is unavoidable to touch electronic parts directly with hands, take necessary precautions. The electronic parts and the hands should have an identical electric potential.
- After dismounting the electronics module, put it in a conductive bag to prevent electrostatic damage.

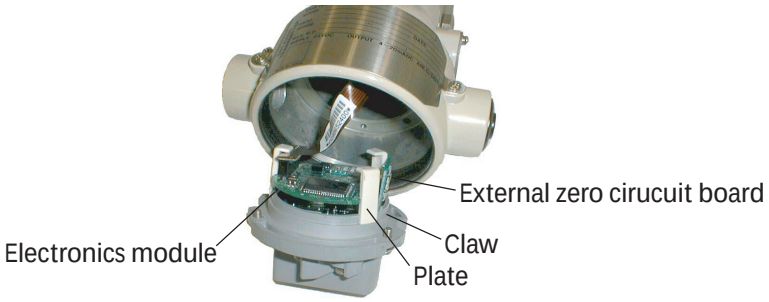
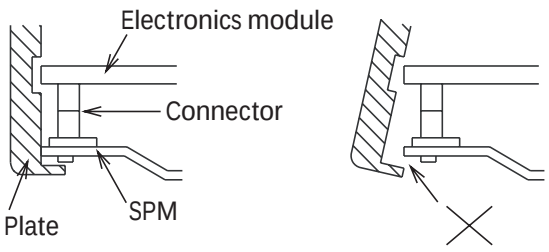
Dismount terminal board assembly

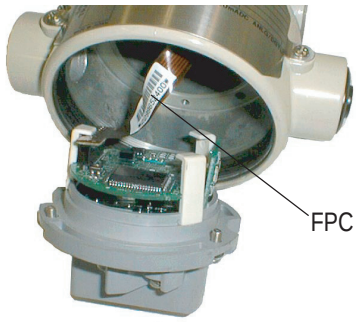
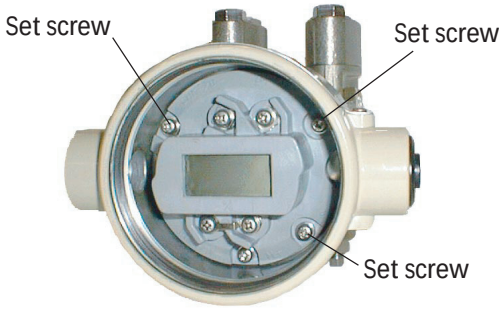
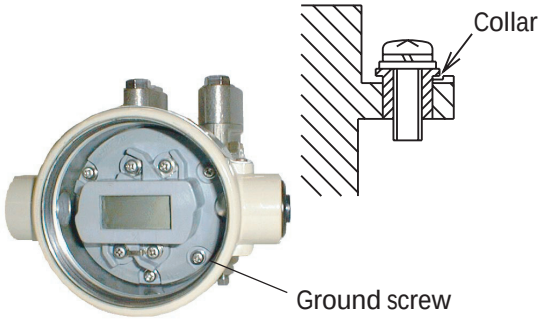
Step	Description
1	Turn off the transmitter.
2	Dismount transmitter case cover.
3	Disconnect signal cables from the terminals. Disconnect the conduit pipe from the case. Pull out the signal cables from the case.
4	Remove the ground screw. Dismount the collar at the same time. 
5	Remove the 3 screws that fix in place the terminal board. 
6	Pull out toward you, the indicator/terminal board assembly. **⚠ CAUTION** • Hold both ends of the display unit with fingers. Pull out gently and without any sideways movement, the assembly. The flexible cable may be destroyed if pulled with too much force.

Step	Description
7	Of the 3 plastic plates that fix the circuit board, dismount the one next to the connector (SPM connector). 
8	Remove the SPM connect to separate the indicator/terminal board assembly from the body.
9	Dismount the remaining 2 plastic plates. 
10	Dismount the electronics module from the terminal.
11	Cut jumper (W1) of the indicator/terminal board assembly. Or, replace the assembly with an indicator/terminal board assembly of -B7 specification. 

Step	Description
12	Assembly the transmitter by reversing the above procedure. Finally, mount the cover on the transmitter case. more details on the next page. • Always lock the cover. **⚠ CAUTION** • Tighten the cover firmly. Any looseness may result in water ingress.

Assembly

Step	Description
1	Mount the electronics module on the indicator/terminal board assembly.
2	Mount the two plastic plates that were dismounted latest. • Ensure that the plates are securely fitted to the indicator/terminal board assembly. • Ensure that the plate groove is securely engaged with the notch of the electronics module. • If an external zero adjustment circuit is connected, ensure that it is inside the claw of the indicator/terminal board assembly. 
3	Connect the SPM connector to the connector of the electronics module and fix it with a plate, as shown in the illustration. • Ensure that the plates are securely fitted to the indicator/terminal board assembly. • Ensure that the plate groove is securely engaged with the notch of the electronics module. • Ensure that the SPM connector is secure, and cannot be displaced. 

Step	Description
4	Insert the indicator/terminal board assembly into the case • Insert carefully without dismounting the plate or catching the flexible printed circuit board (FPC) between the two. 
5	Fix with 3 screws, the indicator/terminal board assembly. • Tightening torque: 12 ±0.1 N•m 
6	Insert the collar into the ground screw. Tighten the screw. • Tightening torque: 12 ±0.1 N•m 
7	Connect cables to the indicator/terminal board assembly.
8	Check the operation and mount the cover.

5-5: Calibrating set range and output signals

5-5-1: Overview

Some calibration work must be performed by Yamatake or our authorized service provider. Generally, this work requires a high-precision reference input device and highly accurate measuring equipment. Such work is not ordinarily performed by end-users of Yamatake equipment. These instructions are provided for the benefit of users who must perform calibration work themselves.

Calibration includes input calibration (set range) and output calibration (output signals)

5-5-2: Calibrating set range based on reference input

5-5-2-1: Preparation

Introduction

The low limit (LRV) and the high limit (URV) of the set range are calibrated by inputting reference pressure.

Calibrate the LRV and the URV, in that order

Equipment

Prepare the following equipment in advance of calibration:

Standard pressure generator:Pressure generated must be close to the measurement range of the transmitter.

- Accuracy requirement: ± 0.05% F.S or ± 0.1% setting
- Power supply: 24V DC
- Precision resistance: 250 Ω ± 0.005%
- Voltmeter: Digital voltmeter with accuracy (10V DC range) of ± 0.02% rdg +1 dgt
- SFC

Calibration conditions

All of the following conditions must be met, before performing calibration:

- A windless laboratory. Wind will apply pressure to the pressure receiving unit on the side open to the air, influencing the calibration accuracy.

- Standard temperature of 23°C and humidity of 65%. Normal pressure range (15°C to 35°C) and normal humidity range (45% to 75%) are allowable, if no sudden changes occur.
- Accuracy of the measuring equipment must be at least 4 times that of the transmitter.

Assemble the transmitter

Generally, cable and pipe the equipment, as shown below.

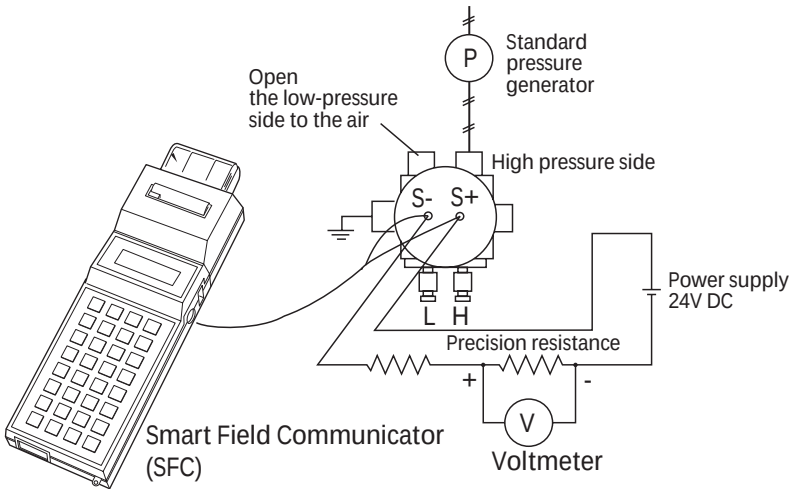


Figure 5-3 Cabling and piping equipment

Set range

Before starting calibration work, use the SFC to check that the set range of the transmitter agrees with the specifications. If no agreement, use the SFC to set correct range. Procedures are found in “4-5-8: Display or change low/high limits and span of set range” on page 4-44.

The set range is calibrated assuming that the low limit 20 kPa and the high limit is 100 kPa.

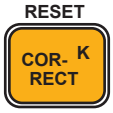
5-5-2-2: Calibrate low limit

Procedure

How to calibrate the low limit value:

It is assumed that the SFC and the transmitter have just started normal communications.

Example: Low limit value of set range: 20 kPa

Step	Key	Description	SFC screen
1		Apply pressure so that the manometer of the standard pressure generator indicates 20 kPa.	DSTJ TAG NO. LIN DP FIT-1234
2		Press the  key. • The low-limit value currently stored in the transmitter is displayed. It is assumed that the value is 20 kPa	LRV FIT-1234 20.00 kPa
3		Press the  key.	LRV FIT-1234 CORRECT LRV?
4	 	Press the  key. Press the  key. • The low-limit value has been calibrated to the current input pressure to the transmitter. • The low-limit value currently stored in the transmitter can be confirmed.	LRV FIT-1234 ARE YOU SURE!? LRV FIT-1234 WORKING... ↓ LRV FIT-1234 LRV CORRECTED LRV FIT-1234 20.00 kPa
5	 NON-VOL 	Press the  and  keys, in that order • The calibrated low-limit value is saved in the transmitter.	SHIFT- DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE

5-5-2-3: Calibrate high limit

Procedure

How to calibrate the high limit value.:

Example: High limit value of set range: 100 kPa

Step	Key	Description	SFC screen
1		Apply pressure so that the manometer of the standard pressure generator indicates 100 kPa.	DSTJ TAG NO. LIN DP FIT-1234
2		Press the  key. • The high-limit value currently stored in the transmitter is displayed. It is assumed that the value is 100 kPa	URV FIT-1234 100.00 kPa
3		Press the  key.	URV FIT-1234 CORRECT URV?
4	 	Press the  key. Press the  key. • The high-limit value has been calibrated to the current input pressure to the transmitter. • The high-limit value currently stored in the transmitter can be confirmed.	URV FIT-1234 ARE YOU SURE!? URV FIT-1234 WORKING... ↓ URV FIT-1234 URV CORRECTED URV FIT-1234 100.00 kPa

Step	Key	Description	SFC screen
5		Press the SHIFT and ENTER (Yes) keys, in that order • The calibrated high-limit value is saved in the transmitter.	SHIFT- DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE

5-5-3: Calibrate output signals

5-5-3-1: Before you start

Introduction

Output signal calibration (adjustment of the D/A conversion unit) is unnecessary under ordinary operating conditions. Normally, this work is performed by an authorized service provider of Yamatake. For end-users who must performed this work, prepare the following equipment in advance of work:

Equipment

- High-precision ammeter with accuracy of 0.03% F.S. or higher
- Precision resistance: 250Ω ±0.005%
- SFC

Setting up

Refer to Figure5-4. Connect a SFC and an ammeter.

Refer to “3-2-1: Starting communications”. Check connections to ensure correct connection. Check that the SFC and the transmitter are in the normal communication status.

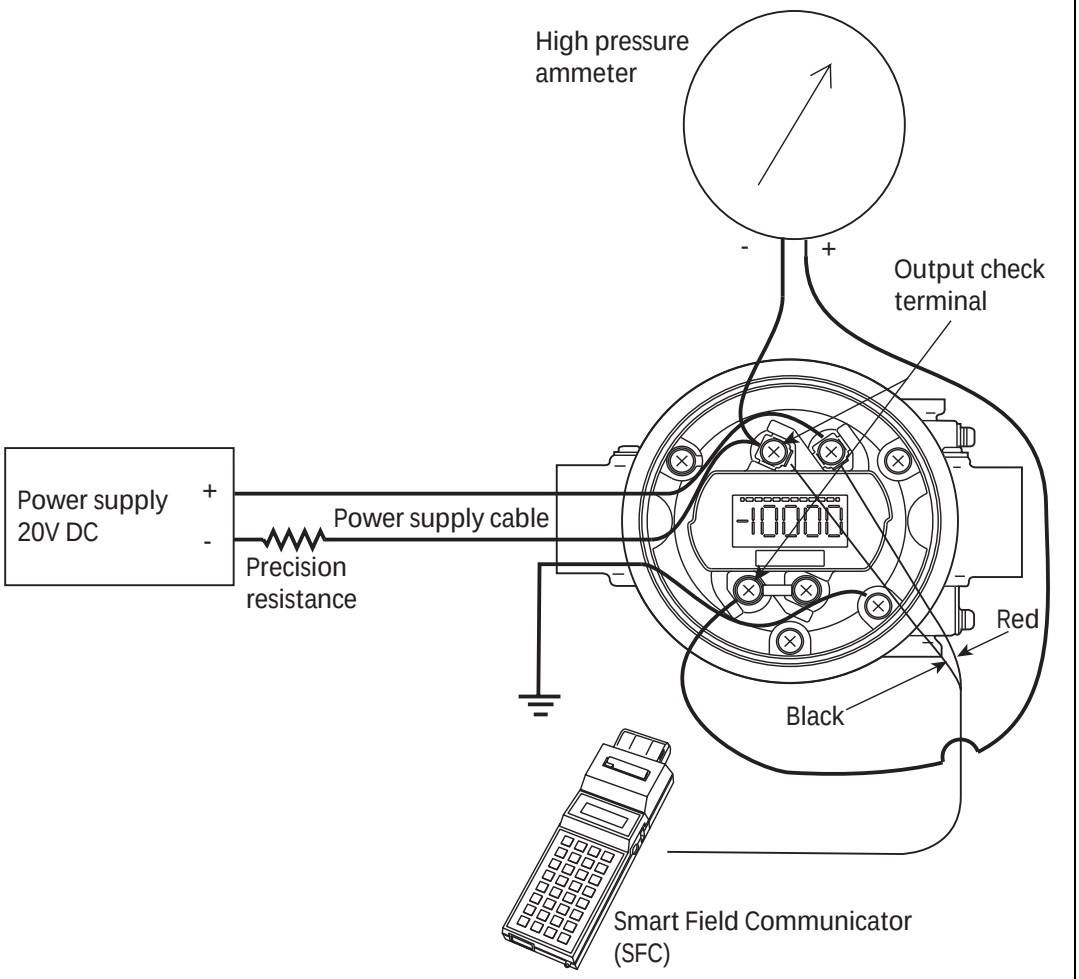


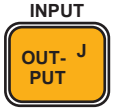
Figure 5-4 Connection for calibration

5-5-3-2: Calibrating output signal 0%

Procedure

Set the output to 0% and calibrate the transmitter so that the ammeter indicates 4 mA:

Step	Key	Description	SFC screen
1	INPUT OUT- PUT J	Press the INPUT OUT- PUT J key. (The current output is displayed.)	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 0.00 %

Step	Key	Description	SFC screen
2		Press the  key.	OUTPUT TAG NO. 0 %
3		Press the  key. • The transmitter has been set to the 4 mA (0%) constant current mode. • # is displayed on the screen during the constant current mode.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 0.00 % #
4		Ensure that the ammeter indicates 4 mA.	OUTPUT FIT-1234 0.00 % #
5		Press the  key. The current output is 0%.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 0.00 % #
6		Press the  key. • If the indicated value is lower than 4 mA, go to <step 7>. If it is higher than 4 mA, go to <step 8>.	DSTJ FIT-1234 CORRECT DAC ZERO#
7		Press the  key. Check the ammeter indication after each key-press.	OUTPUT FIT-1234 WORKING... OUTPUT FIT-1234 INCREASED 4mA # DSTJ FIT-1234 CORRECT DAC ZERO#

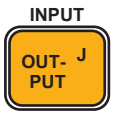
Step	Key	Description	SFC screen
8	▼ L PREV	Press the ▼ L PREV key. • Check the ammeter indication after each key-press.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 DECREASED 4mA OUTPUT FIT-1234 CORRECT DAC ZERO#
9	CLR (No)	Press the CLR (No) key after completing calibration work.	DSTJ FIT-1234 READY...
10		Refer to instruction in Item 4. Save the calibrated value and release the constant current source mode.	

5-5-3-3: Calibrating output signal 100%

Procedure

Set the output to 100% and calibrate the transmitter so that the ammeter indicates 20 mA:

Step	Key	Description	SFC screen
1	INPUT OUT- PUT J	Press the INPUT OUT- PUT J key.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 0.00 %

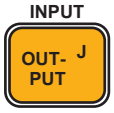
Step	Key	Description	SFC screen
2		Press the 1 V, ACT PR 0 Z and ACT PR 0 Z keys (numeric key), in that order.	OUTPUT TAG NO. 100
3		Press the NON-VOL ENTER (Yes) key. • The transmitter has been set to the 20 mA constant current mode	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 100.00 % #
4		Ensure that the ammeter indicates 20 mA.	OUTPUT FIT-1234 100.00 % #
5		Press the INPUT OUT- J PUT key. • The current output is 100%.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 100.00 % #
6		Press the RESET COR- K RECT key. • If the indicated value is lower than 20 mA, go to <step 7>. If it is higher than 4 mA, go to <step 8>.	DSTJ FIT-1234 CORRECT DAC SPAN#

Step	Key	Description	SFC screen
7	▲ H NEXT	Press the ▲ H NEXT key. • Check the ammeter indication after each key-press.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 INCREASED 20mA OUTPUT FIT-1234 CORRECT DAC SPAN
8	▼ L PREV	Press the ▼ L PREV key. • Check the ammeter indication after each key-press.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 DECREASED 20mA# DSTJ FIT-1234 CORRECT DAC SPAN
9	CLR (No)	Press the CLR (No) key after completing calibration work.	DSTJ FIT-1234 READY... #
10		Refer to instruction in Item 4. Save the calibrated value and release the constant current source mode.	

5-5-3-4: Saving calibrated values and releasing constant current source mode

Procedure

Forcefully save the calibrated value to non-volatile memory of this transmitter and release the constant current mode:

Step	Key	Description	SFC screen
1		Press the  key.	SHIFT- #
2		Press the  key. • Forceful data saving is completed.	OUTPUT FIT-1234 WORKING... ↓ DSTJ FIT-1234 DATA NONVOLATILE DSTJ FIT-1234 READY...
3		Press the  key. • The current output is 100%.	OUTPUT FIT-1234 WORKING... ↓ OUTPUT FIT-1234 100 % #
4		Press the  key. • # disappears, indicating that the constant current mode has been released.	OUTPUT FIT-1234 WORKING... ↓ DSTJ FIT-1234 READY...

5-6: Erasing calibrated data

5-6-1: Erasing calibrated data

Procedure

Reset the calibrated data to the initial values (factory set data):

Step	Key	Description	SFC screen
1	SHIFT RESET COR- K RECT	Press the SHIFT and RESET COR- K RECT keys, in that order.	SHIFT- DSTJ FIT-1234 RESET CORRECTS?
2	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • The calibrated data is initialized.	DSTJ FIT-1234 CORRECTS RESET ↓ DSTJ FIT-1234 READY...

5-6-2: Erasing # mark

Procedure

appears when the calibrated data is reset to the initial values. To erase: Actual pressure is required for this procedure. Input actual pressure to the transmitter. Refer to "3-9: Zero-span adjustment with input pressure equivalent to range" or "5-5-2: Calibrating set range based on reference input".

How to set the low-limit value, based on actual pressure

Step	Key	Description	SFC screen
1		Set the actual pressure applied to the transmitter to 0 kPa.	DSTJ FIT-1234 READY...
2		Press the  key.	LRV FIT-1234 0.0000 kPa #
3		Press the  key.	LRV FIT-1234 SET LRV?
4		Press the  key. • The initial value for the low limit is displayed.	URV FIT-1234 WORKING... ↓ LRV FIT-1234 0.0123 kPa #

How to calibrate the low limit value, based on actual pressure

Step	Key	Description	SFC screen
5		Press the  key.	LRV FIT-1234 0 kPa #
6		Press the  key.	LRV FIT-1234 0.0000 kPa #

Step	Key	Description	SFC screen
7	RESET COR- K RECT	Press the RESET COR- K RECT key. Ensure that no pressure is applied to H.L.	LRV FIT-1234 CORRECT LRV?
8	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key.	LRV FIT-1234 ARE YOU SURE!?
9	NON-VOL ENTER (Yes)	Press the NON-VOL ENTER (Yes) key. • The low limit value is calibrated.	LRV FIT-1234 WORKING... ↓ LRV FIT-1234 LRV CORRECTED#
10	SHIFT ^ NON-VOL ENTER (Yes)	Press the SHIFT ^ and NON-VOL ENTER (Yes) keys, in that order. • Data is forcefully saved.	SHIFT- # DSTJ FIT-1234 WORKING... # ↓ DSTJ FIT-1234 DATA NONVOLATILE#
11		Turn OFF the transmitter. Waiting for at least 2 seconds. Turn on transmitter again.	
12	DE READ ID A	Press the DE READ ID A key.	TAG NO. WORKING... ↓ DSTJ TAG NO. LIN DP FIT-1234

Step	Key	Description	SFC screen
13		Press the  key. The # mark disappears.	DSTJ FIT-1234 WORKING... ↓ DSTJ FIT-1234 STATUS CHECK= OK

5-7: Troubleshooting

5-7-1: Checking operation and actions

Introduction

The operation of the transmitter cam be checked using the SFC. In the event of an abnormality, take appropriate action according to the self-diagnostic message displayed on the SFC.

If the transmitter, the process, the SFC, or the communication system has any abnormality during measurement, take appropriate action by following the self-diagnostic message displayed on the SFC.

Abnormalities can be classified as follows:

- Any abnormality in the transmitter, the process, the SFC, or the communication system is suspect.
- An abnormality of the transmitter is suspect.
- An abnormality of the transmitter or the process is suspect.
- An abnormality of the SFC or the communication system is suspect.

Check operations

Before checking the operation of the transmitter, connect a SFC to the transmitter. Check for communicating state. Employ these procedure.

Step	Key	Description	SFC screen
1		Press the  key.	DSTJ FIT-1234 WORKING...
			DSTJ FIT-1234 STATUS CHECK =OK
		IF a message other than Self-diagnosis Result OK is displayed, take required action. Refer to instructions in the subsequent pages.	(Other message) ↓
			DSTJ FIT-1234 READY...
		• If an error message is displayed, refer to the messages in the subsequent page.	When more than on problem is found during self-diagnostics, messages are displayed, each in its turn, for about 5 seconds.

5-7-2: Error during communications

Message and required action

Respond to error messages that are displayed during communications.

Message	Required action
DSTJ FIT-1234 READY... ↓ (3 seconds later) PRESS STATUS!	• Press the F/S DIR U STAT key. Take action according to the message. • The DE READ A ID, INPUT J OUT- PUT and F/S DIR U STAT keys are effective, even in this state. • After taking the necessary action, press the [n] key to check that Self-Diagnosis Result OK is displayed.
:	Low battery. Charge the SFC by following the instructions in "4-1-7: Charging SFC" on page 4-17.
***** #	• Press the F/S DIR U STAT key and take necessary action according to the message. # disappears when the problem is solved. • When # disappears, press the F/S DIR U STAT key to make sure that Self-Diagnosis Result OK is displayed.

5-7-3: Self-Diagnostic message

Message

The following messages are displayed by pressing the [n] key at the time of a failure. The meanings of the messages and the necessary action are summarized, here.

An abnormality of the transmitter, the process, the SFC, or the communication system is suspect.

Message	Meaning	Required action
NO XMTR RESPONSE	• Transmitter makes no response.	• Repeat the procedure for starting communications. • Press the F/S DIR U STAT and see what message is displayed. • Check the loop, the SFC connection loop, load resistance, and the supply voltage.

Abnormality of the transmitter is suspect.

Message	Meaning	Required action
MDU/DHC FAULT	MDU/DAC fault	Contact the appropriate personnel.
NVM FAULT	Memory fault	Contact the appropriate personnel.
PAC FAULT	PAC fault	Contact the appropriate personnel.
RAM FAULT	RAM fault	Contact the appropriate personnel.
ROM FAULT	ROM fault	Contact the appropriate personnel.

Message	Meaning	Required action
NO DAC TEMP COM	The temperature correction data on the electronics module was lost.	Contact the appropriate personnel.
STATUS UNKNOWN	Unknown error state	Contact the appropriate personnel.

An abnormality of the transmitter or the process is suspect.

Message	Meaning	Required action
SENSOR OVER TEMP #	The temperature in the center body is too high.	Install the transmitter in such a way that the temperature does not become too high.
SUSPECT INPUT	• Input data error. • Problem in the process • Transmitter fault • Differential pressure transmitter fault	Check the process. Set the transmitter to the constant current source mode and press the F/S DIR U STAT key. If no message is displayed, report the problem to the contact point indicated on the rear.
M.B. OVERLOAD OR METER BODY FAULT	• The input differential pressure exceeds 2 times the high limit of the valid range. • Differential pressure transmitter fault	• Check the PV value and replace the transmitter with a model of a larger range if necessary. • Contact the appropriate personnel because the pressure receiving part of the transmitter may be damaged.

An abnormality of the SFC or the communication system is suspect.

Message	Meaning	Required action
SFCFAULT	SFC fault	• Repeat the procedure for starting communications. • If the same message is displayed again, contact the appropriate personnel.

Message	Meaning	Required action
FAILED COMM CHK	Communication failure	• Check that the SFC is connected correctly. • Press the F/S DIR STAT U key. If COMM ERROR is displayed, replace the SFC. If any other message is displayed, take the corresponding action, shown in this list.
ILLEGAL RESPONSE	Communication problem.	Check the connection between the SFC and the transmitter, the cabling, and the power supply.
PRINTER FAIL! #	Printer failure	Contact the appropriate personnel.
LOW ROOP RES	Too-small loop resistance	Adjust the resistance value.
HI RES/LOW VOLT	• Too-large loop resistance • Check the loop resistance and adjust it.	Too-small impressed voltage. Increase the voltage Z.

An operation error is suspect.

Message	Meaning	Required action
KEY NOT ALLOWED!	• Wrong key input • Wrong key input procedure	Press the SHIFT key to check the display and start the key input again.
CORRECT RESET #	Calibration required	Calibrate the low and high limit values of the set range.
NOT SUPPORT	Key unsupported	Press correct key

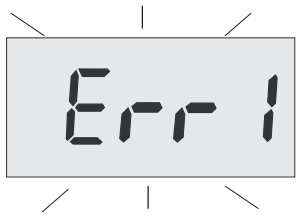
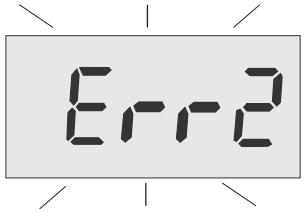
Message	Meaning	Required action
EXCESS SPAN CORR #	Excessive span calibration	Check that the input pressure agrees with the calibrated value and calibrate the high limit of the set range.
EXCESSIVE OUTPUT	Requested output value > Output range (-1.25% to 105%) in constant current source mode	Press the CLR (No) key and input data again.
EXCESS ZERO CORR #	Excessive zero calibration	Check that the input pressure agrees with the calibrated value and calibrate the low limit of the set range.
INVALID DATABASE	The transmitter database is not correct when the SFC is turned ON.	• Start the communications again. • Check the database, calibrate the transmitter again, and in put correct data.
CORRECT LRV?	Appropriate input value for the setting.	Check the input value. If it is wrong, correct it.
ENTRY > SEN RANGE	Set range > High limit of set range × 1.5	Press the CLR (No) key to check the numeric value, and repeat the setting procedure.
INVALID REQUEST	Invalid request	Check SFC operation procedure.

5-7-4: Self-diagnosis by indicator (option)

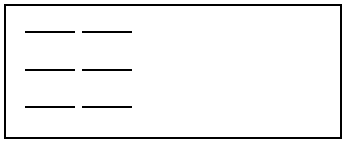
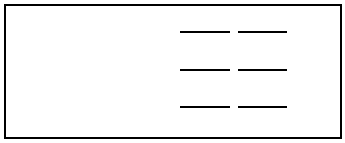
Introduction

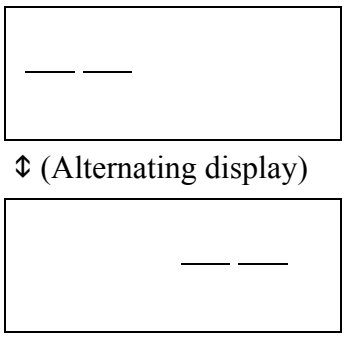
When the indicator or the transmitter has an abnormality (when the indicator is set), the details will be displayed in the digital display unit of the indicator.

Self-diagnostics following power ON

Message	Meaning	Required action
 (Blink)	Digital indicator RAM failure	Contact the appropriate personnel.
 (Blink)	Digital indicator ROM failure	Contact the appropriate personnel.

Self-diagnostics during regular operation

Message	Meaning	Required action
 ↕ (Alternating display) 	Serious failure of transmitter	Contact the appropriate personnel.
 (Blink)	External zero point adjustment failure	Contact the appropriate personnel.

Message	Meaning	Required action
 ↕ (Alternating display)	Transmitter or indicator failure	Contact the appropriate personnel.

5-8: Insulation resistance test and withstand voltage test

⚠ CAUTION

In principle, do not perform an insulation resistance test or a withstand voltage test. In some cases, the built-in varistor with a function for absorbing surge voltage may be destroyed during these tests.
If a test must be performed for an unavoidable reason, carefully follow the procedure.

Test procedure

- Disconnect the external cables from the transmitter.
- Short-circuit the + and - SUPPLY terminals and the + and - METER terminals.
- Perform a test between the short-circuited parts and the ground terminal.
- The required impressed voltage and the judgement criteria are shown bellow. Don't apply higher voltage to protect the instruments from destruction.

Judgement criteria

Test	Judgement criteria
Insulation resistance test	$2 \times 10^7 \Omega$ or higher at test voltage of 25V DC (Not higher than 25°C and 60%RH)
Withstand voltage test	50V AC, 1 minute, set current 2 mA.

Appedix A

Operating principle

Introduction

Ex. Differential pressure transmitter A differential pressure transmitter is a highly-engineered instrument that is specifically designed to measure liquid or gas flow rate, pressure data and liquid level data, and transmit the data to another location.

Combined with a contracting mechanism (such as an orifice and a flow nozzle), because the transmitter detects the pressure difference between two points in a process (differential pressure), one differential pressure transmitter can be used for measuring flow rate.

One transmitter can also be employed to measure multiple process variables such as pressure and liquid level.

Electronic differential pressure transmitters enjoy widespread use. Such instruments offer significant benefits to end-users and construction engineering companies. The instruments have a unified structure that consists of a pressure receiving unitwhich senses high pressure and low pressure-and a transmitting unitwhich transmitting the differential pressure. Before transmission, the instrument converts a differential pressure value into electrical signals (4-20 mA DC).

Operating principle

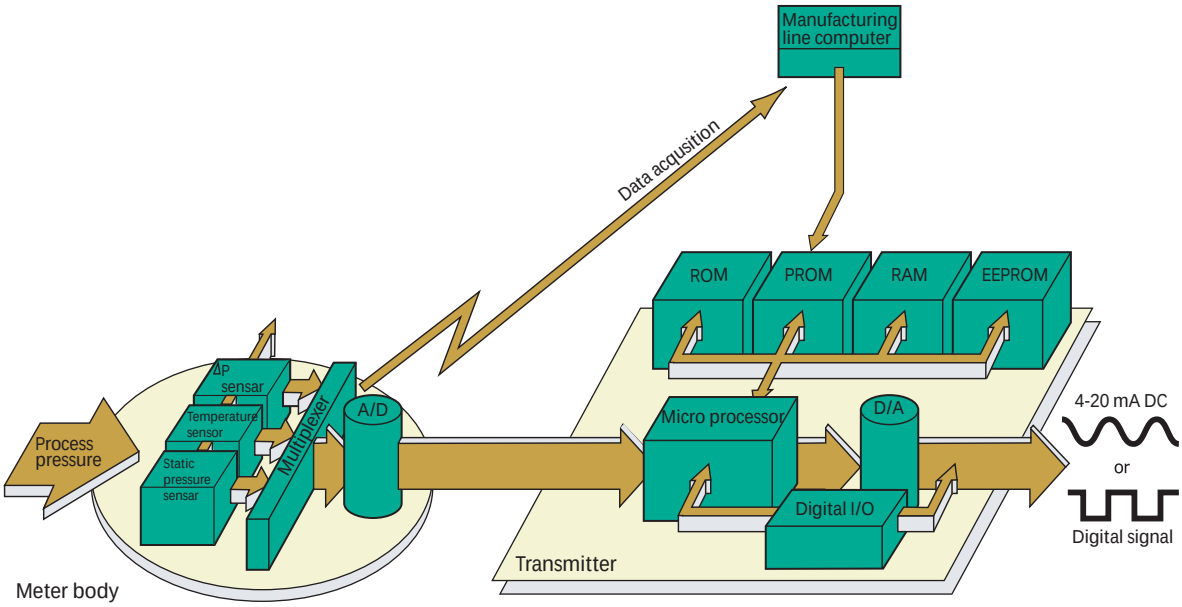
A typical electronic differential pressure transmitter has a composite semi-conductor sensor.

High pressure and low pressure in the process are transmitted to the diaphragm mounted on the both sides of the pressure receiving unit. These diaphragms are in constant with the liquid, and transmit the pressure via a special fluid, to the composite semiconductor sensor inside.

This sensor is strained according to the difference between high pressure and low pressure (differential pressure). For transmission, another unit sends out a signal corresponding to the strain.

At the same time, two auxiliary sensors, a temperature sensor and a static pressure sensor, come into action. These sensors are formed on the sensor chip. They sense the

ambient temperature and the static pressure, which values are also digitalized and sent to the transmitting unit.



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Saving through Automation

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