This condition can be expressed with the following formula;

$P_0 + ((\rho' h) / 102) \geq P (1kPa = 102mmH_2O)$

Therefore, $h \leq (P_0 - P) \times 102 / (\rho')$

Table 4-2:

	Specific gravity of sealed liquid ρ'	**Low limit of allowable pressure P (kPa abs.)**	**Liquid contacting temperature range (°C)**
General application (*1)	0.935	2	-40 - 40
High temperature application (-*2)	1.07	2	-5 - 90
High temperature & vacuum application (*3)	1.07	0.1333	-5 - 50
High temperature & high vacuum application (*4)	1.09	0.1333	-10 - 250
Oxygen application, chlorine application (*5)	1.87	53	-10 - 40

Remarks

1. An application where the pressure in the tank P_0 becomes a vacuum requires special caution.
2. If the above condition is not met, the pulling force applied to the diaphragm surface will exceed the specified range.

   Foaming occurs because the pressure of sealed liquid exceeds the saturated vapour pressure and can cause zero point shifting. Negative pressure applied to the diaphragm can cause buckling and destroy the diaphragm.
3. When the liquid contacting temperature exceeds the levels shown in the table, the low limit of the allowable pressure also changes. Check the specifications.
4. *1. STR9□□-1, STE9□□ -1

   *2. STR9□□-3, STE9□□ -3

   *3. STR9□□-4, STE9□□ -4

   *4. STR9□□-7, STE9□□ -7

   *5. STR9□□-2 & -5 STE9□□ -2 & -5

<Example of calculation>

Let's take up an example in which a remote seal type transmitter of the of the general specifications is used for a vacuum application (3kPa abs.)

- Liquid contacting pressure :Normal pressure (24°C)
- Low limit of allowable pressure (ρ) :2 kPa abs. (15mmHg abs.)
- Specific gravity of sealed liquid (ρ') :0.935
- Inner pressure of tank (ρ_0) :3kPa abs.

The condition that must be met to satisfy the transmitter specifications is as follows:

$$h \leq (P_0 - P) \times 102 / (\rho')$$

$$h \leq (3 - 2) \times 102 / 0.935 \ = \ 109mm$$

Therefore, the high limit of the transmitter position is 109mm.

4-3 : Piping ST3000 Smart Transmitter

Summary

The actual piping arrangement will vary depending upon the process measurement requirements and the transmitter model. Except for flanged and remote diaphragm seal connections, process connections are made to 1/4 inch or 1/2 inch NPT female connections in the process head of the transmitter's meter body. For example, a differential pressure transmitter comes with double ended process heads with 1/4 inch NPT connections but they can be modified to accept 1/2 inch NPT through optional flange adapters.

The most common type of pipe used is 1/2 inch schedule 80 steel pipe.

Many piping arrangements use a three-valve manifold to connect the process piping to the transmitter. A manifold makes it easy to install and remove a transmitter without interrupting the process. It also accommodates the installation of blow-down valves to clear debris from pressure lines to the transmitter.

Figure 4-7 shows a diagram of a typical piping arrangement using a three-valve manifold and blow-down lines for a differential pressure transmitter being used to measure flow.

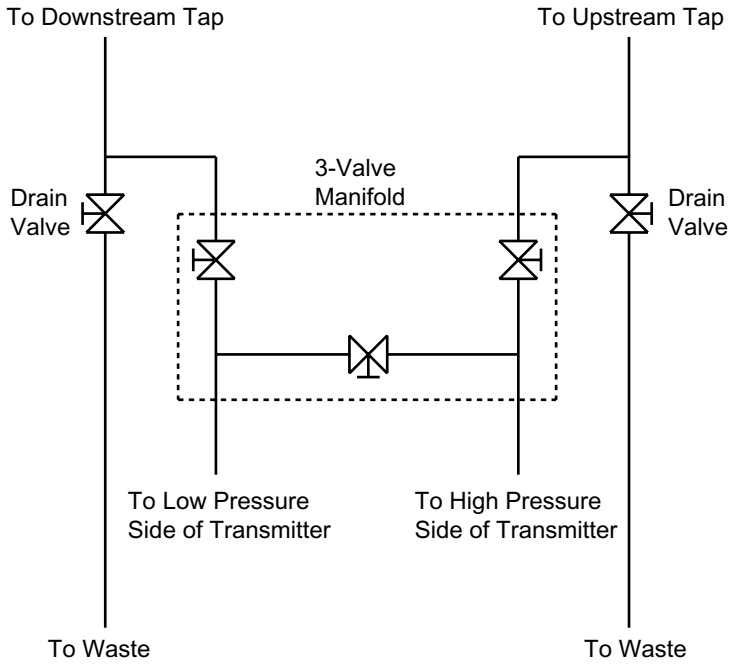


Figure 4-7 Typical 3-Valve Manifold and Blow-Down Piping Arrangement.

Process connections

Table describes typical process connections for a given type of transmitter.

Table 4-3: Process Connections

Transmitter type	Process Connection
Differential Pressure	Process heads with 1/4in. NPT internal thread connection. Flange adapters and manifolds with 1/2in. internal thread connections are optional.
Gauge Pressure	Process head with 1/2in. NPT internal thread connection. Process heads with 1/4in. NPT internal thread connection. (STG9□0) Flange adapters and manifolds with 1/2in. internal thread connections are optional (STG9□0)
Absolute Pressure	Process heads with 1/2in. NPT internal thread connection (STA923, 940)
Flange Mounted Liquid Level	1.5. 2 or 3in. flange with flush or 2, 3 or 4in. extended diaphragm on high pressure side*. Reference side has standard differential pressure process head.
Remote Diaphragm Seals	See Model Selection Guide for description of available Flanged, Button-diaphragm (G1·1/2), and Wafer type process connections.

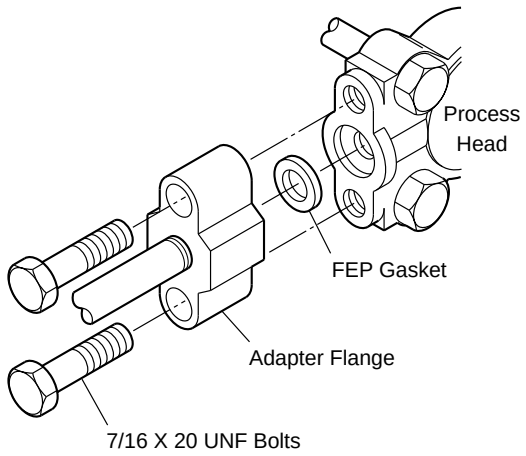
Installing flange Adapter

Table 4-4: gives the steps for installing an optional flange adapter on the process head.

Slightly deforming the gasket supplied with the adapter before you insert it into the adapter may aid in retaining the gasket in the groove while you align the adapter to the process head. To deform the gasket, submerse it in hot water for a few minutes then firmly press it into its recessed mounting groove in the adapter.

Table 4-4: Installing Adapter Flange

Step	Action
1	Carefully seat FEP (white) gasket into adapter groove.
2	Thread adapter onto 1/2in. process pipe and align mounting holes in adapter with holes in end of process head as required.

Step	Action
3	Secure adapter to process head by hand tightening 7/16-20 UNF hexhead bolts. Example-Installing adapter on process head **ATTENTION** Apply an anti-seize compound on the stainless steel bolts prior to threading them into the process head. 
4	Evenly tighten adapter bolts to a torque of 47.5 to 54 $N \bullet m$ (35 to 40 ftlb)

4-3-1 :Piping for Liquid, Gas or Steam Flow Rate Measurement

Recommended Piping -- Example 1

The illustration shows a typical example for liquid Flow Rate Measurement. This Differential pressure transmitter is located below the differential pressure output port of the process pipe.This minimizes the static head effect of the condensate.

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.

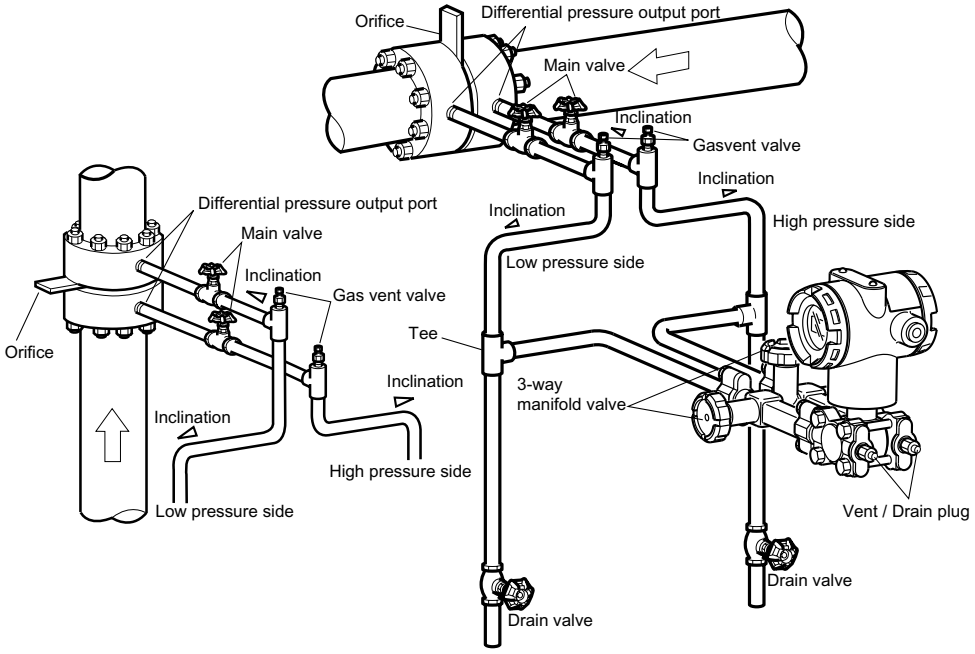


Figure 4-8 Piping for Liquid Flow Rate Measurement (Example)

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

Recommended Piping -- Example 2

The illustration shows a typical example for Gas Flow Rate Measurement. This Differential pressure transmitter is located above the differential pressure output port of the process pipe.The condensate drains away from the transmitter.

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.

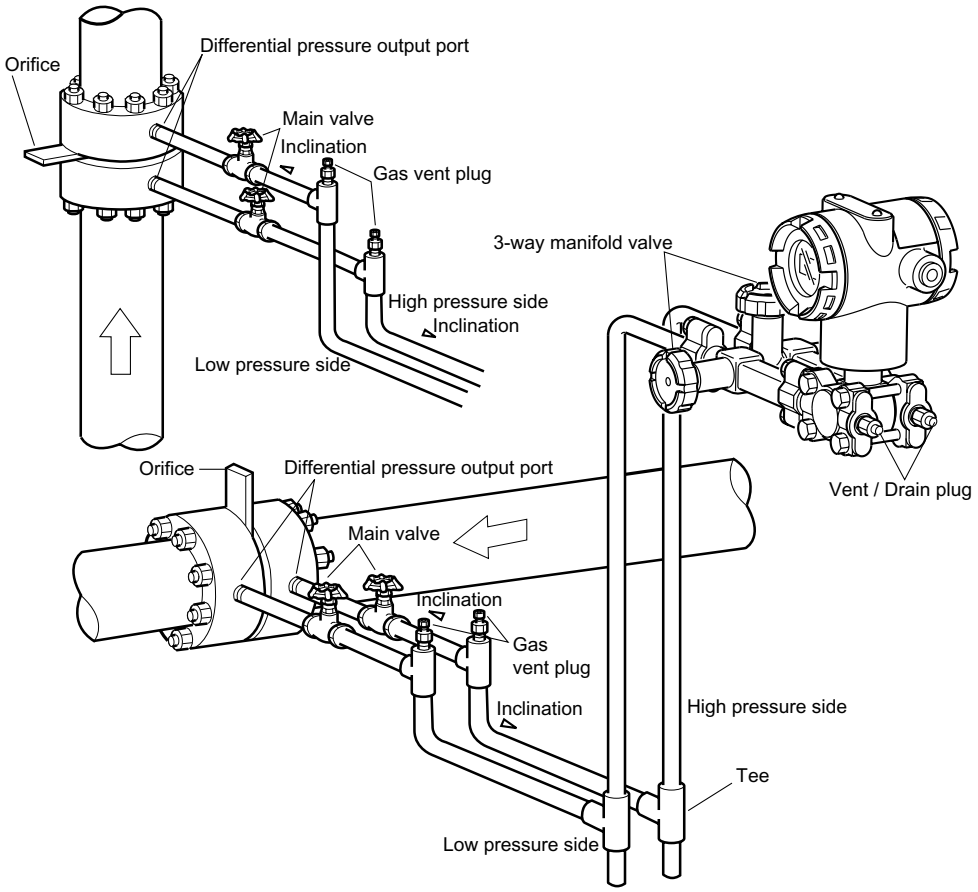


Figure 4-9 Piping for Gas Flow Rate Measurement -- Example

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

Recommended Piping -- Example 3

The illustration shows a typical example for Steam Flow Rate Measurement. Recommended for a Differential pressure 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 leaks.

If the process pipe is vertically mounted, mount seal pots 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.

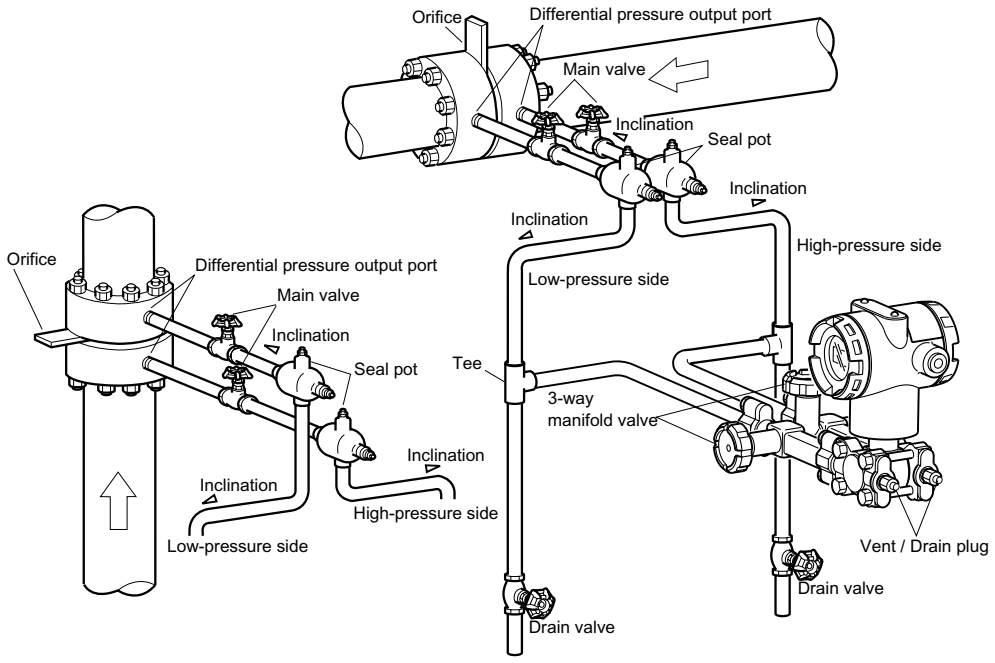


Figure 4-10 Piping for Steam Flow Rate Measurement -- Example

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

4-3-2 :Pressure Measurement - Piping

Recommended piping - 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.

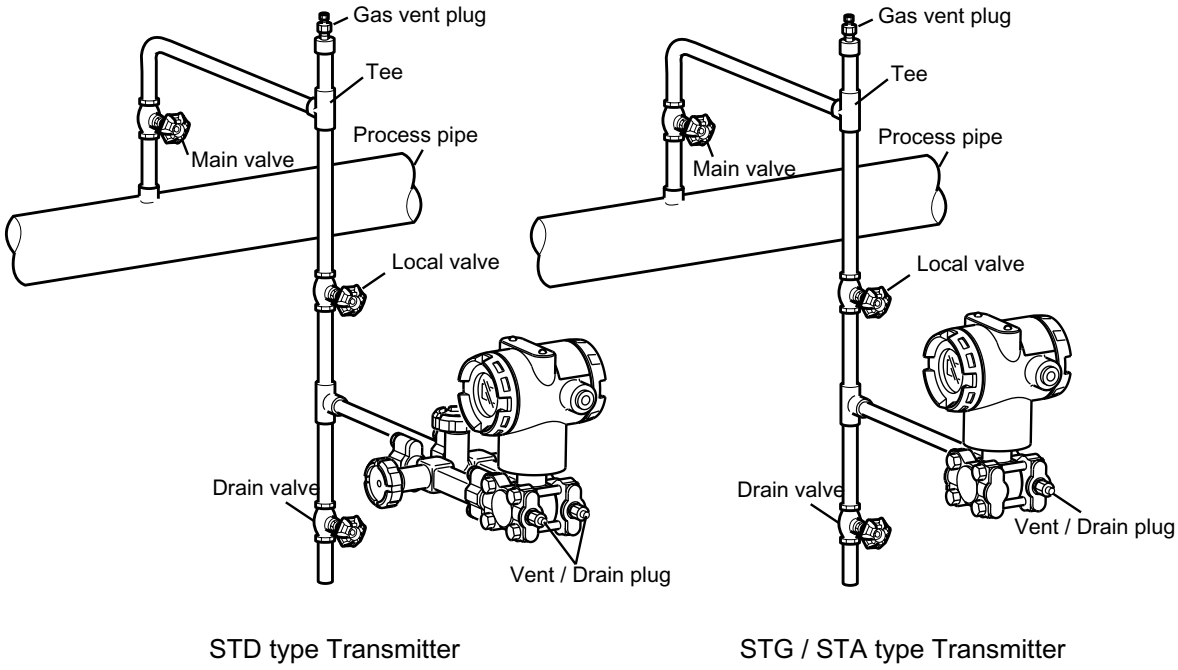


Figure 4-11 Gas Pressure Measurement - Piping

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 4-12.

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.

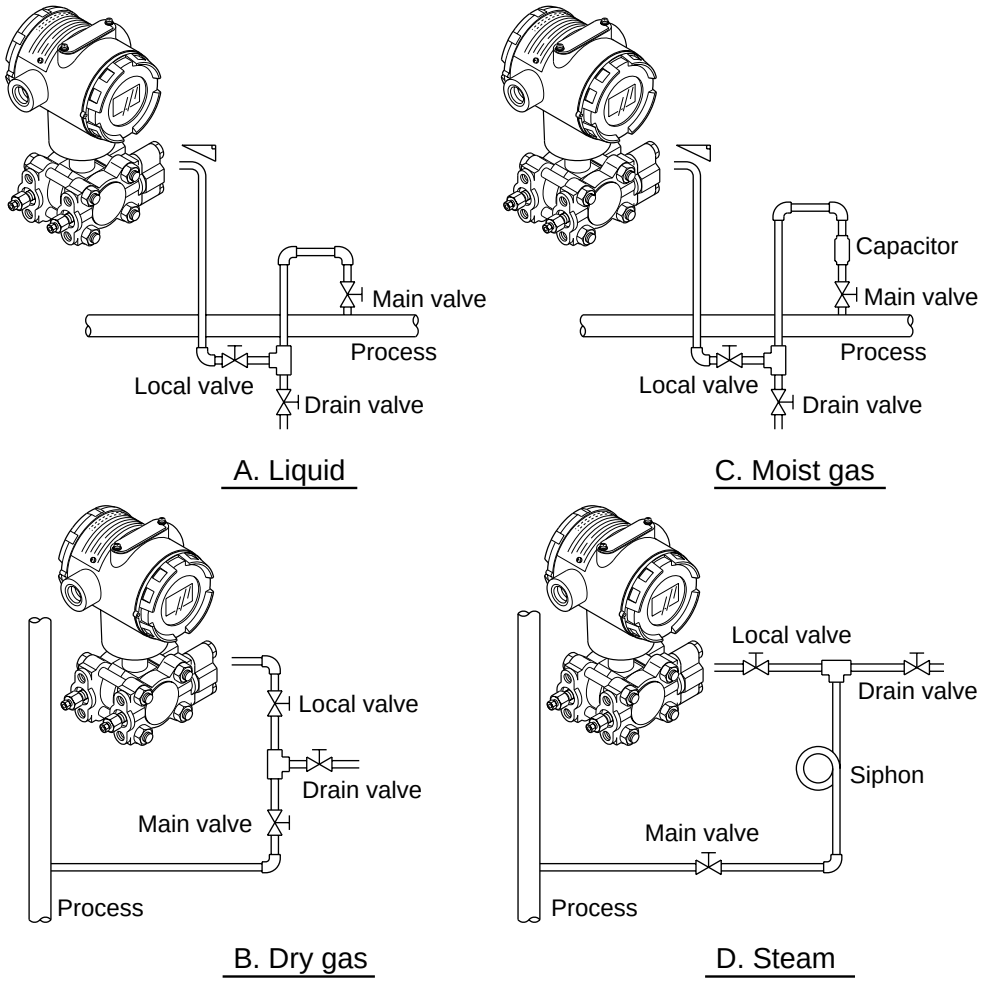


Figure 4-12 Example of Piping

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 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.

4-3-3 :Liquid Level Measurement -- Piping (STD/STG)

4-3-3-1 Piping

Introduction

For measurement by STD type of liquid level in a tank, the 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).

H 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.

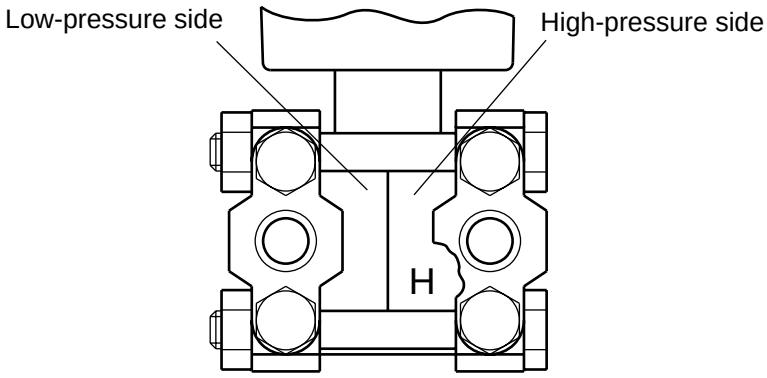


Figure 4-13 H mark on center body

Before your start

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)

4-3-3-2 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.

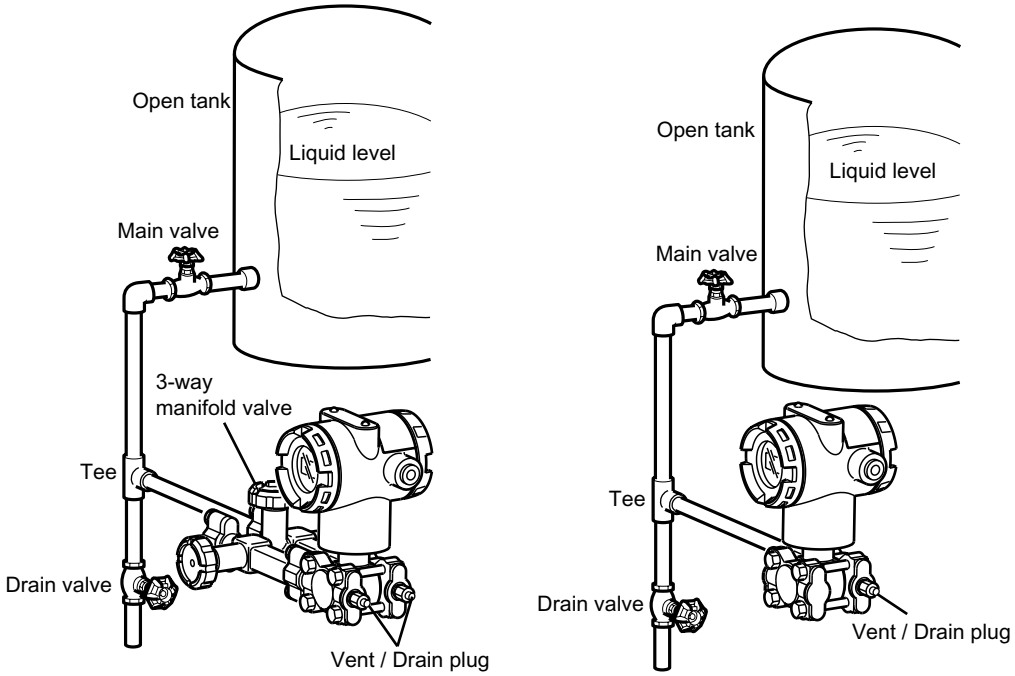


Figure 4-14 Open Tank -- Piping Example

4-3-3-3 Closed Tank - Piping

Recommended piping for dry leg - Example

When using the dry-leg method, connect the high-pressure side of the 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.

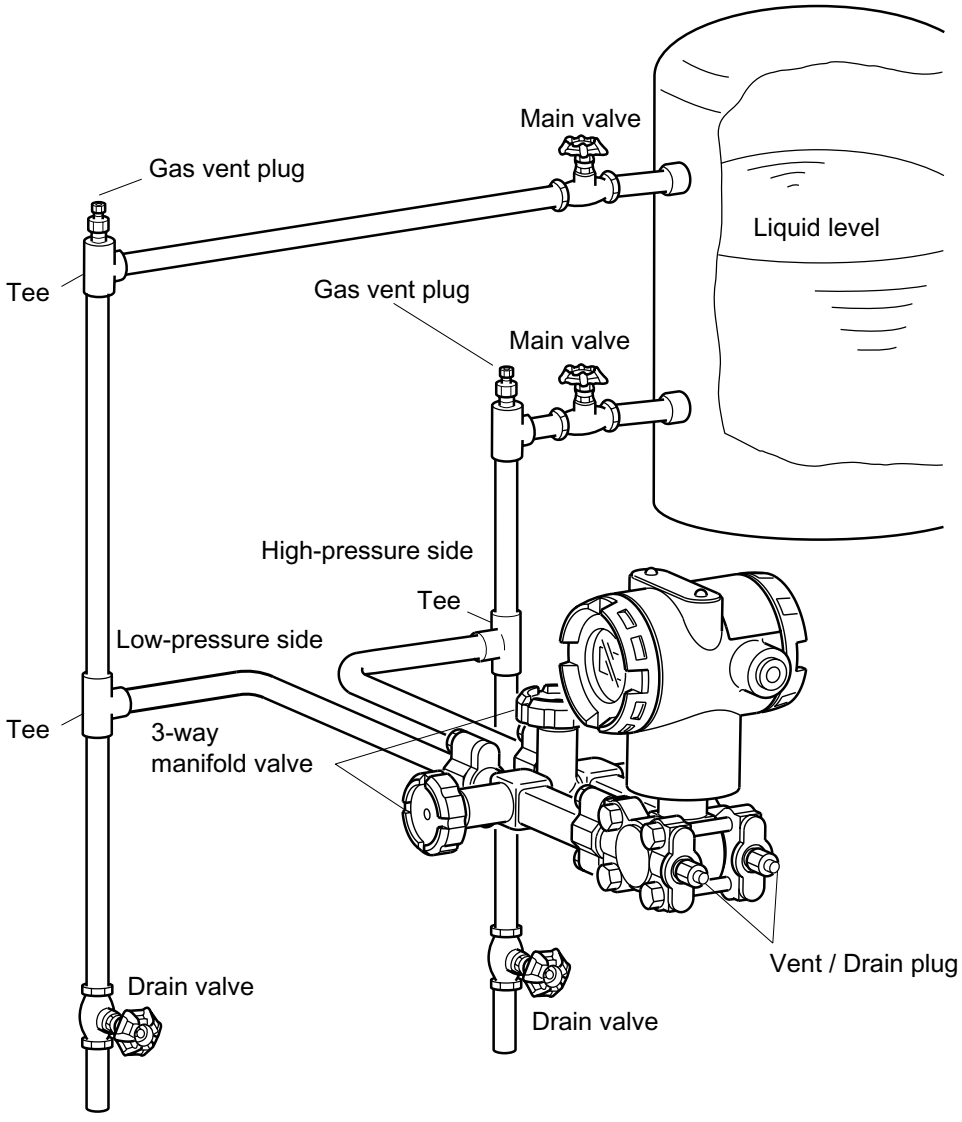


Figure 4-15 Closed Tank -- Piping (Dry-leg Sealing Example)

Recommended piping for wet leg - Example

When using the wet-leg method, connect the high-pressure side of the 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.

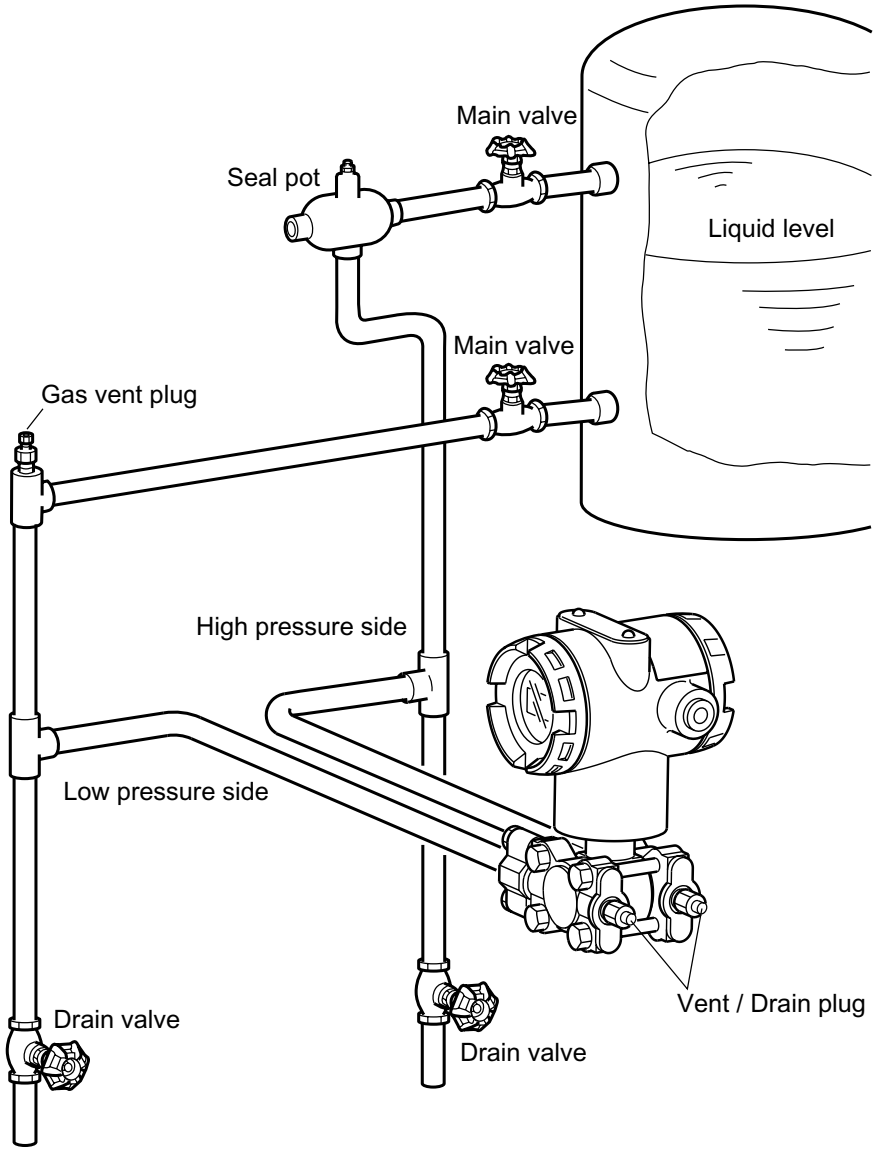


Figure 4-16 Closed Tank -- Piping (Wet-leg Sealing Example)

ATTENTION

For liquid or steam, the piping should slope a minimum of 25.4 mm (1 inch) per 305 mm (1 foot). Slope the piping down towards the transmitter if the transmitter is below the process connection so the bubbles may rise back into the piping through the liquid. If the transmitter is located above the process connection, the piping should rise vertically above the transmitter, then slope down towards the flowline with a vent valve at the high point. For gas measurement, use a condensate leg and drain at the low point (freeze protection may be required here).

4-4 : Wiring ST 3000 Smart Transmitter

4-4-1 :Wiring for Transmitter -- Regular Model

Introduction

Following wiring instructions when no explosion-proof standards apply.

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

Wire and cable this transmitter as shown in the illustrations.

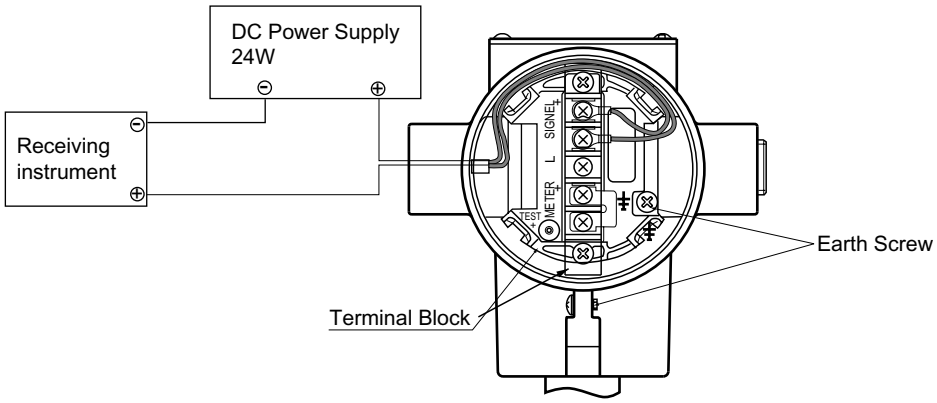


Figure 4-17 Wiring

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

~Note *2. In using Yamateke's field type indicator (Model NWS300, Model NWA300), please consult us.*

Conduit pipe for cables

Lead cables into the transmitter case, as follows:

Mount a conduit pipe in the conduit hole (1/2NPT 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 prevent entry of water.

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

Grounding

If a shielded cable is used, earth (ground) the shield at the receiver only (single point ground). Connecting the shield to signal ground is recommended to make the electric potential difference lower.

If the transmitter is not grounded through a pipe stanchion, ground the transmitter using an earth terminal in the transmitter.

To ground the transmitter, the ground resistance must be 100Ω or lower.

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).

The horizontal axis represents the supply voltage of a transmitter, and vertical axis represents the external load resistance

.

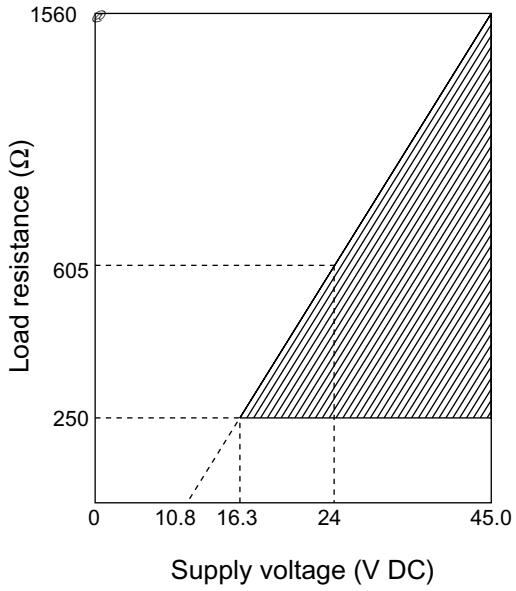


Figure 4-18 Supply Voltage and External Load Resistance - Relationship

~Note *1: 45 volt operation is permitted.*

~Note *2: For communication with SFC, a load resistance of 250 ohms or more is needed.*

Summary

For wiring the transmitter, you simply connect the positive (+) and negative (-) loop wires to the positive (+) and negative (-) signal terminals on the terminal block in the transmitter's electronics housing as shown in Figure 4-19.

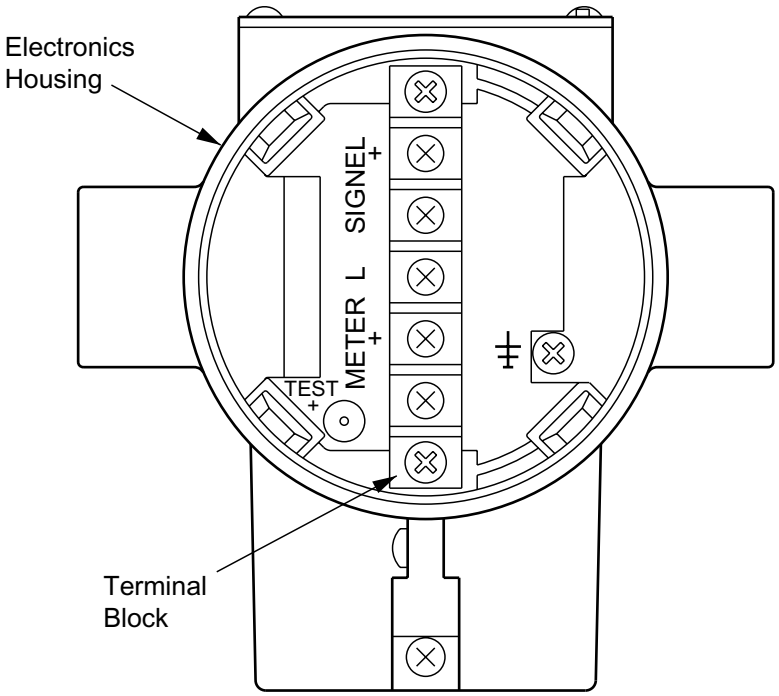


Figure 4-19 ST3000 Smart Transmitter Terminal Block.

4-4-2 :Wiring for Transmitter-- Explosion-Proof

Guidelines

Explosion-proof requires special precautions and installation methods. Refer also to "4-4-1 :Wiring for Transmitter -- Regular Model".

⚠ WARNING

- Tighten the case cover fully, to the end, and lock.
- Clearly delineate safety responsibilities in operating procedures. Especially, for an explosion-proof transmitter, specify locking of the cover of the transmitter case.

Locking

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

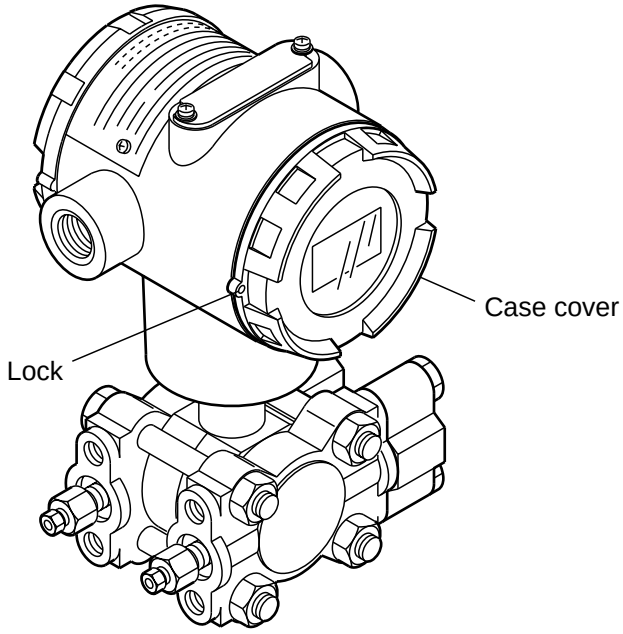


Figure 4-20 Unlock Transmitter Case

Leading-in external cables

Leading in cables to the equipment

Refer to the instructions in the chapter of About Explosion-Proof(“Explosion protected Models” on page Safety-ii) in the front of this manual.

4-4-3 :Wiring Transmitter -- Intrinsically-safe

Guidelines

Intrinsically safe requires special wiring precautions and installation methods. Refer to "4-4-1 :Wiring for Transmitter -- Regular Model".

⚠ WARNING

- Protect transmitter from electrical or magnetic influence (such as mixing and induction) from other electrical circuits.
- Use a Zener barrier approved by an approval body such as FM and NEPSI.

Wiring

- Follow the instructions in the installation drawing (80390790) for FM intrinsically safe loops.
- In case of NEPSI, combine with a NEPSI approved Zener barrier; Z787,MTL787S or LB987S.

  Following parameters must be taken.

  Maximum allowed cable capacitance = 0.1μF

  Maximum allowed cable inductance = 2mH

  See instruction manual of Zener barrier.

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 designated as having conformance that is proved by relevant public organizations.

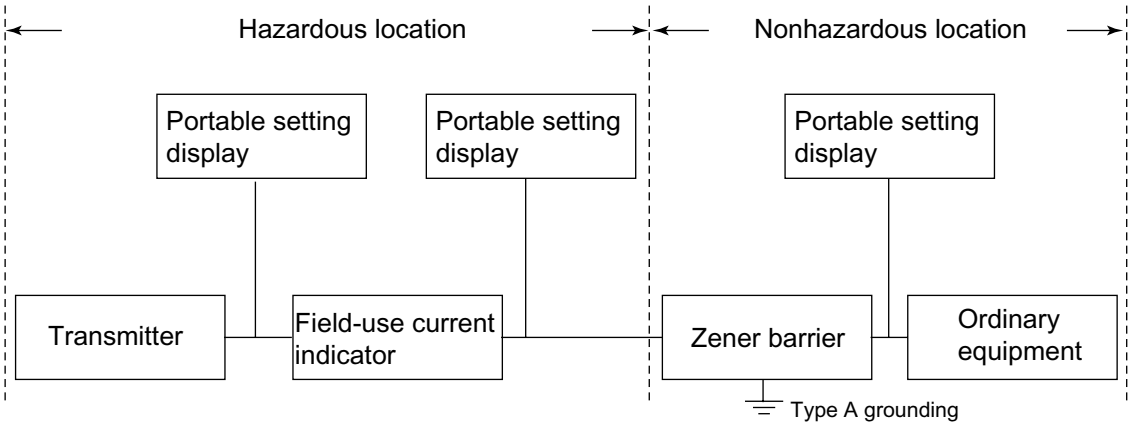
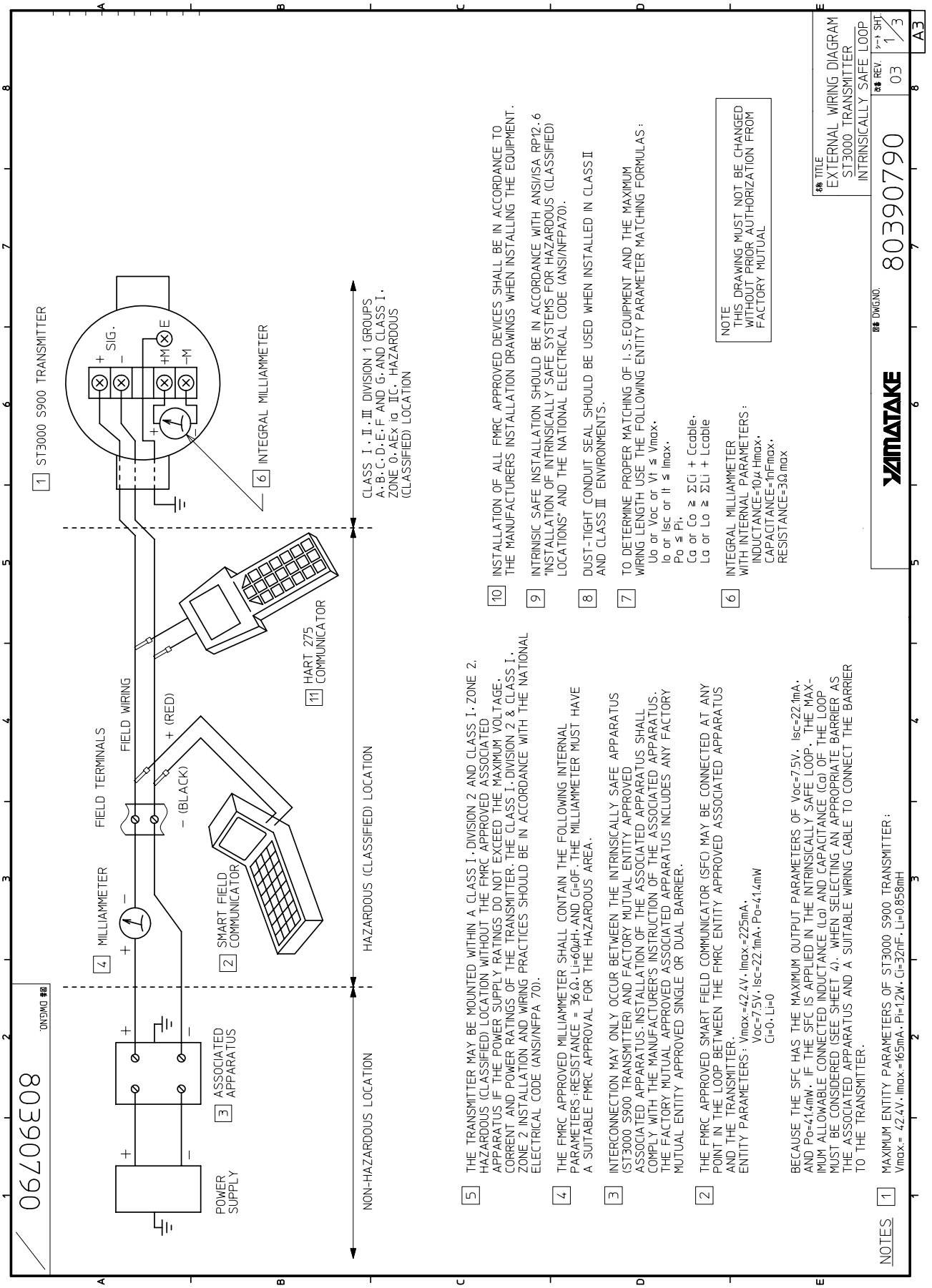


Figure 4-21 System Configuration of Intrinsically-safe Transmitter


80390790
DWG.NO.
1 ST3000 S900 TRANSMITTER
SIG.
+M
-M
E
6 INTEGRAL MILLIAMMETER
FIELD TERMINALS
FIELD WIRING
4 MILLIAMMETER
+ (RED)
- (BLACK)
2 SMART FIELD COMMUNICATOR
11 HART 275 COMMUNICATOR
3 ASSOCIATED APPARATUS
POWER SUPPLY
NON-HAZARDOUS LOCATION
HAZARDOUS (CLASSIFIED) LOCATION
CLASS I. II. III DIVISION 1 GROUPS A.B.C.D.E.F AND G. AND CLASS I. ZONE 0. AEx ia IIC. HAZARDOUS (CLASSIFIED) LOCATION
NOTE
THIS DRAWING MUST NOT BE CHANGED WITHOUT PRIOR AUTHORIZATION FROM FACTORY MUTUAL
TITLE
EXTERNAL WIRING DIAGRAM
ST3000 TRANSMITTER
INTRINSICALLY SAFE LOOP
REV.
03
SHT
1/3
A3
YAMATAKE
NOTES
1 MAXIMUM ENTITY PARAMETERS OF ST3000 S900 TRANSMITTER:
Vmax.= 42.4V. Imax.=165mA. Pi=1.2W. Ci=32nF. Li=0.858mH
2 THE FMRC APPROVED SMART FIELD COMMUNICATOR (SFC) MAY BE CONNECTED AT ANY POINT IN THE LOOP BETWEEN THE FMRC ENTITY APPROVED ASSOCIATED APPARATUS AND THE TRANSMITTER.
ENTITY PARAMETERS: Vmax=42.4V. Imax=225mA.
Voc=7.5V. Isc=22.1mA. Po=41.4mW
Ci=0. Li=0
BECAUSE THE SFC HAS THE MAXIMUM OUTPUT PARAMETERS OF Voc=7.5V. Isc=22.1mA. AND Po=41.4mW. IF THE SFC IS APPLIED IN THE INTRINSICALLY SAFE LOOP, THE MAXIMUM ALLOWABLE CONNECTED INDUCTANCE (La) AND CAPACITANCE (Ca) OF THE LOOP MUST BE CONSIDERED (SEE SHEET 4). WHEN SELECTING AN APPROPRIATE BARRIER AS THE ASSOCIATED APPARATUS AND A SUITABLE WIRING CABLE TO CONNECT THE BARRIER TO THE TRANSMITTER.
3 INTERCONNECTION MAY ONLY OCCUR BETWEEN THE INTRINSICALLY SAFE APPARATUS (ST3000 S900 TRANSMITTER) AND FACTORY MUTUAL ENTITY APPROVED ASSOCIATED APPARATUS. INSTALLATION OF THE ASSOCIATED APPARATUS SHALL COMPLY WITH THE MANUFACTURER'S INSTRUCTION OF THE ASSOCIATED APPARATUS. THE FACTORY MUTUAL APPROVED ASSOCIATED APPARATUS INCLUDES ANY FACTORY MUTUAL ENTITY APPROVED SINGLE OR DUAL BARRIER.
4 THE FMRC APPROVED MILLIAMMETER SHALL CONTAIN THE FOLLOWING INTERNAL PARAMETERS: RESISTANCE = 36Ω. Li=60μH. AND Ci=0F. THE MILLIAMMETER MUST HAVE A SUITABLE FMRC APPROVAL FOR THE HAZARDOUS AREA.
5 THE TRANSMITTER MAY BE MOUNTED WITHIN A CLASS I. DIVISION 2 AND CLASS I. ZONE 2. HAZARDOUS (CLASSIFIED) LOCATION WITHOUT THE FMRC APPROVED ASSOCIATED APPARATUS IF THE POWER SUPPLY RATINGS DO NOT EXCEED THE MAXIMUM VOLTAGE. CURRENT AND POWER RATINGS OF THE TRANSMITTER. THE CLASS I. DIVISION 2 & CLASS I. ZONE 2 INSTALLATION AND WIRING PRACTICES SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70).
6 INTEGRAL MILLIAMMETER
WITH INTERNAL PARAMETERS:
INDUCTANCE=10μ Hmax.
CAPACITANCE=1nFmax.
RESISTANCE=3Ω max
7 TO DETERMINE PROPER MATCHING OF I.S.EQUIPMENT AND THE MAXIMUM WIRING LENGTH USE THE FOLLOWING ENTITY PARAMETER MATCHING FORMULAS:
Uo or Voc or Vt ≤ Vmax.
Io or Isc or It ≤ Imax.
Po ≤ Pi.
Ca or Co ≥ ΣCi + Ccable.
La or Lo ≥ ΣLi + Lcable
8 DUST-TIGHT CONDUIT SEAL SHOULD BE USED WHEN INSTALLED IN CLASS II AND CLASS III ENVIRONMENTS.
9 INTRINSIC SAFE INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP12.6 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS" AND THE NATIONAL ELECTRICAL CODE (ANSI/NFPA70).
10 INSTALLATION OF ALL FMRC APPROVED DEVICES SHALL BE IN ACCORDANCE TO THE MANUFACTURERS INSTALLATION DRAWINGS WHEN INSTALLING THE EQUIPMENT.

DWG.NO. 80390790

11 THE FMRC APPROVED HART 275 COMMUNICATOR (HHT) MAY BE CONNECTED AT ANY POINT IN THE LOOP BETWEEN THE FMRC ENTITY APPROVED ASSOCIATED APPARATUS AND THE TRANSMITTER.
EXAMPLE ENTITY PARAMETERS,SEE HHT CONTROL DRAWING FOR ACTUAL ENTITY PARAMETERS: Vmax.=30V, Imax.=300mA,
Voc=1.7V, Isc=32mA
Ci=0.07μF, Li=0

BECAUSE THE HHT HAS THE MAXIMUM OUTPUT PARAMETERS OF Voc=1.7V AND Isc=32mA. IF THE HHT IS APPLIED IN THE INTRINSICALLY SAFE LOOP, THE MAXIMUM ALLOWABLE CONNECTED INDUCTANCE (La) AND CAPACITANCE (Ca) OF THE LOOP MUST BE CONSIDERED (SEE SHEET 5). WHEN SELECTING AN APPROPRIATE BARRIER AS THE ASSOCIATED APPARATUS AND A SUITABLE WIRING CABLE TO CONNECT THE BARRIER TO THE TRANSMITTER.

12 SMART FIELD COMMUNICATOR (SFC) AND HART 275 COMMUNICATOR (HHT) SHALL NOT BE CONNECTED IN THE LOOP AT THE SAME TIME.

13 AEx ib IS SUITABLE ONLY FOR CLASS I, ZONE 1 HAZARDOUS (CLASSIFIED) LOCATIONS AND IS NOT SUITABLE FOR CLASS I, ZONE 0, OR CLASS I, DIVISION 1 HAZARDOUS (CLASSIFIED) LOCATIONS.

14 THE POWER SUPPLY CONNECTED TO THE ASSOCIATED APPARATUS MUST NOT USE OR GENERATE MORE THAN 250 Vrms OR Vdc.

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 (Lcable, Ccable), 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 (Vmax, Imax, Pmax) 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 TABLE OF NEXT PAGE, La FOR GROUP A/B IS DETERMINED : La=2.50mH.

THE ABOVE OBTAINED La VALUE MUST SATISFY THE BELOW RELATIONSHIP.

La ≧ Li (TRANSMITTER) + Lcable + Li (SFC).

ACCORDINGLY, THE WIRING INDUCTANCE NEVER EXCEEDS THE VALUE La - Li (TRANSMITTER) - Li (SFC), i.e. IF Li OF TRANSMITTER IS 11μH,

Lcable ≦ 2.50mH - 11μH - 0 = 2.489mH.

NOTE : IF THE ABOVE Lcable 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 TABLE OF NEXT PAGE, Ca FOR GROUP A/B IS DETERMINED : Ca=0.08 μF.

THE ABOVE OBTAINED Ca VALUE MUST SATISFY THE BELOW RELATIONSHIP.

Ca ≧ Ci (TRANSMITTER) + Ccable + Ci (SFC).

ACCORDINGLY, THE WIRING CAPACITANCE NEVER EXCEEDS THE VALUE Ca - Ci (TRANSMITTER) - Ci (SFC), i.e. IF Ci OF TRANSMITTER IS 0.032 μF

Ccable ≦ 0.08 μF - 0.032 μF - 0 = 0.048 μF.

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

名称 TITLE	EXTERNAL WIRING DIAGRAM ST3000 TRANSMITTER INTRINSICALLY SAFE LOOP
YAMATAKE	DWG.NO. 80390790
改番 REV.	03
シート SHT.	2
	A3

80390790 図番 DWG.NO.

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

EXAMPLE 3. 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 HHT. IF Isc OF THE BARRIER IS 93mA,

Isum = 93mA + 32mA = 125mA.

THEN, BY APPLYING 130mA (THE NEXT HIGHER VALUE OF THE RESULTING Isum) TO THE RIGHT TABLE, La FOR GROUP A/B IS DETERMINED : La=2.00mH.

THE ABOVE OBTAINED La VALUE MUST SATISFY THE BELOW RELATIONSHIP.

La ≧ Li (TRANSMITTER) + Lcable + Li (HHT).

ACCORDINGLY, THE WIRING INDUCTANCE NEVER EXCEEDS THE VALUE La - Li (TRANSMITTER) - Li (HHT), i.e. IF Li OF TRANSMITTER IS 11μH,

Lcable ≦ 2.00mH - 11μH - 0 = 1.989mH

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

EXAMPLE 4. 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 HHT. IF Voc OF THE BARRIER IS 28V,

Vsum = 28V + 1.7V = 29.7V.

THEN, BY APPLYING 30V (THE NEXT HIGHER VALUE OF THE RESULTING Vsum) TO THE RIGHT TABLE, Ca FOR GROUP A/B IS DETERMINED : Ca=0.12μF.
THE ABOVE OBTAINED Ca VALUE MUST SATISFY THE BELOW RELATIONSHIP.

Ca ≧ Ci (TRANSMITTER) + Ccable + Ci (HHT).

ACCORDINGLY, THE WIRING CAPACITANCE NEVER EXCEEDS THE VALUE Ca - Ci (TRANSMITTER) - Ci (HHT), i.e. IF Ci OF TRANSMITTER IS 0.032μF,

Ccable ≦ 0.12μF - 0.032μF - 0 = 0.088μF.

NOTE: IF THE ABOVE Ccable 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 OR HART COMMUNICATOR)
Vsum = Voc (ASSOCIATED APPARATUS) + Voc (SMART COMMUNICATOR OR HART 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

名称 TITLE
EXTERNAL WIRING DIAGRAM
ST3000 TRANSMITTER
INTRINSICALLY SAFE LOOP

YAMATAKE 図番 DWG.NO. 80390790 改番 REV. 03 シート SHT. 3

A3

Power supply and load resistance

- The load resistance of the intrinsically safe circuit and the supply voltage must be determined in such a way that the following formula holds:

  $$250 \leq R \leq (Supply \cdot voltage - 10.8) / 0.0218$$

  R: Loop resistance (Ω)
  Vz: Voltage drop of Approved Zener Barrier
- Load resistance is the sum of the resistance that is connected to the output terminals of the equipment such as the resistance of the cable loop and the internal resistance of the connected instruments.

Lightning protection

When your transmitter is equipped with optional lightning protection, you must connect a wire form the transmitter to ground as shown in Figure 4-22 to make the protection effective.

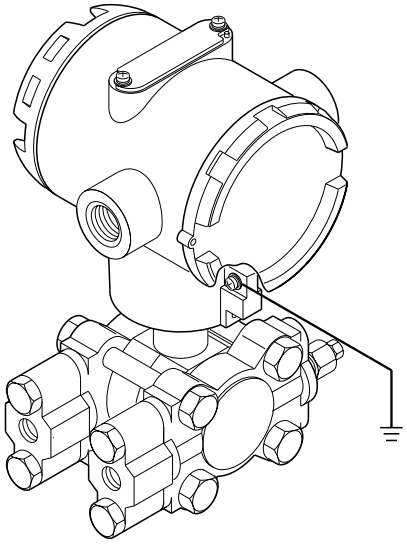


Figure 4-22 Ground Connection for Lightning Protection

Conduit seal

For an explosion proof installation in Class 1,Division 1, Group A locations only, you must seal the conduit entrances in the electronics housing. However, you can skip the conduit seal requirement for installations in Groups B,C, and D locations.

If a seal is required, use a conduit seal on the wiring outlet of the housing or junction box.

⚠ WARNING

In explosive atmospheres and non-intrinsically safe loops, do not apply power to the transmitter with the electronics housing end-cap removed, and do not remove the end-cap with power applied to the transmitter.
Install the conduit seal according to the instructions packaged with the product.

Chapter 5 : Operation of the Transmitter

5-1 : Preparation

5-1-1 :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 250Ω for communications with an SFC. If total load resistance of the receiving instrument is below 250Ω, add the difference to the loops resistance.*

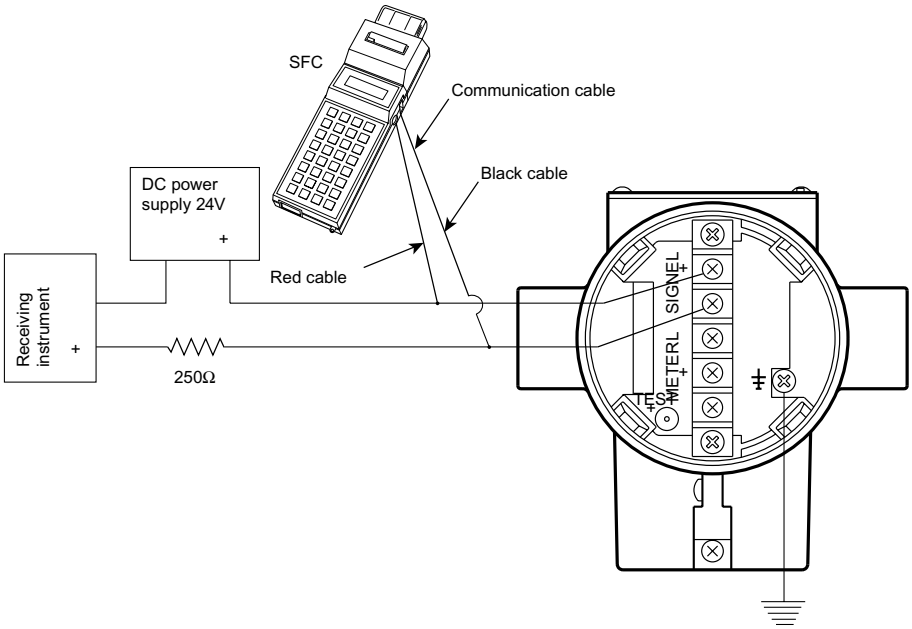


Figure 5-1 Connecting SFC

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 key is not supported by the connected transmitter. You should find the correct key using the manual.

5-2 : Setting Tag No. and Checking Specifications

5-2-1 :Starting Communications

⚠ WARNING

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

Procedure

This procedure starts communications between this transmitter and the SFC:

Step	Description	SFC screen
1	Place in manual mode, the process	No display
2	Refer to Figure 5-1 and connect the SFC to the transmitter.	
3	Turn ON the SFC power switch. Press the key	LOOP IN MANUAL? PRESS ID
4	Press the key	DSTJ TAG NO. LIN DP XXXXXXXX The default tag number is xxxxxxxx

5-2-2 :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	Description	SFC screen
1	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	Press the [ALPHA] and [TIME +/-] keys in that order.	DSTJ TAG NO. LIN DP FIT-
3	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	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 [ALPHA] key to release alphabet mode. Press the [A DE ← Q] key to shift the cursor back by one column and press the [ALPHA] key again. Input correct character.

Correct keying errors using this procedure:

Press the [A DE ← Q] key to shift the cursor back by one column. Input a correct number.

5-2-3 :Checking Output Format

Procedure

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

To change the output format, refer to "6-7-3 : Display or Change Output Format".

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

5-2-4 :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 "6-7-4 : Display or Change Indicator Display Format (Flow Rate /Linear/ Display Flow Rate)".

Step	Description	SFC screen
1	Press the B CONF key.	DSTJ CONFIG CONFORM?
2	Press the ▲ H NEXT key.	DSTJ CONFIG DISPLAY?
3	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 DISP FLOW
4	Press the CLR (No) key twice.	DSTJ FIT-1234 READY...

5-2-5 :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 "6-7-5 : Display or Change Indicator Display Format (Engineering Unit /%)".

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

5-2-6 :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 "6-7-8 : Display or Change Low/High Limits and Span of Set Range".

Step	Description	SFC screen
1	Press the E LRV 0% key.	LRV FIT-1234 0.0000 kPa
2	Press the F URV 100% key.	URV FIT-1234 50.00 kPa

5-2-7 :Checking Damping Time Constant

Procedure

Check the damping time constant using the following procedure.

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

To change the damping time constant, refer to "6-7-10 : Display or Change Damping Time Constant".

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

5-2-8 :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 "6-7-15 : Displaying and changing the sealed liquid temperature correction function".

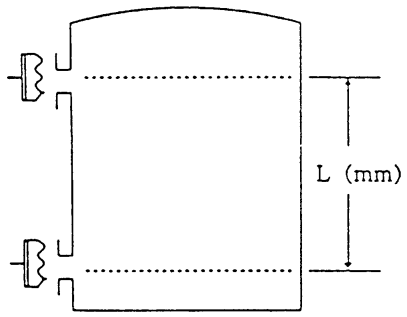
Step	Description	SFC screen
1	Press the B CONF key.	DSTJ CONFIG CONFORM?
2	Press the ▲ H NEXT key. Or else, press the ▼ L PREV key four times.	DSTJ CONFIG SAVE/RESTORE?
3	Press the NON-VOL ENTER (Yes) key.	SAVE DATA WORKING...

Step	Description	SFC screen
4	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 STR/STE 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.)



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

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

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 DSTJ3000: 1%

5-3 : Measurement with STD type

5-3-1 :Flow Rate Measurement

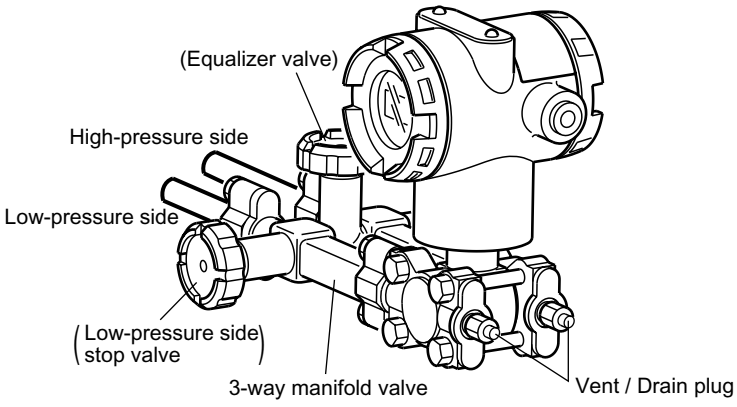
5-3-1-1 Preparation for Measurement

⚠ WARNING

- Make sure that the process is in the manual control mode.
  If in automatic control mode, switch to manual control before starting the following procedures.
- Drain poisonous fluids with care, making provisions to protect personnel.
- Always close the differential pressure output valve (main valve), the drain valve, the gas vent plug (refer to figures 4-8 and 4-9) and the high pressure side and low pressure side stop valves of the 3-way manifold valve. Also, open the equalizer valve of the 3-way manifold valve.

Procedure 1

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

Step	Description
1	Gradually open the main valves of both the high-pressure side and the low-pressure side (Refer to Figure 4-8 and Figure 4-9). Lead process fluid into the connecting pipe.1
2	Fill with process fluid, the pressure-receiving part of the transmitter. 1. Gradually open the high pressure side stop valve. Close, after the pressure receiving part has completely filled with process fluid. 2. Gradually open the low pressure side stop valve. Close, after the pressure receiving part has completely filled with process fluid. 

Step	Description
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	Description	SFC screen
1	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	Press the DE READ ID A key.	DSTJ TAG NO. LIN DP FIT-1234
3	Press the SHIFT ^ and INPUT OUTPUT J keys in that order.	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 0.0000 kPa

Step	Description	SFC screen
4	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	Description	SFC screen
5	Press the SHIFT ^ and INPUT OUT- PUT J keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 0.0000 kPa
6	Press the RESET COR- RECT K key.	INPUT FIT-1234 ZERO INPUT?
7	Press the NON-VOL ENTER (Yes) key.	INPUT ARE YOU SURE?

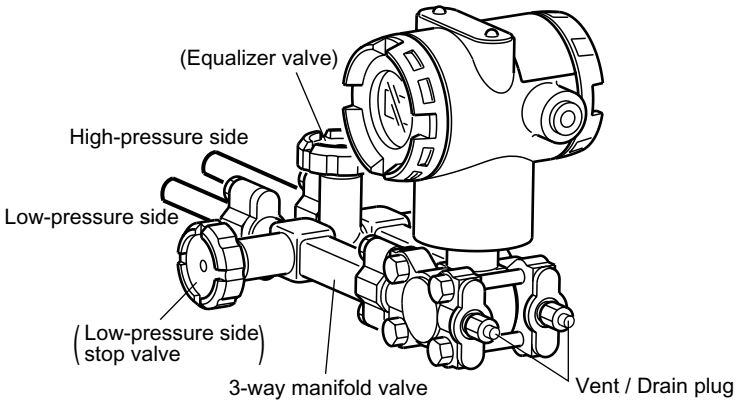
Step	Description	SFC screen
8	Press the NON-VOL ENTER (Yes) key.	INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 INPUT ZEROED
9	Repeat steps 3 and 4 and make sure that 0.00 is displayed. Zero-point calibration is completed.	

5-3-1-2 Starting Measurement

Procedure 3

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

Step	Description
1	Ensure that the 3-way manifold valve is in the following state: 1. High-pressure side stop valve: Fully open 2. Low-pressure side stop valve: Fully closed 3. Equalizer valve: Fully open
2	1. Close the equalizer valve. 2. 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)

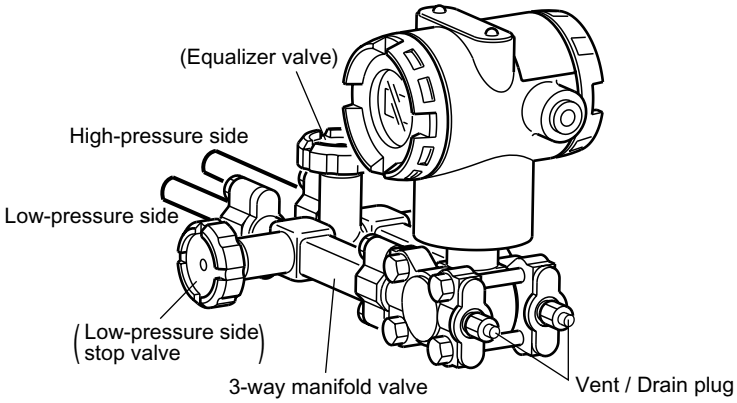
Step	Description	SFC screen
3	Press the SHIFT and INPUT OUTPUT keys, in that order	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
4	Press the INPUT OUTPUT key.	OUTPUT FIT-1234 50.00 %
5	At the completion measurement, remove the clip from the communication cable. Switch the process to normal 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 electronics 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, troubleshot the transmitter as described in "Chapter 7 : Maintenance and Troubleshooting".
- If the displayed data value is unstable, adjust the damping time constant Refer to "6-7-10 : Display or Change Damping Time Constant".

5-3-1-3 Stopping Measurement

Procedure

Stop the transmitter, using this procedure:

Step	Description
1	Turn off the transmitter
2	Operate the 3-way manifold valve by the following procedure: 1. Close the low-pressure side stop valve. 2. Open the equalizer valve. 3. Close the high-pressure side stop valve 
3	Close the main valves on the high and low pressure sides. Refer to Figure 4-8 and Figure 4-9.

⚠ CAUTION

- If you plan 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.

5-3-2 :Gas Pressure Measurement

5-3-2-1 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 with care, making provisions to protect personnel.
- Close the differential pressure output valve (main valve), the local valve, the drain valve, and the gas vent plug. Refer to "Figure 4-11 Gas Pressure Measurement - Piping".

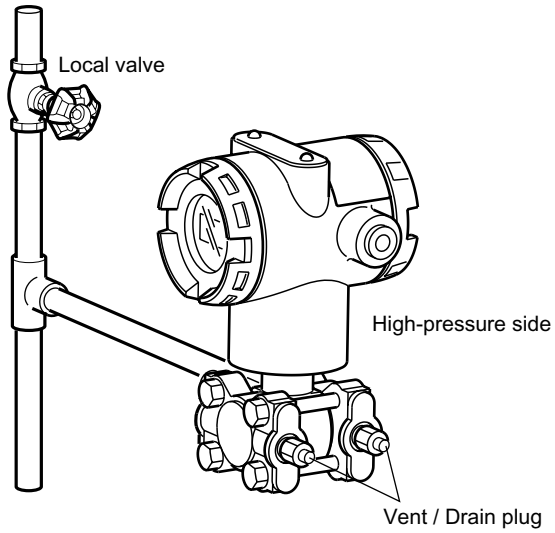
How to measure gas pressure

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

- Zero-point adjustment

Step	Description
1	Open both the high-pressure side and low-pressure side vent plugs and open the pressure receiving part to the air.
2	Refer to procedure 2 on page 5-10. Perform zero-point calibration.
3	After completing zero-point calibration, close the high-pressure side vent plug.

Introducing process pressure and venting air

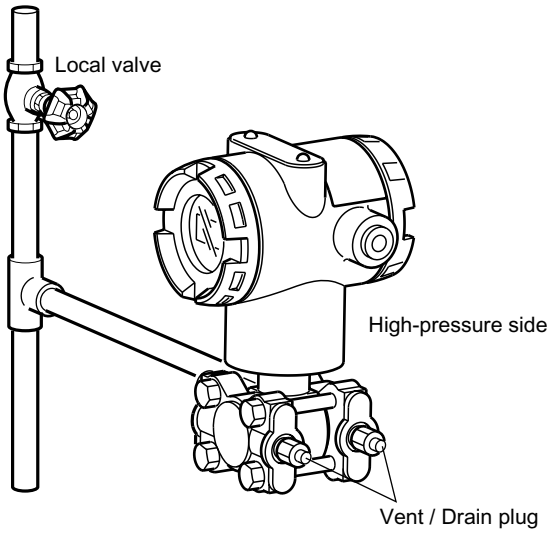
Step	Description
1	1. Open the main valve (refer to "Figure 4-11 Gas Pressure Measurement - Piping".) to introduce process pressure into the connecting pipe. 2. Open the local valve gradually, to introduce process pressure into the pressure-receiving part of the transmitter.
2	1. Open the high-pressure side vent plug gradually, to vent air from the center body. 2. After vent air, close the vent plug and the local valve. 
3	Check for pressure leaks in the connecting pipe and the transmitter.

5-3-2-2 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

Step	Description
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%.

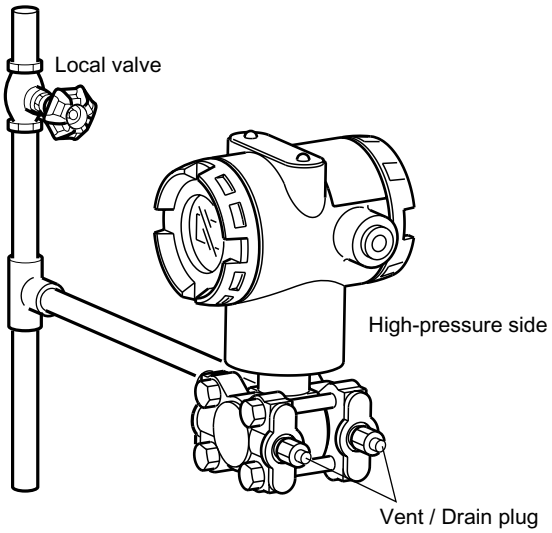
Step	Description	SFC screen
2	Press the SHIFT and INPUT OUTPUT keys in that order.	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
3	Press the INPUT OUTPUT key.	OUTPUT FIT-1234 50.00 %
4	At the end of measurement, remove the clip of the communication cable and switch the process to ordinary operation. **⚠ CAUTION** Securely close 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 inconsistent, troubleshoot the transmitter as described in "Chapter 7 : Maintenance and Troubleshooting".
- If the displayed data value is unstable, adjust the damping time constant by referring to "6-7-10 : Display or Change Damping Time Constant".

5-3-2-3 Stopping Measurement

Procedure

How to stop the transmitter

Step	Description
1	Turn off the transmitter.
2	Close the local valve. 
3	Close the main valve. (Refer to "Figure 4-11 Gas Pressure Measurement - Piping".)

⚠ CAUTION

If you plan 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.

5-3-3 :Liquid Level Measurement of Open Tank and Closed Tank (Dry Leg)

5-3-3-1 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 4-12 Example of Piping".) are closed, as well as the high pressure side and low pressure side stop valves of the 3-way manifold valve. Also, make sure that the equalizer valve of the 3-way manifold valve is open.

Calculating setting range

Calculate the setting range. Refer to "5-10 : Set Range Calculation for Liquid Level Measurement".

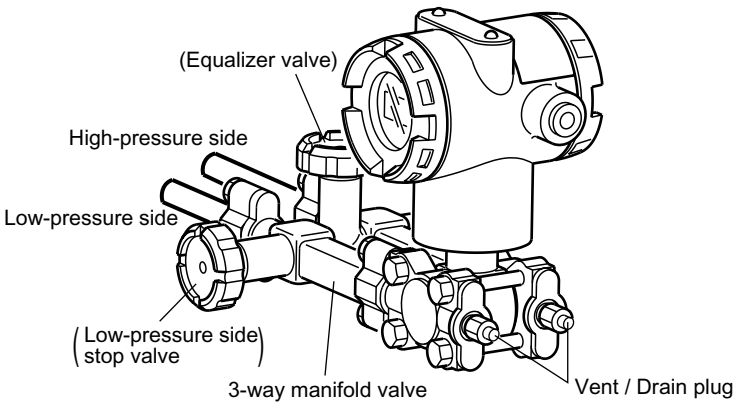
Procedure

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

Zero-point calibration

Step	Description
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 in page 5-10 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

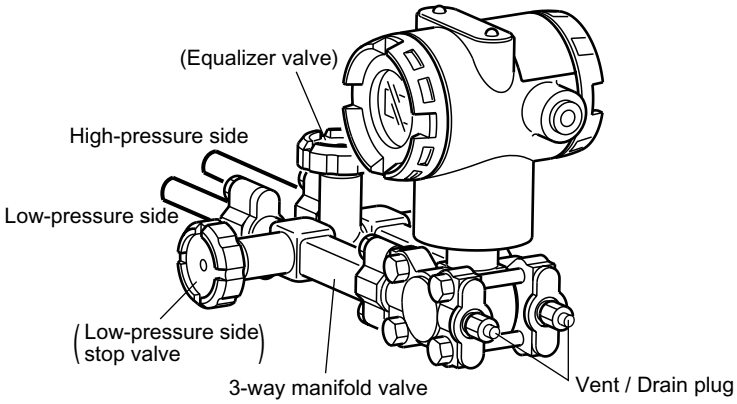
Step	Description
1	1. Open the main valve (refer to "Figure 4-14 Open Tank -- Piping Example".) to introduce process pressure into the connecting pipe. 2. Open the high-pressure side stop valve gradually to introduce process pressure. After introducing process pressure into the pressure receiving part 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.

5-3-3-2 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

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

Zero-point adjustment during measurement

Refer to "5-8 : Zero-point Adjustment -- Based on Actual Liquid Level" 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	Description	SFC screen
2	Press the SHIFT and INPUT OUTPUT keys in that order.	SHIFT- INPUT FIT-1234 WORKING... ↓ INPUT FIT-1234 25.00 kPa
3	Press the INPUT OUTPUT key.	OUTPUT 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** Securely close 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 the input and output values do not match, check the range and recalibrate. If they remain inconsistent, troubleshoot the transmitter as described in "Chapter 7 : Maintenance and Troubleshooting".
- If the displayed data value is unstable, adjust the damping time constant. Refer to "6-7-10 : Display or Change Damping Time Constant".